



# Sustainable Urban Mobility Plan for Medan Metropolitan Area (SUMP Mebidangro)

## Final Report

April 2022

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## Executive Summary

The purpose, major points, key results, and conclusions of SUMP Mebidangro Final Report are summarized in this executive summary. The structure of the executive summary consists of background, objective, scope, final report document structure, key results, conclusions and recommendations of the SUMP Mebidangro.

### 1.1. Background

Mebidangro is the largest metropolitan area outside Java and is, as of 2019, home to 4.855.745 inhabitants. The area consists of two cities and two regencies in the North Sumatra Province, including Medan City, Binjai City, Deli Serdang Regency, and part of Karo Regency. With an increasing urban population, Mebidangro faces growing challenges in transport and mobility. High dependency of private motorized vehicles resulting in more and more congestion along main road axes. The growth of road traffic resulted not only in lost time, but also in increased environmental and social externalities (GHG emissions, injuries and casualties...).

Most of the plans to improve public transport and shift commuters from private vehicles proposed linear projects of mass transit or minibus rerouting, covering Medan City only (monorail, LRT, BRT...). While the development of mass transit would indeed contribute to solving urban mobility challenges (i) it must serve the population regardless of the administration they live in and (ii) its important costs of implementation and operations cannot be borne by a sole sub-national administration. These two last points were reflected in the pending and blocked projects development observed between 2010 and 2020, because of the lack of planning and financing capacities from the municipal governments, and the obligation to have a comprehensive mobility planning document.

This leads to the Sub-National Governments to agglomerate into a Metropolitan area – under the North Sumatra Province – to cover coherent needs of mobility in the area as well as combine strengths for funding capacity. However, support from the central government is still necessary. As per the National Medium-Term Development Plan of 2020-2024, two main criteria are set by BAPPENAS for the regions to benefit from funding support: the existence of a mobility plan and a transport authority body that covers the metropolitan area set out by Presidential Decree.

### 1.2. Objectives and Scope

The objective of the SUMP Mebidangro is to obtain a strategic framework for sustainable mobility projects development through recognized analytical methods and participatory planning. This document provides a comprehensive and data-backed roadmap for mobility development on Mebidangro cities and the North Sumatra Province, that the central government can more easily review for a facilitated support to the region. The SUMP Mebidangro aims to create an urban transport system by addressing the following objectives:

- ✓ Ensure all citizens are offered transport options that enable access to key destinations and services.
- ✓ Improve safety and security.
- ✓ Reduce air and noise pollution, greenhouse gas emissions and energy consumption.
- ✓ Improve the efficiency and cost-effectiveness of the transport of persons and goods.
- ✓ Contribute to enhancing the attractiveness and quality of the urban environment and urban design for the benefits of citizens, the economy and society as a whole.

The geographical scope of the SUMP covers the coherent urban area of Mebidangro. It has fixed time horizons corresponding to different milestones. The recommended actions follow these time references.

- ✓ 1 to 3 years for short-term measures, 2023, which will be consistent with the end of the RPJMD 2019-2023;
- ✓ 8 years for the medium term, 2028 which will be consistent with future RPJMD 2024-2028;
- ✓ 15 to 20 years years for long-term measures, 2035, which consists of projects with complex preparation needed for their implementation.

### 1.3. Methodology

The SUMP is the outcome from work that extended for 18 months, between October 2020 and April 2022. Meshing technical, social, financial, and institutional analyses, it follows a methodology with four main components:

- **Component 1:** Inception of the SUMP. This period starts the engagement period by putting local institutions at the center of the stage, identifying working groups, work plan and preparing the stakeholders engagement activities.

- **Component 2:** Diagnosis of urban mobility. During 6 to 8 months, the opportunities and challenges of urban mobility in Mebidangro were analyzed on all aspects (social, financial...) to map the pain points. The information collected is both quantitative (surveys and investigations) and qualitative (interviews and workshops, focus group discussions). Since the preparation of the SUMP occurred during COVID-19 pandemic outbreak, the mobility is greatly impacted. This impact was assessed by analysing mobility from cellular data before and after the pandemic.
- **Component 3:** Vision and scenarios of urban mobility development. After identifying painpoints, stakeholders are invited to exchange and reflect on the goals for urban mobility, by elaborating a common vision. This is translated into mobility scenarios that are evaluated to form a relevant list of actions. The stakeholders remain at the center of the stage.
- **Component 4:** Preparation of the Action Plan. The most relevant list of measures is translated into an action plan in collaboration with the main actors. The measures for mobility improvement are assigned with the corresponding responsible agencies, high-level schedules of implementation, risk analyses and costing.

Furthermore, to track the SUMP implementation and updates, a framework for Monitoring, Reporting and Verification (MRV) is developed. This framework follows the MobiliseYourCity guidelines and has 20 indicators which will show the improvement and development of mobility in future years. Trainings are provided for preparing and handling this tool, referred to as the Observatory on Urban Mobility.

## 1.4. Document Structure

There are 5 main chapters of the final report document. The chapters are Introduction, Diagnosis, Vision Goals Mobility Scenarios, Action Plan, and Observatory. Key findings from each chapter are highlighted and summarized in this section.

### ■ Diagnosis

The diagnosis chapter of the final report discusses current status and conditions of urban mobility in the Mebidangro area. This diagnosis will allow a better understanding of mobility practices in that geographical perimeter, in order to define a mobility vision for the future and develop different scenarios and their measures to achieve this mobility vision.

This chapter was built by collecting and analysing existing data, and by performing the largest ever mobility survey in Indonesia, with households and transport investigations and countings. This collected data was completed with interviews of plural stakeholders, with summarized conclusions and findings of diverse workshops on multiple subjects.

### ■ Vision goals mobility scenarios

Articulating the SUMP diagnosis with the action plan, this chapter establishes the vision, goals and mobility scenarios for Mebidangro, which is a necessary step for a consensual approach to mobility planning and development.

### ■ Action plan

The Action Plan forms the essence of the Sustainable Urban Mobility Plan of Mebidangro. It delineates the activities and operations for an improved urban mobility on the short, medium, and long terms. The Actions are grouped into integrated packages, or “blocks” which correspond to the themes within the previous scenarios.

Each of the action is dependent on one another. Due to this interdependence between actions, they should be done in an integrated way by a taskforce or transit authority, which should be formalized through regulations. In the absence of this authority, projects might be developed in an unintegrated way which will dampen the benefits of the SUMP.

### ■ Observatory

This chapter presents the observatory specifically prepared to monitor urban mobility and transport improvement in Mebidangro. It includes a general description of the tool, the indicators to track and update, the method for updates and the MRV management.

## 1.5. Results

### ■ The SUMP nature and role

To ensure the relevancy of the SUMP, and that it focuses on most urgent challenges, a study area that covers the coherent functional space where people work and live was defined. The area (1.254 km<sup>2</sup>) has 3.792.245 inhabitants representing 80 % of Mebidangro population and 84 % of its households. The urban areas of Karo Regency are still part of the plan for specific measures and purposes.

### ■ The SUMP actors

While the SUMP offers proposals, monitoring, and capacity, it is fully owned by the Mebidangro stakeholders who are responsible for its execution, update and reporting. Their ownership is thus crucial for the SUMP preparation and later projects

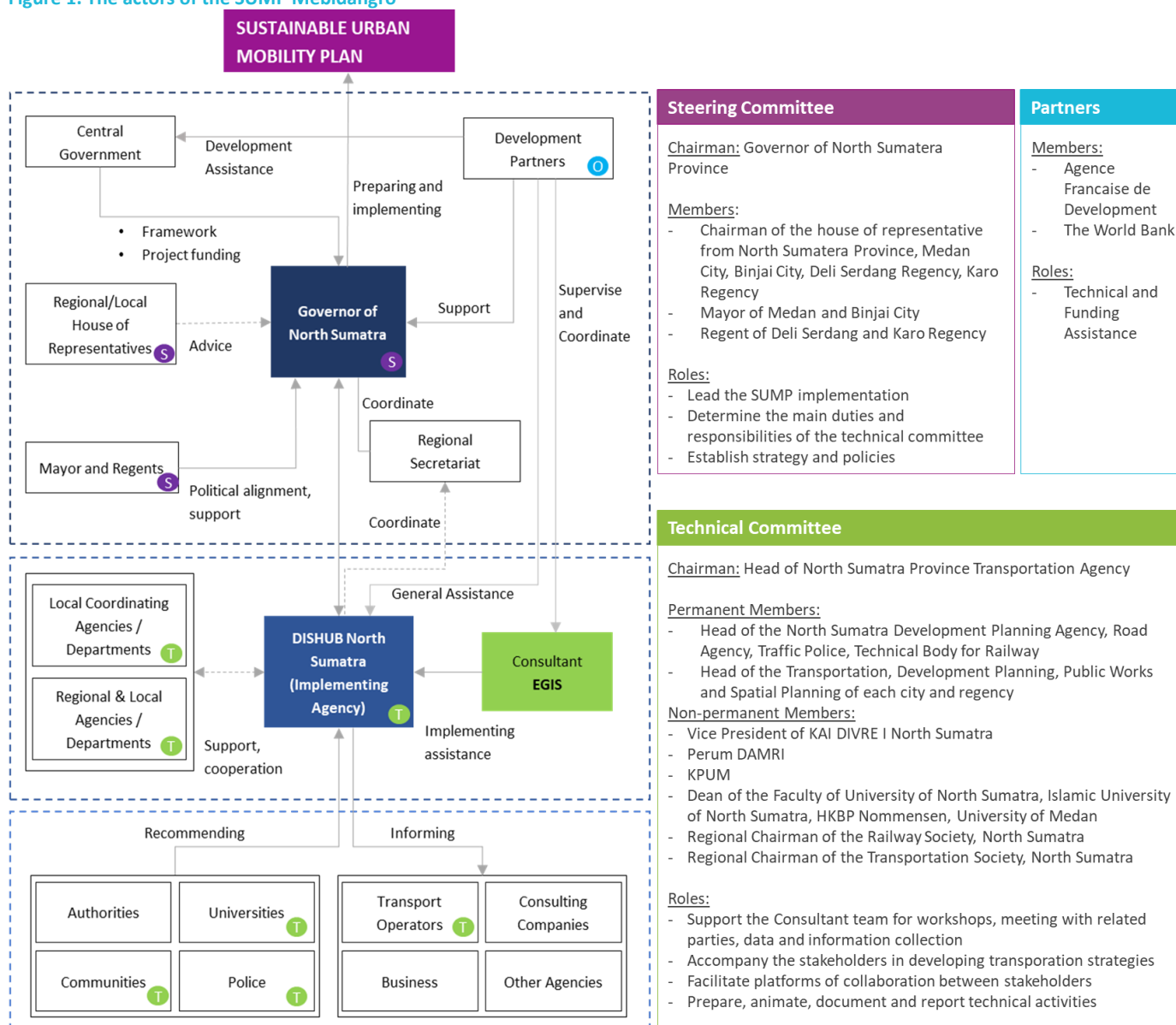
implementation. In a nutshell, the North Sumatra Province leads the SUMP with the cities and regencies of Mebidangro. The organizational structure of the SUMP is set in Provincial Decree No. 188.44/412/KPTS/2020.

### ■ Team and development process

During the preparation of SUMP, necessary arrangements with the stakeholders are taken to optimize the process and decision making involved. The preparation of SUMP engages stakeholders from the Provincial and Mebidangro administrations, central government, and development partners. Thus, to streamline and organize the preparation of SUMP, the stakeholders are organized as follows:

- ✓ DISHUB SU, as the beneficiary and pilot of the SUMP, as well as the leading sector from SU Government;
- ✓ AFD and Egis, as the development partner and pilot of the SUMP;
- ✓ BAPPENAS, as the monitoring ministry of the SUMP from the central government.

Figure 1. The actors of the SUMP Mebidangro



### ■ Diagnosis

The diagnosis shows that the Mebidangro area is quite particular. Although it is in the average of Indonesian cities in terms of roads, it has one of the lowest rates of usage of public transport and the congestion ratio is quite high.

This points to the need of development of public transport, by developing the infrastructure, the offer, and giving an appropriate level of service. Road based PT services are necessary and need to be developed. But Mebidangro has a large number of rail assets that could be used for a rail/LRT based transport services (e.g. Metro do Porto and its tram-trains that are capable of urban and regional services with the same rolling stock): this contributes to reduce the CAPEX and OPEX of rail projects. Other modes, like fluvial bus and cable car, could also be related in the Mebidangro context and contribute to tailor made transport solutions.

Several other key takeaways of the diagnosis are:

- ✓ Urban sprawl is not controlled, and without strict integrated land management – disabling the densification of developments
- ✓ Current public transportation has area of improvement in parallel to mass transit development
- ✓ There is no mass transit developed, nor trunk corridors
- ✓ Traffic safety is low and can be increased through tangible and intangible measures
- ✓ Motorized vehicle fleet will develop strongly and agencies must put in place policies to control the growth
- ✓ Reform transport bodies at Mebidangro and Provincial levels to enhance streamlined management and financing of mobility projects to simplify the currently complex and inefficient procurement schemes and capacities
- ✓ Street and sidewalks shall be improved for people and especially marginalized groups (disabled) as they currently do not allow appropriate circulations
- ✓ Implementation of measures for higher liveability of the public space, for a sustainable built environment to change the current paradigm

Finally, developing soft modes and TOD (stations) could contribute to the constitution of a virtuous mobility system adapted to the population needs and expectations.

#### ■ Participation as a central part of MYC and SUMP

This step allowed important coordination and discussions between the actors who eventually gather behind the same goals and vision, by gathering the voices of all actors of mobility in Mebidangro. The process was conclusive into selecting the ambitious scenario for the development of urban mobility in Mebidangro. The process can now be replicated and improved in future years by sub-national agencies in their infrastructure planning efforts.

#### ■ Selected ambitious scenario for mobility development

However, the selection of the scenario is only a prerequisite for developing sustainable mobility. After the actions are adopted by the authorities, new challenges of implementation will be encountered – but should be mitigated with then enhanced enabling environment.

An important level of effort is expected to execute the ambitious scenario for mobility development. The momentum of the SUMP shall also be used by leading agencies to pursue collaboration with all actors and engage the private sector.

#### ■ Before the vision, goals and mobility scenarios

The vision, goals and mobility scenarios component has shown benefits as beforehand, various provincial and municipal government entities had low coordination around mobility projects, different focuses and interests, and worked on different horizons in a scattered manner. This notably resulted from the lack of translation from national directives into regional regulations.

#### ■ After the vision, goals and mobility scenarios

The actors now benefit from forums for coordination which have proven their use, a common vision for mobility development, consensual measures and agreed methods of planning. The several knowledge dissemination executed during this step also provided for tools to understand and conduct mobility planning. This is an encouraging growth in the readiness for projects implementation, which can be replicated in other cities of Indonesia by the Supervisory entity of the SUMP, BAPPENAS, after the efforts bring to light concrete results.

#### ■ Action Plan

Actions are grouped into integrated packages, or “blocks” which correspond to the themes within the previous scenarios. These blocks cover the six main facets of mobility: Urban Planning & NMT, Road Network & Private Vehicles, Public Transport, Digitalization, Governance and Environment.

##### ■ Urban Planning & NMT

The goal is to tackle the mobility issues at one of their root causes: the need for motorized transport. It is proposed to be approached by enabling active mobility (or non-motorized transport) and improving land management to reduce reliance on vehicles and creating new revenues channels.

- ✓ Mixed-use zones
- ✓ Permanent & periodical closure of roads
- ✓ Comfortable and safe sidewalks
- ✓ Development of safe bicycle lanes
- ✓ Law to restrict urban sprawl
- ✓ TOD & LVC frameworks



The actions of the urban planning & NMT block require limited costs and innovation. However, important coordination between entities between BAPPEDA, DISHUB and PUPR at provincial and Mebidangro levels, and technical support from the central ministries on the regulatory works. Here, non-motorized transport related to soft or active modes, and TOD refers to estate developments tied to transit stations.

#### ■ Road Network & Private Vehicles

The integrated package of actions to address the road network and private vehicles usage in Mebidangro aims at homogenising roads quality across territory, calm traffic and reduce congestion sources by providing multimodal facilities.

- ✓ Enhance road link Medan – Berastagi
- ✓ Medan circular roads
- ✓ Quality road network across Mebidangro
- ✓ Standardized road signage
- ✓ Traffic calming measures at blackspots
- ✓ Limit freight vehicles operating hours
- ✓ Dedicated Park and Ride at transit hubs
- ✓ Key multimodal hubs

The construction and improvement of roads and hubs require particular attention regarding the feasibility. The adequate organizational and funding schemes must be agreed between authorities given that this infrastructure relies on different administrations of Mebidangro – hence emphasizing on the importance on the necessity for an integrated land transport authority. The tangible measures shall be expected on a medium to long-term with the right efforts.

#### ■ Public Transport

The public transport actions drive towards an increased use of collective vehicles by inhabitants of Mebidangro – indicated by the public transport modal share. This increase is possible through structuring backbone transit lines while improvement of existing transport assets proper to the area, and in parallel proposing innovative and alternative public modes to all communities.

- ✓ BRT wider network
- ✓ School bus lines
- ✓ Minibus routes optimization and rejuvenation
- ✓ Urban rail wider network
- ✓ Increase rail service levels
- ✓ Implement waterbus lines
- ✓ Public transport campaigns

BRT line 1 is a committed project under development by the regional and central authorities and partners. Its success is crucial for the feasibility of other lines. However plural governance measures are necessary for their implementation. It is expected to have BRT and rail networks in the long-term.

#### ■ Digitalization

The actions related to digitalization enable to leverage on growing technology uses and actors to provide better collective mobility experience. They cover individual and collective mobility, to respectively optimize and increase them.

- ✓ Traffic monitoring system
- ✓ Mobility as a Service
- ✓ Fare intermodality
- ✓ Passenger information

#### ■ Environment

At the core of the principles for a sustainable and harmonious mobility, environmental considerations on mobility are addressed by this package of actions. The goal is to put in place regulatory tools to improve environmental management and reduce emissions of GHG and air pollutants from mobility.

- ✓ Incentives to reduce fuel consumption
- ✓ Tax on motorized vehicles using urban roads
- ✓ Cleaner energies for all road vehicles
- ✓ Renewable energy for rail
- ✓ Air quality stations

✓ Environmental issues campaigns

■ Governance

Governance actions aim at improving the enabling environment for mobility projects development through regulatory and policy reforms, and creation of new funding channels.

✓ Implement Metropolitan Transit Authority

✓ Corporate tax on mobility

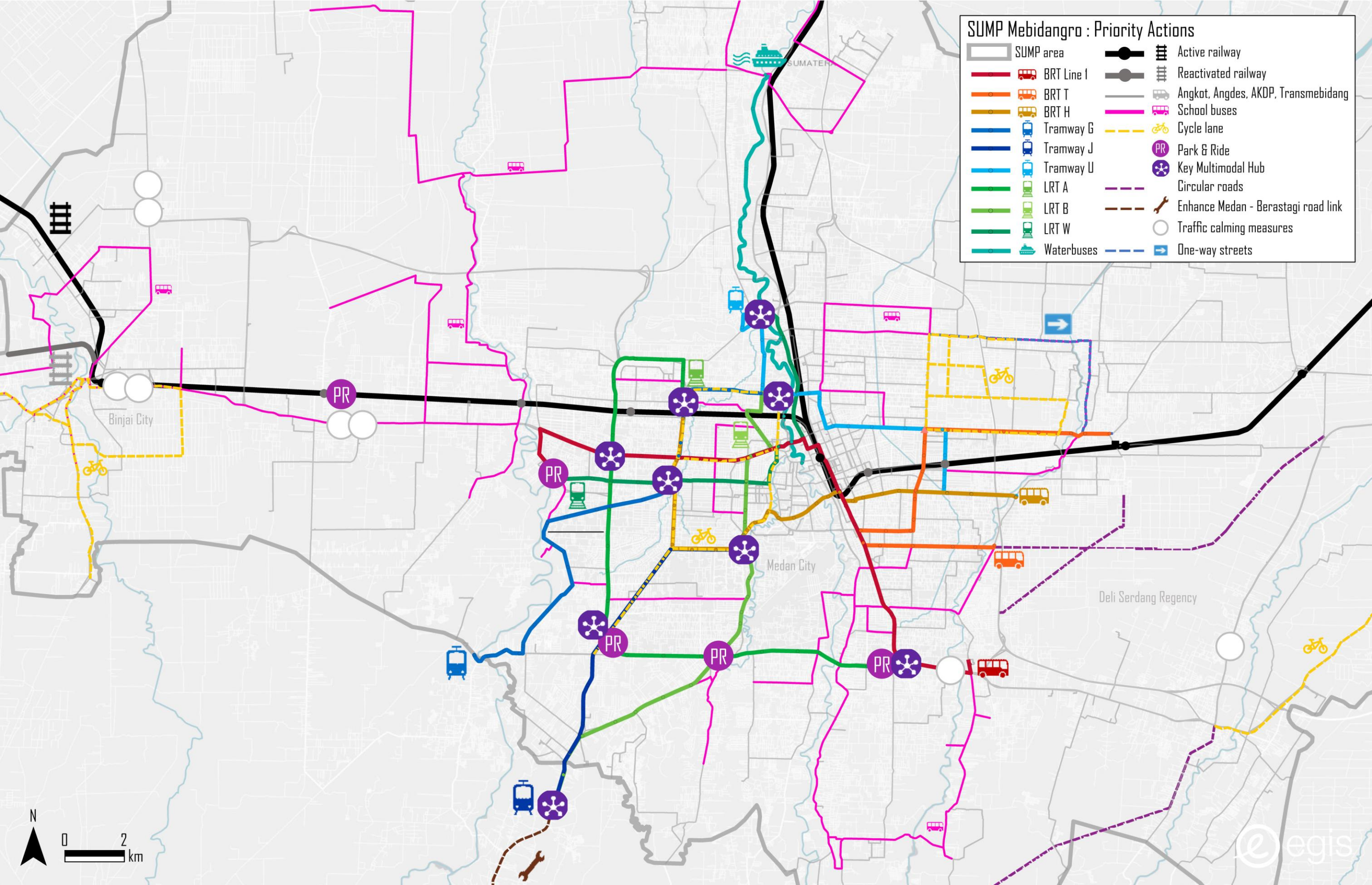
✓ Separate train and track operators

✓ Reform minibus organization and system

✓ Technical assistance of capacity building



Figure 2. Actions of the SUMP Mebidangro





## ■ Observatory

The Observatory on Urban Mobility for Mebidangro is a set of mobility indicators compiled in a visual dashboard. It provides information on the evolution of mobility through years against baseline values and horizon targets. When applied as intended, MRV will benefit sub-national administrations, central agencies, international partners and the community in the management of mobility. It has plural characteristics:

- ✓ Provide strategic insights: indicators allow quick insights on mobility. Output can be used for analyses and evaluations by Mebidangro leaders for mobility planning.
- ✓ Timely and effective response: MRV information and structure help identifying lagging progress and responsible institutions – and in term find quick and effective mitigations, replacing the need for additional studies.
- ✓ Alignment: the impartiality of data with SMART (Specific, Measurable, Attainable, Relevant, Time-Based) indicators avoids advanced coordination between agencies and foster political alignment for diagnosis and projects.
- ✓ Continuous improvement: indicators must remain flexible to allow evolution in their nature (update in the calculation method, update of targets depending on technology or priorities, etc.). Hence the observatory is evolving.

## ■ The set of observatory indicators

Mebidangro mobility agencies have defined a set of 20 indicators based on their priorities, familiarity, and needs – as well as following the MobilizeYourCity standards.

1. Transportation Projects in Official Plans
2. Accessibility to Public Transport
3. Road Safety
4. Affordability of Public Transport
5. Modal split of PT and NMT
6. Multimodal Integration of PT at Hubs
7. Comfort and Bliss of Mobility
8. Security of Collective Mobility
9. Commuting Travel Time
10. Road Congestion and Delays
11. Energy Efficiency of Overall Mobility
12. Reduction of GHG Emissions from Mobility
13. Reduction of Air Pollution from Mobility
14. Quality and Livability of Public Space
15. Mobility Facilities Space Usage
16. Mass Transit Studied
17. Off-Street Parking Hubs
18. Bicycle Lanes
19. Sidewalks and Pedestrian Facilities
20. Financing for Mobility

The set is composed of 15 impact indicators (blue) and 5 investment indicators (purple) (MYC core indicators). They measure environmental, social, economical, financial, planning and technical evolutions of urban mobility for an efficient monitoring. While the impact indicators show the performances of urban mobility in Mebidangro, the investment indicators are clear measures of projects preparation.

## I.6. Conclusions

### ■ Benefits of the mass transit measures

Mass transit projects are highly expected and some are already committed and under preparation. They are structural for the targeted sustainable urban mobility in Mebidangro. Their impacts are sought after.

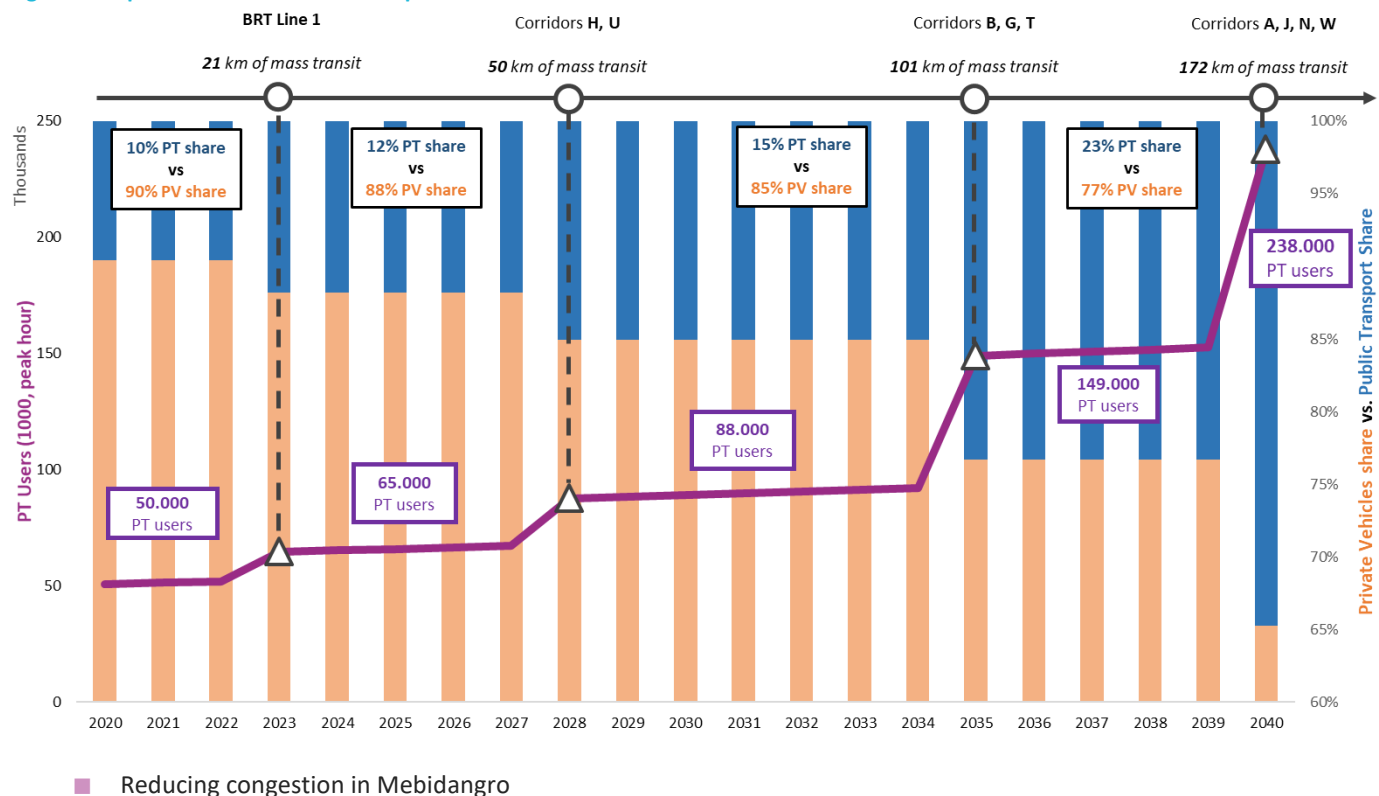
#### ■ Shifting from private vehicles to public transport

The development of mass transit first sought benefit is the increase of public transport modal share, by shifting users from private vehicles and thus reducing their modal share.

Currently, 90% of trips are made using private vehicles. With each corridors' operations, the share of private vehicles shrinks. Ultimately, the share of private vehicle users would be greatly reduced to 65% by 2040, thanks to the implementation of 172 km of mass transit.

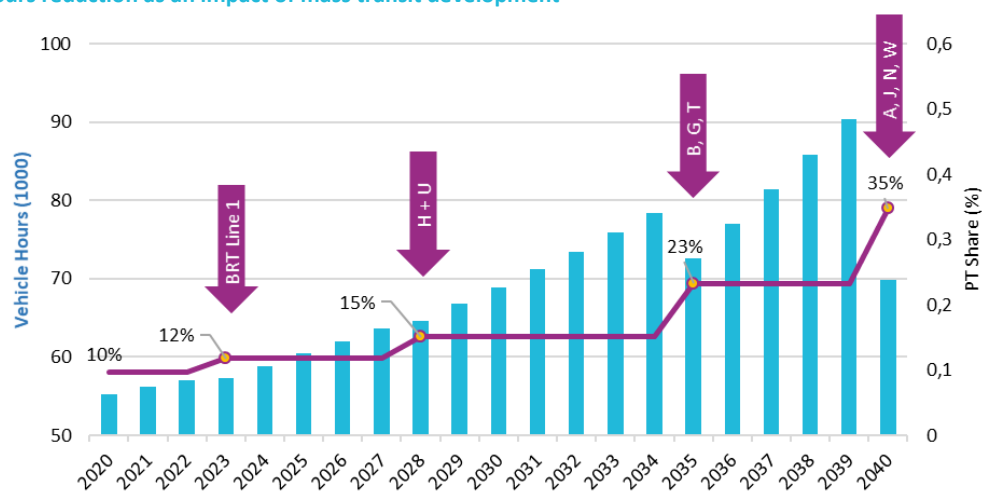
However, an additional vehicle fleet reduction is expected to occur with the implementation of multimodal hubs, integration of public transport modes, as well as the development of NMT and MaaS facilities. The associated decrease is not quantifiable for the moment.

Figure 3. Impacts of mass transit development



As an impact of mass transit development, the congestion in the SUMP area would be decreased as well, with the lower usage of private vehicles for trips. Ultimately, the congestion (represented by Vehicle.Hours) would be greatly reduced by 35% in 2040, with 172 km of mass transit.

Figure 4. Vehicle-hours reduction as an impact of mass transit development



### Overall benefits of the action plan

The overall benefits of the action plan are estimated wherever possible, from all of the measures. However at this stage, not all measures are detailed nor with relevant forecasts (e.g. forecast of private vehicles decrease upon construction of better NMT ways). It can be considered that the following impacts describe a pessimistic outlook.

#### Increased accessibility to formal mobility

It is expected that the SUMP actions provide to five times more people access to formal transit within 750 meters of their habitats. In 2020, less than 4% of the population has access to formal transit for safe and comfortable trips. Upon reforming minibuses, this figure would reach more than 90%.

#### Reduction of GHG emissions from mobility

The proposed actions offer reducing by 20% GHG emissions forecast of 2035. This is allowed by avoiding and shifting from private vehicles with alternatives such as mass transit. Other measures such as awareness raising, fleet rejuvenation, traffic calming, NMT and others would also contribute to increasing this figure but are not quantifiable for the moment.



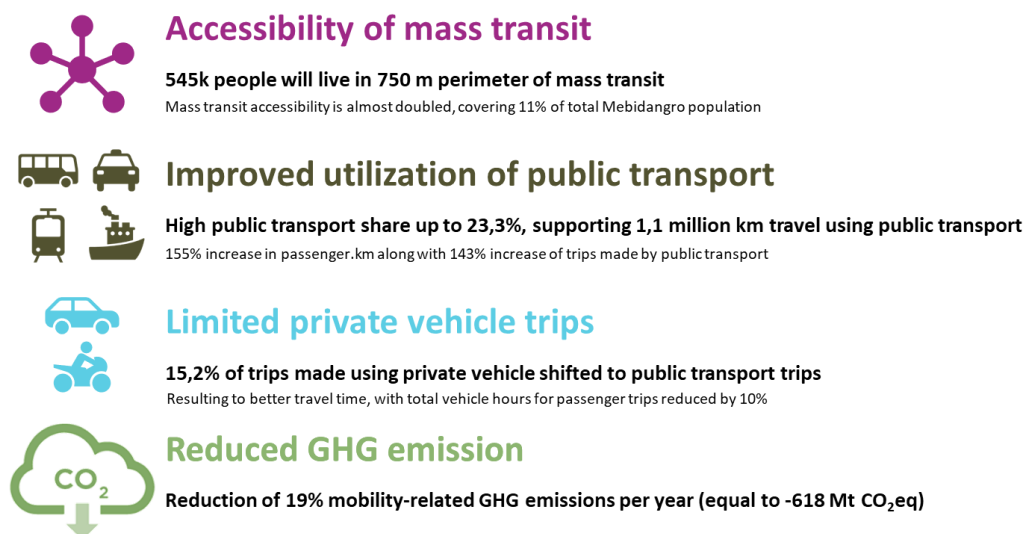
### ■ Other intangible benefits

The Action Plan bears more benefits which are difficult to quantify at the time of the preparation of the SUMP Mebidangro. These include the reduction of congestion and GHG emissions from the growth of NMT, MaaS and school buses, as well as the socio-economic benefits of mixed-use zones, multimodal hubs, sidewalks, improved bus and railways systems and increase road safety. On the other hand, intangible benefits are distinguishable, particularly on the governance and organization of mobility:

- ✓ Existence of an integrated plan and guide for mobility development. Previous plans and initiative for urban transport were isolated and considered to a limited extent the peripheral aspects of mobility. the SUMP provides a common platform and document to integrate approaches and coordinate governmental entities.
- ✓ Clear priorities for investment at the urban scale.
- ✓ Evolving reference for projects necessitating cooperation. Mobility projects being of a grand nature, it is necessary to combine the efforts of all partners, including international and domestic private partners.

To conclude, the SUMP action plan would enhance many different aspects in Mebidangoro in a positive way. Main benefits that could be obtained by implementing SUMP Action plan are the congestion reduction, improved mobility, increased access to formal transit and reduced emissions. Aside from technical and environmental advantages, institutional and financial aspects would also be benefited by the SUMP.

Figure 5. Expected impacts of SUMP implementation in 2035 (compared to the Reference Case)



As a general recommendation, the Action Plan shall be undertaken by SU in accordance with the timeline for a timely execution and gain the maximum benefits. Several key actions must be undertaken promptly by North Sumatra Province to launch the timely execution of the Action Plan.

### ■ Formalization of the taskforce and transit authority

The taskforce and transit authority hold an angular stone role in the SUMP. They allow streamlining instruction and pooling funds from the central government and external parties.

The formation of the taskforce and later transit authority must then be the first step immediately undertaken by the leader of the SUMP, the North Sumatra Provincial government, and its implementing agency DISHUB SU.

This shall be legalized in a dedicated Governor Decree with reference to existing legal ground bases referencing provincial and national plans and regulations in place.

It is feared that without this first organizational novelty, the mobility development of Mebidangro has very little chances being observed in the future, and that projects are again developed in an unintegrated way.

### ■ Commitment and pursued development of BRT Line 1

The development of the project BRT Line 1 (from Pinang Baris to Amplas) is under planning with the Province and National instruction, with international and domestic partners. It has been under study for the past six years.

The delivery of this project would indicate a favourable environment to all parties involved in mobility. Thus, it would serve the higher purpose of fostering efforts for the Action Plan. The commitment on this project is crucial and the development must be pursued until the operations of the line.

### ■ Formalization of MRV as part of the SUMP

Although agreed upon during the SUMP preparation, the Observatory on Urban Mobility of Mebidangro constitutes a component of work with important value, just as the mobility planning of the core SUMP.

It must be budgeted by the transport agency of North Sumatra, on a bi-annual basis. Mobility agencies and the province must adhere in future years and participate to its updates.

Hence, it is crucial for the SUMP Provincial Decree of North Sumatra Governor to include MRV as a full component of the activity implementation, identifying responsible entities and sources of budget.

Such formalization gives way for the central government to publish and use the Mebidangro Observatory as a model to encourage its replication in other cities of Indonesia.

#### ■ Procedure for MRV implementation

Towards formalization and updates of the Observatory, there are several steps to undertake by the North Sumatra Province Transport Agency as the implementing agency of the SUMP.

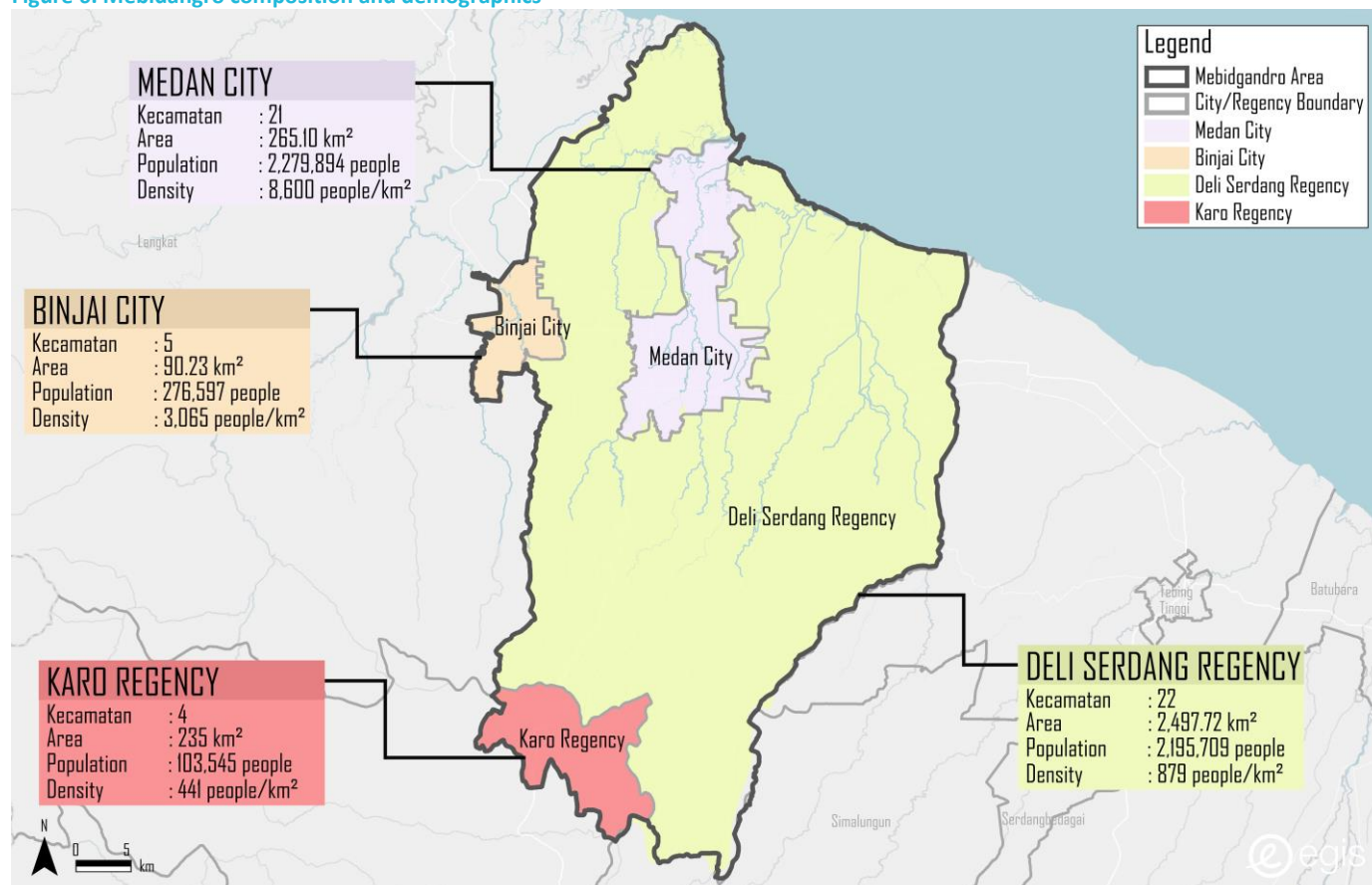
- ✓ Validation of Observatory on Urban Mobility as part of the SUMP Final Report by the Steering Committee.
- ✓ Formalization of the Observatory with Provincial Decree and assignment of the lead to North Sumatra Transport Agency and other entities (must mention the SUMP decree – Decree No. 188.44/412/KPTS/2020).
- ✓ Budgeting and preparation of MRV activities at the North Sumatra Province Transport Agency.
- ✓ Preparation of Terms of Reference based on the recommendations for the Observatory updates during the first quarter of future years (January to March).
- ✓ Bi-annual updates of the Observatory on Urban Mobility in Mebidangro (Tendering, Procurement, Execution, Validation, and Publishing)
- ✓ Sharing the Observatory on Urban Mobility updated reports to central agencies, and simplified dashboard and datasets publicly (for example on the DISHUB SU website).

# I. Preface

## ■ Introduction to Medan Metropolitan Area (Mebidangro)

Mebidangro consists of two cities and two regencies of North Sumatra Province, including Medan City, Binjai City, Deli Serdang Regency, and part of Karo Regency. The metropolitan area was established by Presidential Decree 62/2011 on the Establishment of the spatial Plan for Mebidangro. It is the largest metropolitan area outside Java, and is as of 2019 home to 4.855.745 inhabitants. Compared to other metropolises of Indonesia, it is the fifth largest after Jakarta, Surabaya, Bandung and Semarang.

Figure 6. Mebidangro composition and demographics



The population of Mebidangro is expected to double by 2060. The centre of the metropolitan area, Medan City is the densest with 8.600 inhabitants/km<sup>2</sup>, whereas the districts of Karo are the least dense with 441 inhabitants/km<sup>2</sup>. Several secondary centers in Binjai City and Deli Serdang are observed closer to Medan City.

## ■ Mebidangro and urban mobility setbacks

With an increasing urban population, Mebidangro faces growing challenges in transport and mobility. Inhabitants have had a facilitated access to private motorized vehicles, resulting in increasing congestion along main road axes. The growth of road traffic resulted not only in lost time, but also in increased environmental and social externalities (GHG emissions, injuries and casualties...). The historic minibus industry and rail lines have also seen their traffic plummet as more flexible options are developed, notably with the booming of online hailing services.

These observations, although often unquantified, were the basis of diverse studies in the past and were addressed with different urban transport plans. Most of the plans proposed linear projects of mass transit or minibus rerouting, covering Medan City only (monorail, LRT, BRT...). While the development of mass transit would indeed contribute to solving urban mobility challenges (i) it must serve the population regardless of the administration they live in and (ii) its important costs of implementation and operations cannot be borne by a sole sub-national administration. These two points were reflected in the projects development observed between 2010 and 2020, that failed because of the lack of planning and financing capacities from the municipal governments.

This leads to the Sub-National Governments to agglomerate into a Metropolitan area – under the North Sumatra Province – to cover coherent needs of mobility in the area as well as combine strengths for funding capacity. However, support from the central government is still necessary. As per the National Medium-Term Development Plan of 2020-2024, two main criteria are set by BAPPENAS for the regions to benefit from funding support: the existence of a mobility plan and a transport authority body that covers the metropolitan area set out by Presidential Decree.

The gap between the requirements for central funding assistance and the existing planning for mobility in Mebidangro lies in the accuracy of problems identification, geographical coverage and completeness of the planning and proposals. This is recognized by cities and North Sumatra province who want to develop a comprehensive understanding of mobility patterns and needs in order to define priorities to set up a sustainable urban mobility system. Their priority lies in the development of urban mass transit network and consolidation of the existing one. As part of its efforts to improve air quality, Mebidangro wants to encourage the development of non-motorized transport and restrict the growing number of private vehicles.

This SUMP (Sustainable Urban Mobility Plan) document proposes to cover this lacuna by answering the following questions among others: what and where are the true and quantified challenges for mobility in Mebidangro? what are the most relevant sustainable projects to address? who must be involved in planning and what are the key success factors to avoid other inconclusive plans? what options are available to fund sustainable projects?

### ■ The SUMP nature and role

The SUMP designates a plan and related preparation method. Through recognized analytical methods and emphasized participatory planning, it results in a strategic framework for sustainable mobility projects development. It provides a comprehensive and data-backed roadmap for mobility development on Mebidangro cities and the Province, while central government can more easily review and support the region.

To ensure the relevancy of the SUMP, and that it focuses on most urgent challenges, a study area that covers the coherent functional space where people work and live was defined. The area (1.254 km<sup>2</sup>) has 3.792.245 inhabitants representing 80 % of Mebidangro population and 84 % of its households. The urban areas of Karo Regency are still part of the plan for specific measures and purposes.

Figure 7. Mebidangro SUMP study area



Meshing multidisciplinary analyses and participatory planning, the SUMP has a comprehensive workplan (more information: [MobiliseYourCity](#)) with four main components, reflected in the structure of this report:

- ✓ Component 1: Inception. Engaging Mebidangro stakeholders and setting up the preparation of the SUMP.
- ✓ Component 2: Diagnosis. The opportunities and challenges of mobility in Mebidangro are analyzed on all aspects (social, economical, financial...) to map the problematic points. These are backed by quantitative and qualitative information.
- ✓ Component 3: Vision, goals, scenarios. By elaborating a common vision and goals, stakeholders identify scenarios for mobility development with measures to reach them.
- ✓ Component 4: Action Plan. Most relevant and impactful measures are translated into a realistic action plan for sustainable urban mobility improvement.



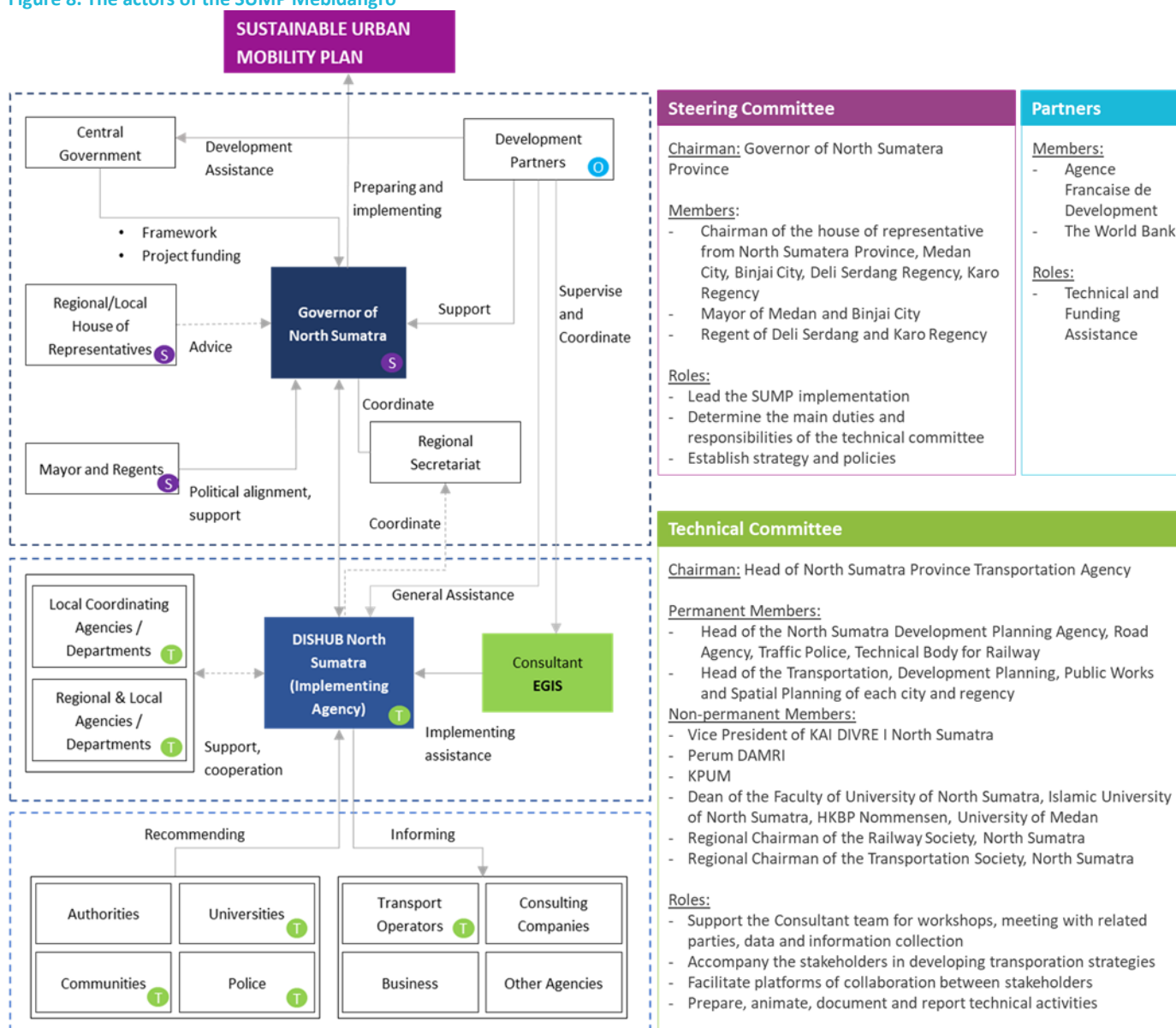
As the SUMP is a plan that will be updated with time, transport planning knowledge will be needed by the Mebidangro stakeholders in future years: the different components are accompanied by knowledge dissemination that is part of a wider capacity development program.

The action plan execution will be monitored with the observatory on urban mobility, including a monitoring, reporting and verification process under MobiliseYourCity guidelines.

### ■ The SUMP actors

While the SUMP offers proposals, monitoring and capacity, it is fully owned by the Mebidangro stakeholders who are responsible for its execution, update and reporting. Their ownership is thus crucial for the SUMP preparation and later projects implementation. In a nutshell, the North Sumatra Province leads the SUMP with the cities and regencies of Mebidangro. The organizational structure of the SUMP is set in Provincial Decree No. 188.44/412/KPTS/2020.

Figure 8. The actors of the SUMP Mebidangro



Several organizations participate in the mobility planning, including non-mobility government agencies and non-governmental institutions (associations, academics, citizen representatives, etc.). It is of utmost importance for the SUMP to carry the voice of the people in need of a more sustainable mobility, which was not always the case in past transport planning initiatives. This first edition of the SUMP is delivered with the development assistance of AFD and MobiliseYourCity, along with Egis as their partner, and under the supervision of BAPPENAS as the coordinating ministry.

It shall be noted that between 2020 and 2022, the COVID19 pandemic outbreak has posed great challenges to the exchanges and coordination between the stakeholders hereby presented. However, the strong lead of the North Sumatra province has resulted in conclusive workshops allowing this consensual final report.

### ■ Summary of regulatory documents



During the preparation of the SUMP, the consultant compiled and took into account the existing regulatory document in order to localize and tailor made the mobility projects proposed to answer to Mebidangro mobility needs. From the documents gathered, the situation on Mebidangro can be summarized into main points as described below.

#### ■ Inconsistent studies and datasets

Most quantitative assessments and analyses do not contain details of methodologies for collection, modelling nor data sources. They are often based on different timeframes and geographical scopes. Thus, most of the assessments will draw a qualitative description. This situation drives the SUMP preparation to a comprehensive data collection to be able to get the clear image on the current mobility of Mebidangro.

#### ■ Central government support programs

The development of mass transit in Medan is set out as a National strategic project in the National Medium-Term Development Plan of 2020-2024. Two main criteria are set by the central government (BAPPENAS) in order for the regions to benefit from support funding for urban transport: the existence of a mobility plan and a metropolitan transit body which authority extends beyond municipal administrative borders.

#### ■ Necessity for a urban mobility plan

The existence of multiple-layer regulations on land use and transportation development have decreased the clarity of the framework which the municipalities shall comply to in order to improve mobility. This has resulted in various initiatives (documented in the rest of the non-regulatory documents) that lack integration, comprehensive assessments, and limitations in terms of geographical covering. The SUMP, under the clear province leadership, will allow for a framework for mobility development with clear responsibilities of each administration within the Mebidangro strategic area.

#### ■ The urgency for a transit authority

The second criteria on the transport authority should be addressed by the Provincial government in parallel to the SUMP preparation. The SUMP will identify key institutional challenges to overcome in order to implement mobility measures in Mebidangro. From this base, an institutional foundation should be ready, in parallel to the Mebidangro cooperative management agency regulation, in order to prepare for the formalization of a cross-city transit authority under the responsibility of the provincial government. The formation of a Mebidangro transportation authority will enable bridging the translation of national and sub-national transport regulations at micro-levels, as well as the executive steering of the transportation projects development.

#### ■ Collaboration between administrations

The non-availability of the Final Business Case (FBC) of the Medan LRT indicates that coordination needs to be improved, and the absence of national urban mobility plan increases the compliance necessity for the SUMP towards various mobility-related regulations.

### ■ SUMP horizons

The SUMP has fixed time horizons corresponding to different milestones. The actions of the SUMP follow these time references.

- ✓ 1 to 3 years for short-term measures, 2023, which will be consistent with the end of the RPJMD 2019-2023;
- ✓ 8 years for the medium term, 2028 which will be consistent with future RPJMD 2024-2028;
- ✓ 15 to 20 years years for long-term measures, 2035, which consists of projects with complex preparation needed for their implementation

### ■ Team and development process

During the preparation of SUMP, necessary arrangements with the stakeholders are taken to optimize the process and decision making involved. The preparation of SUMP engages stakeholders from the Provincial and Mebidangro administrations, central government and development partners. Thus to streamline and organize the preparation of SUMP, the stakeholders are organized as follow:

- ✓ DISHUB SU, as the beneficiary and pilot of the SUMP (via its division of Railways and Development), as well as the leading sector from SU Government;
- ✓ AFD and Egis, as the development partner and pilot of the SUMP;
- ✓ BAPPENAS, as the monitoring ministry of the SUMP.

### ■ Contribution to the SDGs

The Sustainable Development Goals adopted in 2015 by all United Nations Member States provide a shared blueprint for peace and prosperity for people and the planet. Indonesia has rattled the 2030 Agenda for Sustainable Development, committing to develop sustainably in different fields. The mobility and transportation industries are key domains to address, and the SUMP tackles indirectly all SDGs.

A few ones are more directly related with improved and sustainable mobility:

- ✓ Good health and well-being of communities with safer built environments. (3)
- ✓ Gender equality in the access of public infrastructure and its governance. (5)
- ✓ Promoting sustainable economic growth with decent work facilitated by mobility projects. (8)
- ✓ Construction of resilient and sustainable infrastructure through innovation. (9)
- ✓ Reduction of inequalities as for the access to public infrastructure. (10)
- ✓ Insure inclusive, safe and sustainable human settlements and cities. (11)
- ✓ Act on transport modes for climate action. (13)
- ✓ Revitalization and strengthening of international bodies for sustainable development. (17)

Figure 9. Sustainable Development Goals related to the SUMP



#### ■ Goal of this document

This document constitutes the final report of the SUMP Mebidangro, summarizing its preparation and resulting action plan. It aims at providing a clear roadmap for mobility development with data-backed decisions and consensual participatory processes, instead of unquantified observations and theoretical recommendations.

This first edition is based on 2020-2021 field conditions and takes into account parallel works for mobility in Mebidangro. As the urban, economic, technological and economic landscapes will evolve in the coming years, the SUMP shall be updated according to the needs of the community; and its execution monitored and evaluated thanks to the observatory.

This document constitutes the basis for the Provincial Decree of North Sumatra intended to formalize the SUMP implementation, in early 2022. It shall also give way to further studies and planning, before implementation of transportation and mobility projects for the urban area of Medan, Mebidangro.

## ■ Comparison of MYC and UMP Indonesian Guidelines

The sequence of work of the SUMP Mebidangro corresponds to the MYC guidelines, which are very similar with the UMP Indonesian Guidelines but with slight differences in structure as per the table below.

Figure 1. SUMP Mebidangro structure compared to UMP Guidelines.

SUMP Mebidangro Final Report		Equivalence in UMP Indonesian Guidelines
<b>I</b>	<b>Preface</b>	
	<i>Introduction to Medan Metropolitan Area (Mebidangro)</i>	Step 02 : Defining the Study Area
	<i>Mebidangro and urban mobility setbacks</i>	
	<i>The SUMP nature and role</i>	
	<i>The SUMP actors</i>	Step 03 : Establish Working Group
	<i>Summary of regulatory documents</i>	Step 01 : Assembling Resources
	<i>SUMP horizons</i>	Step 02 : Defining the Study Area
	<i>Team and development process</i>	Step 03 : Establish Working Group
<b>II</b>	<b>Diagnosis</b>	
II.1	<i>Introduction</i>	Step 06 : Reviewing the Urban Structure
II.2	<i>Institutional and Financing Aspects</i>	
II.3	<i>Urban Structure and Demographics</i>	
II.4	<i>Mobility Dynamics</i>	Step 07: Assessing the Mobility Situation
II.5	<i>Social Aspects</i>	Step 06 : Reviewing the Urban Structure
II.6	<i>Environment and Mobility</i>	Step 07: Assessing the Mobility Situation
II.7	<i>Summary of the Diagnosis</i>	Step 08: Summarizing Problems and Opportunities
<b>III</b>	<b>Vision, Goals and Mobility Scenarios</b>	
III.1	<i>Vision for Urban Mobility</i>	Step 04: Defining the Vision Step 05: Defining the Goals and Objectives
III.2	<i>Mobility Scenarios</i>	Step 09: Developing and Comparing Scenarios
III.3	<i>Evaluation of the Scenarios</i>	Step 10: Select the best Scenario & design the Strategy
III.4	<i>Summary of the Vision, Goals and Mobility Scenarios</i>	
<b>IV</b>	<b>Action Plan</b>	
IV.1	<i>The Action Plan</i>	Step 11: Defining Measures and Measure Packages
IV.2	<i>Cost estimates, Sustainable Funding &amp; Financing</i>	
IV.3	<i>Implementation Modalities: Planning and Organization</i>	Step 12: Producing the Implementation Plan
IV.4	<i>Summary of Impacts and Way Forward</i>	
<b>V</b>	<b>Mebidangro Urban Mobility Observatory</b>	
V.1	<i>Rationale and Goals</i>	-
V.2	<i>Indicators</i>	
V.3	<i>Monitoring Management</i>	
V.4	<i>Next Steps</i>	

This course of action is taken on considering the need for additional data and comprehensive assembly process needed, as well as the necessity for a monitoring tool (MRV). Additional time was allocated to gather large and comprehensive data, that was used to represent the actual mobility situation of Mebidangro. It provided with the benefit of gathering stakeholders around a consensus and come up with clear vision on mobility goals.

## II. Diagnosis

The diagnosis on urban mobility in Mebidangro depicts the picture of the current state of people and goods movements.

### II.1. Introduction

Stemming from comprehensive information, the diagnosis covers the aspects of urban structure, institutions and regulations, transport infrastructure and services, mobility demand and carbon emissions.

#### ■ Goal and general approach to the diagnosis

The goal of the diagnosis is to feed the reflection on weaknesses and opportunities of the current mobility ecosystem in Mebidangro, and support the establishment of a vision and scenarios in the next work component. However, the diagnosis includes important insights that can be used for parallel studies and other mobility programs by North Sumatra.

The method to complete the diagnosis follows MobiliseYourCity initiative guidelines, that are closely linked with the European Union guidelines for Urban Mobility Plans. However, the approach is adapted to Mebidangro to emphasize adequately on local circumstances.

It is also in line with the requirements of the national and sub-national governments involved. Those are fully engaged during the preparation of the diagnosis, through consultations, workshops, focus group discussions, trainings and reviews. As the first component of the SUMP, the diagnosis component was also the opportunity for the different administrations to align their perspectives on mobility in Mebidangro.

#### ■ Gathering the information necessary

The analyses of the diagnosis are based on an important data assembly developed specifically for Mebidangro. Primary and secondary information were collected:

- Focus Group Discussions and interviews: representatives of all administrations of the North Sumatra Province, and of the cities and regencies of Mebidangro, were interviewed to gather specific insights on mobility infrastructure and services. Those discussions also took place in FGDs, with notably non-governmental stakeholders such as community representatives and academics.
- Documentation assembly: existing studies, regulations and plans were compiled and challenged to deepen the (unbiased) understanding and develop an approach to future mobility in Mebidangro.
- Data collection: the quantitative and qualitative data collected in the first two activities above was completed with an extensive field data collection. Households, passengers of public transport and private vehicle users were part of the investigation across the study area.

The data collected constitutes an important inventory used for the SUMP. It can be used in the future by the beneficiary for other studies.

#### ■ Relevancy through adaptability

It shall be noted that the collection methods was adapted to the Mebidangro context to great extents for best reliability of the information. All engagement activities with people across organizations were made in Indonesian for best depth of exchanges, before being consolidated in English. The field surveys were executed and data consolidated by the prominent academic institution University of North Sumatra, which members know the region in detail.

Several adaptation measures were also necessary in light of the sanitary challenges specific to the survey period (COVID-19 pandemic) – opening the way to innovative uses of digital tools for surveys. All these adapted methods are described in the Survey Report.

The information gathered between 2020 and 2021 allows consolidating the diagnosis and vision for mobility. However, it is likely to evolve in the coming years and hence several data assembly activities shall be carried out again upon the updates of the SUMP and Observatory.



Figure 10. Snapshot of information gathering activities for the diagnosis



### ■ Structure of the diagnosis

The diagnosis covers multiple aspects of mobility in Mebidangro in this section:

- ✓ Institutional and Financing Contexts
- ✓ Urban Structure and Demographics
- ✓ Mobility Dynamics
- ✓ Social Aspects of mobility
- ✓ Environment and Mobility

## II.2. Institutional and Financing Aspects

An overview on the governance of mobility in Mebidangro is proposed. It describes succinctly the existing setbacks of the organizations to implement and run sustainable transport.

### II.2.1. Transport Institutions

#### ■ Administrative and modal boundaries

Today, the governance of mobility development and operations in Mebidangro is scattered by administrative and modal boundaries. Although the responsibility for mobility planning lays under the region (after decentralization), there are several obstacles to its effective development.

North Sumatra Province is responsible for translating national plans into provincial objectives and facilitating important infrastructure development (large terminal facilities, provincial roads, etc.). The cities and regencies have a similar responsibility within their own boundaries (roads, city mass transit).

Furthermore, just like anywhere else in Indonesia, rail infrastructure and services are managed directly by the central government. On the other hand, roads, minibuses and buses are licensed by the sub-national authorities, with intra-city services being under cities and regencies (angkot, bus, small terminals) and inter-city services under the province (angkot, bus, large terminals). However all of these modes are funded by the private sector. The separation of modal responsibilities also applies to hired transport (taxi, online hailing).



**Figure 11. General responsibilities of authorities over mobility infrastructure and services in Mebidangro**

Figure 11: General Responsibilities and Authorities over Mobility Infrastructure and Services in Mebidangro

Republic of Indonesia Ministry of Transport				North Sumatra (SU) Provincial Government				Mebidangro Cities and Regencies Governments						
Directorate General for Land Transport		Directorate General for Railways		Public Works	Road Agency	Transport Agency		Public Works Agencies	Road Agencies	Transport Agencies				
Road Public Transit Terminals A (big)	Road Public Transit Services (BTS)	Rail Services	Rail Infrastructure	NMT Facilities	Provincial Roads	Intercity Road Public Transit Services	Road Public Transit Terminals B (medium)	Intercity Transit Hires (Taxi & Online hailing)	Intercity Urban Mass Transit	NMT Facilities	Municipal Roads	Road Public Transit Terminals C (small)	Intracity Road Public Services	Intracity Mass Transit

The geographical and modal separations of responsibilities over mobility infrastructure and services poses several obstacles to the cooperation between authorities; resulting in the lack of harmonization between facilities (sidewalks, quality of roads...) and services (trunk lines of public transport, parking, intermodal integration...); because projects are done in silos.

The institutions lack capacity in terms of financial and human resources. This results in a low enforcement of regulations and an historical low involvement in the management of public transport. The mere role of the regional authorities over road-based public transportation remains the licensing of routes. This results in exaggerated competition in semi-formal angkot private operations.

The state of regional governance over mobility results from years of decentralization that was not always accompanied with capacity transfer. The lacking regulatory framework for planning also reflects this need of formalization.

#### ■ Plans and programs, emergence of Metropolitan Area

Indonesia does not have a National Urban Mobility Plan. Projects and programs are defined at different ministries (BAPPENAS, MOT) through different documents (blue and green books, national priority projects, etc.). The translation of those national regulations into regional policies is made through the regional strategic plan. However, no dedicated document exists for transportation development.

It is believed that the formalization of mobility in all levels of administration is occurring slowly. The first presidential decree 62/2011 defines the area of Mebidangro as a metropolitan region which shall be managed by a dedicated entity for public infrastructure. Provincial decree 5/2016 sets the grounds for a metropolitan body to manage an integrated manner public facilities over Mebidangro.

These policies have yet to result in the formation of a metropolitan coordinating body, to overlook transportation among others public infrastructure. Other plans and policies are limited to the micro-definition of land use and mass transit lines at municipal and provincial levels (land use in RTRW) – but similarly lack enforcement. Given the geographical and modal separations observed before, and the lack of application of policies due to lack of capacity from existing administrations, it is identified that a dedicated body that is responsible for mobility management over the metropolitan area would support developing projects coherently across this territory.

#### ■ Identification of gaps and institutional salient points

The national government already lists the Mebidangro mass transportation system as one of Indonesia's Priority Projects in the 2020-2024 National Medium Term Development Plan (RPJMN). However, funding support for said project is dependent on the existence of a metropolitan-level mobility plan and transit agency which authority extends beyond municipal borders.

Law 26/2007 on Spatial Planning states that management of areas covering more than one administration is carried out by an inter-regional cooperation body (47.1). If the area is of national strategic importance, planning and management falls under the central government (8.1.c). In case the project is not listed under central government authority to manage, then it shall be assigned to the related provincial government as representation of the central government. Salient elements are as follows:

- ✓ Metropolitan areas are not part of the existing government structure and hierarchy, i.e., only districts, cities or regencies, provinces and the state exist legally.
- ✓ The development plan of a metropolitan area cannot stand alone but must be included in the development plans (RPJM) and spatial plans (RTRW) of the relevant regions.

- ✓ Planning and provision of public service facilities must be jointly managed by relevant city and regency governments (except for those under the central government). However, this is rarely observed because of limited regional and provincial budgets.

The lack of a transit authority in Mebidangro that manages the entire metropolitan area and ensures the coherency of the system has several results. (1) complex allocation of responsibilities for urban transport between the central, provincial, and regional governments. (2) uncoordinated transport planning and management across the cities and regencies that make up Mebidangro. (3) disjointed management bodies for each transport mode, leading to difficulty in integrating the various transport plans, and (4) Institutional silos between government departments, leading to disjointed land-use and transport development, or contradictions between financial needs and fare restrictions.

The planning and management of urban transportation in Mebidangro falls under the purview of local agencies:

**Figure 12. Roles and responsibilities of key institutions**

Institutions	Role and responsibilities
Transport Agency (Dishub)	Responsible for land transport strategies and regulations; construction; maintenance; management & operation of buses; traffic management; tariffs for public transport in SUMUT.
Public Works Agency (Dinas PU)	Responsible for monitoring, supervising, maintaining, developing and securing roads, bridges, water resources and utility lines in SUMUT.
Spatial Agency (Dinas Tata Ruang)	Responsible for planning, utilizing, and controlling SUMUT land use; Assists in transport network planning and land acquisition.
Regional Development Planning Agency (BAPPEDA)	Prepares development plans and budget, conducts research and development, monitors and evaluates progress; Coordinates development planning between district governments and provincial and central governments.
Regional Financial Management (BPKD)	Responsible for managing regional government finance and assets; Sets the amount of financial assistance to regional governments; Prepares project financial plans; arranges financing from MOF for loans, equity, grants, and other forms of financial support.
Regional Investment and Promotion (BPMP)	Supervises and coordinates investment and promotional activities in the province; Reviews investments in transport, provides licenses, attracts investors
Regional Environment Management Agency	Formulates and enforces policies for environmental management; Responsible for reviewing and approving Environmental Impact Assessments.
Communications and Information Technology Agency	Responsible for matters related to communication, informatics, and public relations; Licenses traffic/transport telecommunication systems.
Traffic Police (Ditlantas Polda SUMUT)	Implements and develops traffic police functions including protection, regulation, VIP escort, and patrol of traffic; Assists in managing the traffic flow during the construction and operation.
Civil Service Police (Satpol PP)	Enforcing local regulations, keeping social order, and providing public protection; Assists in providing protection around construction areas to avoid possible local conflicts.
National Transportation Safety Committee (KNKT)	Oversees transportation systems, conducts investigations, and formulates recommendations for safety improvement and accident countermeasures.

#### ■ A brief focus on paratransit

Among the public transport modes available in Mebidangro, minibuses (angkot) deserve a special attention as they represent the largest number of fleets in metropolitan area's road-based systems. An estimated 7.000+ minibuses are operated by 42 for-profit cooperatives across the cities and regencies of Mebidangro. This results in complex management for the authorities and fierce competition among many minibus owners, coupled with a declining ridership rate, resulting in aggressive driving for seeking passengers and low quality of the service.

The authorities, whether municipal for intracity lines or provincial for intercity lines, license the angkot routes, fleets and fares; and provide management of small and medium terminals. The procurement, funding and financing, management and operations of the minibuses remains under the private cooperatives. This semi-formal scheme translates into exaggerated competition in the streets, as routes are not clearly defined and as a result often overlap.

At operational level, the minibuses are ran by drivers renting the minibuses from cooperatives themselves or individual owners working with the cooperatives. The authorities are thus disconnected from the operations. Drivers are incited to maximize ridership and hence stop at any occasion, offering low speeds to passengers, putting important efforts on vehicles, and creating congestions and risks in the streets.

In order to improve and save this ailing industry which serves great purposes to the community (see following section on accessibility), it is suggested that authorities take on a more important role in the management and funding of the minibuses. The increased involvement of the agencies would come with minimum service requirements prioritizing safety and service quality over ridership.

#### ■ Other modes and way forward

The reform of the angkot industry in Mebidangro is being discussed since 2015. It suggests the merging of several operators within holdings for streamlined and unified operation, with the aim of offering higher quality service and better integration

with the bus rapid transit scheme. However, this reform has not evolved nor progressed much. SUMP considers this reform as important to improve the transportation system in Mebidangro, and it is listed in the Action Plan.

Rail operations are centralized and could benefit from the introduction of private actors in their management in order to leverage on competition for better performances. Bus lines, which are semi-formal, run along longer axes and do not suffer from exacerbated competition.

It shall be noted that in the framework of the ongoing BRT Mebidang project development, a public operating company at metropolitan level is taking shape. Its details are unavailable at the time of this edition of the SUMP, but shall be taken into account in any efforts of formalization of public transport management and organization in Medan area in the future. The analysis shows the importance of the needed integrated management with a metropolitan body over Mebidangro.

## II.2.2. Regional Fiscal Capacity

The administration of public affairs within a region is funded by the regional budget. As regional authorities typically do not have enough fiscal capacity, they are dependent on central transfers. In accordance with Law 33/2004, regional revenue comes from own-source revenue (PAD); balancing funds or transfers from the central government; and other incomes.

Own-source revenue consists of regional taxes, levies, revenue from the management of separated regional assets, and other permitted sources. In North Sumatra Province, own-source taxes typically include motor vehicle tax, motor vehicle name transfer duties, fuel tax, underground water utilization tax, hotel tax, restaurant tax, entertainment tax, advertising tax, street lighting tax and parking tax. The first three are the largest and are directly related to transportation.

Considering the small amount of own-source revenue, the central government has been providing financial support for the transportation sector in North Sumatra through special allocation funds (Dana Alokasi Khusus or DAK). The table below presents the size of DAK for transport development between 2015 and 2019. The average received was about IDR 52 billion per year, with a rising annual trend since 2018.

Figure 13. Special Allocation Fund from Central Government to North Sumatra Province by type (2015-2019)

Description	2015	2016	2017	2018	2019
Road Infrastructure Sector	47,746,880,500				31,023,213,200
Transportation Sector		14,924,958,000			
Special Allocation Fund (Road / Bridge)		28,010,756,000			
Road Connectivity			39,206,464,000	59,342,150,000	39,766,889,591
Total	47,746,880,500	42,935,714,000	39,206,464,000	59,342,150,000	70,790,102,791

Fiscal capacity, the extent to which regional governments have fiscal independence, is high or very high in North Sumatra, Medan, and Deli Serdang, but very low in Binjai and Karo. Fiscal capacity is measured by taking the proportion of own-source revenue over total revenue.

Another measurement as per the Ministry of Finance Regulation (PMK No. 120 /07/2020) is the Fiscal Capacity Index, which is obtained by calculating the fiscal capacity of each regency / city divided by the average fiscal capacity of all regencies / cities in the province. These measurements for Mebidangro are shown in the table below:

Figure 14. Proportion of Local Own Revenue (PAD) to Total Regional Revenue & Fiscal Capacity Index.

Government	Fiscal Capacity, FY 2015-2019	Fiscal Capacity Index, FY 2020 Per PMK No. 120/07/2020
North Sumatra Province	excellent to good (57-40%)	1.115 (high)
Medan City	sufficient (<40%)	3.384 (very high)
Binjai City	low (<20%)	0.486 (very low)
Deli Serdang Regency	medium (<30%)	1.805 (high)
Karo Regency	low (<20%)	0.338 (very low)

**Note:** Binjai, Deli Serdang, Karo experienced deficits for the last 5 years, therefore need support from the North Sumatra Province to cover their expenses

Loans are one of the sources of regional revenue. They are typically intended to finance regional infrastructure and other fixed assets that are revenue-generating, so that the proceeds can be used to repay the loans. The size of regional loans needs to be adjusted to the capacity of the region and managed by skilled staff with disciplined loan repayments.

A region's capacity to pay back loans is measured by the Debt Service Coverage Ratio (DSCR), which is a ratio of net revenue (revenue minus expenditures) over the sum of all loan installments due in a year. North Sumatra Province's debt service capacity is projected to be IDR 7,8 trillion in 2021-2025 based on an assumed DSCR of 2.5.

Figure 15. North Sumatra's debt service capacity and assumptions

Description	2015-2019 (According to Historical Data)	2021-2025 (Projection)
Debt service capacity ratio (DSCR)	IDR 8,7 trillion	IDR 7,8 trillion

Assumptions	<ul style="list-style-type: none"> <li>• DSCR Target: 2.50</li> <li>• Interest Rate: 7.00% (7-day Repo Rate + 2.75%)</li> <li>• Loan Period: 5 years</li> </ul>	<ul style="list-style-type: none"> <li>• Revenue Growth: 2,8% / year</li> <li>• Increase in Salaries: 4,2% / year</li> <li>• DSCR Target : 2,50</li> <li>• Interest Rate: 7,00% (7-day Repo Rate + 2.75%)</li> <li>• Loan Period: 5 years</li> </ul>
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### 11.2.3. Metropolitan-Level Authority

The metropolitan mobility authority is a necessity as identified in the previous paragraphs. Furthermore, it is a clear requirement from ministry BAPPENAS to unlock funding aid towards sub-national governments for mobility projects investment and operations. Hence, it is necessary to discuss the existing grounds and possible way forward for the formation of this authority.

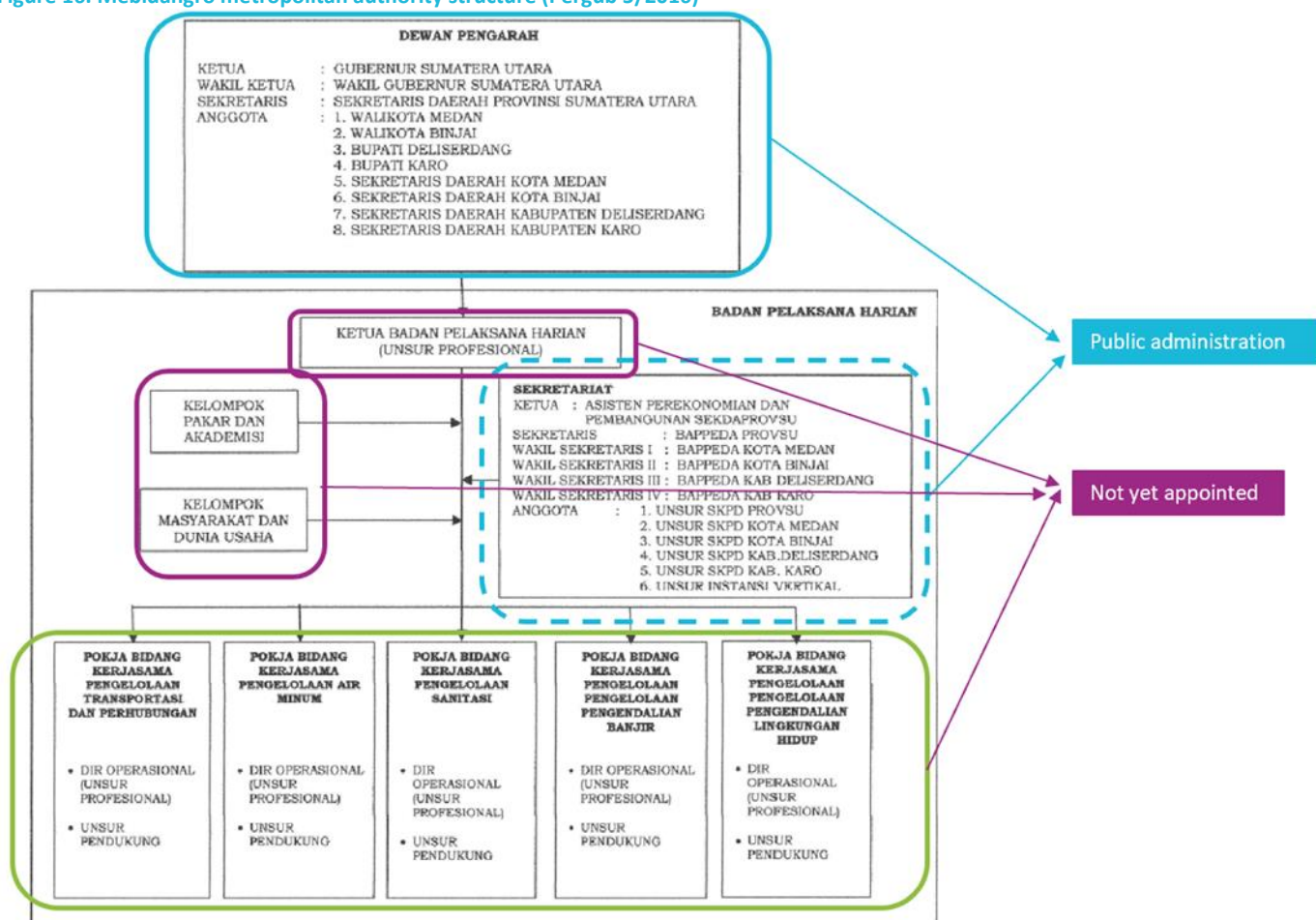
#### ■ Legal grounds for the authority, definitions

Law no. 23/2014 on Regional Government acknowledges urban agglomerations as “urban areas” which should be managed by regions or institutions established and accountable to the regional governments. For cross-regional urban areas, spatial planning and public services are jointly managed by the relevant regions or institutions accountable to the provincial government. To enable an integrated and metro-wide urban transportation system, the role of the province is critical.

Several other cases in Indonesia could be analysed, such as the Jakarta Area operational body (BPTJ) and Bandung Area transport authority in formation. However, as administrations, geographies and funds vary greatly from one region to another, a specific approach must be defined for the formation of an authority for public infrastructure and mobility for Mebidangro.

The government of North Sumatera supports the formation of an urban area-wide management cooperation agency through Governor Regulation 5/2016.

Figure 16. Mebidangro metropolitan authority structure (Pergub 5/2016)



#### ■ Composition of the authority

According Pergub 5/2016, the metropolitan authority would be directed by a steering committee led by the Governor and Vice Governor of SU, and would involve all the mayors and regents of Mebidangro. Daily operations would be led by an executive body with appointed professionals as heads.

The executive body is supported by a panel of experts, a panel of civil society and private sector representatives, and a secretariat led by the assistant governor of North Sumatra, involving the planning agencies and related departments in



Mebidangro. The executive body would have various technical working groups (pokja), and one of them deals with transportation cooperation. However, this regulation has not provided a detailed explanation regarding the structure and management of transportation in Mebidangro and must be deepened through additional regulations in that regard.

#### ■ Further details on the authority

The Pergub serves as a legal umbrella to form the Mebidangro transport authority, but until now there has been no substantial follow-up to the formation of the cooperation agency. To date, the authority has not been formally launched, the executive body is not yet established, and the professionals who are to lead the executive body and technical working groups are not appointed yet. The SUMP provides momentum to move this institutional initiative forward, as described in the Action Plan.

## 11.2.4. Funding & Financing Opportunities

Available funding and financing opportunities for urban mobility are diverse in terms of mechanism, duration, and level of risk. Nevertheless, institutional complexities and the lack of a metropolitan-level transport authority becomes an obstacle in mobilizing the funding and financing to expand the coverage and maintain the quality of transit services.

The figure below shows the range of financing and funding sources available for public transport projects, be it from public or private sources.

Figure 17. Financing v. Funding (WB 2017)

Financing		Funding	
Type	Source	Type	Source
Public financing	Multilateral development banks	Government Revenue	Government taxes
	Bilateral development institutions		Intragovernmental transfer
	Public or municipal debt	User revenue	Farebox revenue
	Tax exemptions	Commercial revenues	Advertising
	Government backed security		Leasing of commercial space
Private financing	Banks		Naming rights
	Equity Investor	Land value capture	Merchandising
	Capital Market		Development base
	Equipment suppliers	Other revenue	Tax base
			Dedicated / earmark taxes

In public private partnerships, commercial lenders and equity investors finance part of the project, while the funding to repay such financing comes from farebox, ancillary, and sometimes real estate development revenues or from the government's budget.

The availability of funding influences the size of financing, especially in privately financed projects. Reliable funding sources are required to make the debt issuance affordable and financially viable over the long-term.

#### ■ Sources of Financing

Financing refers to the resources or capital required to implement a new urban transport project or to extend an existing one before the project-implementing agency generates the necessary revenue to pay for the investment. Sources of financing for an urban transport project are classified into two broad groups: (1) Public financing refers to finance provided to state-owned enterprises (or governments) without exposure to project performance risk; it is not considered private debt if the obligation is backed or guaranteed by the state. (2) Private financing refers to a loan provided by a private entity and is bound by market discipline, meaning that its repayment is subject to project performance risk and its rate of return corresponds to that risk (ADB et al. 2016). Sources of financing include:

- ✓ Multilateral Development Banks, Official Development Agency, Export Credit Agency, Domestic Development Institutions, International Commercial Banks, Local Banks, Vendors
- ✓ Budget allocations
- ✓ Public debt/ regional loans
- ✓ Specific purpose bonds / municipal bonds

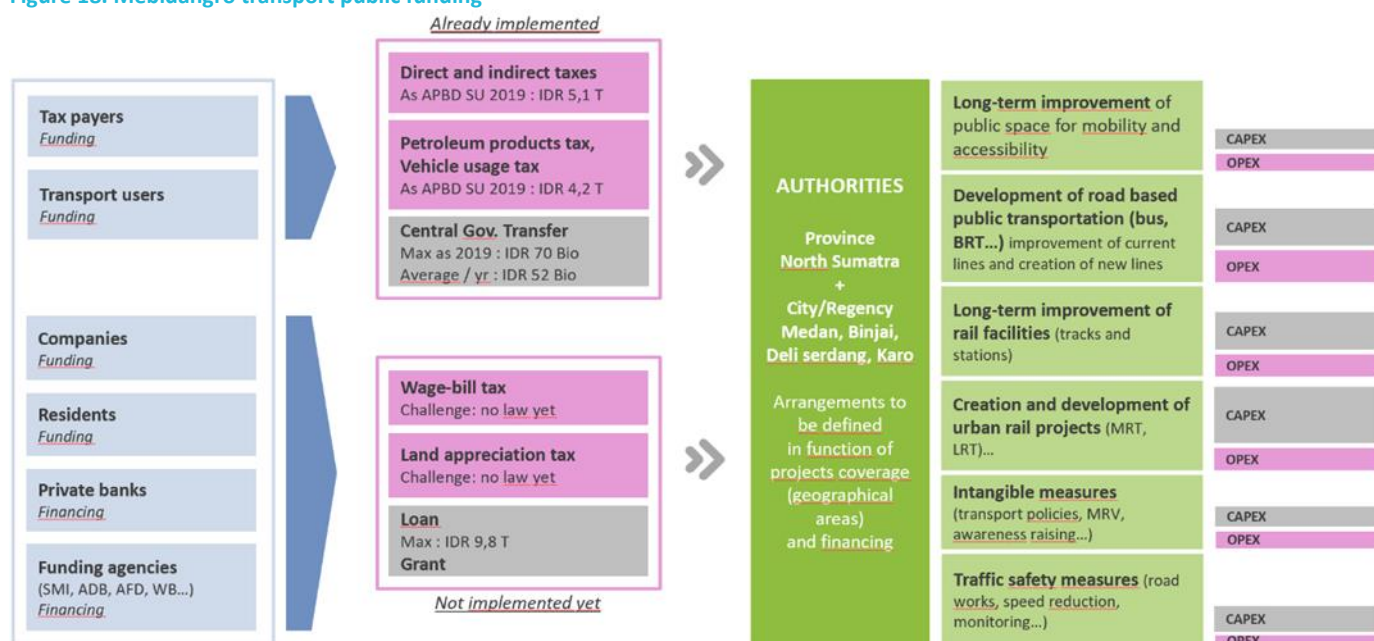
- ✓ SOE financing
- ✓ Development contributions
- ✓ Public Private Partnerships (PPP)
- ✓ Government Non-Budget Investment Financing (PINA)

#### ■ Sources of Funding

Regardless of the type of financing, the sources of funding include government budget, farebox revenues, non-fare commercial revenues (such as advertising, merchandising, leasing of commercial spaces), and development charges or tax-based land value capture (LVC). Funding for public transport in Indonesia up to now is only generated through government transfers and subsidies, either to the APBD, or directly to BUMN. Sources of funding include:

- ✓ Government taxes
- ✓ Inter-government transfer
- ✓ User revenues
- ✓ Commercial revenues
- ✓ Land Value Capture

Figure 18. Mebidangro transport public funding



Two key sources of funding are important and will be explored in more detail in the SUMP Action Plans: Corporate tax on mobility (measure 33) and land value capture tax (measure 6). Both apply taxes on those who benefit from improved mobility: firms and landowners.

It is important for North Sumatra to consolidate funding needs by integrating urban transport planning and management, including land use, prices, and regulations. Public funding is an important part of the development of urban transportation systems. The creation of the Mebidangro transit authority allows all resources to be channeled to achieve medium and long-term goals.

A dialogue must be put in place between the relevant regional governments, as well as between the city, provincial and national governments to move forward. The formation of an organizing authority for transport and mobility in the Mebidangro area will be important to concentrate and rationalize the different possible sources of funding. Another key point will be the necessary mobilization of the central government on the planning and funding of the proposed measures.

### 11.2.5. Summary of the Governance Aspects

The diversity of authorities related to urban transport in Mebidangro has led to a complexity of interactions, leading to lack of coordination, decreasing service quality and failures in attempts at launching new projects. Changing this towards a unified transport and mobility authority in Mebidangro that will implement integrated policies will be a major breakthrough towards achieving sustainable mobility.

Regardless of the legal status of the transit authority, it is necessary to establish one institution in charge of planning, managing, and overseeing all transport modes and systems in an integrated manner at the Mebidangro metropolitan level. Pergub

5/2016 already mandated the formation of an urban area-wide management cooperation agency and should be followed up with.

Reforming the angkot (angkot) industry is critical. The angkot is the predominant mode of public transportation by fleet size, and improvements to the existing system will be immediately felt. The declining level of service performances has much to do with the government's low level of funding. Financing commitments (in the form of subsidies) determine the sustainability of a modern urban transportation system. Securing new types of funding, i.e., through corporate mobility tax and land value capture would be beneficial.

Funding and financing options are available but under-utilized. The capacity to conduct financial modelling, proposals, and management is low. There is a need to consolidate and follow up with funding and financing opportunities on a metropolitan level. This will benefit from having a Mebidangro-wide land transport authority and improved capacity in fiscal management.

The institutional and financial takeaways are addressed in the mobility scenarios and action plan, with measures aimed at improving the governance of mobility.

## II.3. Urban Structure and Demographics

The urban and demographic contexts are the roots of mobility. They are thus analysed first for the Mebidangro diagnosis, through assessment of the settlements and land use, demographics and vehicle ownership (motorization).

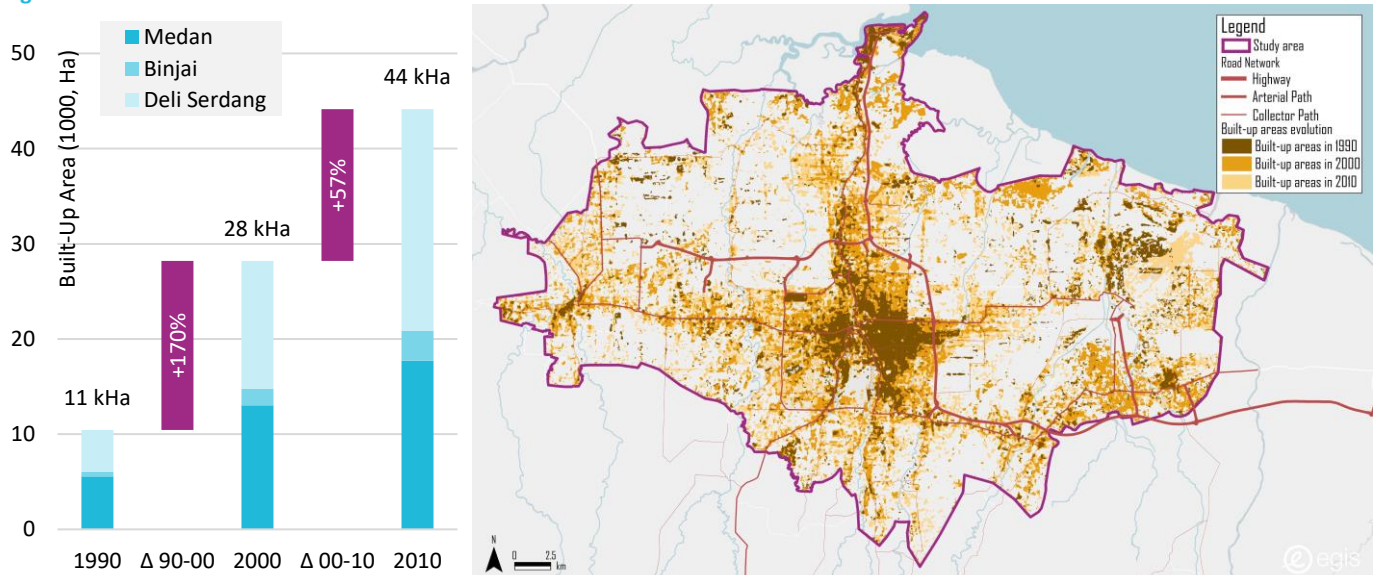
### II.3.1. Land Use and Settlements

#### ■ Understanding the current urban structure

In the Dutch colonial era, the development of roads and railways connected agricultural areas with the city centre and the port of Medan. This gave the particular North-South backbone of the city that also coincides with the Deli River, but the peripheral poles of Binjai and Lubuk Pakam set another East-West axis of development. Ineffective land use planning and enforcement, allowing private acquisition and organic use of land along axes, have resulting in a fast urbanization of the area. The land in question is totally flat but gains in height towards the South where the Toba volcanoes lay (see appendix).

Confirming Medan as the hyper-center of the region, the settlements grew beyond administrative boundaries with now the largest built area in Deli Serdang, strengthening the case for a metropolitan area approach.

Figure 19. Growth of settlements between 1990 and 2010



With an influx of workers, Medan City is now the core urban center of Mebidangro, with radial developments following North-South and East-West axes towards secondary poles of Binjai, Lubuk Pakam and Belawan. Outskirt industrial activities triggered the appearance of intermediary urban poles Sunggal, Percut Sei Tuan and Tanjung Morawa.

With the settlements multiplied by four in 20 years, the urban challenges of Mebidangro have grown plenty. Political priorities were put on the provision of public services in education and healthcare. However, energy and transportation networks are lagging.

#### ■ Mobility generators and public facilities

Household surveys show that more than 85% of inhabitants are satisfied with the public amenities availability and accessibility. They are indeed concentrated in built areas and lie under the cities and regencies responsibility.

The region airport was moved from inner Medan to East Deli Serdang in Kualanamu in 2011 to promote a development towards the East and the province. It also strengthens the East-West axis and desaturates Medan City.

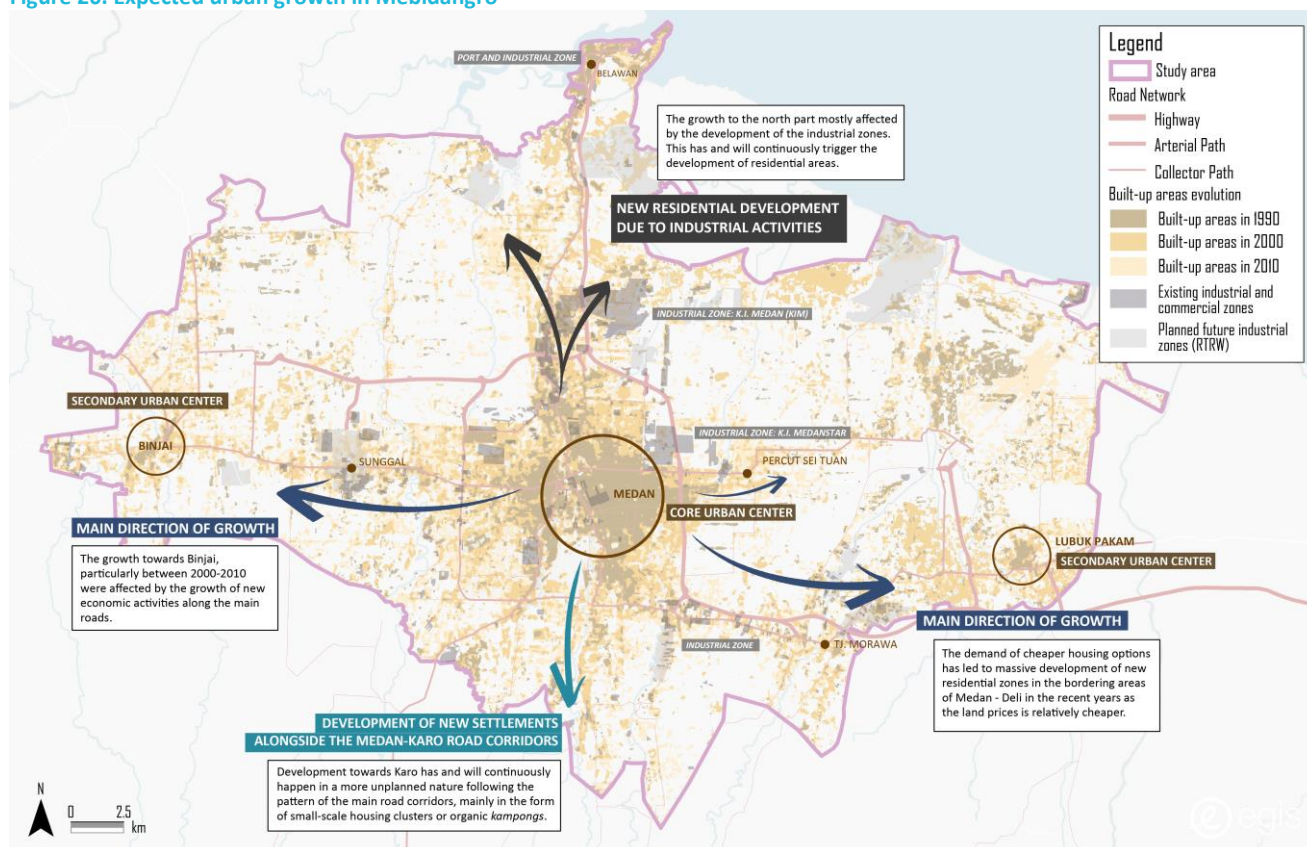
It shall be noted that the built environment of Mebidangro is heterogeneous in nature. While Medan City has mixed-use dense districts, more spacious settlements lies in the South and West, while more informal urban structures are observed in the North and East of the Region.

### ■ Future developments and expected growth

The future areas of development for Mebidangro are limited in the ongoing policies. Current discussions include the construction of a Sports Center between Medan City and Kualanamu in the vicinity of Sena; and the expansion of Medan Industrial Zones along the axis between the city center and Belawan. These developments are part of the land use regulations (RTRW). The latter includes several conversion of areas activities (shown in appendix), however its lack of enforcement suppose a continued organic growth. These are foreseen towards the East, West and South.

The land use shall be consolidated with the objective of limiting urban sprawl. A more dense land use, with for example mixed-use areas, would limit the urban sprawl.

Figure 20. Expected urban growth in Mebidangro





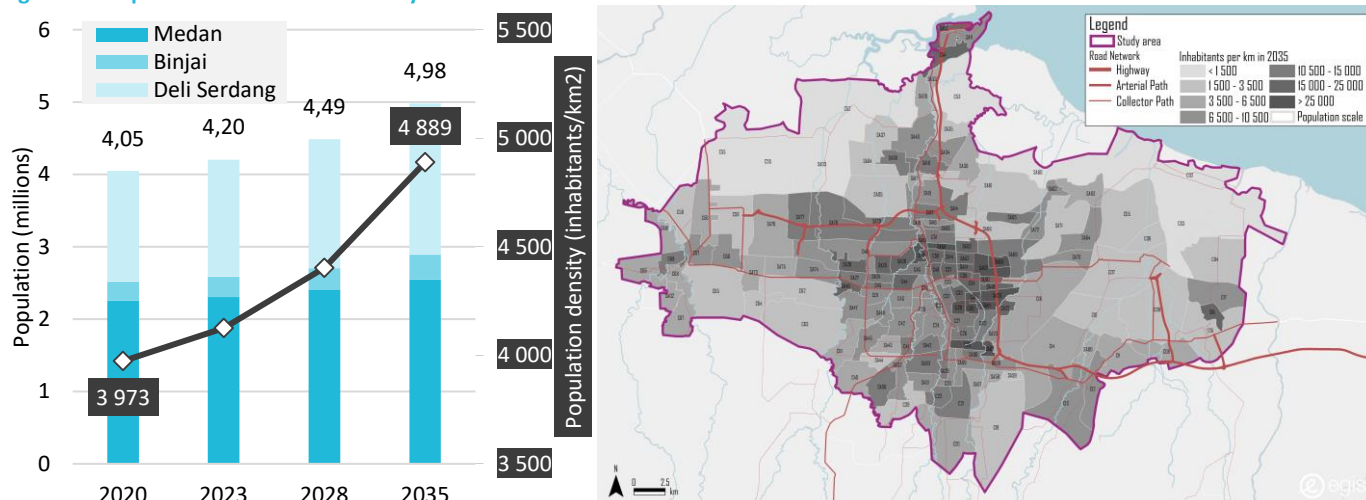
## 11.3.2. Demographics

### Population trends

The growth of the urban area results from a strong increase in population, with a continued trend towards five million inhabitants in 2035. It is one million more individuals than in 2020, raising the density of population from 4.000 inhabitants/km<sup>2</sup> to close to 5.000 inhabitants/km<sup>2</sup>.

This increase is foreseen to settle along the growth axes: in Sunggal and West Helvetia, towards the South around Simalingkar, to the East in Tanjung Morawa and along the North-south axis with the new industrial developments.

Figure 21. Population amount and density forecast

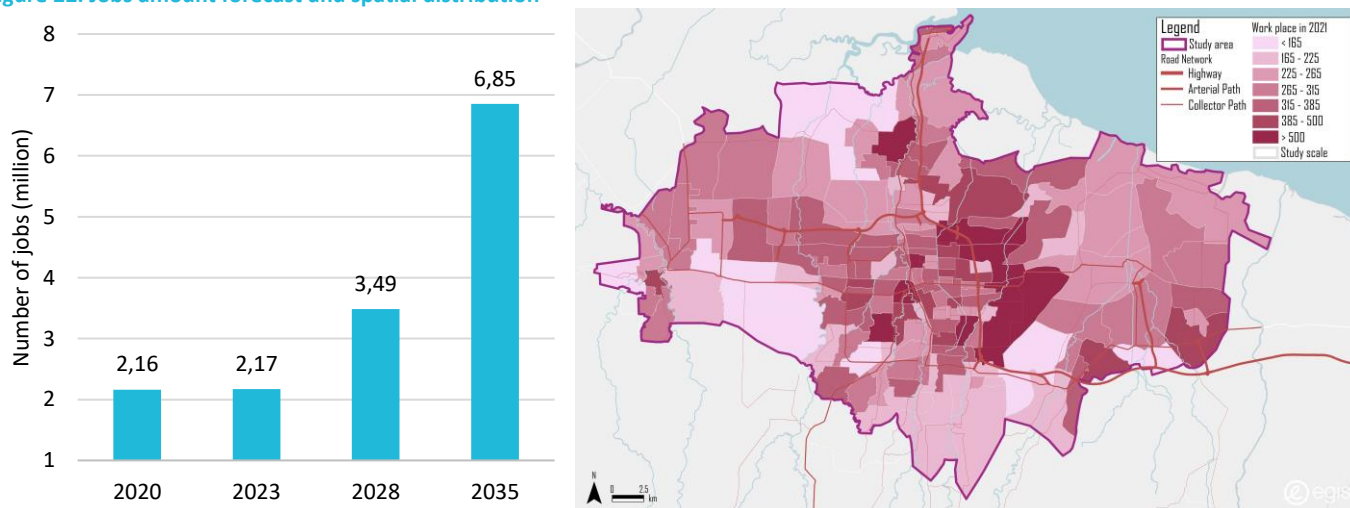


The density is shown with the increasing household size of 3,3 in average. The urban challenges are likely to be regional and local, moving forward: increased need of public services in denser districts and necessity of connectivity between them.

### An economy in transition

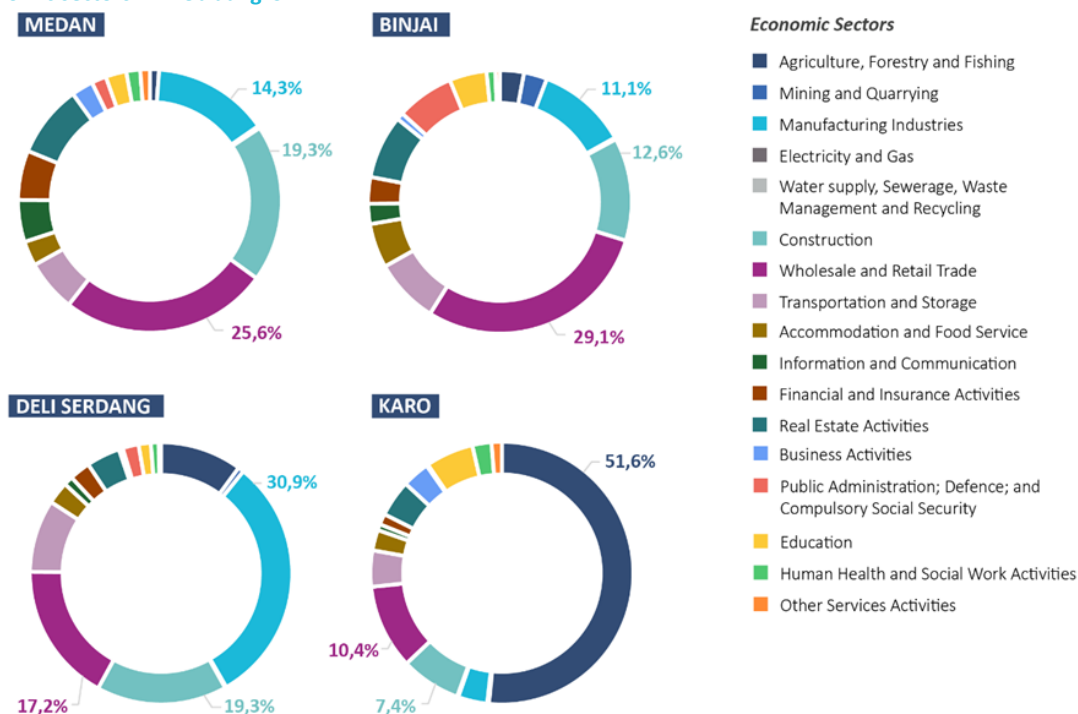
The distribution of jobs follows the density of settlements and population. In 2020 and in 2035, jobs are likely to follow similar distributions given the lack of land organization plan.

Figure 22. Jobs amount forecast and spatial distribution



Furthermore, as stated before, the urban structure originates from the agricultural activities and movement to the port. Today, the economy of Mebidangro is dominated by retail activities and manufacturing industries. Therefore, there is a mismatch between the urban structure and its use, which puts emphasis on the expected pressure on the connectivity axes between districts.

Figure 23. Economic sectors in Mebidangro



The increase in jobs is expected to be of industrial nature in the periphery of Medan, in the Industrial zones towards Belawan, East of the city in Percut Sei Tuan and West in Sunggal and Binjai. The economic activities hint at important implications on goods movements. Karo activities in agriculture makes it rely heavily on its road link towards Medan, while logistics systems are required for tertiary activities on the study area.

#### ■ Diffuse organic growth of the middle class

With the forecasted growth of the number of jobs, without effective plans to reorganize the spatial distribution of economic activities, and with the increasing population, the demographic growth is expected to need inter-districts connectivity and localized mobility.

Without adequate limitation of urban sprawl and concentration of activities, organic settlements are expected to take place mainly along North-South and East-West growth axes in a diffuse manner. Necessary measures of limitation of urban growth seem necessary at the scale of the territory, beyond cities and regencies boundaries.

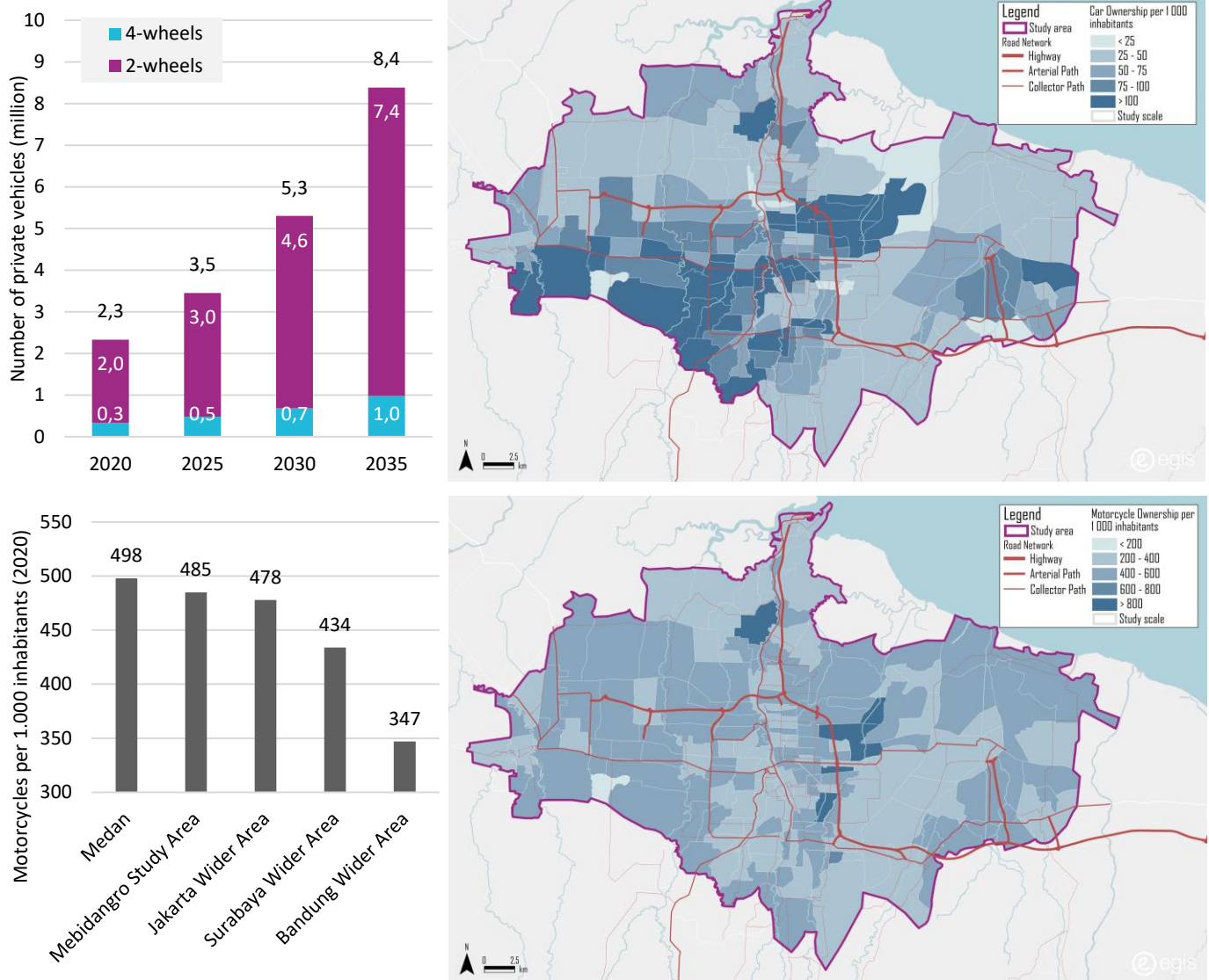
As the economy of Medan grows and people have more and more access to private vehicles, these challenges are topped with the high motorization rate of the population of Mebidangro, which is described in the next paragraph.

### 11.3.3. Motorization

The motorization is directly linked with the economic and urban conditions of the area. Since most mobility issues come from private vehicles (PV) circulation, it is important to understand them.

#### ■ Ownership of private vehicles

The motorized fleet of 2,3 millions vehicles is expected to grow up to 8,4 millions in 2035. The cars make up for less than 20% but are responsible for main congestion issues. Motorcycles dominate the fleet as it is the preferred mode of transportation. The forecasting method takes into account SUMP household surveys, registered vehicle ownership from BPS publication, GRDP trends for economic aspect, demographic trends, and elasticity. It is worthnote that it has proven its accuracy on the 2010-20 evolutions.

**Figure 24. Private vehicle number and ownership rate**

Car ownership is high in the central areas and in the wider South West of the area, in South Binjai, Sunggal, West and South-West Medan. It is supposed that road stress is higher on radial axes towards the West, hence the existing proposed developments towards the East. The ownership rate is 82 cars per 1.000 habitants in the area, only second to Jakarta Wider Area which has 97 cars per 1.000 habitants.

The motorcycle rate is excessively high compared to other Indonesian metropolises; and Mebidangro has a case for the highest motorcycle ownership rate in the country. Locally, it is identified that the districts of Percut Sei Tuan and Marelán have the highest numbers of motorcycles ownership. These districts are areas with high employment, dense and low revenues population.

Further statistics show that 97% of the population own a PV, out of which 74% own a motorcycle and 2% a car. An alarming 24% own both a motorcycle and a car. More details are available in appendix.

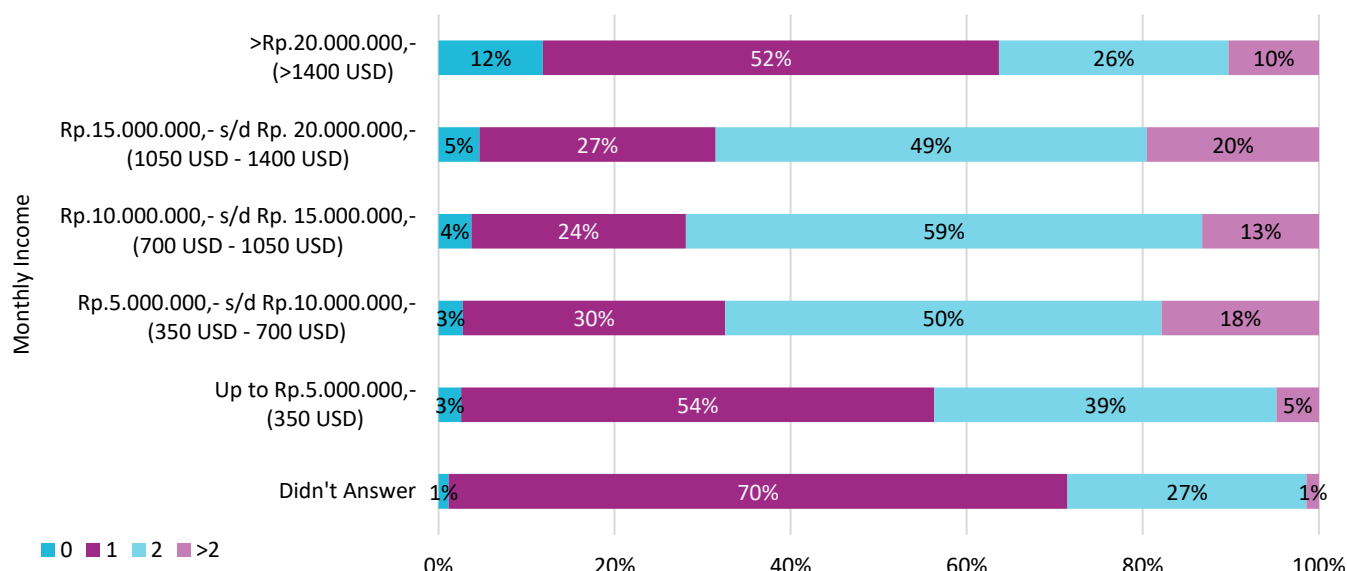
Flexibility (20%), low cost (18%), and travel time (17%) are the top three factors that influence people to select private motorized vehicles as their main mode of transport.

#### ■ Economic considerations of the motorization

The high ownership of motorcycles is linked with the affordability of the vehicles. The average price of a new motorcycle is IDR 27 million, while a new car has an average price of IDR 175 million. This shows a gap of acquisition costs between these private modes. Furthermore, the tax regime is based on the price of the vehicles: 2-wheels have low ownership taxes.

Lower parking fares compared to cars, fuel government subsidies and ease of use add to the incentives to travel by motorcycle instead of using public transportation. This is particularly observed for low-income households.

Figure 25. Motorcycle ownership against household income



### ■ Key takeaways of the motorized vehicle fleet analysis

As Mebidangro ranks first and second for ownership rates of motorcycles and cars respectively, it is important to reduce the PV fleet and its uses for a more sustainable mobility; and avoid the consequences of congestion, air pollution, road casualties and time losses. The central government fuel subsidies has an important role in PV, introducing a bias in the competition with PT.

Actions to reduce the use of PV shall be identified to avoid the alarming forecast of a four-time growth of the fleet in 2035. Additionally, as the potential users of PT mainly use motorcycles, flexibility, travel time and affordability must be insured in public transport actions. More details are available in appendix.

## 11.3.4. Summary of the Urban Context

The urban structure and demographics analysis show the trend of social, economic and settlement developments which all influence mobility at large and small scales.

### ■ Urban axes of development and lack of plans

The lack of efficient planning and enforcement of land management policies gives way to organic urban sprawl driven by private investments. The formalized plans seem to be limited to industrial zones and sports facilities, which are both falling under the management of the government agencies.

However, the North-South and East-West axes of development result in secondary and intermediary urban poles which are considered in the SUMP. As Deli Serdang combines more than half of the built area of the region, an integrated approach to planning beyond administrative borders is needed.

### ■ Demographic strength and economic growth

The population is forecasted to increase from 4 million inhabitants in 2020 to 5 million in 2035, increasing its density from 4.000 to close to 5.000 inhabitants/km<sup>2</sup>. Without appropriate sprawl regulations, it is expected that the communities settle more and more along growth axes towards the West (Sunggal), South (Simalingkar) and East (Tanjung Morawa).

### ■ Alarming motorization rate trends

Mebidangro tops the national ranking in motorcycle and car ownership rates, due to their affordability allowed by favourable contexts and lack of flexible and reliable PT alternative. Combined with the two points above, the dependency on PV is set to increase if no restricting measure is adopted.

The population increase in peripheries and constant commuting to work towards the center (with increasing economic tertiary activities and no plan to relocate them) by PV will put great pressure on the facilities (roads, parkings) and increase the externalities of road traffic. At the local scale, intradistrict mobility will also increase.

### ■ Influence on the SUMP

The urban axes of development indicate geographical trends along which important volume of people will travel and are likely to use mass transit. Hence mass transit lines can be contextualized. Additionally, the increase in employment locate the areas



of the region to serve in priority to give economic opportunities to the communities. Demographics are taken into account in modelling traffic as part of the scenarios.

On the other hand, the lack of plans and enforcement, as well as the organic urban sprawl observed shall be limited through regulatory consolidation of land management. The appetite for private developments also hint at a possible monetization of land value increases resulting from transit development.

The motorization level and its consequences shows that the number of vehicles owned and used must be limited. Additionally, the current fleet represents a potential source of revenue for the authorities. New tax schemes on PV could generate important public revenues and strongly disincentive the ownership of private vehicles.

## II.4. Mobility Dynamics

This section offers an outlook on the transport services and their demand, as well as their evolutions when available, in order to identify obstacles to sustainable mobility in Mebidangro. This is closely tied to the urban structure and demographics of the area, and has social consequences.

### II.4.1. Mobility Offer: Infrastructure and Services

By first drawing an inventory of individual and collective transport infrastructure and services, analysing their accessibility and affordability, and looking at the facilities for soft modes, it is aimed to identify challenges and opportunities for mobility.

#### II.4.1.a. Road and Rail Networks

The road and rail networks initially follow the historic urban structure depicted before. While the road network has evolved and has now complex characteristics, the rail network of Mebidangro has had mixed evolutions.

##### ■ Road network

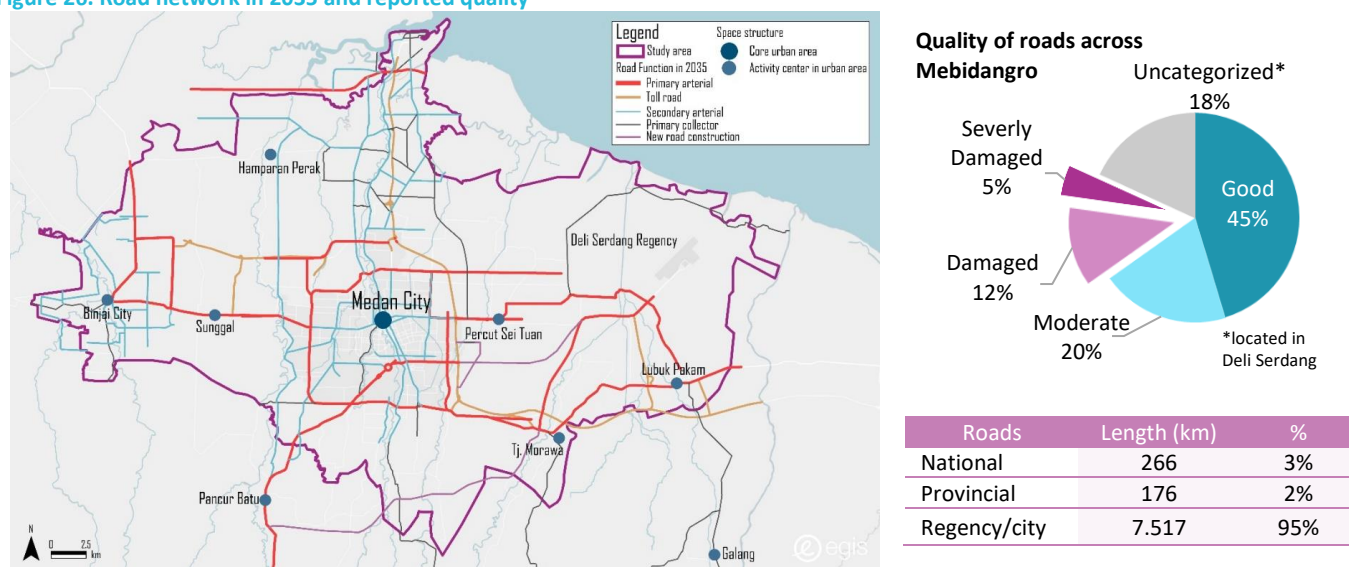
##### ■ Complex composition and heterogeneous quality

The roads are classified and follow a complex organization, under the responsibility of either the cities and regencies, the province, or the state. While respective budgets are allocated for their maintenance, the lack of coordination and cooperation between administrations result in heterogeneous qualities across the territory, especially at frontiers.

As a whole, 45% of Mebidangro roads are good. Cities like Medan and Binjai only have 10,2% and 4,4% damaged and severely damaged roads. On the opposite, Deli Serdang and Karo have a large proportion of bad quality roads, reaching 57,6% and 38,4% respectively – but also they have more area to cover.

This lack of quality is observed all across Mebidangro and felt by road users either in individual or collective mobility. Perhaps more importantly, the reflection of the lack of cooperation between agencies is exacerbated on the Medan-Berastagi link.

Figure 26. Road network in 2035 and reported quality



Berastagi being the main city of Karo and highly dependent on its agricultural economy, its main gate of commerce is Medan. Hence Berastagi does not only rely on the intercity road link for passenger comfort, but also for goods movements. However, the vast majority of this link lays in Deli Serdang, which does not have particular economic interests in this road. Plans to

improve the road link have long been discussed but were non conclusive. It is suggested to relaunch the discussions on this topic in this Action Plan.

Furthermore, the interdependency of the different districts of the urban area, shown in the urban structure analysis, implies movements between them. Those movements benefit in one way or another all administrations. Putting the responsibility of 95% of roads under the cities and regencies seems decorrelated from real uses. Centralizing the responsibility of roads under a single authority would avoid these coordination and conflicting priorities issue. This strengthens the case for a single metropolitan area authority to oversee land transportation and mobility in general.

#### ■ Future plans and coverage

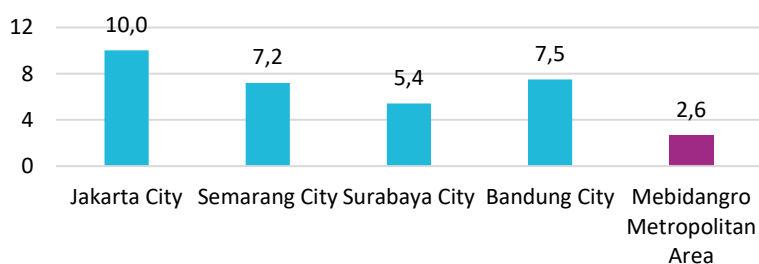
The plans for expansions are limited. According to official plans, they include peripheral roads in the south east of Medan City, to bypass circulations from Tanjung Morawa and Pancur Batu, as well as going from Sisimangaraja to Kualanamu by avoiding Amplas. Other plans of road capacity increase and road widenings are stated in the plans.

The official plans (*RTRW*) are rarely enforced and plans for road expansions have been compiled without effect in the past years. Hence, there is reasonable pessimism regarding the expansion plans. However, road widening and expansions increase the offer to private vehicles, which are then set to use them more. The limited road coverage of the area could then be seen as an opportunity to keep road situation as it is, and favour vertical developments instead of urban sprawling.

#### ■ Road signage and traffic management

Road signage in Mebidangro is heterogenous as well. The standard national codes are respected in the city center, but lacking in secondary and tertiary areas. This results in the lack of clarity for rules, hence less respect of them, and often dangerous behaviors. Furthermore, as highlighted later, it disadvantages more the persons with disabilities in accessing and using the road network.

Figure 27. Road coverage ratio (km/km<sup>2</sup>), and traffic management



The observed traffic management methods that are used in the area are thus manual interventions on circulation flows. The redirection of traffic flows to adjust to conditions (congestion, construction, demonstrations) are done with temporary barriers. Although there are traffic management methods that have been implemented in Medan City, its efficiency has yet to be proven before being generalized. Secondary challenges are to provide road users with real-time information on network and deadlocks in order to incentivize on route alternatives and increase comfort on overall network.

There is room for improvement, i.e., fully integrating all junctions in the study area with ATCS, implementing electronic road pricing (ERP) to manage the traffic and congestion in the main roads. Other measures could be the usage of Variable Message Sign (VMS) to inform the road users of the current traffic situation and give route suggestions, and implementing other features of ITS (Intelligent Transport System) to advance the traffic management system. All these are pertaining to the financial and regulatory feasibilities and shall be the subject to further studies.

#### ■ Parkings

Parking is heterogenous, as implemented by each city or regency with different policies, schemes and management. On-street parking is omnipresent in the area, and dedicated parking facilities are just emerging in Medan city center at important sites. They are needed in greater numbers to mitigate the congestion resulting from on-street parking.

Mirroring the fares for public transport (PT), having harmonized parking fares across Mebidangro would allow better readability for private vehicle (PV) users. It shall also be the opportunity to implement unfavorable parking fares pricing to discourage PV – but such scheme should come when sustainable alternatives for mobility are offered (MaaS and PT).

#### ■ Rail infrastructure

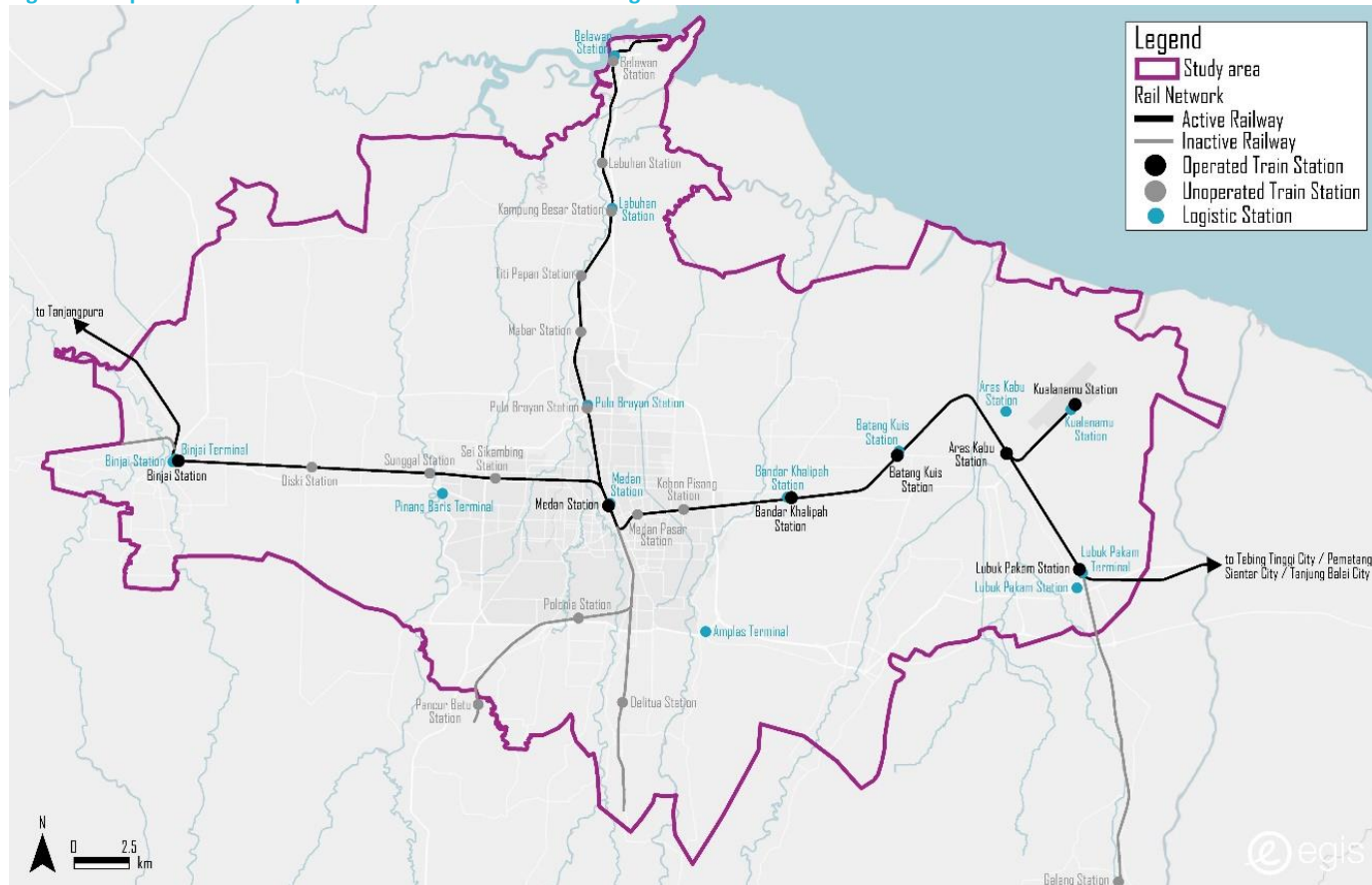
##### ■ Railways structure

Railways were established in the colonial times and the first operations began in 1889, first to transport goods from and to Belawan, as well as from and to Southern Toba (Labuhan Batu). It became a trans-regional means of trade with ways being developed to the northern parts of Sumatra. The early structures gave way for a radial network around Medan, towards Binjai and Deli Serdang.

In the last decades, railways towards Binjai and the further Western Aceh were developed with success. An airport link is operated between the city center and the new airport Kualanamu since early 2010s, but only offer limited capacity (single tracks) and conventional energies (fuel). For now, Karo does not benefit from railways.

As the rail infrastructure has more inertia than roads (less maintenance and longer implementation after urban developments), the current systems was not upgrade much from its origins. Several sections are now passive and recycled for other usages (in the South). The state of railways does not allow good commercial speeds, and the network is not electrified, meaning that trains run on fuel.

Figure 28. Operated and unoperated train stations in Mebidang



#### ■ Railway stations

The railways have more inactive stations (12) than active stations (10). Although the city has developed towards the south, tracks and stations heading South are inactive (Deli Tua, Polonia, Pancur Batu). These closures came with the inhabitants preferring private modes over public ones.

The national state company PT. KAI which operates trains and infrastructure has plans to reactivate stations between Medan and Binjai in 2023. The expected urban growths along the North-South and East-West axes could also benefit from reactivating several stations, particularly towards the industrial areas of KIM between Medan and Belawan.

#### ■ Takeaways from the transport infrastructure

While the networks of roads and rails could benefit from a more integrated management and ownership, they also present the opportunity of maximizing their use by limiting their development and reactivating certain assets.

The roads need more maintenance and signage, as well as efficient traffic management, instead of expansions. This is particularly needed on the Medan-Berastagi road link, and could be allowed better with a metropolitan authority. On the other hand inactive rail assets offer the opportunity to reassess their attractiveness and consider their reactivation with the forecasted urban developments. Rail infrastructure could also be equipped for the use of cleaner and renewable energies, as all trains are currently ran on fuel.

### 11.4.1.b. Road and Rail-based Services

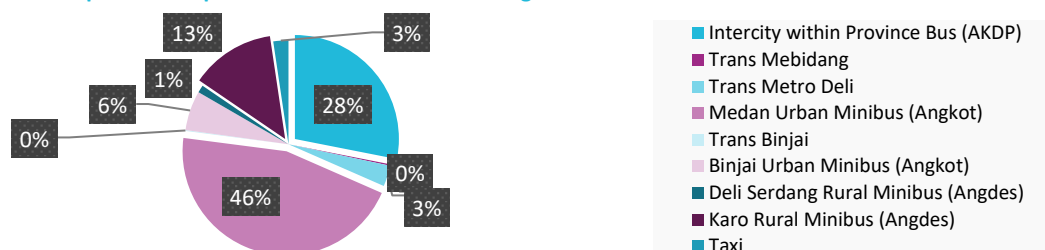
Mebidangro has important services for public transport at the image of its infrastructure networks. Either road or rail-based, services have not reached the best possible performances, partly due to a growing disregard for PT from inhabitants, but also the lack of upgrades and modernization in the past years.

#### ■ Existing road-based public transit (PT) services

Road-based transit consists of various types of modes such as long-distance buses AKDP (Inter-City within Province), urban minibuses (Angkutan Kota), rural minibuses (Angkutan Desa), and urban buses of Trans Mebidang, Trans Metro Deli, Trans Binjai. Hires present an important number of passengers.

The dominant fleet is Medan minibuses with 4.844 vehicles, followed by long-distance buses with 2.992 vehicles. On the opposite, Deli Serdang that has the largest area and most recent urban settlements only has 124 rural minibuses.

Figure 29. Road-based public transport lines and fleets in Mebidangro



All road-based PT are conventional with polluting combustion engines, without integration with digital technologies nor clear passenger information (fares, schedules, lines). Road-based PT does not have stops in the streets of Mebidangro, except for the recent BTS on-demand trial. Road-based PT is allocated to terminals managed by the authorities, but are run by private companies on routes licensed by the government(s). In Medan city, the amount of minibuses circulating has an impact in the traffic congestion. To tackle these challenges, the replacement of small vehicles with medium or large ones may help improve the traffic condition, especially since their occupancy rate is relatively low.

#### ■ Minibuses (angkots)

It is estimated that 7.000+ minibuses are operational within Mebidangro. Owners, operators, syndicates vary, and their governance is scattered by route and administration, as highlighted in the institutional section. This aging and uncomfortable pool of low-capacity vehicles (10-15 pax) is an existing asset and shall be considered for improvement.

The current system, by lack of readability and accessibility, is exclusive of certain communities (persons with reduced mobility, visitors). Additionally, the routes multiplicity, administrative complexity, low quality of service but high coverage and importance of vehicle assets make the angkot system obsolete regarding the needs of the inhabitants of Mebidangro.

It is estimated however that more than 3.500 workers are directly and indirectly tied with the operations of the minibus system in Mebidangro (drivers, ticketing, terminals, cleaning, etc.), showing the importance of the industry in the local economy and sensitivity of any reform project of the system.

Figure 30. Minibuses in Mebidangro

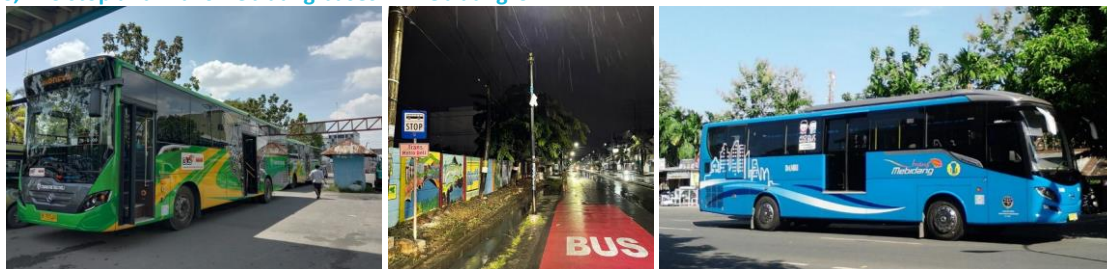


#### ■ Bus lines

The multiplicity of actors, operators of buses in Mebidangro result in a system rich in vehicle assets with medium capacities (20-40 pax), but unclear services and routes, posing an obstacle to the success of the mode. For example, urban buses and regional buses have different areas of service (no cabotage) but are not clearly distinguishable and are available at the same locations. It does not integrate nor combine operations with minibuses nor trains. Geographical scopes are also to be reconsidered, given the current regional and urban allotments that are inefficient.

The MOT has ran BTS (BuyTheService) buses in the past couple of years with mixed results. The lack of readability of the service and lack of stations have not allowed a successful implementation and ridership levels are low.



**Figure 31. BTS, BTS stop and TransMebidang buses in Mebidangro**

The buses and minibuses have the same constraints as the general traffic in poor quality roads and lack of infrastructure.

#### ■ Online hailing

Whether with cars or motorcycles, online hailing is simplifying mobility for users with immediate on-demand services. It offers on-demand fast and affordable door-to-door short-distance trips. Another strong advantage is the transparency of fares, which are fixed and transparent unlike conventional PT. However, on longer distances (>10 km), online hailing has a higher kilometeric fare that does not compete against PT.

From the survey results, there are approximately 60.000 daily trips made by online hailing. This number is expected to increase in the future due to new emerging companies. The number of the available fleet is unknown due to the fact that one driver may serve multiple applications. Conventional PT and online hailing must work together in improving intermodal facilities and points of exchange, as well as more integrated fare schemes, to convince the users from using both.

#### ■ Motorized tricycles

As of 2019, close to 8.000 vehicles were licensed in Deli Serdang only. (wider geographical and annual data remains unavailable). Their usage is decreasing sharply since the introduction of online hailing in Medan area in 2014-2015. For up to 2-3 pax, the vehicles offer comfortable rides compared to motorcycles, but less comfortable than cars. As presented later, they are preferred by women for these reasons.

The informal nature of this paratransit does not allow clear monitoring of passengers. Population perceive it as hassling, since fares are spontaneously offered by drivers. In Medan, stakeholders state that motorized tricycles will gradually disappear with the growth of online hailing, and if not, will be integrated within online hailing systems.

In late 2010s, a program to electrify motorized tricycles was discussed between authorities and online hailing operators, prevailing for the integration of their operations within the purview of the private companies.

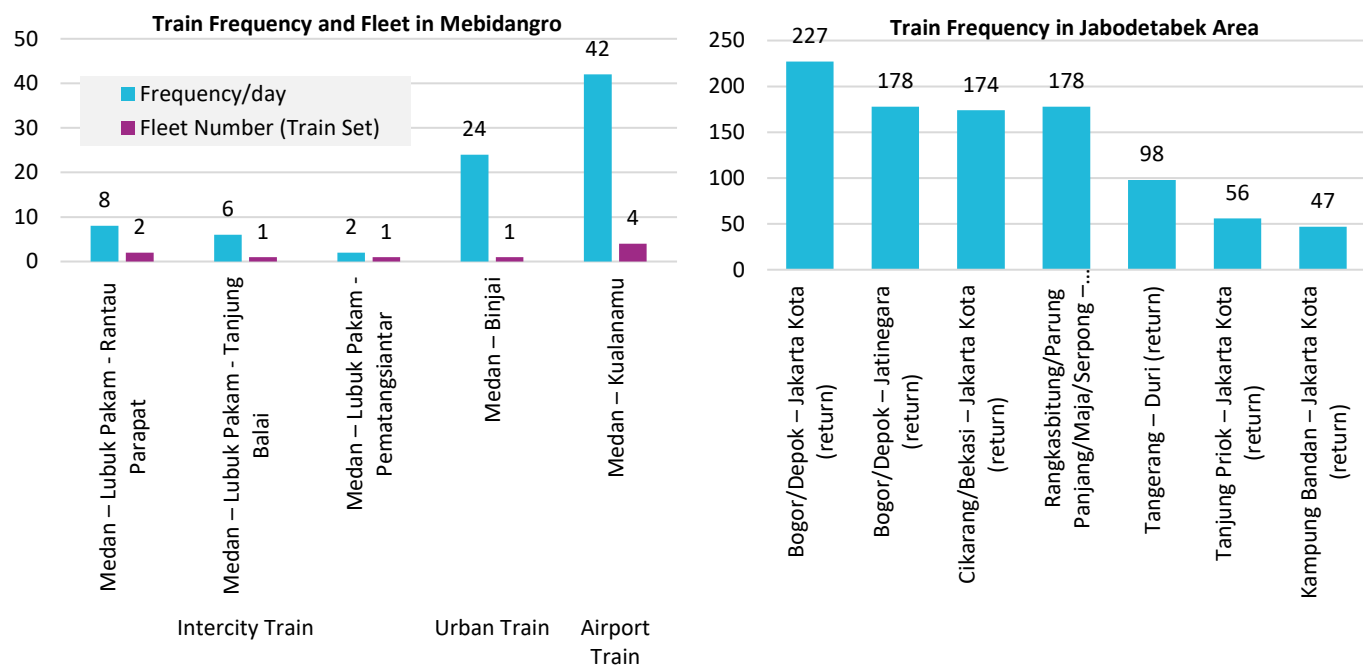
**Figure 32. Motorized tricycles in Medan**

However, this program did not reach completion, but offers a path to explore if the conservation of this historic mode of transportation is considered a priority by authorities. The current state of motorized tricycles is poor, and actions should be considered to whether terminate or integrate their operations with operators as they become every year more obsolete against users evolving needs and habits.

#### ■ Existing rail-based public transit services

Different rail service lines exist in Mebidangro, mainly between Medan and Binjai, Kualanamu and Lubuk Pakam. The Medan-Belawan route only offer freight services. While urban and airport lines have high frequencies and relate to trips at the urban scale, long-distance trains have less departures per day. The latter cover distances over 100 km and are irrelevant in the urban transport offer.

Figure 33. Train services in Mebidangro



All rail lines are in direct competition with road-based transport lines, as road axes connect the same points and cities as rail. The rail services are way behind the capital commuter network performances. The asset utilization and improvement of services shall be considered in Mebidangro, to trigger a mode shift and accommodate the future needs of the growing population.

#### Future public transit services

##### BRT Line 1

BRT Line 1, from Pinang Baris to Amplas, is being prepared by the Mebidang agencies, Province, central government and international partners. It is a confirmed project in the pipeline for the area. On a Northwest to Southeast axis, it serves busy areas of Medan City along a BRT corridor. 15 angkot routes, upgraded to BRT, shall serve this corridor and extend its service reach up to Binjai and Lubuk Pakam.

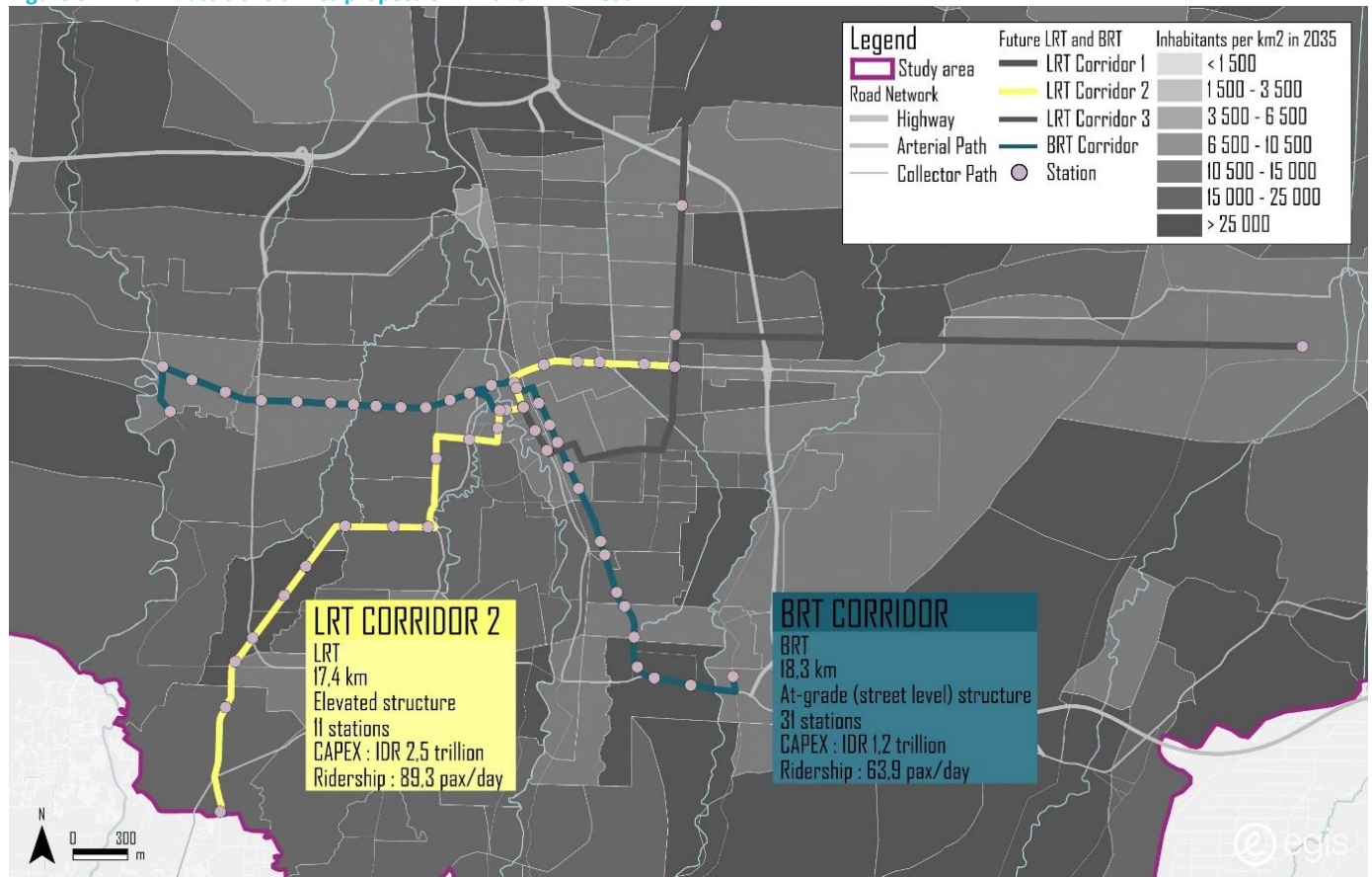
##### Medan-Binjai Railways

The railways between Medan and Binjai are currently being upgraded with the reopening of stations. The construction of an elevated railway was also announced by MOT in 2021, although with unclear and undocumented preparation.

##### LRT Medan

The LRT systems proposed in Medan extends on more than 17 km between the residential area of Setiabudi up to the historical center of Merdeka. It has been the object of numerous studies between 2015 and 2018, but has not resulted in conclusive implementation due to the lack of municipal and provincial funds to built and run it. Furthermore, Mebidangro did not group required criteria to apply for subventions from the central government on the CAPEX and OPEX. The LRT route and mode choice are possibly challengeable given the lack of analysis determining it.

Figure 34. Main mass transit lines proposals: LRT and BRT Medan



The project of BRT Line 1 is considered as committed and fully part of the SUMP. The rail-based plans are excluded from the SUMP and challenged. Other improvement plans that are part of official plans (RTRW) are also excluded from considerations as for the road network plans.

#### Commercial speeds

Below, the commercial speeds of urban PT are compared to those of their Jakarta equivalents, for rail and road-based transit (worthnote that Jakarta lines are electrified).

Figure 35. Commercial speeds in Mebidangro compared to Jakarta equivalents



\*Current road-based transport do not have traditional bus stops. Their commercial speed is assimilated to their average speed.

Urban rail lines to and from Medan are the airport connection and Medan-Binjai lines. They have commercial speeds approximately 25% lower than their equivalent from Jakarta, even if the capital lines serve intermediary stations. Medan lines only serve terminuses, and are diesel-powered. Improving infrastructure and fleet with clean energies shall be considered to improve its performances and attract users.

Current minibuses and buses have speeds comparable to road traffic speeds, slightly higher than bicycles, what illustrates their inefficiency. Upgrading the fleets with cleaner engines would then make it more sustainable with comparable travel times. Segregated lanes such as busways could improve performances too.

Slow travel is one of the reasons for the inhabitants of Mebidangro not choosing PT. Increasing the current systems performances could improve their attractiveness, even if time savings are not considered a priority compared to comfort, as described in the liveability section.

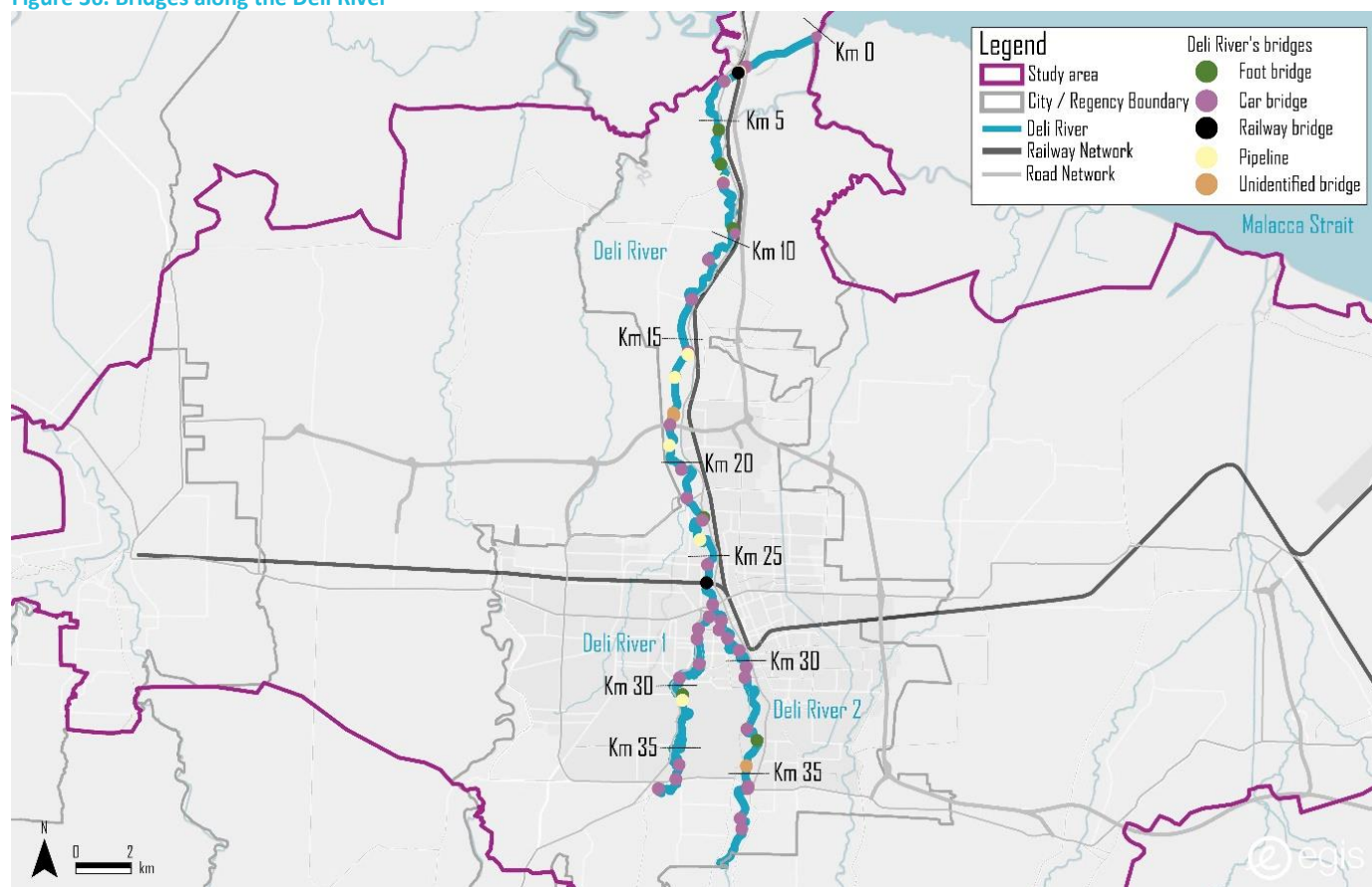
## 11.4.1.c. River, Air and Aerial Mobility

### River transport

Mebidangro is crossed by the main Deli River which is partly canalized and has potential to accommodate boat services. Currently, the river is not exploited for fluvial transport and mainly serves as rainwater and used water drainage.

Two streams join in the center (Petisah) and run towards the mouth in Belawan, on approximately 27 kilometers. Widths vary between 20 and 30 meters near the city center; to 60 meters closer to the mouth. The two streams are only 10 meters wide before joining. Along with the low density of obstacles identified along the river, these widths allow for circulation of small water buses or boats.

Figure 36. Bridges along the Deli River



As for any other transport line, a detailed definition of the route and level of service, is needed to further develop fluvial transport. It depends on passenger forecasts, feasibility of docks construction, commercial speeds (depending on flows, river elbows and depths), and other technical aspects. However, it shall be noted that this opportunity gathers strong enthusiasm and motivation from all authorities of Mebidangro, as a cheap and fast way to improve urban mobility creatively.

### Air transport

The current regional airport, Kualanamu international airport, is located in Deli Serdang northeast and is the major generator of inter-regional and international influx into Mebidangro. In January 2020 alone, close to 800k passengers used Kualanamu airport. It represents three times the population of Binjai City and has inevitable impacts on land transportation.

Figure 37. KNO airport and related PT passengers in January 2020

January 2020	Passengers
<b>Total Kualanamu Airport Passengers (international and domestic arrivals and departures)</b>	<b>782 221</b>
<b>Total Airport Public Transport Passengers (in and outbound)</b>	<b>79 757 (10%)</b>
<i>Including Airport Rail Passengers (both directions)</i>	<i>52 002 (&lt;7%)</i>
<i>Including Airport Bus Passengers (both directions; Carrefour, Amplas and Stabat lines)</i>	<i>27 755 (&lt;4%)</i>

Combined airport and rail operators' information show that air passengers use the rail link and buses at a low rate. A modal share of 10% of public transportation for air passengers shows the importance of private vehicles and individual hires (taxi) for the airport for surface access and egress. In large European cities such as Frankfurt, this modal share can jump up to 20% or more. The existing line could be improved to attract more users who currently use road transport. This can start with its electrification and upgrade of fleet, with increased speeds and stations reactivation between terminuses.



## ■ Cable-Car and Aerial Transit

Since Mebidangro is mostly flat (Medan is the Indonesian word for “field” or “plain”), and its rivers allow the construction of bridges, the main opportunities for cable-car implementation are limited to increasing the accessibility to Berastagi and connecting high-rise buildings in Mebidangro. The latter shall be under private purview.

The northern entrance of Berastagi city has high slopes and presents several touristic attractions. Aerial transit, combined with park and ride facilities, could be considered to decrease influx of PV arriving from Medan, particularly on the weekend, as well as increase the safety of its entrance road. However it constitutes a micro-scale project that does not help metropolitan mobility and comes second in priority after the improvement of the road Medan-Berastagi.

From a regulatory standpoint, the cable-car is not implementable for passenger PT in Indonesia yet. It can be assimilated to railways (PM 23/2007) for its principles but is not certifiable yet, except for private leisure and tourism purposes (two cable-pulled cabins systems are operated in leisure parks of Jakarta). It shall be kept in mind that important regulatory works are necessary to develop this mode, in possible future identification of projects.

Other aerial modes such as drones and air shuttles are inexistent. They were however discussed with stakeholders of Mebidangro, but do not have their interest due to their lack of maturity and high risks in the current industrial context.

### II.4.1.d. Accessibility and Affordability

Accessibility and affordability of PT, as key success factors, are assessed in this paragraph. They shall be considered in all planning exercises for improvement of current assets or implementation of new mass transit, and are directly correlated with the social aspects described later in this report.

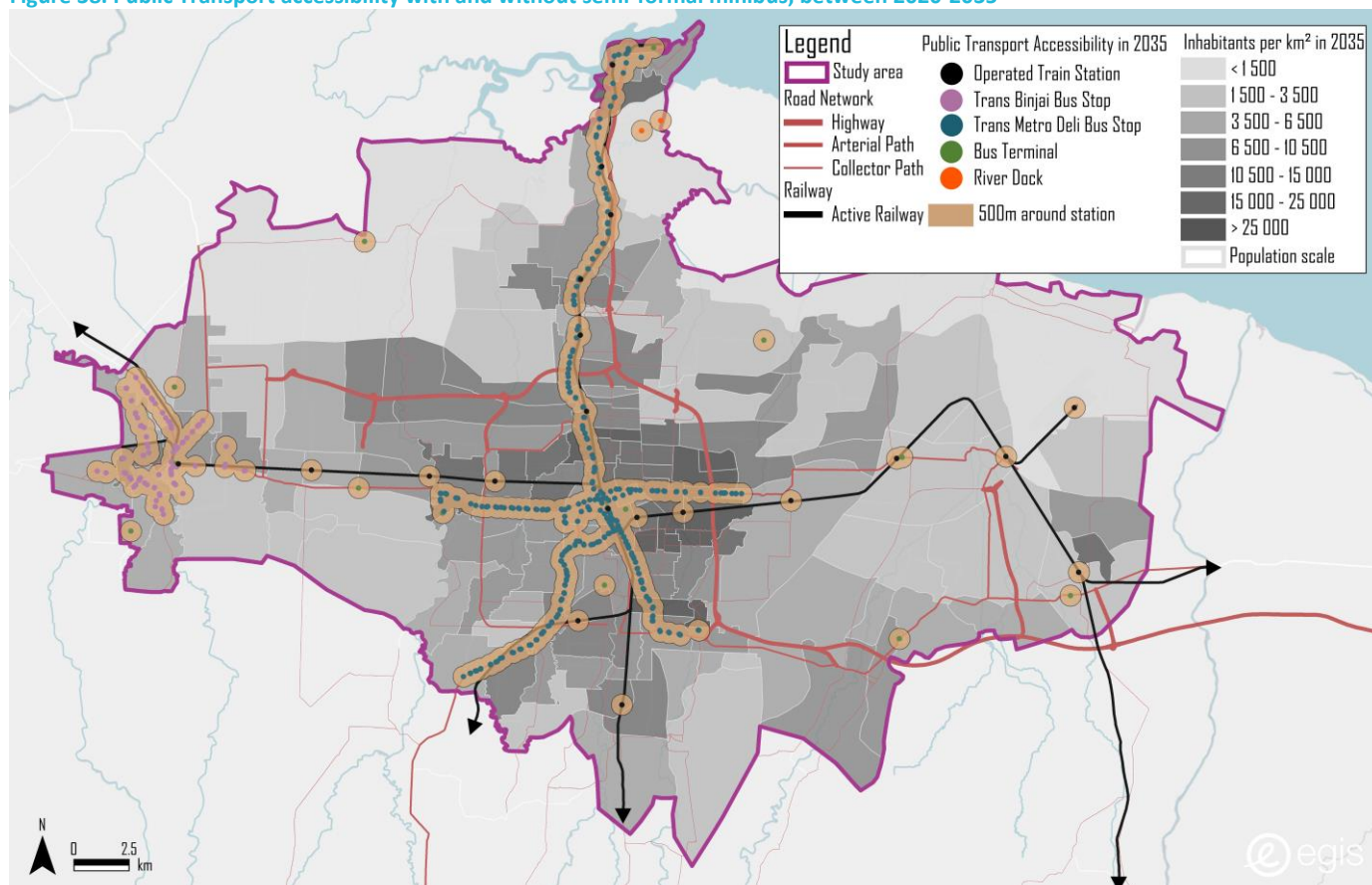
## ■ Accessibility to public transport

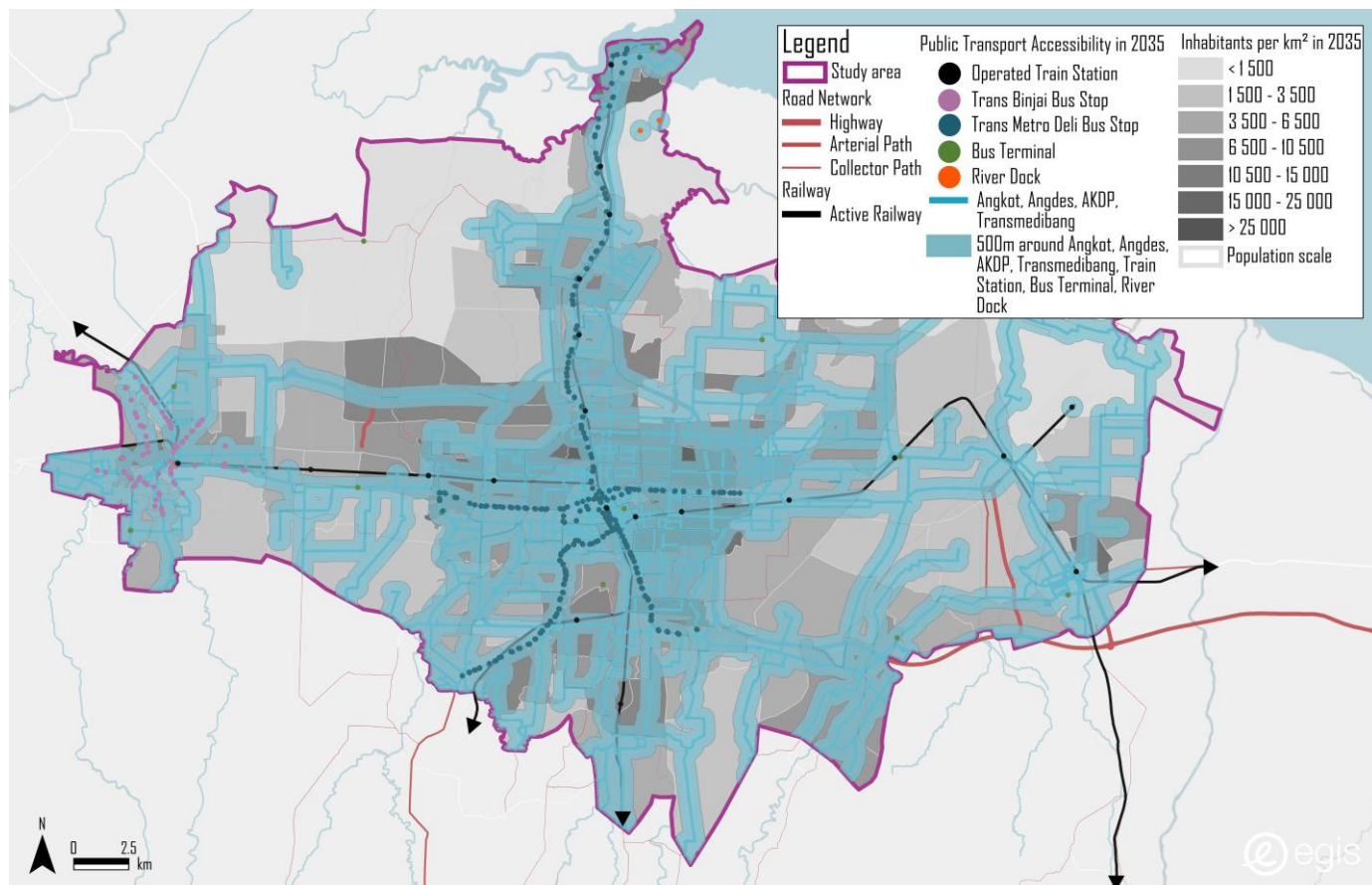
### ■ Population coverage by PT

An indicator of accessibility to PT is the number of inhabitants living within 500 meters distance of PT facilities. PT is represented by minibuses (no stop), buses stops, minibuses and bus terminals, and rail stations. Formal PT covers 87 km<sup>2</sup> from Mebidangro, only equalling to 8% of the study zone. By adding angkot routes, the coverage jumps to 56% (586 km<sup>2</sup>).

The current system shows a rich surface coverage thanks to the minibuses, that shall be leveraged in the development of other transit modes (mass transit, for example), by using minibuses as feeders on adapted routes. With limited new projects of formal transit in the pipeline, the accessibility is not set to improve significantly up to 2035.

Figure 38. Public Transport accessibility with and without semi-formal minibuses, between 2020-2035





Development of new rail and bus lines should be prioritized over roads development to increase the accessibility to PT. Additional measures such as concentrated developments (residential and commercial, transit oriented developments) around PT facilities and improved quality of the transport offer are also considered in this SUMP.

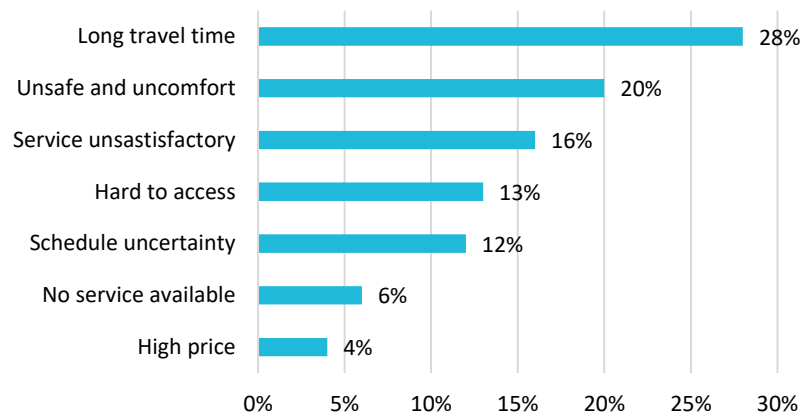
#### Issues and perception on accessibility

The high coverage of PT does not induce a high usage by inhabitants, which can be explained by its low liveability, as described in the related section (dissatisfaction of safety and punctuality). The lack of facilities in the public space – such as sidewalks and lighting, also discourage inhabitants to walk and wait for PT. Authorities recognize that the current state of public spaces do not allow for good NMT. These conditions, of low safety of pedestrians, lack of protection against the weather, waiting area in mixed traffic, can be easily observed throughout Mebidangro, for buses and minibuses likewise.

It is then clear that the development of PT must be associated with the enhancement of public works for access and egress. It can be mirrored with the road network, which is recommended not to be expanded but rather improved and densified for optimized movements of people.

#### Information accessibility

Beyond physical accessibility to PT, it was previously identified that the lack of formal information on PT services reduce their awareness and usage. It is particularly noticeable for people with disabilities who need to plan in advance their trips but cannot access clear information on PT. In consequence, information access must be improved. As of today, no website nor physical platform exist for the schedule of PT in Mebidangro, except for trains (PT. KAI) and BTS buses. However, since minibuses are crucial to access those last modes, minibuses schedule or frequencies shall be informed to passengers too, for the benefit of the whole system.

**Figure 39. Reasons for not using PT for Mebidangro inhabitants**

As the investigations with the population of Mebidangro show, the main reasons for not using PT are its long travel time (including waiting time at stops), lack of safety and comfort, but also 25% refer to the lack of accessibility to services and information. Hence several barriers of entry to PT exist and shall be addressed.

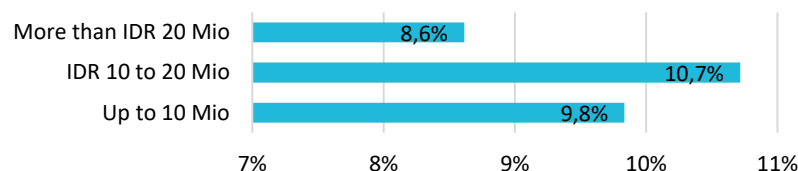
### ■ Affordability and spendings in mobility

#### ■ Monthly transport spendings

Monthly transport spendings vary between 8,6 and 10,7% of household incomes. These are low compared to international levels (12% for low-income communities and 24% for wealthiest communities). Hence, the average Mebidangro traveler is more sensitive to transport price variations e.g., fuel increase, parking fees, public transport fares and others.

#### ■ Readability of fares

It shall be noted that the variety of fares does not contribute to a good readability of PT by potential users. An opportunity is present to equalize fares and possibly integrate them – in parallel of increasing physical integration as well, for better attractiveness of trains and buses.

**Figure 40. Mobility spendings against household incomes**

#### ■ Subsidies of operations

In general, minibuses and regional buses are not subsidized, while urban buses are, such as TransBinjai. Trans Metro Deli are still subsidized but later fares will be determined with the service system. However, it remains unclear at this stage to what level the subsidies are set.

All Indonesians have a facilitated access to fuel with subsidies. It also benefits operators, as both rail and road vehicles of PT are petrol and diesel engines in Mebidangro. However, it also eases private vehicle owner operating costs which are not beneficial to the reduction of the number of cars and motorcycles on the roads.

#### ■ Affordability considerations in the SUMP

Providing improved solutions for mobility, such as mass transit and MaaS, shall remain affordable for inhabitants so that they can access and use them. The limited spendings in mobility shows a preference for options with lower costs, such as private vehicles, whatever the costs of parking. Furthermore, it identifies clearly the population using motorcycles as the target group for mass transit users. Hence, areas with higher motorcycles modal share shall receive mobility proposals in priority.

Finally, the sensitivity of the inhabitants to price changes suppose a strong response to financial penalties for PV usage, as policies to decrease vehicles on roads. Such penalties shall be studied attentively and prepared so that social response is as intended and without resistance. This SUMP proposes some actions on this domain.

### 11.4.1.e. Facilities for Soft Modes

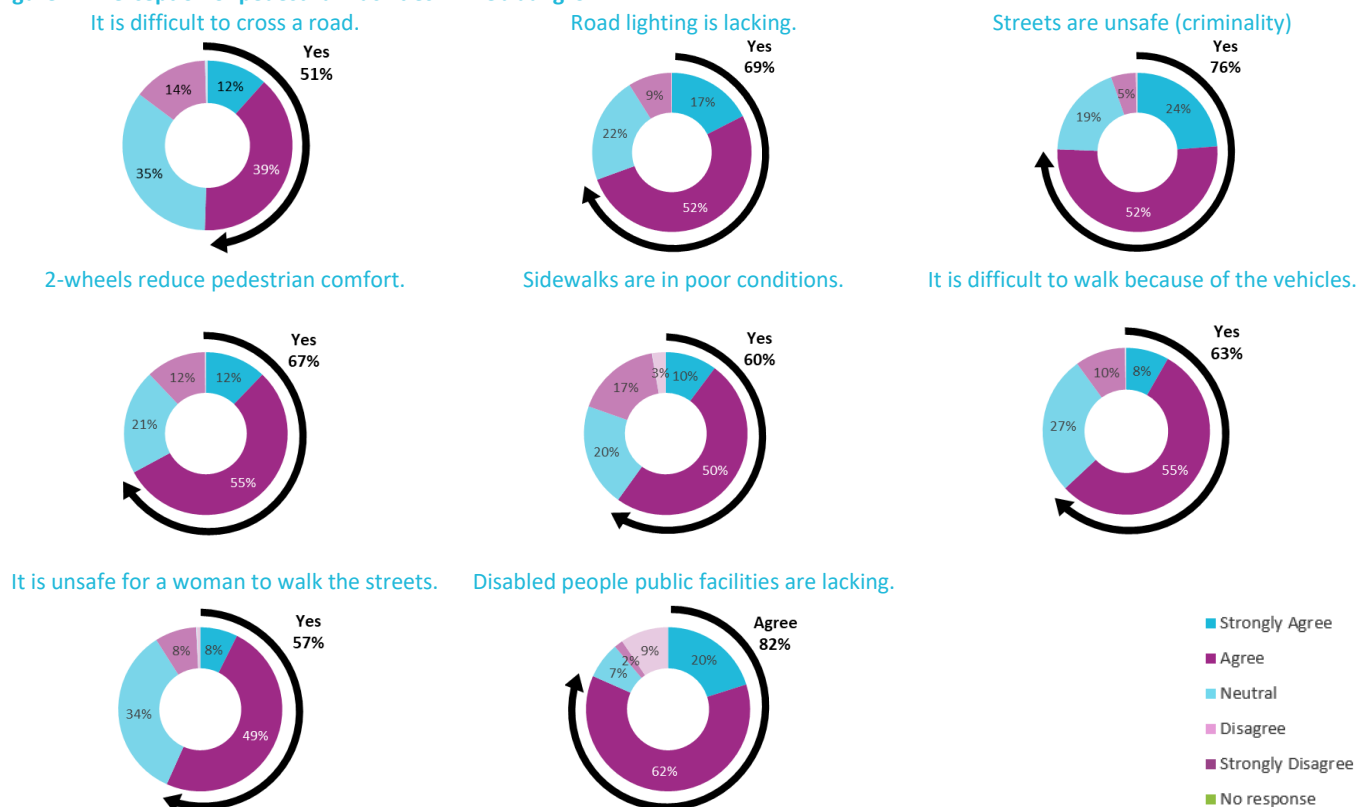
It was shown and expressed by stakeholders, that current NMT facilities do not allow sound and safe travels, especially for the case of vulnerable groups as described later in this report. However, efforts have been made by the cities to improve this feature in Mebidangro in the past years, with mixed results. As a catalyst to PT adoption and as a result of PT implementation, NMT facilities cannot be separated from sustainable mobility.

#### ■ Pedestrian and bicycle facilities

##### ■ Sidewalks

In Medan city, roads without sidewalks can still be found, and sidewalk absence is high in Mebidangro. Moreover, sidewalks are often only to fulfil the requirement of road construction standards, ignoring its functionality: sidewalks are blocked by trees, lacks, ramps, street light, etc.

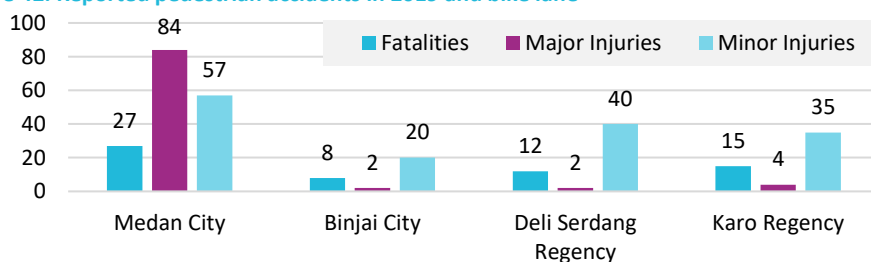
Figure 41. Perception of pedestrian facilities in Mebidangro



##### ■ Road crossings

Crossing facilities, or zebras, are essential for pedestrian comfort and safety. However, many accidents involving pedestrians occur on crossings. In Mebidangro itself, crossing facilities and road safety have not become a concern. The lack of quantity and quality of crossing facilities is still common even on the major roads in Medan City. This, and the crowd traffic in Medan have caused high pedestrian accidents that reach 168 victims in 2019 only.

Figure 42. Reported pedestrian accidents in 2019 and bike lane



##### ■ Bike lanes

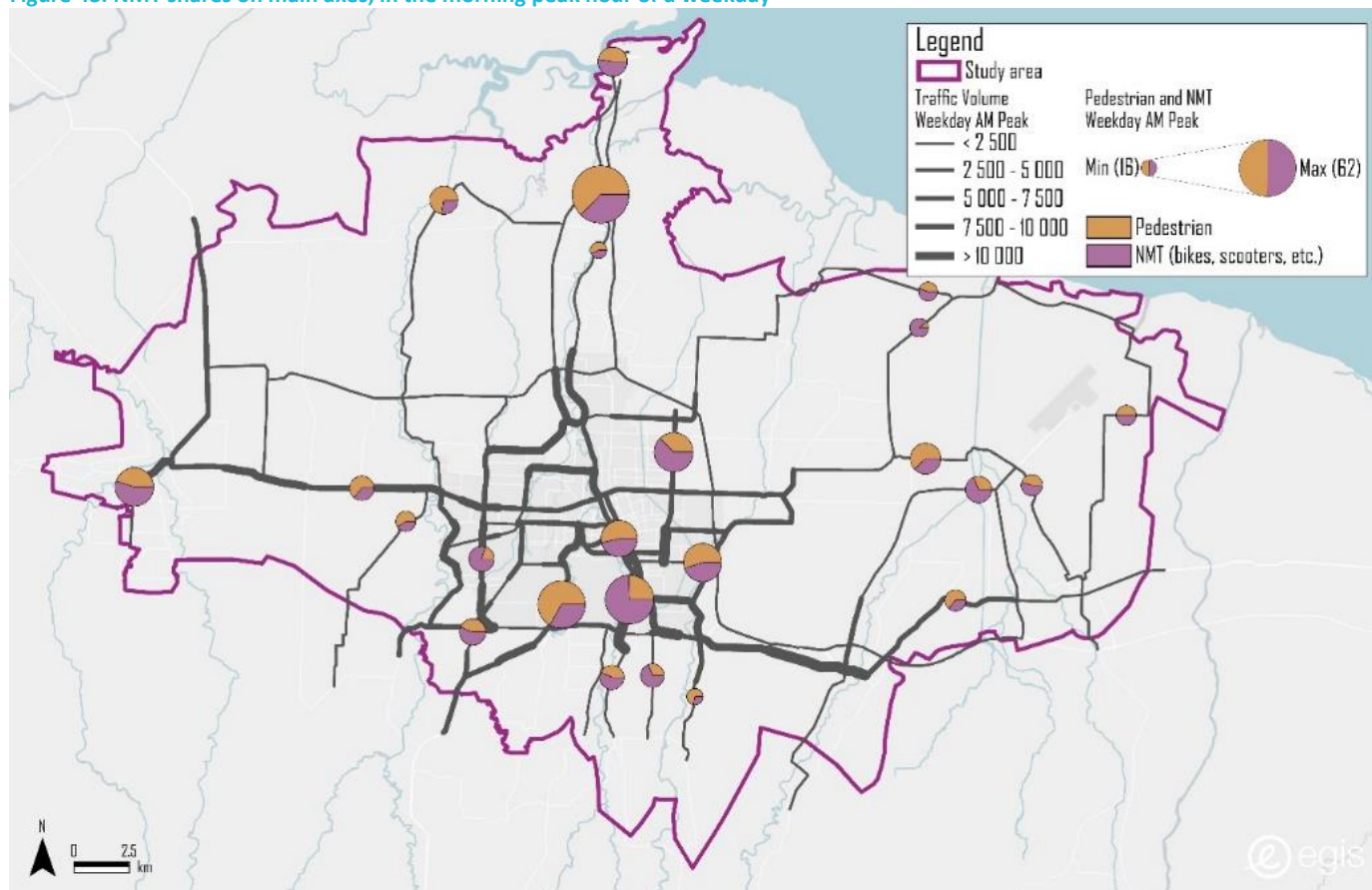
Bicycle lanes are very limited. Bike lanes are only available in one street of Medan City (Jl. Setiabudi). But motorized vehicles use bicycle lanes to park and circulate, which is possible as there is no segregation between ways. Segregation would help increase the usage of bicycle lanes and the safety of its users. It shall be noted that bicycle lanes and sidewalks are absent from Mebidangro planning (RTRW).



### ■ NMT representation

NMT were observed during traffic counts for micro-mobility in dense areas. NMT users do not cover long distances, but current trends show that it is probably because they don't have the required facilities to do so.

Figure 43. NMT shares on main axes, in the morning peak hour of a weekday



Areas close to universities (Jl. Jamin Ginting next to USU), plazas in Binjai, densely populated districts and the hypercenter of Medan in Lapangan Merdeka are where the highest presence of NMT was observed. These locations coincide to specific uses of the urban spaces and could serve as pilot areas for the implementation of NMT facilities.

It shall be noted that roads accommodating most NMT have important semi-vegetized medians (between 0,5 and 1 meter). Developing NMT facilities would offer the opportunity to review the road geometry and its components.

### ■ NMT consideration in the SUMP

During the COVID-19 pandemic, a rise in bicycle usage was observed in Medan, as people rediscovered soft modes in streets with lower vehicle occupation. This opportunity for adherence to soft modes, the alarming number of pedestrian death due to insufficient facilities, and the criticality of sidewalks and bicycle lanes for the PT success, all point out the need for investments in infrastructure for soft modes.

As of today, NMT is not prioritized by authorities as it is completely absent from mobility policies. The SUMP proposes addressing this gap with dedicated facilities for a more sustainable mobility in Mebidangro.

## II.4.1.f. Summary of the Inventory

### ■ Opportunities from the infrastructure side

Road and rail networks could benefit from a more integrated management for their state. They present the opportunity to maximize the use of their assets. Roads shall not be extended more, but instead vertical and mixed-use developments shall adapt to the current network. Furthermore, an integrated authority overseeing roads in Mebidangro could address their heterogeneous quality and signage, and the needed upgrade of the Medan-Berastagi road link.

Furthermore, parking and law enforcement shall be reinforced in Mebidangro, to not only ease traffic attitudes but also grant higher access to mobility for vulnerable groups. These shall support the accommodation of forecasted urban developments, which would be supported by railways too.

Rail infrastructure needs investments to increase its operational and environmental performances, by improving speeds and use cleaner technologies. The aging fleet shall be replaced to attract more passengers. Furthermore, reactivating stations could cope for the expected demographic growths.

#### ■ Opportunities from the services side

Accessibility and affordability to mobility in Mebidangro presents a contrasted situation. While the geographical and population coverage is high with the minibuses, patronage is decreasing due to the low quality of vehicles and accessing facilities (soft modes). This directly points out at the need for better sidewalks and bike lanes, which shall contribute to the better adoption of PT by inhabitants.

Better readability is also needed to convince users to shift to PT. Currently, fares, services and schedules are unclear, and particularly felt by people with disabilities who need to plan their trips in advance. Information to passengers is crucial and shall be enhanced.

Soft modes also present some challenges. The rare bike lanes are misused due to unclear identification and awareness. Important accidents occur with pedestrians and the perception of walking facilities is very poor. Investments towards soft modes facilities shall be considered to allow access to PT, and in turn secure the access to future mass transit; but also to allow the use of NMT as a standalone mode of transportation that grew during the COVID-19 pandemic.

#### ■ Harmony in the transport landscape

While the complexity of mobility organization was shown in the related paragraph, it is noticeable that authorities of Mebidangro cities and regencies, as well as the North Sumatra Province, lack considerations for future projects in official plans. This could either show a lack of pipeline identification and anticipation or organic development of projects. Either way, the planning shall be improved and supported by capacity development assistance, as proposed in this SUMP.

Multimodal integration and affordability of mobility is part of its success. Multimodality shall be observed by integrating rising online hailing services with long-distance mass transit, turning wide systems of minibuses into feeders for mass transit – as proposed in the preparation of the BRT Line 1 – and in dedicated park and ride facilities for PV users to shift to PT. This harmony can only be granted if a single authority oversees land transport across the territory and all modes, marking another case for this governance action.

All takeaways to explore are further confirmed and quantified with the mobility demand of the next paragraph. The road network is used for the modelling of the mobility scenarios and identification of best measures, while more qualitative aspects are available in dedicated actions.

## 11.4.2. Mobility Demand: Current and Expected Trends

The mobility demand reflects the mobility habits and behaviors of users of transport infrastructure and services in Mebidangro. The analyses are based on information gathered mainly through the investigations of the SUMP, i.e. interviews of people in their household (declared responses) or in movement (intercepted responses) on-board public transit (PT) vehicles or stations, or in the streets in their non-motorized or motorized vehicles (PV). Given the unusual mobility conditions during the COVID-19 pandemic, advanced analytics are used to draw a picture of normal mobility conditions and trends. These are described later in this report and in appendix. The mobility demand section covers the general outlook on mobility in Mebidangro, the road traffic and public transport uses, as well as urban freight considerations.

### 11.4.2.a. General Outlook on Mobility

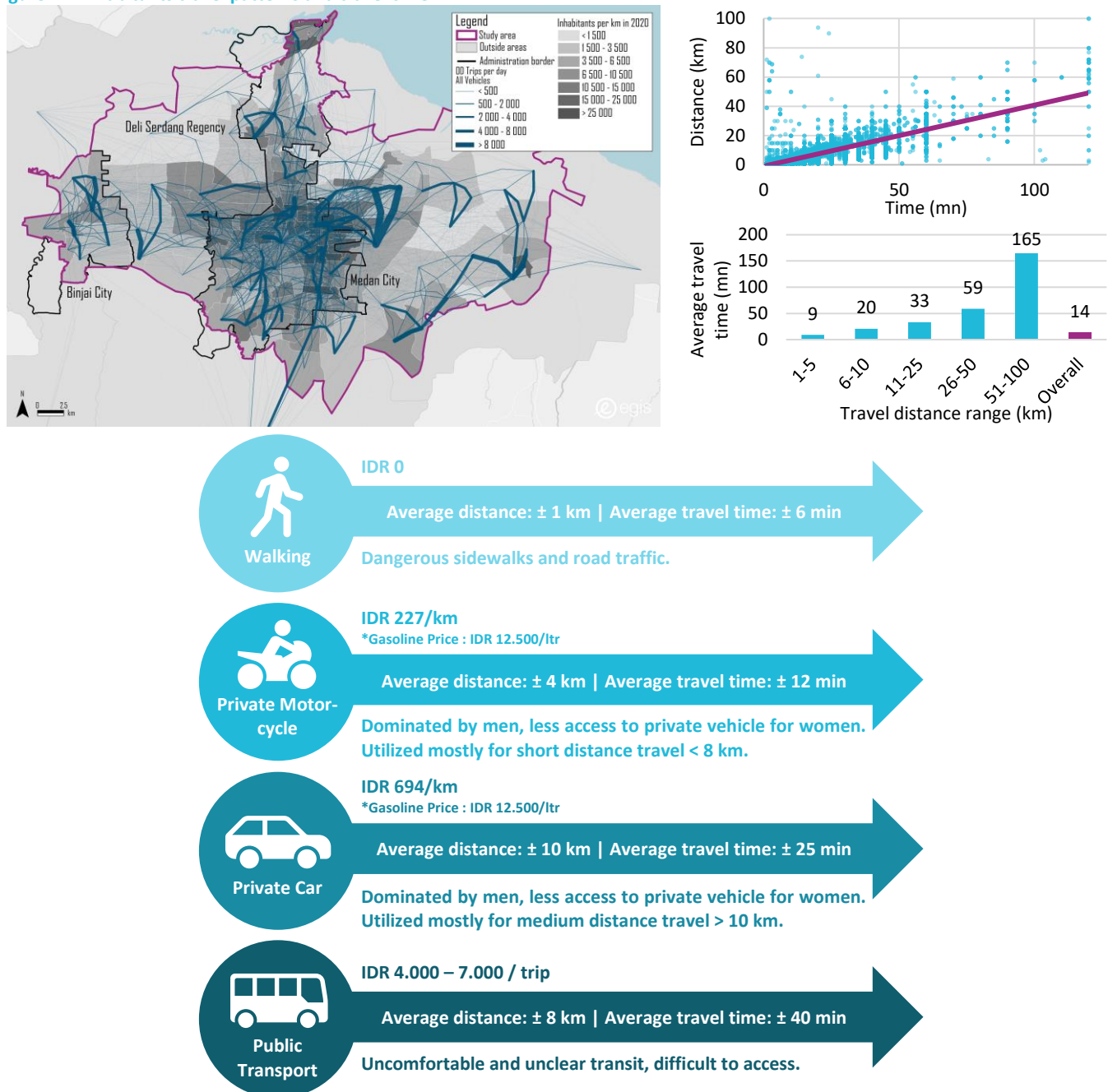
This paragraph offers a perspective on the general mobility at the macroscale of the urban area to identify the general dynamics.

#### ■ Urban trips

##### ■ Number and nature of urban trips

There are 4,76 million daily urban trips in Mebidangro, which is the equivalent to 2,5 trips per person daily. The majority of urban trips, i.e. 2,86 million trips (60%), are in and out of Medan City. It shows the importance of administrative areas outside Medan City in terms of mobility. On the other hand, 2,45 millions trips are done within Medan City boundaries daily. The trips patterns are thus concentrated towards the center of Medan and rely on radial axes.

Figure 44. Inhabitants travel patterns and travel time



#### Travel time

These trips are dominantly done on short distances as shown by the low average of 14 minutes for a trip. Contrasted with the number of trips, it also shows the strong interrelation between the urban settlements of Medan and Deli Serdang.

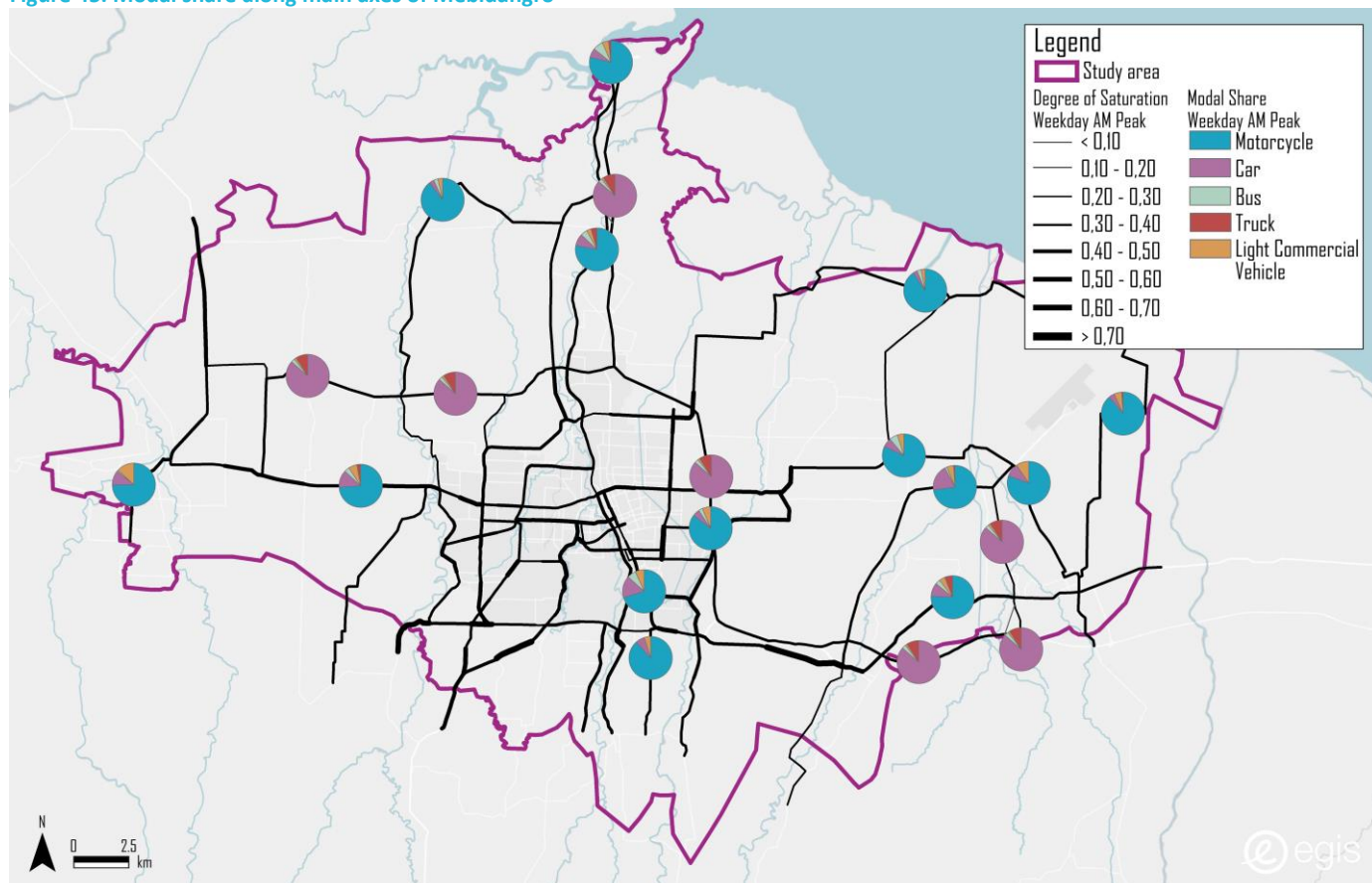
It shall be noted that these insights are produced thanks to extensive household surveys (15.000+ households and 40.000 individuals) during the COVID19 pandemic. In order to re-create a pre-pandemic outlook of average trips, cellular data (Telkomsel) was used between the two periods (pre and in-pandemic). Adjustments regarding the samples and total population were made to describe a most comprehensive picture possible. More details are available in appendix on the reconstitution methods.

#### Modal split

##### Localized view

The modal split along main axes shows the prevalence of motorcycles, for all roads except toll roads (where motorcycles are forbidden). Light commercial vehicles are the third type of vehicle represented. All conventional roads are dominated by motorcycles, before trucks and cars. It is concluded here that the modal split across the area is relatively homogeneous and present the same nature in different districts.

Figure 45. Modal share along main axes of Mebidangro



#### Generalized modal split

The generalized modal split of daily trips is analysed with a finer breakdown in modes thanks to the household surveys where modes were declared. The modal share in the area are dominated by private vehicles (72%), especially motorcycles constituting more than three quarters of those.

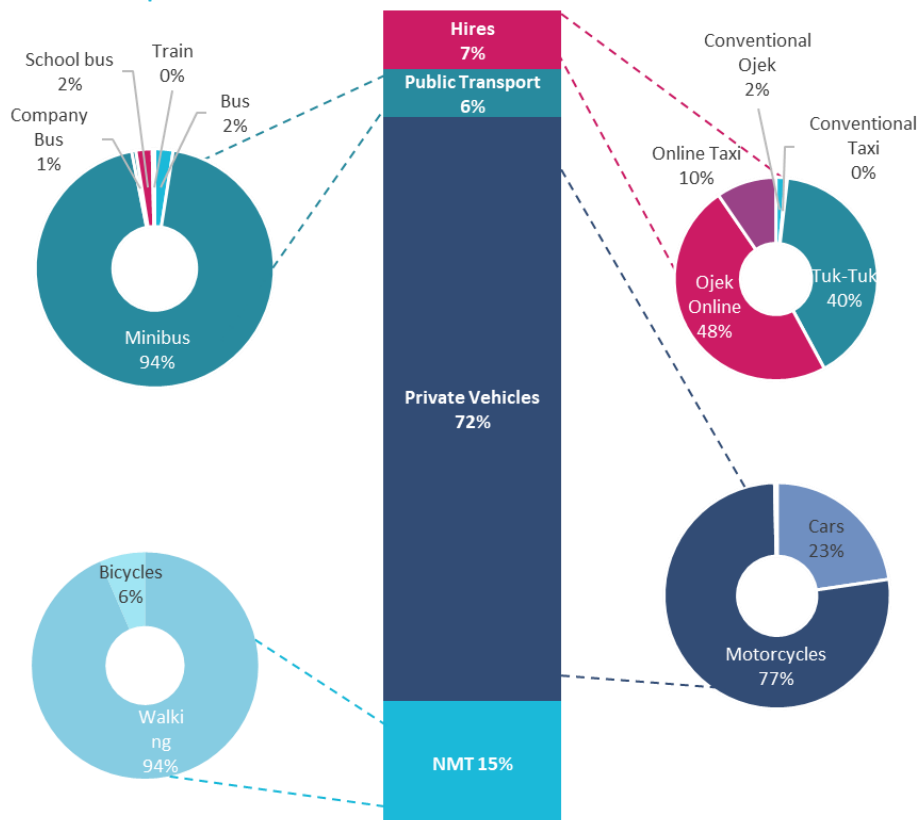
Public transit (PT) modal share is very lowly represented across Mebidangro. Mebidangro has the lowest PT share at 6%, compared to other metropolitan areas in Indonesia: Jakarta (27%), Bandung (22%) and Surabaya (11%). Train riders represent close to 0% in the overall number of trips. Minibuses dominate by more than 90% the PT trips.

Interestingly, hires only represent 7% of daily trips, and are mainly divided between online hailing and tuk-tuk (motorized tricycles). Conventional ojek (hailing motorcycle taxis) are still present despite their disappearance in other parts of Indonesia. Inhabitants often declare using those despite their antique nature because they are familiar with their drivers. This relays the safety concerns of the people over mobility.

NMT, in very localized areas as identified before, is present with limited number of bicycles and mostly pedestrians. It still represents a higher share than hires and Pt combined, showing the very low distances the people cover. Those trips shall be safe and done with functional facilities.



Figure 46. Modal share of declared trips in household interviews



#### Load factor of private vehicles

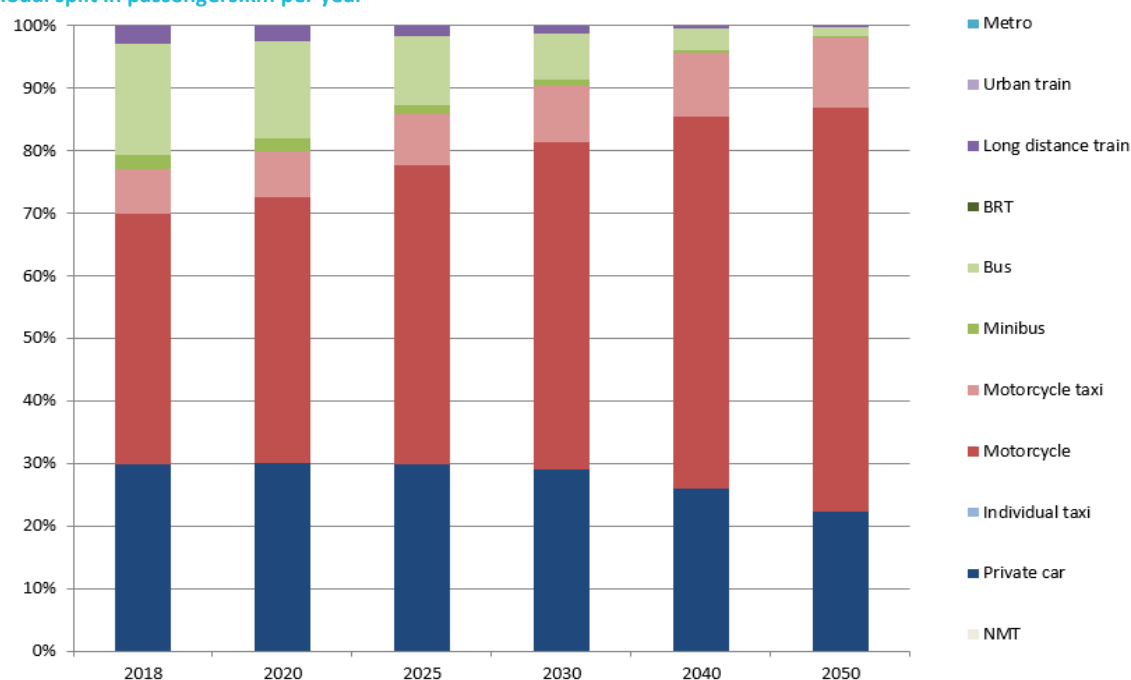
Cars carry 2,2 pax and motorcycles 1,3 pax in average. These numbers are higher than the load factors in Bangkok (1,2 and 1,1 respectively) which has very strong motorization rates. Higher load factors mean more efficient trips in terms of road space and energy usage, and GHG emissions per person trips.

#### Modal split of kilometers travelled, trends

The passenger kilometer levels indicate the presence of vehicles on the road per their usage by inhabitants. At the image of trips and, it is dominated by motorcycles and cars – although their load factors are relatively low, reflecting high motorization rates. Motorcycles are predicted to overtake cars in modal split in future years, with a relatively low hires share.

The forecast is made following the **MYC GHG tool** model. It is based on demographic, modal spit, load factors and vehicle kilometers trends. It provides an approximate trend that confirms the growing importance of motorycles and continued decrease of angkot uses in the status quo situation. These trends are used for the traffic modelling and GHG emissions estimations later.

Figure 47. Modal split in passengers.km per year



## ■ Mobility rates

### ■ Amount of trips per person

Household surveys, completed and redressed to the area level, indicate the number of individual daily trips. By disaggregating it per socio-economic criterias, this provides important information on the context of mobility in Mebidangro for designing specific policies.

The total mobility in the SUMP area presents a global volume of 4,76 million daily trips ie. 2,5 trips per person with mobility, or 1,2 return trip per person when compared against the total population. Compared to other Asian cities (Jakarta and Bangkok), it is relatively low. This mobility rate is even lower compared to European cities (up to 3,6 trips per person).

This finding means that the economic activity and transportation affordability in Mebidangro is not as high as other urban cities. Furthermore, obstacles such as accessibility, travel speeds, comfort and quality of infrastructure pose obstacles to a more efficient and voluminous mobility.

### ■ Gender and age discrepancies

Women are generally travelling less than men, corroborating the fact that they have a lesser access to private vehicles and rely more on inflexible public transport for safety and accessibility reasons. Meanwhile, the age classes of 15-19 and 45-49 years old are the most mobile in Mebidangro, correlating with the strong trip purposes of work and education presented later on.

It shall be noted that the age classes 50 to 60 years old have higher mobility rates than the age class 20 to 34 years old. This supposes a strong linkage of the mobility with revenues.

Figure 48. Contextualized mobility rates

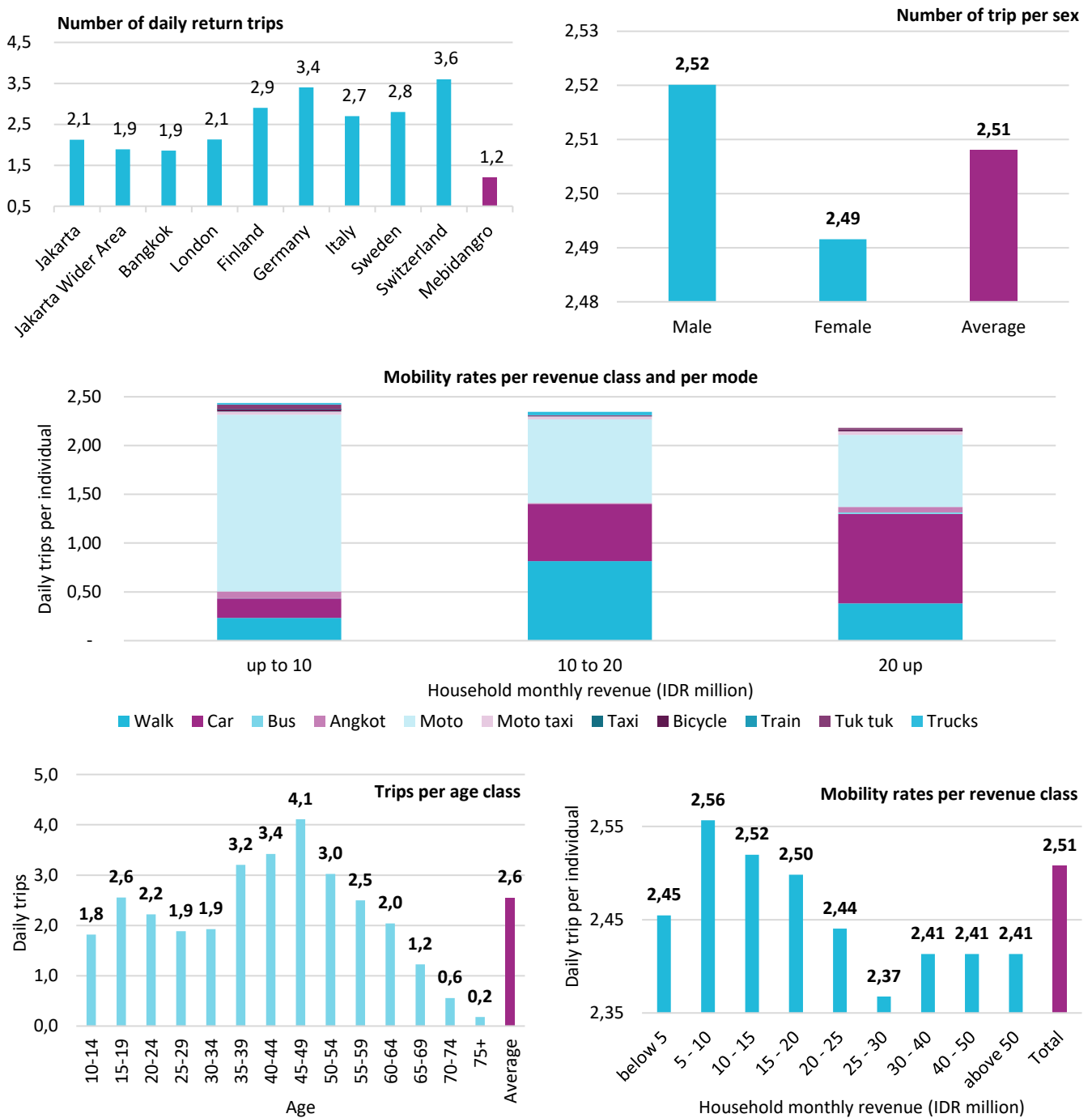
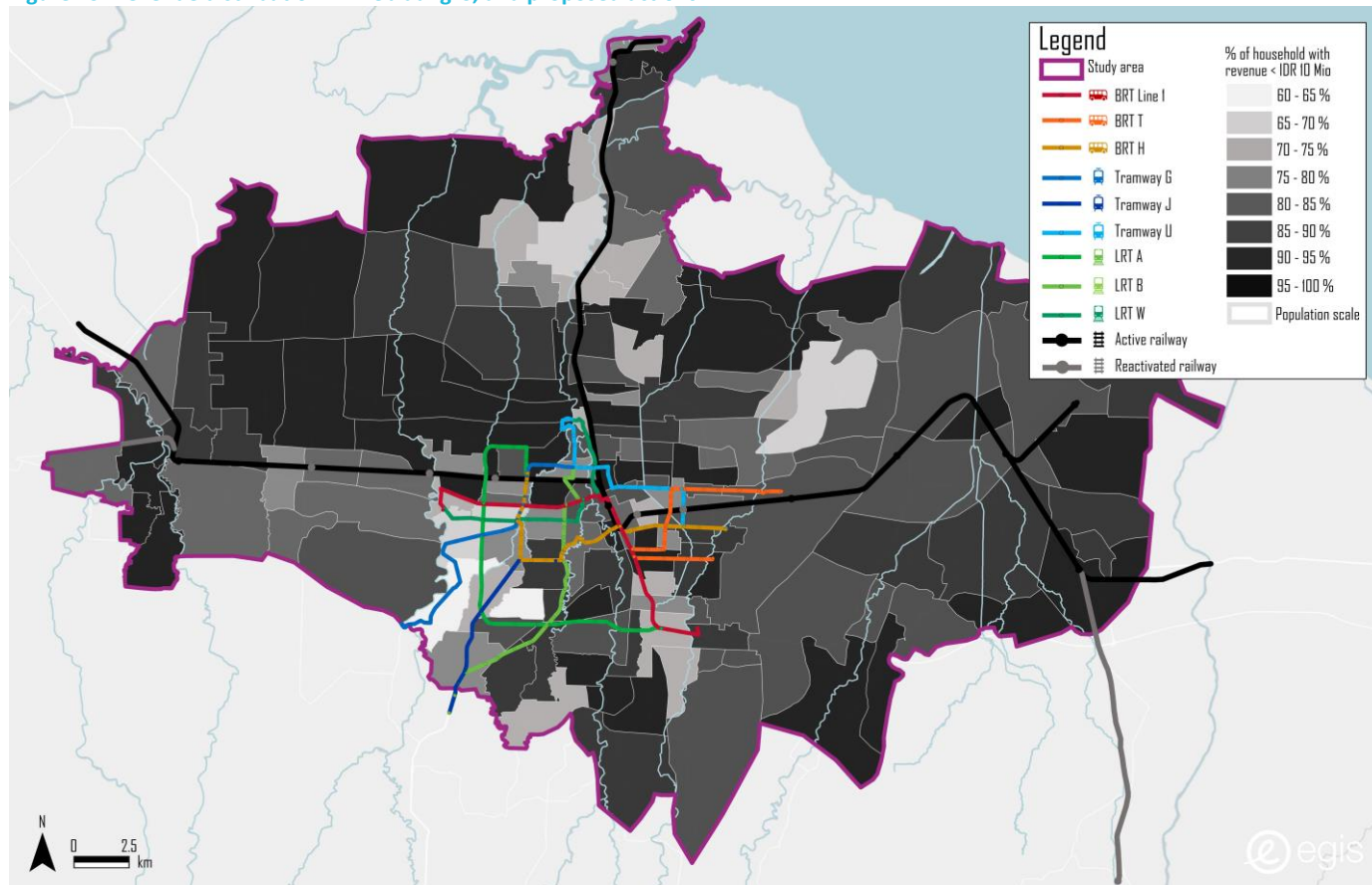


Figure 49. Revenue distribution in Mebidangro, and proposed actions



#### Revenues and modes

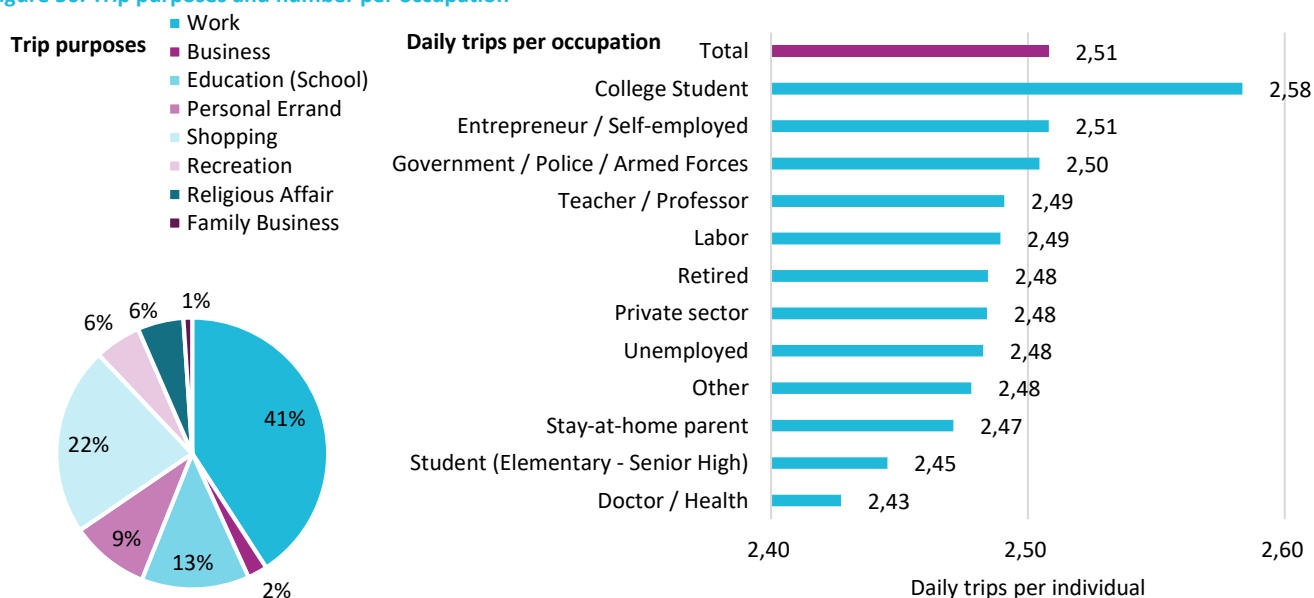
The motorcycle is more used for trips of people with low revenues (IDR 0 to 15 million per month). The use of cars gradually increase and are maximal for the revenue class IDR 30-40 million/month. It corroborate with high mobility rates for lower revenue classes than for high revenue classes, given the flexibility given by motorcycles.

Furthermore, low revenues and walking are not necessarily associated, showing the importance of pedestrian facilities for all communities, including the middle class.

#### Trip purposes

Work purposes represent 41% of all trips. This is coherent with the share of trips made by workers (almost 50%). Shopping and education are the following main purposes. This is reflected by men having a higher mobility rate than women, as per the employment assessment.

Figure 50. Trip purposes and number per occupation



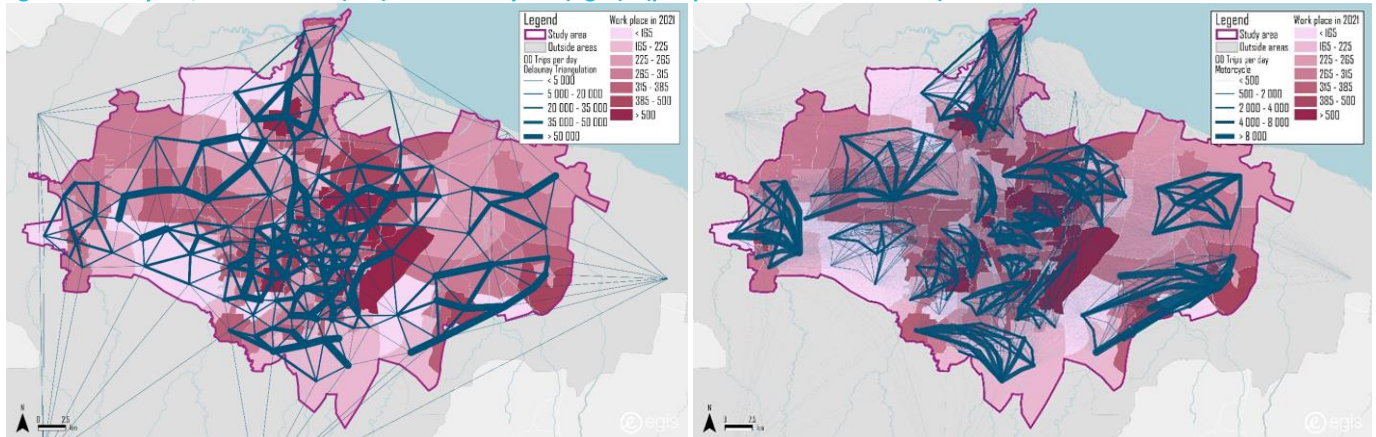


Education is the second reason for trips, and college students have the highest mobility rates among all occupations with 2,6 trips per day. These provide early indications of the importance of school facilities in the spatiality of trips, as well as the need for regular and reliable transport services for work areas. The groups of workers and students shall be the targeted users for new modes to provide meaningful impacts.

### ■ Spatiality of trips

The analysis of origin and destinations of individual trips between transport macro-zones show an interdependence between areas with workplaces and the intensity of trips.

Figure 51. Daily OD, for all modes (left) and motorcycles (right) - (pre-pandemic reconstitution)



Per mode, localized districts in Percut Sei Tuan, Belawan, Lubuk Pakam and Binjai shows high usage of motorcycles. On the other hand, trips are longer and more diffuse near Sunggal, as a transition zone between Binjai and Medan. Important activity also stems from the South in Simalingkar, where motorcycle trips are strongly represented.

The OD analysis for Mebidangro is mainly used in determining future corridors of high demand within traffic modelling. However, here, the mapping of OD for motorcycles confirms the importance of intra district and short distance trips, which shall be addressed specifically.

### ■ Summary of the general outlook on mobility

Mebidangro mobility at high and low scales has prevalent motorcycle and car usages across the territory. Almost three quarters of the 4,86 millions daily trips in Mebidangro are made with these private vehicles. The main issue to tackle shall be their use.

The lack of attractiveness of PT previously identified is confirmed here with a very low modal share (6%), which is low even for Indonesia. NMT and hires show growing trends, and shall be fully integrated within proposals later on.

Disparities in mobility are identified between revenue groups, gender, occupations and modes used. It is reflected in the mobility rates, which are higher for motorcycle users. Mobility rates prove the efficiency and flexibility of motorcycles against cars and PT. workers and students also constitute the main target market of sustainable mobility users.

However several challenges lay ahead of their implementation, namely their localization adaptation and effective travel speeds. Today, the average trip is very short (14 min) and shows important intradistrict mobility. Alternatives in NMT for short distances and mass transit for long distances shall be identified and take those aspects into account.

Many of the takeaways of this paragraph are used in later quantitative exercises (traffic modelling, emissions estimations). However, they also provide data to authorities for preparing specific policies to restrict private vehicles usage.

## 11.4.2.b. Individual and Public Transit Traffic

Characteristics of the road traffic are identified here, to pinpoint the challenges of the high demand on the infrastructure. Vehicles volumes along the main axes of the area show expected high usage of radial ways into and from Medan.

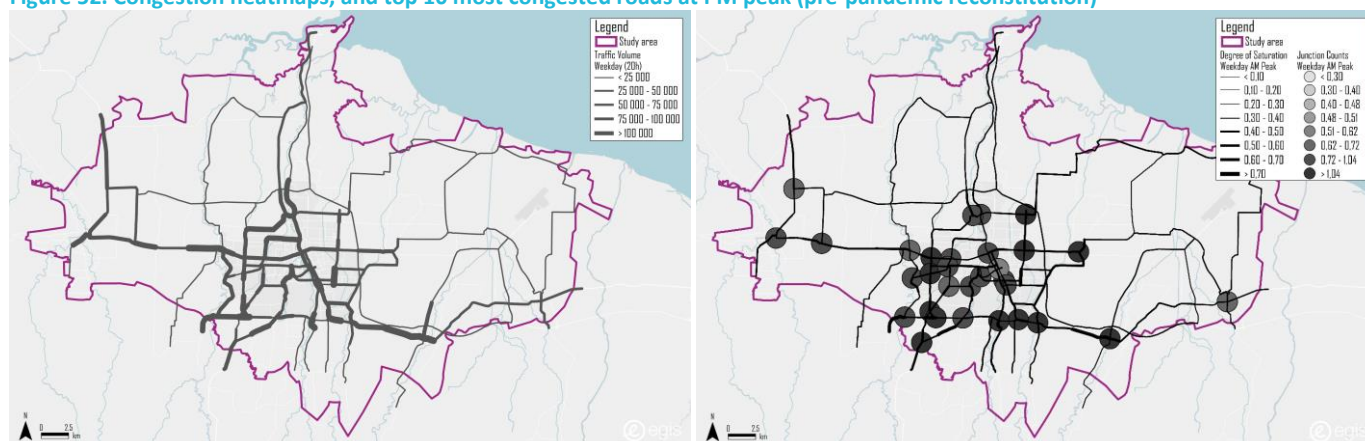
### ■ Road traffic

The map below illustrates the highest volumes of vehicles on the roads on the main road network of the urban area. The road network situation is quite good: more often than not, the degree of saturation of roads indicate that their capacities are not exceeded by their traffic volume. However, the degrees saturation hint towards delays occurring in some of road segments to some extent.

The severity of road traffic varies upon location rather than being homogeneous throughout the area, and most severe saturation is located nearby junctions: 6 out of 10 most congested road sections are located near junctions.

Peripheral western and southern junctions' saturation have high volumes of vehicles nearing the capacity of the road and creating congestion. This is coherent with the high motorization rate of the districts that are west and south of Medan, as well as the commuting segments. Peripheral eastern saturated junctions follow high density neighbourhoods with high volumes of motorcycles and intense interdistrict mobility.

Figure 52. Congestion heatmaps, and top 10 most congested roads at PM peak (pre-pandemic reconstitution)



Road Name	Saturation	Junction name / locator	Saturation
Jl. Jamin Ginting - Jl. Dr. Mansyur	0,85	Sp. BW Sampali	1,84
Jl. Jamin Ginting - Jl. Setiabudi	0,85	Sp. Jl. Medan Batang Kuis - Jl. Besar Tembung	1,46
Jl. Amir Hamzah - Jl. H. Adam Malik	0,76	Sp. Jl. Ngumban Surbakti	1,39
Jl. Amir Hamzah - Jl. Kapten Muslim	0,76	Sp. Underpass Katamso	1,36
Jl. Raya Medan (Sp. Jl. Batang kuis – Jl. Limau Manis)	0,74	Sp. Kayu Besar	1,35
Jl. Lintas Sumatera (Sp. Jl. Ngumbang Surbakti)	0,70	Sp. Jl. Sisingamangaraja - Ringroad	1,33
Jl. Panglima Denai (Sp. Jl. Sisingamangaraja)	0,68	Sp. Ringroad - Jl. Setiabudi	1,31
Jl. Besar Tembung (Sp. Jl. Pasar 7)	0,66	Sp. Melati	1,28
Jl. Sisingamangaraja (Sp. Jl. Medan - Tebing Tinggi)	0,62	Sp. Jl. Gatot Subroto - Jl. Medan - Binjai	1,25
Jl. Flamboyan Raya	0,60	Sp. Sunggal	1,24

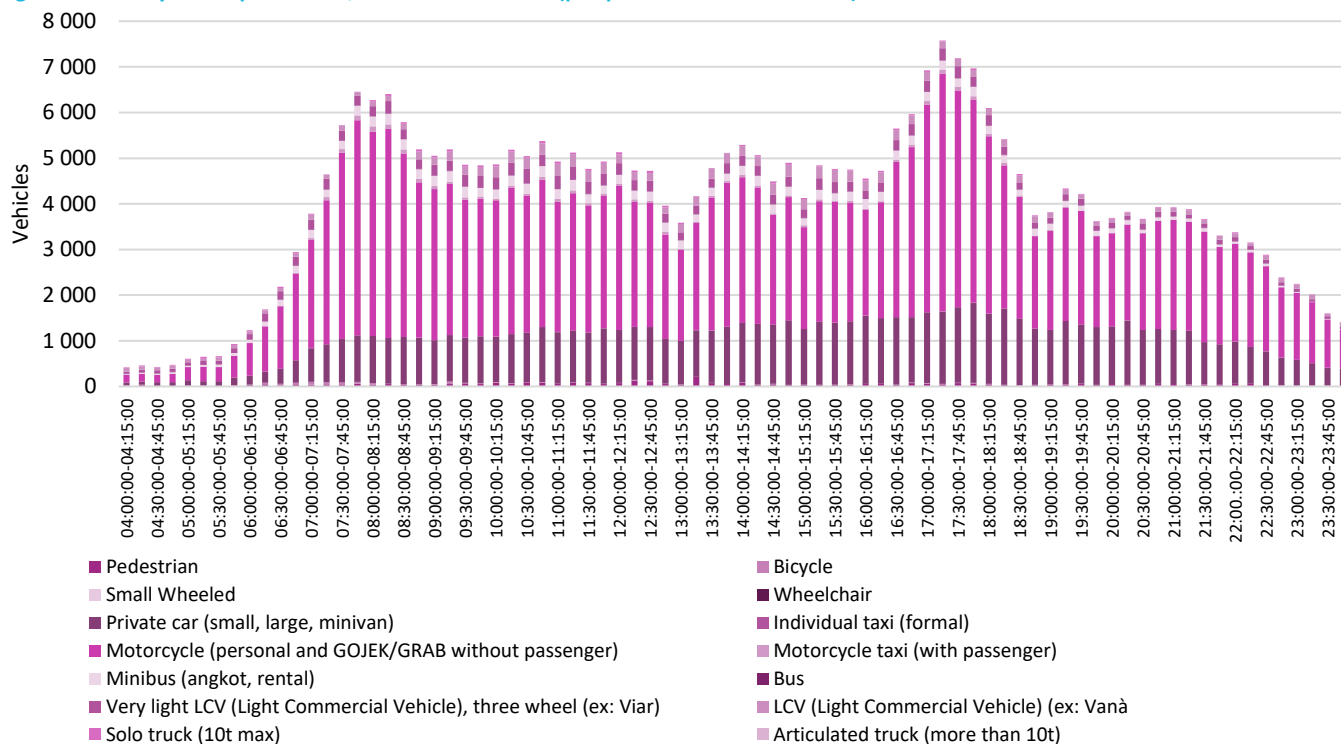
All saturated junctions receive important shares of freight vehicles, which are slower than private vehicles and increase saturations.

### ■ Peak hour characteristics

The day-long traffic counting allows identifying the peak hour factor, which represents the share of vehicles travelling on roads in the busiest hour, against the full day. It allows extrapolating peak hour volumes to daily volumes, for current and future traffic estimates of road and public transportation measures. The identified peak hours range from 07:30 to 08:30 in the morning and from 17:00 to 18:00 in the evening. The average peak hour factor is 9,54%.

This ratio is a result of the economic tissue of the area and the formality of jobs. In perspective, DKI Jakarta has an estimated peak hour factor of 11,14% (PT. MRT Jakarta, 2020). This metric will be used for further modelling purposes. However, it shows here that the economic tissue of Mebidangro is less formal than the one of the capital, with important informal activities. In the section dedicated to the COVID-19 impacts on mobility, it is confirmed.

Figure 53. Hourly traffic per vehicle, from four locations (pre-pandemic reconstitution)

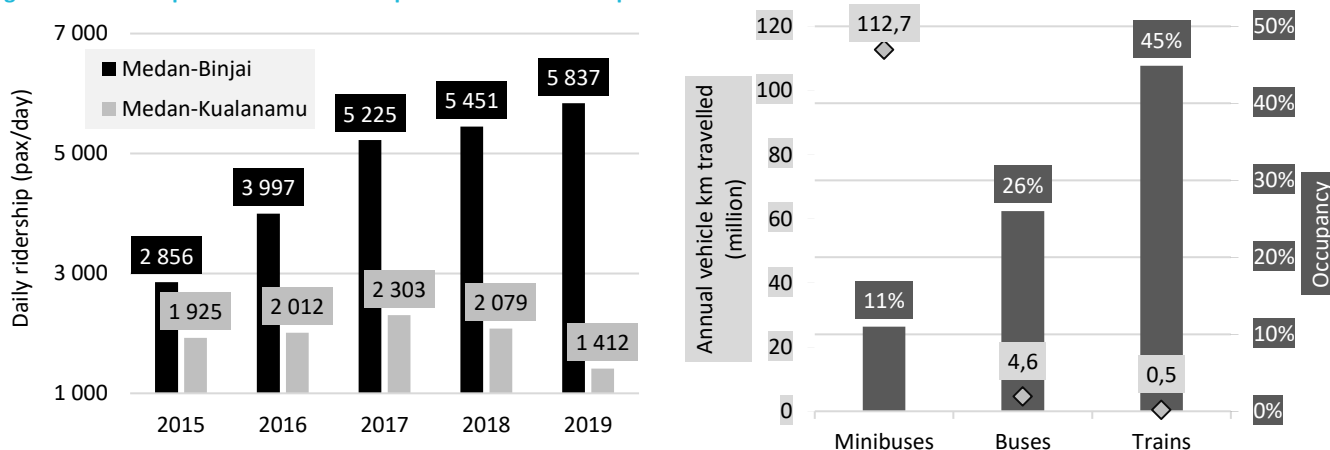


## Public transport demand

### Train patronage level and seasonality

The number of daily passengers remains relatively low for rail infrastructure and services, but shows upward trends. The urban rail lines show an increased adoption of the Medan-Binjai route by inhabitants, with growing yearly volumes every year, to reach more than 2,1 million riders in 2019. On the other hand, the Medan-Kualanamu line has a rather stable ridership, which depends on air traffic.

Figure 54. Ridership of rail lines and occupancies of urban transport modes



Trains have a low occupancy rates at 46% and 41% respectively for the binjai and Kualanmu lines. Standard occupancies of trains range between 60% and 80% for normal operations.

Passengers must be attracted more, especially in potentially captive markets such as the Kualanmu airport. Increasing the usage of trains would in turn allow attracting the private sector for increasing performances (with low public budget mobilization) needed as identified in the infrastructure paragraph. A virtuous cycle towards sustainable and successful train operations would then start.

### Minibus and bus patronage

The minibuses and buses present very low occupancy rates of 26% and 11% respectively. This reflects the increased accessibility to motorized vehicles as well as their decreasing attractiveness and comfort against online hailing. Minibuses and buses are less popular than trains.

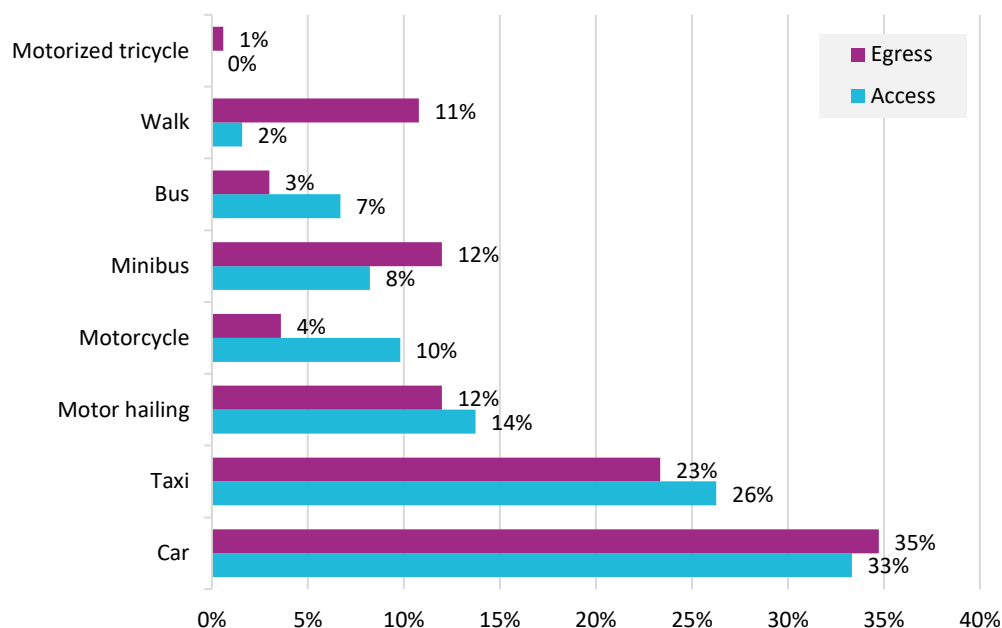
The comparison against vehicle kilometers travelled by existing fleets of vehicles for minibuses, buses and trains show the inefficiency of road-based modes today in Mebidangro – against the relative kilometeric efficiency of rail. A strong parallel

exists as the occupancies are inversely low for high mileages. The road-based modes are highly irrelevant in today's context for Mebidangro.

### ■ Multimodal integration demand

As multimodality is demanded by users, access and egress to urban PT were surveyed. Rail users mainly access stations from cars and taxis. Motorcycle hailing comes third.

Figure 55. Access and egress to urban PT



Walking represents a low portion of access and egress modes, showing the poor accessibility and coverage of current PT. On the other hand, buses and minibuses only represent 15% of rail access and egress trips, showing a poor multimodality and inadequacy of minibuses to carry luggages, which decreases their attractiveness for multi-trips.

### ■ Takeaways of the demand analysis

In a nutshell, current PT offer does not meet the expected demand as travellers prefer private modes, with relatively circual-able roads – whoever however get congested at peak hours. The very low carrying effieincy of road-based modes states the total irrelevancy of minibuses in the context of mebidangro today. Passengers demand more quality and information, which is present in rail, which has better efficiencies despite its low occupancies.

Rail ridership show increasing riderships on the Medan-binjai axis, which is encouraging and shall be levered on by the authorities. The overall system of road-based PT shall be revised in its governance and composition. Furthermore, another case for a unique and integrated authority over land transport is made by the demand for multimodal facilities which supposes an integrated management of modes.

## 11.4.2.c. Urban Freight

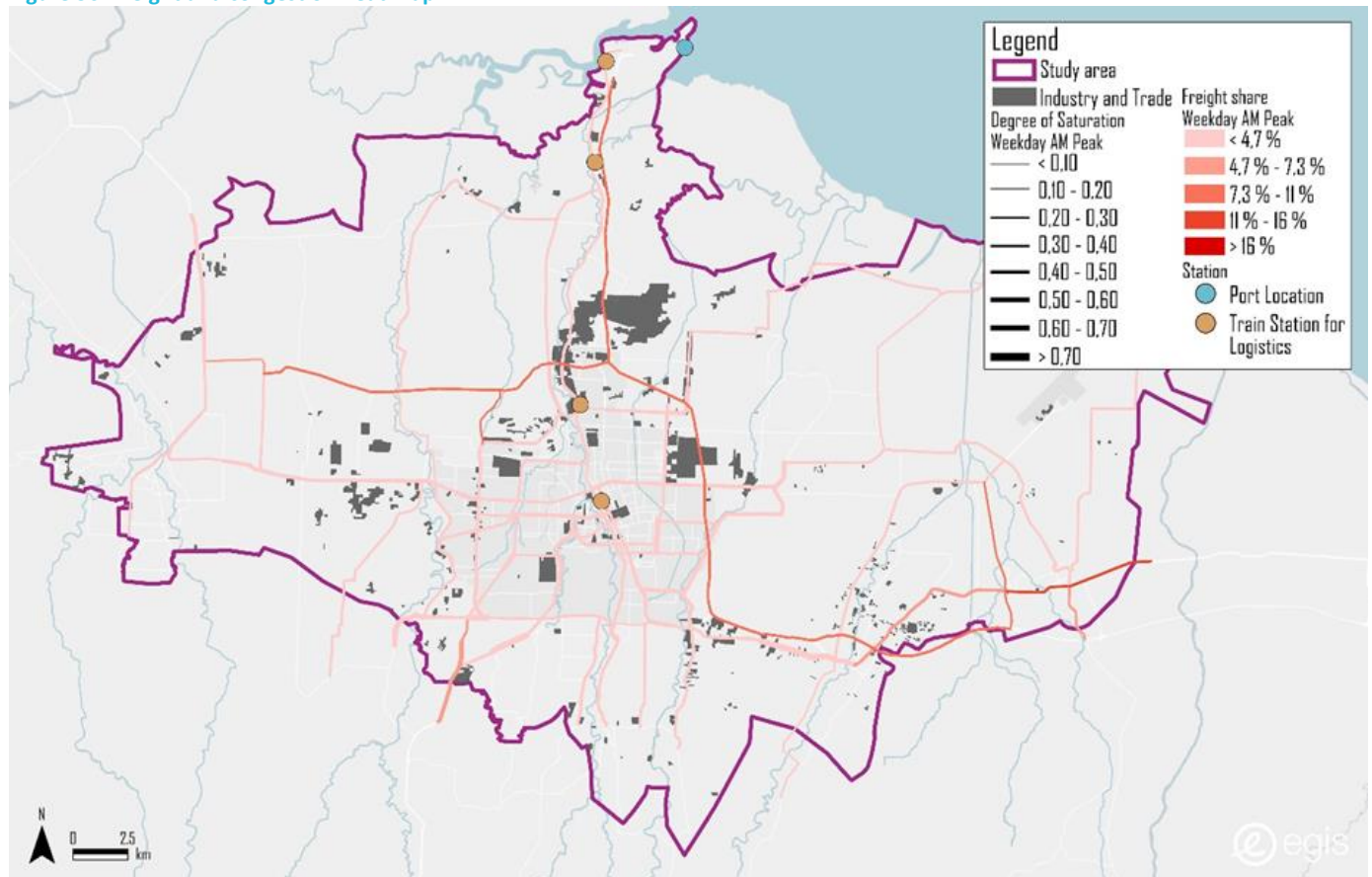
The movement of goods is briefly assessed in this paragraph through the analysis of impacts, nature, composition and challenges and opportunities in Mebidangro.

### ■ Segmented impacts of freight on traffic

The roads outside Medan are the most congested and have high shares of freight vehicles. Freight vehicles slow down the general traffic, especially at junctions. The periphery of Medan is impacted, lowering travel speeds for PV and road PT.



Figure 56. Freight and congestion heat map



However, core Medan and Binjai have forbidden the circulation of trucks – but as the freight movements and poles become more regional (just as passenger traffic), mitigations within administrative borders have less and less impacts on the overall performance of the road network. Furthermore, commercial vehicles allowed impact centers as well.

It shall be noted that an important volume of freight vehicles head towards Berastagi on the intercity road link, showing its importance and lack of alternatives.

The largest industrial area is Medan Industrial Area, located in the north. It is strategically located close to the Belmera Toll Gate with good accessibility, at equidistance between Belawan and Medan. Other industrial areas are scattered in Mebidangro. As a result, most congested roads have the highest shares of freight vehicles.

The Ampals section exiting Jl. Sisimangaraja and entering the toll road towards Lubuk Pakam shows a high degree of saturation and high freight vehicles share. The roads before the delta in Simalingkar have high shares of freight vehicles resulting in high saturation of roads, exceeding capacities. High freight shares are also observed in Jl. Medan – Banda Aceh, Jl. Megawati and Lubuk Pakam.

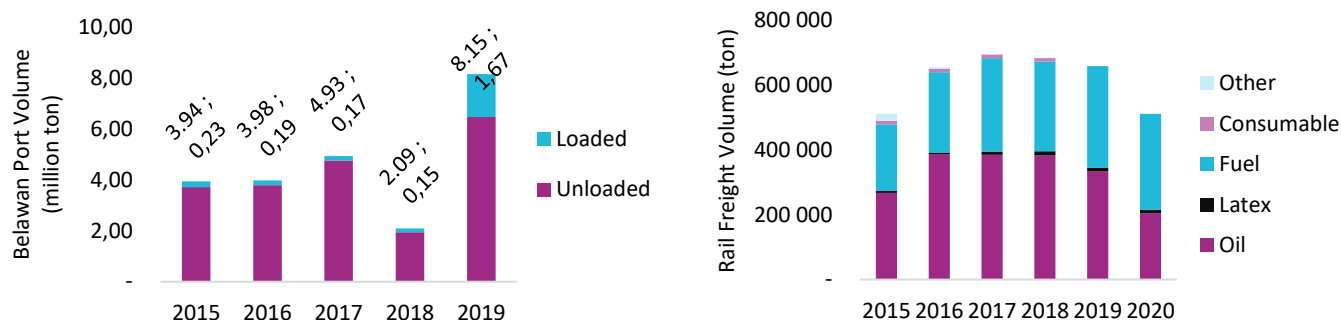
These sections shall be considered in segregating freight from mixed traffic to reduce its congestion effects. Alternatives could be re-routing or shifting to rail freight transport.

#### ■ Rail freight

Belawan Port, about 24 km from Medan centre, is the largest port in Sumatra in terms of TEUs, and remains the main sea gateway of import and export for Sumatra. It accommodates all container types, RoRo, bulk and break-bulk cargo. Belawan port is operated by PT. Pelindo (Persero) I.

The annual volume of goods in Belawan Port reached 8,15 millions tons in 2019, making it the second most important port of Indonesia after Tanjung Priok of Jakarta. As such, Belawan Port plays a key role in Mebidangro logistics.

Figure 57. Rail freight



Belawan port connects to the rail network for freight. There are 4 stations that accommodate freight between Belawan and Medan Center. The annual volume of goods transported by rail is quite high, fluctuating towards 700.000 tons, mainly for bulk (oil & fuel). However, the share of rail freight is low on the overall throughout Belawan.

The importance of Belawan as a key trade gate, the existence of rail infrastructure and the important number of freight vehicles observed on the roads suggest a shift of freight to rail. It is difficult to determine the detailed logistics dynamics at this stage, but suggestions to restrict freight vehicles shall be part of the SUMP.

### ■ Vehicles and pricing

#### ■ Types of vehicles

The type of freight vehicles used in Mebidangro varies in capacities and axle types, in the form of light commercial vehicles, pick-up trucks, solo trucks, trailer and articulated trucks. While freight vehicles of all sorts are regulated by the transportation agencies of cities, regencies and the province (vehicle documents and authorization to circulate delivered after inspection), it shall be noted that there is an exception for three-wheelers which are considered personal vehicles. These are the sources of congestion for intra-city links.

#### ■ Pricing

An indicator on the differentiated management of passenger and freight vehicles is the pricing of the Belmera toll road. Heaviest freight vehicles are priced close to 200% more than cars, following a contributing capacity policy. It stems from the important damages on roads. Such a pricing is inexistent on conventional roads, while physical damages by freight vehicles are similar if not greater (at intersections with braking and acceleration phases), and socio-economic consequences higher (congestion, pollution, noise). In order to force the limitation of freight vehicles on conventional roads, and light commercial vehicles in the city, an homogenisation of the pricing and regulations could be explored, depending on the prioritization of the limitation of socio-economic impacts.

### ■ Takeaways from the urban freight brief

Several paths to explore to optimize urban freight and reduce its impacts on the mobility systems are identified. However, it is difficult at this stage to analyse localise and dedicated problematics to freight due to the organic flux and lack of documentation on the licensing of vehicles and depots.

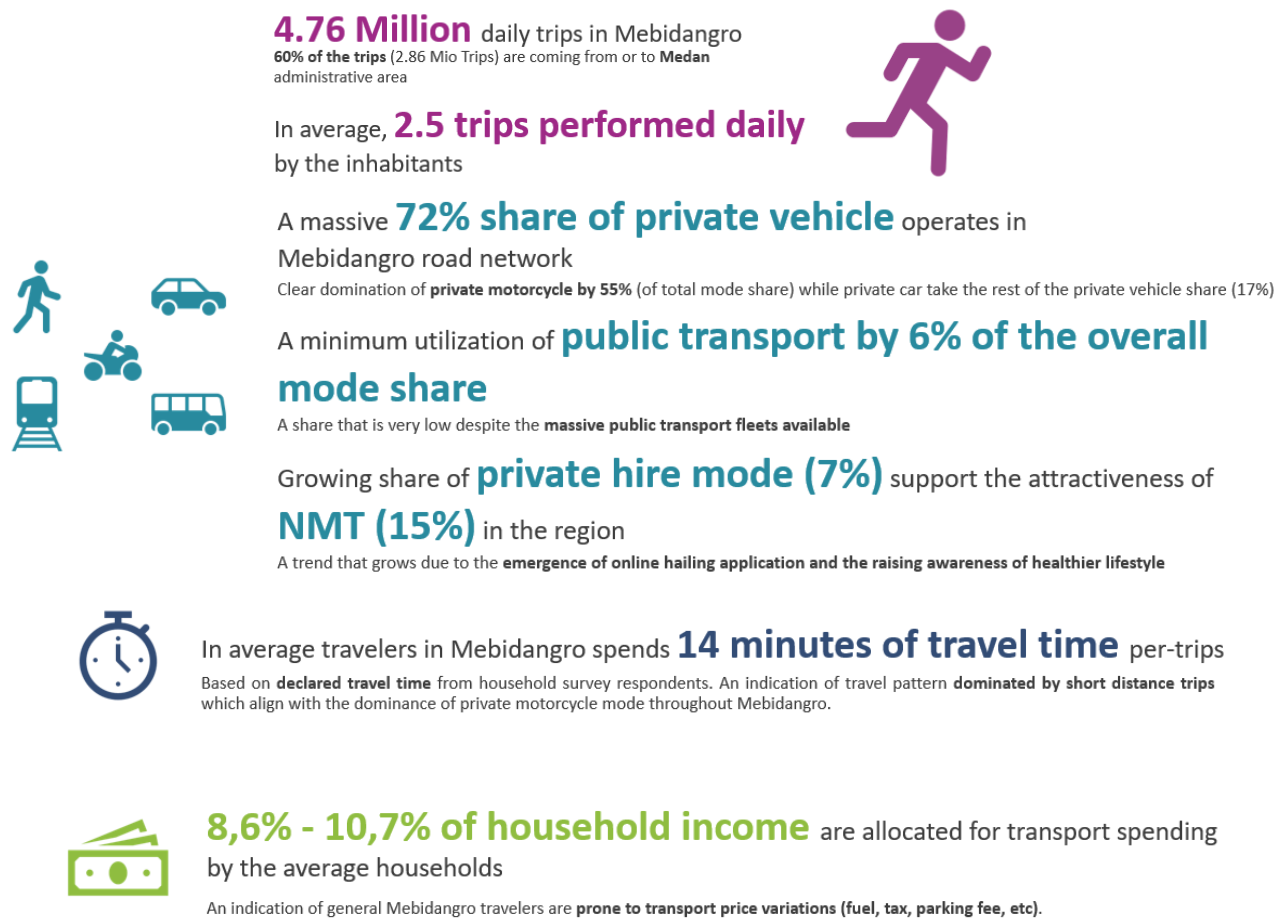
- Pricing of non-toll road usage for heavy freight vehicles: these can be explored through different pricing schemes. International benchmarks have shown that differentiated fuel pricing (taxes) are not always adapted to all contexts, and that vehicle ownership taxes must also be implemented with caution. This shall be detailed in a dedicated study with important legal assessments.
- Categorization of light commercial vehicles as freight vehicles: as triggers for congestion in city centers, small freight vehicles shall be regulated as such and possibly priced as per the above.
- Increase of the rail freight modal share: in order to lower the intensity of road freight from Belawan port, and allow constant growth of the port activity, it shall be considered to increase the rail freight share by providing additional services and enhancing container transport, for examples by implementing dry ports and new freight stations along the existing line. Line extensions and connections could also be considered to allow rail freight towards Lubuk Pakam and Binjai.

Furthermore, road accidents in Mebidangro show that 14% of vehicles involved are trucks. Optimizing the number of freight vehicles on the roads can then have an important social impact. Traffic safety is assessed in the next section.

### 11.4.3. Summary of the Mobility Dynamics

Mebidangro mobility dynamics proved heterogeneous and complex in terms of organization, composition, allocations and utilizations. The takeaways of this summary on existing and future mobility is the workbase to establish a long-term sustainable vision for Mebidangro.

Figure 58. Synthesis of Mobility Dynamics



#### ■ Roads and private vehicles

##### ■ Heterogeneous road quality and facilities

Roads quality and facilities are heterogeneous in terms of quality, capacity, and geographies. They do not offer the same accessibility to all geographical and social groups. Upgrading all roads to the same level of quality and accessibility is important for all social groups and especially for the city of Berastagi. Parkings shall be developed, along with the enhancement of NMT facilities.

##### ■ Ultra-dominance of PV on roads, potential for NMT

Modal shares indicate that three quarters of vehicles are private. Most used PV are motorcycles as flexible and cheap options, posing competition challenges to future projects of mass transit and intradistrict mobility. Those projects will need to integrate rising online hailing and NMT as well, which uses have grown during the COVID-19 pandemic, and demand stem from all social classes.

##### ■ Road congestion from urban structure, PV and freight

The high portion of PV on heterogeneous and unclear roads connecting the poles of Mebidangro results in congestion mainly around the Medan center, on radiating growth axes. In light of the strong demographic and motorization forecasts, these shall be worse in the future. Since urban freight also contributes to the adverse road situation, they shall be restricted on their routing, shifted to rail and potentially priced differently.

#### ■ Important assets and potential for public transit

##### ■ Important potential for rail and angkot networks

Existing rail infrastructure and minibuses service networks are developed and present huge potentials. However, they are aging because of the lack of maintenance and complex governance. Attracting passengers and changing their organisation is suggested to unlock their potential. These would present low capital investments improvements for mobility. The potential

of minibuses stems from its massive fleet of more than 7.000 vehicles. While they are currently irrelevant because of ailing performances and comfort offer, they shall be upgraded and fully integrated to future mass transit lines as feeders.

#### ■ Environmental and operational performances of PT

These upgrades are necessary after the analysis of their poor performances. Occupancies of urban PT is at a mere 12% average for rail and road PT combined. Their attractiveness is indeed low, and upgrade in clean-energy engines and comfort shall be put in place, before considering new projects.

#### ■ Future and potential PT services

The future BRT line 1 is committed and under development. It is important that the project reaches completion for the momentum of mobility implementation to pick up. Rivers present strong potential for waterbuses, and mass transit lines shall be identified. The latter will carry important momentum in accelerating the development of mobility and soft modes uses around stations, as well as multimodality with angkote and rail services as feeders. This multimodality is currently highly demanded by the people.

#### ■ High but tainted accessibility numbers

Indeed, soft modes are necessary to access PT. In the current setting, sidewalks and bicycle lanes are clearly insufficient and shall be developed. Awareness raising to the communities shall accompany this measure to educate on their uses for best expected results, in contrast with their current use for parking and vending. The latter results in limited accessibility to PT although formal and informal networks cover an important 56% of the area.

Furthermore, the sensitivity of inhabitants to prices, which is reflected by the low amount of money spent for mobility, shows a facilitated access to PV instead of PT. Implementing new projects will imply catering this important affordability challenge.

#### ■ Clear mobility rates to be increased and homogenized

Actions upon the suggested areas of improvement shall homogenize the mobility across social categories. Small and large scale sustainable measures shall be offered to the communities, to cater with predicted demographic and economic growths, and localized motorcycle movements in dense and poor areas. On the other hand, regular and quality PT services is expected by educational and professional travellers who execute more than half of the urban trips.

### ■ Considerations in the SUMP

These considerations form the workbase for the preparation of the mobility vision on the long-term with the stakeholders of Mebidangro. The analyses are taken into consideration when drafting the future measures, either qualitatively or quantitatively. Either way, the mobility dynamics show that integrated management is needed for all infrastructure and services of land transport in Mebidangro. The current resulting setbacks mostly stem from governance problems (paratransit, rail, roads). The case for the unique Mebidangro transport authority is strengthened by the mobility dynamics.

Several integrated blocks of challenges with interrelated issues are already identifiable at this stage. However, it is shown here that the mobility setbacks are inseparable from the transport offer and demand, urban structure and governance considerations. The next paragraphs highlight the socio-environmental consequences of those setbacks, and identify areas of improvements too.

### ■ Baseline on key mobility indicator

Mebidangro mobility agencies have defined a set of 20 indicators based on their priorities, familiarity and needs – as well as following the MobilizeYourCity standards. The set is composed of 15 impact indicators and 5 investment indicators. They measure environmental, social, economical, financial, planning and technical evolutions of urban mobility for an efficient monitoring.



## II.5. Social Aspects

The social aspects of mobility relate to the direct and intangible experience of people moving. Transport studies often address them qualitatively although understanding in detail the communities and answering their problematics is critical for sustainable mobility. Furthermore, in current Indonesian planning practices, the social aspects are secondary.

Solutions to social challenges must be fully part of mobility planning and its importance emphasized. Therefore, the SUMP proposes a quantitative and data-backed assessment to analyse road safety, liveability and security, gender and vulnerable groups issues in the mobility of Mebidangro.

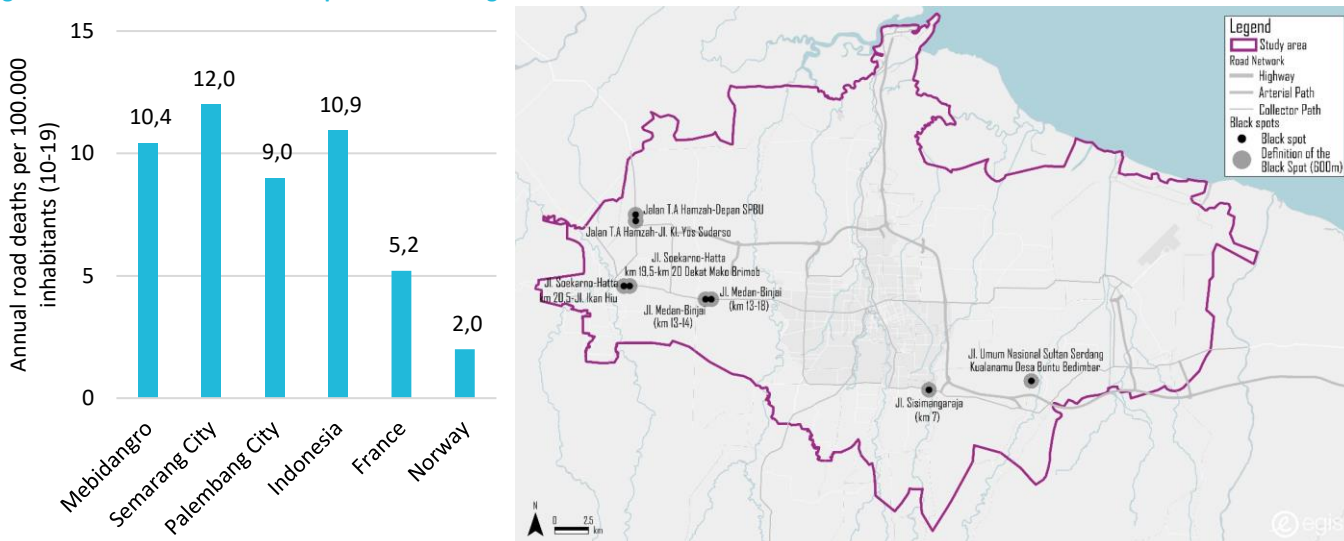
### II.5.1. Road Safety

Medan area is known for having daring driving conditions among all vehicles, partially due to the lack of enforcement and clear signage.

#### ■ A noticeable number and distribution of road deaths

Between 2010-20, Mebidangro alone had 5.546 road deaths. Of which 525 in 2020: this is equivalent to two domestic flights. Road deaths figures have been stable in the past 10 years, showing no betterment. For 100.000 inhabitants, Mebidangro has 10,4 annual road deaths. It is below the national average. However, it is five times higher than the one of Norway.

Figure 59. Location of road black spots in Mebidangro



The geographical disparity of road deaths is noticeable. Most urbanized areas are safer than rural ones: Binjai and Karo have high death rates (27,5 and 15,6), while Medan and Deli Serdang have lower ones (11,5 and 5,9).

#### ■ Failing plans and programs, indicators

The past decade has not seen any improvement in the safety of the roads in Mebidangro, although it has been the object of plans and programs.

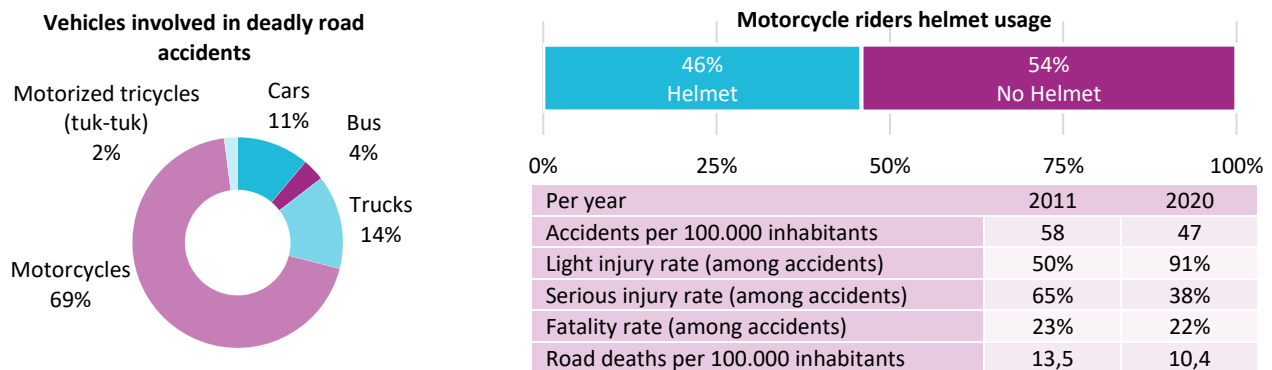
- Decade of Actions 2011-2020: the UN program of 2010 was relayed by DGLT of MOT. Against 2010 levels, a 50% drop of road deaths between 2010-20, and 80% by 2035 was targeted. The North Sumatra failure on this topic shows the need for a specific program, involving local stakeholders – as disaggregated roles and responsibilities demand a higher level of consultation for effective results.
- National initiatives: the national police, with limited means, continues efforts to improve road safety with various programs, including traffic management (with mixed results), Electronic Registration and Identification (struggling to be implemented), Safety Driving Center, Intelligent Traffic Analysis System. These measures have barely seeing the light in Jakarta with unclear plans for secondary cities.
- WHO indicators on national policies. The WB-led Global Road Safety Facility shows that basic regulations set out by the UN-WHO, necessary to improve road safety, are not completely in place in Mebidangro. Only the ban of import second-hand vehicles, new import age limit and import inspections are in place among a total of ten recommendations. These shall be explored to solve basic sources of accidents.

#### ■ Vehicles involved and possible contributors to accidents

Almost three quarters of vehicles involved in Mebidangro accidents are motorcycles. Followed by trucks and cars, before motorized tricycles and buses. To decrease road casualties, motorcycles users must be safer.

Increase of speeds, lack of signage and width of roads contribute to accidents. These are the characteristics of the blackspots detailed in appendix. Other additional factors contribute to the occurrence of road accidents.

**Figure 60. Road fatal accidents composition, damage levels and helmet usage**



However, traffic investigations have shown that 54% of motorcycle riders (passengers and drivers) did not wear helmets. This highlights a lack of law enforcement, but also a widespread lack of awareness. The fatality rate of accidents is rather constant over the years, while light injuries increase and serious injuries decrease. This might reflect the increased safety features of cars among increasing traffic volumes, and the lack of changes in the habits of the motorcycle drivers.

#### ■ Areas of improvement

The lack of road signage and law enforcement the poor helmets usage and unclarity of road rules, are identified as accident reasons, leaving the drivers to interpret rules and commit dangerous infractions. Furthermore, dangerous behaviours must be forced beyond information of the rules: traffic calming measures, that are currently lacking in Mebidangro, shall be implemented. This shall be the object of dedicated and Mebidangro-specific actions.

Lastly, it was found that congestion is correlated with freight vehicles density of circulation. The road fatalities seem to be related to them too, freight vehicles being involved in more accidents than private vehicles. The analysis shows that limiting the circulation of freight vehicles with other vehicles may be necessary.

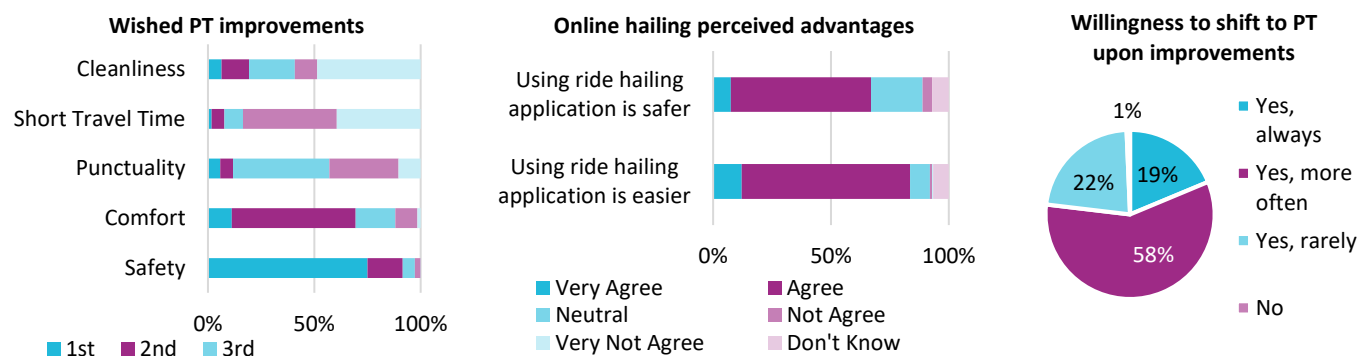
## 11.5.2. Liveability and Security

The liveability and security of PT as perceived by its users is important to understand how to attract them in future mass transit. These aspects are highly cultural and local. The current assessment is thus based on the information gathered in Mebidangro to identify specific PT liveability areas of improvement for better mode attractiveness.

#### ■ The perception of the public

The opinion surveys have shown that the first factor of reluctance to PT is the lack of safety and comfort. People seek sound commutes on sidewalks, stations and vehicles. Other opinions are in appendix.

**Figure 61. Perception of PT and online hailing for inhabitants**



On the other hand, punctuality and travel time are not ideal but do not justify not using PT. The sought features are simplicity, safety and comfort as provided by online hailing. These show that the communities prioritizes the soundness of moving against travel speeds. This shall be considered when defining the mobility of tomorrow.

#### ■ Organizations and operators perception

Civilian organizations and operators shared that the main liveability challenges are on the quality and reliability of PT as well as its integration as a connected network. They align with inhabitants on the priorities of PT improvement. Failure to improve might continue decreasing PT modal share.

#### ■ Urgent improvements needed to attract users

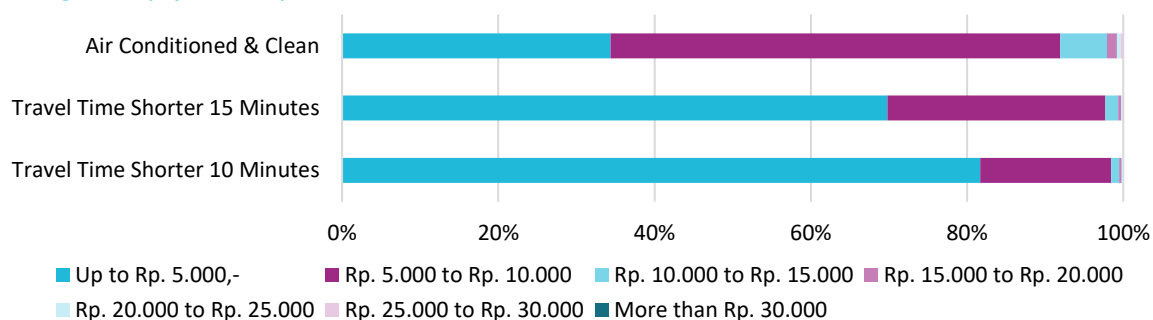
PT must adapt quickly with modern services (clarity of information, accessibility and multimodality) and higher levels of quality (punctuality, cleanliness) to answer the inhabitants' requirements. More than 90% of sounded inhabitants indicate being ready to shift to PT upon these improvements. The stakes are millions of trips per day and losing them to private and hauling transport.

These takeaways are addressed in the SUMP, on tangible and intangible actions at operational, tactical and strategic levels.

#### ■ Willingness to pay for better liveability

More than half of the inhabitants are ready to pay more than IDR 5.000 for comfortable public transport (air condition and cleaningness). The current average fare being IDR 5.000, increases are acceptable for the priority improvements. This level of willingness to pay shall be taken into account in mass transit planning and design.

Figure 62. Willingness to pay for PT improvements



### 11.5.3. Vulnerable Groups

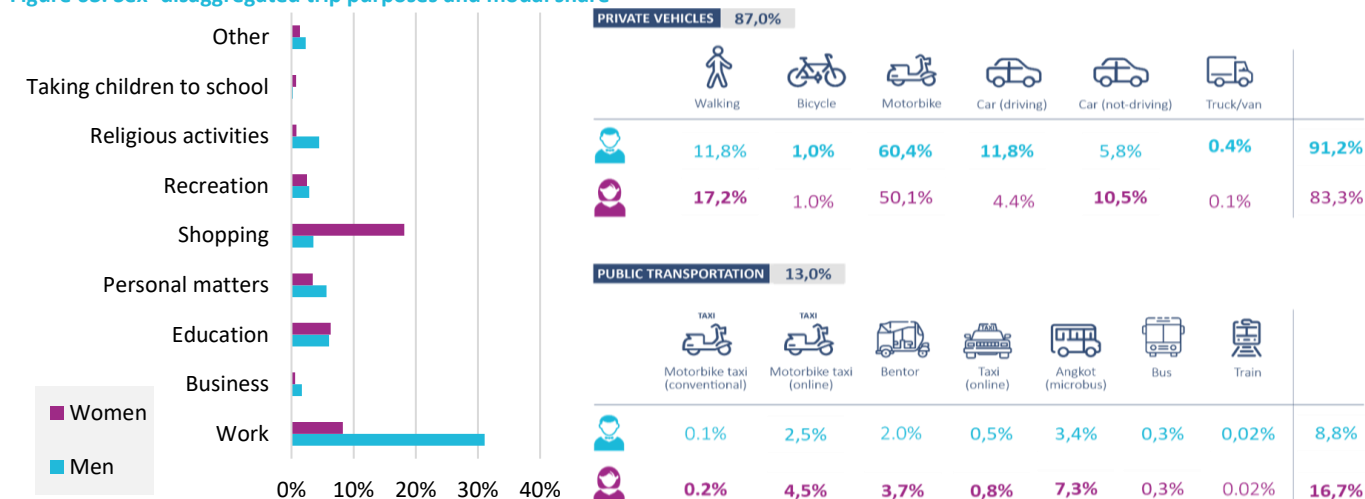
Accommodating the needs of vulnerable groups in providing PT that is safe, secure, convenient, accessible, and affordable, including mass transit, is required by law 22/2009. These shall be carefully considered and integrated into the PT design. Women, persons with disabilities, children, and the elderly are much more likely to use PT in Mebidangro, because they lack access to, and control over, the use of private vehicles. However, 82% of inhabitants agreed that there is a lack of facilities for persons with disabilities (84% and 78% of women and men respectively). This emphasizes the need to include this population in consultations and transit planning.

#### ■ Women concerns on safety and fare in transit

In Mebidangro, gender issues exist in individual and collective mobility. In fact, women use PT at a greater rate than men, yet they face many barriers that limit their ability to travel. On the opposite, men trips tend to be more linear.

In general, women make shorter, but more frequent journeys with multiple stops. They are likely to be economically disadvantaged if they have to use public transport, as they will face higher costs of ticketing in the current system. However, they face challenges in using less accessible private vehicles and they are more vulnerable to the risks of traffic.

Figure 63. Sex- disaggregated trip purposes and modal share



Both men and women use motorbikes as the primary mode to travel. However, women use public transport for their daily mobility almost twice as much as men (17% vs 9%). Investigations show that women's vulnerability to road traffic and public spaces (unlit sidewalks, etc.) is a factor to choosing PT.

### Affordability considerations

Transportation costs can be a barrier for women, the elderly, and persons with disabilities who lack independent resources. The wide coverage of angkots and low price of tuk-tuk have made these services a preferred mode. However, while single trips on PT are mostly affordable, women have more diverse purposes and shorter distance trips, and a higher usage of PT. Vulnerable groups are thus disadvantaged economically with the current fare structure. This opens the door for a specific tariffication for women and the need for an integrated fare scheme between modes.

### Low involvement of women in transport jobs

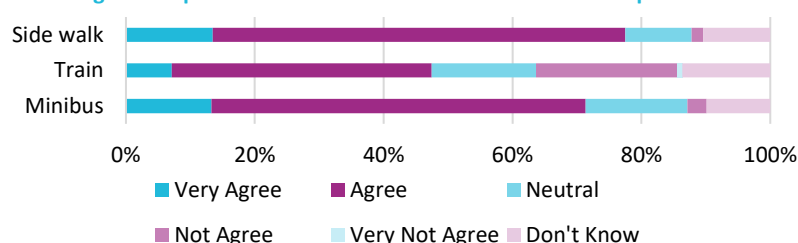
According to Mebidangro authorities, women working in transport governance represent less than 10% of the workforce. It is still dominated by male professionals. Thus, it is important to explore the type of transport jobs that can involve and empower women. This would in turn allow more accommodation of women-specific features in the systems. On the operational side, although statistics are inexistent, participants to workshops firmly believe that no women works in the running of PT lines.

### Persons with disabilities and the elderly

All the shortcomings of the Mebidangro public transportation are stressed and present higher constraints to the persons with disabilities and elderly who have a need to plan trips and travel with limited physical capacities. Hence, PT needs to accommodate their handicap by proposing clear information (fare, schedules, lines) and facilities usable with reduced physical mobility. It is not the case today. The wide majority of inhabitants (>60%) believe sidewalks and minibuses are difficult to access for persons with reduced mobility. Half of the respondents believe the trains are difficult to access too.

While some physical measures already exist (access ramps, guides, guiding blocks), they are not widely available and adequately maintained to a functioning level, and are often misused due to the lack of knowledge and awareness from the wider public on their functionality. In some cases, they are not designed nor built properly.

Figure 64. Mebidangro transport is difficult to access and use for disabled persons



Beyond PT, the associations of persons with disabilities emphasize that clear information on the roads is needed. The lack of clarity often remains an obstacle to their mobility.

### Addressing gender and vulnerable group issues

To develop a GESI responsive mobility in Mebidangro, several recommendations need to be developed. These take into account the Gender Equality and Social Inclusion Assessment of Mebidangro Mass Transit, 2021, World Bank Group.



- Understand vulnerable groups challenges: the SUMP workshops were the first time associations for women equality, people with disabilities and the elderly were involved in public infrastructure discussions. Mebidangro authorities shall require planning related to PT investments to include women and people with disabilities to reflect their views in planning.
- Develop inclusive mobility infrastructure and services: upgrades in facilities (sidewalks, stations) and vehicles (comfort) are necessary to provide safe mobility to women and attract them to PT. Investments in footpaths and cleanliness of the public space by the authorities can improve greatly the adoption of PT by vulnerable groups. Intermodality shall also be improved in dedicated facilities. The overall ecosystem shall be made safer with security measures in-vehicle and at facilities.
- Improve the readability of mobility: marginalized groups need clear information on road signage and public transportation services to be able to use them. This stems from the need to plan ahead of time a trip to accommodate specific needs (reduced mobility). Hence passenger information and road signage shall be improved and homogenized in Mebidangro.
- Empower women and persons with disabilities in transport: previous points are more likely to bear results with vulnerable groups involved in the process. Adapting operations to have more women also offers economic opportunities. Putting in place a quota of actions and workforce would help increasing the representation of women and persons with disabilities. This shall be accompanied by awareness raising and training of key staff of authorities and operators.
- Work with authorities and operators to adapt fare structures to marginalized groups and women who present specific needs in terms of readability, integration, and transfer discounts; making PT more attractive.

These considerations and recommendations are taken forward to the mobility scenarios and reflected with specific measures in the Action Plan.

#### II.5.4. Summary of the Social Aspects of Mobility

To answer regulatory requirements and policies, Mebidangro must improve the safety and liveability of its transport environment and public space. It comes through several measures identified in this diagnosis.

##### ■ Involvement of vulnerable groups in planning

The social aspects of mobility must be taken into account at the core of mobility and transit planning and investments, through qualitative or quantitative ways in consultation of vulnerable groups or targeted improvements. Including these considerations is the only way for improving them.

##### ■ Standardization and homogenization

There is a clear need for improved and homogenized road signage to increase road safety and accessibility to persons with disabilities. Furthermore, the readability of the public transport information is also necessary for vulnerable groups to be able to plan in advance.

##### ■ Investment in public spaces

People walking are more likely to use PT. In order to increase attractiveness of public transit, authorities shall thus improve and build sidewalks with sufficient safety features (light for women at night, segregation for safety from cars) and enforcement (no obstacles nor parkings to allow persons with reduced mobility to use them).

##### ■ Areas of improvement

It was identified that the comfort and safety of public transit are key points of improvement expected by the inhabitants for them to use it. Meanwhile, women undergo poor travel conditions and economic disadvantages because of the lack of other sustainable option given the lack of access and control over private vehicles. Operators and authorities must work together on upgrading fleets for more comfort and safety, but also proposing adapted and intermodal fares.

These considerations shall be acted on by the authorities to provide mobility access to all communities. They are translated into actions in the SUMP Action Plan.

## II.6. Environment and Mobility

One of MobiliseYourcity overall objectives is targeting reduction of transport-related GHG emissions in participating cities (>50% until 2050). The relationship between mobility and the environment is strong due to the emissions from vehicles, particularly in Mebidangro where clean fuels are unavailable. However, the environment also poses threats to mobility. Perturbations can come from natural disasters or sanitary crises, such as the COVID-19 pandemic.

It is proposed to overview the effect of mobility on GHG emissions and air quality, as well as the impacts observed by environmental threats and how mobility can be more resilient against them; in the context of Mebidangro.

### 11.6.1. Effects of Mobility on the Environment: mobility acts on emissions

This paragraph offers an outlook on applicable regulations related to climate change in Indonesia and their applicability for Mebidangro, current carbon emissions from mobility and air quality considerations are elements to take forward for a more environmental-friendly mobility.

#### ■ National and regional contexts for climate change

To limit the climate change impacts and address the sustainability challenges, GOI prepared legal foundations for developing, issuing, and implementing climate change mitigation policies for each sector at national and sub-national levels.

Figure 65. Indonesian regulations to reduce green house gas emissions

<b>Agreement at Global Level</b>  <i>Key Policies in Climate Change Response</i> 	<b>Paris Agreement</b>  The aim of this agreement is to strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty
<b>Regulation at National Level</b>  <i>Key Policies in Climate Change Response</i>  	<b>Act No. 6 of 1994 on the Ratification of United Nations Framework Convention on Climate Change</b>  A law concerning the ratification the United Nations Framework Convention on Climate Change.  <b>Presidential Regulation No. 61/2011 on National Action Plan to Reduce GHG Emissions</b>  Consists of strategical planning on each sector to tackle the emissions problem, along with the target, period of time, location, indicator, and related responsible parties.  <b>Act No. 16 of 2016 on Ratification of Paris Agreement to the UNFCCC</b>  A law concerning the ratification of the Paris Agreement to the United Nations Framework Conference on Climate Change (Paris Agreement on the United Nations Framework Convention on Climate Change).
<b>Provincial Level</b>  <i>Key Policies in Climate Change Response</i>	<b>Government Regulation No. 36 year 2012 on ratification of RAD-GRK document (Regional Action Plan for Greenhouse Gas emission)</b>  SUMUT government commitment to implement an effective action plan in order to reduce the greenhouse gas emission in the province.

It is agreed that global mitigation actions are required to limit global warming to less than 2°C below pre-industrial levels. To achieve this, it is necessary to reduce GHG emissions by involving all related authorities. Indonesia has voluntarily pledge to reduce emissions by 26% on its own efforts, and up to 41% with international support.

To do so, the capacity to monitor and control GHG emissions and air quality must also be ensured. The legal foundations at national level are available. Among other regulations, these include the PP 71/2011 on GHG inventories and MOE 12/2010 on air pollution control in the regions (see appendix). These must be translated into provincial decrees for application.

#### ■ Current policies of the transport sector against for sustainable

According to Presidential Regulation 61/2011, the emissions-reduction strategy that shall be implemented in the urban transport sector by regional authorities are the following:

- Avoid transport: using tools such as trip demand management and efficient spatial planning.
- Shift: from private vehicles to environmental friendly public transportation.
- Improve: increase energy efficiency of motorized vehicles.

Based on the Government Regulation 36/2012, which is a ratification of *RAD-GRK* (Regional Action Plan for Greenhouse Gas Emissions), several plans and initiatives are identified to curb the mobility-related emissions:

- ✓ Development of ITS (Intelligent Transport System) and traffic management system;
- ✓ Parking management;
- ✓ The development of BRT/Semi-BRT system;
- ✓ Rejuvenation of angkot (micro-bus) vehicles;
- ✓ Smart eco driving training;

- ✓ Development of Non Motorized Transport (NMT);
- ✓ Development of Intercity train in Medan Area (Medan- Binjai – Deli Serdang – Delitua –Pancurbatu);
- ✓ Development of double track in Kualanamu airport;
- ✓ Development of bus routes to Kualanamu airport;
- ✓ Implementation of car free day;
- ✓ Installation of converter kit in passenger car;
- ✓ Development of campus buses throughout all dense college student area to the designated campus areas;
- ✓ Implantation of trembesi trees on the pavement;
- ✓ Addition of non-emitter fuels;
- ✓ Integration of the Regional Action Plan to the students' curriculum.

However, these initiatives have not been implemented since 2012, showing the lack of coverage of the regulation, lacking implementation modalities and recommendations. However, the SUMP supports these by taking them into account within the Action Plan (most feasible and relevant ones at the scale of Mebidangro).

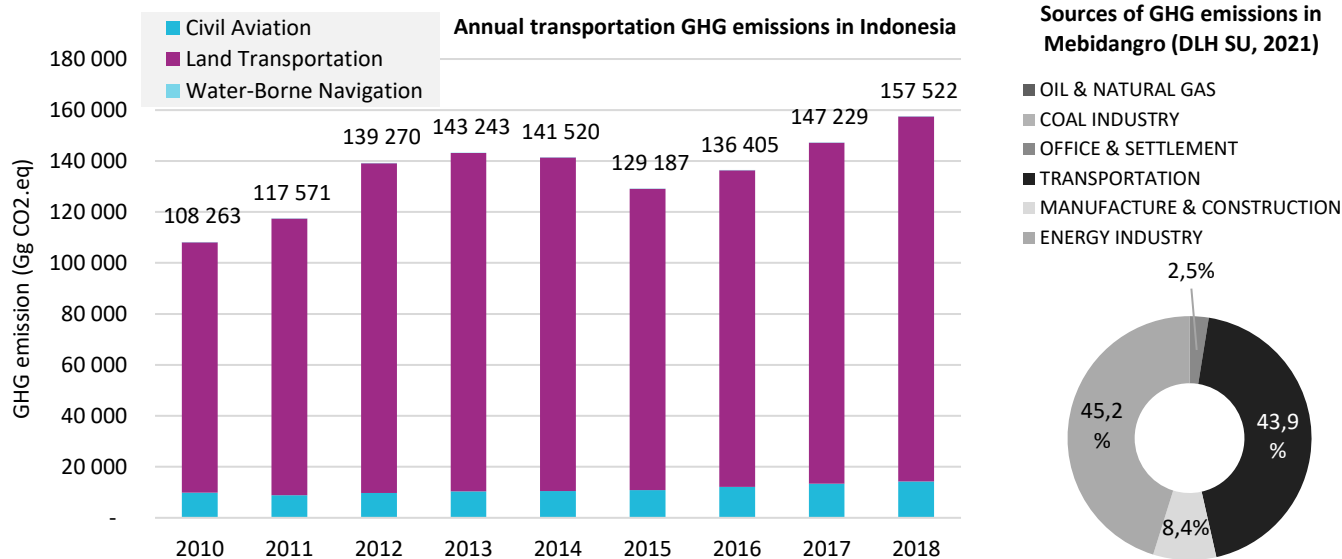
### GHG emission from mobility

#### Indonesian context

Close to 160.000 Gg CO<sub>2</sub> eq are emitted from transportation each year in Indonesia and the trend is increasing. According to IESR, a quarter of overall energy GHG emissions in Indonesia originate from transportation. Mobility is thus an important domain to act on to mitigate emissions increase.

Land transportation (including railways) dominates carbon emissions of transportation, with an average increase of 90% between 2010-18. This high contribution means that national and sub-national governments in Indonesia shall invest in mitigating actions and transit alternatives with low emissions. Such countermeasures are categorized in PP 61/2011. Amongst other, we find measures like parking and traffic management, Non-Motorized Transport development, intercity trains, etc. The SUMP supports the translation of the presidential regulation for North Sumatra and Mebidangro.

Figure 66. GHG emissions in Indonesia by urban transport source (MPV, 2019) and Mebidangro



It is estimated that half of GHG emissions of Mebidangro originate from transportation (. However, the detailed breakdown and tracking of this number is unavailable, highlighting the need for better monitoring and methods. However, the importance of transportation GHG emissions confirms the need for alternative transportation and environmental policies.

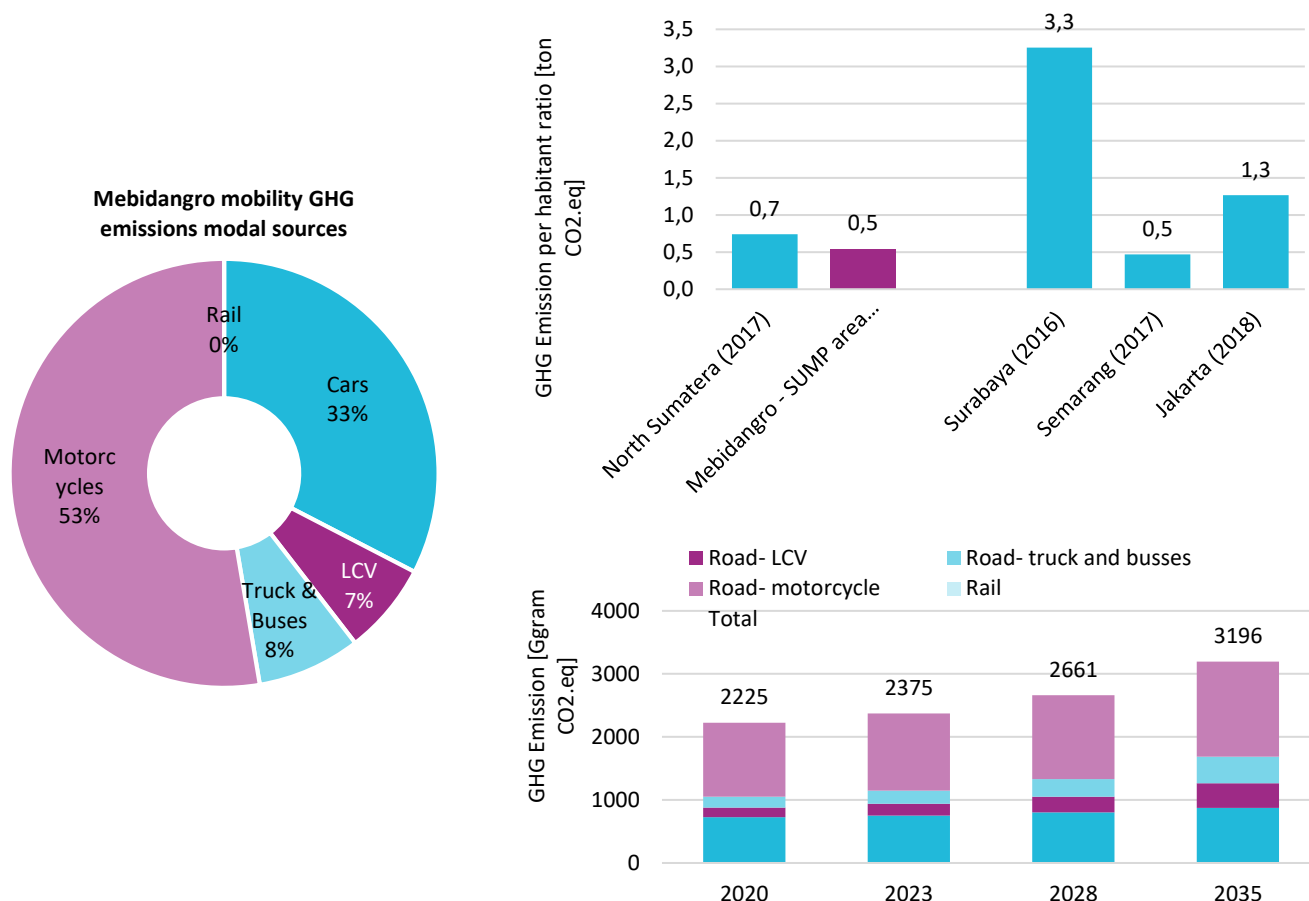
The goal of the SUMP is directly in line with the GOI and North Sumatra commitments by proposing sustainable measures of mobility instead of conventional ones, by targeting the implementation of innovative solutions with low GHG emissions. It supports the ongoing RAD-GRK action plan (see appendix).

#### Composition and trends in Mebidangro

The total mobility-related GHG emissions in Mebidangro are 2.225 Gg CO<sub>2</sub> eq in 2020, representing 0,5 ton of CO<sub>2</sub> eq per capita. This is equivalent to Semarang (0,5). Jakarta is almost three times as high (1,3) and Surabaya six times as high (3,3).

Based on the latest United Nations Emission Gap Report, to stay on track for an average global temperature rise of 1,5 celsius by 2050 as per the Paris Agreement, the average CO<sub>2</sub> eq per capita would need to be around 2,1 tons by 2030. Since transportation contributes to 16% of global emissions (WRI, 2020), the transportation target would be 0,34 tons of CO<sub>2</sub> eq per capita. The average Mebidangro inhabitant should thus cut its transport emissions by half on the long-term.

Figure 67. Mebidangro mobility GHG emissions and trends



Motorcycles contribute to more than half (53%) of the emissions, while private cars contribute to a third of it. Reducing GHG emissions from mobility implies reducing the use and ownership of private vehicles. Therefore, restricting policies shall be implemented in Mebidangro. Furthermore, since mass transit will capture PV to shift to PT, their implementation is critical to a sustainable mobility.

To secure a clean transition to PT, it is found that PT shall also undergo a shift from thermal to clean energies (electricity, hydrogen). These shall be part of the Action plan for both road and rail-based public transit modes.

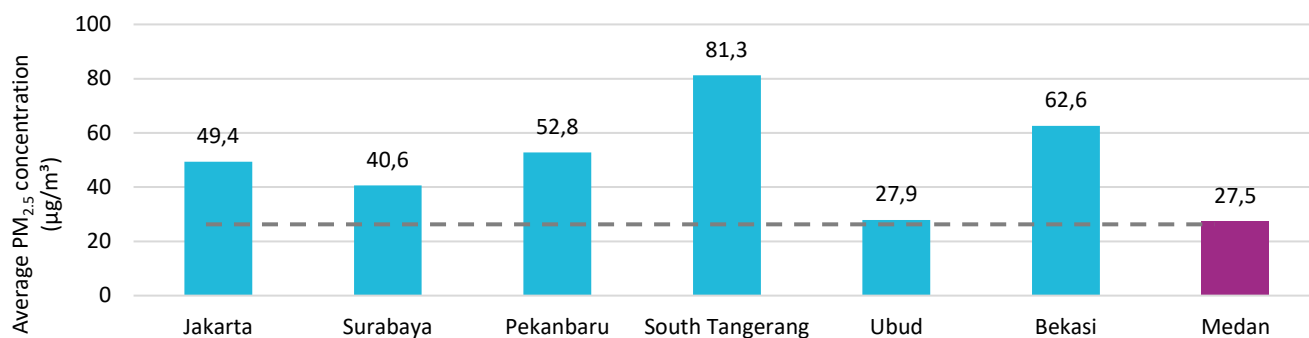
#### ■ Air quality (AQ) considerations

Tracking and monitoring particulate matter for AQ measurements is instructed by the national directives. As of now, only three AQ stations are currently active in Medan, and only one is functional according to the MOE requirements (Air Quality Map Index).

Most of the challenges for air quality in Indonesia are due to the rapid urbanization, population growth, and seasonal agricultural fires. The figure below shows the comparison between Medan among megapolitan cities in Indonesia as per the result from the functioning AQ station.

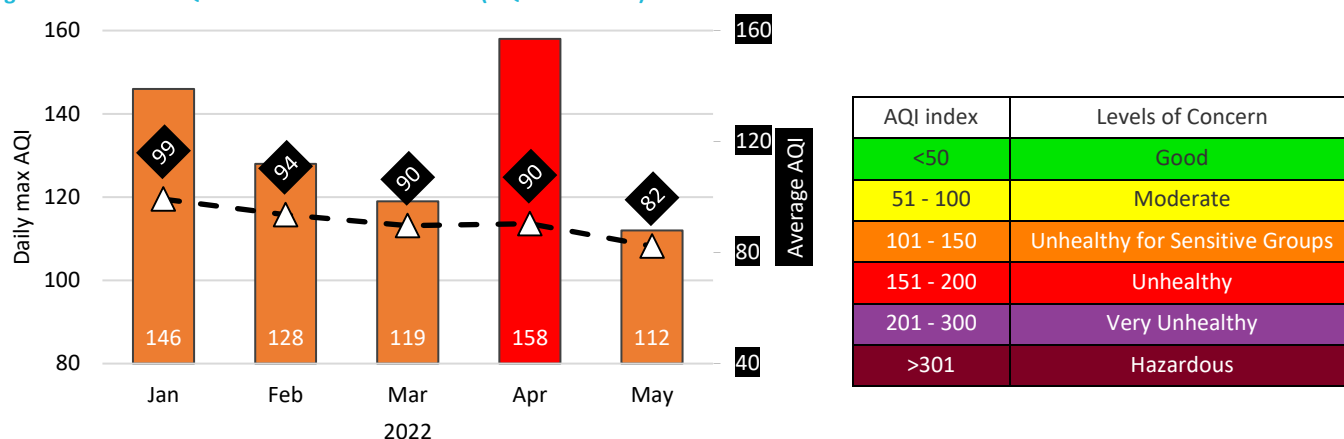
While Medan emits a low level of PM<sub>2.5</sub> concentration compared to other Indonesian cities, it has a growing trend. However, it is still above the threshold value of PM<sub>2.5</sub> standardized by WHO with a 10 µg/m<sup>3</sup> annual mean value or 25 µg/m<sup>3</sup> 24-hour mean value.



Figure 68. PM<sub>2.5</sub> exposure in Medan and Indonesia (Egis adaptation from IQAir & AQLI)

However, the air quality index (taking into consideration other parameters than just PM<sub>2.5</sub>) of Medan area is moderate and increasingly unhealthy as the daily maximums show below. The decreasing These levels shall provide sufficient basis for making stations functional again and putting in place additional ones.

Figure 69. Medan AQI in the first months of 2022 (AQIcn &amp; BMKG)



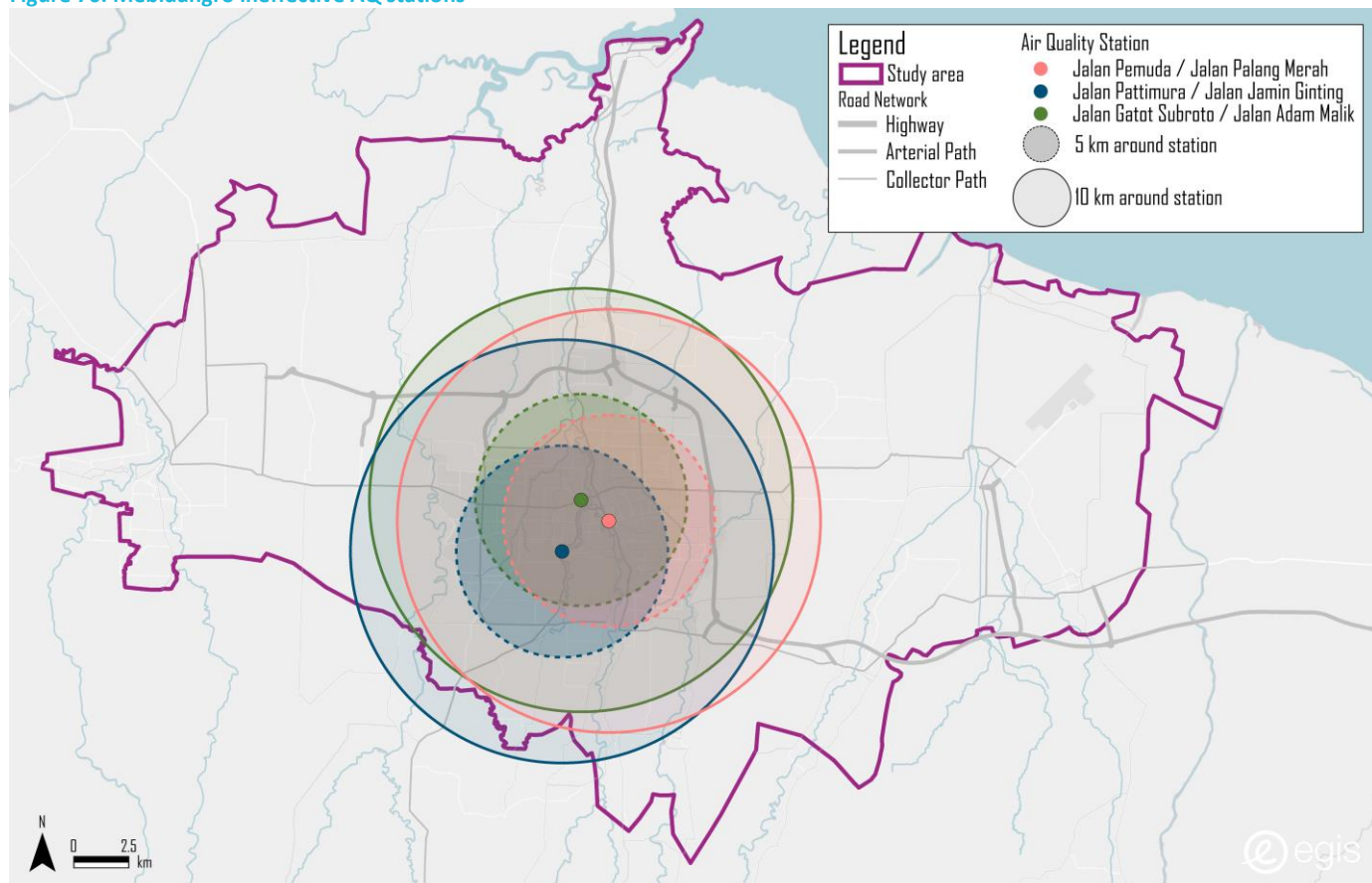
However, the air quality index (taking into consideration other parameters than just PM<sub>2.5</sub>) of Medan area is moderate and increasingly unhealthy as the daily maximums show. AQI lowers with the dry months, however April 2022 shows a spike in AQI to unhealthy levels. These hid behind the relatively moderate average observed.

Since half of air pollutants stemming from transportation, the air quality shall be improved with more sustainable and calm mobility. Even if the data source is small, and the averages moderate, it is highly likely that the air pollution has adverse consequences on the health of the inhabitants.

It shall be noted that the data is sourced in a single station in the center of Medan. The AQI levels shall provide sufficient basis for making stations functional again and putting in place additional ones.

Lack of air quality monitoring station in Mebidangro, reduce the robustness and the reliability of the air quality data. To cater with this situation, it is recommended to put in place more monitoring stations in Mebidangro and as one of the SUMP impact indicator of the Observatory, these shall then be assessed and way for improvement identified. This is in line with national directives and provincial regulation shall translate them, eventually with the support of the SUMP.

Figure 70. Mebidangro ineffective AQ stations



### ■ Summary of emissions and mobility

Urban transport is a major source of GHG emissions in Indonesia, having a slightly bigger contribution than the coal industry. Among the transport modes, motorcycles and rail are the principal contributors to the GHG emissions; this being the consequence of the massive use of motorcycles for individual transportation, and the Indonesian railway network not being electrified, with rolling stock being diesel powered and having a certain age.

This clearly highlights the need to reduce the modal share of motorcycle and to electrify the existing railway network while rejuvenating the rolling stock assets. It also shows that the future high capacity transport projects must comply with this need of reducing GHG emissions using the most sustainable modes as possible.

In terms of air quality, Medan has levels of emissions that are growing and becoming more and more comparable to national averages. Indonesia being far above the international average of particles emission. However, current equipment does not allow proper tracking and estimates.

Since the national legislation exists for GHG emissions and air quality index estimations, targets and tracking, they shall be translated to more concrete and applicable regulations in North Sumatra and Mebidangro. The SUMP proposes several actions in line with this diagnosis in the Action Plan.

## II.6.2. Efek Lingkungan pada Mobilitas: factor eksternal aksi pada infrastruktur dan pelayanan

Environmental factors such as natural disasters and pandemics impact the mobility in Mebidangro. The diagnosis offers an outlook on the management of mobility and mass transit in the event of natural disasters, and the effect of the COVID-19 pandemic on mobility; before identifying measures for increasing resilience.

### II.6.2.a. Natural Risks and Growing Threats

Medan area is located on flat land between the sea and active volcanoes in the South near the Toba region, exposing it to natural events and growing threats from climate change. This part of the diagnosis is based on the works of the World Bank in Addressing Disaster Risk Management and Climate Change Adaptation for Mass Transit Systems in Indonesian Cities, Resilient Mobility Diagnostics on Medan Metropolitan Area, 2021. It takes as study object the BRT Line 1 being prepared for Mebidang, but its takeaways are applicable to all proposed projects that are part of the SUMP.

### ■ Existing risks and vulnerability, threats from climate change

Given the geography of Mebidangro, the urban area and related transport activities are subject to several natural threats including volcanic, landslide, earthquake and flood risks. Landslides and floods constitute the most significant risks and pose threats to transport infrastructure operations in localized small areas.

According to local stakeholders, the climate change effects of the past 20 years locally has been observed through more intense floods and soil risks due to dryer warm seasons. Both these threats directly influence the planning and design of transport projects and are expected to grow in the long-term.

On a regulatory standpoint, Mebidangro already benefits from regional disaster management agency. The building code is already mandatory for all buildings nationally and covers most risks Indonesia is subject to. However specific and localized disaster management plans are rarely prepared and applied, showing the need to take into account resilience in the preparation of mobility projects in Mebidangro.

### ■ Key findings and recommendations

Contingency planning and business continuity procedures are identified for lesser risks, and planning & design considerations proposed for the most significant risks to which transport infrastructure are vulnerable to.

#### ■ Planning and design

Each system, part of the SUMP Action Plan, shall be planned and designed with consideration of natural risks and their own vulnerabilities. These include locating facilities in safe areas and using upgraded materials in civil works; along with upgraded solutions in systems. All designs shall follow applicable Indonesian standards emitted by SNI.

#### ■ Contingency

Organizational plans, response procedures, training programme and robust communication systems are recommended to be put in place by the Mebidangro authorities to increase resilience against all risks. These shall be instructed by the province and cities agencies, and monitored by central ministries, during the design and certification of projects.

#### ■ Locational issues

Overall, hazards associated with each site considered to accommodate transit projects must be considered to ensure they can be suitably mitigated. The location of assets shall avoid the exposed location as far as possible.

Figure 71. Medan essential DRM plan (World Bank)

	Flooding	Landslide	Earthquake	Volcanic
Planning	<ul style="list-style-type: none"> <li>• Avoid the station/building located in flood prone area from the planning phase.</li> <li>• Improving resilience of the energy source by multiple connections to the grid</li> <li>• Energy storage technologies to accommodate fluctuation of demand.</li> <li>• Backup Generator</li> <li>• Backup signalling/communication system</li> </ul>		<ul style="list-style-type: none"> <li>• Avoid the station/building located in earthquake prone area from the planning phase</li> </ul>	
Design	<ul style="list-style-type: none"> <li>• Application of waterproof materials for building (B3 Treatment Plant)</li> <li>• Upgrade trains resilience to flooding.</li> <li>• High-capacity flood gate at the tunnel entrance</li> </ul>		<ul style="list-style-type: none"> <li>• Station is designed according to applicable national standard for building (SNI 1726:2019)</li> <li>• Bridge structure is designed according to applicable national standard for bridge (SNI 2833:2016)</li> <li>• Preparation in the case of government updates the SNI during the construction phase</li> </ul>	
Contingency Planning	<ul style="list-style-type: none"> <li>• Early flooding warning detection system and communication</li> <li>• Evacuation and rescue procedure</li> </ul>	<ul style="list-style-type: none"> <li>• Evacuation and rescue procedure</li> </ul>	<ul style="list-style-type: none"> <li>• Evacuation and rescue procedure</li> <li>• The provision of emergency exit and assembly point</li> </ul>	<ul style="list-style-type: none"> <li>• Evacuation and rescue procedure</li> </ul>

Resilience shall be fully integrated within the planning and design processes as to ensure the integrity of infrastructure, continuity of operations and protection of important investments. It shall be noted that more and more, public infrastructure

banks take into account risk management in the issuance of guarantees and debt for funding projects. Increasing the resilience of infrastructure shall ease their funding.

The climate change consequences (intensity of floods, dryer seasons posing soil risks...) also pose a long-term threat to the integrity of the transport infrastructure and services. Not only for the current risks, but also for the future ones, the infrastructure projects shall fully take into account disaster risk measures in their planning, design and construction.

## 11.6.2.b. COVID-19 Pandemic

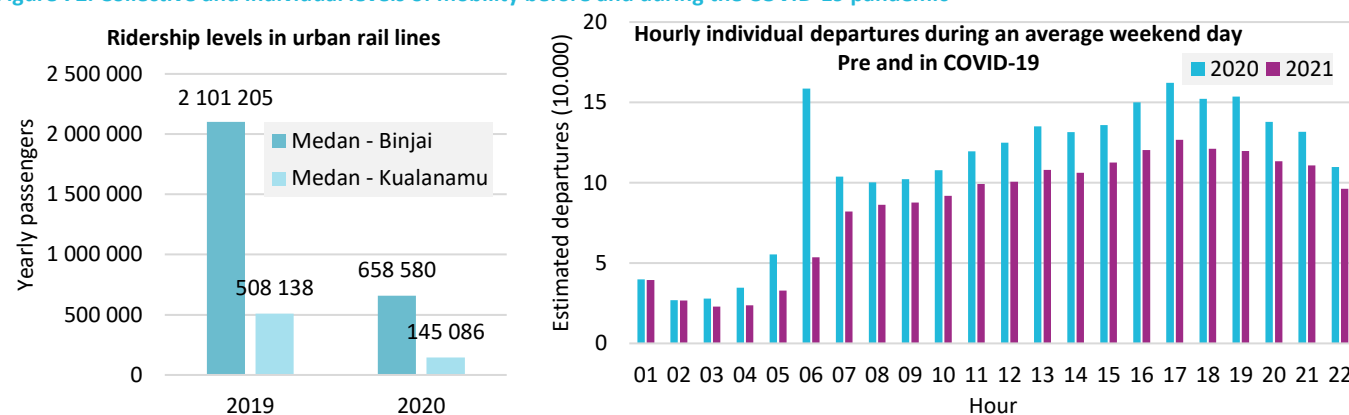
### ■ The impacts of the pandemic on mobility

Mobility and activity restrictions during the pandemic have impacted the PT lines by decreasing sharply their ridership. Train lines of Mebidangro saw a 70% drop in ridership, while minibuses estimate the decrease at 60% (informal).

Individual mobility was measured thanks to cellular data analysis before and during the pandemic, in January 2020 and January 2021. More details on this innovative data collection is in appendix. The information showed a drop of 13% on overall movements in Mebidangro during the crisis.

The spatiality of mobility was altered. Mobility on radial axes towards the center of Medan decreased, but intradistrict mobility increased, showing the need for localized measures.

Figure 72. Collective and individual levels of mobility before and during the COVID-19 pandemic



### ■ Lessons learnt and recommended mitigations

The measures to increase readiness against pandemics shall be taken at all scales of the mobility organizations.

- ✓ Short-term measures are identified and described in appendix. These include operational considerations for public transport lines (trains & buses), such as limiting accesses and training staff.
- ✓ Communication and PT promotion: passengers must be reassured that using PT is safe during sanitary crises. This is proven in advanced studies, and it is mainly due to the limited time spent in vehicles by passengers. Authorities and operators shall then have dedicated crises communication plans for PT.
- ✓ Long-term measures: Mebidangro agencies shall rely on innovations in NMT and digital tools to reduce contacts in PT facilities, and allow sustainable mobility at district levels. There shall be changes in overall arrangements at stations. The vehicles can benefit from more resilient and clean features. These investments shall be taken into account in the design of future lines, and in the improvement of current systems.

## 11.6.3. Summary of Environment and Mobility

The analysis shows that several environmental challenges must be addressed in the SUMP.

### ■ Lowering mobility GHG emissions

National directives shall be translated with more effect in North Sumatra Province and Mebidangro, to track, estimate and target GHG emissions more effectively. Given the high share of transportation-related emissions among the global estimates, Mebidangro shall undertake limiting the ownership and use of private vehicles through dedicated policies and the implementation of mass transit lines.



### ■ Monitor air quality

Air Quality (AQ) cannot be monitored in the current state of things in Mebidangro, given the ineffective equipments in place. Similarly to GHG emissins, AQ regulations shall be formalized regionally with provincial decrees and AQ stations put in place. This is important for the monitoring of mobility and hence shall constitute a dedicated action in the SUMP.

### ■ Prepare for crises

The consequences of the COVID-19 pandemic and potential risks from natural disasters show the relevancy and emergency to protect mobility investments. This shall be done through authorities and operators trainings first, before increasing the resilience of vehicles and facilities of transport through dedicated measures. In turn, an expected continued operability and limitation of economic losses is expected. At the scale of districts, soft and intense mobility shall be ensured and allowed by specific localized measures.

## II.7. Summary of the Diagnosis

The paragraph proposes a snapshot of the general diagnosis on urban mobility in Mebidangro.

### ■ Governance challenges

The complex urban transport related authorities has led to a complexity of interfaces and lack of coordination, decreasing service quality and failures at launching projects. Furthermore, there is no integrated transport authority at the metropolitan level, which is required by BAPPENAS for central funding assistance. Pergub 5/2016 already mandated the formation of an urban area-wide management cooperation agency and should be followed up with.

Reforming the minibus industry is critical. Minibuses are the predominant mode of PT by fleet size, workforce and coverage; however ridership is plummeting and improvements are necessary. The declining level of service performances has much to do with the government's low level of funding. Securing new types of funding, i.e., through corporate mobility tax and land value capture would be beneficial.

Funding and financing options are available but under-utilized. The capacity to conduct financial modelling, proposals, and management is low. There is a need to consolidate and follow up with funding and financing opportunities on a metropolitan level. This will benefit from having a Mebidangro-wide land transport authority and improved capacity in fiscal management.

### ■ Urban structure and demographics

#### ■ Urban axes of development and lack of plans

The lack of efficient planning and enforcement of land management policies gives way to organic urban sprawl driven by private investments. However, the North-South and East-West axes of development result in secondary and intermediary urban poles which are considered in the SUMP. As Deli Serdang combines more than half of the built area of the region, an integrated approach to planning beyond administrative borders is needed.

#### ■ Demographic strength and economic growth

The population is forecasted to increase from 4 million inhabitants in 2020 to 5 million in 2035, increasing its density from 4.000 to close to 5.000 inhabitants/km<sup>2</sup>. Without appropriate sprawl regulations, it is expected that the communities settle more and more along growth axes towards the West (Sunggal), South (Simalingkar) and East (Tanjung Morawa).

#### ■ Alarming motorization rate trends

Mebidangro tops the national ranking in motorcycle and car ownership rates, due to their affordability allowed by favourable contexts and lack of flexible and reliable PT alternative. Combined with the two points above, the dependency on PV is set to increase if no restricting measure is adopted. The motorization level and its consequences shows that the number of vehicles owned and used must be limited.

### ■ Mobility dynamics

#### ■ Opportunities from the infrastructure side

Road and rail networks could benefit from a more integrated management for their state. With very different service levels, rail carrying more efficiently a higher number of passengers, they present the opportunity to maximize the use of their assets. Roads shall not be extended more, but instead vertical and mixed-use developments shall adapt to the current network. Furthermore, an integrated authority overseeing roads in Mebidangro could address their heterogeneous quality and signage, and the needed upgrade of the Medan-Berastagi road link. Rail infrastructure needs investments to increase its operational and environmental performances, by improving speeds and use cleaner technologies. The aging fleet shall be replaced to attract more passengers. Furthermore, reactivating stations could cope for the expected demographic growths.

Furthermore, parking and law enforcement shall be reinforced in Mebidangro, to not only ease traffic attitudes but also grant higher access to mobility for vulnerable groups.

### ■ Opportunities from the services side

Accessibility and affordability to mobility in Mebidangro presents a contrasted situation. While the geographical and population coverage is high with the minibuses, patronage is decreasing due to the low quality of vehicles and accessing facilities (soft modes). Better readability is also needed to convince users to shift to PT. Currently, fares, services and schedules are unclear, and particularly felt by people with disabilities who need to plan their trips in advance. Soft modes also present some challenges. The rare bike lanes are misused due to unclear identification and awareness. Important accidents occur with pedestrians and the perception of walking facilities is very poor.

### ■ Harmony in the transport landscape

While the complexity of mobility organization was shown in the related paragraph, it is noticeable that authorities of Mebidangro cities and regencies, as well as the North Sumatra Province, lack considerations for future projects in official plans. This could either show a lack of pipeline identification and anticipation or organic development of projects. Either way, the planning shall be improved and supported by capacity development assistance, as proposed in this SUMP.

Multimodal integration and affordability of mobility is part of its success. Multimodality shall be observed by integrating rising online hailing services with long-distance mass transit, turning wide systems of minibuses into feeders for mass transit – as proposed in the preparation of the BRT Line 1 – and in dedicated park and ride facilities for PV users to shift to PT. This harmony can only be granted if a single authority oversees land transport across the territory and all modes, marking another case for this governance action.

### ■ Roads and private vehicles

#### ✓ Heterogeneous road quality and facilities

Roads quality and facilities are heterogeneous in terms of quality, capacity, and geographies. They do not offer the same accessibility to all geographical and social groups. Parkings shall be developed, along with the enhancement of NMT facilities.

#### ✓ Ultra-dominance of PV on roads, potential for NMT

Modal shares indicate that three quarters of vehicles are private. Most used PV are motorcycles as flexible and cheap options, posing competition challenges to future projects of mass transit and intradistrict mobility. Those projects will need to integrate rising online hailing and NMT as well, which uses have grown during the COVID-19 pandemic, and demand stem from all social classes.

#### ✓ Road congestion from urban structure, PV and freight

The high portion of PV on heterogeneous and unclear roads connecting the poles of Mebidangro results in congestion mainly around the Medan center, on radiating growth axes. In light of the strong demographic and motorization forecasts, these shall be worse in the future. Since urban freight also contributes to the adverse road situation, they shall be restricted on their routing, shifted to rail and potentially priced differently.

### ■ Important assets and potential for public transit

#### ✓ Important potential for rail and angkot networks

Existing rail infrastructure and minibuses service networks are developed and present huge potentials. However, they are aging because of the lack of maintenance and complex governance. Attracting passengers and changing their organisation is suggested to unlock their potential. These would present low capital investments improvements for mobility. The potential of minibuses stems from its massive fleet of more than 7.000 vehicles.

#### ✓ Environmental and operational performances of PT

These upgrades are necessary after the analysis of their poor performances. Occupancies of urban PT is at a mere 12% average for rail and road PT combined. Their attractiveness is indeed low, and upgrade in clean-energy engines and comfort shall be put in place, before considering new projects.

#### ✓ Future and potential PT services

The future BRT line 1 is committed and under development. It is important that the project reaches completion for the momentum of mobility implementation to pick up. Rivers present strong potential for waterbuses, and mass transit lines shall be identified. This multimodality is currently highly demanded by the people.

#### ✓ High but tainted accessibility numbers

Indeed, soft modes are necessary to access PT. In the current setting, sidewalks and bicycle lanes are clearly insufficient and shall be developed. Awareness raising to the communities shall accompany this measure to educate on their uses for best expected results, in contrast with their current use for parking and vending. The latter results in limited accessibility to PT although formal and informal networks cover an important 56% of the area. Furthermore, the sensitivity of inhabitants to prices, which is reflected by the low amount of money spent for mobility, shows a facilitated access to PV instead of PT.

### ■ Social aspects

#### ■ Involvement of vulnerable groups in planning

The social aspects of mobility must be taken into account at the core of mobility and transit planning and investments, through qualitative or quantitative ways in consultation of vulnerable groups or targeted improvements. Including these considerations is the only way for improving them.

#### ■ Standardization and homogenization

There is a clear need for improved and homogenized road signage to increase road safety and accessibility to persons with disabilities. Furthermore, the readability of the public transport information is also necessary for vulnerable groups to be able to plan in advance.

#### ■ Investment in public spaces

People walking are more likely to use PT. In order to increase attractiveness of public transit, authorities shall thus improve and build sidewalks with sufficient safety features (light for women at night, segregation for safety from cars) and enforcement (no obstacles nor parkings to allow persons with reduced mobility to use them).

#### ■ Areas of improvement

It was identified that the comfort and safety of public transit are key points of improvement expected by the inhabitants for them to use it. Meanwhile, women undergo poor travel conditions and economic disadvantages because of the lack of other sustainable option given the lack of access and control over private vehicles.

### ■ Environment and mobility

#### ■ Lowering mobility GHG emissions

National directives shall be translated with more effect in North Sumatra Province and Mebidangro, to track, estimate and target GHG emissions more effectively.

#### ■ Monitor air quality

Air Quality (AQ) cannot be monitored in the current state of things in Mebidangro, given the ineffective equipments in place. Similarly to GHG emissions, AQ regulations shall be formalized regionally with provincial decrees and AQ stations put in place.

### ■ Considerations in the SUMP

These considerations form the workbase for the preparation of the mobility vision on the long-term with the stakeholders of Mebidangro. The analyses are taken into consideration when drafting the future measures, either qualitatively or quantitatively.

Either way, the mobility dynamics show that integrated management is needed for all infrastructure and services of land transport in Mebidangro. The current resulting setbacks mostly stem from governance problems (paratransit, rail, roads). The case for the unique Mebidangro transport authority is strengthened by the mobility dynamics.

Several integrated blocks of challenges with interrelated issues are already identifiable at this stage. However, it is shown here that the mobility setbacks are inseparable from the transport offer and demand, urban structure and governance considerations. The next paragraphs highlight the socio-environmental consequences of those setbacks, and identify areas of improvements too.

### III. Vision, Goals and Mobility Scenarios

The vision, goals and mobility scenarios mission is the corner stone of the MobiliseYourCity programme: it invites all stakeholders of Mebidangro to discuss, share their vision and plan the mobility of tomorrow in a participatory and consensual approach – in contrast with traditional one-sided planning.

This section summarizes results of the works conducted during the component 3 of the SUMP Mebidangro preparation, which articulates the conclusions of the diagnosis (challenges and opportunities for urban mobility) with the measures proposed to address them.

The territorial dialogue starts with the elaboration of a vision and identification of mobility goals, before scenarios are discussed and measures agreed upon. This workflow is reflected in the structure of this section.

#### III.1. Vision for Urban Mobility

The vision for the urban mobility development and improvement in Mebidangro serves to identify priorities that will allow to address the challenges identified previously. Based on the vision, areas of improvement will be prioritized.

As the SUMP area is wide and the challenges plural, it is expected that different actors of mobility have different priorities and interests. However, according to the National and Regional Medium-Term Strategic Plans, regional and municipal institutions must collaborate more closely in the preparation of their future infrastructure plans. For this reason, the SUMP proposes a collaborative planning process.

The vision for Mebidangro urban mobility emerges from a participatory process, which results (areas of improvement) and approach (collaboration between stakeholders) are hereby described.

##### III.1.1. Common Vision for Mobility

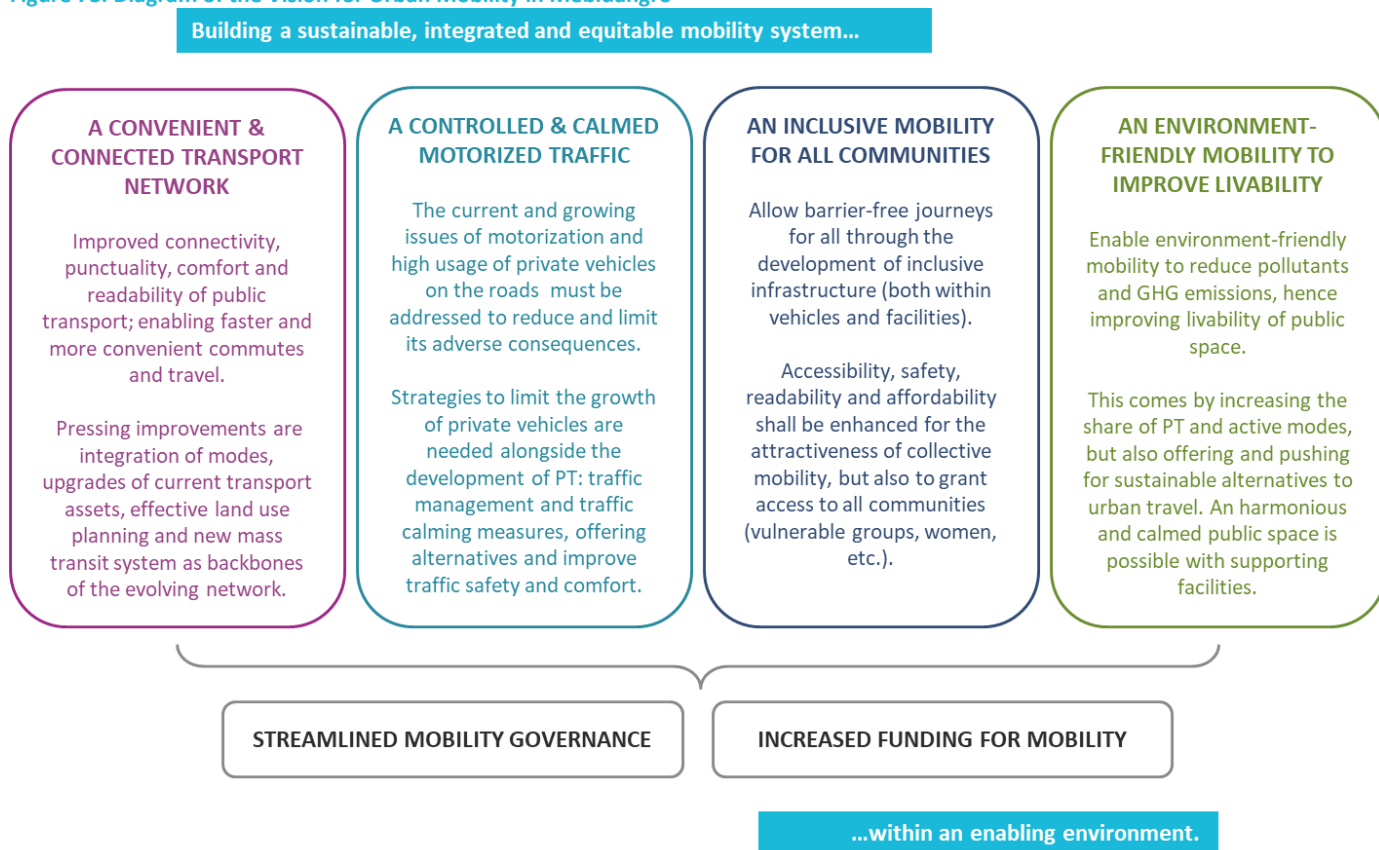
###### *Visi Umum Mobilitas*

###### ■ The principles and pillars of the vision

The vision for urban mobility in Mebidangro is to build a sustainable, integrated and equitable mobility system, translated into four main principles:

- ✓ A convenient and well-integrated public transport network, with enhanced readability and integration for all users between all modes.
- ✓ Tackling current and growing issues of motorization. With alarming forecasted growth of private vehicles, the consequences of important road traffic must be tackled (congestion, casualties, pollution, etc.).
- ✓ Inclusive mobility infrastructure improving accessibility and safety. Accessibility and safety are identified as key drivers of sustainable mobility success.
- ✓ A low-carbon mobility ecosystem improving livability. Mebidangro must improve the livability of its public space, notably by having more sustainable travel options.

Figure 73. Diagram of the Vision for Urban Mobility in Mebidangro



### ■ The enabling environment

Heading towards that vision is only possible with the implementation of an enabling environment, or a context with facilitation for the development of programs and projects.

It is identified that the two main levers to an enabling environment are the streamlining of mobility governance, namely by increasing collaboration between agencies to fast track the instruction of projects, and increasing the funding capacity for mobility projects, by putting in place a structure to identify and seek internal and external financing sources.

It shall be noted that the two levers to an enabling environment address the main obstacles of the past projects, that lead to delays or their cancellation. Thus, providing an enabling environment is not an option nor a secondary consideration – but a key success factor at the core of mobility improvement.

### ■ A vision specific to Mebidangro

The vision for mobility reflects the challenges experienced by communities, but also by the agencies which efforts to develop projects encounter obstacles. It is in line with regional and national plans, and offers an operational and working translation of the regulatory requirements. These are the first steps towards identifying and prioritising projects. To establish the vision, several consultations occurred during the SUMP preparation. These are listed in the next paragraph.

### ■ 2035 targets associated with the mobility goals

Each vision principle constitute a goal for mobility in Mebidangro, quantified with available literature and analyses. Given the lack of quantified policies on the topic, these targets should however be used with precautions.

- ✓ Double the public transport modal share: Set as a long-term target, the improvement of PT and provision of new services shall attract new users and trigger shift from PV.
- ✓ Limit or decrease the GHG emissions per capita: Limiting on the long term the GHG emissions from mobility per inhabitant will decrease the share of mobility-related emissions among other sources.
- ✓ Cut by half the road casualties: It is aimed to reduce by half the road casualties, in an incremental approach with actual and realistic measures (target-zero plans failed in the past).
- ✓ Double the affordability of public transport: The provision of mass transit shall increase by double the affordability of public transport in Mebidangro.

It is preferred by the stakeholders to limit the quantified targets at this high-level stage of the SUMP, given the long-term horizon; and instead prefer appreciating measures most relevant to Mebidangro in a hands-on approach.



### III.1.2. Hands-On Approach

To establish the vision for urban mobility in Mebidangro described before, governmental and non-governmental local stakeholders were invited to discuss and exchange in several occasions in the first half of 2021. Although the vision is established at the start of component 3, there were opportunities to exchange with agencies before this milestone.

#### ■ Preliminary exchanges with stakeholders

During the component 1 and 2 of the SUMP preparation (inception and diagnosis), several institutions were consulted to have a better grasp and depth of their perception of challenges of mobility in Mebidangro. The discussions covered the past and current issues in urban transport, the planning process, but also gave institutions a stage to voice out their vision for the future of mobility. This step is particularly important as, as expressed by several groups, it was the first time institutions were consulted for infrastructure planning. Through Focus Group Discussions, Workshops and interviews, multiple entities were engaged:

- ✓ Academics: Universitas Sumatera Utara, Universitas Medan, Universitas HKBP Nommensen
- ✓ Operators: Medan Bus Transport, PT. Railink, PT. Mutiara Karya Mitra, PT. KAI, PT. Antar Lintas Sumatera (ALS)
- ✓ Associations and NGOs: Citizens of Transportation Indonesia (MTI), Indonesia Inclusive of Elderlies, Disabled Association Indonesia, Association of deafs Indonesia, Railway citizens, ASWGI, United Nations Pulse Lab
- ✓ Sub-national agencies: Agency for women empowerment and child protection North Sumatra, Biro Hukum North Sumatra, Biro Organisasi North Sumatra
- ✓ Communities: through participation in the diagnosis.

All activities led during the inception and the diagnosis of the SUMP helped identify the pillars of the vision for urban mobility; but their confirmation and consolidation took place in a specific workshop by a dedicated group.

#### ■ Technical Committee to consolidate the vision

After summarizing the diagnosis takeaways, the vision of the Mebidangro citizens and associations, communities, and after proposing thoughts and compiling regulatory requirements, the SUMP taskforce gathered the Technical Committee in a collaborative workshop. The aim of this workshop was to confirm the major areas of improvement, and for all members, to share on what should urban mobility be on the long-term. All members were invited to the following process:

- ✓ Summarize their vision in one sentence and identify top goals for urban mobility
- ✓ Classify goals in categories (urban, mass transit...) and horizons (short, medium, long term)
- ✓ Validate, after consultant's processing, the four principles of the vision and identification of scenarios

Figure 74. Vulnerable groups workshop (top) and stakeholders' workshop for the vision (bottom)



#### ■ Summary of the engagement for the vision

The actors involved in the elaboration of the vision are governmental and non-governmental from strategic, tactical and operational levels; although the finalization and completion is led by the Technical Committee.

In the future SUMP editions as well as for future planning initiatives for mobility, it is recommended to engage with at least these organizations. The vision for mobility development gives way to several scenarios for actions to be developed, as described in the next paragraph.

## ■ A vision stemming from actual challenges

Diagnosis takeaways			Vision for mobility		
Governance Challenges			<ul style="list-style-type: none"><li>• A convenient &amp; connected transport network</li><li>• A controlled &amp; calmed motorized traffic</li><li>• An inclusive mobility for all communities</li><li>• An environment-friendly mobility to improve livability</li></ul>		
Urban Structure & Demographics	Urban axes of development and lack of plans		A convenient and connected transport network		
	Demographic strength and economic growth		An inclusive mobility for all communities		
	Alarming motorization rate trends		A controlled & calmed motorized traffic		
Mobility Dynamics	Opportunities form the infrastructure side		A convenient and well-integrated public transport network		
	Opportunities from the services side				
	Harmony in the transport landscape				
	Roads & private vehicles	Heterogeneous road quality & facilities		A controlled & calmed motorized traffic	
		Ultra-dominance of PV on roads, potential for NMT			
		Road congestion from urban structure, PV and freight			
	Important assets and potential for public transit	Important potential for rail and angkot networks		A convenient and well-integrated public transport network	
		Environmental and operational performances of PT			
		Future & potential PT services			
		High but tainted accessibility numbers			
Social aspects	Involvement of vulnerable groups in planning		An inclusive mobility for all communities		
	Standardization and homogenization				
	Investment in public spaces				
	Areas of improvement				
Environment & mobility	Lowering mobility GHG emissions		An environment-friendly mobility to improve livability		
	Monitor air quality				

## III.2. Mobility Scenarios

The SUMP preparation works, up to this component 3, have been rich in discussions and intense workshops between all actors of mobility in Mebidangro. With the past plans for projects development, as well as the clear directives from the central government, stakeholders express visions centered around mobility safety and quality, and the need for mass transit.

The consensus is naturally formed, and the discussion around a common vision does not let arise any contradictory plans nor priorities. Hence, the different stakeholders align on a similar appreciation of current and future needs for mobility.

### III.2.1. Emergence of the Scenarios

In this context, three paths to the vision are envisageable for the stakeholders of Mebidangro to develop mobility: the reference, the conventional and the ambitious scenarios. Each corresponds to a level of effort and feasibility.

In parallel, stakeholders identified and completed a set of mobility measures. The latter are proposals for projects and programs which address mobility challenges. Similarly to the vision, no major contradiction arose from the measures identification. However, not all measures are realistically feasible in combination with others or individually, and hence must be combined into different sets. These sets constitute the contents of the scenarios, which thus remain relevant and realistic.

#### ■ Introducing the mobility scenarios

- Scenario 0: Reference. This scenario describes the development of urban mobility on a status quo, and without additional plans to the existing ones. It is also often referred to as the “do-nothing” or “business as usual scenario” and includes commitment projects under development, but excludes the SUMP proposals.
- Scenario 1: Conventional Development. This case prioritizes the improvement of current assets and low-risk projects. It reflects the organic development of mobility, without major change in governance and with limited formalization of an enabling environment.
- Scenario 2: Ambitious Development. This illustrates a path with more efforts into changing the mobility paradigm in Mebidangro, by first reforming mobility governance and creating new funding channels, and taking disruptive actions for modern structuring projects.

For the relevancy of the SUMP, only two alternative scenarios are proposed. Furthermore, the consensus between stakeholders on their vision and goals allow focusing on two paths only.

#### ■ Rationale for scenarios

The scenarios are tools to evaluate sets of measures with the end-goal of formalizing an action plan. All scenarios cover the period from the base year 2020 up to long-term horizon 2035 and later. They have assigned measures that are described in the next paragraph.

### III.2.2. Potential Mobility Measures

The mobility development measures, or simply “measures”, are identified in collaboration with the stakeholders. These describe concrete projects and programmes to develop in order to facilitate and implement mobility improvements.

#### ■ Themes for the measures

The relevant policy areas to engage for mobility improvements are plural in Mebidangro: the measures are numerous and for better understanding, they are classified into themes, or “blocks”.

The themes of the measures address a facet of mobility in Mebidangro. Each holds a general objective as described above. However, the themes are indicative and are used to categorize the measures for clarity, and ponderate their evaluation according to priorities, as described later on.

The six themes are:

- ✓ Public Transport Development. To maintain and increase the PT modal share, with improved and additional services.
- ✓ Urban Planning and NMT. A block of measures meshing land use and mobility for a more livable urban space.
- ✓ Road Network & Private Vehicles. To calm and/or avoid road traffic at critical locations for more safety.
- ✓ Governance. Structural reforms to enhance the enabling environment of sustainable mobility.
- ✓ Environment & Climate. To enhance environmental management and monitoring of mobility in Mebidangro.
- ✓ Digitalization. Make use of available tools for a better management of road traffic and enhancement of PT.

All measures are addressed from the position of the sub-national government of North Sumatra and Mebidangro. While there are different ways of presenting measures (geographical coverage, external finance, modes...), the long list of measures for

Mebidangro is presented by theme, horizon and scenario in this paragraph. This is associated with the necessity of the Mebidangro stakeholders to have a multidisciplinary and comprehensive coverage of all policy areas – at an equal level of detail.

### ■ Relevancy and limitations of measures for Mebidangro

All measures are identified one by one for the context of Mebidangro. The measures are sourced from best practices, international and national benchmarks, expert opinions and are adapted to address the hard points of mobility. Ongoing and committed projects are taken into account.

Since each measure is a proposal, they all are treated equally with a similar depth. The SUMP process and comprehensiveness allow for high-level evaluations and comparisons. It is worth to note that there are no quantified target for mobility (level of service, emissions, etc.) applicable for Mebidangro in current policies. However, further studies for a given measure is part of its development after the SUMP, and is taken into account in the measure proposal and evaluation.

Since the measures address specific challenges of Mebidangro mobility, it is relevant to update them in horizon years when the situation evolves and new problems arise.

## III.2.2.a. Public Transport

As identified during the diagnosis, the current PT of Mebidangro is limited in terms of quality of service whatever the mode (train, minibuses and buses). However, it has a great coverage of the population with flexible routes.

The PT measures propose upgrading the current assets to improve services at limited costs, while several new mass transit lines are proposed in order to form backbones of the PT network.

The only committed project as per 2021 is the BRT line 1 from Pinang Baris to Amplas (central government instruction ongoing). The rest of the PT network is proposed after the analysis of movements as per the diagnosis, and traffic modelling in future years.

Figure 75. Public Transport measures for the Mobility Scenarios

No	Measure name	Measure description	Scenario 0 Reference	Scenario 1 Conventional	Scenario 2 Ambitious
19	BRT line 1	Implementation and operations of BRT Line 1	Medium 2028	Medium 2028	Short 2023
20	Wider BRT network	Implementation and operations of a wider high-capacity BRT network		Long 2035	Medium 2028
21	Wider city buses network	Develop efficient bus lines for low demand axes across the urban area.		Short 2023	
22	Implement water-buses	Implement and operate water bus lines using the Deli river asset.			Medium 2028
23	Urban rapid rail lines	Implement and operate high-capacity rail-based rapid transit lines			Medium 2028
24	Increase service levels of existing rail	Improve current conventional rail operations assets betterment			Short 2023
25-A	Minibuses: routing and operations optimization	Improve efficiency of minibuses as public transportation		Long 2035	Short 2023
25-B	Minibuses: riding quality and comfort increase	Increase minibuses attractiveness by improving the offered service		Medium 2028	Short 2023
26	Increase quality of service of existing buses	Increase load factor and readability of existing urban buses (TMD).		Long 2035	
27	Dedicated school bus lines	Implement and operate school buses in front of educational facilities			Short 2023
28	Promote public transportation	Raise awareness on public transportation and its benefits towards citizens			Short 2023

Supporting measures are important for the success of PT: this includes the promotion of PT (as it was observed that most inhabitants are not aware of existing services), and the implementation of bus lines, in order to provide safe and affordable travel to vulnerable groups while reducing congestion along school axes.

### III.2.2.b. Urban planning and NMT

The urban planning block of measures aims at giving back the urban space to the people instead of let it being used in majority by motorized vehicles. This translates into maximizing soft and active modes, against roads and parkings. It includes regulatory measures, which are needed for developments that will decrease the need for mobility, such as mixed-use development in secondary urban centers.

The urban planning and NMT measures are the first one proposed as they hold an important role in the success of the implementation of mobility measures. Indeed, the investigations have shown an overwhelming usage of motorized vehicles by the inhabitants, as well as the lack of facilities to soundly access public transit.

Providing facilities and encouraging active modes such as walking and cycling are key to instaure new travel habits. If inhabitants cannot replace private vehicles by active modes on short distances, then they are less likely to shift to collective mobility on medium to long distances.

**Figure 76. Urban Planning and NMT measures for the Mobility Scenarios**

No	Measure name	Measure description	Scenario 0 Reference	Scenario 1 Conventional	Scenario 2 Ambitious
1A	Car free zones: Permanent closure	Road sections closure to traffic indefinitely.		Medium 2028	
1B	Car free zones: Periodical closure for events	Road sections closure to traffic for defined periods of time.			Short 2023
2	Comfortable and safe sidewalks	Comfortable and safe sidewalks.		Medium 2028	Short 2023
3	Mixed-use zones in secondary urban centers	Increase diversity of activities and services in dense secondary urban centers.			Medium 2028
4	Law to restrict urban sprawl	Prepare a law at Province or Mebidangro level to restrict urban sprawl.		Long 2035	Medium 2028
5	Framework for TOD developments	Prepare framework to include TOD as part of mass transit development.			Short 2023
6	Land Value Capture tax law	Introduce regulation for tax of land value rise from transit betterment.			Medium 2028
7	Safe NMT and bicycle lanes	Develop dedicated & safe NMT lanes along main road axes.		Medium 2028	

On the institutional side, land use regulations help restrict the observed organic urban sprawl to limit the associated expansion of the road network, as identified in the diagnosis. It is additionally proposed, to develop legal frameworks for TOD developments and land value capture taxation in order to strengthen the business cases of mobility projects, and in particular mass transit.

### III.2.2.c. Road Network and Private Vehicles

The main address of the SUMP being the reduction of private vehicles on the road, the related theme comes second. Most of the mobility challenges regarding safety, congestion, travel time and the environment arise from road traffic.

Measures to calm traffic and improve livability are proposed, alongside the creation of new (circular) roads in already densely populated areas. No additional road extension is proposed, to limit the urban sprawl and maximize mixed development along existing ones.

Instead, avoiding congestion can be achieved by limiting the number of freight vehicles along urban axes (relation with congestion identified) and easing parking at dedicated facilities, which also serve as multimodal hubs or Park & Rides.

Finally, providing homogeneous road quality to users across Mebidangro is identified as a goal: it is present in the standardisation of signage and improvement of the link Medan-Berastagi. Other supporting measures are proposed, such as the reinforcement of licensing in line with national directives, or the enhanced enforcement of traffic rules following the diagnosis on road safety.



**Figure 77. Road Network and Private Vehicles measures for the Mobility Scenarios**

No	Measure name	Measure description	Scenario 0 Reference	Scenario 1 Conventional	Scenario 2 Ambitious
8	Circular roads	Roads to allow regional traffic to avoid city center and busy intersections.	Medium 2028	Medium 2028	Medium 2028
9	Enhance road link Medan - Berastagi	Improvement of regional link to allow safer travels.		Medium 2028	Short 2023
10	Standardized road signage accross Mebidangro	Standardization of road signage		Medium 2028	Short 2023
11	Traffic calming measures, in city centre and periphery	Decrease speeds to favorize pedestrians, NMT and reduce accidents		Medium 2028	Short 2023
12	Reinforce driving license process	Tighten and improve the driving license process		Medium 2028	Short 2023
13	One-way streets	Conversion into one-way streets on important congested axes		Short 2023	
14 A	Dedicated parking hubs: at main attractions	Create off-street parking hubs near to urban attractions and activity		Medium 2028	
14 B	Dedicated parking hubs: P&R at transit hubs	Create off-street parking hubs near to transit hubs			Medium 2028
15	Key multimodal hubs	Develop key multimodal hubs on important PT lines junction		Medium 2028	Short 2023
16	Larger traffic law enforcement and campaigns	Conduct campaigns to strengthen the respect of traffic law		Medium 2028	
17	Quality road network all accross Mebidangro	Increase the quality of roads accross the Mebidangro territory.		Long 2035	Medium 2028
18	Limit freight vehicles to certain period of time	Decrease the share of freight vehicles amongst overall traffic			Short 2023

### III.2.2.d. Governance

The governance theme gathers regulatory and institutional measures of general nature that are not part of any other theme.

First, as a clear requirement from the central government to grant funding assistance to transportation projects, a transit authority at Mebidangro level must be formed. Its roles, responsibilities and funding are to be defined according to legal contexts and implementation needs, in association with all sub-national agencies and central ministries – and by taking into account previous initiatives in Jakarta and Bandung.

The second pressing initiative is to reform the obsolete minibus system with ailing fleets and decreasing ridership, dangerous road behaviours, polluting vehicles, etc. A relevant and impactful change will only be possible by altering the governance of the system, which today is semi-formal with the implication of the authorities only in the route operating rights delivery.

**Figure 78. Governance measures for the Mobility Scenarios**

No	Measure name	Measure description	Scenario 0 Reference	Scenario 1 Conventional	Scenario 2 Ambitious
33	Mebidangro transit authority	Create a single transit authority for land transportation			Medium 2028
34	Reform minibus industry	Reform the schemes of minibuses to optimize private finance and services.		Long 2035	Medium 2028
35	Corporate tax on mobility	Corporate tax on companies which benefits, from implemented PT projects.			Medium 2028
36	Capacity building (Technical Assistance)	To reinforce skills needed for planning and implementing mobility measures.		Medium 2028	Short 2023
37	Separate track and train operators	Separate activities of trains and infrastructure operations			Medium 2028

It is proposed in parallel to instaurate a corporate tax on companies benefiting from mobility projects, such as increased accessibility for their employees resulting in improved travel and productivity. This revenue source should increase the fiscal capacity to fund mobility measures.

Finally, a way to enhance the use of current railway assets is to separate track and train operators to introduce commercial competition on passengers services, for increased value for money for governments.

These measures are proposed to be accompanied by international financial and technical assistance, in order to have an improved governance that follows international standards and leverages on decades of experience from other countries. The medium and long term goal being the capacity building of the planning and implementing agencies for their autonomy and sovereignty.

### III.2.2.e. Environment

The environment measures aim at increasing the environmental management capacity of the authorities with better monitoring and reducing emissions of GHG and air pollutants created by mobility.

The replacement of cleaner engines for individual and collective vehicles is accompanied by the implementation of incentives to reduce motorized vehicles usage, such as the introduction of new road taxes and parking penalties.

**Figure 79. Digitalization measures for the Mobility Scenarios**

No	Measure name	Measure description	Scenario 0 Reference	Scenario 1 Conventional	Scenario 2 Ambitious
38	Tax on motorized vehicles using urban roads	Use Electronic Road Pricing at city center to discourage usage of PV		Long 2035	Medium 2028
39	Incentives to reduce fuel consumption	Make difficult the usage of private vehicles on urban roads		Long 2035	Short 2023
40	Take down fuel subsidy	Cancel the government subsidy on fuel retail in Mebidangro			Medium 2028
41	Renewable energies for rail transportation	Implement renewable energy use in the operations of the rail network of Mebidangro			Short 2023
42	Renewable energies for road public transportation	Shift fleets of road-based PT lines to renewable energies			Medium 2028
43	Renewable energies for private vehicles	Encourage the adoption of electric technologies for private vehicles			Medium 2028
44	Cleaner fuels for existing road public transportation lines	Upgrade existing fleets of angkot and buses to cleaner thermal engines		Medium 2028	
45	Installation of air quality stations	Implement air quality stations to better monitor and control air quality			Medium 2028
46	Communities' engagement for environmental issues	Conduct campaigns for awareness raising on environmental issues		Medium 2028	Short 2023

The environment subject has important potential social impacts, thus the communities must be educated regarding the environmental challenges faced because of mobility, to accept more responsible and sustainable modes.

However, while some measures address the growing concerns on fleets and usage of private vehicles, they can only be implemented and accepted upon the success of public transport. The households being sensitive to price variations, a clear affordable and performant alternative to private vehicles must be offered if incentives and penalties to reduce the use of private vehicles are put in place.

Furthermore, the development of these measures need strong political alignment and important communities consultation, to reach expected results and avoid uprisers.

### III.2.2.f. Digitalization

Digitalization of tools for operators, authorities and users have grown unequally in the past years. While paratransit and Mobility as a Service (MaaS) has grown exponentially in the past decade (e.g. online hailing), conventional operators and authorities have not adapted their services to the evolving technologies.

It is first proposed for Mebidangro authorities to take advantage of the MaaS strengths by regulating it better for enhanced safety, and deepening the range of these services: allowing electric rentals, non-motorized vehicle sharing, etc. It must be noted that main investments in those systems shall remain on the private sectors under schemes to be defined.

Current operators lack digital systems, and a salient point of the diagnosis shows that most inhabitants identified the lack of travel information (fares, routes, schedules) as a main obstacle for the use of public transportation. Therefore, it is proposed that authorities impose operators the use of passenger information systems at PT facilities and vehicles to increase their readability and attractiveness, as well as accessibility for vulnerable groups.

**Figure 80. Digitalization measures for the Mobility Scenarios**

No	Measure name	Measure description	Scenario 0 Reference	Scenario 1 Conventional	Scenario 2 Ambitious
29	MaaS (On-demand service)	Increase safe use of MaaS on existing structures for greater benefits		Long 2035	Short 2023
30	Monitoring system at Mebidangro level	Monitor traffic and real-time traffic management measures			Medium 2028
31	Real-time passenger information On-board & at stations	Operators to provide passenger information to increase PT attractiveness.		Long 2035	Short 2023
32	Fare intermodality	Homogenize and integrate fares of current and future PT lines		Long 2035	Short 2023

Finally, it is proposed to pursue the efforts initiated by Medan City on monitoring its main road axes, by generalizing the CCTV to the metropolitan area. In order to assess traffic in real-time and offer adapted traffic management measures. While this is an ideal solution, the first steps are to define the needs for such system at Mebidangro level by prioritizing the reduction of congestion and increasing road safety. In the long term, this should be ran in association with any implemented operations control centre of mass transit.

With a growing adoption of mobile phones, modernization of the transit experience in Mebidangro must take into account the new digital applications. This is critical to attract the working and studying populations, which operate for more than half of the total daily trips in the area.

## III.3. Evaluation of the Scenarios

The scenarios are used to consolidate and select best relevant mobility measures for Mebidangro. To that end, a clear and unbiased evaluation method is used, with the aim of selecting the best set of integrated packages of measures to translate forward into an action plan specific to Mebidangro.

The evaluation method is as follow:

- ✓ Evaluation of measures regarding different sets of criteria specific to Mebidangro
- ✓ Evaluation of scenarios based on the measures and preference for quick wins
- ✓ Adaptation of selected scenario with relevant measures and formation with the stakeholders of a best case.

### III.3.1. Evaluation of Measures

The measures are evaluated in the context of Mebidangro, i.e. against criteria agreed by all local agencies, and with a criteria ponderation reflecting their priorities and vision. The technical, financial and institutional feasibility, economic costs and benefits, along with environmental and social impacts are part of the evaluation.

- ✓ Technical feasibility (10%)
  - ✓ Availability of solution (Relevant; 1,0%): Mature solutions available in Indonesia and Medan are preferred for easiness of procurement and market acceptance.
  - ✓ Technical risks (Significant; 4,0%): Industrial and operational risks with technology that is not mastered.
  - ✓ Operability (Significant; 4,0%): Complexity of operating the solution by direct local players.
  - ✓ Promotion of innovative tools (Relevant; 1,0%): Modernity of the solution to promote Mebidangro.
- ✓ Financial and institutional feasibility (40%)

- ✓ Capital expenditure (Critical; 15,0%): CAPEX shall be in line with financial capacities. A quantitative estimate is made wherever possible.
- ✓ Operations & maintenance expenditure (Significant; 5,0%): OPEX shall be in line with financial capacities. A quantitative estimate is made wherever possible.
- ✓ Financial profitability (Significant; 5,0%): Potential of the solution to generate revenues (qualitative estimate).
- ✓ Definition of institutional structure (Significant; 5,0%): Roles and readiness of current institutions to design, procure, implement, operate, finance and manage the solution.
- ✓ Adequacy with existing policies (Critical; 10,0%): Does the regulatory framework and development policies allow for the measure?
- ✓ Economic costs and benefits (30%)
  - ✓ Economic costs – externalities (Significant; 5,0%): Estimated importance of economic externalities (indirect impacts).
  - ✓ Transport accessibility (Significant; 5,0%): Does the measure increase the accessibility or ease of use of PT or NMT modes?
  - ✓ Modal split (Relevant; 2,5%): Does the measure increase the share of PT and NMT?
  - ✓ Speed gains (Relevant; 2,5%): Do people travel faster as a whole and save time?
  - ✓ Road safety (Critical; 10,0%): Does the measure have potential to reduce road accidents and the number of injured and killed?
  - ✓ Quality improvement of transport (Significant; 5,0%): Measuring the potential to improve quality, comfort and overall attractiveness of PT.
- ✓ Environmental and social impacts (20%)
  - ✓ Communities settlements impact (Significant; 5,0%): Impact on communities private land settlements, either directly (land acquisition) or indirectly (liveability).
  - ✓ Land use impact (Relevant; 2,5%): Is land use improved to reduce the need for transportation?
  - ✓ Improvement of economic opportunities (Significant; 5,0%): Provide communities higher access to economic opportunities, as well as creation of jobs by the measure itself.
  - ✓ Accessibility to vulnerable groups (Significant; 5,0%): Increase accessibility to mobility for fragile communities: elderlies, women and children, disabled & the poor.
  - ✓ Gender inclusion (Relevant; 2,5%): Potential of the measure to improve women mobility with higher accessibility, comfort and safety.

All these criteria are appraised using quantitative or qualitative evaluation at the detail level of the SUMP, or using expert opinion and experience. An example on the evaluation of the measure 11 (traffic calming measures) is in appendix.

### III.3.2. Evaluation of Scenarios

Now that each measure can be appraised with a “Mebidangro SUMP” score, it is possible to evaluate the scenarios 1 and 2.

#### ■ Modulating the measures

Each scenario either excludes or includes the measures proposed. When included, a measure can either be fit for short, medium or long-term implementation. Hence, if a measure can belong to both scenarios, it can also be proposed on different time horizons depending on the coherence of the said scenario.

With a preference for quick wins and rapid implementations, a bonus factor is attributed to measures proposed on the short-term – and a penalty factor to measures proposed on the long-term.

- ✓ Short term measures (2023): bonus of +10%
- ✓ Medium term measures (2028): no effect
- ✓ Long term measures (2035): penalty of -10%

The resulting scores of the measures are taken forward for the overall scenario evaluation.

#### ■ The overall scenario evaluation

To provide an apple-to-apple comparison between scenarios and scorings, it is necessary to adopt a rationalized evaluation based on included measures.

The average modulated scores of measures are aggregated per blocks for each scenario before the overall average is set for the ambitious and conventional alternatives.

#### ■ The final scores of the scenarios

The conventional scenario for mobility development has a score of 68%. The ambitious scenario has a score of 74%. Not only the higher score of scenario 2 shows higher benefits, but also a higher ease to implement and adapt it to Mebidangro. The relatively close scores of the scenarios show their relevancy and adequate comprehensiveness against the vision of mobility for the territory.

However, although the evaluation method is unbiased and elaborated for the benefit of the planning, with data-backed decisions, it is important to keep in mind that the scenarios are tools and the results of the comparison needs to be discussed between the stakeholders before moving forward.

### III.3.3. Territory Dialogue for Measures Concertation

With the evaluation selecting the Scenario 2 “Ambitious Mobility Development”, the mathematical conclusion must be completed with the knowledge of the local authorities. Through different steps, the Mebidangro agencies have completed the set of measures towards the action plan.

- ✓ Review of the evaluation: the stakeholders review and approval of criteria and ponderations, confirm the method.
- ✓ Variation on horizons of measures: several adjustments are requested by stakeholders on the implementation timelines, notably to propose faster implementation periods (considered while keeping plans realistic).
- ✓ Completion with modes: certain routes and modes were adjusted (between road and rail-based) in order to reflect the vision of the stakeholders.
- ✓ Consolidation of measures: the measures of the selected scenario were completed with additional ones that were judged necessary and critical for the stakeholders, as well as new committed programs, forming a set of consolidated measures.

This dialogue is important for the comprehensiveness of the set of measures, as well as its relevancy for Mebidangro. Furthermore, it increases the stakeholders ownership of the plan, which contributes towards the SUMP implementation.

In a nutshell, the measures of the scenario 2 are completed with additional ones to form the action plan, which is described in the next section, and details for each action are available in appendix.

### III.3.4. Main Impacts of the Scenarios

The main impacts of the mobility scenarios for Mebidangro are estimated at high-level with the available technical depth at the time of the preparation of component 3.

#### ■ Comparison of main impacts between scenarios

At macro-level and for 2035, it is clear that the most structural measures to shift from PV to PT (mass transit, incentives...) reduce at a greater scale the congestion: the ambitious scenario decreases congestion three-fold compared to the conventional one.

The public transport modal share is also increased twice as much (+27%) in the ambitious case against the conventional one (+15%). The mass transit lines and disruptive measures bear important impacts.

**Figure 81. Main impacts in 2035 of each SUMP scenario at macro level**

*Dampak utama pada tahun 2035 dari setiap skenario SUMP di tingkat makro*

Main impacts in 2035	Scenario 0 Reference	Scenario 1 Conventional	Scenario 2 Ambitious
<b>Congestion</b>			
Vehicle.hours per peak hour (PM)	92,952 veh.hours	86,314 veh.hours	72,264 veh.hours*
Variation vs. reference	-	- 7%	- 22%
<b>Public transport modal share</b>			
Trips per year	9,6%	24,6 %	36,1 %*
Variation vs. reference	-	+ 15%	+ 27 %
<b>Number of km mass transit lines</b>			
Exclude existing angkot & bus lines	73,0 km	102,2 km	153,3 km
Variation vs. reference	-	+40%	+110%
<b>%Access to Public Transport</b>			
Excluding angkot	3,8%	7,7%	11,1%
Variation vs. reference	-	+3,9%	+7,3%
<b>Mobility-related GHG emissions</b>			
Per year	3,196 Gg of CO <sub>2</sub> eq	2,843 Gg of CO <sub>2</sub> eq	2,578 Gg of CO <sub>2</sub> eq
Variation vs. reference	-	- 11%	- 19%

\*Full PT network implemented

Lastly, the mobility related emissions also decrease more sharply in the ambitious scenario (-19%) rather than in the conventional scenario (-11%), thanks to consequent actions.



The absence of proportionality between the different main impacts show that all measures must be undertaken together, as integrated packages. Focusing on only several actions may not result in expected impacts on mobility.

### ■ Verification of goals reachability

The measures which can be quantified and modelled were so for their evaluation, and an impact assessment is conducted for those to verify that the selected scenario answer the targets of the vision. Preliminary indicators such as accessibility, air pollution, modal share and affordability, shown good association of the scenario.

Figure 82. Main impacts in 2035 of the Scenario 2

Indicator	Impacts 2035 (Sc. 2 v. Reference)	2020 Baseline	2035 Reference	2035 Ambitious scenario
<b>Total annual GHG emissions</b> (Mt CO <sub>2</sub> eq)	-618 Mt CO <sub>2</sub> eq	2225 Mt CO <sub>2</sub> eq	3196 Mt CO <sub>2</sub> eq	2578 Mt CO <sub>2</sub> eq
<b>GHG emissions from mobility</b>				
Annual transport related GHG emissions per capita (kg CO <sub>2</sub> eq)	-124 kg CO <sub>2</sub> eq / capita	549 kg CO <sub>2</sub> eq / capita	641 kg CO <sub>2</sub> eq / capita	517 kg CO <sub>2</sub> eq / capita
<b>Accessibility</b>				
Increase of proportion of population living within 750 m of a mass transit stop	+7,3%	3,8%	3,8%	11,1%
<b>Modal share</b>				
Increase of the modal shares of trips by public transport	Public Transport 13,7%	Public Transport 9,6%	Public Transport 9,6%	Public Transport 23,3%
<b>Road safety</b>				
Decrease of traffic fatalities in the urban area, per 100.000 inhabitants	-9,0 deaths/100k hab	10,4 deaths/100k hab	13,9 deaths/100k hab	Target: 4,9 deaths/100k hab
<b>Affordability of public transport</b>				
% disposable household income spent on PT for the 2 <sup>nd</sup> quintile income group	-15,5%	13,0%	20,5%	5,0% (Target)

It shall be noted that critical indicators such as casualties from road accidents and affordability are not modellable at SUMP preparation, and can only result from intangible measures (education, traffic calming...); hence the limitation of fully-quantified targets for Mebidangro. However, these are reported and analyzed in the Observatory on Urban Mobility (cf. related section).

It can be considered that since the adjusted scenario 2 answers the vision and targets set out by the stakeholders of Mebidangro, its related measures will define the action plan.

### III.4. Summary of the Vision, Goals and Mobility Scenarios

Articulating the SUMP diagnosis with the action plan, the component establishing the vision, goals and mobility scenarios for Mebidangro, is the necessary step for a consensual approach to mobility planning and development. This was lacking, although it was recommended by the national and sub-national strategic plans.

#### ■ Participation as a central part of MYC and SUMP

This step allowed important coordination and discussions between the actors who eventually gather behind the same goals and vision, by gathering the voices of all actors of mobility in Mebidangro.

The process was conclusive into selecting the ambitious scenario for the development of urban mobility in Mebidangro. The process can now be replicated and improved in future years by sub-national agencies in their infrastructure planning efforts.

#### ■ Selected ambitious scenario for mobility development

However, the selection of the scenario is only a prerequisite for developing sustainable mobility. After the actions are adopted by the authorities, new challenges of implementation will be encountered – but should be mitigated with then enhanced enabling environment.

An important level of effort is expected to execute the ambitious scenario for mobility development. The momentum of the SUMP shall also be used by leading agencies to pursue collaboration with all actors and engage the private sector.

#### ■ Before the vision, goals and mobility scenarios

The vision, goals and mobility scenarios component has shown benefits as beforehand, various provincial and municipal government entities had low coordination around mobility projects, different focuses and interests, and worked on different horizons in a scattered manner. This notably resulted from the lack of translation from national directives into regional regulations.

#### ■ After the vision, goals and mobility scenarios

The actors now benefit from forums for coordination which have proven their use, a common vision for mobility development, consensual measures and agreed methods of planning. The several knowledge dissemination executed during this step also provided for tools to understand and conduct mobility planning.

This is an encouraging growth in the readiness for projects implementation, which can be replicated in other cities of Indonesia by the Supervisory entity, BAPPENAS, after the efforts bring to light concrete results.

#### ■ Considerations on the mobility scenarios and measures

Since the planning is based on the current situation, the evolving conditions shall be updated along with consequent planning.

The comprehensiveness (geographical, social, modal) of the scenario does not allow for all the measures to be treated in more depth at the time of the SUMP elaboration, but all measures are considered equal in their potential to help developing sustainable urban mobility.

The measures are deepened in the action plan and described in more length in the following section.

## IV. Action Plan

The Action Plan forms the essence of the Sustainable Urban Mobility Plan (SUMP) of Mebidangro. It delineates the activities and operations for an improved urban mobility on the short, medium and long terms. The objectives of the Action Plan are those of a roadmap to improve urban mobility:

- ✓ Identify the activities to be undertaken with sufficient supporting information;
- ✓ Point out necessary arrangements and modalities of each action (timeline, costs, phasing);
- ✓ Name responsible Mebidangro institutions for the development and implementation of each action;
- ✓ Highlight, as targets and/or justification for actions, the expected effects and impacts of implementation

Mobility actors, public or private, shall refer to the SUMP Mebidangro Action Plan when engaging efforts to improve urban mobility. The formalized roadmap shall act as any other regulatory document that covers in a package tangible projects (infrastructure and investments) and intangible actions (public policies, governance, regulations and frameworks, capacity building and the monitoring and evaluation framework).

### ■ Action Plan as a support and catalyst for mobility

The Action Plan benefits the Mebidangro sub-national governmental institutions as a support for the plotting of their efforts for mobility improvement in the metropolitan area. The Action Plan also acts as a catalyst for mobility improvement, since its adoption increases the potential resources available by engaging with national and international actors.

The Plan includes 40+ actions, that include further sub-actions, to address the mobility diagnosis of 2020/2021 and steer developments towards the vision for 2035. Actions cover the fields of urban planning and NMT, road network and private vehicles, public transport, digitalization, environment and governance and result from the Ambitious Scenario previously assessed. While all actions are prepared equally, governance aspects are particularly important to stimulate and accelerate the rest of the actions.

Up to 2040, the global cost of the Action Plan is preliminary appraised at IDR 54,4 trillion (USD ±3,8 billion); and running implemented projects will necessitate a cumulated operational expenditure of IDR 20 trillion (USD ±1,4 billion), for actions gaugeable at this stage. Funding and financing channels are initially identified.

### ■ Profiling the actions

This section provides the grounds for the programming of Actions through the following paragraphs:

- ✓ Action plan overview
- ✓ Cost estimate and sustainable funding
- ✓ Implementation modalities
- ✓ Impacts and way forward

Actions Sheets are available in appendix for each action: they describe their nature, content and activities. Moreover, a summary of the objectives, resources, institutions, timeline and risks is proposed.

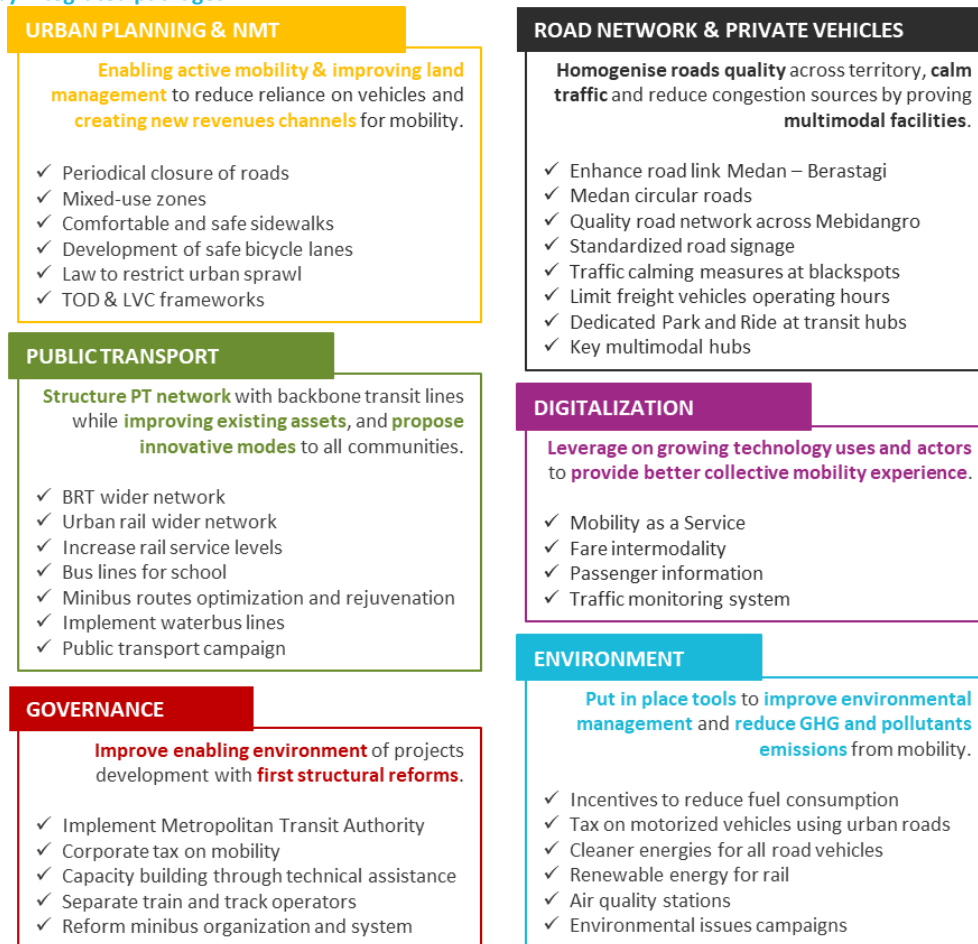
### IV.1. The Action Plan

After the vision for mobility on the long-term was determined by the Mebidangro stakeholders, development scenarios were proposed and evaluated. The ambitious scenario, which proposes disruptive measures to make the governance of mobility evolve, and launch capital-intensive projects, was selected against the conventional scenario.

The proposed measures of the selected scenario compose the actions of the Action Plan. With their nature, they require a high level of preparedness by the authorities of Mebidangro, and a high level of effort that should be supported by the central authorities. It is expected that the Action Plan brings important positive socio-economic impacts and enhances the enabling environment of mobility projects.

This paragraph presents the actions and related integrated packages, a focus on mass transit, as well as a preliminary appraisal of the global costs.

Figure 83. Actions by integrated packages



### IV.1.1. Actions and their Integrated Packages

Action packages	Main stake-holders	Total CAPEX (in million IDR)	Expected impacts
Urban Planning & Non-Motorized Transport	PUPR, DISHUB, BAPPEDA, and BPKAD of North Sumatera, Medan, Binjai, Deli Serdang, and Karo	976.000	<ul style="list-style-type: none"> <li>• Reduce GHG and pollutants emissions.</li> <li>• Increase livability of section for inhabitants and users.</li> <li>• Potentially increase economic activities.</li> <li>• Develop NMT and pedestrian modes</li> <li>• Awareness raising of the possibility to travel without private vehicles.</li> <li>• Increase in NMT and PT share.</li> <li>• Increase of the quality of multimodal integration.</li> <li>• Increased of safety for woman and vulnerable groups to access public transportation.</li> <li>• Reduce travel time within the mixed-use area.</li> <li>• Increase land value around developments.</li> <li>• More compact and orderly development in the selected zones.</li> <li>• Long term impact will be the imitation of urban sprawl and related challenges.</li> <li>• Increased affordability of housing in centers and positive social inclusivity and access to economic opportunities.</li> <li>• Increase the possibility of TOD as financing lever of transit (both financing and fiscal capacity for PT) by improving the financial risk management understanding, attracting and gaining interest from investors, and identifying the potential property developers.</li> <li>• Enhanced funding and financing capacity of city and province governments (to be defined) for transit projects.</li> <li>• Reduced traffic congestions</li> <li>• Economic and environmental benefits from reduced energy consumption.</li> <li>• Reducing costs of roadway and parking construction and maintenance.</li> </ul>
Road network for private vehicles and public transport	PUPR, Bina Marga, DISHUB, SAT-LANTAS, of North Sumatera, Medan, Binjai, Deli Serdang, and Karo	3.381.900	<ul style="list-style-type: none"> <li>• Increased mobility and accessibility.</li> <li>• Improved speed.</li> <li>• Reduced travel time and congestion in the city center</li> <li>• Indirect economic benefits.</li> <li>• Increased mobility between Medan – Berastagi.</li> <li>• Reduced vehicle operating costs.</li> <li>• Reduced congestion and GHG emission.</li> <li>• Reduction in the number of accidents and related injuries and casualties.</li> <li>• Safety to road-users in travelling across Mebidangro roads as well as road violation management</li> <li>• More comfort in the streets concerned.</li> <li>• Increase driving competencies for drivers of private and public vehicles.</li> <li>• Calmed and organized traffic on the medium-term, with less road incivilities.</li> <li>• Indirect impacts are the road-law abiding citizens and long-term reduction of road casualties</li> <li>• More efficient traffic flow in roads and intersections.</li> <li>• Reduced travel time with higher speed and better signal timing.</li> <li>• Improved road safety due to reduced conflicting maneuvers.</li> <li>• Lower congestion from on-street parking.</li> <li>• Increase attractiveness of PT and indirectly increase PT share.</li> <li>• Enhance inter-modality with private modes &amp; employment opportunities.</li> <li>• Public awareness to drive more safely to minimize the accidental and fatality rate</li> <li>• Reduced pavement maintenance costs</li> </ul>
Public transport	PUPR, DISHUB, Bina Marga of North Sumatera and Central Government	49.820.000	<ul style="list-style-type: none"> <li>• Reduction of private vehicle share and reduced congestion and VKT.</li> <li>• Beneficial from the perspective of energy/fuel consumption, vehicle emission, and GHG reduction.</li> <li>• BRT system would be a catalyst in transforming the Mebidangro area into more livable and eco-friendly environments.</li> <li>• Mode shift from private vehicles to a more diverse PT modes, reducing road congestion and economic losses.</li> <li>• Increased number of tourists in Medan.</li> <li>• Providing commuters with trips that are safer, faster, more accessible and efficient;</li> <li>• Enhancing urban landscape and accessibility, inter-modality.</li> <li>• Political impact at national level.</li> <li>• Increase of transport capacity of railway lines.</li> </ul>



			<ul style="list-style-type: none"> <li>• Increase of commercial speed.</li> <li>• Increase of attractiveness of rail as a mode to further improve PT modal share.</li> <li>• More efficient routes.</li> <li>• Rationalization of workforce.</li> <li>• Optimization of depots.</li> <li>• Reduction of competition.</li> <li>• Healthier driving conducts.</li> <li>• Increased attractiveness of angkot and resulting in increased ridership.</li> <li>• A more effective and efficient bus network system.</li> <li>• Modal share of non-motorized transportation and public transport (PT) in the selected zones/lines are expected to increase.</li> <li>• Encourage the people using public transport by mode shifting in order to gain the economic benefits and air quality improvement.</li> </ul>
Digitalization	Dishub of North Sumatera and Central Government	10.000	<ul style="list-style-type: none"> <li>• Expected to decrease GHG emissions and travel time, that cannot be determined quantitatively for the moment.</li> <li>• Better traffic management and safer roads.</li> <li>• Optimized travel routes</li> <li>• Better travel time management.</li> <li>• Increased users experience and attractiveness of PT which leads to expected modal shift to PT.</li> </ul>
Governance	Dishub and BPKAD of North Sumatera and Central Government	122.500	<ul style="list-style-type: none"> <li>• The LTA is expected to unlock urban transportation and mobility projects by streamlining administrative and coordination requirements and allowing channeling external finance. Having a single authority responsible for all land transportation modes across the territory of Mebidangro is also expected to increase policy coherency and multi-modal integration and efficiency.</li> <li>• Increase the capacity in efficiency of administrations, capable decision-making, and better understanding in the economic mobility domain.</li> <li>• Government to control over levels of service of minibus (routes &amp; vehicles) with clear management and fairness of operations according to public standards.</li> <li>• Provide the ability to rejuvenate and manage better and more sustainably the assets.</li> <li>• Ease the integration with other modes and provide transport service to vulnerable groups.</li> <li>• Provide adapted services to the users easily and increase the attractiveness of minibus and in consequence its ridership.</li> <li>• Increase the capacity in efficiency of administrations, capable decision-making, and better understanding in the economic mobility domain.</li> <li>• Establish capable authorities (all stakeholders and governments) to implement the SUMP by improving the efficiency in administrations skills, good decision making.</li> <li>• Implementing performance-based contracts for operations and maintenance will grant higher value for money for the government.</li> <li>• Lowered expenses, higher satisfaction and attractiveness of PT for users.</li> <li>• Indirectly increasing the ridership.</li> <li>• Good financial risk management.</li> <li>• Financial capacity.</li> <li>• Fiscal capacity levels.</li> <li>• Sustainability and emission decrement</li> <li>• Reduction of number of vehicles</li> <li>• Travel time cut-off.</li> </ul>
Environment	DISHUB of North Sumatera and Central Government	45.000	<ul style="list-style-type: none"> <li>• Increase of public transport share and reduce private vehicle shares.</li> <li>• Air pollution, GHG emission and noise pollution reduction.</li> <li>• Improvement of energy efficiency for overall mobility.</li> <li>• Reduced OPEX for operators and cost savings on the long term.</li> <li>• Increased attractiveness of road-based public transportation and resulting increased ridership</li> <li>• Increased capacity to measure air quality data and build air quality model.</li> <li>• Implement data driven decisions on pollution reduction.</li> <li>• Raise the public awareness in supporting the environmental improvement by modal shifting to the public transport in order to reduce the mobility which brings the GHG emissions and air pollutions in Mebidangro area.</li> </ul>

Actions are grouped into integrated packages, or “blocks” which correspond to the themes within the previous scenarios. These blocks cover the six main facets of mobility: Urban Planning & NMT, Road Network & Private Vehicles, Public Transport, Digitalization, Governance and Environment. All the actions are specific to the context of Mebidangro.

## ■ Urban Planning & NMT

### ■ Rationale and goals

The goal of this package is to tackle the mobility issues of Mebidangro at one of their root cause: the need for motorized transport. It is proposed to approach this mobility issue by enabling active mobility (or non-motorized transport) and improving land management to reduce reliance on vehicles and creating new revenues channels for mobility.

### ■ Challenges addressed in Mebidangro

It is observed that most of public spaces are dedicated to the circulation of motorized vehicles, land use grows organically in a disorganized manner, and authorities lack funding capacity. Through urban planning and land management, the actions propose a first step towards addressing those issues:

#### ■ The list of actions

- ✓ Mixed-use zones
- ✓ Permanent & periodical closure of roads
- ✓ Comfortable and safe sidewalks
- ✓ Development of safe bicycle lanes
- ✓ Law to restrict urban sprawl
- ✓ TOD & LVC frameworks

#### ■ Feasibility and horizon

The actions of the urban planning & NMT block require limited costs and innovation. However, they require important coordination between entities: BAPPEDA, DISHUB and PUPR at provincial and Mebidangro levels, and technical support from the central ministries on the regulatory works.

Medium-term feasibility is expected. The actions are in line with national and regional plans. However, the levers for application and enforcement of the regulatory actions must be activated and hence rely heavily on an improved governance.

Each action is described in more details in terms of timeline, geographical scope and responsibilities in the action sheets in appendix.

## ■ Road Network & Private Vehicles

### ■ Rationale and goals

The integrated package of actions to address the road network and private vehicles usage in Mebidangro aims at homogenising roads quality across territory, calm traffic and reduce congestion sources by proving multimodal facilities.

### ■ Challenges addressed in Mebidangro

The stakes of this packages are important. Road safety, congestion, pollution from mobility and accessibility to mobility stem from the road network usage. Hence and to answer the needs of the communities, it is proposed to increase the accessibility to mobility with standardized information and quality of roads; increase safety with dedicated traffic calming measures and centralize parking in multimodal facilities.

#### ■ The list of actions

- ✓ Enhance road link Medan – Berastagi
- ✓ Medan circular roads
- ✓ Quality road network across Mebidangro
- ✓ Standardized road signage
- ✓ Traffic calming measures at blackspots
- ✓ Limit freight vehicles operating hours
- ✓ Dedicated Park and Ride at transit hubs
- ✓ Key multimodal hubs

#### ■ Feasibility and horizon

The construction and improvement of roads and hubs require particular attention regarding their feasibility. The adequate organizational and funding schemes must be agreed between authorities given that this infrastructure relies on different administrations in Mebidangro – hence emphasizing on the importance and the necessity for an integrated land transport authority. The tangible measures shall be expected on a medium to long-term with the right efforts.

Furthermore, standardization and traffic calming measures shall be implemented on the short-term to answer the urgency for readability and increased road safety.

Each action is described in more details in terms of timeline, geographical scope and responsibilities in the action sheets.

## ■ Public Transport

### ■ Rationale and goals

The public transport actions drive towards an increase use of collective vehicles by inhabitants of Mebidangro – indicated by the public transport modal share. This increase is possible through structuring backbone transit lines while improving existing transport assets proper to the area, and in parallel proposing innovative and alternative public modes to all communities.

### ■ Challenges addressed in Mebidangro

Using the public space realm for collective mobility, road-based public transit is proposed to be increased with committed projects of BRT and additional lines to form a wider network on the long term. Similarly, urban rail lines shall be implement to provide rapid and safe transit to the commuting population. Since half of Mebidangro trips are related to work and education, school buses are also proposed at peak hours to serve dense communities and avoid bottlenecks around schools. These structuring measures are accompanied by the improvement of rich current assets which cover most of the area (minibuses and rail), as well as awareness raising on the benefits of collective mobility.

### ■ The list of actions

- ✓ BRT wider network
- ✓ School bus lines
- ✓ Minibus routes optimization and rejuvenation
- ✓ Urban rail wider network
- ✓ Increase rail service levels
- ✓ Implement waterbus lines
- ✓ Public transport campaigns

### ■ Feasibility and horizon

The BRT line 1 is a committed project under development by the reginal authorities, central government and international partners. Its success is crucial in the feasibility of following lines. Furthermore, plural governance measures are necessary for their implementation. Hence it is expected to have BRT and rail networks in the long-term.

More localized actions, such as the implementation of waterbuses, school buses, rejuvenation of minibuses and increase of the rail services shall be undertaken rapidly. By starting with their detailed planning and design in order to have improved public transportation with current assets in the medium-term.

Mass transit in-depth look is proposed in the related paragraph of this section. Each action of the block is described in more details in terms of timeline, geographical scope and responsibilities in the action sheets in appendix.

## ■ Digitalization

### ■ Rationale and goals

The ations related to digitalization enable North Sumatra and Mebidangro to leverage on growing technology uses and actors to provide better collective mobility experience. They cover individual and collective mobility, to respectively optimize and increase them.

### ■ Challenges addressed in Mebidangro

The first action allows a better monitoring and traffic management of road circulations in line with Medan City initiatives on the organizer side. In line with the goal to implement modern transportation in Mebidangro, MaaS (Mobility as a Service) is proposed to be fostered by the authorities to provide an alternative to conventional individual mobility while providing access to mobility to vulnerable groups.

Fare intermodality and passenger information systems are supporting measures to current and future public transit facilities and services that will contribute to increase the intermodal integration and readability of services, two painpoints diagnosed in Mebidangro. They in turn are expected to increase the attractiveness and hence usage of public transportation.

### ■ The list of actions

- ✓ Traffic monitoring system
- ✓ Mobility as a Service
- ✓ Fare intermodality
- ✓ Passenger information

### ■ Feasibility and horizon

Planning and design works for the digitalization measure are important as they require integration between different systems and mobilization of different governmental institutions. However, their implementation does not present major challenges. Their operations can be expected in medium-term.

Each action is described in more details in terms of timeline, geographical scope and responsibilities in the action sheets.

## ■ Environment

### ■ Rationale and goals

At the core of the principles for a sustainable and harmonious mobility, the environmental considerations of mobility are addressed by this package of actions. The goal is to put in place regulatory tools to improve environmental management and reduce the emissions of GHG and air pollutants generated by mobility activities.

### ■ Challenges addressed in Mebidangro

With an important vehicle fleet in Mebidangro (forecasted to increase more), the reduction of cars and motorcycles on the roads will not be immediate nor directly observed after the improvement of public transit. Hence, measures must be taken on the short-term to limit the usage of private vehicles and raise awareness on these issues.

It is proposed to do that by first discouraging the use of motorized vehicles through incentives to reduce fuel consumption in the urban area (increased on-street parking fares, etc.) and implementing a taxation system on roads usage (road pricing). These must be accompanied by the shift towards cleaner energies for all vehicles, either private or public, and road or rail-based. To better monitor the air quality and raise awareness on environmental issues, it is proposed to install air quality stations (which are currently insufficient) and conduct community engagement.

### ■ The list of actions

- ✓ Incentives to reduce fuel consumption
- ✓ Tax on motorized vehicles using urban roads
- ✓ Cleaner energies for all road vehicles
- ✓ Renewable energy for rail
- ✓ Air quality stations
- ✓ Environmental issues campaigns

### ■ Feasibility and horizon

Environmental management actions present important social risks. Mebidangro inhabitants being fragile to variations in the mobility expenses, the incentives to reduce fuel consumption and road pricing shall be accompanied by mode choice alternatives such as improved public transport. The feasibility of those policies rely on the context in which they are introduced. Hence, with the legal work necessary, they are expected to be applicable in the medium-term.

The energy shift from conventional to cleaner engines (fuel-efficient, electric) is more straightforward for rail and road PT. The feasibility of those actions will be greatly improved after the governance measures are undertaken (reform of the two organizational schemes). However, their funding highly depends on it, given the expected private investments due to the lack of governmental funding capacity on these subjects. A medium to long-term horizon is thus expected.

## ■ Governance

### ■ Rationale and goals

Governance actions aim at improving the enabling environment for mobility projects development through regulatory and policy reforms, and creation of new funding channels.

### ■ Challenges addressed in Mebidangro

With inter-governmental coordination lacking, reduced funding capacity and important complexity in project instruction, Mebidangro authorities inherit of challenges observed across Indonesia. To tackle those, it is proposed, to answer central government requirements, to implement a metropolitan transit authority in charge of mobility across the territory of Mebidangro. Increased funding capacity shall be observed with new corporate taxation systems. Organizational reforms are proposed in the management and operations of the principal modes currently under operations: minibuses and rail, to respectively increase public stakes in them and introduce private actors for better services. These actions are accompanied by technical assistance, from international partners.

### ■ The list of actions

- ✓ Implement Metropolitan Transit Authority
- ✓ Corporate tax on mobility
- ✓ Separate train and track operators

- ✓ Reform minibus organization and system
- ✓ Technical assistance of capacity building
  - Feasibility and horizon

The governance block shall be the first one to be activated and focused on. It supports the feasibility of the other actions given the organizational streamlining and additional funding channels expected with the implementation of the Mebidangro transit authority, which is expected on the short term. Its necessity is aligned with national and provincial priorities, as well as base regulations already in place.

The rest of the actions shall also be undertaken in the short-term given their importance for the feasibility of the other measures of the Action Plan. Organizational reforms and introduction of new tax will improve the enabling environment. Technical assistance of capacity building towards the authorities will also secure the implementability of the Action Plan. Each action is described in more details in terms of timeline, geographical scope and responsibilities in the action sheets.

## IV.1.2. Focus on Mass Transit

Mass transit lines are a central mobility improvement measure that addresses the needs for a public transit backbone of the inhabitants and public transport users of Mebidangro. By carrying efficiently important volumes of passengers on short to medium distances (0-25 kilometers), it provides the territory with additional public transportation systems around which informal transit and non-motorized transport can be developed and integrated with. In fact, mass transit stations do not only provide alternative modes for safe and sustainable transport, but act also as a trigger for the improvement of public space.

As such, the role of mass transit is key in the development of sustainable urban mobility and this paragraph is dedicated to their planning as part of the Action Plan.

### ■ Method adopted for the mass transit definition

The mass transit lines stem from the Origin-Destination and urban assessment of Mebidangro. Corridors are defined upon the analysis of commuting volumes in the pre-pandemic period (computing of the pre-COVID19 situation from the in-COVID19 mobility data collected). The corridors are assigned, service levels defined depending on the needs (demand forecast), possible operational speeds and insertion (urban constraints). The different levels of services hint at the technologies adapted to the mobility demand in the corridors, and are defined as such:

- ✓ Level 1: a medium level of demand (3,000 to 6,000 pphpd) is present on the corridor which does not allow for heavy infrastructure (curves, right-of-way...). It is adapted for example for BRT, trolleybus, automated shuttles or people movers, aeromoval, cable-pulled modes.
- ✓ Level 2: the travel demand of the corridor is medium to high (6,000 to 8,000 pphpd) and allows for more demanding modes to be implemented (curves, right-of-way). Modes such as BRT, tramway and light metro (LRT) can be adequate.
- ✓ Level 3: high demand (8,000 to 15,000 pphpd) corridors with important physical allowance, which enables important infrastructure and modes to be implemented, such as tramway and metro (LRT) to heavy metro (MRT).

To estimate the potential demand of mass transit, a 4-step transport model was used. Several parameters (vehicle kilometers travelled, vehicle hours, modal share for main modes and number of trips for each mode) are evaluated to help the decision-making for the selection of scenarios of mobility growth and related measures..

This transport model is essential to identify the most impactful mass transit lines and to prioritize the operational sequence of mass transit lines.

### ■ Proposed mass transit lines and prioritization

All proposed modes in the public transport corridors shall be challenged for confirmation upon further studies. The modes are identified based on the service levels and the urban constraints observed in Mebidangro. Hence, all mass transit proposed are adapted to the local conditions. Stations and depots locations are identified thanks to urban conditions, line alignment and typical interstation distances for a given mode. The analysis results in 10 lines of mass transit totaling 152 km.

The different mass transit lines identified constitute a network – a vision for the future landscape of urban transport for Mebidangro. However, it is unrealistic to expect the lines to be ran simultaneously in the short-term. The limited financial, organizational and technical resources of the Mebidangro authorities do not allow for the direct implementation of the 152 km of PT infrastructure. Hence, it is proposed to prioritize lines by their expected operability, social impacts and costs. Consideration is also given to the distribution of costs and coherence of the implementation schedule.



Figure 84. Priority lines and packages for mass transit lines

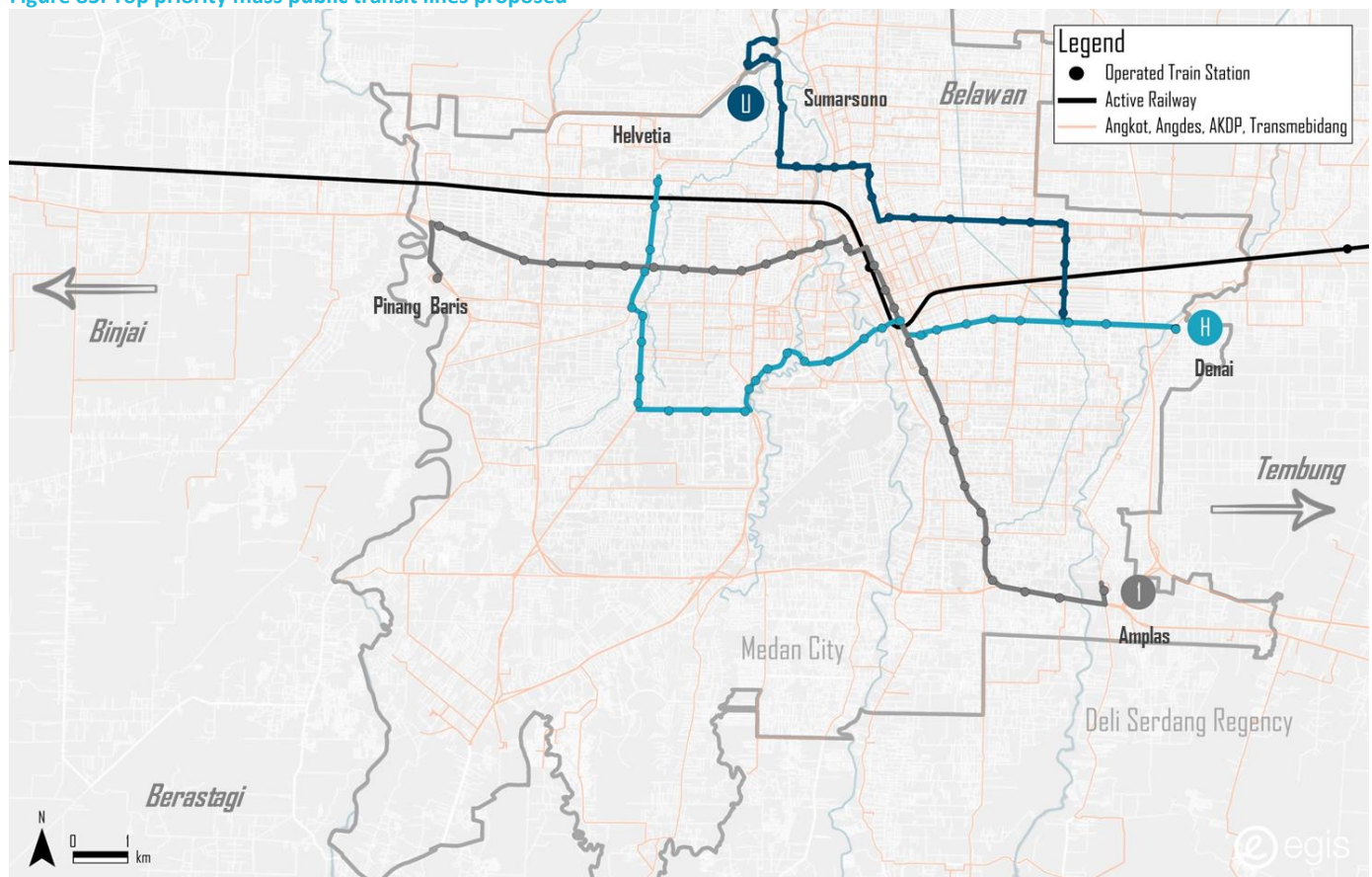
Mass transit corridor	Route	Level of service	Length (km)	Example of mode	Daily boardings (pax/day)	OPEX (IDR billion/year)	CAPEX (IDR trillion)	Priority
BRT Line 1	Pinang Baris - Amplas	-	18	BRT	210 000			
Corridor H	Helvetia - Denai	Level 1	15,4	BRT	202 000	214,4	1,7	82%
Corridor U	Sumarsono - Denai	Level 2	13,8	TRAMWAY	187 000	146,2	3,7	78%
Corridor B	Simalingkar - Jl. T. Amir Hamzah	Level 3	15,5	LRT	260 000	181,1	10,9	74%
Corridor G	Bunga Sakura - Jl. T. Amir Hamzah	Level 2	21,8	TRAMWAY	222 000	162,6	3,9	72%
Corridor T	Denai - Batang Kuis	Level 1	13,8	BRT	197 000	185,5	1,6	72%
Corridor N	Sunggal - Sumarsono	Level 1	22,3	BRT	324 000	320,7	2,3	68%
Corridor A1	Amplas - West Setiabudi	Level 3	9,29	LRT	255 000	134,6	6,5	63%
Corridor A2	West Setiabudi - Helvetia	Level 3	10,4	LRT	192 000	128,7	7,0	63%
Corridor J	Pinang Baris - Sumarsono	Level 2	15,4	TRAMWAY	128 000	115,8	2,7	59%
Corridor W	Simalingkar - Dr. Mansyur	Level 3	13,8	LRT	226 000	169,1	9,1	59%

#### ■ Top priority mass transit lines

The resulting prioritization proposes the corridors H and U to be planned and implemented first, as the ones to carry most passengers and having the most acceptable OPEX and CAPEX.

After the implementation of committed BRT Line 1, Lines H and U cover the dense districts of Tegal Sari Mandala, Denai, towards the Medan City center and Sidorame Barat, Perjuangan. These communal neighbourhoods, where motorcycles heavily represent the main mode currently in use, shall benefit from the priority lines.

Figure 85. Top priority mass public transit lines proposed



The lines are estimated to be ran in parallel of bus, minibus and conventional railways operations. They also assume inter-connections with those modes at identified overlapping stations.

It is primarily identified that Corridor H could be serviced by a BRT and corridor U by a tramway. However, these modes shall be later confirmed in further studies.

### ■ Secondary priority mass transit lines

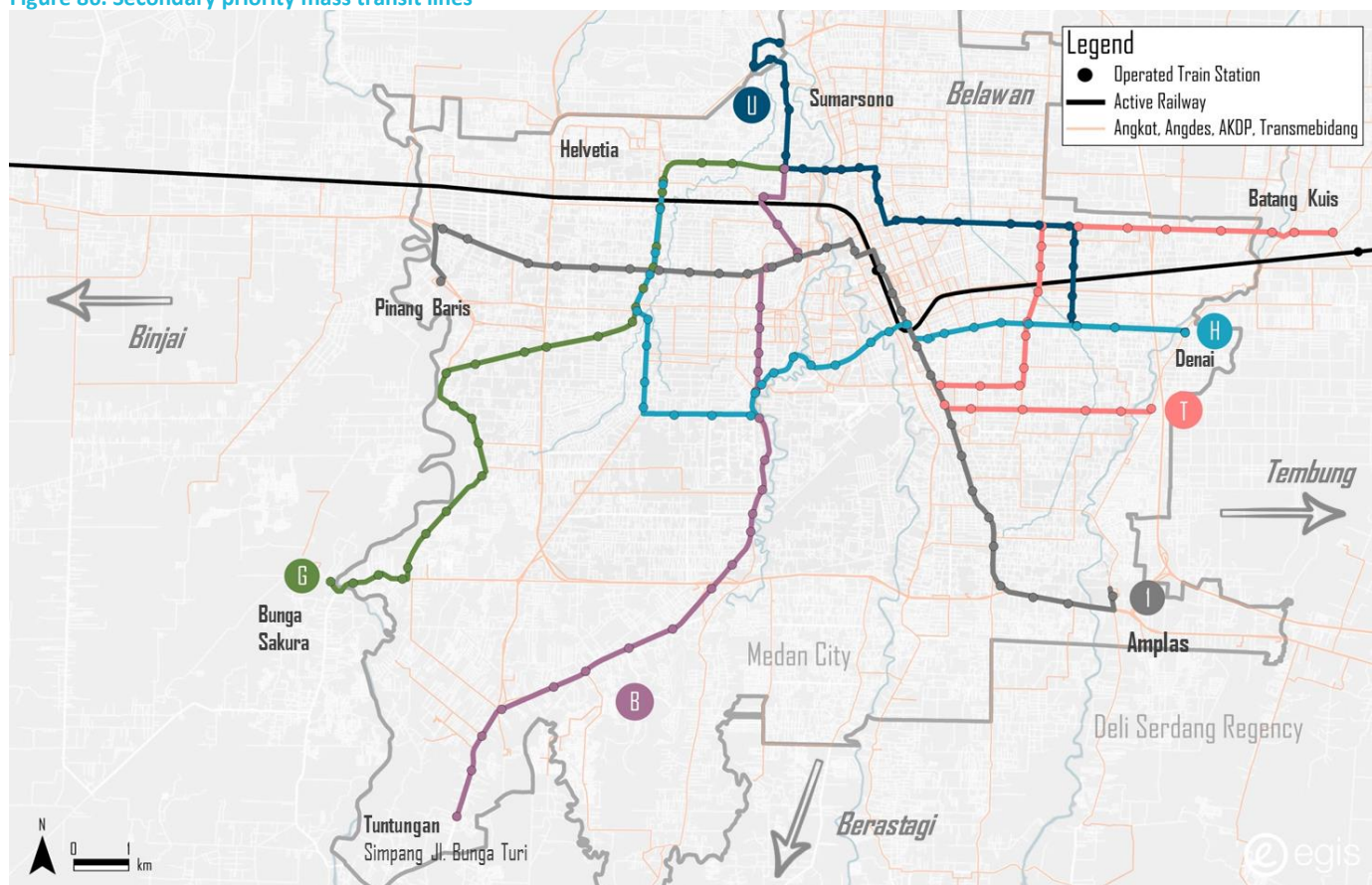
A second package is proposed on the long-term: it is made of corridors B, G and T. With important demand, these corridors come to complement the first implemented lines. Corridor T complements the top priority corridors H and U in the East of Medan City by covering the district of Sudirejo. It also extends the public transport network towards Batang Kuis, which is likely to receive the future national sports complex of North Sumatra.

Corridors G and B expand the reach of the network crossing the Medan core city center from Amir Hamzah towards the South and East (Tuntungan and Bunga Sakura). It can be noted that this follows the direction of organic growth of urban developments observed. Hence, potential extensions are taken into account.

The corridors B and G could be associated with tramway and/or LRT modes. Corridor T can be serviced by a BRT. These modes shall be confirmed in later studies.

At this stage of the network, after the second phase of mass transit lines implemented, location for potential hubs can be identified in the northern part of the city (Jl. Pertempuran, east of Helvetia district). This way the centrality of the existing railway stations is confirmed.

Figure 86. Secondary priority mass transit lines



Communal districts are covered with important lines and radial corridors extend towards the densely populated and lively southwestern parts of Medan City, following the urbanization trend observed in the past decades. These give way to a proposed wider network considered for the long term.

### ■ Last mass transit lines and for later consideration

The lines coming in lower priority are the N, A1+A2, J and W, which by their nature complete the network. Corridors S, C and D shall be considered at a later stage and can be further prioritized in the later updates of the SUMP. This third phase of the network development has several objectives:

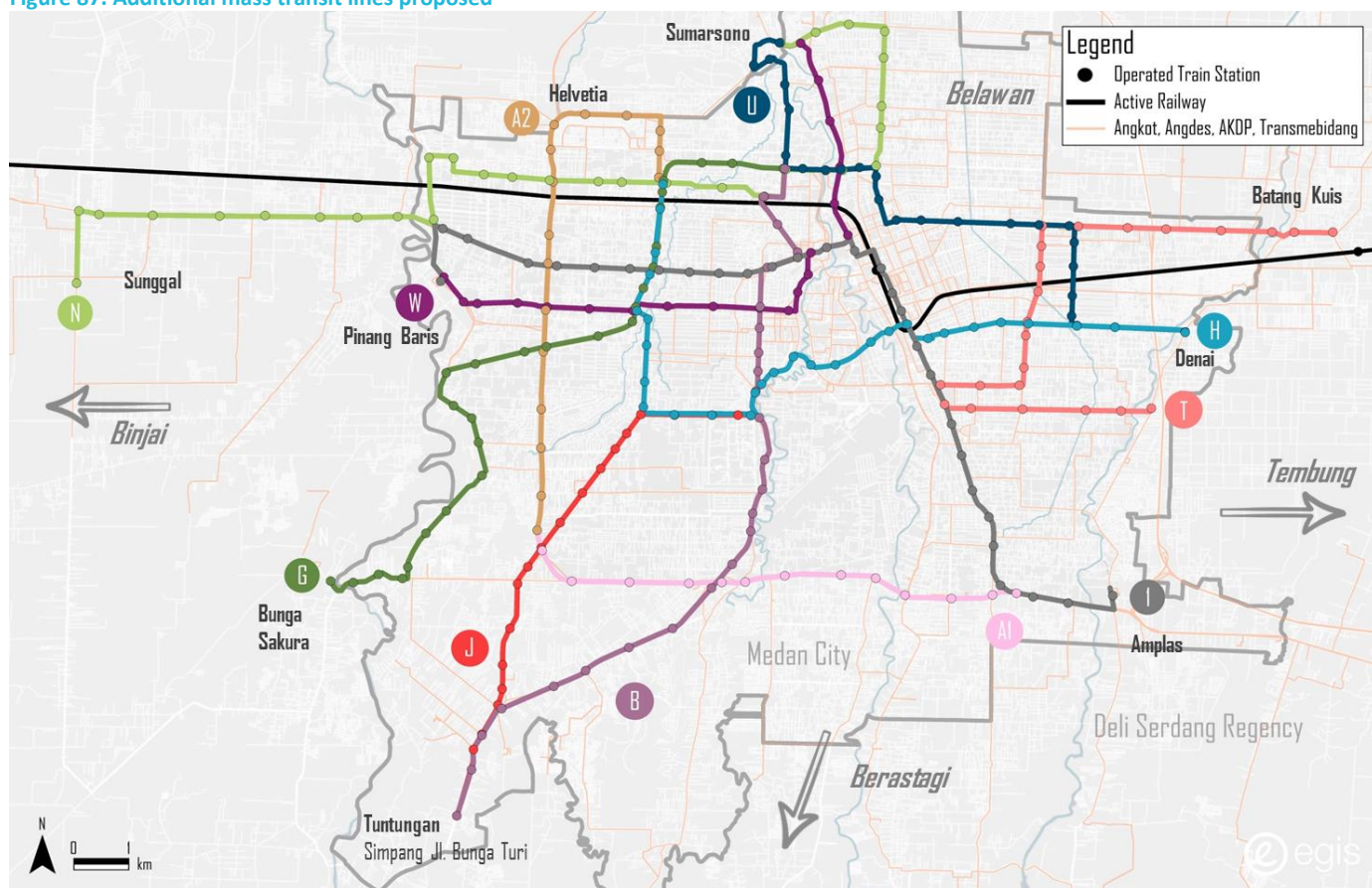
- ✓ Consolidate hypercenter heavy transit with Corridor W (suggested LRT), linking Pinang Baris with Sumarsono.
- ✓ Address Medan-Sunggal-Binjai demand with structuring Corridor N (suggested BRT), supporting line 1.
- ✓ Reinforce the offer along strategic axis Setiabudi-Tuntungan with Corridor J (suggested tramway).



- ✓ Loop network with Corridors A1+A2 (suggested LRT) along Ring Road, between Amplas and Helvetia.

This last phase is the most likely to evolve with SUMP updates given the long-term nature and assumption of previous phases implemented.

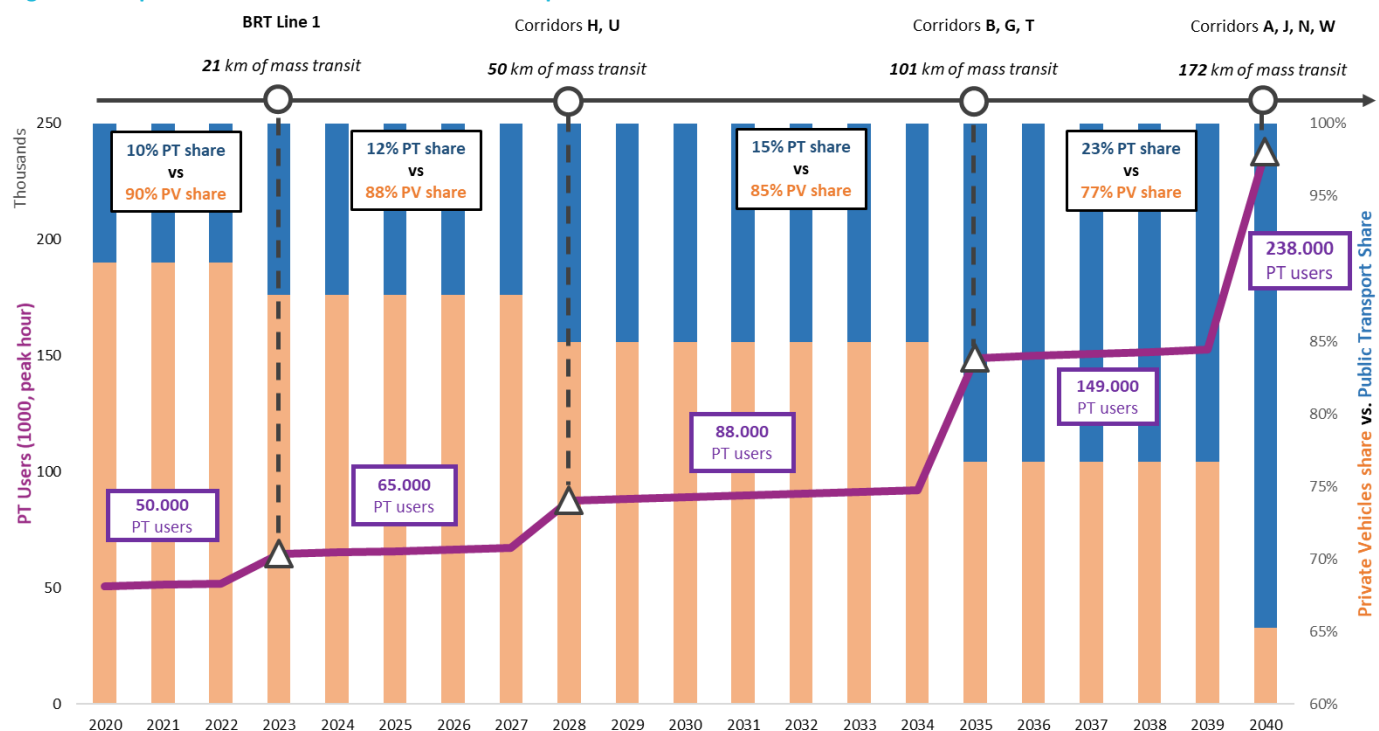
Figure 87. Additional mass transit lines proposed



### Mass transit expected impacts and the “network effect”

The mass transit network is a structural heavy action for Mebidangro. It aims at massively triggering a modal shift from private vehicles to public transportation, the first step for increasing collective mobility.

Figure 88. Impacts of the mass transit network development



Given these features and although the lines are adapted to the field conditions, their maximum positive effect is expected only when implemented altogether. The impacts of each isolated line is not optimal. Indeed, the analysis of effect on modal shift shows that the BRT line 1 and corridors H and U (committed and top priority) only trigger a 5% increase in modal share in 2028, from the 10% observed in 2021.

This modal share increases to 23% upon the second phase, and close to 35% with the global network. This shows that the impacts on modal share are limited for each isolated mass transit line, and that a “network effect” is expected. Upon its growth: ridership increases more rapidly with new lines as mass transit becomes more attractive and relevant.

Hence, strong efforts in the development of the first lines and following ones is required from the authorities to induce a true change of paradigm with mass transit. It is nonetheless confirmed to be the right direction, given the important drop in private vehicles modal share on the long-term horizon, upon implementation of the full network.

## IV.2. Cost estimates, Sustainable Funding and Financing

### IV.2.1. Cost Estimates of the Action Plan

The capital and operational expenditures of the Action Plan is assessed in this paragraph. The important working assumptions to note are:

- ✓ Costs are estimated for Medan area. The unit costs (materials, human resources, energy...) are evaluated at local values already proven on other exercises. Procurement likely to be done internationally (import) follows international values observed in the countries of origin. The costs are expressed in Indonesian Rupiahs in their 2021 values.
- ✓ Expenditures are only preliminary appraised. The appraisal is based from the definition of the actions, which are quantified wherever possible at the level of details allowed in the SUMP Mebidangro. Most estimates shall be refined upon further definition (during studies) and evolution of costs in future years. Wherever possible, the cost of instruction (public budget) is included. Typical time distribution of expenditure is used for multi-years projects.
- ✓ The cost appraisal is not conducted for all actions. Several actions are not quantifiable or do not present tangible components at this stage of the SUMP, either because of the global character of the study, or their dependency on other factors (e.g. future events, etc.)

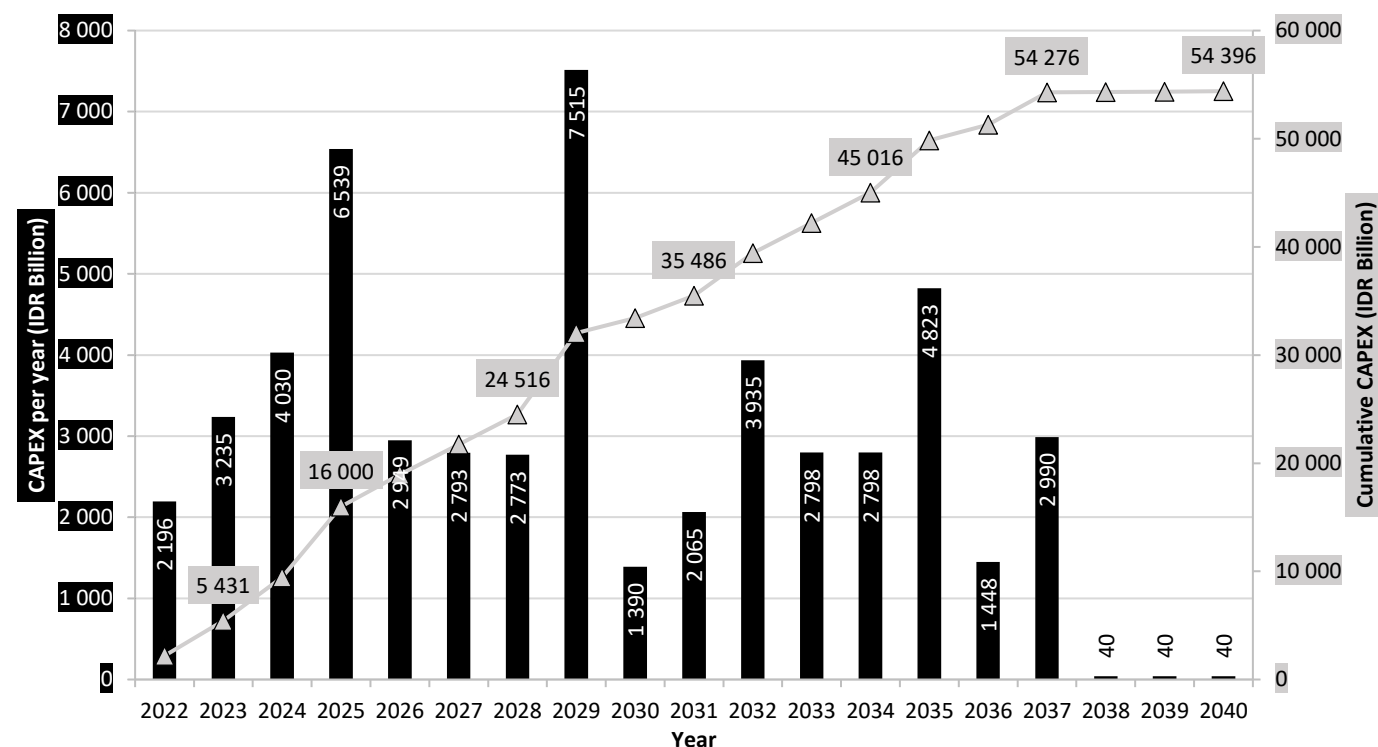
The action plan cost estimate provides an appreciation of the resources to be mobilized to observe a true impact on the mobility of the communities. It is used to preliminary assess a funding plan and explore financing channels. However, it is upstream and shall be refined per action upon development.

#### ■ Capital Expenditure

The CAPEX of the Action Plan comprises all tangible actions proposed, covering the cost of studies, design, project preparation and construction, up to commissioning. Intangible or regulatory actions, and organizational actions, are not included in this estimate.

The global CAPEX cumulative estimate for the action plan is IDR 54,4 trillion (USD ±3,8 billion) up to 2040. Per year, the investment costs vary between IDR 40 billion (USD ±2,8 million) per year up to IDR 7,5 trillion (USD ±522 million) per year. The average amount of yearly investment costs is IDR 2,8 trillion (USD ±194 million).

Figure 89. SUMP Action Plan Capital Expenditure Preliminary Appraisal



This important amount of investment is marked by years 2025, 2029 and 2035 where important projects are launched in parallel (see implementation schedule).

The most structuring actions are the mass transit projects, which account for close to 70% of the cumulative CAPEX. The year of the end of their studies and start/end of construction coincide with the important years of investment: 2025, 2029, 2032 and 2035. Hence, those years shall be adequately prepared for and anticipated by the authorities with project and funding preparation.

Years with low investment amounts do not indicate a lowered activity. 2028, 2030 and 2036 are years with important construction works. Furthermore, 2038-2040 are the last years of the current plan, which is the first edition of the SUMP Mebidangro. In later updates, the horizon years shall be extended and the 2038-2040 years may be associated with more important investments of reidentified actions.

It is not possible to compare these expenditures against the current level of spending on mobility because of the lack of details in the current public budget disbursement tracking systems and publications. However, the current expenses in mobility are rather low and limited to road maintenance and management, road-based public transport terminals management and buses management.

The CAPEX appraisal is the object of the preliminary funding plan. However, its coverage by the authorities of Mebidangro highly depends on the constitution of a transport authority that will allow pooling funds more efficiently, as well as on the supporting governance measures (TOD frameworks, new taxes...) which will enhance the funding capacity of the Mebidangro authorities, and bankability of projects.

All CAPEX and necessary information per action are indicated in the Action Sheets in appendix.

### ■ Operational Expenditure

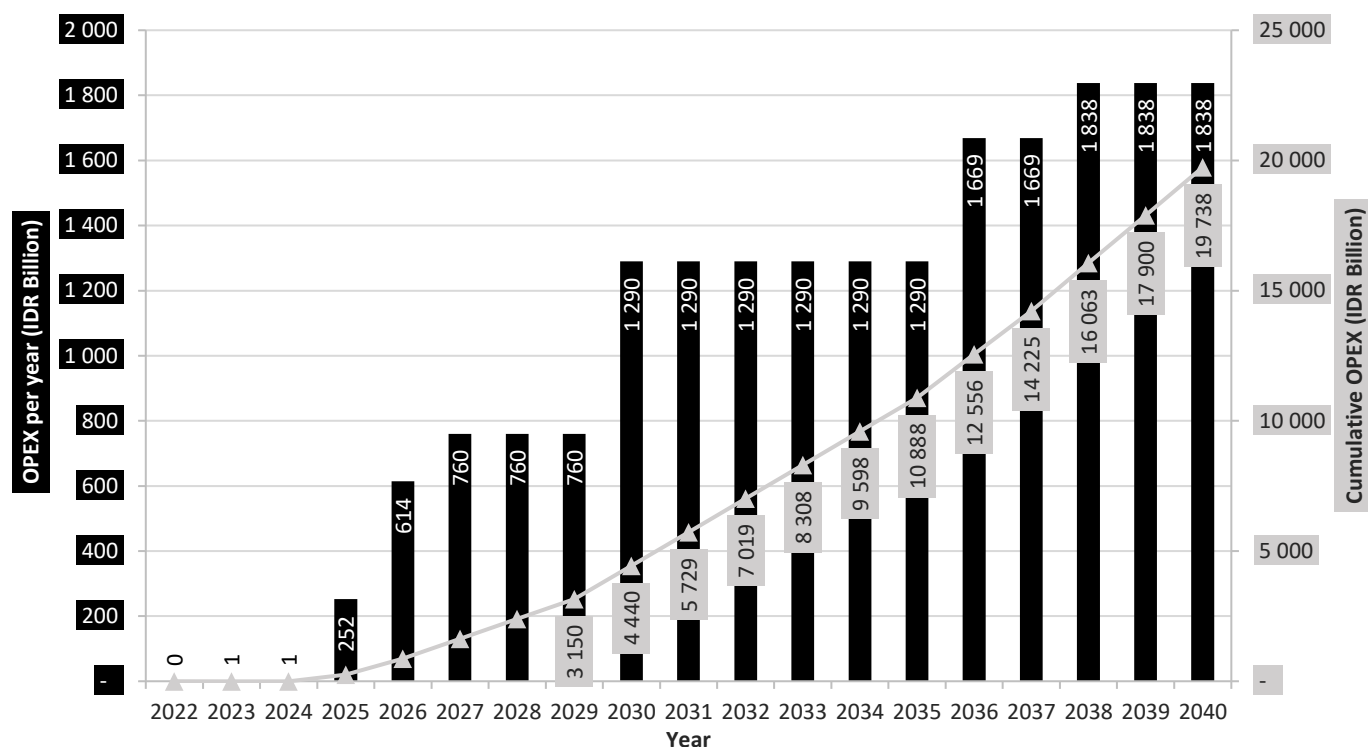
The OPEX are assessed for all quantifiable and operating actions. These include public transport and digital systems, and excludes governance measures that have to be defined in more details through further studies.

Although the amounts of OPEX are obviously lower than those of CAPEX for mobility projects, they often become problematic due to the low financing capacities of regional authorities and low financing support from the central government (cf. Palembang LRT case).

Here, the OPEX accounts for a cumulative IDR 20 trillion (USD ±1,4 billion) up to 2040, for an average annual value of IDR 1 trillion (USD ±69 million) per year. It starts at its lowest value of IDR 252 billion (USD ±17 million) in 2025 for the operations of the first actions and ends at the highest value of IDR 1,9 trillion (USD ±132 million) in 2040.



Figure 90. SUMP Action Plan Operational Expenditure Preliminary Appraisal



The operations of mass transit lines constitute more than half of the maximum OPEX of 2040, as they require important resources (human, energy). The actions requiring the least human intervention have the lower OPEX, such as bicycle lanes or sidewalks. However, it shall be noted that both these high and low OPEX actions are both necessary to the sustainable mobility planned for Mebidangro.

Each detailed cost-benefit analyses should be part of the further studies of important projects (pre-feasibility and feasibility studies, design) to observe the quantified benefits against these operational costs. Furthermore, just as for the CAPEX, the OPEX forecast shall be updated in the future SUMP editions to reflect the revised actions and implementation plans.

The OPEX of the action plan is also the object of the funding plan. It shall be covered as much as possible by projects revenues (to be estimated in further studies) and mobilize less public funds. In order to do that, the Action Plan recommends supporting measures such as the P&R, multimodal hubs, TOD framework and new mobility taxes, which shall contribute to the sustainable operations of PT in Mebidangro.

All OPEX and necessary information per action are indicated in the Action Sheets in appendix.

#### ■ Moving forward with the expenditures

The yearly distribution of the expenditure is interrelated with the implementation schedule presented in the related paragraph. The relative amounts are tentatively distributed homogeneously through the phasing of the actions.

The capital and operational expenditures are the object of the funding plan in the related paragraph. All analyses are at preliminary stage for appreciation of the efforts required to execute the Action Plan.

Since the mass transit actions are structural to the costing of the SUMP, a closer look is proposed in the following paragraph, to understand their phasing and costs in better depth.

## IV.2.2. Sustainable Funding and Financing

#### ■ Potential sources of funding and financing

Significant funds are needed to not only for the smooth operation of public transportation, but also to attract people to switch from private vehicles. This is even more critical considering the size of CAPEX and OPEX required for SUMP implementation, which accumulates to IDR 54,4 trillion and IDR 1,8 trillion from 2022 to 2040.

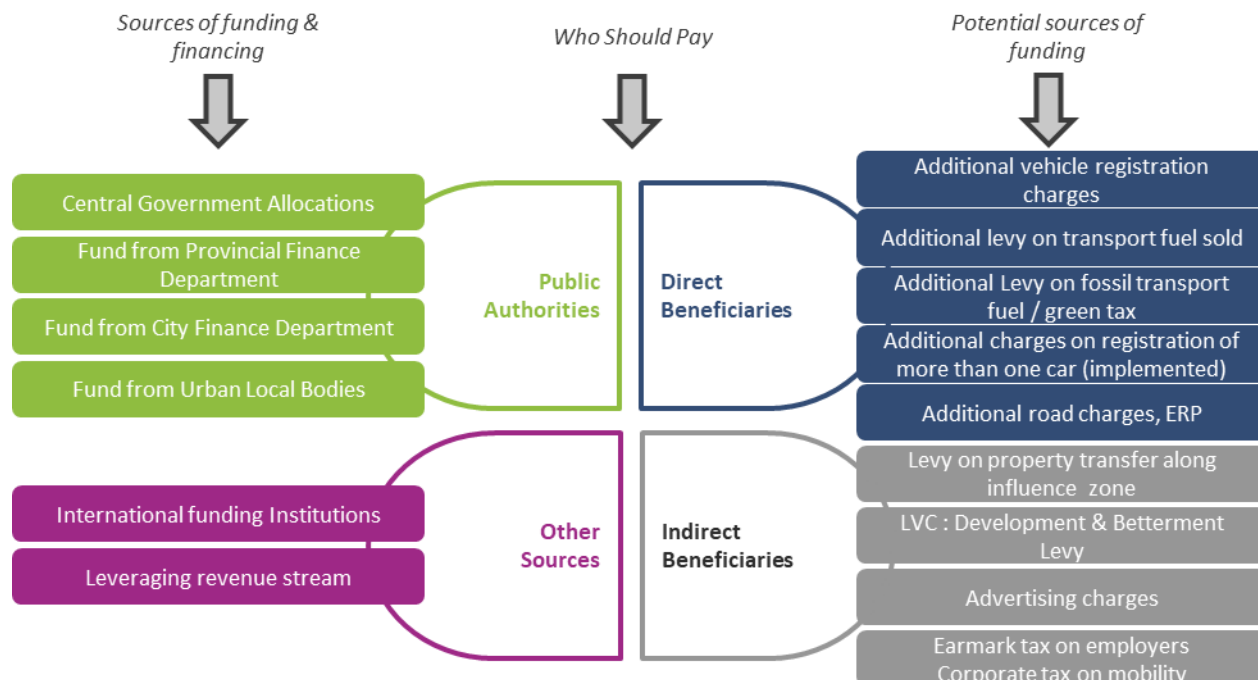
It is therefore critical that the transport authority has its own funding. A stable flow of funds allows consistent planning and efficient implementation of urban transportation systems. However, such funding (i.e., from taxes) should not be channeled through the general government budget.

It is normal that government agencies see the public budget as a common resource that is fungible and could easily be reallocated for other sectors. Therefore, the dedicated fund is critical to ensure sustainable and stable funding.

The proposed transportation funds do not only come from the regional budget (APBD), but from several other sources identified as follows:

- ✓ The Regional and Central Government
- ✓ Direct beneficiaries, in this case the general public, especially road users
- ✓ Indirect beneficiaries, in this case are the owners of infrastructure or property and corporations
- ✓ Other sources of funds, grants or loans, both from local and international sources

**Figure 91. Potential sources of funding and financing**



Measure 23 of the SUMP Action Plan, which consists of urban rapid rail lines, requires by far the largest CAPEX and OPEX compared to other measures. Altogether, they need:

- ✓ CAPEX of IDR 43,8 trillion for 2022-2040 (equivalent to 80% of the total CAPEX).
- ✓ OPEX of IDR 8,4 trillion for 2022-2040 (equivalent to 42% of the total OPEX).

These are much higher than the special allocation fund (DAK) transferred from the central government to the North Sumatra provincial government for transport-related purposes (which averaged at IDR 52 billion per year, 2015-2019), as stated in section 1.7. Therefore, the gap needs to be covered through other sources of funding and financing.

The maximum loan amount that regional and provincial governments can take should follow the general acceptance rate of 75% of the total government revenue. This translates to an amount of IDR 14,37 trillion (IDR 9.8 trillion for North Sumatra province, IDR 4,57 trillion for Medan city) in 2019. The remaining amount should be covered by the central government, as the project is a national priority as stated in the 2020-2024 National Medium-term Development Plan (RPJMN).

The gap in CAPEX and OPEX could be filled by financing sources such as multilateral development banks, official development assistance, export credit agencies, domestic development financial institutions, international banks, local banks, and specific vendors. The mechanisms may include loans, grants, guarantees, credit enhancements, technical assistance, leases, etc. Public-private partnerships and the issuance of municipal bonds could also be explored.

Aside from generating more financing, more funding should be sought from increasing government revenue (i.e., petroleum tax, vehicle tax, central government transfers, public service obligations), user revenue (fares, tariffs), commercial revenue, Land Value Capture, climate funds, etc. Targeted, area-based taxation could also be explored such as higher tax rates for businesses and property owners within a certain vicinity of transit stops.

#### ■ BAPPENAS requirements for central funding aid

In order to benefit from government funding support, BAPPENAS currently elaborates a program to regulate funding to regions, with a number of criteria. The main requirements are the availability of an integrated urban mobility plan and the existence of urban transportation authority institution that goes beyond administrative boundaries. Furthermore, the Direction closing the RPJMN recommend the strengthening of ties between cities/regencies and provincial governments in order to develop the metropolitan areas (page 14, section 6 of appendix IV.).

The SUMP preparation paved the way to complete two requirements: the production of the SUMP Mebidangro document and strengthening the collaboration of all entities of the metropolitan area in the planning process. During the closing of the SUMP preparation, the province of SUMUT has launched discussions to initiate the formation of the transport authority at metropolitan level.

Given the possible involvement of foreign assistance only through the central government of Indonesia, the importance of these requirements is exacerbated for foreign aid to get involved.

### ■ Foreign aid

The last point is all the more important where foreign bodies can assist through funding and provision of equipment manufactured that Indonesia may not master for the moment. The best example is the sustainable and performant metro line MRT Jakarta Phase 1 which saw the light under Japanese funding through JBIC and JICA.

Out of the standard sources of fund: Public Debt, Private Debt, Foreign Debt, Equity – Public, Equity – Private and VGF (Viability Gap Fund), it thus can be seen that the previous BAPPENAS requirement acts on 3 to 4 of them. In the event of the mobilization of foreign funds, the following multilaterals shall be considered as active in Indonesia and with a track record:

- ✓ AFD: Agence Française de Développement with strong activities in south-East Asia and Indonesia.
- ✓ EIIB: European Infrastructure Investment Bank
- ✓ KfW: German Bank for Development (*Kreditanstalt für Wiederaufbau*)
- ✓ ADB: Asian Development Bank
- ✓ JICA: Japanese International Cooperation Agency
- ✓ WB: World Bank.

So far, the BRT Mebidang Line 1 project is the object of the co-investment between AFD and WB, in partnership with central government GOI and provincial government SU.

### ■ Operational considerations

An important part of the SUMP institutional readiness is also with the operations of the mass transit projects. As of today and in this early stage, it is proposed to identify the related ministry and possible operator contracting scheme for each line identified. It shall be noted that these early identification do not constitute legal grounds but shall be reviewed and deepened during project definition, as the mode selected are still examples and not firm recommendations.

Figure 92. Operators arrangements for mass transit lines

Mass transit corridor	Example of mode pre-identified	OPEX (IDR billion per year)	Related ministry	Operator scheme	Mebidangro coverage
BRT Line 1	BRT	N/A	MOT (DGLT)	BUMD through Satker	Mebidang
Corridor H	BRT	214,4	MOT (DGLT)	Should prefer PPP (DBOFT)	Medan
Corridor U	TRAMWAY	146,2	MOT (DGR)	Should prefer PPP (DBOFT) - See revenues	Medan
Corridor B	LRT	181,1	MOT (DGR)	Public company through PSO Can consider PPP – see revenues	Medan
Corridor G	TRAMWAY	162,6	MOT (DGR)	Should prefer PPP (DBOFT)	Medan – Deli Serdang
Corridor T	BRT	185,5	MOT (DGLT)	Should prefer PPP (DBOFT)	Medan – Deli Serdang
Corridor N	BRT	320,7	MOT (DGLT)	Should prefer PPP (DBOFT)	Medan – Deli Serdang
Corridor A1	LRT	134,6	MOT (DGR)	Public company through PSO	Medan
Corridor A2	LRT	128,7	MOT (DGR)	Public company through PSO	Medan
Corridor J	TRAMWAY	115,8	MOT (DGR)	Should prefer PPP (DBOFT)	Medan
Corridor W	LRT	169,1	MOT (DGR)	Public company through PSO	Medan

All projects shall benefit from performance-based contracts to optimize the value for money obtained by the Mebidangro authorities from the operations services. These contracts shall be tendered publicly and internationally, regardless of the coverage of the projects (city or province). These contracts can be apparented as PPPs, but however necessitate a clear up-front definition from the construction phase. This is allowed by the growing readiness from central agencies to launch such arrangements, guarantee funding and procure so. The first performance-based contract for public transport in Indonesia is starting soon on the Makassar-Pare Pare line and important first steps will be experienced. All operations of the SUMP shall be under the Metropolitan Transport Authority of Mebidangro.

### ■ Preliminary estimate of farebox revenues

The potential revenues from service operation and the balance between OPEX and revenue were estimated to verify how the fare and the trip patterns would allow to cover the OPEX and make the proposed heavy transit system sustainable, or identify

if deficits are to be expected. This also allows to identify if revenues could be used to finance the operation of other conventional modes, that are not calculated here.

This analysis is a preliminary calculation that needs to be deepened along with further studies on the traffic, modes and technologies for the proposed mass transit corridors. Changes in the corridor alignment and evolutions in the expected ridership will have an impact in the potential revenue of each line.

The main assumptions used in the calculations are the following:

- ✓ Calculations are for 2040, when the network operating;
- ✓ The mass transit lines characteristics, the daily boarding and OPEX are summarized before.
- ✓ The considered traffic is expressed in the number of entire trips per day, including the different transfers between mass transit lines, and per direction;

Figure 93. Number of transfer between mass transit lines (2040)

Line	Direction	PT users	Number of transfers				Consolidated ridership (pax)
			0	1	2	> 2	
BRT-H	Direction 1	161 730	84 562	65 664	10 400	1 105	121 136
	Direction 2	161 721	89 674	66 096	5 406	545	124 661
TRAM-U	Direction 1	137 888	74 639	55 505	7 401	343	104 944
	Direction 2	170 026	112 956	47 837	8 272	960	139 873
LRT-B	Direction 1	216 065	93 370	97 401	20 373	4 921	150 092
	Direction 2	153 608	64 332	72 663	16 026	586	106 153
TRAM-G	Direction 1	137 936	64 386	57 818	14 608	1 125	98 445
	Direction 2	127 056	53 249	56 646	15 609	1 553	87 163
BRT-T	Direction 1	126 840	62 613	48 311	14 112	1 804	91 923
	Direction 2	128 427	69 163	43 326	15 471	467	96 100
BRT-N	Direction 1	142 387	80 087	49 702	10 100	2 497	108 929
	Direction 2	181 265	96 801	71 743	11 695	1 027	136 827
LRT-A1	Direction 1	148 497	76 762	55 130	15 378	1 227	109 760
	Direction 2	107 006	51 632	42 129	11 315	1 930	76 951
LRT-A2	Direction 1	97 872	32 175	44 203	21 009	485	61 401
	Direction 2	94 012	38 227	43 392	10 187	2 206	63 870
TRAM-J	Direction 1	51 229	20 814	21 411	7 675	1 328	34 410
	Direction 2	76 822	33 577	27 092	15 370	782	52 442
LRT-W	Direction 1	123 484	46 539	60 056	14 633	2 257	82 008
	Direction 2	102 677	40 493	49 213	12 155	815	69 355

- ✓ The BRT lines C, D and S are not taken into account as they are proposed, in the SUMP, to be considered after the 2040 horizon;
- ✓ The conversion of daily traffic, to annual boarding data is made using a multiplying factor of 220;
- ✓ Taking into account the current legislation, the trip patterns, the current public transportation market (minibuses) and the willingness to pay, a flat fare of IDR 5.000 IDR per trip was retained;
- ✓ Balance between OPEX and Revenue is the indicator that allows identify if a mass transit line is at balance or has a deficit.

If the ticket cost is kept (IDR 5000), the farebox revenues amount expected in 2040 allows to cover the operating costs of the mass transit lines and these lines would contribute to finance the operation of traditional modes and other mobility policies.

Figure 94. Annual farebox revenues.

	Line	Consolidated annual boardings (pax/year)	Annual farebox revenues (preliminary estimate, IDR trillion/year)	Operational Expenditure (IDR trillion/year)	Balance A (ticket @5.000, IDR trillion/year)	Balance B (ticket @4.000, IDR trillion/year)	Balance C (net balance, IDR trillion/year)
	BRT-H	54 075 356	270,4	214,4	56,0	1,9	11,2
	TRAM-U	53 859 757	269,3	146,2	123,1	69,3	78,5
	LRT-B	56 373 792	281,9	181,1	100,8	44,4	54,0
	TRAM-G	40 833 774	204,2	162,6	41,5	0,7	7,7
	BRT-T	41 365 127	206,8	185,5	21,3	-20,1	-13,0
	BRT-N	54 066 333	270,3	320,7	-50,4	-104,4	-95,2
	LRT-A1	41 076 381	205,4	134,6	70,8	29,7	36,8
	LRT-A2	27 559 670	137,8	128,7	9,1	-18,5	-13,8
	TRAM-J	19 107 513	95,5	115,8	-20,2	-39,3	-36,1
	LRT-W	33 300 063	166,5	169,1	-2,6	-35,9	-30,2
	<b>Total</b>	<b>421 617 766</b>	<b>2 108,1</b>	<b>1 758,7</b>	<b>349,4</b>	<b>-72,2</b>	<b>0,0</b>
<b>Ticket Fare (IDR/trip)</b>							
					5 000	4 000	4 171

A net balance on the network is obtained with a ticket fare at IDR 4.171/trip. However, the fare of 5.000 IDR/trip is estimated acceptable given the current market conditions and willingness to pay investigations.

The balances hereby obtained only take into account the farebox revenues. Other types of revenues could be considered such as the advertisement revenues, land value capture revenues (regulatory framework needed, object of the action plan), partnership revenues and commercial estate revenues. At the moment, it is estimated too early to estimate those, and the farebox revenues only are considered to have an appreciation of the viability of the lines.

Last but not least, the simulation ran considers a full network operating to obtain a relevant comparison between the lines.

Worth noting that Tram-U and LRT-B lines financial balance could push these lines to be privately financed.



## IV.3. Implementation Modalities: Planning and Organization

This section offers an outlook on operational modalities of the Action Plan, with its proposed schedule, funding plan, capacity development strategy and institutional considerations.

### IV.3.1. Schedule of Implementation and Updates

#### IV.3.1.a. Implementation Schedule

The structuring elements of the SUMP schedule are the infrastructure projects (such as mass transit lines) and the reinforcement of the enabling environment.

The high-level schedule aims at giving an appreciation of the time and chainage needed for packages of measures. The SUMP of 2022 is a set of proposals for mobility development, which addresses the observed issues. In future years, with the introduction of new habits, technologies, regulations, the mobility context is likely to change, and therefore the SUMP must be updated. It is anticipated that the first edition shall be updated in 2024 or 2025.

Actualizing the schedule will depend on the observatory. This tool can be used for progress reviews on the development of measures. The implementation of measures depend also on the improvement of the regulatory and financial frameworks.

It is expected to have at least two additional mass transit lines, on top of BRT line 1, in the mid-term in 2028. Actions demanding only low resources can be implemented as soon as possible. Integration between modes and different administration is only realistically feasible in the medium-term, for adequate planning and the constitution of the transport authority. Existing assets can be improved as early as 2022.

The timelines are indicative and represent minimum periods. They show important time is needed to implement large infrastructure projects, and that definition and preparatory works must be started early.

Figure 95. High-level SUMP implementation schedule

Blocks	Actions	Name	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	Preparation and Implementation no longer than	Earliest delivery
Urban planning & non-motorized transport	01A	Car free zones (permanent closure)	D&P	D&P	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	24 mo.	2024
	01B	Car free zones (temporary/periodical closure)	D&P	D&P	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	24 mo.	2024
	02	Comfortable & safe sidewalks		I	D	DC	S	S	S	S	R	S	S	S	S	R	S	S	S	S	R	12 mo.	2030
	03	Mixed-use zones in secondary urban centers		D&P	D&P	D&P	D&P	D&P	D	S	S	S	S	S	S	S	S	S	S	S	S	60 mo.	2028
	04	Regulation to restrict urban sprawl	D&P	D&P	D&P	D&P	D&P	D&P	D	S	S	S	S	S	S	S	S	S	S	S	S	72 mo.	2028
	05	Framework for Transit Oriented Development	D&P	D&P	D&P	D	DC	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	36 mo.	2025
	06	Land Value Capture tax law	D&P	D&P	D&P	D&P	D&P	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	60 mo.	2027
	07	Safe NMT & bicycle lanes	D&P	I	D	S	S	S	S	R	S	S	S	S	R	S	S	S	S	R	S	24 mo.	2024
Road network & private vehicles	08	Circular roads		D&P	I	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	S	24 mo.	2025
	09	Enhance Medan-Berastagi road link		D&P	D&P	I	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	36 mo.	2026
	10	Standardized road signage		D&P	I	D	DC	S	S	S	S	S	S	S	S	S	S	R	S	S	S	24 mo.	2025
	11	Traffic calming measures		D&P	I	D	DC	S	S	S	S	S	S	S	S	S	S	R	S	S	S	24 mo.	2025
	12	Reinforce driving license process		D&P	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	12 mo.	2024
	13	One-way streets		D&P	D&P	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	24 mo.	2025
	14	Park & Ride at transit hubs		D&P	I	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	S	24 mo.	2025
	15	Key multimodal hubs		D&P	D&P	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	24 mo.	2025
	16	Traffic regulation enforcement and campaigns	D&P	D	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	12 mo.	2023
	17	Quality road network all across Mebidangro		D&P	I	D	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	24 mo.	2025
	18	Limit freight vehicles circulations	D&P	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	12 mo.	2023
Public Transport	19	BRT Line 1	D&P	D&P	I	I	I	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	60 mo.	2027
	20	Wider BRT network (BRT-H)	D&P	D&P	I	I	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	48 mo.	2026
	20	Wider BRT network (BRT-T)				D&P	D&P	I	I	I	D	DC	S	S	S	S	S	S	S	S	S	60 mo.	2030
	21	Impement waterbuses		D&P	D&P	I	I	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	48 mo.	2027
	22	Urban rapid rail lines (TRAM-U)	D&P	D&P	I	I	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	48 mo.	2026
	22	Urban rapid rail lines (LRT-B)				D&P	D&P	I	I	I	D	DC	S	S	S	S	S	S	S	S	S	60 mo.	2030
	22	Urban rapid rail lines (TRAM-G)				D&P	D&P	I	I	I	D	DC	S	S	S	S	S	S	S	S	S	60 mo.	2030
	22	Urban rapid rail lines (LRT-A1)								D&P	D&P	I	I	I	I	I	D	DC	S	S	S	84 mo.	2036
	22	Urban rapid rail lines (LRT-A2)								D&P	D&P	I	I	I	I	I	D	DC	S	S	S	84 mo.	2036
	22	Urban rapid rail lines (LRT-W)											D&P	D&P	I	I	I	I	D	DC	S	72 mo.	2038
	22	Urban rapid rail lines (TRAM-J)										D&P	D&P	I	I	I	I	I	D	DC	S	84 mo.	2038
	23	Improve existing rail services	D&P	D&P	I	I	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	48 mo.	2038
	24A	Minibuses: routing and operations optimization	D&P	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	12 mo.	2023
	24B	Minibuses: riding quality and comfort increase	D&P	D	DC	S	S	S	S	S	S	S	S	S	R	S	S	S	S	S	S	12 mo.	2023
	25	Service of existing bus transport quality improvement		D&P	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	12 mo.	2024
	26	School buses		D&P	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	12 mo.	2024
	27	Promote public transport		D&P	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	12 mo.	2024
	28	Mobility as a service	D&P	I	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	24 mo.	2024
	29	Monitoring system at Mebidangro level		D&P	D&P	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	S	24 mo.	2025
	30	Real-time passenger information on-board & at stations		D&P	D&P	I	I	I	D	S	S	S	S	S	S	S	S	S	S	S	S	60 mo.	2028
	31	Fare Intermodality				D&P	I	D	S	S	S	S	S	S	S	S	S	S	S	S	S	24 mo.	2027
Governance	32	Mebidangro land transport authority		D&P	D&P	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	S	S	24 mo.	2026
	33	Reform minibus industry under Province		D&P	D&P	D&P	D&P	D	DC	S	S	S	S	S	S	S	S	S	S	S	S	48 mo.	2027
	34	Corporate tax on mobility			D&P	D&P	D&P	D&P	D	S	S	S	S	S	S	S	S	S	S	S	S	48 mo.	2028
	35	Technical assistance of capacity building	D&P	D	D	D	D	S	S	S	S	S	S	S	S	S	S	S	S	S	S	12 mo.	2022
	36	Separate rail infrastructure & train operations		D&P	D&P	D&P	D&P	D&P	D	DC	S	S	S	S	S	S	S	S	S	S	S	60 mo.	2028
Environment	37	Taxing motorized vehicles on urban roads			D&P	D&P	D	S	S	S	S	S	S	S	S	S	S	S	S	S	S	24 mo.	2026
	38	Incentives to reduce fuel consumption	D&P	D&P	D&P	D	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	36 mo.	2025
	39	Renewable energies for rail transportation		D&P	D&P	I	D	S	S	S	S	S	S	S	S	S	S	S	S	S	S	36 mo.	2026
	40	Renewable energies for road transportation		D&P	D&P	D&P	I	D	S	S	S	S	S	S	S	S	S	S	S	S	S	48 mo.	2027
	41	Renewable energies for private vehicles		D&P	D&P	D&P	D	S	S	S	S	S	S	S	S	S	S	S	S	S	S	36 mo.	2025
	42	Cleaner fuels and engines for existing road PT		D&P	D&P	I	I	D	S	S	S	S	S	S	S	S	S	S	S	S	S	48 mo.	2027
	43	Installation of air quality stations		D&P	DC	D	S	S	S	S	S	S	S	S	S	S	S	S	S	S	R	12 mo.	2025
	44	Community engagement for environmental issues		D&P	D	S	S	S	D	S	S	S	D	S	S	S	D	S	S	S	D	12 mo.	2024

D&P	Definition & Preparation (studies / planning / budgeting)
I	Implementation (procurement / construction / installation)
D	Delivery (commissioning / applicability)
C	Contingency (delays / completion)
S	Service (operations / maintenance)
R	Refurbishment (important maintenance)

### IV.3.1.b. Updates and Future Editions

The SUMP Mebidangro, as a comprehensive documented process, stems from the diagnosis, vision and action plan, all conducted within a participatory process. However, the SUMP shall be updated every five years.

#### ■ Why does the SUMP need updates?

The Action Plan execution sets targets for all responsible entities. In future years, the activities and progress will be monitored thanks to the Observatory on Urban Mobility and standard governmental monitoring. The targets, hence the Action Plan, shall be re-evaluated upon this monitoring.

Furthermore, the Actions aim at solving challenges appraised in the current ecosystem of Mebidangro. Shall the conditions of the ecosystem vary in future years, the painpoints are likely to evolve too. The changes can originate from new technologies in vehicles and digitalization, urban formations, policies, crises, etc. Hence, the changes must be addressed with revised actions to maintain the relevancy of the SUMP.

#### ■ Why are the SUMP updates important?

As a regulatory document, the SUMP reflects the interrelations between mobility and the society in Mebidangro, and hence must remain relevant at all times. It is important for the SUMP to maintain its relevancy to maintain efforts to improving mobility organized and coordinated (as highlighted by Central and North Sumatra Medium-Term Strategic Plans).

Furthermore, maintaining an applicable plan is crucial for the enabling environment of the vision for mobility. The document can only keep its value as a support and catalyst of mobility for Mebidangro if considered as a valid and applicable reference by all actors to be involved in it (institutional, financial and technical, etc.).

#### ■ Who should conduct the SUMP updates and how?

The SUMP updates shall be led by the Steering Committee (North Sumatra Provincial Government), by appointment of the Implementing Agency DISHUB SU, or the transit authority of Mebidangro once operational. The Technical Committee and consultative stakeholders shall maintain their role.

SUMP updates shall be formalized, just like the first edition, by Provincial Decree of North Sumatra. With validation and support from the Central Ministry of Planning BAPPENAS.

In line with the Observatory and to avoid unnecessary updates, it is suggested to revise the SUMP Mebidangro every five years: 2026/2027, 2032, 2037. These in turn allow for synchronized updates of regional official plans, such as the urban land use plan (RTRW), etc.

Thanks to the updates of the Observatory published yearly and reporting the evolution of mobility, updating the SUMP shall not last more than six months. The cost associated is IDR ±2 billion (USD ±140.000) – outside separate update of the Observatory which includes surveys. The North Sumatra Province, with assistance from the Central Government, shall be responsible for it.

## IV.3.2. Institutional Arrangements

The process of preparing the SUMP in Mebidangro has involved all stakeholders related to the de-velopment of mobility. This were carried out in various technical committee meetings, and informal discussions with the steering committee to ensure a sense of belonging from the stakeholders to-wards this project and the subsequent action plan.

The following figure indicates the leading institutions and their respective roles in the six packages of action in the SUMP action plan, as well as implementation and monitoring.

Figure 96. Recap of leading actors of the SUMP

	Urban Planning & NMT	Road Network & Private Vehicles	Public Transport	Digitalization	Environment & air quality	SUMP Actions & Monitoring
Central Ministries	PUPR can support with guidelines.		MOT leads land & rail projects. (cf. BRT1)	Kominfo to share experience from Jakarta		
North Sumatra Province	The province leads by providing framework and monitoring.	The province leads for the monitoring of the maintenance of roads homogeneously throughout Mebidangro.	The province must lead as the main funding agent to gather external financing.  The TA would assume this role.	MaaS and other measures without boundaries must be undertaken by province.	The province leads the implementation of environmental measures with more regulatory power and borderless considerations.	The province leads the execution of the SUMP Action Plan with constant monitoring (observatory on urban mobility).
Mebidangro Urban Transport Authority	Most urban measures are at small scale and require the lead of cities /regencies.	The TA would assume this role.		Cities /regencies must lead the digitalization of current angkots and buses.	The TA would assume this role.	
Mebidangro Cities & Regencies	The TA would assume this role.	Most measures fall within city and regency scopes.	Cities and regencies are responsible for necessary land acquisition.	The TA would assume this role.	Cities and regencies must support implementing measures.	

Such involvement of actors must be continued within a common institutional framework under the umbrella of a Mebidangro metropolitan authority according to Governor Regulation 5/2016. This will be outlined in more detail later.

The institutional aspects are key to securing funding and financing for the capital expenditures (CAPEX) and operational expenditures (OPEX) throughout the program. SUMP estimates a cumulative CAPEX of IDR 55 trillion, and cumulative OPEX of IDR 1,8 trillion between 2022 and 2040. The breakdown of these figures and plans to secure the necessary funding and financing are outlined.

Ministries hold an important role in the financing and instruction, delivery of projects. While BAPPENAS recommends the projects to be funded, MOT prepares them until delivery, and MOF funds them. The most direct implication for the SUMP proposals will be the strong involvement of MOT for all land transportation and rail projects, which also require funding aid from MOF.

The general concept is completed in appendix and in the action plan summary, by identifying each leading agency and contributing agencies.

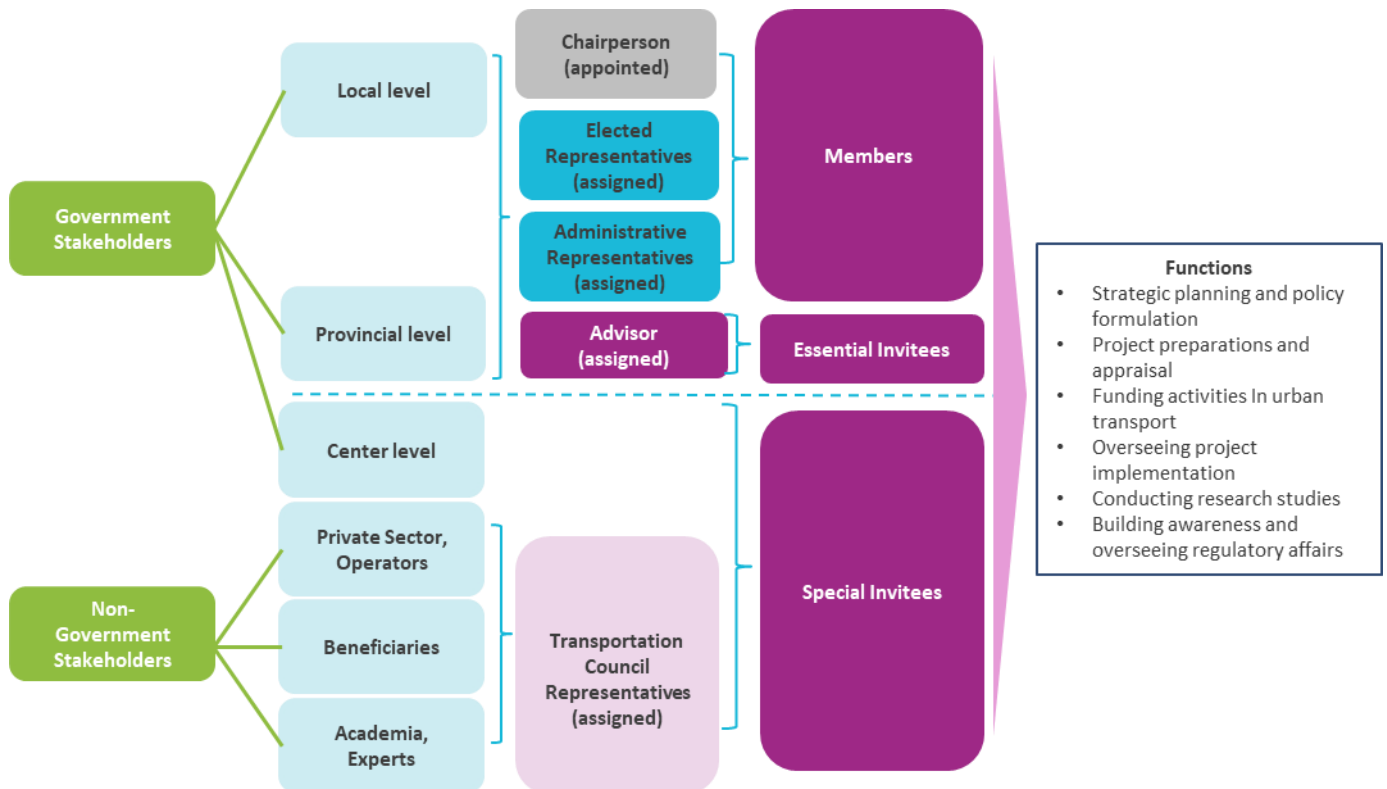
### IV.3.2.a. Institutional Strengthening

In carrying out mobility development activities in Mebidangro, an organizational structure is needed to cover all aspects of mobility development, both from a technical and non-technical perspective. The organization will coordinate and monitor the results of the implementation of the SUMP action plan, and ensure they are in accordance with the vision and targets of mobility development.

#### ■ The Mebidangro authority

The Government of North Sumatra has provided the legal basis for the establishment of the Mebidangro authority, per Governor's Regulation (Pergub) 5/2016, but no substantial progress is underway. SUMP will provide technical assistance to the Government of North Sumatra to facilitate the establishment of this metropolitan authority.

Figure 97. Suggested composition of the metropolitan authority



A single, unified agency in charge of land transportation in Mebidangro is suggested to deal with the current gaps and overlapping authorities between institutions. The figure above shows the proposed internal structure of the executive body (*badan pelaksana harian*), which is in line with Pergub 5/2016.

Each of the local urban transportation agencies has roles and responsibilities that are interrelated with those of the other agencies, and it is necessary to harmonize and synergize them.

An initiator is required to consolidate all land transport agencies in the metropolitan area, involving not just the city and regency governments, but also relevant provincial and national government agencies.

As early as possible, the initiator should form a metro-wide transportation taskforce according to the suggested composition above. The taskforce would strengthen the existing technical working group on transportation cooperation to further develop it into the land transport authority for Mebidangro, under the metropolitan authority.

Figure 98. Suggested composition of the transportation taskforce within the metropolitan authority





The formation a specific unit with dedicated and capable staff is crucial to the technical assistance in the formation of the authority. The taskforce should have the following mandates:

- ✓ Facilitate the amendment of Pergub 5/2016, regarding the composition of the transport technical working group
- ✓ Setting up of Transport Secretariat & Governing Board
- ✓ Appointment of Transport & Traffic Officer (similar to “Operational Director-POKJA”)
- ✓ Appointment of Experts Within TA Technical Cell

As the transport authority focuses on planning, regulating, and decision making, it is not expected to conduct construction, operations, and maintenance. These will be conducted by the existing agencies and bodies at their respective level.

### IV.3.2.b. Main Considerations Moving Forward

#### ■ Main modalities of the Action Plan

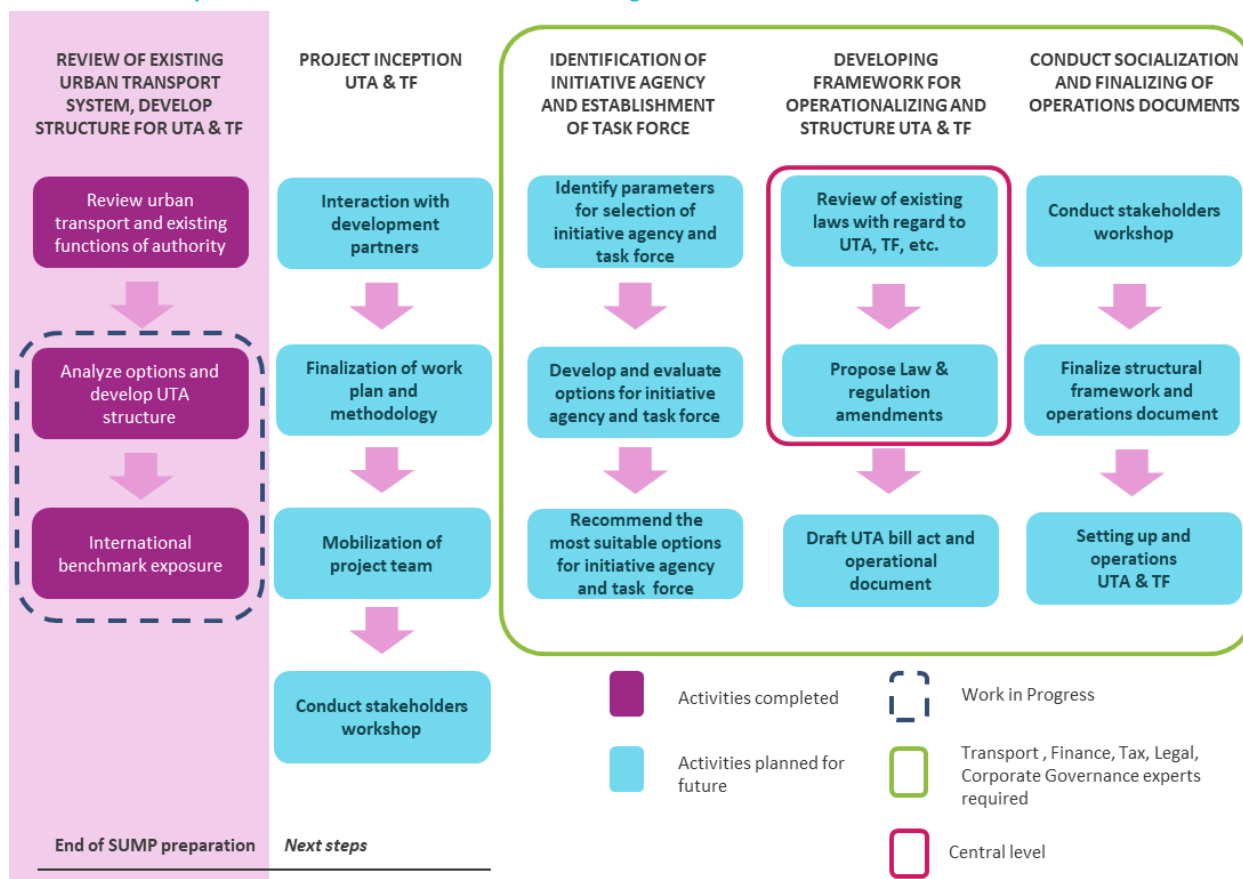
The modalities of the Action Plan are plenty but can be summarized into the following salient points:

- Detailing of costing along detailed studies, especially for mass transit. Working hypotheses will be refined with detailed studies (pre-FS, FS), with applicable regulations and technologies (taxes, market, import, etc).
- Exploration of additional revenue streams to reduce deficit imbalance: TOD, LVC, creative taxing and charges are paths to explore legally in Mebidangro to implement without await-ing the intervention of other government levels.
- Additional revenue streams (TOD, LVC, Levies, charges) will only be actionable with adequate regulations. Hence the regulatory and legal work must start as soon as possible at the metropolitan or provincial level.
- Regulations and funding will be greatly facilitated if a Transport Authority at Mebidangro level is operational in the short or medium term. Hence the groundwork for the TA should start early as well to allow for the development of these recommended projects.

#### ■ Direct next steps

The steps that the Taskforce shall take for managing the transport authority are described in the establishment process. The options presented in the report on the proposed transport authority will be discussed and finalized.

Figure 99. Direct next steps for the institutional and financial enabling frameworks



The first step is the formation of a Taskforce within Provincial Government, to provide technical assistance in strengthening the existing POKJA. It is envisaged that the initiating agency will bring together urban transport representatives from the cities

and regencies in Mebidangro, as well as the provincial and national governments. This requires the constitution of a specialized unit, which proficiently undertakes all planning and management required for the strengthening process.

After finalization of the transport authority's structure, the next steps (light blue boxes) would involve drafting of operational documents for the setting up and operationalization of the transport authority for Mebidangro.

### IV.3.2.c. Capacity Development Strategy

To execute the Action Plan, a high-level capacity development strategy is identified.

#### ■ Capacity goals and existing situation

The principles and goals of the capacity development are:

- ✓ Have an autonomous entity iterating and executing the SUMP, and its updates: Mebidangro must be autonomous in the short-term on the SUMP execution and in the updates of the Observatory. This implies the availability of competencies in the North Sumatra Province administration for production, coordination, budget planning.
- ✓ Participate actively to the formation of the Transport Authority: DISHUB SU will have a critical role in the definition of the authority. DISHUB needs to be in a position to prepare and issue these recommendations during and after the preparation of the SUMP.

However, the current situation shows that several setbacks do not allow a good readiness for those. The setbacks include: over-representation of administrative staff; lack of availability of existing staff for coordination with other agencies; lack of technical skills due to the lack of technical managers (middle-officers) in all fields of mobility discussed in the SUMP; lack of financial management skills.

#### ■ Works initiated and to carry on

The challenges were addressed during the SUMP preparation with initial knowledge transfer and sensitization on technical topics mainly, and also by the discussions and organizational suggestions to be operated. These include trainings on mobility data collection, planning, modelling, innovations and monitoring and reporting. Focus group discussions and workshops further gathered the mobility-related agencies to discuss governance and the need for the transport authority, and necessary related organizational changes.

This initiation must be pursued with several capacity development measures at the beginning of the SUMP implementation to undertake the ambitious Action Plan:

- Internal reinforcement and growth of staff, to insure wide coverage of management, technical and operational skills, through the recruitment by DISHUB SU and Mebidangro of middle level officers; and through the training of staff on planning efforts needed to deliver successful and sustainable mobility projects.
- Cooperation with BAPPEDA SU and Mebidangro every step of the way with, if possible, with a recruited generalist in order to gain high-level traction. Coordination with other agencies (PU, Bina marga, etc.) is also recommended.
- Externalize legal expertise to prepare for the transport authority formation. Support will be needed for the legal ground-work that is necessary. This legal assistance being needed only for a certain period of time, it is suggested to externalize it for cost efficiency.
- Externalize technical assistance for transportation planning and engineering, for the SUMP and Observatory updates. This is agreed upon with the leader of the SUMP. Necessary studies that are part of the actions shall be externalized as well. However, this externalization highlights the need of technical managers on the authorities side to manage contractors and challenge solutions proposed.
- At the scale of the transport and planning agencies of SU and Mebidangro, regular workshops and discussions shall be implemented to maintain the momentum.

The capacity development technical assistance part of the action plan directly relates to this capacity development strategy and is necessary for the proper development of mobility, at least in the short-term. The formation of the transport authority shall also carry important skills growth given its suggested composition.

The capacity development shall take place with external partners skilled in the required mobility domains and project development and preparation, with proven track records of implemented projects. However, the specificities of the local context must be taken into account for a most efficient development of capacity. Hence, it is suggested to engage with international partners familiar with Mebidangro and the central government of Indonesia.

#### ■ Capacity development strategy summary

In a nutshell, the required competencies for short-term SUMP activities and sustainable urban mobility development follow several steps:

- ✓ Reinforcement of current staff with training and additional members at technical manager level, to cope with lack of skills and availability.
- ✓ Externalization of specific expertise on legal and technical elements of mobility, that is only possible with prepared and capable internal managers.
- ✓ Assistance from partners with proven track records for the two items, which is compatible with the funding assistance needed from the same partners.

DISHUB SU, as the current leading agency for the SUMP activities at Mebidangro level, shall initiate this improvement. The capacity shall be re-assessed after 4 to 5 years after the initiation of capacity development measures.

## IV.4. Summary of Impacts and Way Forward

The Action Plan of the SUMP Mebidangro shall be undertaken as soon as possible by the North Sumatra Province. For a proper execution, it is important to understand its beneficial impacts and first steps, or way forward.

### IV.4.1. Expected Impacts

#### ■ Benefits of the mass transit measures

Mass transit projects are highly expected and some are already committed and under preparation. They are structural for the targeted sustainable urban mobility in Mebidangro. Their impacts are sought after.

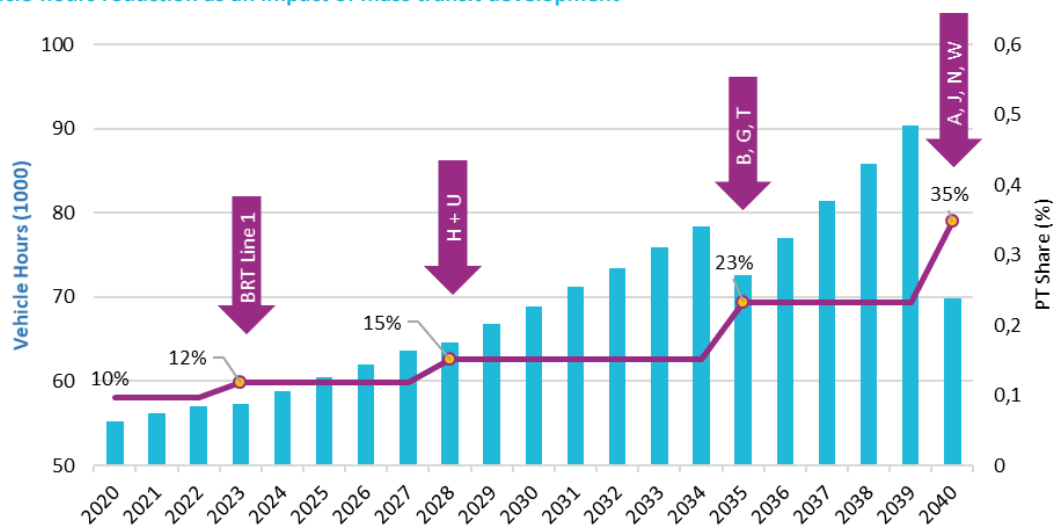
##### ■ Shifting from private vehicles to public transport

The development of mass transit first sought benefit is the increase of public transport modal share, by shifting users from private vehicles and thus reducing their modal share.

Currently, 72% of trips are made using private vehicles. With each corridors' operations, the share of private vehicles decreases. Ultimately, the share of private vehicle users would be greatly reduced to 65% by 2040, thanks to the implementation of 172 km of mass transit.

However, an additional vehicle fleet reduction is expected to occur with the implementation of multimodal hubs, integration of public transport modes, as well as the development of NMT and MaaS services. The associated decrease is not quantifiable for the moment.

Figure 100. Vehicle-hours reduction as an impact of mass transit development



##### ■ Reducing congestion in Mebidangro

As an impact of mass transit development, the congestion in the SUMP area would be decreased as well, with the lower usage of private vehicles for trips. Ultimately, the congestion (represented by Vehicle.Hours) would be greatly reduced by 23% in 2040, assuming 172 km of mass transit in service.

#### ■ Overall benefits of the action plan

The overall benefits of the action plan are estimated wherever possible, from all of the measures (urban, environmental...). However at this stage of the SUMP, not all measures are detailed nor with relevant forecasts (e.g. forecast of private vehicles decrease upon construction of better NMT ways). Hence it can be considered that the following impacts of the action plan describe a pessimistic outlook.

### ■ Increased accessibility to formal mobility

It is expected that the SUMP actions provide up to five times more people access to formal transit facilities within 750 meters of their habitats. In 2020, less than 4% of the population has access to formal transit for safe and comfortable trips. Upon reform of the minibus industry, this figure would reach more than 90% of the Mebidangro population.

### ■ Reduction of GHG emissions from mobility

The proposed actions offer reducing by 20% the GHG emissions forecasted for 2035. This is possible by avoiding and shifting from private vehicles with sustainable alternatives such as mass transit. Other supporting measures such as awareness raising, fleet rejuvenation, traffic calming measures, NMT and others would also contribute to increasing this figure but are not quantifiable for the moment.

### ■ Other intangible benefits

The Action Plan bears more benefits that are difficult to quantify at the time of the preparation of the SUMP Mebidangro. These include the reduction of congestion and GHG emissions from the growth of NMT, MaaS and school buses, as well as the socio-economic benefits of mixed-use zones, multimodal hubs, sidewalks, improved bus, railways and road safety.

On the other hand, intangible benefits are distinguishable, particularly regarding the governance of mobility:

- ✓ Existence of an integrated plan and guide for mobility development. Previous plans and initiative for urban transport were isolated and considered to a limited extent the peripheral aspects of mobility. The SUMP provides a common platform and document to integrate approaches and coordinate governmental entities.
- ✓ Clear priorities for investment at the urban scale. Where previous studies did not base their recommendations on the actual measured needs of the communities, the SUMP, thanks in part to its comprehensive data assembly, pinpoints the specific corridors and areas in need for mobility projects, to draw clear priorities of investment beyond administrative borders.
- ✓ Evolving reference for projects necessitating cooperation. Mobility projects being of a grand nature, it is necessary to combine the efforts of all partners, including international and domestic private partners. The groups need a clear reference document with performance tracking and evolutions anticipated in order to follow a common line of discussion and base their cooperation on. The SUMP and the observatory provide those bases.

The Action Plan thus provides a clear priority projects pipeline with recommended actions to an enabling environment. The latter start with several regulatory steps.

Figure 101. Accessibility to mass transit (within 750 m)

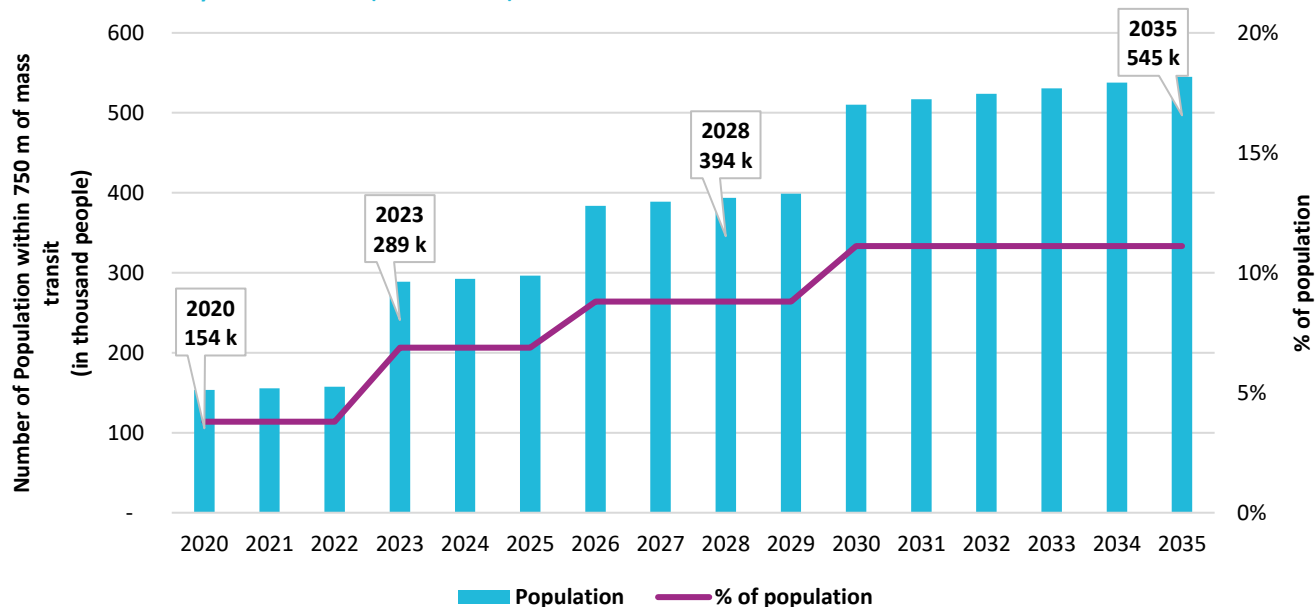
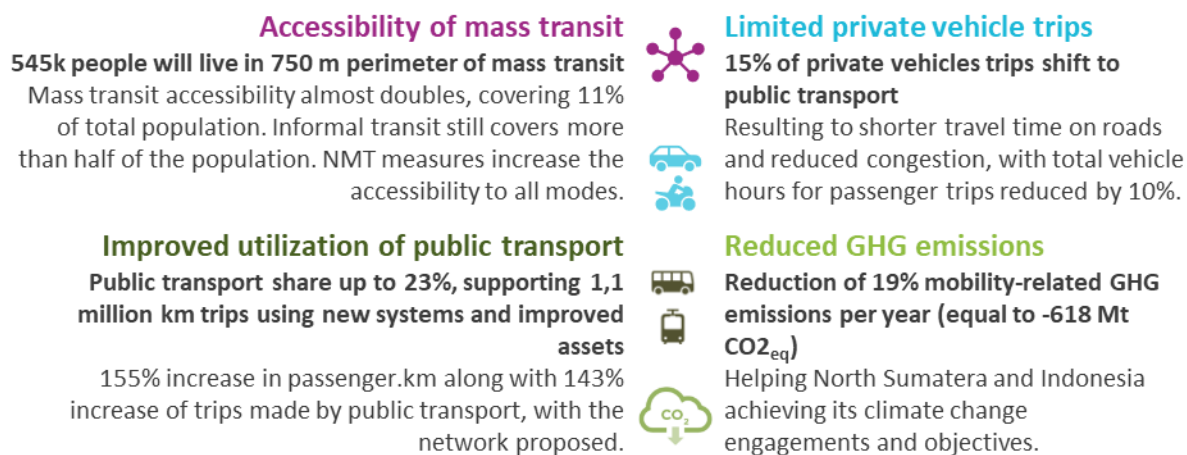


Figure 102. Expected impacts of SUMP implementation in 2035 (compared to the Reference Case)



## IV.4.2. Way Forward

Several key actions must be undertaken promptly by North Sumatra Province to launch the timely execution of the SUMP Mebidangro Action Plan.

### ■ Formalization of the taskforce and transit authority

The taskforce and transit authority hold an angular stone role in the SUMP execution. They allow streamlining instruction process and pooling funds from the central government and external parties. The formation of the taskforce and later transit authority must then be the first step immediately undertaken by the leader of the SUMP, the North Sumatra Provincial government, and its implementing agency DISHUB SU.

This shall be legalized in a dedicated Governor Decree with reference to existing legal ground bases referencing provincial and national plans and regulations in place. It is feared that without this first organizational evolution, the mobility development of Mebidangro has very little chances of being observed in the future, and that projects are again developed in an unintegrated way.

### ■ Commitment and pursued development of BRT Line 1

The development of the BRT Line 1 (from Pinang Baris to Amplas) is under planning with the Province and National Supervision, with international and domestic partners. It has been in the works for the past six years. The delivery of this project would indicate a favourable environment to all parties involved in mobility in Mebidangro. Thus, it would serve the higher purpose of fostering efforts for the Action Plan. The commitment on this project is crucial and the development must be pursued until the operations of the line starts.



## V. Mebidangro Urban Mobility Observatory

The actions of the SUMP Mebidangro shall be pursued and executed by the designated governmental agencies. In future years, their implementation shall be tracked and reported to enable timely and effective response to tackle the mobility challenges. An ad-hoc process was designed for this purpose: the Observatory on Urban Mobility, also referred to as Monitoring, Reporting and Verification process (MRV).

Not only a requirement and insurance of follow-up for the international partners of the SUMP, the Observatory provides a base for formalization of progress tracking, which is often lacking in Indonesia; and thus help towards the actual implementation of mobility projects in Mebidangro.

This section presents the observatory specifically prepared to monitor urban mobility improvement in Mebidangro. It includes a description of the tool, the indicators, the updates method and the MRV management. More on the design approach to the Observatory is available in the related reports.

### V.1. Rationale and Goals

The Observatory on Urban Mobility for Mebidangro is a set of mobility indicators compiled in a visual dashboard. It provides information on the evolution of mobility through years against baseline values and horizon targets. When applied as intended, MRV will benefit sub-national administrations, central agencies, international partners and the community in the management of mobility. It has plural characteristics:

- ✓ **Provide strategic insights:** indicators allow quick insights on mobility. Output can be used for analyses and evaluations by Mebidangro leaders for mobility planning.
- ✓ **Timely and effective response:** MRV information and structure help identifying lagging progress and responsible institutions – and in term find quick and effective mitigations, replacing the need for additional studies.
- ✓ **Alignment:** the impartiality of data with SMART (Specific, Measurable, Attainable, Relevant, Time-Based) indicators avoids advanced coordination between agencies and foster political alignment for diagnosis and projects.
- ✓ **Transparent information:**
  - ✓ Information for citizens: inhabitants of Mebidangro shall be involved in the planning process by accessing information and increasing their awareness.
  - ✓ If repeated over time, MRV will reveal the measures impacting mobility the most efficiently, thus creating a benchmark allowing to select best measures in the context of targeted actions in other cities.
  - ✓ Lastly, the transparent information can benefit mobility initiatives from associations and citizens, developments and residents, other agencies unrelated to mobility, etc.
- ✓ **Continuous improvement:** indicators must remain flexible to allow evolution in their nature (update in the calculation method, update of targets depending on technology or priorities, etc.). Hence the observatory is evolving.

### V.2. Indicators

#### ■ The set of indicators

Mebidangro mobility agencies have defined a set of 20 indicators based on their priorities, familiarity and needs – as well as following the MobilizeYourCity standards.

1. Transportation Projects in Official Plans
2. Accessibility to Public Transport
3. Road Safety
4. Affordability of Public Transport
5. Modal split of PT and NMT
6. Multimodal Integration of PT at Hubs
7. Comfort and Bliss of Mobility
8. Security of Collective Mobility
9. Commuting Travel Time
10. Road Congestion and Delays
11. Energy Efficiency of Overall Mobility
12. Reduction of GHG Emissions from Mobility
13. Reduction of Air Pollution from Mobility
14. Quality and Livability of Public Space
15. Mobility Facilities Space Usage
16. Mass Transit Studied

17. Off-Street Parking Hubs
18. Bicycle Lanes
19. Sidewalks and Pedestrian Facilities
20. Financing for Mobility

The set is composed of 15 impact indicators (blue) and 5 investment indicators (purple) (MYC core indicators). They measure environmental, social, economical, financial, planning and technical evolutions of mobility for an efficient monitoring. While the impact indicators show the performances of mobility in Mebidangro, investment indicators are measurements of projects preparation and implementation.

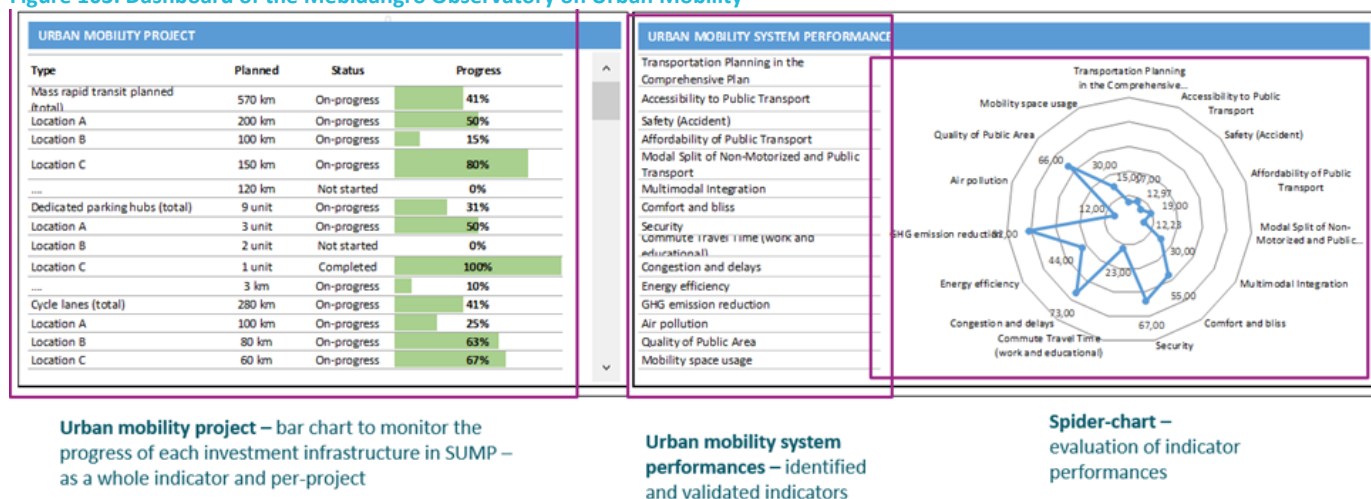
To draw a coherent and contextualized understanding of mobility, all indicators shall be used as a whole set. The isolated use of a single or several indicators provides no context and misses on built interrelations.

### ■ The dashboard

The dashboard is the main output of the MRV tool. It summarizes the indicators values thanks to several blocks:

- Urban mobility performances: on the right side, the indicators scores appear on a spider chart. It shows the value (and evolution) of indicators as well as practical visualization tool to conduct comparisons against other cities or past and/or future years.
- Urban mobility projects: on the left side, the dashboard shows the progress of specific mobility projects. This bar-chart allows monitoring the progress of specific investments. It is optional and up to the government agencies to fill in the information or not, to put against the urban mobility performances.

Figure 103. Dashboard of the Mebidangro Observatory on Urban Mobility



### ■ Baseline values and Mebidangro targets

All indicators are evaluated at baseline year and have targets in accordance with the SUMP action plan.

Figure 104. Baseline values and targets of Observatory indicators

No	Indicator	Baseline value (2021)	Target value (2035)	Rationale
1	Transportation Projects in Official Plans	-	10/10 SUMP measures	This indicator measures the integration of transport planning within public plans, to gauge the efforts and priority put on public transport planning and development by the Provincial Government of North Sumatra.
2	Accessibility to Public Transport	16% without minibus 90,1% with minibus	50% without minibus 100% with minibus	The target is to have 50% of Mebidangro population covered by quality public transport (stations, terminals, passenger facilities). The target is to have 100% of the population covered. This shall be enhanced by developing mass transit but also the public space and its walkability, and the quality of minibuses.
3	Road Safety	487 Road Casualties	250 Road Casualties	Regardless of growths in population, motorized vehicle fleet, road network, vehicle-kilometers traveled and other parameters, it is urgent to decrease its death toll from road accidents in Mebidangro. Supporting measures are included in the action plan (separating and calming traffic, campaigns...).
4	Affordability of Public Transport	13% Disposable Household Income	5% Disposable Household Income	As the communities are currently fragile and sensitive to price variations (fuel, tolls, parking...), it is aimed to make public transport more affordable. The 2035 target is to have only 5% of disposable household income dedicated to transportation (for inhabitants with minimum salary) in Mebidangro.
5	Modal split of PT and NMT	w/o minibus: 8.9% w/ minibus: 12.2% NMT: 8.8%	w/o minibus: 17.8% w/ minibus: 24.4% NMT: 17.6%	The 2035 target is to double the modal shares of NMT and PT. Supporting actions of the plan contribute to that goal, but a decrease in private vehicle usage and reduction of the need of mobility and trips is also another lever for increasing this modal split.

No	Indicator	Baseline value (2021)	Target value (2035)	Rationale
6	Multimodal Integration of PT at Hubs	<b>30%</b> of area hubs are multi-modal	<b>100%</b> of area hubs are multi-modal	To prioritize interchanges development for the better-integrated management of modes as well as the increase of the comfort of transit for the passengers. Given the multimodality of the roads and rails in Mebidangro, these hubs are important for PT efficiency and are a need directly expressed by the inhabitants and users (cf. FGD).
7	Comfort and Bliss of Mobility	<b>30%</b> Comfort & Bliss index	<b>70%</b> Comfort & Bliss index	Based on the household survey, “not safe and uncomfortable” (20%), is one of the top three discouraging factors to inhabitants to use PT. The target of 2035 is to increase the public perception regarding comfort and bliss in mobility system performances to a total score of 70%.
8	Security of Collective Mobility	<b>39%</b> Security index	<b>70%</b> Security index	This indicator is important as it will describe the perception of the inhabitants regarding the security of PT vehicles and spaces in Mebidangro. It directly hints at the willingness of inhabitants to use PT. The target of 2035 is to increase the public perception regarding security (crime) in mobility system performances to a total score of 70%.
9	Commuting Travel Time	<b>31 min</b> over-all <b>67 min</b> PT	<b>24 min</b> over-all <b>24 min</b> PT	Commute travel time is an indicator identified by assessing stakeholders' goals as necessary to integrate to the MRV in order to improve current mobility performances to be more effective and able to operate in the long term.
10	Road Congestion and Delays	<b>0,6 – 0,85</b> Degree of saturation	<b>0,6</b> Degree of saturation	As main road axes of Mebidangro are getting more and more congested, peripheral actions proposed in the action plan shall help towards reducing bottlenecks (public area works, road quality and public transportation).
11	Energy Efficiency of Overall Mobility	<b>14,4 MJ/km</b>	<b>7 MJ/km</b>	Energy efficiency is an indicator selected by the stakeholders in their vision of an environmentally friendly road-based PT system in Mebidangro; with minimum emissions. The target of 2035 is to decrease the fuel used per vehicle unit by 50%, causing each unit to generate 7 MJ/km on average.
12	Reduction of GHG Emissions from Mobility	<b>3.196 Gg CO<sub>2</sub>.eq</b>	<b>2.578 Gg CO<sub>2</sub>.eq</b>	Corresponding to the goals of Mebidangro, it is aimed to reduced GHG emissions from mobility on the long term, via the development of transport alternatives to private vehicles and other actions (action plan).
13	Reduction of Air Pollution from Mobility	-	<b>&lt; 10 µg/m<sup>3</sup></b>	PM2.5 air pollutants are one of the most harmful to health. The MYC indicator refers to WHO (2005), with a 10 µg/m <sup>3</sup> annual mean value or 25 µg/m <sup>3</sup> 24-hour mean value as the fine particulate matter threshold to maintain the Mebidangro levels under. Currently, it is not measurable but shall become so with the action plan (installation of air quality stations).
14	Quality and Livability of Public Space	<b>77%</b> Quality of Public Area (index)	<b>90%</b> Quality of Public Area (index)	The quality of public areas is identified by inhabitants by one of the main factors discouraging NMT and accessing public transport (road-based). Furthermore, the disabled have the impossibility to travel safely, and vulnerable groups have constant threats on their security. This opinion metric should approach 90% on the long term with the actions proposed.
15	Mobility Facilities Space Usage	<b>19</b> Mobility Space Usage Per-Capita	<b>25</b> Mobility Space Usage Per-Capita	The proportion of the area dedicated to mobility uses includes direct and indirect ones: roads, terminals, stations, railways, parking spots, bicycle lanes, etc. The current mobility space usage in Mebidangro is 19 m <sup>2</sup> /capita. This shows a lack of infrastructure outside roads. Mobility can be increased while not expanding the zone and use land more efficiently, in the years to come.
16	Mass Transit Studied	1	cf. Action Plan	Mass transit lines are a central mobility improvement measure that addresses the needs of the inhabitants and users of Mebidangro, the role of mass transit is key in the development of sustainable urban mobility - all lines proposed in the SUMP, should be monitored for their further development and implementation.
17	Off-Street Parking Hubs	refer to SUMP measure 14A & 14B	cf. Action Plan	As of today the parking is not managed by authorities and private initiatives are left to poor service levels or on-street parking generating congestion. An off-street parking hubs shall allow comfortable shift between PV and PT at P&R and encourage using PV only for the last kilometer.
18	Bicycle Lanes	refer to SUMP measure 12	cf. Action Plan	To encourage the usage of soft modes for inhabitant, as well as to increased user convenience, comfort, safety, accessibility and enjoyment as well as savings from reduced vehicle ownership and use. These indicator shall be monitor in order to envision an environmentally friendly road-based public transportation in Mebidangro with minimum emissions
19	Sidewalks and Pedestrian Facilities	refer to SUMP measure 2	cf. Action Plan	
20	Financing for Mobility	refer to total costs for MRV indicator 16-19	refer to total costs for MRV indicator 16-19	This indicator is to monitor the overall costs of the SUMP implementation.

### V.3. Monitoring Management

Because the MRV activities form a small-sized project on its own, several management requirements are set by MobiliseYour-City and adjusted in the context of Mebidangro.

- **Methodology:** methodological requirements for data collection, processing and assessment, monitoring frequency, time-plan by indicator and monitoring procedures are described in detail for each indicator of the Observatory in the related MRV report.
- **Resources:** updating the Observatory is estimated to take up to three months with its validation. Based on the schedule and organization structure, the estimated budget for the MRV process is at IDR 1,9 billion.
- **Reporting:** the Observatory updates shall be reported in a standard publishable report following a specific outline proper to MobiliseYourCity guidelines (see appendix).
- **Institutional arrangements and roles:**

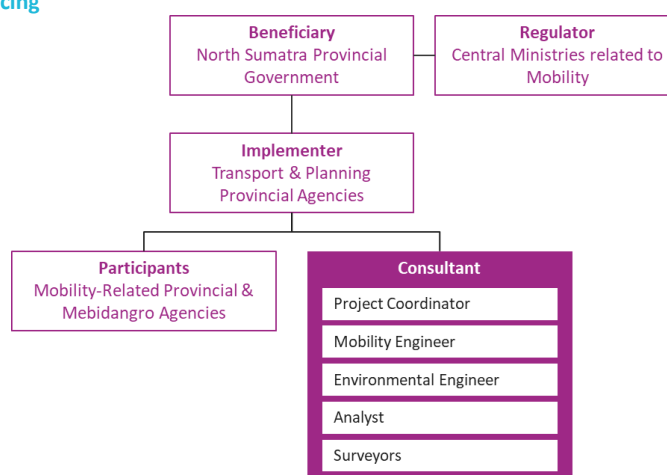
Figure 105. Implementing entities of the Observatory



Agencies	Phase	Role	Description
DISHUB SU	Planning	Sectoral Working group	To prepare scenario/measurement for mobility system improvement To prepare indicators
	Implementation	Technical Coordinator Sectoral Working Group	To check the process of MRV by related entities To monitor, verify, and report the indicators
BAPPEDA SU	Planning	Planning coordinator	To coordinate between related entities for the development of planning in MRV implementation
Mebidangro entities	Implementation	Sectoral Working Group	To prepare, monitor, implement and report the measures & indicators

- **Outsourcing:** for value for money, it was decided by the SUMP leading agency to outsource the MRV updates to consultants in future years. Hence a team composition and budgeting is proposed (IDR 1,9 billion per year from APBD North Sumatra). See appendix for more details.

Figure 106. MRV updating outsourcing



No	Position	Main Responsibilities
1	Project Coordinator	<ul style="list-style-type: none"> <li>- Coordinates with and manages stakeholders</li> <li>- Referent for the Steering and Technical Committees during the entire process</li> <li>- Ensures quality and consistency of all output, timely execution, validation and delivery</li> </ul>
2	Transport & Mobility Engineer	<ul style="list-style-type: none"> <li>- Ensures quality and consistency of transport related input</li> <li>- Coordinates, plans and manages data collection</li> </ul>
3	Environment Engineer	<ul style="list-style-type: none"> <li>- Ensures quality and consistency of environment related input</li> <li>- Coordinates with the analyst and surveyor regarding data collection</li> </ul>
4	Analyst	<ul style="list-style-type: none"> <li>- To ensure the quality of data collection</li> <li>- To analyze the data based on the expert/surveyor input.</li> </ul>
5	Surveyors	Field data collection

## V.4. Next Steps

### ■ Formalization of MRV as part of the SUMP

The Observatory on Urban Mobility constitutes a component of work as important as mobility planning. It must be budgeted by the transport agency of North Sumatra, on a bi-annual basis. Mobility agencies of Mebidangro and the province must adhere in future years and participate to its updates.

Hence, it is crucial for the Provincial Decree to include MRV as a full component of the SUMP, identifying responsible entities and sources of budget. It gives way for the central government to publish and use the Observatory as a model to encourage its replication in other cities of Indonesia.

### ■ Procedure for MRV implementation

Towards formalization and updates of the Observatory, there are several steps to undertake by the North Sumatra Province Transport Agency as the implementing agency of the SUMP.

- ✓ Validation of Observatory on Urban Mobility as part of the SUMP by the Steering Committee
- ✓ Formalization of the Observatory with Provincial Decree and assignment of the lead to DISHUB SU and other responsible entities (mention to SUMP decree 188.44/412/KPTS/2020)
- ✓ Budgeting and preparation of MRV at DISHUB SU
- ✓ Preparation of Terms of Reference based on the SUMP recommendations for the Observatory updates during the first quarter of future years (January to March)
- ✓ Bi-annual updates of the Observatory on Urban Mobility in Mebidangro (Tendering, Procurement, Execution, Validation, and Publishing)
- ✓ Sharing the Observatory on Urban Mobility updated reports to central agencies, and simplified dashboard and datasets publicly (for example on the North Sumatra Transport Agency website)



## VI. Conclusion

### ■ Fulfilment of the objectives of the SUMP

The base legislation for the ambitious development of urban mobility in the Mebidangro area is in place at national and sub-national levels. Based on those, the **SUMP was prepared to catalyze mobility planning and development.**

The SUMP preparation was the start of new planning and project preparation practices in Mebidangro. By gathering all mobility stakeholders and from governmental and non-governmental organizations, a discussion was opened to take into account all social aspects and priorities for transport development. This innovative participatory process was successfully implemented despite the challenges posed by the COVID-19 pandemic, thanks to the **strong lead of the North Sumatra Province government.**

The SUMP provides the authorities of North Sumatra Province and cities and regencies of Medan, Binjai, Deli Serdang and Karo a **consensual diagnosis and action plan to head towards the vision for urban mobility.**

### ■ Central support to the province initiative

At central level, the plan also supports the execution of the GOI strategic plan for the metropolitan area. The further intervention and assistance of the central government is required to move forward with mobility development.

The mobilization of resources, human and financial, is dependent on the assistance from the related ministries (planning, transport, public works), which shall be prepared as the **SUMP was prepared partly as a requirement** of BAPPENAS for the province of SUMUT to benefit from it. Moreover, the initiative of forming the transport authority at metropolitan level is underway.

Rolling out the action plan will not be possible without additional efforts. The priorities identified and related actions proposed are the base for further development implementation in construction by the authorities. However, the central government and international partners accompany these efforts by providing assistance.

The foremost effort is the formalization of the SUMP and taskforce by the North Sumatra Province. This would open the way to starting the formation of the metropolitan transport authority needed at Mebidangro level, and improve the enabling environment of mobility projects.

### ■ Continuity

The consistency of the efforts is also key to the obtention of tangible results. The Observatory on Urban Mobility, built together with the agencies, shall allow **adequate monitoring and reporting procedures to support consistent efforts.**

Mebidangro being one of the main metropolitan areas of Indonesia, the GOI international commitments towards actions against climate change cannot be separated from the readiness of the North Sumatra Province to make its mobility more sustainable, by continuing its efforts with urban transport policy-making – that is now allowed with the SUMP.

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# I. General Appendices

## I.1. Reports

No	Name	Brief	Date
R.4	<b>SUMP Final Report</b>	Summary of the SUMP process and action plan	Apr 2022
R.4.3	<b>Action Plan Report</b>	Summary of the SUMP actions	Jan 2022
R.3.4	<b>Scenario Report</b>	Summary of the vision, goals and mobility scenarios	Nov 2021
R.2.4	<b>Diagnosis Report</b>	Summary of the diagnosis on urban mobility	Apr 2021
R.1	<b>Inception Report</b>	Works confirmation and early documentation review	Dec 2020

### Additional Reports:

M.D.1	<b>MobiliseDays Report</b> alongside <i>Inception Report</i>	Summary of the delivery of the SUMP launching event	Dec 2020
R.2.1	<b>Capacity Development &amp; Workshops Report</b> (Component 2)	Trainings and workshops delivered in component 2	Mar 2021
R.2.2	<b>Interviews Report</b> (Component 2)	Interviews conducted during component 2	Mar 2021
R.2.3	<b>Surveys Report</b> alongside <i>Diagnosis Report</i>	Methods & results of the surveys and investigations	Mar 2021
R.3.1&2	<b>Engagement Report</b> (Component 3) As a compilation of (i) <i>Capacity Development Measures And Workshops (Component 3)</i> (ii) <i>Interviews and Stakeholders Meetings (Component 3)</i>	Trainings, workshops & interviews delivered in component 3	Oct 2021
R.3.3	<b>Traffic Forecast Report</b> alongside <i>Scenario Report</i>		Oct 2021
R.5.2	<b>Engagement Final Report</b> As a compilation of (i) <i>Capacity Development Measures &amp; Workshops (Component 4)</i> (ii) <i>Report on Interviews &amp; Stakeholders Meetings (Component 4)</i> (iii) <i>A Concept Note on the Ownership</i> (iv) <i>Documentation of All Communication &amp; Consultation Measures Delivered</i>	Trainings, workshops and interviews delivered during component 4; Way forward for after the SUMP and capacity development plan	Dec 2021
D.SM.R.1	<b>Monitoring and Reporting Activities</b> (Component 2)	Reported activities for the Observatory in component 2	May 2021
D.SM.R.2	<b>Monitoring and Reporting Activities</b> (Component 3)	Reported activities for the Observatory in component 3	Oct 2021
D.SM.R.3	<b>Monitoring and Reporting Activities</b> (Component 4)	Reported activities for the Observatory in component 4	Dec 2021

Link to public platform of SUMP Mebidangro reports:

<https://drive.google.com/drive/folders/1Dhj6sAoHnXVkfPO5dDjBjfvq1Z9tX9qf?usp=sharing>

Alternative short link to public platform of SUMP Mebidangro reports:

<https://bit.ly/3vCEh61>

## 1.2. Abbreviations and Symbols

Abbreviation	Language	Definition	Translation (English)
ADB	English	Asian Development Bank	same
AFD	French	Agence Française de Développement	French Development Agency
AIDB	English	Asian Infrastructure Development Bank	same
APBD	Indonesian	Anggaran Pendapatan Dan Belanja Daerah	Regional Revenue And Expenditure Budget
APBN	Indonesian	Anggaran Pendapatan Dan Belanja Negara	State Budget
APM	English	Automated People Mover	same
BAPPEDA	Indonesian	Badan Perencanaan dan Pengembangan Daerah	Planning And Development Regional Entity
BAPPENAS	Indonesian	Badan Perencanaan dan Pengembangan Nasional	Planning And Development Ministry
BRT	English	Bus Rapid Transit	same
BTS	English	Buytheservice	same
CAPEX	English	Capital Expenditure	same
DISHUB	Indonesian	Dinas Perhubungan	Transportation Agency
DRM	English	Disaster Risk Management	same
ERP	English	Electronic Road Pricing	same
EV	English	Electric Vehicles	same
GDP	English	Gross Domestic Product	same
GESI	English	Gender Equality and Social Inclusion	same
GHG	English	Greenhouse Gases	same
GOI	English	Government Of Indonesia	same
GPS	English	Geographical Positioning System	same
GRDP	English	Gross Regional Domestic Product	same
GRK	Indonesian	Gas Rumah Kaca	Greenhouse Gases
h	English	Hour	same
HSL	English	High-Speed Line	same
HSR	English	High-Speed Rail	same
IMTP	English	Indonesia Mass Transit Program	same
IT	English	Information Technology	same
JBIC	English	Japanese Bank for International Cooperation	same
JICA	English	Japanese International Cooperation Agency	same
KADIS	Indonesian	Kepala Dinas	Head Of Agency
Kemenhub	Indonesian	Kementerian Perhubungan	Ministry Of Transportation
KFW	German	Kreditanstalt für Wiederaufbau	Reconstruction Credit Institute
Km	English	Kilometer	same
KNO	Indonesian	Kualanamu (Airport)	Kualanamu Airport
KPBU	Indonesian	Kerjasama Pemerintah Dengan Badan Usaha	Public-Private Partnership
KPUM	Indonesian	Koperasi Pengangkutan Umum Medan	Medan General Transportation Cooperative
LRT	English	Light Rail Transit	same
MaaS	English	Mobility As A Service	same
Mebidang	Indonesian	Medan – Binjai – Deli Serdang	same
Mebidangro	Indonesian	Medan – Binjai – Deli Serdang – Karo	same
MOE	English	Ministry Of Environment	same
MOF	English	Ministry Of Finance	same

Abbreviation	Language	Definition	Translation (English)
MOT	English	Ministry Of Transportation	same
MRT	English	Mass Rapid Transit	same
MRV	English	Monitoring, Reporting, Verification	same
Munibond	English	Municipal Bond	same
MYC	English	MobiliseYourCity	same
NMT	English	Non-Motorized Transport	same
NUMP	English	National Urban Mobility Plan	same
OPEX	English	Operational Expenditure	same
ORGANDA	Indonesian	Organisasi Angkutan Darat	Land Transport Organization
Pax	English	Passenger	same
Pemda	Indonesian	Pemerintah Daerah	Regional Government
Pemkot	Indonesian	Pemerintah Kota	Municipal Government
Pemprov	Indonesian	Pemerintah Provinsi	Provincial Government
Perda	Indonesian	Peraturan Daerah	Regional Decree
Pergub	Indonesian	Peraturan Gubernur	Governor Decree
Perpres	Indonesian	Peraturan Presiden	Presidential Decree
PPP	English	Public-Private Partnership	same
PT	English	Public Transport	same
PT. KAI	Indonesian	PT. Kereta Api Indonesia	National Railways Company
PU	Indonesian	Pekerjaan Umum	Public Works
PUPR	Indonesian	Pekerjaan Umum Dan Pekerjaan Rakyat	Public Works And Community Activities
PV	English	Private Vehicle	same
RPJMD	Indonesian	Rencana Pembangunan Jangka Menengah Daerah	Regional Medium-Term Development Planning
RPJMN	Indonesian	Rencana Pembangunan Jangka Menengah Nasional	National Medium-Term Development Planning
SATGAS	Indonesian	Satuan Tugas	Task Force
SATPOL	Indonesian	Satuan Polisi	Police Unit
SDG	English	Sustainable Development Goals	same
SOP	English	Standard Operational Procedure	same
SU	Indonesian	Sumatera Utara (Pemerintah Provinsi)	North Sumatra (Provincial Government)
SUMP	English	Sustainable Urban Mobility Plan	same
SUMUT	Indonesian	Sumatera Utara (Pemerintah Provinsi)	North Sumatra (Provincial Government)
TOD	English	Transit Oriented Development	same
TP	Indonesian	Transportasi Publik	Public Transportation
UMP	English	Urban Mobility Plan	same
UN	English	United Nations	same
USU	Indonesian	Universitas Sumatera Utara	University Of North Sumatra
Vkt	English	Vehicle Kilometer Traveled	same
WB	English	World Bank	same
WHO	English	World Health Organization	same



### I.3. Events

No	Reference	Name of event	Brief	Date
N.1	Kick-off	MobiliseDays for Mebidangro SUMP	Official launch of the SUMP	22/10/2020
N.1	MobiliseDays	MobiliseDays for Mebidangro SUMP	Initiate and promote the SUMP towards city stakeholders	23/10/2020
N.2.2.1	Focus Group Discussion 1	FGD1: Civilians mobility needs in mebidangro	Focus on city's population mobility practices and needs	25/01/2021
N.2.2.2	Focus Group Discussion 2	FGD2: Operating transportation in Mebidangro	Focus on current transport players (passengers, operators, businesses)	25/01/2021
N.2.2.3	Focus Group Discussion 3	FGD3: Shaping a Mebidangro transportation	Focus on geographical areas and their representatives	05/02/2021
N.2.2.4	Focus Group Discussion 4	FGD4: Vulnerable groups and mobility in Mebidangro	Focus on vulnerable communities and their mobility access	16/03/2021
T.1	Training 1	Training: Data collection – Mobility survey design	Mobility survey design	05/02/2021
N.2.4	Diagnosis presentation	Urban mobility: a diagnosis before setting joint targets	Consensus on the diagnosis & the vision for urban mobility in Mebidangro	15/04/2021
N.2.3	Gender issues	Gender issues within urban mobility in Mebidangro	Raise awareness on women accessibility to transport and other public services	23/03/2021
N.3.1	Component kick off	Urban mobility: a diagnosis before setting joint targets	Launch of the Component 3 activity: Vision and scenarios	29/04/2021
N.3.2	Goal setting & prioritization	Creating the vision for urban mobility	Formalize mobility goals that are specific with Mebidangro vision	18/06/2021
T.2.1	Training 2: Data monitoring and reporting 1	Defining mobility scenarios & identifying measures to reach our common mobility goals	Function, targets, requirement, quality control	18/06/2021
N.3.3 + N.3.4	Scenario validation & Measure identification and selection	Defining mobility scenarios & identifying measures to reach our common mobility goals	Describe the scenarios to be developed and compared between each other & Defining actions and integrated packages of measures	07/07/2021
T.2.2	Training 2: Data monitoring and reporting 2	Trainings on readiness for SUMP implementation: Mobility growth monitoring and reporting	Calculation of GHG emissions reduction	24/09/2021
T.4	Training 4	Trainings on readiness for SUMP implementation: Innovative urban transport for future cities	Stakes of innovation, design process	23/09/2021
N.3.5	Scenario comparison workshop	Setting-up the comparison of mobility scenarios and related missions	Commenting and reacting to the developed scenarios and their comparison	16/09/2021
T.3	Training 3	Trainings on readiness for SUMP implementation: Transport modelling for the SUMP	Generation, Distribution, Modal distribution, Allocation	22/09/2021
N.3.6	Scenario comparison & selection	Evaluate and select the sustainable mobility scenario for Mebidangro	Decision makers to select a preferred scenario for the SUMP	25/10/2021
N.4.1.1	Workshop 1 review proposals	Finalization of the SUMP action plan for Mebidangro	Description of prioritization of measures, implementation schedule & action plan.	01/12/2021
N.4.1.2	Workshop 2 review proposals	Finalizing the SUMP action plan for Mebidangro	Description of prioritization of measures, implementation schedule & action plan	10/12/2021
N.4.2	Official presentation of the SUMP	The SUMP action plan and first implementation steps	SUMP presentation and way forward	04/02/2022

## 1.4. List of contributors

Level	English
Partner	Agence Française de Développement
Partner	The World Bank
Central	Ministry of Planning and Development
Central	Ministry of Transportation
Province	Chairman of the House of Representatives of North Sumatra Province
City/Regency	Chairman of the House of Representatives of Medan City
City/Regency	Chairman of the House of Representatives of Binjai City
City/Regency	Chairman of the House of Representatives of Deli Serdang Regency
City/Regency	Chairman of the House of Representatives of Karo Regency
City/Regency	Mayor of Medan City
Province	Head of the Development Planning Agency of North Sumatra Province
Province	Head of Road Agencies of North Sumatra Province
Province	Director of Traffic of the North Sumatra Provincial Police
City/Regency	Head of Transportation Agencies of Medan City, Binjai City, Deli Serdang Regency, Karo Regency
City/Regency	Head of the Development Planning Agencies of Medan City, Binjai City, Deli Serdang Regency, Karo Regency
City/Regency	Head of Public Works and Spatial Planning Agencies of Medan City, Binjai City, Deli Serdang Regency, Karo Regency
Province	Head of the North Sumatra Technical Body for Railway
Province	Vice President of PT. Kereta Api Indonesia (Persero) Divre I, North Sumatra
City/Regency	General Manager of Perum Damri, Medan Branch
City/Regency	Chairman of KPUM
City/Regency	Dean of the Faculty of Engineering, University of North Sumatra
City/Regency	Dean of the Faculty of the Islamic University of North Sumatra
City/Regency	Dean of the Faculty of HKBP Nommensen, University of Medan
City/Regency	Regional Chairman of the Railway Society, North Sumatra
City/Regency	Regional Chairman of the Transportation Society, North Sumatra

## II. Action Sheets

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The Action Sheets are hereby presented in English.



# ACTIONS

## List of actions

01A Car free zone (permanent closure)	optimization
01B Car free zone (temporary closure)	24B Minibuses: riding quality and comfort
02 Comfortable and safe sidewalks	increase
03 Mixed-use zones in urban centers	25 Increase quality of service of existing buses
04 Regulation to restrict urban sprawl	26 Dedicated schoolbuses
05 Framework for TOD developments	27 Promote public transportation
06 Land value capture mechanism	28 MaaS (on-demand services)
07 Reinforce driving license process	29 Monitoring system at Mebidangro level
08 Circular roads	30 Passenger information in real-time & at stations
09 Enhance road link Medan-Berastagi	31 Fare intermodality
10 Standardized road signage across Mebidangro	32 Mebidangro transit authority
11 Traffic calming measure	33 Reform minibus industry under Province
12 Safe NMT and bicycle lanes	34 Corporate tax on mobility
13 One-way streets	35 Capacity building (Technical Assistance)
14A Dedicated parking hubs at main attractions	36 Separate track and train operators
14B Dedicated parking hubs at transit hubs	37 Tax on motorized vehicles using urban roads
15 Key multimodal hubs	38 Incentives to reduce fuel consumption
16 Larger traffic law enforcement and campaigns	39 Renewable energies for rail transportation
17 Quality road network all across Mebidangro	40 Renewable energies for road public transportation
18 Limit freight vehicles to certain period of time	41 Renewable energies for private vehicles
19 BRT Line 1	42 Cleaner fuels and engines for existing road PT
20 Wider BRT network	43 Installation of air quality stations
21 Implement waterbuses	44 Communities engagement for environmental issues
22 Urban rapid rail lines	
23 Increase service levels of existing rail	
24A Minibuses: routing and operations	

## Indexes

INSTITUTIONS	BAHASA INDONESIA	ENGLISH
DISHUB	<i>Dinas Perhubungan</i>	Department of Transportation
PUPR	<i>Dinas Pekerjaan Umum dan Perumahan Rakyat</i>	Department of Public Works and Public Housing
BINA MARGA	<i>Dinas Bina Marga dan Bina Konstruksi</i>	Department of Highways and Construction Development
BAPPEDA	<i>Badan Perencanaan Pembangunan Daerah</i>	Regional Development Plan Agency
CIPTA KARYA	<i>Dinas Sumber Daya Air, Cipta Karya dan Tata Ruang</i>	Department of Water Resources, Cipta Karya and Spatial Planning
ATR/BPN	<i>Kementerian Agraria dan Tata Ruang/Badan Pertanahan Nasional</i>	Ministry of Agrarian and Spatial Planning/National Land Agency
DLH	<i>Dinas Lingkungan Hidup</i>	Department of Environment
BPKAD	<i>Badan Pengelola Keuangan Daerah</i>	Regional Financial Management Agency
DPPPA	<i>Dinas Pemberdayaan Perempuan dan Perlindungan Anak</i>	Department of Women Empowerment and Child Protection
DISPERKIM	<i>Dinas Perumahan dan Permukiman</i>	Department of Housing & Settlements
SATLANTAS	<i>Satuan Lalu Lintas</i>	Traffic Police Unit
DISKOMINFO	<i>Dinas Komunikasi dan Informatika</i>	Department of Communication and Informatics

## LIST OF INDICATORS

01 Transportation Projects in Official Plans	11 Energy Efficiency of Overall Mobility
02 Accessibility to Public Transport	12 Reduction of GHG Emissions from Mobility
03 Road Safety	13 Reduction of Air Pollution from Mobility
04 Affordability of Public Transport	14 Quality and Liveability of Public Space
05 Modal Split of PT and NMT	15 Mobility Facilities Space Usage
06 Multimodal Integration of PT at hubs	16 Mass Transit Studied
07 Comfort and Bliss of Mobility	17 Off-street Parking Hubs
08 Security of Collective Mobility	18 Bicycle Lanes
09 Commuting Travel Time	19 Sidewalks and Pedestrian Facilities
10 Road Congestion and Delays	20 Financing for Mobility



### Theme Urban Planning & Non-Motorized Transport

#### Goal

This measure aims to increase the value and activities of certain areas currently crossed by roads by closing the circulation of traffic and giving place to alternative activities. Ultimately, the measure aim to promote NMT modes within the designated area by prioritizing pedestrians and forbidding motorized vehicles. The development can be integrated with different economic activities e.g. tourism, cultural, culinary, shopping, sightseeing.

#### Background

Traffic in Mebidangro is dominated by private vehicles, that are taking the already limited space for its inhabitant to perform their activities. Moreover, the current situation indirectly encourage the inhabitant of Mebidangro to own their own vehicle rather than using any available public transportation. This measure is important has private vehicles are forecasted to reach  $\pm 8,4$  million in 2035, which will increase the pressure over the limited and valuable space, while limiting any outdoor activities by Medan inhabitants.

#### Strategy

This can be achieved by selecting roads that currently have major economic activity throughout Mebidangro with the selected locations preferably having a minimum impact on the existing travel pattern. A trial location and mechanism should be identified and tested, prior to full scale implementation.

#### Expected Output and Outcomes

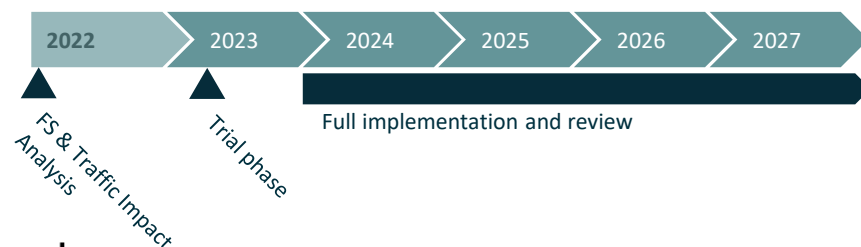
Reduce GHG and pollutants emissions and increase livability of section, potential to increase economic activities, develop NMT and pedestrian modes. Measurable impacts are marginal. The main benefit being the awareness raising of the possibility to travel without private vehicles.

#### Cost estimation and funding

An estimated IDR 1,0-1,5 billion shall be allocated to complete studies (feasibility, traffic) and implement new road signs. Source of funding: APBD (Municipal Budgets)

#### Schedule

The timeline is quite short as the action only requires a traffic study to confirm the positive effect on road traffic.

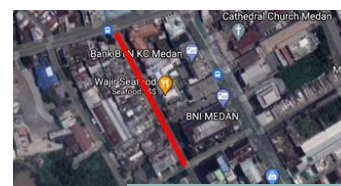
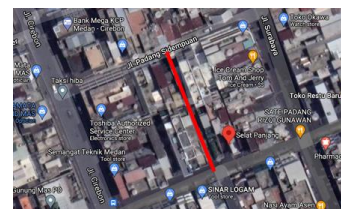


#### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

#### Risks

Description	Level
Environmental	None
Social	Low
Implementation	Medium
Operational	Low
Political	Low
Sovereignty	None



Possible locations: Street food center in Jl. Selat Panjang & Jl Kolonel Sugiono

#### Entities involved (lead, participant)

<b>DISHUB</b>	<b>OF</b>	<b>NORTH SUMATRA</b>
<b>PUPR</b>		<b>MEDAN</b>
<b>BINA MARGA</b>		<b>BINJAI</b>
<b>BAPPEDA</b>		<b>DELI SERDANG</b>
<b>CIPTA KARYA</b>		<b>KARO</b>
<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

#### Observatory indicators related

- 05. Modal Split of PT and NMT
- 07. Comfort and Bliss of Mobility
- 10. Road Congestion and Delays
- 14. Quality and Livability of Public Space
- 19. Sidewalks and pedestrian facilities



### Theme Urban Planning & Non-Motorized Transport

#### Goal

This measure aims to lower the volume of traffic passing through a certain road segment during a certain time period to increase the share of PT and NMT temporarily and lower the usage of private vehicle. The implementation of this measure is also expected to promote healthier lifestyle by encouraging active mobility.

#### Background

Traffic in Mebidangro is forecasted to reach  $\pm 8,4$  million vehicles in 2035. This will directly affect the traffic situation with increased congestion and associated pollution. It was observed that the peak hour range from 07:30-08:30 in the morning and 17:00-18:00 in the evening is counting for  $\pm 10\%$  of the daily traffic. An intervention is needed to ease the traffic during peak hours.

#### Strategy

Since travel patterns are different on weekdays and weekends, different strategies are proposed:

- Weekday:** selected location are any road segment that can induce mode shift to public transport and the closed segment need to be served by existing public transport route
- During weekend:** selected locations are necessary to be nearby any public transport route and have sufficient open area for the inhabitant to do sports and other activities, and be near attraction zones.

#### Expected Output and Outcomes

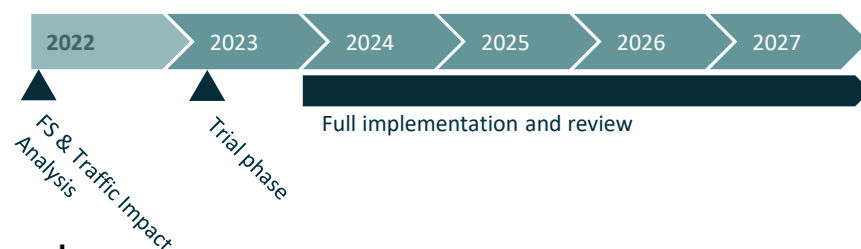
Reduce GHG and pollutants emissions and increase livability of section, potential to increase economic activities, develop NMT and pedestrian modes. Measurable impacts are marginal. The main benefit being the awareness raising of the possibility to travel without private vehicles.

#### Cost estimation and funding

An estimated IDR 1,0-1,5 billion is needed to conduct studies (impact) and implement new traffic management. Operation costs are estimated at IDR  $\pm 800$  million per year (assuming 30 personnel needed to manage the traffic). Source of funding: APBD (Municipal Budgets)

#### Schedule

The timeline is quite short as the action only requires a traffic study to confirm the positive effect on road traffic.

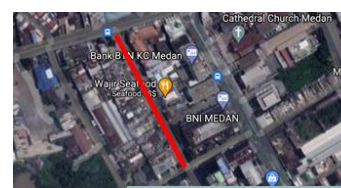
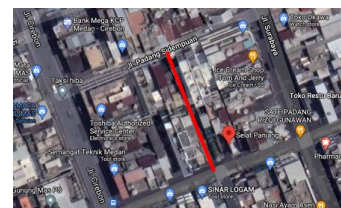


### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	Low
Implementation	Medium
Operational	Low
Political	Low
Sovereignty	None



Possible locations: Street food center in Jl. Selat Panjang & Jl Kolonel Sugiono

### Entities involved (lead, participant)

<b>DISHUB</b>	<b>OF</b>	<b>NORTH SUMATRA</b>
<b>PUPR</b>		<b>MEDAN</b>
<b>BINA MARGA</b>		<b>BINJAI</b>
<b>BAPPEDA</b>		<b>DELI SERDANG</b>
<b>CIPTA KARYA</b>		<b>KARO</b>
<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

### Observatory indicators related

- 05. Modal Split of PT and NMT
- 07. Comfort and Bliss of Mobility
- 10. Road Congestion and Delays
- 14. Quality and Livability of Public Space
- 19. Sidewalks and pedestrian facilities



### Theme Urban Planning & Non-Motorized Transport

#### Goal

To encourage active mobility for inhabitants and increase mass transportation accessibility. This entails development of new sidewalks and improvement of current sidewalks accommodating the principle of universal design.

#### Background

Active mobility can increase the health of inhabitants and reduce air pollution related to transportation. Developing safe and comfortable sidewalks in Mebidangro can be prioritized in the following location: along main PT corridors (PT with high passenger capacity), future multimodal hub area (LRT/BRT/intercity train), and activity center. In Mebidangro, pedestrians and non-motorized transport users are plural across the area. Their trip distance is generally shorter than motorized vehicles. It shall be noted that roads accommodating most NMT have important semi-vegetalized medians (between 0,5 and 1 meter). Developing NMT facilities would offer the opportunity to review the road geometry and functionality of its components.

#### Strategy

The implementation can be based on local and national regulation, such as Minister of Public Works Regulation No. 03/2014 and 14/2017 and should adapt the universal design principles. This includes following the standard width & additional facilities such as street lamp, tactile/guiding blocks, ramps (disabled friendly facilities), closed drainage type, suitable dimension and gradient. The safety audit should be undertaken with the community to ensure accessibility for all.

#### Expected Output and Outcomes

Increase in NMT and PT share, increase of the quality of multimodal integration, increase of the livability of area for inhabitants and users, and increased of safety for woman and vulnerable groups to access public transportation.

#### Cost estimation and funding

Ranging from IDR 3-5 million/m2 for a new constructed sidewalk and IDR 10.000/m2.year for maintenance cost for street lamp, tactile and pavement. Total cost for construction of 5-km sidewalk per year, both left and right sides, is estimated at IDR 680 billion.

Source of funding: APBD (Regional and Municipal Budgets)



Pedestrian sidewalk in Medan



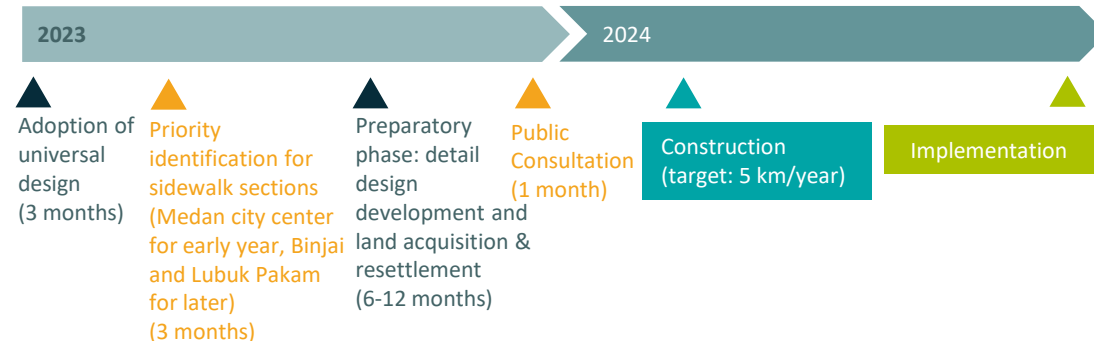
#### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

#### Risks

Description	Level
Environmental	None
Social	Low
Implementation	Low
Operational	Low
Political	None
Sovereignty	None

#### Schedule



#### Entities involved (lead, participant)

DISHUB	OF	NORTH SUMATRA
PUPR		MEDAN
BINA MARGA		BINJAI
BAPPEDA		DELI SERDANG
CIPTA KARYA		KARO
ATR/BPN		CENTRAL GOV.
DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

#### Observatory indicators related

02. Accessibility to Public Transport
03. Road Safety
05. Modal Split of PT and NMT
06. Multimodal Integration of PT at hubs
07. Comfort and Bliss of Mobility
08. Security of Collective Mobility
10. Road Congestion and Delays
14. Quality and Livability of Public Space
17. Off-street parking hubs
19. Sidewalks and Pedestrian Facilities



### Theme Urban Planning & Non-Motorized Transport

#### Goal

This measure aims to increase diversity of activities/services within dense urban centers to reduce the need of mobility.

#### Background

Mixed-use developments combine residential and non-residential building uses, in planned and developed buildings, within a zone and allow multiple activities within a short range of distance. A balanced mix of complementary uses and activities within an area (e.g. a mix of residences, workplaces, recreational and retails), can help many daily trips remain short and walkable.

#### Strategy

Mixed-use developments require a regulatory framework but also involving private actors:

- 1) Integration of vision for mixed-use development in spatial planning documents (RTRW & RDTR), alongside with TOD concepts. Adoption of mixed-use zoning should also be integrated with an increase in density or Floor Area Ratio;
- 2) Identification of potential zones for piloting/promoting the developments. This includes identification of land status & potential models of implementation in different urban settings;
- 3) Specify the concept of mixed-use developments in the detailed master plan (RTBL) that provides a set of design regulations for type of buildings and interspaces allowed;
- 4) Identification of actors to involve in the development. This should include public agencies (government), property owners, private investors and business actors, as well as residents;
- 5) Build consensus and buy-in on the principles of mixed-use among key local actors;
- 6) Implementation of mixed-use developments.

#### Expected Output and Outcomes

Modal share of non-motorized transportation and public transport are expected to increase, and accessibility to facilities improved, leading to less travel time within the mixed-use area. It is expected to indirectly improve livability for residents and increase land value around developments.

#### Cost estimation and funding

Implementation costs vary from site to site for the governments, but include: (i) Cost of study on models of for mixed-used zoning, (ii) Cost of revising regulations, (iii) Possible land acquisition for development of new facilities and (iv) Dialogue with community/stakeholders/land owners.



#### Impacts

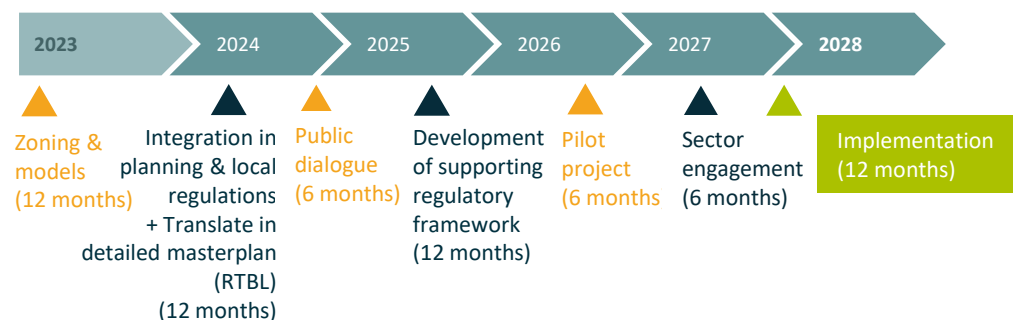
Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

#### Risks

Description	Level
Environmental	None
Social	Medium
Implementation	Medium
Operational	None
Political	Medium
Sovereignty	Low

#### Schedule

Implementation of mixed-use development could be varied from one place to another depending on the site context, and might take a longer time as this need institutionalization and regulatory processes. With implementation foreseen in 2028, several steps are recommended:



#### Entities involved (lead, participant)

DISHUB	OF	NORTH SUMATRA
PUPR		MEDAN
BINA MARGA		BINJAI
BAPPEDA		DELI SERDANG
CIPTA KARYA		KARO
ATR/BPN		CENTRAL GOV.
DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

#### Observatory indicators related

- 05. Modal Split of PT and NMT
- 09. Commuting Travel Time
- 11. Energy Efficiency of Overall Mobility
- 14. Quality and Livability of Public Space
- 15. Mobility Facilities Space Usage





### Theme Urban Planning & Non-Motorized Transport

#### Goal

The objective of this measure is to limit the urban sprawl and enable more effective land use which minimizes the need of long-commute (using public transportation or private vehicles). This measure should be implemented alongside the development of mass transport, TOD infrastructures and comfortable and safe NMT facilities. With the integrated approach, this action is not only aiming at creating an effective land use, but also preserving the environmental capacity, avoid the loss of productive land, and provide better opportunities for environmental management.

#### Background

The current situation of Mebidangro indicates an uncontrolled urban development, materialized by the emergence of unplanned settlements. This situation might hinder any urban development planned by the government. Currently, household settlements were developed along the axis towards Binjai and Lubuk Pakam, meanwhile high revenue households settlement develop along the southern axis of Medan, stressing roads radiating from Medan. Furthermore, the current road coverage is quite low and should be kept in such way in order to ease and push the modal shift to public transport (see below).

#### Strategy

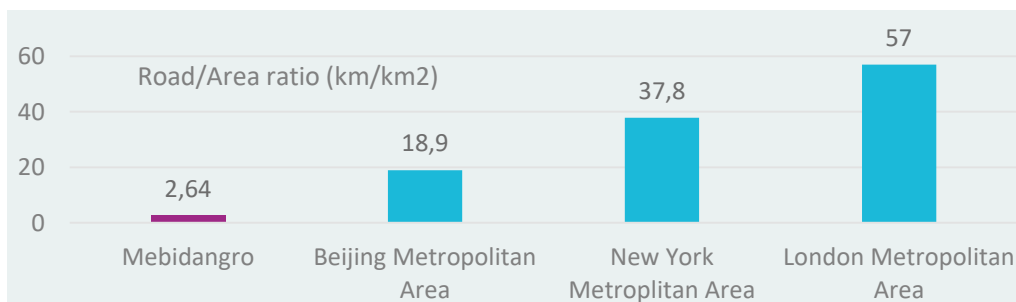
This measure will be initiated by series of studies prior to the development of the new regulation. The key success point of this measure relies on how to ensure the law maker to legislate this new regulation and appoint an agency to monitor the implementation of this law regularly.

#### Expected Output and Outcomes

More compact and orderly development in the selected zones. Alongside with development of public transport system, this regulation will contribute to increase the share of public transport (PT) in the area. Improve the life quality of the residents with less commute time. Long term impact will be the imitation of urban sprawl and related challenges. Increased affordability of housing in centers and positive social inclusivity and access to economic opportunities.

#### Cost estimation and funding

Cost of spatial studies and legal studies are roughly estimated around IDR 10 Billion  
Source of funding: APBD (Regional and Municipal Budgets)



#### Impacts

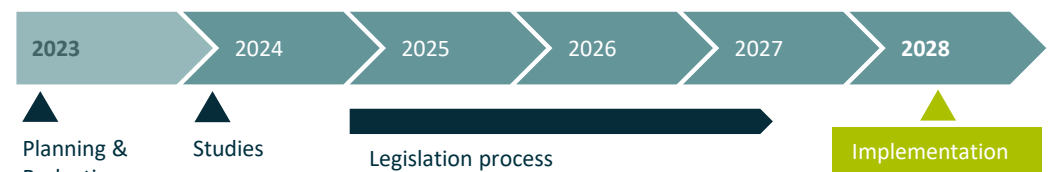
Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

#### Risks

Description	Level
Environmental	None
Social	Medium
Implementation	Medium
Operational	Medium
Political	Medium
Sovereignty	None

#### Schedule

While the activities are straightforward on paper, the several risk listed above pose an important threat to the schedule proposed (long consultations in case of resistance, formation of the monitoring team, etc.).



#### Entities involved (lead, participant)

DISHUB	OF	<u>NORTH SUMATRA</u>
<u>PUPR</u>		<u>MEDAN</u>
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BAPPEDA		<u>DELI SERDANG</u>
CIPTA KARYA		<u>KARO</u>
ATR/BPN		<u>CENTRAL GOV.</u>

DLH  
BPKAD  
DPPPA  
DISPERKIM  
SATLANTAS  
DISKOMINFO

#### Observatory indicators related

- 10. Road Congestion and Delays
- 14. Quality and Livability of Public Space
- 15. Mobility Facilities Space Usage



### Theme Urban Planning & Non-Motorized Transport

#### Goal

To initiate the definition of the official regulation regarding the TOD developments in the real estate. This regulation would ne aimed to be implemented and managed by the transportation projects owners as well as developers and act as a funding lever for mobility projects.

#### Background

TOD is identified by Presidential Regulation as a lever to fund transportation projects and increase their viability. However, the legal framework to push and guide for project operators and/or owners to include TOD within their activities and consider it as part of a transportation project, does not exist.

#### Strategy

The national government should:

- Support a dedicated TOD unit (primarily in technical assistance);
- Create and maintain the TOD project banks in prioritized list for funding and implementation;
- Develop co-financing scheme for public transport systems and social housing financed by the national government and territorial entities;
- Investigate additional strategies to attract private investment;
- Summarize the guidance and coordinate the changes by proposing a TOD national policy document for approval by the government.

#### Expected Output and Outcomes

Increase the **possibility of TOD as financing lever of transit** (both financing and fiscal capacity for PT) by improving the financial risk management understanding, attracting and gaining interest from investors, and identifying the potential property developers.

#### Cost estimation and funding

The costs should consider several variables primarily related to studies and assistances, public consultation, and legalization of the regulation (including the approval process, socialization, and monitoring). Source of funding: APBN (Provincial Budgets)

#### Schedule

Preparing a functional framework for TOD should take no less than 3 to 4 years.



### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	None
Implementation	None
Operational	None
Political	Low
Sovereignty	None



### Entities involved (lead, participant)

<b>DISHUB</b>	<b>OF</b>	<b><u>NORTH SUMATRA</u></b>
<b>PUPR</b>		<b>MEDAN</b>
<b>BINA MARGA</b>		<b>BINJAI</b>
<b>BAPPEDA</b>		<b>DELI SERDANG</b>
<b>CIPTA KARYA</b>		<b>KARO</b>
<b>ATR/BPN</b>		<b><u>CENTRAL GOV.</u></b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

### Observatory indicators related

- 06. Multimodal Integration of PT at hubs
- 16. Mass Transit Studied
- 20. Financing for Mobility





### Theme Urban Planning & Non-Motorized Transport

#### Goal

To create a new revenue stream for governments to fund transportation projects from the creation of value of these projects themselves. This law will enable governments to reap out land value increases of estates and land along PT corridors. Thus enabling city government bodies to collect new taxes and charges, and develop new retribution. Ultimately improving the current financial situation of the local government to fund its transportation projects and public transport services.

#### Background

The current financial situation of Mebidangro government indicate limited financial capability and capacity to fund the operation of mass transit operation sustainably. An innovative collection scheme need to be developed and explored in order to finance and fund the mobility development project throughout Mebidangro. These development projects will bring a direct benefit in the increase of land value to the surrounding area of the projects, which can be capitalized by the government to improve their financial situation.

#### Strategy

This measure will be initiated by a series of studies prior to the development of the new regulation. The key success point of this measure relies on how to ensure the law maker to legislate this new regulation and appoint an agency to monitor the implementation of this law regularly. Also develop tools for the identification of responses from the market regarding the implementation of this new law. Along with sound marketing activities to the public regarding the benefit of the implementation of this new law.

#### Expected Output and Outcomes

Enhanced funding and financing capacity of city and province governments (to be defined) for transit projects.

#### Cost estimation and funding

Cost of Tax, Legal, Financial and Land Studies roughly estimated around IDR 8 Billion  
Source of funding: APBD (Regional and Municipal Budgets)

#### Schedule

While this issue has been studied in the past for Jakarta case, an ideal timeline is proposed but highly depends on the level of effort that will be put into it. Furthermore, the timeline also depends on the works being currently conducted at central level (LVC for infrastructure projects framework) and its translation into provincial regulations.

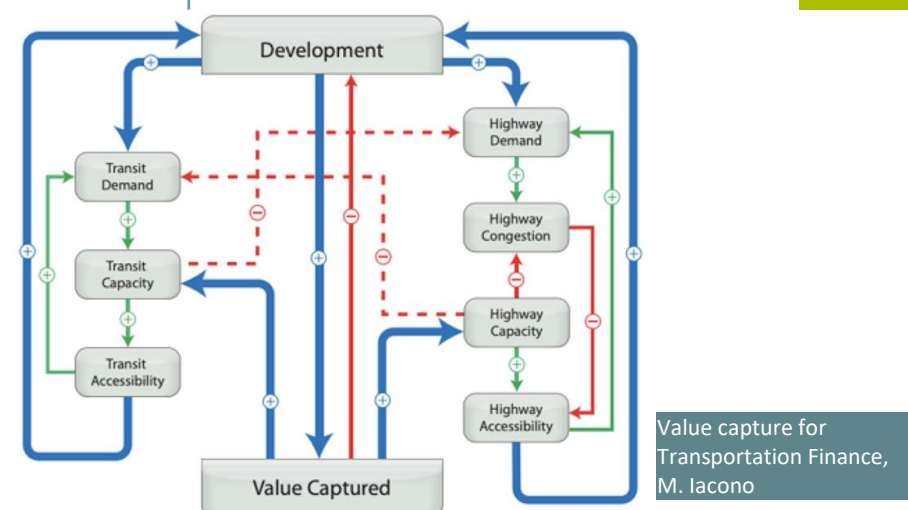


### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	Medium
Implementation	Medium
Operational	Medium
Political	Medium
Sovereignty	None



Value capture for Transportation Finance, M. Iacono

### Entities involved (lead, participant)

DISHUB	OF	<u>NORTH SUMATRA</u>
PUPR		MEDAN
BINA MARGA		BINJAI
BAPPEDA		DELI SERDANG
CIPTA KARYA		KARO
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DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

### Observatory indicators related

20. Financing for Mobility



### Theme Urban Planning & Non-Motorized Transport

#### Goal

To encourage the usage of NMT for inhabitants and increase user convenience, comfort, safety, accessibility and enjoyment as well as savings from reduced vehicle ownership and use.

#### Background

Safe transport facilities for non-motorized transport (NMT) is essential to encourage active mobility. NMT and bicycle lanes development in Mebidangro will be prioritized in the following locations: along corridors with a high-share of NMT and transit hubs or future multimodal hub area. The implementation will adopt the universal design principles and consider local regulation.

#### Strategy

The planning and implementation should follow the construction and standards guideline in *PEDOMAN Bidang Jalan dan Jemabatan Perancangan Fasilitas Pesepeda 05/P/BM/2021* and *Peraturan Pemerintah Nomor 34 Tahun 2006 tentang Jalan*.

#### Expected Output and Outcomes

Reduced traffic congestions, economic and environmental benefits from reduced energy consumption, improving accessibility, and reducing costs of roadway and parking construction and maintenance.

#### Cost estimation and funding

Implementation cost ranges from IDR 3 million – IDR 5 million/km for new constructed bicycle lanes, and IDR 10.000/m<sup>2</sup>/year for the maintenance cost. Total length of the proposed cycle length is 68.4 km, thus the construction cost will be around IDR 273.6 billion in total. Source of funding: APBD (Regional and Municipal Budgets).

#### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

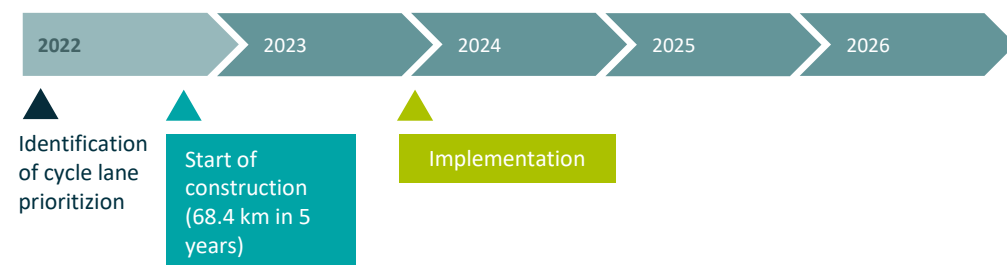
#### Risks

Description	Level
Environmental	None
Social	Low
Implementation	Low
Operational	Low
Political	Low
Sovereignty	None



Segregated and on-street cycle lane

#### Schedule



#### Entities involved (lead, participant)

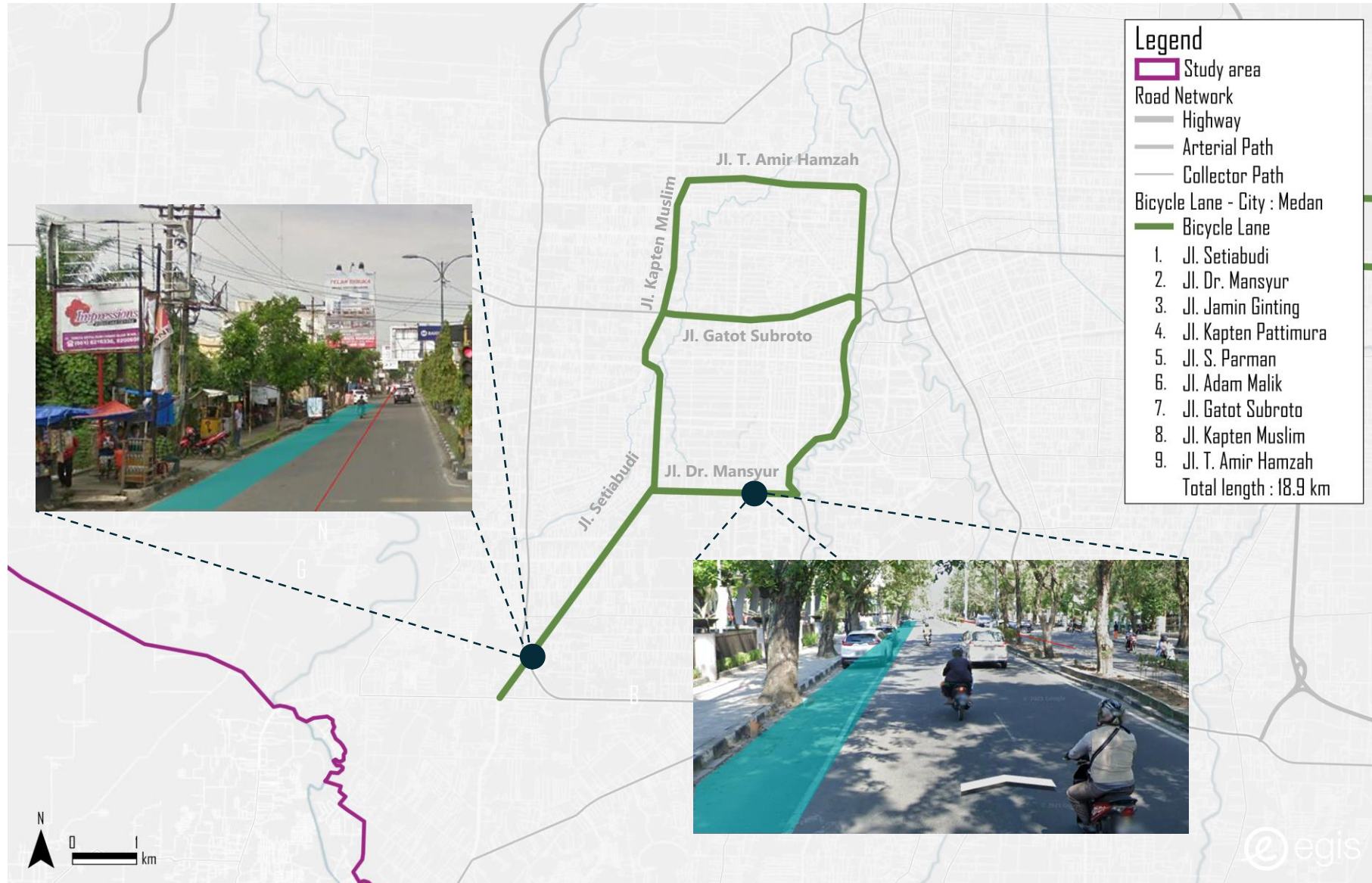
<b>DISHUB</b>	OF	<b>NORTH SUMATRA</b>
<b>PUPR</b>		<b>MEDAN</b>
<b>BINA MARGA</b>		<b>BINJAI</b>
<b>BAPPEDA</b>		<b>DELI SERDANG</b>
<b>CIPTA KARYA</b>		<b>KARO</b>
<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

#### Observatory indicators related

- 03. Road Safety
- 05. Modal Split of PT and NMT
- 07. Comfort and Bliss of Mobility
- 09. Commuting Travel Time
- 10. Road Congestion and Delays
- 14. Quality and Livability of Public Space
- 15. Mobility Facilities Space Usage
- 18. Bicycle Lanes
- 19. Sidewalks and Pedestrian Facilities



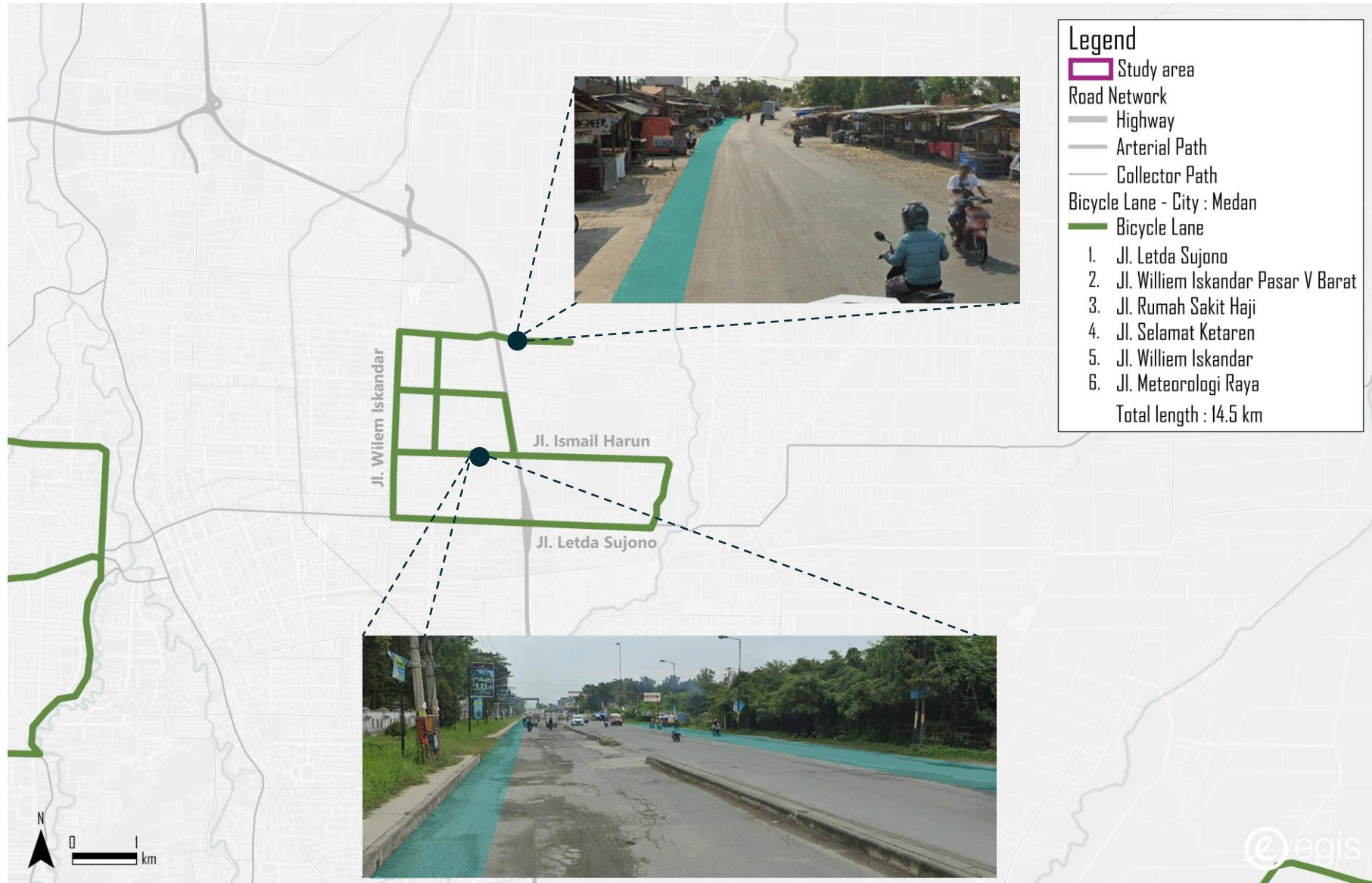
### Proposed bicycle lane in Medan (1/2)







### Proposed bicycle lane in Medan (2/2)





### Proposed bicycle lane in Binjai







### Proposed bicycle lane in Deli Serdang





**Theme** Road network for private vehicles

**Goal**  
The goal of the measure is to construct 3 segments of circular roads in order to reduce the congestion and delay of the traffic in Medan city center.

**Background**  
Currently, there are several external-to-external trips that are passing through the Medan city center even though these external trips do not necessarily need to pass or to stop in the city center. The purpose of the circular road is to assist in reducing traffic volumes in the urban center, by offering an alternate route around the city for drivers who do not need to cross or stop in the city center. Circular roads can also serve to connect Medan-Binjai-Deli Serdang, allowing efficient travel between them.

**Strategy**  
Circular roads are planned to be constructed around Medan area (3 segments) in order to allow through-traffic to avoid Medan city center and busy intersections.

**Expected Output and Outcomes**  
Increased mobility and accessibility, improved speed, reduced travel time and congestion in the city center, and indirect economic benefits. With the implementation of these new roads, we estimate it could help save 720 Vehicle-Hours during the PM peak hour.

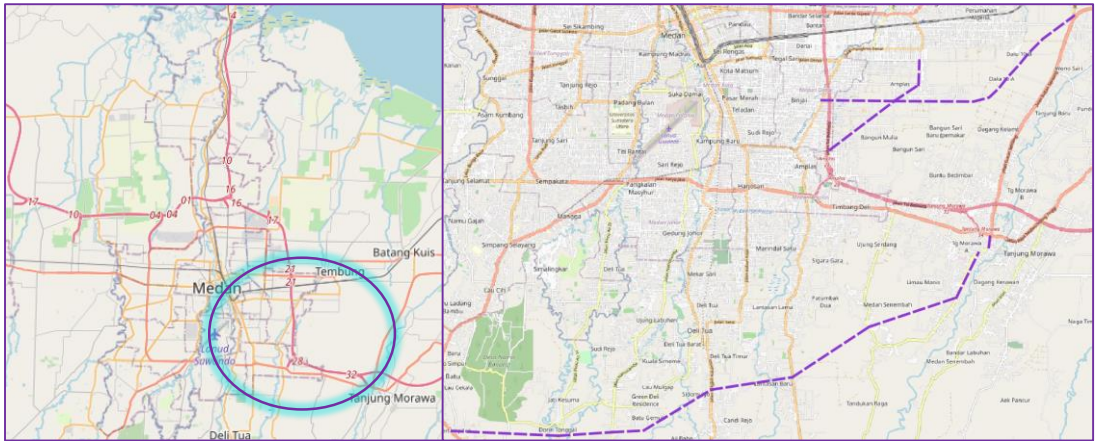
**Cost estimation and funding**  
With a rough estimation of road construction 4-7 billion IDR/km, the total cost is up to 263.9 billion IDR. Source of funding: APBD (Regional and Municipal Budgets)

Schedule



Impacts	Risks	Description	Level
Environmental	Environmental	Potential during construction	Medium
Socio-economic	Social	Potential during land acquisition	Medium
Governance	Implementation	-	Low
Novelty	Operational	-	None
	Political	-	None
	Sovereignty	-	None

Planned Circular Road Construction



Entities involved (lead, participant)	Observatory indicators related
<b>DISHUB</b> <b>PUPR</b> <b>BINA MARGA</b> <b>BAPPEDA</b> <b>CIPTA KARYA</b> <b>ATR/BPN</b> <b>DLH</b> <b>BPKAD</b> <b>DPPPA</b> <b>DISPERKIM</b> <b>SATLANTAS</b> <b>DISKOMINFO</b>	03. Road Safety 09. Commuting Travel Time 10. Road Congestion and Delays 15. Mobility Facilities Space Usage





**Theme** Road network for private vehicles

### Goal

The goal of the measure is to improve the mobility between Medan and Berastagi. In order to do so, the pavement quality and road geometry should be improved. The safety aspects also should be improved, especially in sharp curves with short sight distance.

### Background

The road between Medan and Berastagi is about 65 km with up to 3.5 hours travel time (average speed 20-30 km/h) between the two cities. This is the only road directly connecting Medan and Berastagi and it is used by important freight traffic in daily basis. The relatively low speed on this road is caused by the road geometry (sharp curves and steep terrain) and poor pavement quality. Road type 2/2UD: 2 lanes for 2 ways, undivided. Since there is only 1 lane for each direction and due to a large share (%) of freight vehicle, there is a high probability of platoon movements. In addition, trucks move at a significantly lower speed especially in mountainous terrain. If there is not enough provision for passing at frequent intervals, passenger vehicles are forced to platoon, resulting to a significantly longer travel time.

### Strategy

This could be achieved by redesigning the horizontal and vertical alignment to provide adequate passing sight distance over a large proportion of the road length as practical. Where achievement of sufficient passing sight distance is not practical, auxiliary lanes such as truck climbing lanes or passing lanes should be considered as a means to obtain the desired average speed and travel time.

### Expected Output and Outcomes

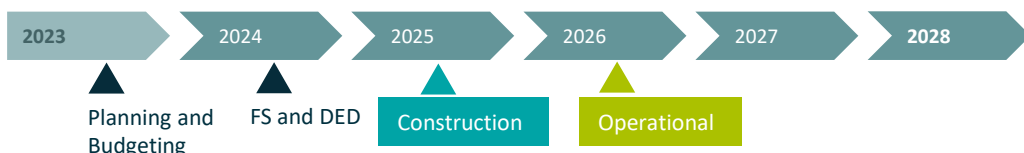
Increased mobility between Medan – Berastagi, reduced travel time, reduced vehicle operating costs, reduced congestion and GHG emission, reduction in the number of accidents and related injuries and casualties, and indirect economic benefits.

### Cost estimation and funding

With a rough estimation of road improvement (patching and overlaying) 500 million IDR/km, the total cost is up to 30 billion IDR. Source of funding: APBD (Regional and Municipal Budgets)

### Schedule

An ideal timeline makes the road operational and safe within 2026.



### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Risks	Description	Level
Environmental	Potential during construction	Medium
Social	-	Low
Implementation	Resources-intensive project	High
Operational	-	Low
Political	Depends on regional leadership	Medium
Sovereignty	-	None

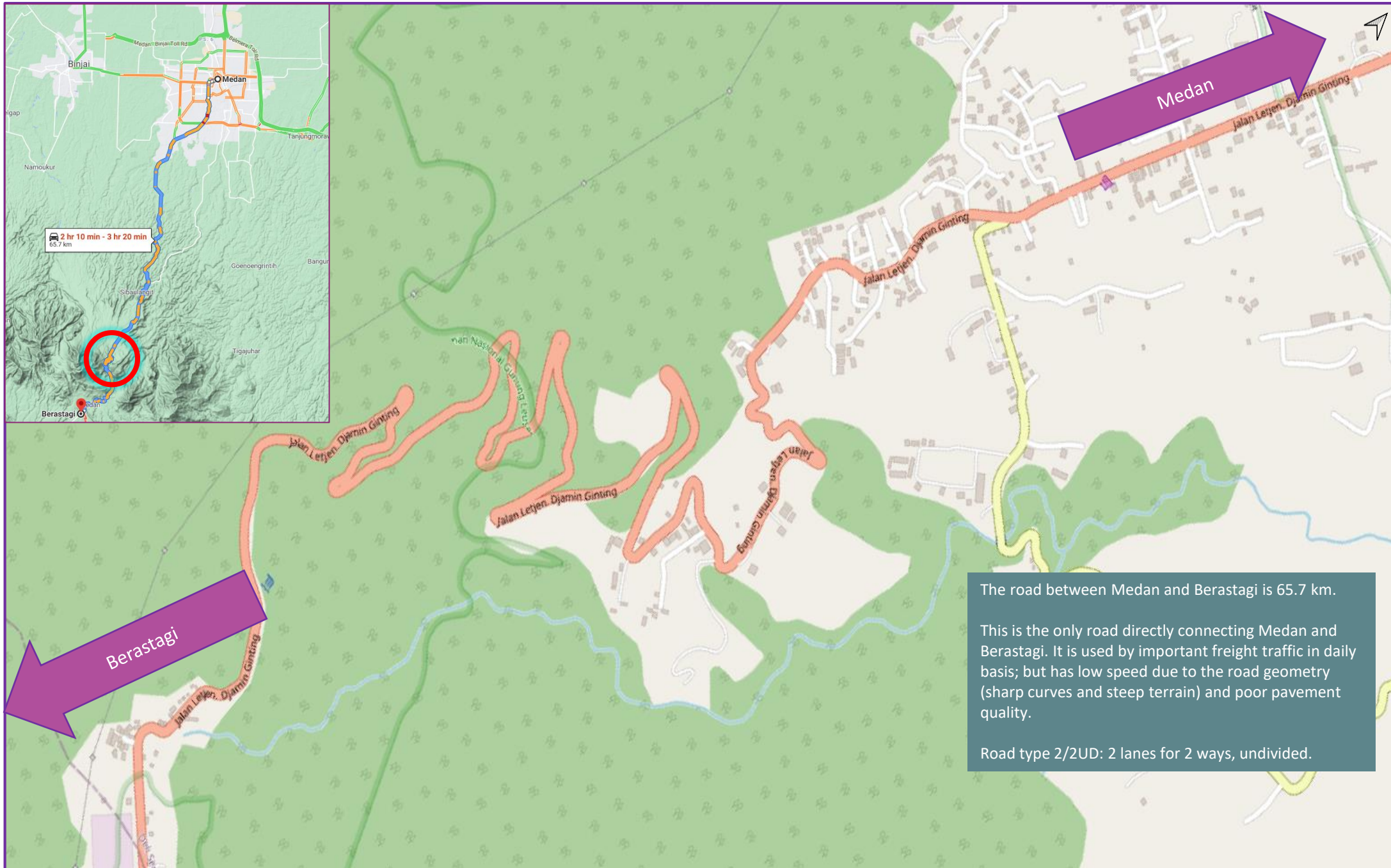


### Entities involved (lead, participant)

DISHUB	OF	<u>NORTH SUMATRA</u>
PUPR		MEDAN
<u>BINA MARGA</u>		BINJAI
BAPPEDA		<u>DELI SERDANG</u>
CIPTA KARYA		KARO
ATR/BPN		CENTRAL GOV.
DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

### Observatory indicators related

- 03. Road Safety
- 07. Comfort and Bliss of Mobility
- 08. Security of Collective Mobility
- 10. Road Congestion and Delays
- 12. Reduction of GHG Emissions from Mobility
- 13. Reduction of Air Pollution from Mobility





**Theme** Road network for private vehicles

### Goal

Standardization of road signage in Mebidangro to increase the clarity of instructions to road-users and indirectly increase vulnerable groups accessibility to mobility, as well as improve road behaviors. The long-term goal is to decrease road casualties.

### Background

Many road-users find it difficult to understand road signs in Mebidangro. Indonesia Standard Regulation & Ministerial Regulation 13/2014 have emitted standards for road signage that should be applied in Mebidangro. However, this is not always the case.

### Strategy

- Inventory of rules and homogenization needed
- Inventory of used signage and actors
- Homogenization of related signage in standards
- Implementation of road signage
- Training of agents and police staff

### Expected Output and Outcomes

Standardized signage criteria shall provide convenience and safety to road-users in travelling across Mebidangro roads as well as road violation management.

### Cost estimation and funding

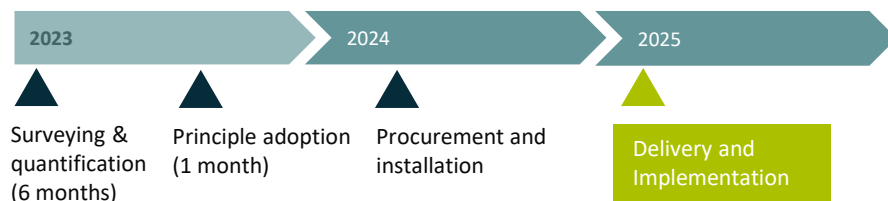
With a rough estimation of road signage, marking, and delineator improvement, the total of implementation *(CAPEX) is up to 4 billion IDR/km*. With a first priority on 751 km of main-axes road, the total CAPEX is up to 3 trillion.

And the operational cost which should be provided in order to do the maintenance *(OPEX) is up to 100 million IDR/year*.

Source of funding: APBD (Regional and Municipal Budgets)

### Schedule

While the procurement and installation of new road signage is relatively rapid, the challenge is in identifying and quantifying accurately the needs.

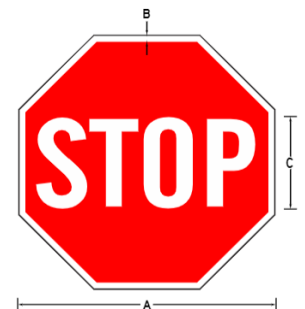


### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

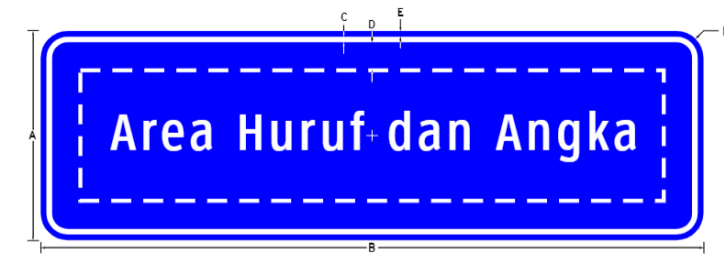
### Risks

Description	Level
Environmental	None
Social	None
Implementation	Low
Operational	None
Political	Low
Sovereignty	None



Jenis Ukuran	A	B	C
Kecil	450	9	150
Sedang	600	16	200
Besar	750	19	250
Sangat Besar	900	22	300

(dalam mm)



Jenis Ukuran	A	B	C	D	E	r
Minimal	1.200	1.600	15	45	15	40
Maksimal	1.600	4.000	60	90	60	-

(dalam mm)

Source: Permenhub 13/2014

### Entities involved (lead, participant)

DISHUB	OF	NORTH SUMATRA
PUPR		MEDAN
BINA MARGA		BINJAI
BAPPEDA		DELI SERDANG
CIPTA KARYA		KARO
ATR/BPN		CENTRAL GOV.
DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

### Observatory indicators related

- 02. Accessibility to Public Transport
- 03. Road Safety
- 08. Security of Collective Mobility
- 10. Road Congestion and Delays
- 14. Quality and Livability of Public Space





### Theme Road network for private vehicles

#### Goal

Decrease speeds to favorize NMT and reduce road accidents, by forcing speed decrease and raising awareness.

#### Background

Mebidangro has a high road fatality rate with approximately 550 casualties every year, which is equivalent to two commercial jet planes between Jakarta and Medan. At the root of it, the lack of road education amongst its users as well as the lack of identified signaling and traffic calming measures. It is an accompanying measure parallel to the other actions.

Traffic calming measures are proposed to be implemented in priority at black spots of Mebidangro as identified in the next page, procuring a low cost solution and quick win over road safety. Education and awareness raising towards road users shall be conducted, at least at the start of the effectiveness of traffic calming measures, to ensure road users are familiar with the rules implied.

#### Strategy

After having identified the priority locations to receive traffic calming (black spots), the measures have to be studied (traffic impact analysis...) and costed before their detailed design. The validation of these projects should be smooth and socialized by the traffic police. By having the road agency of the Province leading this action, city/regency administrations are more likely to follow. The implementation can occur in different phases with trial periods, before replication in all Mebidangro territory.

#### Expected Output and Outcomes

- Gain in safety because those measures can reduce the number of accidents, especially between different modes.
- More comfort in the streets concerned.

#### Cost estimation and funding

To be evaluated depending on priority spots during technical design.

#### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

#### Risks

Description	Level
Environmental	None
Social	Low
Implementation	None
Operational	Low
Political	None
Sovereignty	None



Simple yet efficient measures such as roundabouts, median islands, diagonal diverters or corner extensions help forcing the decrease of traffic speeds and reduce the danger of road traffic, and by extension increasing the safety of the users of the public space and reducing road congestion.

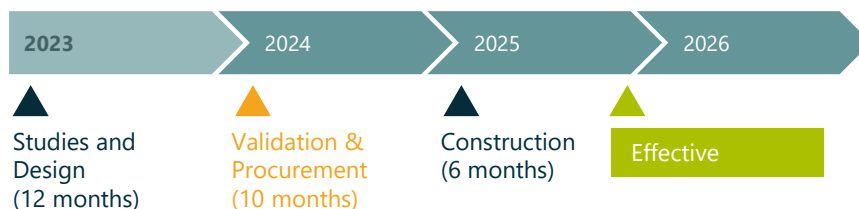
#### Entities involved (lead, participant)

DISHUB	OF	<u>NORTH SUMATRA</u>
PUPR		MEDAN
<u>BINA MARGA</u>		BINJAI
BAPPEDA		DELI SERDANG
CIPTA KARYA		KARO
ATR/BPN		CENTRAL GOV.
DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

#### Observatory indicators related

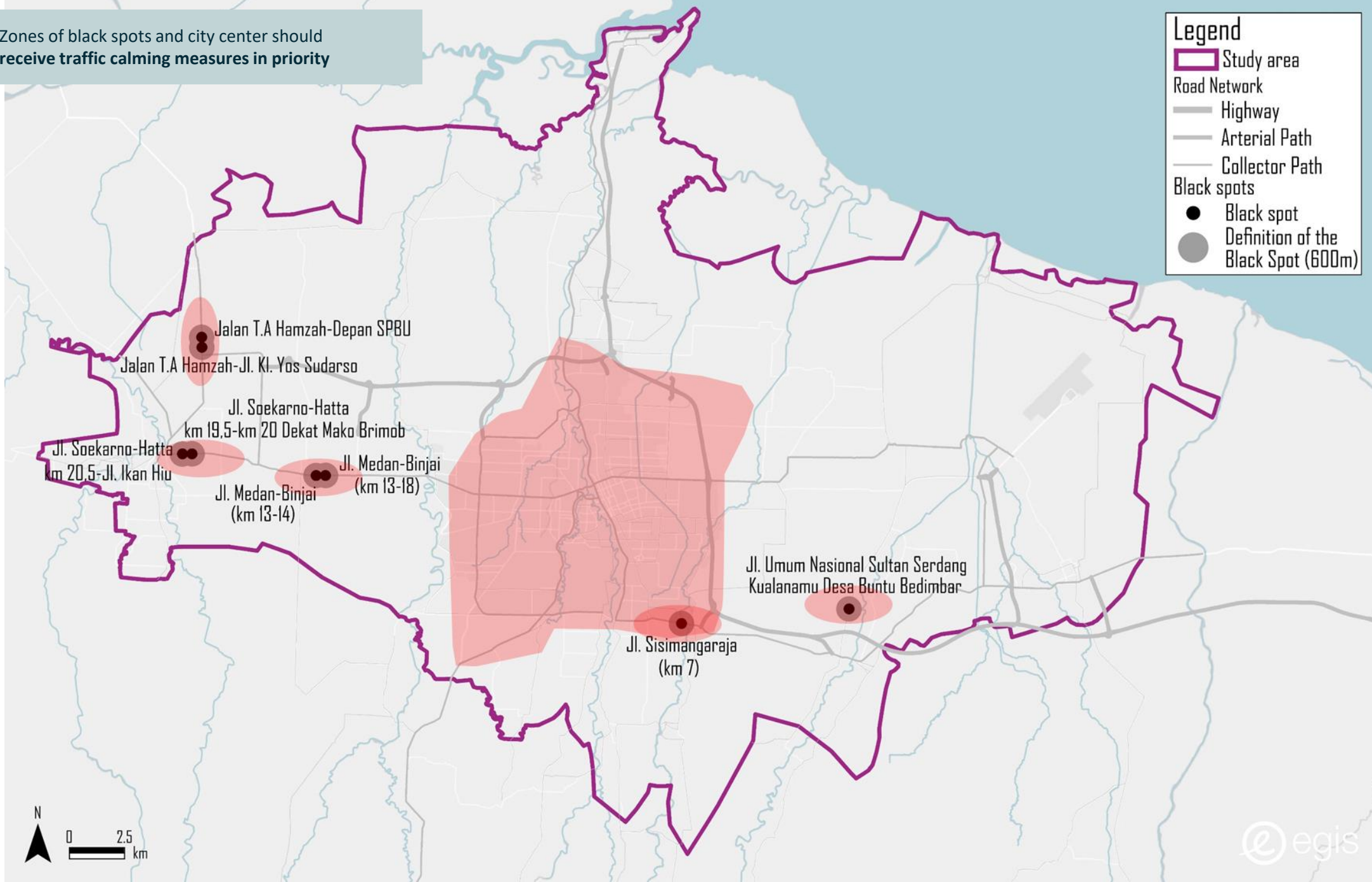
1. Transportation Projects in Official Plans
03. Road Safety
07. Comfort and Bliss of Mobility
08. Security of Collective Mobility
10. Road Congestion and Delays
14. Quality and Livability of Public Space
15. Mobility Facilities Space Usage
18. Cycle Lanes
19. Sidewalks
20. Financing

#### Schedule





Zones of black spots and city center should receive traffic calming measures in priority





### Theme Road network for private vehicles

#### Goal

To reduce the number of people that don't have driving competencies – this is expected to indirectly reduce the number of road accidents in Mebidangro and calm traffic.

#### Background

Mebidangro has a particularly high rate of road casualties with approximately 550 deaths per year. While the reasons of that high figure are investigated on many facets, the infamous driving behaviors of road users is often mentioned and observed, although challenging to report or state given the tolerant police authority.

Incidencies being observed up to the motorcycle users wearing of helmets, it is proposed to follow the central government directive to reinforce and tighten the process for the delivery of driving licenses for road and private vehicles users.

#### Strategy

This measure could be implemented quickly since a new regulation for driving license reinforcement was recently issued by the National Government. No particular challenge is identified. All media already exist and are provided by the Central Government.

To reinforce the driving license delivery process in Mebidangro, the province police should refer to the recent regulation issued by Presidential Decree, with several steps:

- A new regulation has been set by the Government for acquiring driving license permit (Perpol 05/2021): to apply for a driving license, applicants have to acquire a driving certificate from certified bodies – with a minimum age of 6 months.
- Penalty points are applied (Perpol 05/2021). Exceeding the threshold would cancel the driving license.
- Several capacity building for PT/freight driving permits are needed.
- Data integration with Dukcapil: only person above 17 years old or more (ID card) can register for a driving license permit

#### Expected Output and Outcomes

It is expected to increase driving competencies for drivers of private and public vehicles, and have calmed and organized traffic on the medium-term, with less road incivilities. Furthermore, indirect impacts are the road-law abiding citizens and long-term reduction of road casualties.

#### Cost estimation and funding

Increased mobilization and training for police officers on driving license delivery – should not incur additional costs.

### Impacts

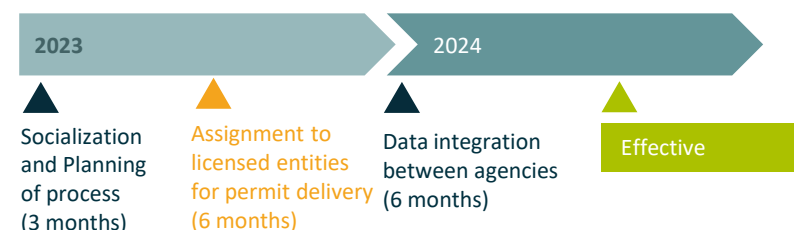
Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	Medium
Implementation	Medium
Operational	Low
Political	Low
Sovereignty	None

### Schedule

Since the relevant regulation already issued by the Government, it is Mebidangro Government obligation to implement, socialize, and maintain. The estimated timeline for accelerating reinforcement of driving license process are the following:



### Entities involved (lead, participant)

<b>DISHUB</b>	<b>OF</b>	<b><u>NORTH SUMATRA</u></b>
<b>PUPR</b>		<b>MEDAN</b>
<b>BINA MARGA</b>		<b>BINJAI</b>
<b>BAPPEDA</b>		<b>DELI SERDANG</b>
<b>CIPTA KARYA</b>		<b>KARO</b>
<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b><u>SATLANTAS</u></b>		
<b>DISKOMINFO</b>		

### Observatory indicators related

- 03. Road Safety
- 08. Security of Collective Mobility
- 10. Road Congestion and Delays
- 14. Quality and Livability of Public Space





### Theme Road network for private vehicles

#### Goal

The goal of the measure is to improve the flow of traffic and to reduce congestion by converting bidirectional roads into one-way streets.

#### Background

The implementation of one-way street system could facilitate a smoother flow of traffic through the city. In addition, one-way street would improve the traffic where the streets are too narrow for movement in both directions. In Mebidangro, there are several streets that could have an improvement on traffic performance by implementing the one-way street configuration, especially in the streets that have these characteristics:

- Narrow streets (less than 3 m for each lane)
- High volume capacity ratio (> 0.85)
- Preferably undivided roads (with no median)
- Have another adjacent parallel road in the road network

#### Strategy

This measure could be implemented by:

- Creating a thorough traffic analysis to measure impact of the change;
- Discussing and socializing with BAPPEDA, Dinas PUPR/Bina Marga, and current public transport operator. Public socialization on local newspaper, social media, and others;
- Placing road signage and installing temporary water barriers at intersections for the trial run, and then change it to permanent separators later;
- Assigning police and DISHUB officer to manage traffic, especially during the trial and first weeks of implementation.

#### Expected Output and Outcomes

- More efficient traffic flow in roads and intersections;
- Reduced travel time with higher speed and better signal timing;
- Improved road safety due to reduced conflicting maneuvers.

#### Cost estimation and funding

Relatively low costs, as it only requires public socialization and procurement of some road signs and barriers. The total estimated cost is up to 3 billion IDR. Source of funding: APBD (Regional and Municipal Budgets)

#### Schedule



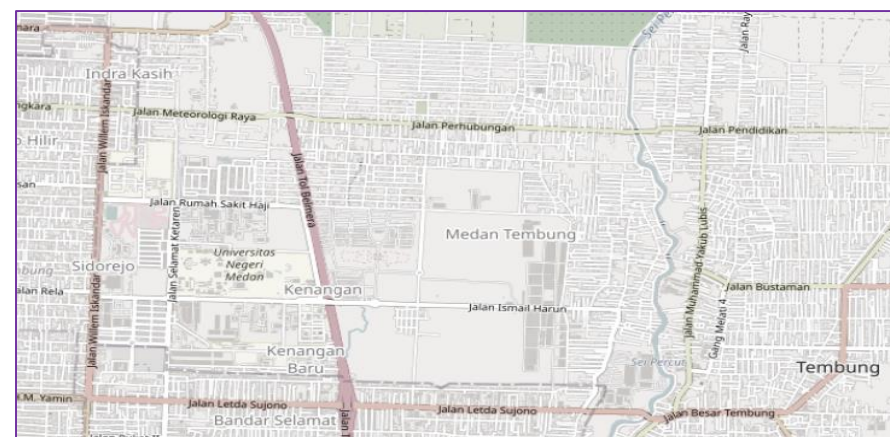
#### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

#### Risks

Description	Level
Environmental	None
Social	Medium
Implementation	Low
Operational	High
Political	Medium
Sovereignty	None

Potential road for one-way street implementation



#### Entities involved (lead, participant)

DISHUB	OF	NORTH SUMATRA
PUPR		<u>MEDAN</u>
BINA MARGA		BINJAI
BAPPEDA		<u>DELI SERDANG</u>
CIPTA KARYA		KARO
ATR/BPN		CENTRAL GOV.
DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

#### Observatory indicators related

- 03. Road Safety
- 12. Reduction of GHG Emissions from Mobility
- 13. Reduction of Air Pollution from Mobility
- 14. Quality and Livability of Public Space



### Theme Road network for private vehicles

#### Goal

Allow comfortable shift between PV and PT at P&R and encourage using PV only for the last kilometer. This action should be undertaken outside key multimodal hubs.

#### Background

It is identified that the main road traffic inducing road congestion in the periphery of the city center of Medan are the radial flows. Hence, it is proposed to introduce P&R facilities as a measure to cater with intra and inter-district traffic congestion at strategic locations of the current and future public transport network, where users will have ease to shift to public transportation and limit the use of private vehicle to the first and last miles. Furthermore, off-street parking will reduce greatly the impact of on-street parking on traffic fluidity, and increase PT attractiveness.

#### Strategy

5 priority spots located along current and future mass transit lines, for periphery P&R (as PV entering Medan are the strongest contributor to congestion in city periphery) are identified. All allow private vehicles to see them from the road, a proximity with mass transit line (present and future) as well, and integration between modes and fares. The main challenge remains to have an authority to manage them. Technical requirements to follow:

- Keputusan Direktur Jenderal Perhubungan Darat 272/HK.105/DRJD/96 tentang Pedoman Teknis Penyelenggaraan Fasilitas Parkir
- Permen PUPR 22/PRT/M/2018 tentang Pembangunan Gedung Negara

#### Expected Output and Outcomes

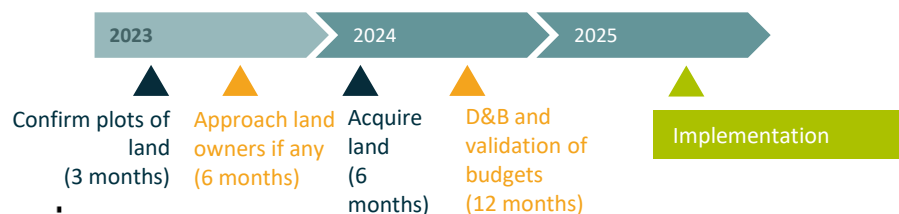
Lower congestion from on-street parking, and increase attractivity of PT and indirectly increase PT share. The action shall enhance inter-modality with private modes & employment opportunities.

#### Cost estimation and funding

The design & requirements of P&R facilities shall define the costs of implementation and operations. For example, private funding & operations shall be sophisticated and include commercial estate, requiring higher CAPEX. Indicatively, a typical parking building of 7.000 m<sup>2</sup> (5 fl.) has construction costs of IDR 21-35 billions and maintenance costs of 2% per year per m<sup>2</sup>.

#### Schedule

Effective action should be available to the public in 2025, to prepare for familiarity before the operations of mass urban public transportation lines.



### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	Low
Implementation	Medium
Operational	None
Political	Low
Sovereignty	Low



Park and Ride of Lebak Bulus in Jakarta, Indonesia offering a safe and comfortable exchange point between private vehicles (motorcycles and cars) and mass transit (MRT). (Source : Liputan6)

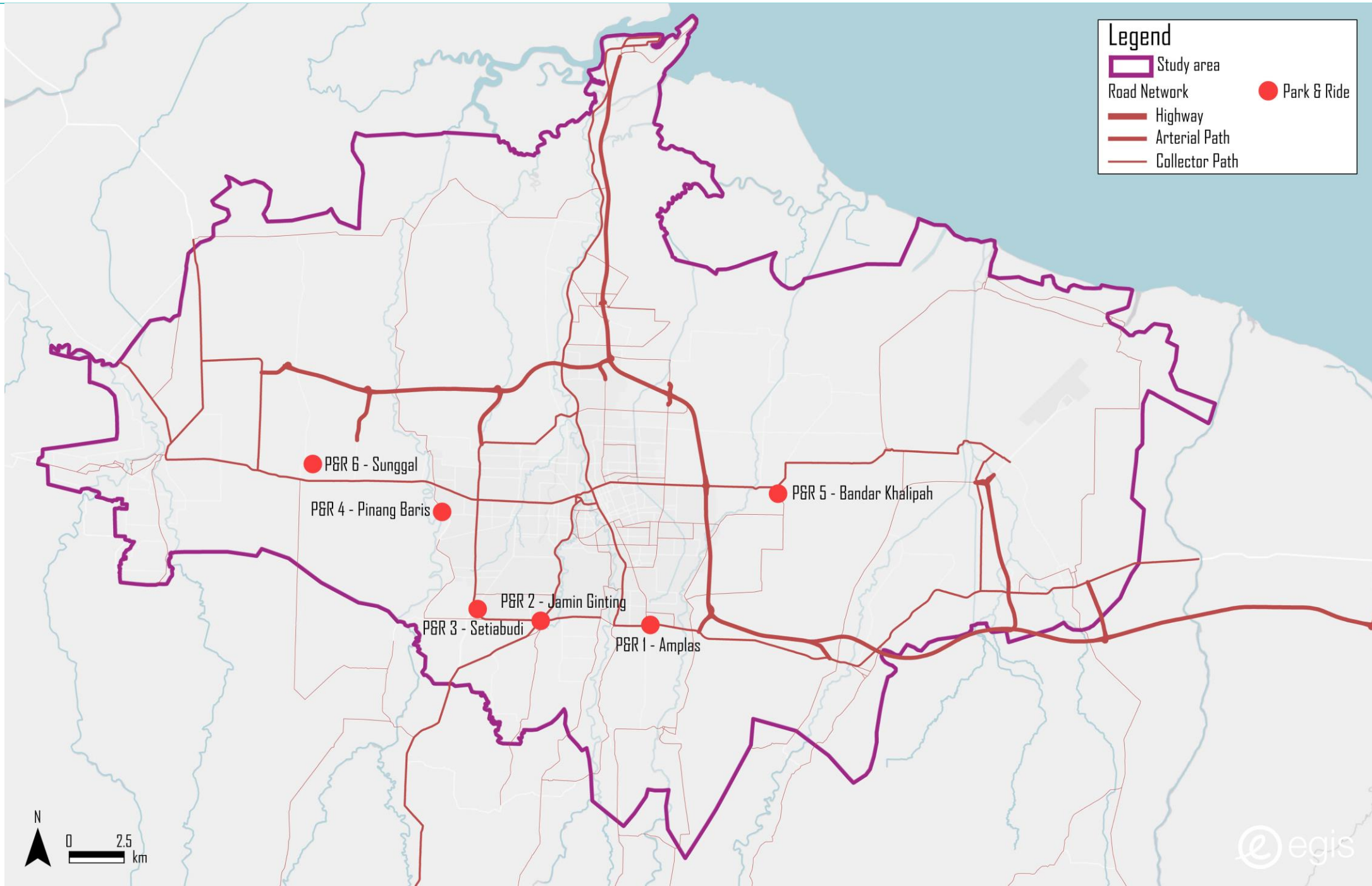
### Entities involved (lead, participant)

<b>DISHUB</b>	<b>OF</b>	<b>NORTH SUMATRA</b>
<b>PUPR</b>		<b>MEDAN</b>
<b>BINA MARGA</b>		<b>BINJAI</b>
<b>BAPPEDA</b>		<b>DELI SERDANG</b>
<b>CIPTA KARYA</b>		<b>KARO</b>
<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

### Observatory indicators related

01. Transportation Projects in Official Plans
02. Accessibility to Public Transport Services
05. Modal split of PT and NMT
07. Comfort and Bliss of Mobility
08. Security of Collective Mobility
10. Road Congestion and Delays
12. Reduction of GHG Emissions related to mobility
13. Reduction of Air Pollution related to mobility
15. Mobility Facilities Space Usage







### Theme Road Network for Private Vehicles & Public Transport

#### Goal

Multimodal hubs aim at providing easy alternatives to private vehicle travelers, and increase public transport ridership by pushing for a modal shift. These hubs are located in areas attractive for Transit Oriented Developments.

#### Background

Multimodal hubs are complex facilities owned by one authority and allowing travelers to seamlessly change modes, between public transport lines and private modes. They must connect PV, mass transit, and ideally NMT for users to shift modes wherever possible, thanks to operations schemes overseen by authorities. They must allow comfortable modal and encourage usage of PV only for the last kilometer. A multimodal hub should at least include a Mass Transit line (Rail, MRT, LRT, BRT, Bus or Waterbus line), and parking facilities for PV and NMT.

#### Strategy

The multimodal hubs locations shall be confirmed along with the future mass transit routes, before engaging the land owners. Once land is acquired by the government (province, metropolitan, cities to be determined depending on the nature of the hub), the conceptualization can start and further procurement engaged (DB, DBO, DBOT, DBOTF...).

#### Expected Output and Outcomes

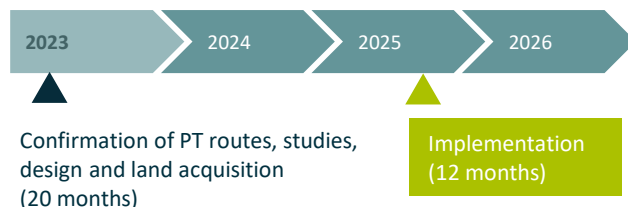
It is expected to increase the attractiveness of PT and indirectly increase PT ridership and modal share, reduce road traffic congestion. Indirectly it can contribute to create new job opportunities.

#### Cost estimation and funding

The detailed costs of acquisition will vary depending on the multimodal hub location, and could be very variable. Private finance shall be leveraged to fund these hubs (and operate them) to reduce the risk on the government. However, traffic risk costs and land acquisition remain under the government.

#### Schedule

The structural elements defining the hubs implementation are the PT routes, funding and management. The design of the hub itself can be very fast as observed in Indonesia.

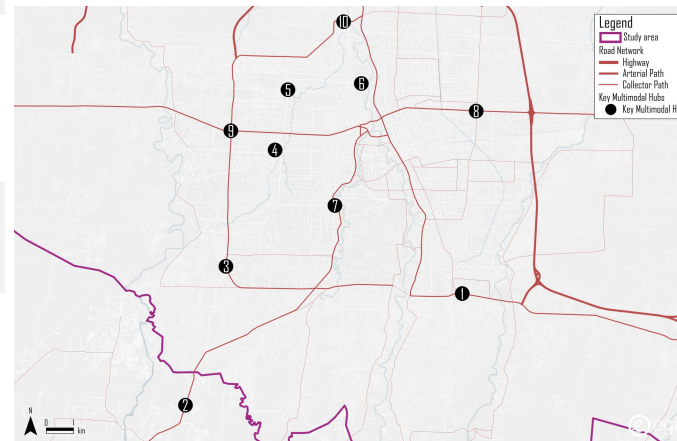


#### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

#### Risks

Description	Level
Environmental	None
Social	Low
Implementation	Low
Operational	Low
Political	None
Sovereignty	Low



Several areas with greenfield land for multimodal hubs were identified with traffic in existing and future conditions:

1. Amplas
2. Simalingkar
3. Setiabudi
4. Batang Hari
5. Kapten Muslim
6. Hamzah
7. Mansyur
8. Sudjono
9. Gatsu
10. Pertempuran

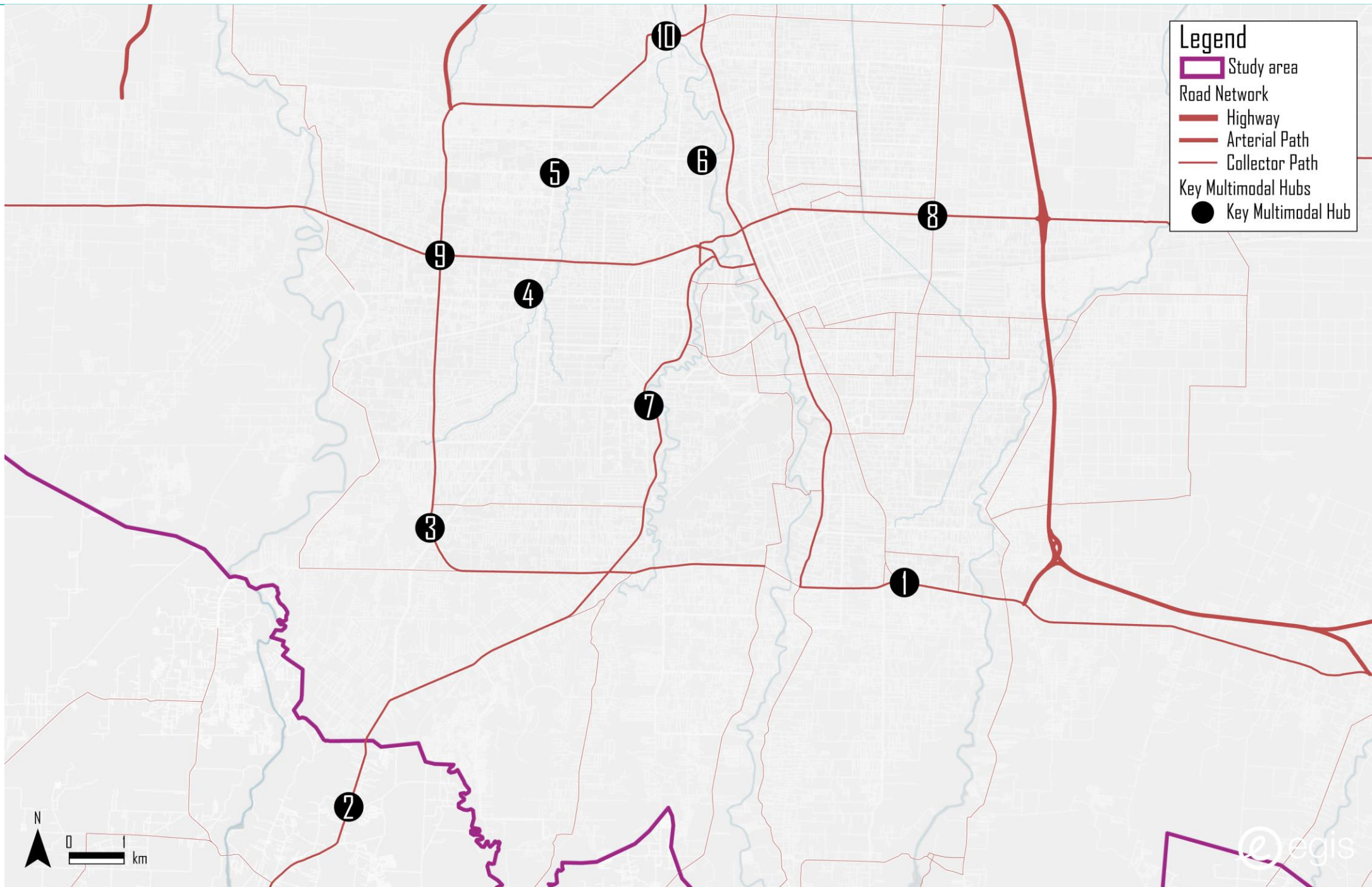
#### Entities involved (lead, participant)

<b>DISHUB</b>	<b>OF</b>	<b>NORTH SUMATRA</b>
<b>PUPR</b>		<b>MEDAN</b>
<b>BINA MARGA</b>		<b>BINJAI</b>
<b>BAPPEDA</b>		<b>DELI SERDANG</b>
<b>CIPTA KARYA</b>		<b>KARO</b>
<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

#### Observatory indicators related

02. Accessibility to Public Transport Services
05. Modal Split of PT and NMT
06. Multimodal Integration at PT hubs
07. Comfort and Bliss of Mobility
10. Road Congestion and Delays
15. Mobility Facilities Space Usage
16. Mass Transit Studied
17. Off-street Parking Hubs
20. Financing







**Theme** Road network for private vehicles

### Goal

Acceleration of behavioral change towards safer traveling habits of Mebidangro travelers by increasing the public awareness and compliance of traffic regulation and safety, shown by the decrease of accidents and related fatalities per year.

### Background

The public's behavior in travelling which tends to endanger both the person and people in the area, needs to be well-managed. The criteria is divided into several categories for the measurement controls: speeds, behaviors, and licensing. To handle those matters, the government should act on strengthening the traffic regulation (primarily in traffic enforcement) and raising the public awareness.

### Strategy

A push and pull strategy to modify public behavior could be used. Pull strategy comes in the form of campaign delivery through direct and indirect message constructed in a persuasive and informative manner to communicate the desired message to the public. The extensive public engagement is the main requirement to have a successful campaign in order to give a comprehensive understanding and optimum social engineering in Mebidangro.

### Expected Output and Outcomes

Public awareness to drive more safely to minimize the accidental and fatality rate

### Cost estimation and funding

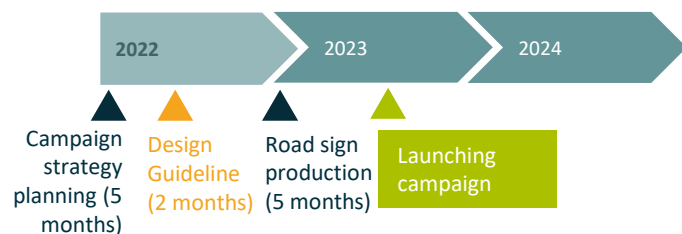
The estimated cost is divided into 2 categories which are:

- Enforcement: To be discussed with related stakeholders
- Campaign: Estimated at IDR 10 billion for implementation.

Source of funding: APBD (Regional and Municipal Budgets)

### Schedule

The timeline is rather simple but must not be underestimated, especially if a large scale and high impact campaign is envisaged.



### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	Low
Implementation	Low
Operational	Low
Political	Low
Sovereignty	None



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### Entities involved (lead, participant)

DISHUB	OF	<u>NORTH SUMATRA</u>
PUPR		MEDAN
BINA MARGA		BINJAI
BAPPEDA		DELI SERDANG
CIPTA KARYA		KARO
ATR/BPN		CENTRAL GOV.
DLH		
BPKAD		
DPPPA		
DISPERKIM		
<u>SATLANTAS</u>		
DISKOMINFO		

### Observatory indicators related

- 03. Road Safety
- 10. Road Congestion and Delays
- 14. Quality and Livability of Public Space
- 17. Off-street Parking Hubs



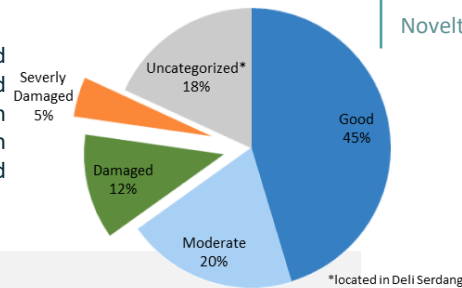
### Theme Road network for private vehicles

#### Goal

The goal of this measure is to increase the quality of the road network, in order to reduce travel time and vehicle operating costs and increase road safety. In addition, this measure would reduce road maintenance costs with a proper road maintenance program.

#### Background

As a whole, 45% of Mebidangro roads are good. Cities like Medan and Binjai only have 10,2% and 4,4% damaged and severely damaged roads. On the opposite, Deli Serdang and Karo have a large proportion of bad quality roads, reaching 57,6% and 38,4% respectively. High percentage of heavy freight vehicles (up to 27%) and overloaded vehicles have a huge impact on the deterioration of road pavements.



#### Strategy

##### Sub-action 1: Road maintenance program

This could be achieved by creating adaptive road maintenance program. The adaptive program means that the forecasting of pavement deterioration is continuously predicted by constantly updating its input from real traffic data, pavement condition, and even climate condition.

##### Sub-action 2: Overloaded vehicles control

This could be achieved by installing weight in motion (WIM) sensors to measure the weight of each passing freight and integrating the system with electronic traffic law enforcement (ETLE).

#### Expected Output and Outcomes

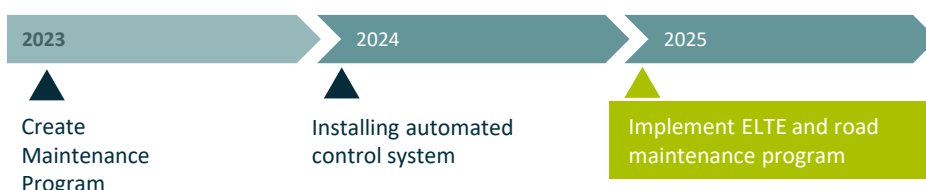
Reduced vehicle operating costs, improved road safety & reduced pavement maintenance costs.

#### Cost estimation and funding

Cost will be dependent on the scale of implementation. To limit the cost needed for this, the pilot project of this measure would be implemented on several checkpoints, preferably along the vital national road, in the entrance of Medan (from south, east, and west) and toll road only. The total estimated cost is up to 30 billion IDR.

Source of funding: APBD (Regional and Municipal Budgets)

#### Schedule



#### Impacts

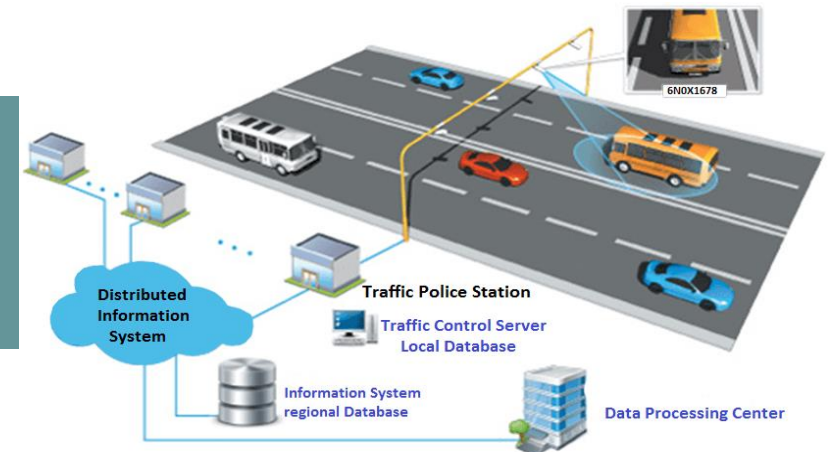
Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

#### Risks

Risks	Description	Level
Environmental	-	None
Social	Disturbance to logistic industry	Medium
Implementation	Installing the equipment	Medium
Operational	Maintain the equipment	Low
Political	Depends on regional leadership	Low
Sovereignty	-	None

Automated overloading control system illustration

Source:  
<https://www.omni-academy.com/internet-of-things-projects-iot-projects-malaysia/>



#### Entities involved (lead, participant)

<b>DISHUB</b>	<b>OF</b>	<b>NORTH SUMATRA</b>
<b>PUPR</b>		<b>MEDAN</b>
<b>BINA MARGA</b>		<b>BINJAI</b>
<b>BAPPEDA</b>		<b>DELI SERDANG</b>
<b>CIPTA KARYA</b>		<b>KARO</b>
<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

#### Observatory indicators related

- 03. Road Safety
- 07. Comfort and Bliss of Mobility
- 09. Commuting Travel Time
- 10. Road Congestion and Delays
- 14. Quality and Livability of Public Space





**Theme** Road network for private vehicles

### Goal

The goal of the measure is to decrease the share of freight vehicles amongst overall traffic in urban areas to decrease congestion and calm traffic.

### Background

In Mebidangro, roads with high freight share are mostly located in the main axes and ring roads around the city of Medan. It was identified that most of the congested roads during the peak hour on working days have highest shares of freight vehicles compared to the overall traffic. Freight vehicles slow down the general traffic, especially at junctions. Several sections that are heavily impacted by high share of freight vehicles are Amplas, Jl. Jamin Ginting, Jl. Medan-Banda Aceh, Jl. Megawati, and in central Lubuk Pakam.

### Strategy

In order to reach the goal, the operational running time of freight vehicles should be limited to certain period of time. Similar measures have been applied in many urban areas, where heavy freight vehicles are restricted to a particular time window, usually at night (e.g., 10 pm to 5 am). This measure could be implemented by providing road signage and implementing law enforcement to make sure the time restrictions are obeyed. Socialization to the impacted stakeholders (especially actors on logistics and transportation industry) is also essential prior to the implementation of the measure.

### Expected Output and Outcomes

With the absence of heavy freight vehicles during the day, there are several positive impacts that would benefit the general road users i.e., decreased congestion, calmer traffic, improved road safety and shorter travel time.

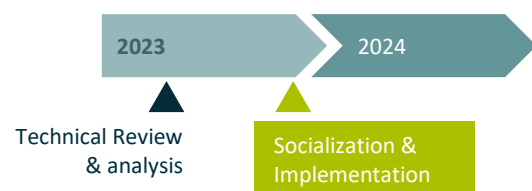
### Cost estimation and funding

Relatively low costs, as it only requires public socialization, procurement of some road signs, monitoring and law enforcement action. The total estimated cost is up to 10 billion IDR.

Source of funding: APBD (Regional and Municipal Budgets)

### Schedule

Analyses might be fast but the translation into regulation is the structural factor of the timeline.

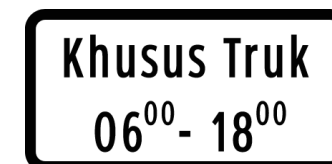


### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	Medium
Implementation	Medium
Operational	Medium
Political	Low
Sovereignty	None



### Entities involved (lead, participant)

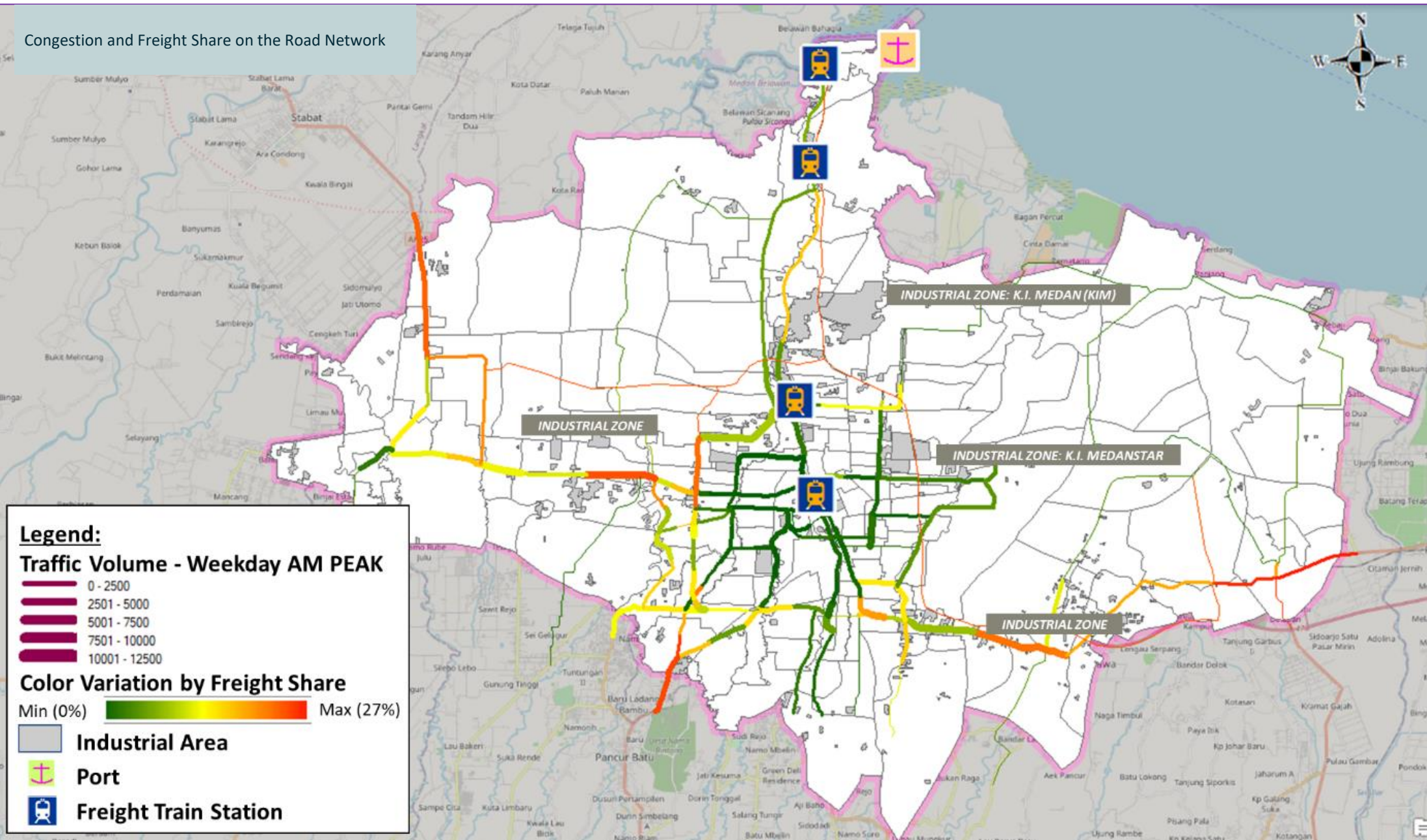
<b>DISHUB</b>	<b>OF</b>	<b>NORTH SUMATRA</b>
<b>PUPR</b>		<b>MEDAN</b>
<b>BINA MARGA</b>		<b>BINJAI</b>
<b>BAPPEDA</b>		<b>DELI SERDANG</b>
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<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

### Observatory indicators related

- 03. Road Safety
- 09. Commuting Travel Time
- 10. Road Congestion and Delays
- 12. Reduction of GHG Emissions from Mobility
- 13. Reduction of Air Pollution from Mobility



Congestion and Freight Share on the Road Network





### Theme Public Transport

#### Goal

The goal of this measure is to increase the usage of public transportation by introducing a new corridor of bus rapid transit (BRT Line 1) in Mebidangro. As opposed to an internal combustion engine, the bus will be powered using electric motors, making it eco-friendly.

#### Background

Current public transport share in the mebidangro area is relatively low, with only 9.6% share. In 2035, the VKT will be increased by 25% compared to 2020 condition. Meanwhile, the vehicle hours in 2035 will be increased by 47% compared to 2020 condition. These results imply that the congestion in the road network will be significantly higher in the future years if there are no measures and interventions to reduce it.

#### Strategy

The only committed mass transit project in Mebidangro as per 2021 is the BRT line 1 from Pinang Baris to Amplas. The BRT is a road-based mode with dedicated lanes, an average speed of 25 to 40 km/h, with headways ranging from 3 to 10 minutes and vehicles with a capacity of 30 to 70 passengers. The infrastructure of dedicated lanes for BRT would also be used by existing public transport (angkot, bus, minibus) that passes through the BRT corridor. There are 19 direct service routes which would be benefited by the BRT dedicated lanes, by increasing the commercial speed and providing proper bus stop, which leads to increased ridership for each individual route.

#### Expected Output and Outcomes

Reduction of private vehicle share (-2.2%) which leads to reduced congestion and VKT. The estimated ridership of BRT Line 1 is 210.000 pax/day. This new implementation of electric BRT mode will also be beneficial from the perspective of energy/fuel consumption, vehicle emission, and GHG reduction. Furthermore, this BRT system would be a catalyst in transforming the Mebidangro area into more livable and eco-friendly environments.

#### Cost estimation and funding

With the main cost of electric bus procurement, construction of 18-km BRT dedicated lanes and construction of 23 BRT stations, the estimated cost is approximately 1.8 – 2.2 trillion IDR. Source of funding: APBD (Regional and Municipal Budgets), Central Govt and International Partners

#### Schedule

The timeline of the project is currently under study.



Studies, Design and Project Preparation

Construction

Operational



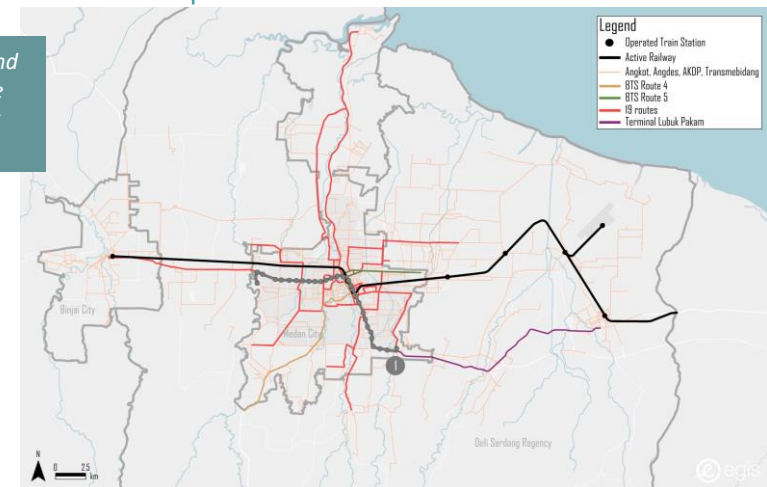
### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	Medium
Social	Medium
Implementation	High
Operational	Medium
Political	Medium
Sovereignty	None

BRT Line 1 and direct service routes under study



### Entities involved (lead, participant)

<b>DISHUB</b>	<b>OF</b>	<b>NORTH SUMATRA</b>
<b>PUPR</b>		<b>MEDAN</b>
<b>BINA MARGA</b>		<b>BINJAI</b>
<b>BAPPEDA</b>		<b>DELI SERDANG</b>
<b>CIPTA KARYA</b>		<b>KARO</b>
<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

### Observatory indicators related

01. Transportation Projects in Official Plans
02. Accessibility to Public Transport
04. Affordability of Public Transport
05. Modal Split of PT and NMT
07. Comfort and Bliss of Mobility
09. Commuting Travel Time
10. Road Congestion and Delays
11. Energy Efficiency of Overall Mobility
12. Reduction of GHG Emissions from Mobility
13. Reduction of Air Pollution from Mobility
16. Mass Transit Studied
20. Financing for Mobility





### Theme Public Transport

#### Goal

The goal of the measure is to increase the usage of public transportation by expanding new corridor of bus rapid transits on top of BRT Line 1. As opposed to an internal combustion engine, the bus will also be powered using electric motors, making it eco-friendly.

#### Background

Current public transport share in the SUMP area is relatively low and the congestion in the road network will be significantly worse in the future years if there are no measures and interventions to prevent it. Since the measure of BRT Line 1 alone is not sufficient in reducing private vehicle share and congestion, a wider corridor of BRT network is needed.

#### Strategy

In this measure, wider BRT network would be implemented in addition of BRT Line 1 corridor. There are two potential corridors to be added to the BRT network, planned to be implemented before 2035. The first one is **Corridor H** (from Helvetia to Denai) with a 15 km total length and 29 stations that would be implemented in 2026. The second one is **Corridor T** (from Denai to Batang Kuis) with a 14 km total length and 23 stations that would be implemented in 2035. The BRT is a road-based mode with dedicated lanes, with an average speed of 25 to 40 km/h, with headways ranging from 3 to 10 minutes and vehicles with a capacity of 30 to 70 passengers.

#### Expected Output and Outcomes

The expected benefit of this measure is the reduction of private vehicle share which leads to reduced congestion and VKT. The estimated ridership of Corridor H and Corridor T is 202.000 pax/day and 197.000 pax/day respectively. This new implementation of electric BRT will also be beneficial from the perspective of energy/fuel consumption, vehicle emission, and GHG reduction. Furthermore, this wider BRT Network would be a catalyst in transforming the Mebidangro area into more livable and eco-friendly environments.

#### Cost estimation and funding

With the main cost of electric bus procurement, construction of BRT dedicated lanes, and construction of BRT stations, the estimated cost is approximately 1.7 trillion IDR for Corridor H and 1.6 trillion IDR for Corridor T.

Source of funding: APBD (Regional and Municipal Budgets) with the aid from central government budget and international partners

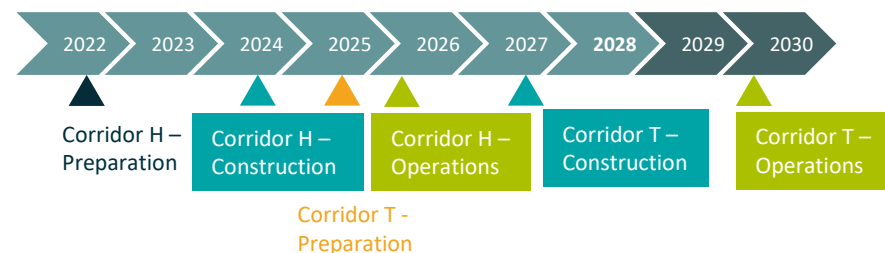
### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	Medium
Social	Medium
Implementation	High
Operational	Medium
Political	Medium
Sovereignty	None

### Schedule

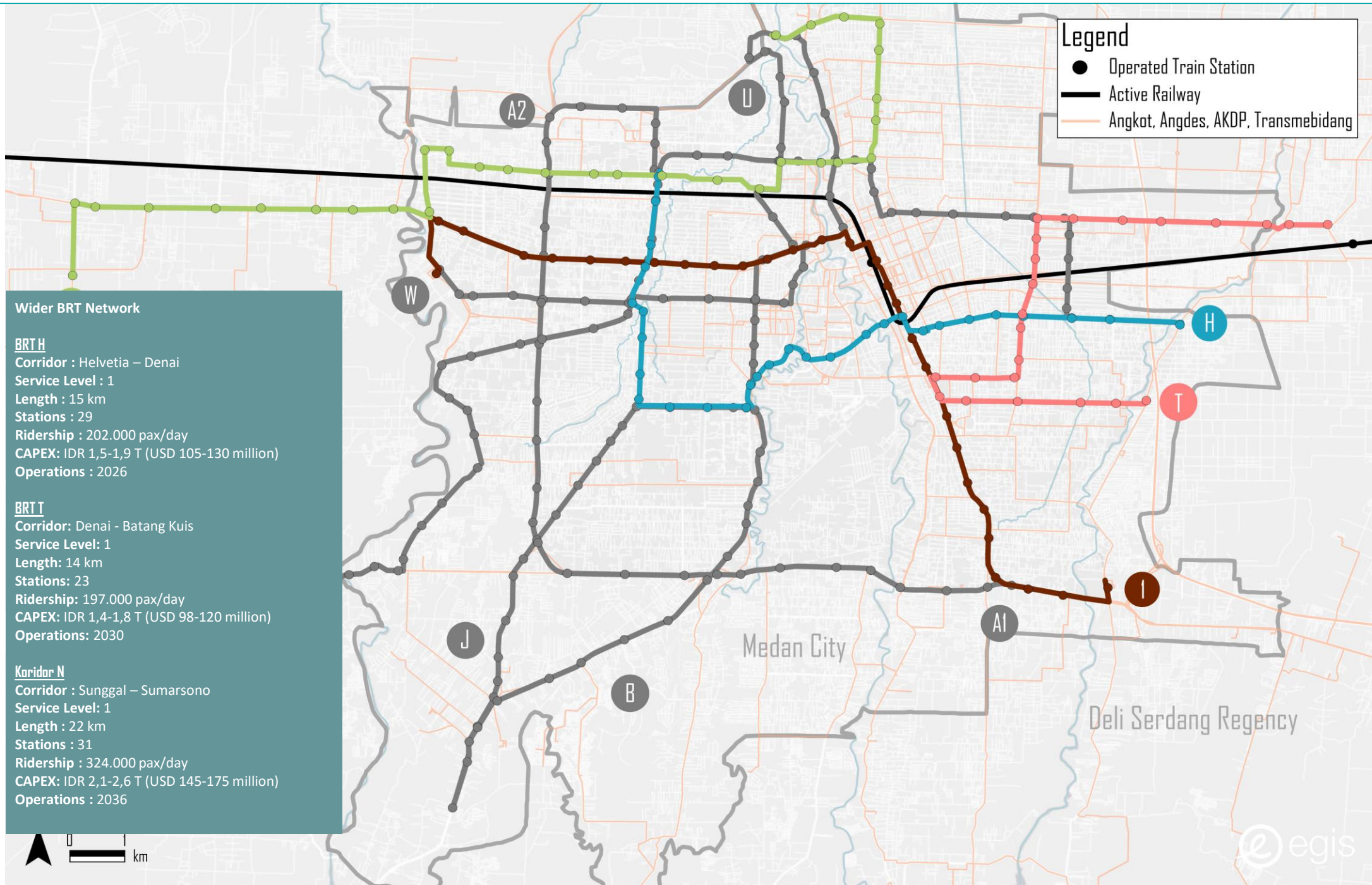


### Entities involved (lead, participant)

<b>DISHUB</b>	OF	<b>NORTH SUMATRA</b>
<b>PUPR</b>		<b>MEDAN</b>
<b>BINA MARGA</b>		<b>BINJAI</b>
<b>BAPPEDA</b>		<b>DELI SERDANG</b>
<b>CIPTA KARYA</b>		<b>KARO</b>
<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

### Observatory indicators related

01. Transportation Projects in Official Plans
02. Accessibility to Public Transport
04. Affordability of Public Transport
05. Modal Split of PT and NMT
07. Comfort and Bliss of Mobility
09. Commuting Travel Time
10. Road Congestion and Delays
11. Energy Efficiency of Overall Mobility
12. Reduction of GHG Emissions from Mobility
13. Reduction of Air Pollution from Mobility
15. Mobility Facilities Space Usage
16. Mass Transit Studied







### Theme Public Transport

#### Goal

To offer an alternative public transport service and increase tourist attractions.

#### Background

Mebidangro is crossed by several rivers which are partly canalized and have potential to accommodate boat services. The Deli River is the main one, between Medan City center and the Malacca Strait. Currently, the rivers are not exploited for fluvial transport and mainly serve the function of rainwater and used water drainages. Nevertheless, the river was once used for tourism purpose, and it was also used for freight transport centuries ago. Two streams of approximately 8 km each, join in the center (Petisah) and run towards the mouth in Bela-wan, on a distance of approximately 27 kilometers. Widths vary between 20 and 30 meters near the city center; to 60 meters closer to the mouth. The two streams are only 10 meters wide before joining. These widths allow for circulation of small water buses or boats.

#### Strategy

The design of water infrastructures could follow the existing, international examples of water city transportation, with adaptation to local condition and regulation. Also, the establishment of waterbuses should be complemented by the environmental campaign for Medan citizens as well as the waterbuses users, since currently, Deli river has garbage problem along the bank, that could be addressed with this initiative.

#### Expected Output and Outcomes

Mode shift from private vehicles to a more diverse PT modes, and increased number of tourists in Medan. From the traffic modelling, approximately 667 daily passengers will be shifted from private vehicles.

#### Cost estimation and funding

##### CAPEX

The total estimated cost of investment for waterbuses is IDR 422 billion, including procurement of 25 waterbus fleets, construction of 17 stations and 1 depot.

##### OPEX

Operational costs, once all lines are running, account for IDR 146 billion/year.

Source of funding: Provincial budget with the aid from central government budget.

### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	None
Implementation	Low
Operational	Low
Political	Low
Sovereignty	None



Water buses in Venice (Italy) and Bangkok (Thailand)

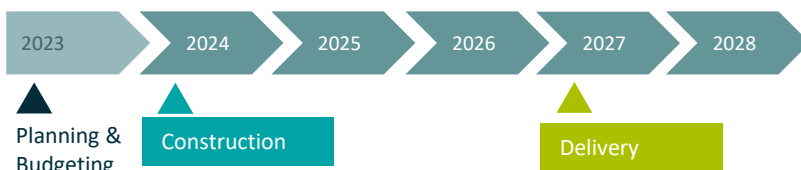
### Entities involved (lead, participant)

<b>DISHUB</b>	<b>OF</b>	<b>NORTH SUMATRA</b>
PUPR		MEDAN
BINA MARGA		BINJAI
BAPPEDA		DELI SERDANG
CIPTA KARYA		KARO
ATR/BPN		CENTRAL GOV.
DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

### Observatory indicators related

1. Transportation Projects in Official Plans
2. Accessibility to Public Transport
5. Modal Split of PT and NMT
7. Comfort and Bliss of Mobility
9. Commuting Travel Time
10. Road Congestion and Delays
14. Quality and Livability of Public Space
15. Mobility Facilities Space Usage
16. Mass Transit Studied

### Schedule



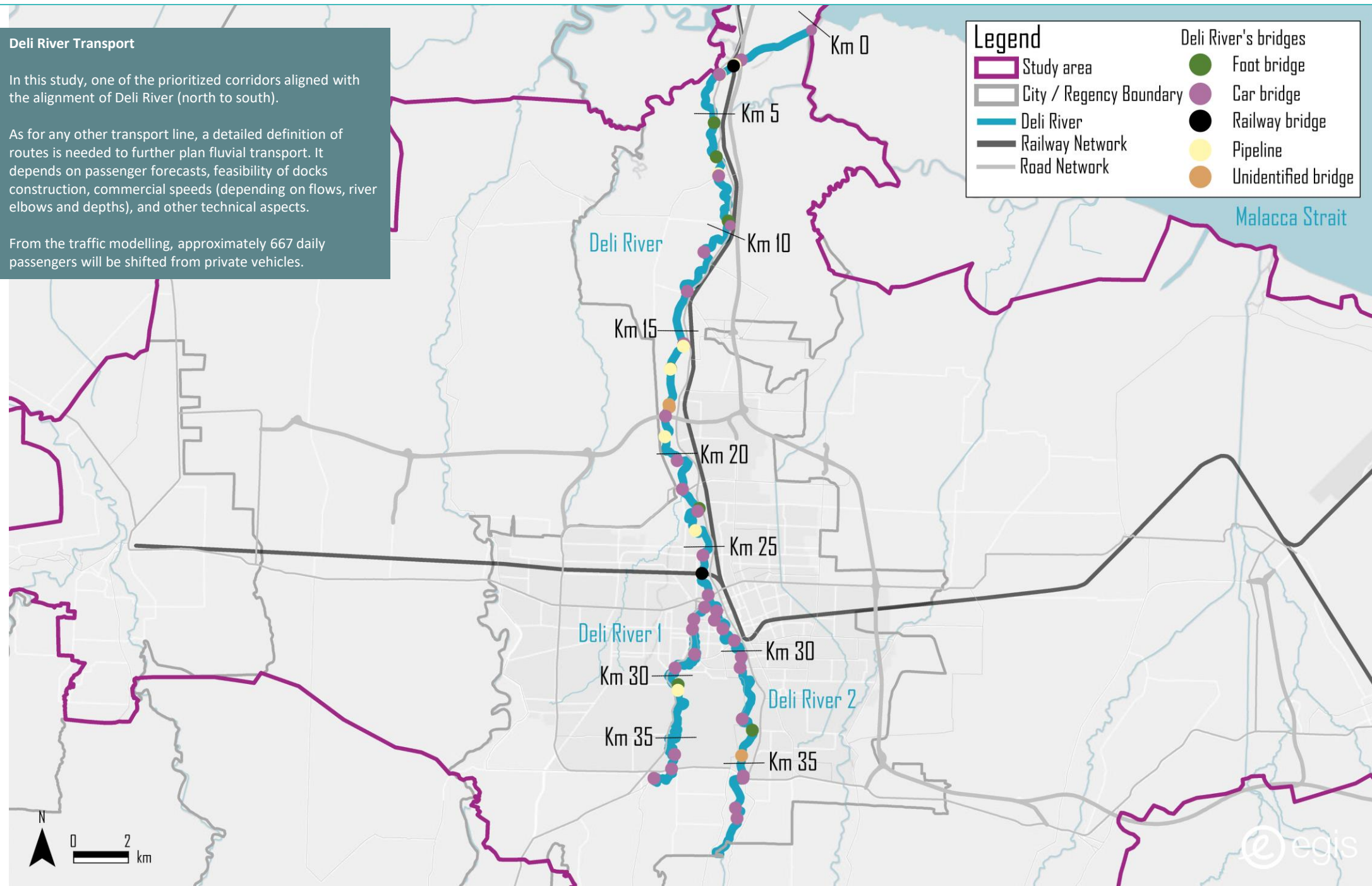


### Deli River Transport

In this study, one of the prioritized corridors aligned with the alignment of Deli River (north to south).

As for any other transport line, a detailed definition of routes is needed to further plan fluvial transport. It depends on passenger forecasts, feasibility of docks construction, commercial speeds (depending on flows, river elbows and depths), and other technical aspects.

From the traffic modelling, approximately 667 daily passengers will be shifted from private vehicles.





### Theme Public Transport

#### Goal

This Urban Mobility Plan proposes 7 urban rapid rail lines, that will be the backbone of the public transportation network of Mebidangro, allowing important PT shift from PV on busy road axes of the metropolis, and providing modern, safe and efficient mobility.

#### Background

The externalities of road traffic growth and accessibility to motorized private vehicles, coupled with alarming forecasts of motorized vehicles fleet growth, make it an absolute priority for Mebidangro to offer alternatives for urban mobility to commuters. The lack of backbone in the public transport network, as well as the need for safe, efficient, comfortable and modern public transport point towards the implementation of urban rail lines (light rail transit and tramway).

After identifying main corridors susceptible to have mass transit, as well as technologies and costs, mass transit lines are prioritized and phased. Each line needs to evolve into feasibility studies for more details.

#### Strategy

The phasing of urban rail lines is proposed depending on their ridership forecast, investment costs and operational costs. They are conceptualized as indicated in this sheet and shall be further analyzed in feasibility studies. Since the development of urban rail lines is structural for urban mobility in Mebidangro, and that it represents the highest share of the costs generated by the measures proposed on the SUMP, all levels of the government shall be involved in the planning process.

#### Expected Output and Outcomes

- Shifting from PV to PT, reducing road congestion and economic losses;
- Providing commuters with trips that are safer, faster, more accessible and efficient;
- Reduction of GHG and air pollutants emissions;
- Enhancing urban landscape and accessibility, inter-modality;
- Political impact at national level.

#### Cost estimation and funding

##### CAPEX

The total cost of investment for urban rail lines identified is IDR 44 trillion on a 15-year investment plan. It is assumed that the funds are pooled by the land transport authority of Mebidangro. The funding of the urban rapid rail lines shall combine provincial and municipal funds, central funding as well as foreign debt from international aid and the private sector.

##### OPEX

Operational costs, once all lines are running, account for IDR 1 trillion/year in 2040. For commercial operations, the province and metropolitan authority must build up financial capacity with central government assistance to ensure sustainable operations.

Sources of revenue include private contributions (advertisement & partnerships) as well as innovative public finance (innovative corporate tax and land value capture, etc.).

Source of funding: Municipal, Province & Central Budgets, International Partners & Private Sector

### Impacts

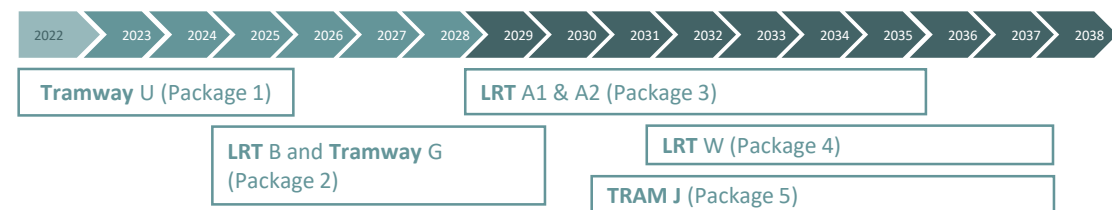
Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Environmental	Potential during construction	Low
Social	Land acq. and acceptability	Low
Implementation	Resources-intensive megaproject	High
Operational	Important running costs	Medium
Political	Depends on regional leadership	Medium
Sovereignty	Local component requirements	Low

### Schedule

Implementation of 7 urban rapid rail lines is phased to trigger most socio-economic impacts rapidly. Each line is associated with an important shift to PT. However, a full network is needed to observe substantial change in the modal shares at Mebidangro level; and each project follows intense development processes.



All projects undergo the following estimated process: studies (12 months); basic design (8 months); validation and funding (10 months); procurement for D&B (6 months); construction (15 months).

The successful implementation of the first line will help fast tracking the following ones.

### Entities involved (lead, participant)

<b>DISHUB</b>	OF	<b>NORTH SUMATRA</b>
PUPR		MEDAN
BINA MARGA		BINJAI
BAPPEDA		DELI SERDANG
CIPTA KARYA		KARO
ATR/BPN		CENTRAL GOV.
DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

### Observatory indicators related

All indicators are related to the implementation of mass transit in Mebidangro, the main one being:

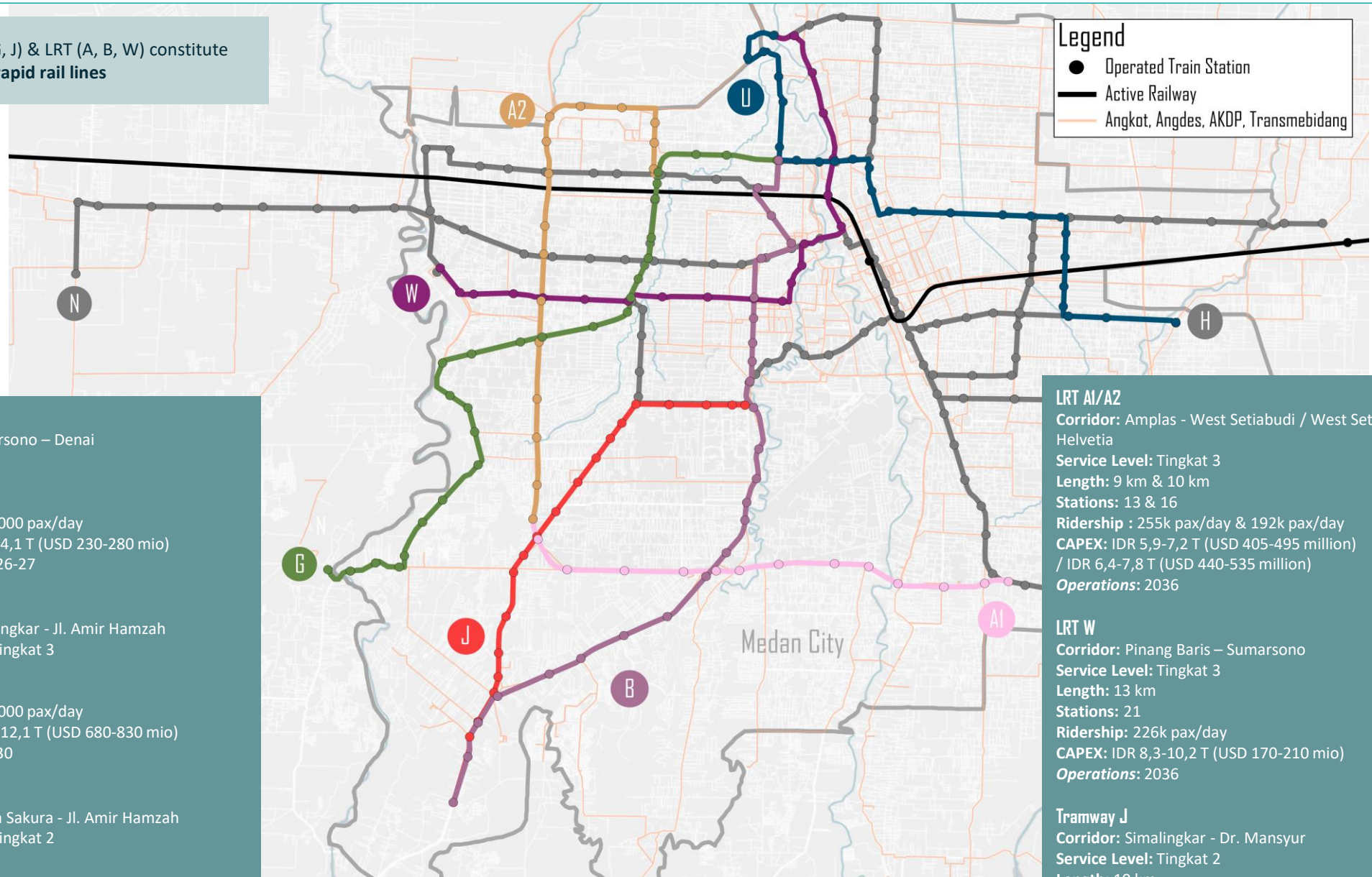
#### 16. Mass Transit Planned

Furthermore, given the prime importance of this action for the mobility development of the Metropolitan area (Central Government criteria for funding assistance), this action shall be monitored by Government activity monitoring.





Tramways (U, G, J) & LRT (A, B, W) constitute **priority urban rapid rail lines**



### Tramway U

**Corridor:** Sumarsono – Denai  
**Service Level:** 2  
**Length:** 13 km  
**Stations:** 25  
**Ridership:** 187.000 pax/day  
**CAPEX:** IDR 3,3-4,1 T (USD 230-280 mio)  
**Operations:** 2026-27

### LRT B

**Corridor:** Simalingkar - Jl. Amir Hamzah  
**Service Level:** Tingkat 3  
**Length:** 16 km  
**Stations:** 25  
**Ridership:** 260.000 pax/day  
**CAPEX:** IDR 9,9-12,1 T (USD 680-830 mio)  
**Operations:** 2030

### Tramway G

**Corridor:** Bunga Sakura - Jl. Amir Hamzah  
**Service Level:** Tingkat 2  
**Length:** 15 km  
**Stations:** 27  
**Ridership:** 222.000 pax/day  
**CAPEX:** IDR 3,5-4,3 T (USD 240-295 mio)  
**Operations:** 2030

### LRT A1/A2

**Corridor:** Amplas - West Setiabudi / West Setiabudi – Helvetia  
**Service Level:** Tingkat 3  
**Length:** 9 km & 10 km  
**Stations:** 13 & 16  
**Ridership :** 255k pax/day & 192k pax/day  
**CAPEX:** IDR 5,9-7,2 T (USD 405-495 million)  
 / IDR 6,4-7,8 T (USD 440-535 million)  
**Operations:** 2036

### LRT W

**Corridor:** Pinang Baris – Sumarsono  
**Service Level:** Tingkat 3  
**Length:** 13 km  
**Stations:** 21  
**Ridership:** 226k pax/day  
**CAPEX:** IDR 8,3-10,2 T (USD 170-210 mio)  
**Operations:** 2036

### Tramway J

**Corridor:** Simalingkar - Dr. Mansyur  
**Service Level:** Tingkat 2  
**Length:** 10 km  
**Stations:** 19  
**Ridership:** 128k pax/day  
**CAPEX:** IDR 2,5-3 T (USD 170-210 mio)  
**Operations:** 2038



### Theme Public Transport

#### Goal

Increase the performances of current rail assets and maximize their use.

#### Background

The conventional rail network of Mebidangro cover urban poles and main axes. However, it has a low transport offer with long headways and low commercial speeds. More than half of the existing rail stations are inactive. Hence these assets are proposed to be used up to their potential, by re-activating some stations and improving railway assets.

#### Strategy

A clear OD rail study should be conducted to select lines to improve by adding trains to their fleets and re-opening inactive stations. The permanent way and railway systems shall be audited and upgraded if necessary, as well as the operations center.

#### Expected Output and Outcomes

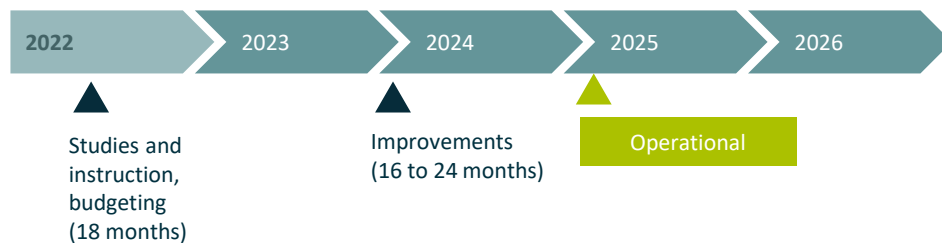
Increase of transport capacity of railway lines, Increase of commercial speeds, and increase of attractiveness of rail as a mode to further improve PT modal share.

#### Cost estimation and funding

While studies and design are expected to cost up to IDR 15-20 million, the procurement and implementation depend on the brownfield upgrades. The total cost of reactivation of 2 existing railway stations is estimated at IDR 20 billion. In the current setting these costs should be funded by the central government (APBN) and MOT, as the project owner.

#### Schedule

The implementation timeline depends on the ongoing re-opening of the stations between Medan and Binjai, and their success.

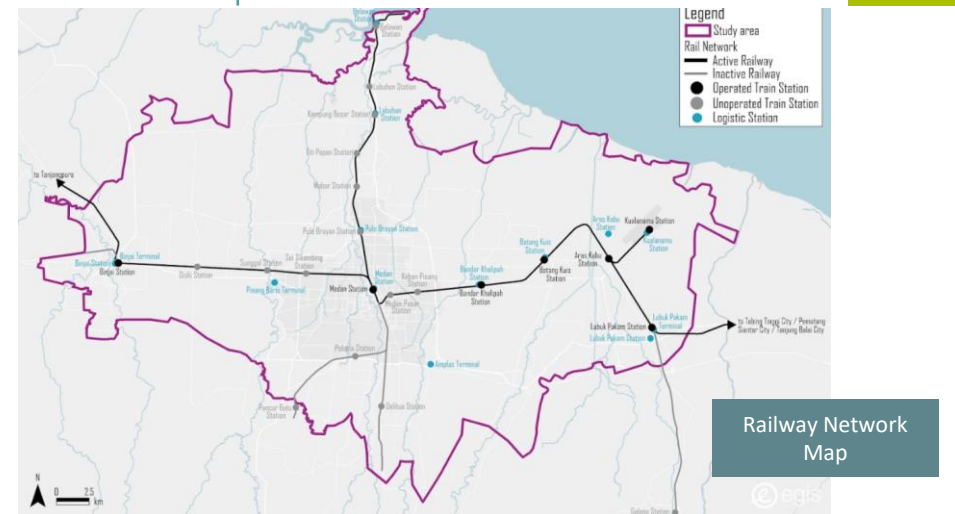


### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	None
Implementation	Low
Operational	None
Political	Medium
Sovereignty	None



### Entities involved (lead, participant)

DISHUB +BTP	OF	NORTH SUMATRA
PUPR		MEDAN
BINA MARGA		BINJAI
BAPPEDA		DELI SERDANG
CIPTA KARYA		KARO
ATR/BPN		CENTRAL GOV.
DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

### Observatory indicators related

01. Transportation Projects in Official Plans
04. Affordability of Public Transport
05. Modal Split of PT and NMT
07. Comfort and Bliss of Mobility
09. Commuting Travel Time
11. Energy Efficiency of Overall Mobility
12. Reduction of GHG Emissions from Mobility
13. Reduction of Air Pollution from Mobility





### Theme Public Transport

#### Goal

Improve ridership and overall effectiveness of angkot routes.

#### Background

Angkot (minibuses) represent the majority of the total fleet of Mebidangro road-based system. In Medan city, the high amount of angkot circulating contributes to the heavy congestion. This transport system is composed by a great number of owners, operators, and syndicates. This situation is contributing to the lack of readability and accessibility of the system, resulting in routes multiplicity and low quality service although there is a high coverage. The optimization of routes and integration of the network will help untangle the system. In addition of alleviating the traffic congestion, the optimization of the angkot fleet on the routes will help operators to have better revenue with balanced operating costs.

#### Strategy

Undertaken using local method with assistance from international consultants. The activities comprise data collection of angkot (routes, operators, workforce, user survey), analysis of new routes and suppression of former ones if necessary, and procurement of route operations.

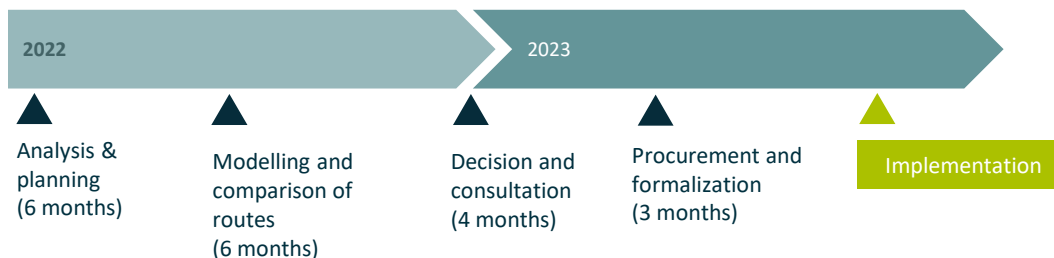
#### Expected Output and Outcomes

More efficient routes, rationalization of workforce, optimization of depots, reduction of competition and healthier driving conducts, and increase ridership and PT share.

#### Cost estimation and funding

A study at feasibility and basic design levels, with procurement assistance, has an estimated cost of IDR 35 billion. Source of funding: APBD (Regional and Municipal Budgets)

#### Schedule



#### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

#### Risks

Description	Level
Environmental	None
Social	Medium
Implementation	Medium
Operational	Low
Political	Medium
Sovereignty	None



Crowded traffic dominated by angkot

#### Entities involved (lead, participant)

DISHUB	OF	NORTH SUMATRA
PUPR		MEDAN
BINA MARGA		BINJAI
BAPPEDA		DELI SERDANG
CIPTA KARYA		KARO
ATR/BPN		CENTRAL GOV.
DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

#### Observatory indicators related

- 02. Accessibility to Public Transport
- 04. Affordability of Public Transport
- 06. Multimodal Integration of PT at hubs
- 07. Comfort and Bliss of Mobility
- 09. Commuting Travel Time
- 10. Road Congestion and Delays



### Theme Public Transport

#### Goal

Improve ridership and overall comfort of all vehicles of the angkot network.

#### Background

According to the result of household interviews, 80% of respondents use private motorcycle and 13% of them use private car for their daily trips. Currently, Mebidangro has a PT modal share of only 3,21%, among the lowest ones in Indonesia. To encourage people to use PT, one of the method is to improve the quality and comfort of the fleets, including angkot. In Medan city, for instance, it is common that the old, low quality angkots still operate, as the operators tend to have low maintenance cost. This is the main reason why many angkots are in bad shape, i.e. loose spare parts, or even break down in the middle of traffic. Revitalizing the fleet will not only provide users with a comfort service, but also to ensure the safety and convenience of other road users.

#### Strategy

Undertaken using local method with assistance from international designers. The activities comprise data collection of angkot (routes, operators, workforce, user survey), analysis of most frequented routes and rejuvenation of corresponding fleets, and promotional campaigns with visual identities of new vehicles.

#### Expected Output and Outcomes

Increased attractiveness of angkot and resulting in increased ridership.

#### Cost estimation and funding

The costs are assimilated to those of a feasibility study with basic design, and procurement assistance, equivalent to IDR 15 billion. Later, the procurement costs of new vehicles depends on the prioritization of lines and vehicle quality. Source of funding: APBD (Regional and Municipal Budgets).

### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

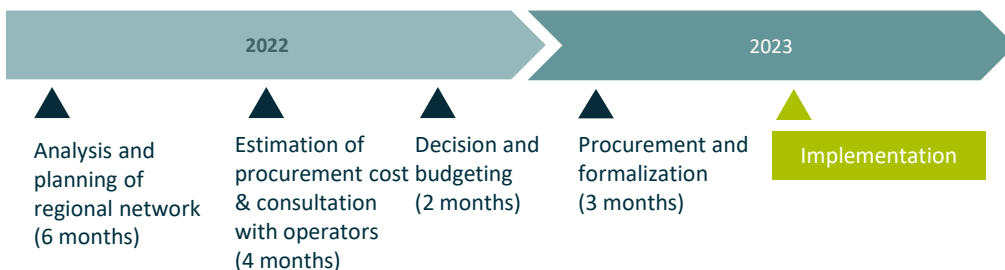
### Risks

Description	Level
Environmental	None
Social	Medium
Implementation	Medium
Operational	Low
Political	Low
Sovereignty	None



Modern angkot in Bogor

### Schedule



### Entities involved (lead, participant)

<b>DISHUB</b>	<b>OF</b>	<b>NORTH SUMATRA</b>
<b>PUPR</b>		<b>MEDAN</b>
<b>BINA MARGA</b>		<b>BINJAI</b>
<b>BAPPEDA</b>		<b>DELI SERDANG</b>
<b>CIPTA KARYA</b>		<b>KARO</b>
<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

### Observatory indicators related

- 05. Modal Split of PT and NMT
- 06. Multimodal Integration of PT at hubs
- 07. Comfort and Bliss of Mobility



### Theme Public Transport

#### Goal

The objective is to improve the performance of the bus transport system in order to attract daily user, and optimally increase the PT share and ridership considerably.

#### Background

Since the bus transport system is a road-based public transport, it does not attract much people for their daily mobility since bus public transport is not segregated and tend to get caught in the highly-crowded traffic. which causes it to have a longer travel time and lower speed. Moreover, inadequate accessibility to the bus stop / shelter / station and inconvenient modes are also a reason that explain its poor usage today. Therefore, in order to achieve the modal shifting from private to public transport maximally, a good bus transport system that is efficient and effective needs to be developed in order to encourage modal report, and increase PT modal share.

#### Strategy

This could be achieved by conducting several studies to collect some necessary information, which is: perception and detailed seasonal demand survey, design of operational plans (passenger information adjustments), and procurement systems. These studies could be conducted in approximate 18 months.

#### Expected Output and Outcomes

The improvement of bus transport system is expected to help achieve a more effective and efficient bus network system, a PT share increment, and reduce the GHG emissions from the modal shift.

#### Cost estimation and funding

With a rough estimation of the basic improvement by conducting the feasibility and basic design assistance, the cost is up to IDR 20 billion. The procurement costs are not taken into account at this stage. Source of funding: APBD (Regional and Municipal Budgets).

### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

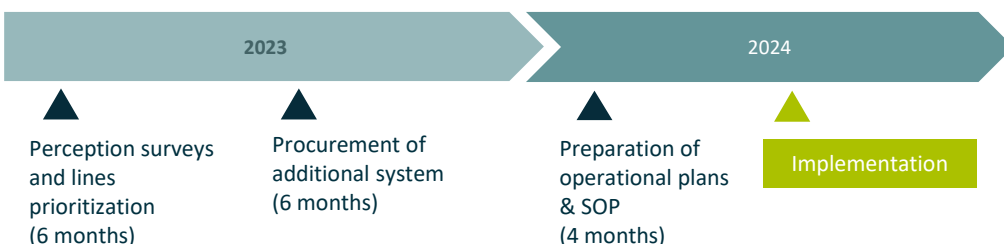
### Risks

Description	Level
Environmental	None
Social	None
Implementation	Medium
Operational	Low
Political	Medium
Sovereignty	None



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### Schedule



### Entities involved (lead, participant)

<b>DISHUB</b>	<b>OF</b>	<b>NORTH SUMATRA</b>
<b>PUPR</b>		<b>MEDAN</b>
<b>BINA MARGA</b>		<b>BINJAI</b>
<b>BAPPEDA</b>		<b>DELI SERDANG</b>
<b>CIPTA KARYA</b>		<b>KARO</b>
<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

### Observatory indicators related

- 05. Modal Split of PT and NMT
- 06. Multimodal Integration of PT at hubs
- 07. Comfort and Bliss of Mobility
- 08. Security of Collective Mobility



### Theme Public Transport

#### Goal

Implement school and employee buses is a possible solution to solve congestion problems in front of these facilities. This measure aims to minimize the use of private vehicles to school and workplace by providing public bus dedicated for certain school zones and activity centers.

#### Background

According to the household survey result, work purposes represent 41% of all trips, followed by shopping (22%) and education (13%). One of the alternatives to ease traffic in Mebidangro is to provide dedicated bus lines for school and employee. Employee buses will be beneficial not only for the employees, but the companies as well. The companies can cut down on parking lot expenses and transport expenditures of the employees. On the other hand, providing school buses for students will also reduce the number of trips considerably, as the parents do not have to take their children anymore.

#### Strategy

The implementation can start in identifying school and/or workplaces congestion and common origin. The operational model and scheme could be in the form of government-led bus services or school/private-led bus services (for the latter, there should be a more detailed regulation). Public consultation and engagement to school should also be undertaken in selected zones.

#### Expected Output and Outcomes

Modal share of non-motorized transportation and public transport (PT) in the selected zones/lines are expected to increase. Also, reduced traffic congestion in the selected lines, particularly in the area surrounding schools and activity centers.

#### Cost estimation and funding

Cost of implementation study, public outreach, buses procurements, and operational. The cost of medium bus (8 m) is IDR 500-600 mil, 12-meter bus is IDR 750-1000 mil, articulated bus is IDR 1,200-1,500 mil. Standard bus operation costs IDR 12,200/km and bus maintenance costs IDR 1,912/km. Source of funding: APBD (Regional and Municipal Budgets)

### Impacts

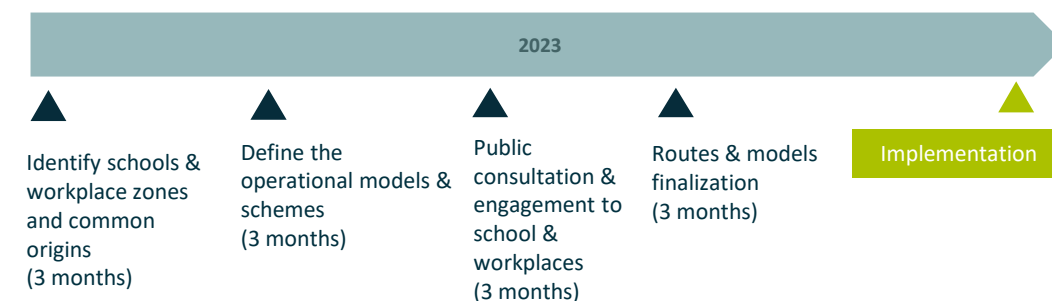
Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	None
Implementation	Low
Operational	Medium
Political	None
Sovereignty	Low

### Schedule

Highly dependent on social acceptability, the implementation timeline does not present any major risk outside the procurement of the buses.



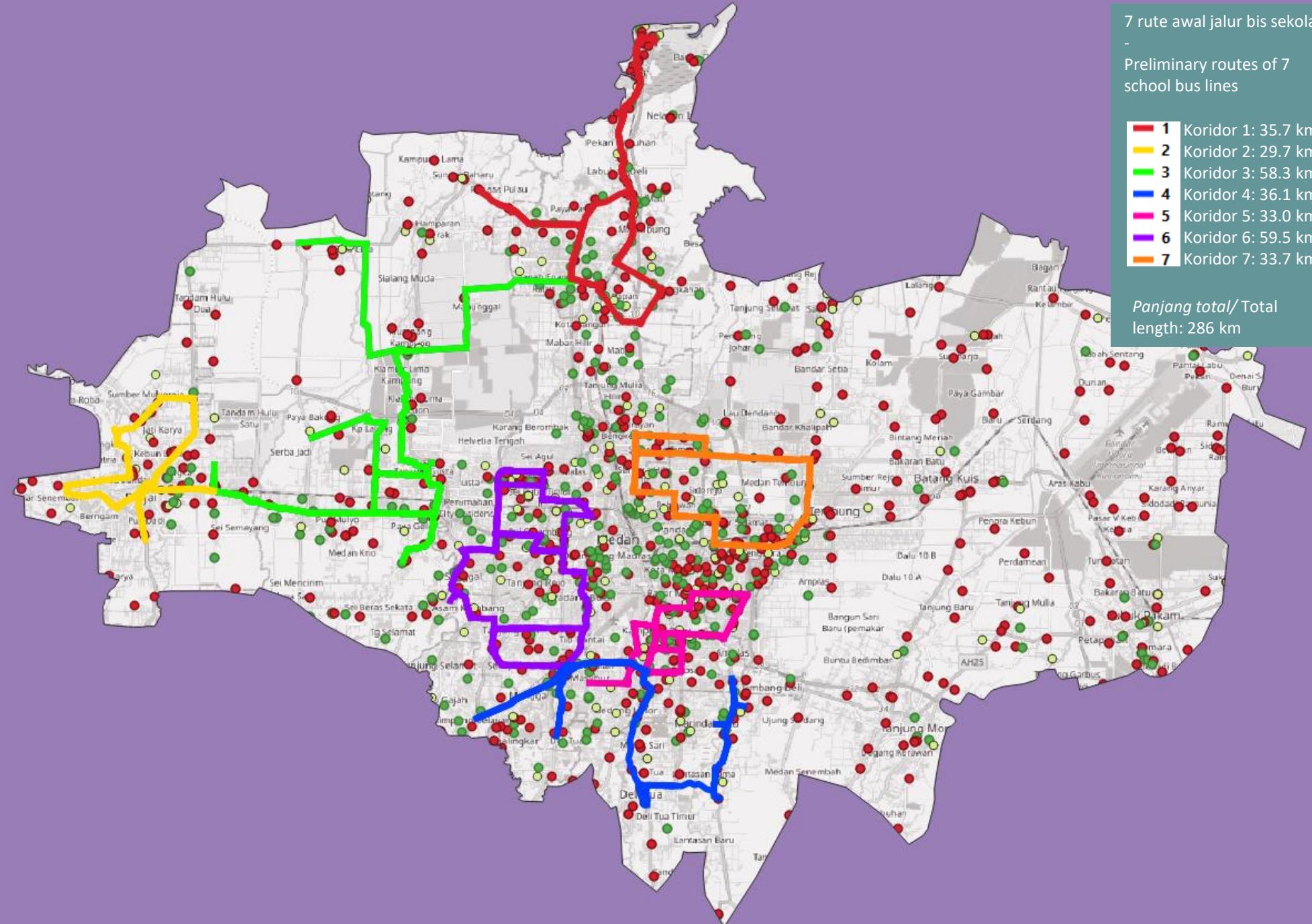
### Entities involved (lead, participant)

<b>DISHUB</b>	<b>OF</b>	<b>NORTH SUMATRA</b>
<b>PUPR</b>		<b>MEDAN</b>
<b>BINA MARGA</b>		<b>BINJAI</b>
<b>BAPPEDA</b>		<b>DELI SERDANG</b>
<b>CIPTA KARYA</b>		<b>KARO</b>
<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

### Observatory indicators related

01. Transportation Projects in Official Plans
03. Road Safety
05. Modal Split of PT and NMT
07. Comfort and Bliss of Mobility
08. Security of Collective Mobility
09. Commuting Travel Time
10. Road Congestion and Delays
11. Energy Efficiency of Overall Mobility





7 rute awal jalur bis sekolah

Preliminary routes of 7 school bus lines

1	Koridor 1: 35.7 km
2	Koridor 2: 29.7 km
3	Koridor 3: 58.3 km
4	Koridor 4: 36.1 km
5	Koridor 5: 33.0 km
6	Koridor 6: 59.5 km
7	Koridor 7: 33.7 km

Panjang total/ Total length: 286 km





### Theme Public Transport

#### Goal

Promote existing public transport services of Mebidangro in order to increase the public transport share through image enhancement.

#### Background

To encourage the community of Mebidangro area to use the public transport in order to support the urban sustainable mobility, all-related stakeholders must realize a successful promotional activity. This is necessary to give a comprehensive understanding and to promote the advantage of using Public Transport.

#### Strategy

In order to promote the sustainable development in Mebidangro area, all stakeholders-related shall work together to provide the persuasive message in order to encourage people to use public transport. A good image will bring a good perception in the community. Therefore, a good coordination between the Transportation Agency (along with the Public Transport Operators) and the Communication Information Agency should be provided to define:

- Marketing strategy (market analysis and product/service inventory)
- Brand guideline
- Marketing and promotional media
- Implementation plan
- Deliverables

#### Expected Output and Outcomes

Encourage the people using public transport by mode shifting in order to gain the economic benefits and air quality improvement.

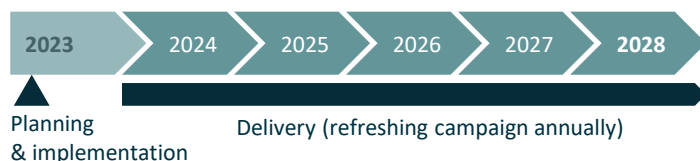
#### Cost estimation and funding

The cost approximation is divided in 2 types of categories, which are: the implementation cost for marketing cost (CAPEX) that is roughly 2 Billion (one time cost) meanwhile the operational cost is divided into several categories and depends on various conditions.

Source of funding: APBD province North Sumatra

#### Schedule

No major timeline challenge is identified, and social media offer the opportunity for fast promotions. Yearly updates shall be conducted.



### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	Public interest
Implementation	None
Operational	None
Political	None
Sovereignty	None



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### Entities involved (lead, participant)

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<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

### Observatory indicators related

- 02. Accessibility to Public Transport
- 05. Modal Split of PT and NMT



### Theme Digitalization

#### Goal

Provide information and access to mobility with ease by digital support on smartphones/computers for different modes. Developing MaaS allows decreasing the modal share of private vehicles by increasing the information on PT, increasing PT load factor, increasing active non-motorized modes modal share to in turn calm the city traffic by reducing saturation of roads and turning towards sustainable energies for transport.

#### Background

Digitalization of tools for operators, authorities and users have grown unequally in the past years. While paratransit and Mobility as a Service (MaaS) has grown exponentially in the past ten years for users (online hailing), conventional operators and transportation authorities have not made disruptive changes to their systems. While the use of mobile phones is now generalized in Mebidangro, it is important to address mobility with digital considerations for more sustainable successes of projects.

#### Strategy

Implementing MaaS in Mebidangro combines the strengths of different private and public actors through the following steps: inventory of existing MaaS, benchmarking and selection of adapted ones to Mebidangro, public consultation & survey; adoption of all operators to MaaS, and gather around a single platform supported by the authorities; implementation of new modes: carpooling, bike-sharing, car-sharing, scooter-sharing (with/without docks); implementation of public transport fare integration: ticketing through online portals.

#### Expected Output and Outcomes

Expected to decrease GHG emissions and travel time, that cannot be determined quantitatively for the moment.

#### Cost estimation and funding

The cost of implementation for the government is close to none. Main costs for companies providing MaaS are on infrastructures. The government shall nonetheless allocate resources for: 3-4 months of licensing of the MaaS companies; and possible land acquisition facilitation for points/stations of MaaS and related time allocation. Those investment cost of the government shall be below IDR 1 billion. Source of funding: APBD (Regional and Municipal Budgets) and the aid from central government budget and international partners.

### Impacts

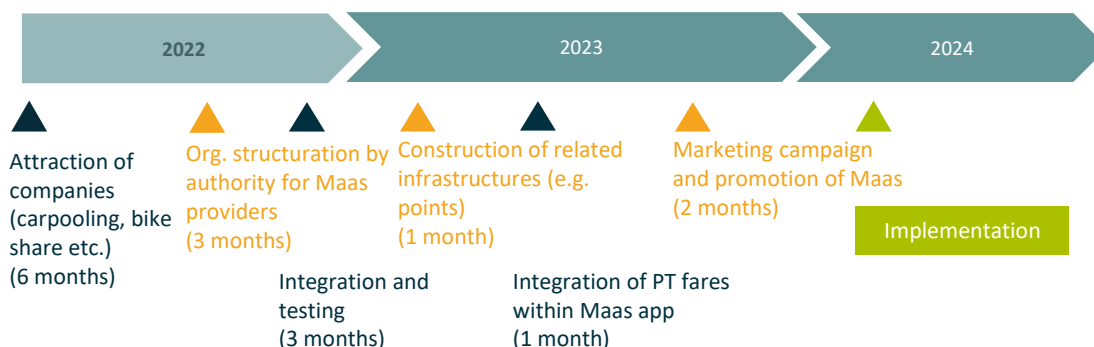
Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	Medium
Implementation	Low
Operational	Medium
Political	Low
Sovereignty	Low

### Schedule

While the regulatory framework is rapid to prepare (base available with online hailing), the timeline depends on the market soundings towards private players.



### Entities involved (lead, participant)

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ATR/BPN		CENTRAL GOV.
DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

### Observatory indicators related

01. Transportation Projects in Official Plans
06. Multimodal Integration of PT at hubs
07. Comfort and Bliss of Mobility
10. Road Congestion and Delays
11. Energy Efficiency of Overall Mobility
12. Reduction of GHG Emissions from Mobility
13. Reduction of Air Pollution from Mobility
15. Mobility Facilities Space Usage
20. Financing for Mobility

Mobility as a service in a mobile app





### Theme Digitalization

#### Goal

To monitor traffic and management measures, as well as public transport.

#### Background

In general, Medan has already implemented a working ATCS (Area Traffic Control System) which is part of an Intelligent Transportation System (ITS) that is used to manage and coordinate all traffic lights in an area, this system is adaptive to the real-time condition of the traffic. Nevertheless, additional technical designs are needed to automatically count vehicles and to record plate number of each passing vehicle. Tracking movement of Public Transport by installing in-vehicle GPS is also needed to provide public transport users with information on the time estimation of the next arriving vehicle.

#### Strategy

The measure can be implemented by : Installing CCTV, equipped with classified traffic counter and plate number recognition; tracking movement of Public Transport by installing in-vehicle GPS; and installing Variable Message Sign (VMS) panels along the main road axes in order to deliver information on traffic conditions and recommended routes to road users.

#### Expected Output and Outcomes

Better traffic management and safer roads.

#### Cost estimation and funding

Cost will be dependent on the scale of implementation. Economies of scale are expected depending on the size of the implemented system.

Source of funding: APBD (Regional and Municipal Budgets)

### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

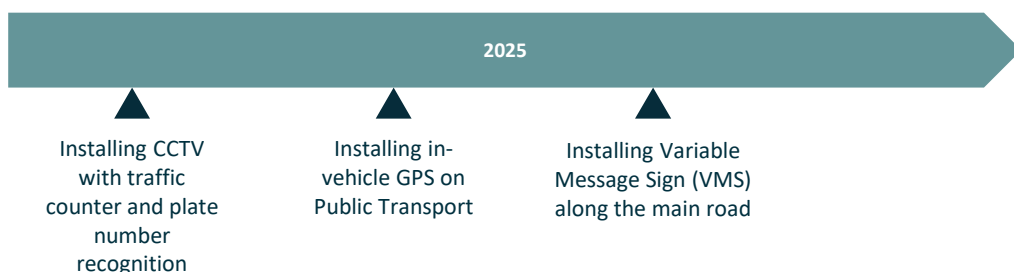
### Risks

Description	Level
Environmental	None
Social	None
Implementation	Medium
Operational	Low
Political	Low
Sovereignty	None



Traffic CCTV and VMS

### Schedule



### Entities involved (lead, participant)

<b>DISHUB</b>	OF	<b>NORTH SUMATRA</b>
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<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

### Observatory indicators related

- 03. Road Safety
- 09. Commuting Travel Time
- 10. Road Congestion and Delays
- 20. Financing for Mobility



### Theme Digitalization

#### Goal

Offer real time and dynamic information to travelers about waiting time, next bus/train/ LRT/MRT direction, stops location and next stops, route duration, interconnections with other modes, or other relevant information.

#### Background

Current operators lack digital systems, and a salient point of the diagnosis shows that most inhabitants find the lack of travel information (fares, routes, schedules) a main obstacle to the use of public transportation. Therefore, it is proposed that the provincial and metropolitan authorities impose to operators the use of passenger information systems at stations, stops and onboard angkots to provide travel information at all times to passengers. This measure is expected to increase the attractiveness of PT and indirectly increase its modal share.

#### Strategy

The implementation of PIDS in all PT stations and on-board throughout Mebidangro can be divided into several steps, which are the followings: (1) Define local regulation that enforces operators to install these equipment and share information, as well as the entity in charge of its collection, treatment and distribution on board and at stations; (2) Define the technical specifications of the system: at onboard, station and operational center level; (3) Install live information medias at all stations and PT vehicles regardless of road/rail/water based; (4) Include SU and all DISHUB if need of support for funding for these technologies.

#### Expected Output and Outcomes

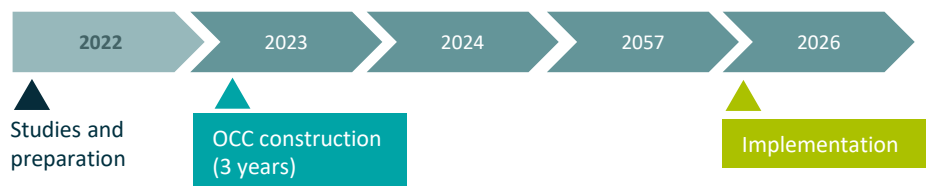
Expected gain in travel time reduction, optimized travel routes, better travel time management.

#### Cost estimation and funding

CAPEX is IDR 150 million per bus, IDR 300 million per train, and IDR 750 million per station. OCC CAPEX is around IDR 80 billion. OPEX is rather limited, around IDR 14 billion per year for a full system. Life expectancy on onboard and station system is 15 years.

Source of funding: APBD (Regional and Municipal Budgets)

#### Schedule



#### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

#### Risks

Description	Level
Environmental	None
Social	None
Implementation	Low
Operational	Medium
Political	Low
Sovereignty	None



PIDS illustration from France public transportation system

#### Entities involved (lead, participant)

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ATR/BPN		CENTRAL GOV.
DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

#### Observatory indicators related

- 02. Accessibility to Public Transport
- 04. Affordability of Public Transport
- 05. Modal Split of PT and NMT
- 06. Multimodal Integration of PT at hubs



### Theme Digitalization

#### Goal

Improve public transport users experience and overall public transport attractiveness by providing seamless interchanges between modes and clear fare policies.

#### Background

To increase the attractiveness of public transport services in Mebidangro, the government could implement an integrated fare payment system. It will facilitate the customers on paying those services, as well as providing seamless transfer and reducing travel time in the transit. A previous step will consist on the homogenization and integration of fares on the current public transportation lines (even with different operators). This will be the basis of an integrated fare scheme for future lines and P&R.

#### Strategy

The implementation of fare modality will require several activities, as follows : inventory of current fares and structures; identification of existing and future mode operated in the region along-side with definition of fare breakdown from each mode/operators; consultation with public authorities on best scheme to involve authority in fare collection, analysis of schemes; development of fare intermodality institutional framework; budgeting and instruction, consultations; development of business feasibility and scheme for fare intermodality; and establishment of fare regulating entity and intermodal fare system.

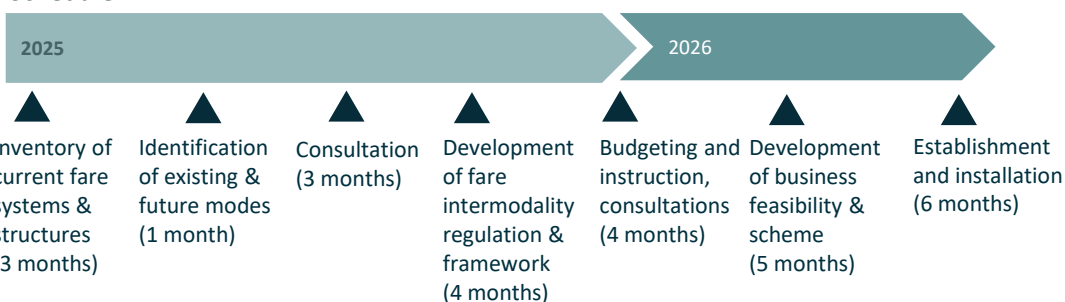
#### Expected Output and Outcomes

Increased users experience and attractiveness of PT, expected modal shift to PT, and reduced GHG emissions from private vehicles.

#### Cost estimation and funding

The costs are assimilated to those of a feasibility and basic design with procurement assistance, equivalent to IDR 30 billion for the authorities of Mebidangro. The procurement costs are not taken into account at this stage. Source of funding: APBD (Regional and Municipal Budgets) and from central government budget if necessary.

#### Schedule



### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	None
Implementation	Medium
Operational	Medium
Political	None
Sovereignty	None



Multipurpose card for ticket payment

### Entities involved (lead, participant)

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<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

### Observatory indicators related

- 02. Accessibility to Public Transport
- 04. Affordability of Public Transport
- 05. Modal Split of PT and NMT
- 06. Multimodal Integration of PT at hubs
- 07. Comfort and Bliss of Mobility



### Theme Governance

#### Goal

From the metropolitan entity to manage land transport as a whole, beyond city and regency administrative borders, to smoothen the instruction and development of mobility project through streamlining regulatory constraints and allowing and enabling external funding of projects.

#### Background

Project development in Mebidangro face important organization and funding obstacles, where capacity is lacking and coordination requirements are important. Furthermore, the financing capacities are insufficient for mass transit projects, and assistance from the central government is required most of the time. BAPPENAS has set the formation of a transport authority at metropolitan level to enable financing assistance from the central government for transportation projects.

It is expected to establish and set-up a (i) Mebidangro Urban Transit Authority , (ii) Public Transport Council and (iii) Transport Trust Funds through this action.

At the scale of Mebidangro, the LTA is expected to be responsible for the funding, financing, authorization, licensing, integration, procurement, construction, operations, maintenance and ownership of transit infrastructure and services for road-based PT (minibuses, buses, BRT) and rail-based PT (trains, MRT, LRT, tramways), as well as water based PT (waterbuses), to improve efficiency of administration and channel funding, avoid administrative and financing bottlenecks for project development, and manage sustainably the infrastructure.

#### Strategy

- Confirm feasibility through regulations and legal analyses
- Set out scopes and responsibilities and related legal framework
- Check and adjust current legal framework (Governor decree for Mebidangro management)
- Form working group and form regulation to implement authority, at provincial & central levels

#### Expected Output and Outcomes

The LTA is expected to unlock urban transportation and mobility projects by streamlining administrative and coordination requirements and allowing channeling external finance. Having a single authority responsible for all land transportation modes across the territory of Mebidangro is also expected to increase policy coherency and multi-modal integration and efficiency.

#### Cost estimation and funding

Costs are dependent on ambitions set and sharing between levels of the Mebidangro administrations.

- Consultants fee for studies and assistance
- Focus Groups discussions and Workshops
- New Regulations & Policy making
- Legislation processes and approval processes
- Socialization and trial

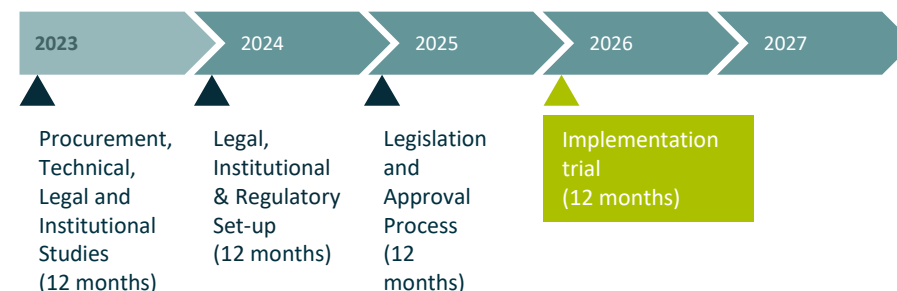
### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	None
Implementation	High
Operational	Low
Political	Medium
Sovereignty	None

### Schedule



### Entities involved (lead, participant)

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### Observatory indicators related

All indicators are related to the formation of the land transport authority of Mebidangro, the main one being:

#### 20. Financing

Furthermore, given the prime importance of this action for the mobility development of the Metropolitan area (Central Government criteria for funding assistance), this action shall be monitored by Government activity monitoring.



### Theme Governance

#### Goal

Restructure the minibus institutional arrangements to have a sustainable system with fair and equitable operations to the benefit of users.

#### Background

The existing minibus fleet in Mebidangro is estimated around 7.000+ units. It represents +/- 66% of identified public transport in Mebidangro. However, it is indicated as the most under utilized modes with the emergence of online hailing transport in the recent years. This situation is worsened as the existing fleet is aging and not well maintained or managed, which further lower the interest of the market to utilize this mode. However, the flexibility of minibus, enables them to provide transport service through the narrow street of residential area and provide a massive transport network that cover the majority of Mebidangro area.

#### Strategy

This measure require 2 key items to ensure it success during its implementation. First is a sound and implement ability of the reformation plan and scheme, which come from technical, economic and legal analysis, strengthen by success story in other cities. Second is the market acceptability from the main stakeholder of this measure, the existing minibus operator, on the reformation scheme offered through intensive market sounding and open discussions.

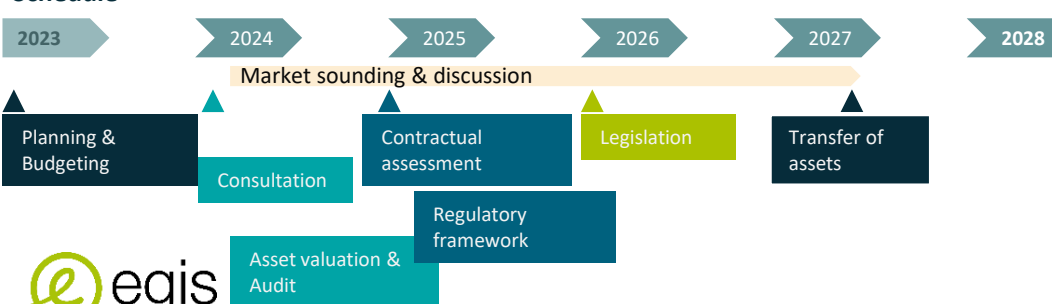
#### Expected Output and Outcomes

Government to control over levels of service of minibus (routes & vehicles) with clear management and fairness of operations according to public standards. Provide the ability to rejuvenate and manage better and more sustainably the assets. And also ease the integration with other modes and provide transport service to vulnerable groups. Which ultimately will provide adapted services to the users easily and increase the attractiveness of minibus and in consequence its ridership.

#### Cost estimation and funding

The costs are assimilated to management and merger advisory, as well as transport operations planning, regulatory works and audits, equivalent to IDR 70 to 80 billion.  
Source of funding: APBD (Regional and Municipal Budgets)

#### Schedule



### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	High
Implementation	Medium
Operational	Medium
Political	Low
Sovereignty	None



### Entities involved (lead, participant)

<b>DISHUB</b>	<b>OF</b>	<b>NORTH SUMATRA</b>
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<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

### Observatory indicators related

03. Road Safety
05. Modal Split of PT and NMT
06. Multimodal Integration of PT at hubs
07. Comfort and Bliss of Mobility
08. Security of Collective Mobility
09. Commuting Travel Time
10. Road Congestion and Delays
11. Energy Efficiency of Overall Mobility
12. Reduction of GHG Emissions from Mobility
13. Reduction of Air Pollution from Mobility



### Theme Governance

#### Goal

To generate new source of funding for public transportation development and operations by taxing the companies which get the benefit directly / indirectly.

#### Background

A transport tax, the *Versement Transport* was created by the Act of July 12th, 1971 in the Paris Region, underpinned by the idea that transport networks should not only be financed by users, but also by employers – enterprises and administrative services – who, directly or indirectly, benefit from them, as a good transport network allows the employers to enlarge their recruiting opportunities and improve the transport conditions of their employees and customers.

Considering the needs to find resources to finance urban transport and mobility, due to constrained public budgets, in any country but mainly in developing ones, some have considered creating a tax inspired by VM.

#### Strategy

This could be achieved by redesigning the horizontal and vertical coordination between all governments (national and regional) to describe the VM regulation into local context including: the stakeholder mapping and identification, pros-and-cons in the implementation, and define the suitable conditions in which it would be well implemented in Indonesia, primarily in Mebidangro local context.

#### Expected Output and Outcomes

Increase the capacity in efficiency of administrations, capable decision-making, and better understanding in the economic mobility domain.

#### Cost estimation and funding

The cost to conduct the action will include (1) the preliminary cost (form survey and data collection to the socialization process) and (2) implementation project.

Source of funding: APBD (Regional and Municipal Budgets) and APBN (National budget), International Partners

### Impacts

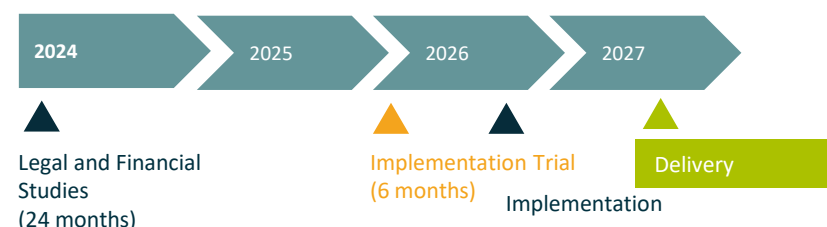
Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	High
Implementation	Low
Operational	Medium
Political	High
Sovereignty	Low

### Schedule

The timeline of such action highly depends on the political willingness and private companies resistance. Benefits and/or compensation for private companies shall be identified in parallel of this action to ensure its timeline.



### Entities involved (lead, participant)

<b>DISHUB</b>	OF	<b>NORTH SUMATRA</b>
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DISPERKIM		
SATLANTAS		
DISKOMINFO		

### Observatory indicators related

- 02. Accessibility to Public Transport
- 04. Affordability of Public Transport
- 05. Modal Split of PT and NMT
- 20. Financing for Mobility





### Theme Governance

#### Goal

Enhancing the capability of the regional government (Provinces and Municipalities) to implement the SUMP by conducting technical assistance and training.

#### Background

Sustainable Urban Mobility Planning (SUMP) is a relatively new urban mobility strategy in Indonesia. Therefore, to implement a decent SUMP by the authorities, it is required to reflect and inspire on the implementation process used in other countries before it is adapted and implemented into local context. To achieve the objective, it is essential to define the idea of the training requirement to overcome the technical gaps by doing the technical assistance.

#### Strategy

To achieve this measure, the training needs should be identified and quantified by defining the technical gaps to overcome in SUMP implementation. The action needs to bring all the technical assistance in order to strengthen the basic knowledge and functionalities to the authorities or related stakeholders, on sustainable mobility deployment, with the assistance from the experienced consulting company from overseas. This action could be implemented immediately in the first 2 or 3 years, after SUMP conclusion, to realize all the trainings necessary, in a first approach.

#### Expected Output and Outcomes

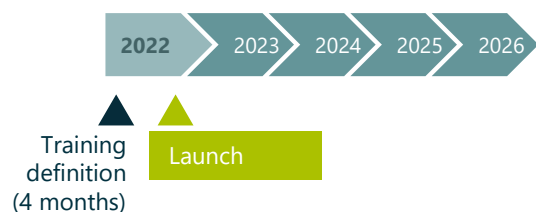
Establish capable authorities (all stakeholders and governments) to implement the SUMP by improving the efficiency in administrations skills, good decision making, and better understanding in mobility domain.

#### Cost estimation and funding

The cost is estimated and defined by the training needs and technical assistances provided (including the intensity, the quality, and duration). It is estimated at approximately IDR 2.5 billion per year. Source of funding: APBN (National Budgets) and foreign assistance

#### Schedule

The action is implemented yearly to provide constant support to the agencies in planning and projects implementation.



### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	-
Social	-
Implementation	-
Operational	-
Political	-
Sovereignty	-

Level

None

None

None

None

None

None



### Entities involved (lead, participant)

<b>DISHUB</b>	OF	<b>NORTH SUMATRA</b>
<b>PUPR</b>		<b>MEDAN</b>
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<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

### Observatory indicators related

- 01. Transportation Projects in Official Plans
- 16. Mass Transit Studied
- 20. Financing for Mobility



### Theme Governance

**Goal** Separate activities of infrastructure management and railway operations to allow competitiveness and higher levels of service for the users, as well as reduced costs of O&M.

**Background** This measure needs strong patronage from the Central Government. It could be implemented as a test at North Sumatra level, before spreading it at national level (at the image of South Sulawesi). This needs a good assessment of the needs and roles of infrastructure maintainer and train operator, in order to keep the economic balance between both and not introduce market distortions that could have *in fine* an impact on the infrastructure maintenance policy and assets degradation, and on the passenger service quality. KPI's for both entities (track maintainer and train operator) will be necessary to monitor the implementation and its functioning. It could be interesting to have private operator(s) enter the North Sumatra/national market for passengers and freight, and have some competition with PT KAI.

### Strategy

The framework must be clearly determined beforehand. The authorities play a critical role in defining the operations contracts and how the separation can ultimately be implemented. A thorough study case on Makassar-Pare Pare (DBFOMT) must be conducted beforehand and adapted to Mebidangro.

### Expected Output and Outcomes

Implementing performance-based contracts for operations and maintenance will grant higher value for money for the government, lowered expenses and higher satisfaction and attractiveness of PT for users, indirectly increasing the ridership.

### Cost estimation and funding

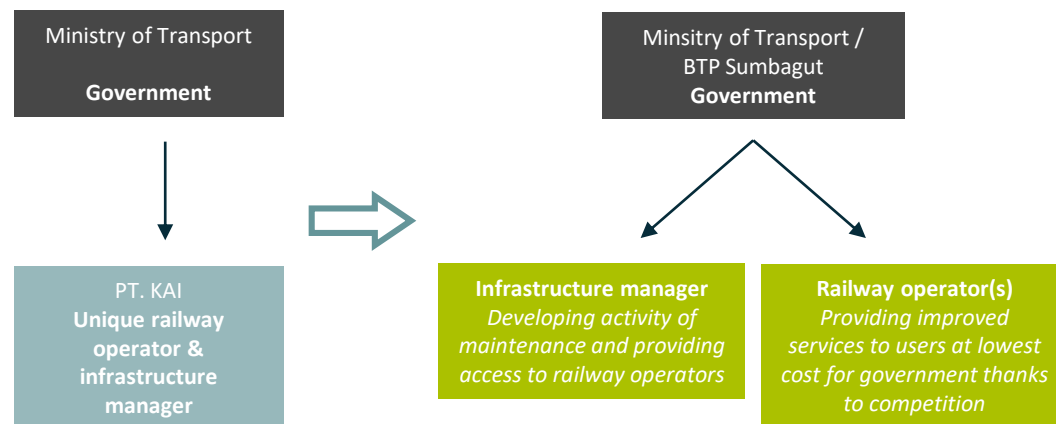
By itself the measure will not generate costs. But this should be done in an optimal way, in order to not create additional / extra costs generated by the separation and the duplicity of some roles, or exigencies of level of service. However, the central ministry of transportation and/or representation shall lead and fund the action.

### Impacts

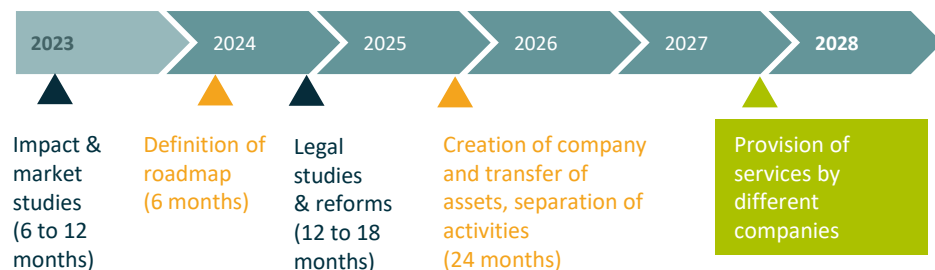
Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Environmental	Potential during construction	Medium
Social	-	None
Implementation	Framework does not exist	High
Operational	New schemes to be defined	Low
Political	Depends on regional leadership	Low
Sovereignty	Local components to be secured	Low



### Schedule



### Entities involved (lead, participant)

<b>DISHUB</b>	<b>OF</b>	<b>NORTH SUMATRA</b>
PUPR		MEDAN
BINA MARGA		BINJAI
BAPPEDA		DELI SERDANG
CIPTA KARYA		KARO
ATR/BPN		<b>CENTRAL GOV.</b>
DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

### Observatory indicators related

- 02. Accessibility to Public Transport Services
- 05. Modal split of PT and NMT
- 07. Comfort and Bliss of Mobility
- 08. Security of Collective Mobility
- 09. Commuting Travel Time
- 10. Road Congestion and Delays
- 15. Mobility Facilities Space Usage
- 20. Financing for Mobility



### Theme Governance

#### Goal

To implement the Transport Demand Management (TDM) maximally by applying the taxing system for operating private motorized vehicles based on economic measures and pricing.

#### Background

The *Road User Charging (RUC)* was first introduced in a form of fuel tax to recover infrastructure maintenance and capital cost. In several years back then, tracking every vehicle to charge for road usage was not feasible due to the technical and administrative adversities. Thus, taxing fuel was introduced as an indirect method of charging, since fuel was a good supplementary product, associated with vehicle usage, in order to encourage the Transportation Demand Management (TDM). TDM aims to maximize the efficiency of the urban transport system using a wide range of measures, including congestion pricing, public transport improvement, promoting non-motorized transport, fuel taxation and parking management.

#### Strategy

Economic measures should be prioritize in defining the tax rate policies, which shall be the most effective way to address the transportation problems and improve the systems efficiently and effectively. Several principles which must be defined in tax rate policies are: consumer options; cost-based price; and economical neutrality comparing to the equal goods. Therefore, it can be implemented by:

- Increase the fuel taxes
- Road-use metering and kilometer charging
- Transport improvement fee

#### Expected Output and Outcomes

Establishing the motorized vehicles taxation system is expected to come up with several benefits, which are: good financial risk management, financial capacity, fiscal capacity levels, sustainability, reduction of number of vehicles, emission decrement, and travel time cut-off.

#### Cost estimation and funding

The cost to implement this measure should include the preliminary cost, which is composed by: survey and data collection; studies and assistances; workshop and FGD; regulatory and policy making; legislation process; and socialization.

Source of funding: APBD (Regional and Municipal Budgets)

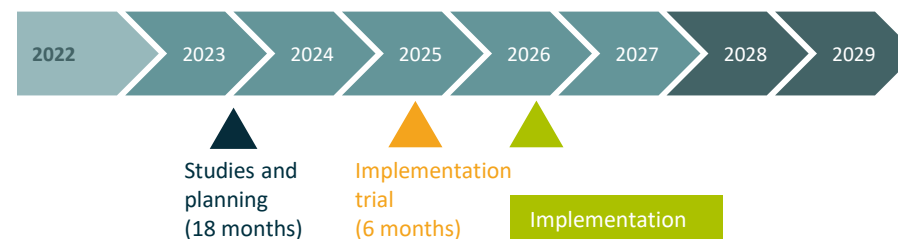
### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	Medium
Implementation	Medium
Operational	None
Political	High
Sovereignty	None

### Schedule



### Entities involved (lead, participant)

<b>DISHUB</b>	OF	<b>NORTH SUMATRA</b>
<b>PUPR</b>		<b>MEDAN</b>
<b>BINA MARGA</b>		<b>BINJAI</b>
<b>BAPPEDA</b>		<b>DELI SERDANG</b>
<b>CIPTA KARYA</b>		<b>KARO</b>
<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

### Observatory indicators related

- 03. Road Safety
- 05. Modal Split of PT and NMT
- 09. Commuting Travel Time
- 10. Road Congestion and Delays
- 14. Quality and Livability of Public Space
- 20. Financing for Mobility



### Theme Environment

#### Goal

To reduce private vehicle shares and increase public transport shares, and at the same time to increase the share of low-carbon & energy efficient private vehicles.

#### Background

In Mebidangro, most of the travel are done by utilizing private vehicles, which are the direct indication on the absence of adequate public transportation system. This situation force the public to self procure their means of transport, which directly burden the road network due to the sheer volume of vehicle travelling in the road. The great majority of those vehicles is fossil fueled, thus producing GHG emission in an alarming rate, which degrades the air quality in the Mebidangro area.

#### Strategy

This measure requires a firm and comprehensive analysis for the basis of its implementation. As the implementation of this measure potentially affects a wide range of daily aspect of the Mebidangro inhabitants. Thus a legal and institutional studies need to be conducted, and followed up by the implementing body in order to set up the defined measures. Due to the extent and potential effect towards Mebidangro, a trial phase is to be expected.

#### Expected Output and Outcomes

Increase of public transport share and reduce private vehicle shares.  
Air pollution, emission and noise pollution reduction.

#### Cost estimation and funding

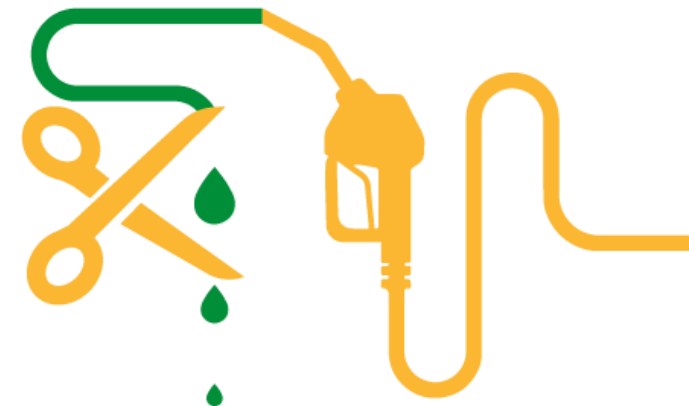
Benchmark of EcoFuel saver: 700K – 1.4 MIDR per/car  
Incentives for eco friendly vehicle purchase (lower tax rate, lower electricity bill etc.)  
Source of funding: APBD (Regional and Municipal Budgets) & APBN (National Budget)

### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	High
Implementation	Medium
Operational	Low
Political	High
Sovereignty	None



### Schedule



### Entities involved (lead, participant)

<b>DISHUB</b>	OF	<b>NORTH SUMATRA</b>
PUPR		MEDAN
BINA MARGA		BINJAI
BAPPEDA		DELI SERDANG
CIPTA KARYA		KARO
ATR/BPN		CENTRAL GOV.
DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

### Observatory indicators related

- 03. Road Safety
- 05. Modal Split of PT and NMT
- 10. Road Congestion and Delays
- 11. Energy Efficiency of Overall Mobility
- 12. Reduction of GHG Emissions from Mobility
- 13. Reduction of Air Pollution from Mobility





### Theme Environment

#### Goal

The ultimate goal is to convert the entire rail network of Mebidangro in order for it to be powered by electricity or hydrogen based fuel.

#### Background

The current GHG emission of Mebidangro were driven by the sheer number of private vehicles operate in streets. While intervention to reduce the utilization of private vehicle might taken a longer time to show its results on air quality, a fuel conversion on the existing public transport fleet enable the stakeholders to yield the desired results faster.

#### Strategy

A review on the existing train technology implemented and alignment with the national strategic direction issued by central government is needed to give an overview of the necessary figure to convert the existing fleets. A review of the necessary energy infrastructure (power plant or hydrogen production plant) is also necessary, in order to support the fuel supply during train operation.

#### Expected Output and Outcomes

Air pollution and noise pollution reduction. Improvement of energy efficiency for overall mobility. Reduced OPEX for operators and cost savings on the long term.

#### Cost estimation and funding

In case of electrification :

CAPEX well known and mastered, OPEX is quite elevated

In case of use of hydrogen :

CAPEX still to be mastered, as there are lack of REX. But could be mastered as this concerns punctual installations and not linear equipment. OPEX is expected to be lower than for electrification.

Source of funding: APBD (Regional and Municipal Budgets) & APBN (National Budget), International partners and Private Sector

### Impacts

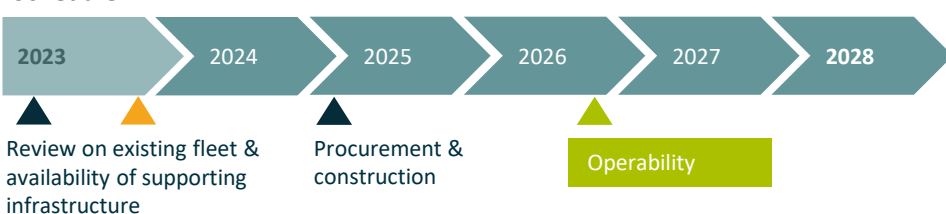
Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	None
Implementation	Medium
Operational	Low
Political	Low
Sovereignty	None



### Schedule



Technical studies  
and procurement  
studies



### Entities involved (lead, participant)

<b>DISHUB</b>	<b>OF</b>	<b>NORTH SUMATRA</b>
PUPR		MEDAN
BINA MARGA		BINJAI
BAPPEDA		DELI SERDANG
CIPTA KARYA		KARO
ATR/BPN		<b>CENTRAL GOV.</b>
DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

### Observatory indicators related

- 04. Affordability of Public Transport
- 07. Comfort and Bliss of Mobility
- 11. Energy Efficiency of Overall Mobility
- 12. Reduction of GHG Emissions from Mobility
- 13. Reduction of Air Pollution from Mobility

SUSTAINABLE URBAN MOBILITY PLAN MEBIDANGRO

ACTION 40

RENEWABLE ENERGIES FOR ROAD PT



Theme Environment

**Goal**  
Shift fleets of road-based PT to sustainable energies like electricity of green origin and decarbonized hydrogen: minibuses, buses and regional buses.

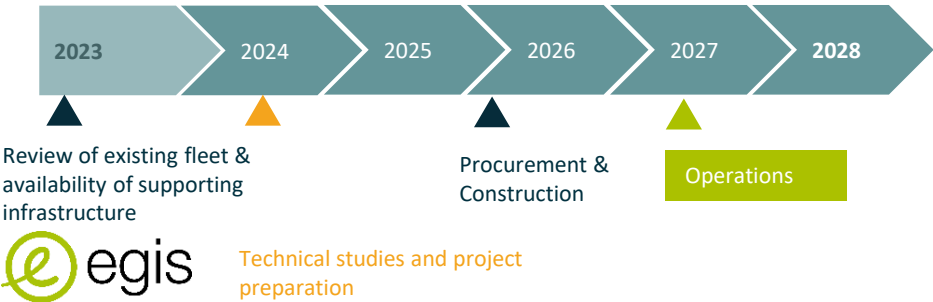
**Background**  
The current GHG emission of Mebidangro were driven by the sheer number of private vehicles operating in streets. While intervention to reduce the utilization of private vehicle might taken a longer time to show its results on air quality, a fuel conversion on the existing public transport fleet enable the stakeholders to yield the desired results faster.

**Strategy**  
A review on the existing train technology implemented and alignment with the national strategic direction issued by central government is needed to give an overview of the necessary figure to convert the existing fleets. A review of the necessary energy infrastructure (power plant or hydrogen production plant) is also necessary, in order to support the fuel supply.

**Expected Output and Outcomes**  
Air pollution and noise pollution reduction. Reduced OPEX on the long term and costs savings.

**Cost estimation and funding**  
In both case:  
Incentive funds for electric/hydrogen vehicle conversion  
In case of electrification :  
CAPEX well known and mastered, OPEX is quite elevated  
IDR 4.500.000.000 – 6.000.000.000 (USD 313.000 – 417.000) per-vehicle (BYD-Laksana)  
Other Brand  
USD 378.000 – 635,000  
In case of use of hydrogen :  
CAPEX estimated at USD 1.270.000 per vehicle  
Source of funding: APBD (Regional and Municipal Budgets) & APBN (National Budget)

Schedule



Impacts	Risks	Description	Level
Environmental	Environmental	-	None
Socio-economic	Social	-	None
Governance	Implementation	Vehicle price, availability and resources to operate	Medium
Novelty	Operational	Capacity	Low
	Political	Depends on regional leadership	Low
	Sovereignty	-	None



Entities involved (lead, participant)		Observatory indicators related
<u>DISHUB</u> PUPR BINA MARGA BAPPEDA CIPTA KARYA ATR/BPN DLH BPKAD DPPPA DISPERKIM SATLANTAS DISKOMINFO	OF <u>NORTH SUMATRA</u> MEDAN BINJAI DELI SERDANG KARO <u>CENTRAL GOV.</u>	01. Transportation Projects in Official Plans 04. Affordability of Public Transport 07. Comfort and Bliss of Mobility 11. Energy Efficiency of Overall Mobility 12. Reduction of GHG Emissions from Mobility 13. Reduction of Air Pollution from Mobility 16. Mass Transit Studied



### Theme Environment

**Goal** The goal is to shift from combustion engines to clean vehicles in Mebidangro, thus helping to reach its carbon reduction goals, and increase the share of low-carbon & energy efficient PVs.

### Background

Technologies for electric cars and charging stations are available in Indonesia (Jakarta). The recent ministerial regulation for the creation of standards for this growing market is (*Peraturan Menteri ESDM No. 13/2020* regarding Provision of Electricity Charging Infrastructure) has pushed for the availability of charging stations in personal houses, stations, offices, etc. Hence, a positive environment for this action is enabled and can be strengthened with metropolitan-level targets. The mission of the agencies will be to enable and push for the purchase of electric vehicles for organizations and individuals, as well as provide charging stations.

**Strategy** Main steps identified to implement this measure are as follows.

#### Identification of the related regulation in Indonesia

- *Peraturan Presiden* No. 55/2019 regarding Acceleration program for Battery Electric Vehicle
- *Peraturan Menteri ESDM* No. 13/2020 regarding Provision of Electricity Charging Infrastructure for Battery-Based Electric Vehicle

#### Carry out strategies within national regulation towards Mebidangro regulation

- Define target fleet share of electric vehicles in Mebidangro
- Define supporting infrastructure needed (charging) in Mebidangro
- Adapt PLN network accordingly

#### To promote green vehicles by technology development and fleet improvement

- (additional) Subsidies for purchasing eco-cars ; Providing incentives for clean vehicles
- (additional) Government to support the construction of charging facilities

### Expected Output and Outcomes

Reducing pollution of the environment through reduction of GHG emissions, air pollutants emissions and noise.

### Cost estimation and funding

Quantities of charging stations and the cost to government of their procurement, as well as the incentives to organizations and people to purchase electric vehicles shall be the subject of a dedicated study. However, the Indonesian market indicates the following premiums:

#### Authorities:

Public charging station (level 2, most common to implement in public): IDR ±100 million per station for purchase, IDR 20 million/year for maintenance

#### Users (Organizations & Individuals)

Home charging station: IDR 5,5 - 15 million

Vehicles: Motorcycle: IDR 18 – 20 million for purchase, IDR 88k/month for O&M (3x lower than gasoline engines)

Cars: IDR 0,4– 4,4 billion for purchase, IDR 4,5 million/year for O&M

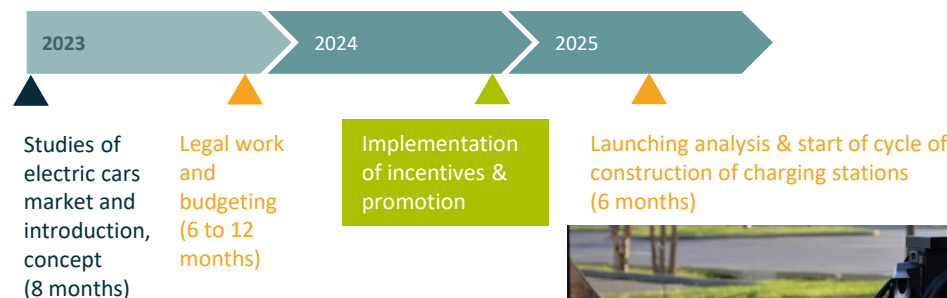
### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Lifecycle of batteries to manage	Low
-	None
High premium of technology	High
Availability of reliable electricity	Low
Need incentives to trigger shift	Low
-	None

### Schedule



### Entities involved (lead, participant)

<b>DISHUB</b>	OF	<b>NORTH SUMATRA</b>
<b>PUPR</b>		<b>MEDAN</b>
<b>BINA MARGA</b>		<b>BINJAI</b>
<b>BAPPEDA</b>		<b>DELI SERDANG</b>
<b>CIPTA KARYA</b>		<b>KARO</b>
<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		



### Observatory indicators related

01. Transport Projects in Official Plans
07. Comfort and Bliss of Mobility
12. Reduction of GHG Emissions from mobility
13. Reduction of Air Pollution from mobility
14. Quality and Livability of Public Space
15. Mobility Facilities Space Usage
20. Financing



### Theme Environment

#### Goal

To upgrade all of the existing minibuses and bus fleets in Mebidangro with cleaner fuel engines

#### Background

The existing public transport fleet relies on fuel engine, thus GHG emission from public transport sector is relatively high. This situation was worsened due to the fact that most of the operating vehicle are aging. This will intensify the decrease of air quality in Mebidangro.

#### Strategy

Start with inventory on all of the existing vehicle per type of engine and vehicle age to get the overview of the needed improvement scale. Followed up by budgeting and prioritization of actions needed to improve. On this stage a clear and intensive market sounding is needed to gain the existing public transport operator support prior to the procurement and implementation of this measure.

#### Expected Output and Outcomes

Increased attractiveness of road-based public transportation and resulting increased ridership  
Reduction of GHG and air pollutants emissions from current road-based transport vehicles

#### Cost estimation and funding

Costs are assimilated to consultancy (technical and financial) for the equivalent of IDR 20 billion. It is assumed that the costs of the new fleet are not under the authorities scope, but remains under the operators as the current owners of the fleets.  
Source of funding: APBD (Regional and Municipal Budgets)

### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	None
Implementation	Medium
Operational	Medium
Political	None
Sovereignty	None



### Schedule



### Entities involved (lead, participant)

<b>DISHUB</b>	OF	<b>NORTH SUMATRA</b>
PUPR		MEDAN
BINA MARGA		BINJAI
BAPPEDA		DELI SERDANG
CIPTA KARYA		KARO
ATR/BPN		CENTRAL GOV.
DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

### Observatory indicators related

- 04. Affordability of Public Transport
- 11. Energy Efficiency of Overall Mobility
- 12. Reduction of GHG Emissions from Mobility
- 13. Reduction of Air Pollution from Mobility





### Theme Environment

#### Goal

Increase capacity to measure in more detail the GHG emissions and air pollutants emissions related to mobility in Mebidangro, in order to draw data-driven policies and further measures.

#### Background

Currently the number of air quality monitoring station is very limited. This fact decreases the ability of Mebidangro to track the air quality on its area and lose the opportunity to build an important database, that is relevant for sound decision regarding air quality improvement.

#### Strategy

Inventoried thoroughly air quality stations (public and private ones). Develop the current air quality station location to gain maximum data capture and estimate the needs of new installation. Prepare specification and procurement. Training and coaching of task team to follow works and monitor regularly emissions levels. Implementation and operation.

#### Expected Output and Outcomes

Increased capacity to measure air quality data and build air quality model. Implement data driven decisions on pollution reduction.

#### Cost estimation and funding

Costs are assimilated to consultancy (technical and financial) for the equivalent of IDR 15 billion. The costs of the stations and training should be determined in further studies upon sizing and operations planning of the air quality control.

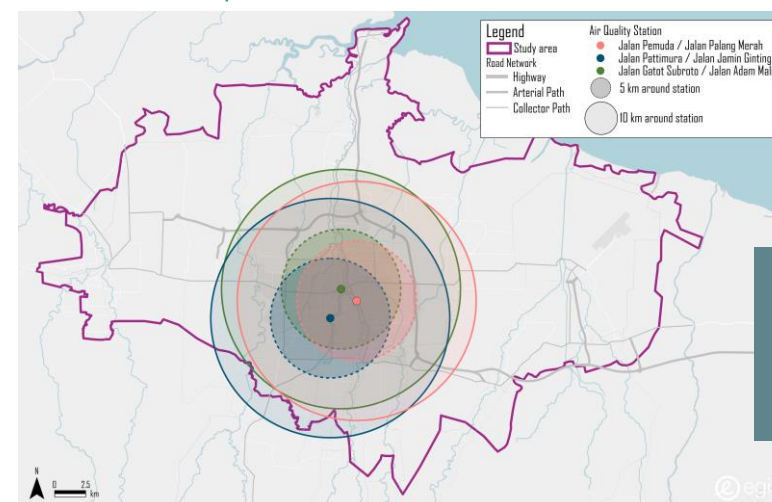
Source of funding: APBD (Regional and Municipal Budgets)

### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

Description	Level
Environmental	None
Social	None
Implementation	Higher investment
Operational	Monitoring
Political	None
Sovereignty	None



Existing air quality stations cover the area insufficiently and are malfunctioning.

### Schedule



### Entities involved (lead, participant)

<b>DISHUB</b>	<b>OF</b>	<b>NORTH SUMATRA</b>
<b>PUPR</b>		<b>MEDAN</b>
<b>BINA MARGA</b>		<b>BINJAI</b>
<b>BAPPEDA</b>		<b>DELI SERDANG</b>
<b>CIPTA KARYA</b>		<b>KARO</b>
<b>ATR/BPN</b>		<b>CENTRAL GOV.</b>
<b>DLH</b>		
<b>BPKAD</b>		
<b>DPPPA</b>		
<b>DISPERKIM</b>		
<b>SATLANTAS</b>		
<b>DISKOMINFO</b>		

### Observatory indicators related

- 12. Reduction of GHG Emissions from Mobility
- 13. Reduction of Air Pollution from Mobility
- 14. Quality and Livability of Public Space
- 20. Financing for Mobility



### Theme Environment

#### Goal

The goal of the measure is to increase the community awareness of environmental issues and inform about the strategies to deal with it, starting from the personal area in order to foster new habits on mobility.

#### Background

Considering the Mebidangro area is the agglomeration of Medan Metropolitan area, it means that the mobility of the commuting people from the inside to outside, or the other way, is inextricable. To facilitate this daily mobility, the related-governments should see this as something that really matters, considering the environmental impact which might come up and bring severe impact to the community. Therefore, the coordination between all stakeholders should be well defined to raise the significant public awareness on Mebidangro area.

#### Strategy

This could be achieved by focusing on the campaigns and events as well as promote it using many platforms such as social media (such as Instagram, Twitter, Facebook), road banners, engage influencers / celebrities to join the action, having collaboration with NGO in environmental area from the local to international, etc. And to raise the public awareness about the modal shifting action, primarily in order to reduce the GHG emission, in North Sumatera.

#### Expected Output and Outcomes

Raise the public awareness in supporting the environmental improvement by modal shifting to the public transport in order to reduce the mobility which brings the GHG emissions and air pollutions in Mebidangro area.

#### Cost estimation and funding

The assimilated cost to provide the planning program is up to IDR 10 billion (excluding the annual costs in campaigns and events). Source of funding: APBD (Regional and Municipal Budgets), and possible grant from collaboration with NGO.

#### Observatory indicators related

- 03. Road Safety
- 05. Modal Split of PT and NMT
- 10. Road Congestion and Delays
- 11. Energy Efficiency of Overall Mobility
- 12. Reduction of GHG Emissions from Mobility
- 13. Reduction of Air Pollution from Mobility

#### Entities involved (lead, participant)

<u>DISHUB</u>	OF	<u>NORTH SUMATRA</u>
PUPR		MEDAN
BINA MARGA		BINJAI
BAPPEDA		DELI SERDANG
CIPTA KARYA		KARO
ATR/BPN		CENTRAL GOV.
DLH		
BPKAD		
DPPPA		
DISPERKIM		
SATLANTAS		
DISKOMINFO		

### Impacts

Environmental	●	●	●
Socio-economic	●	●	●
Governance	●	●	●
Novelty	●	●	●

### Risks

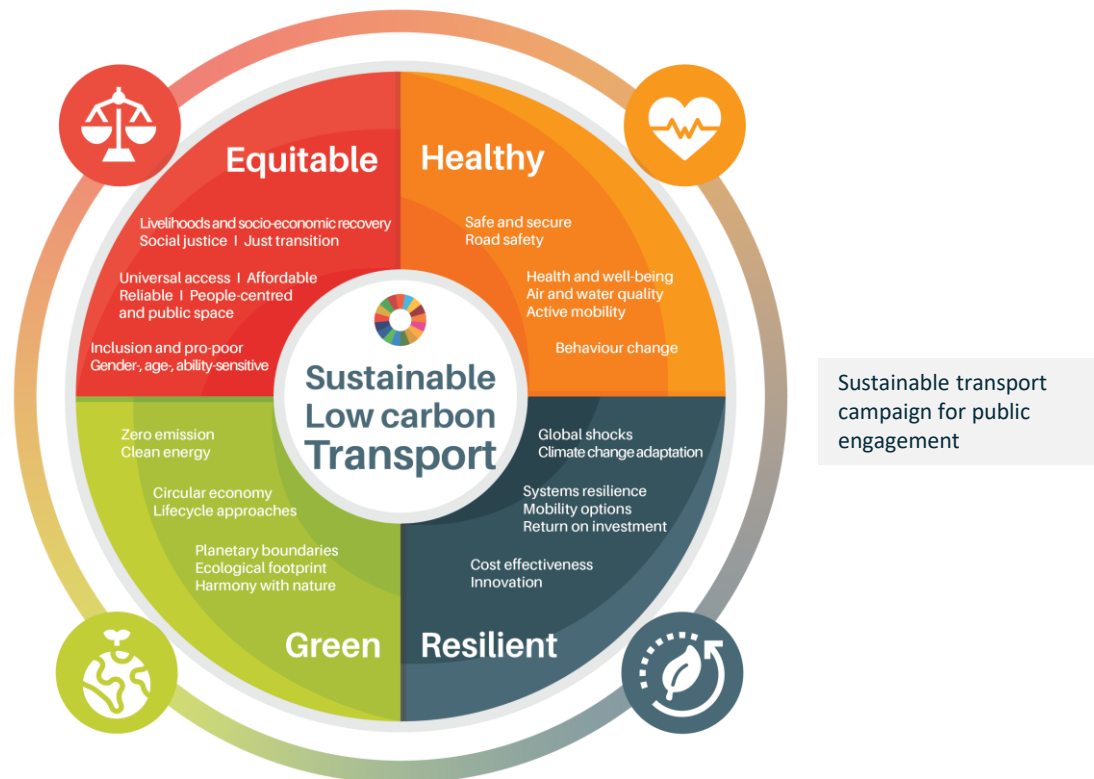
Environmental	-
Social	-
Implementation	-
Operational	-
Political	-
Sovereignty	-

### Description

### Level

None
None
None
None
None
None

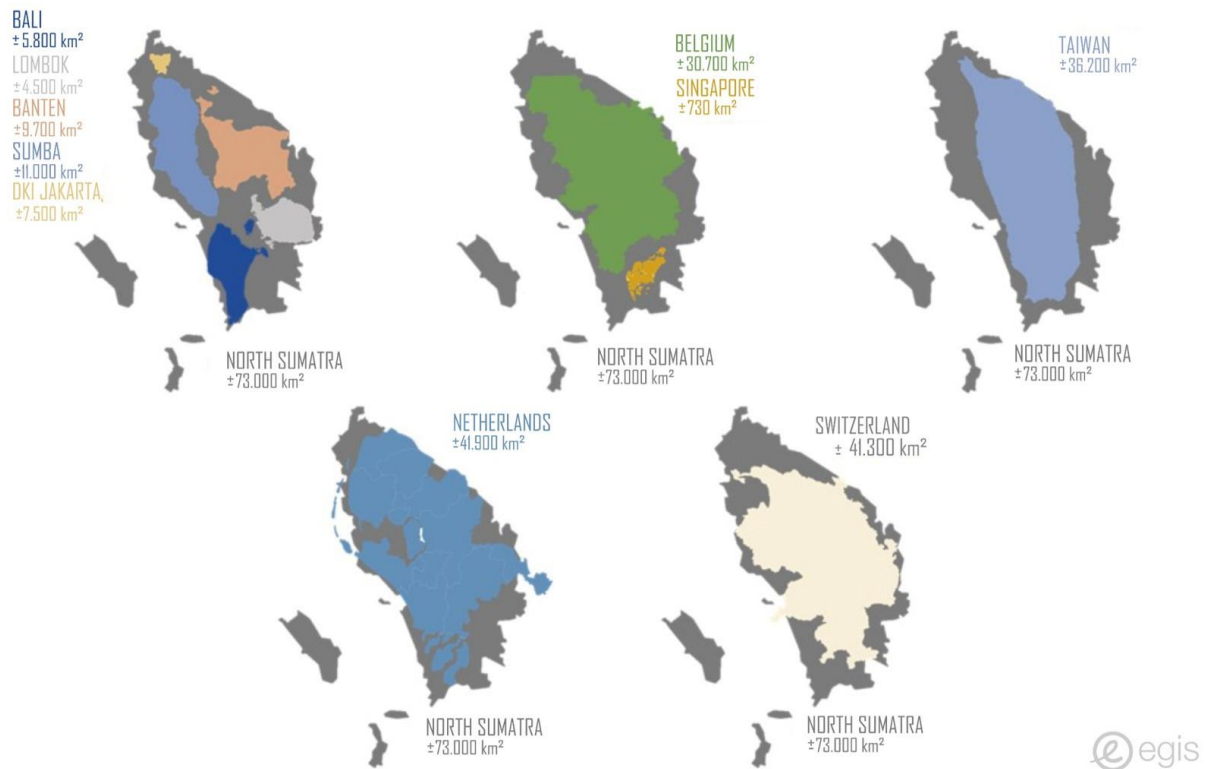
### Schedule



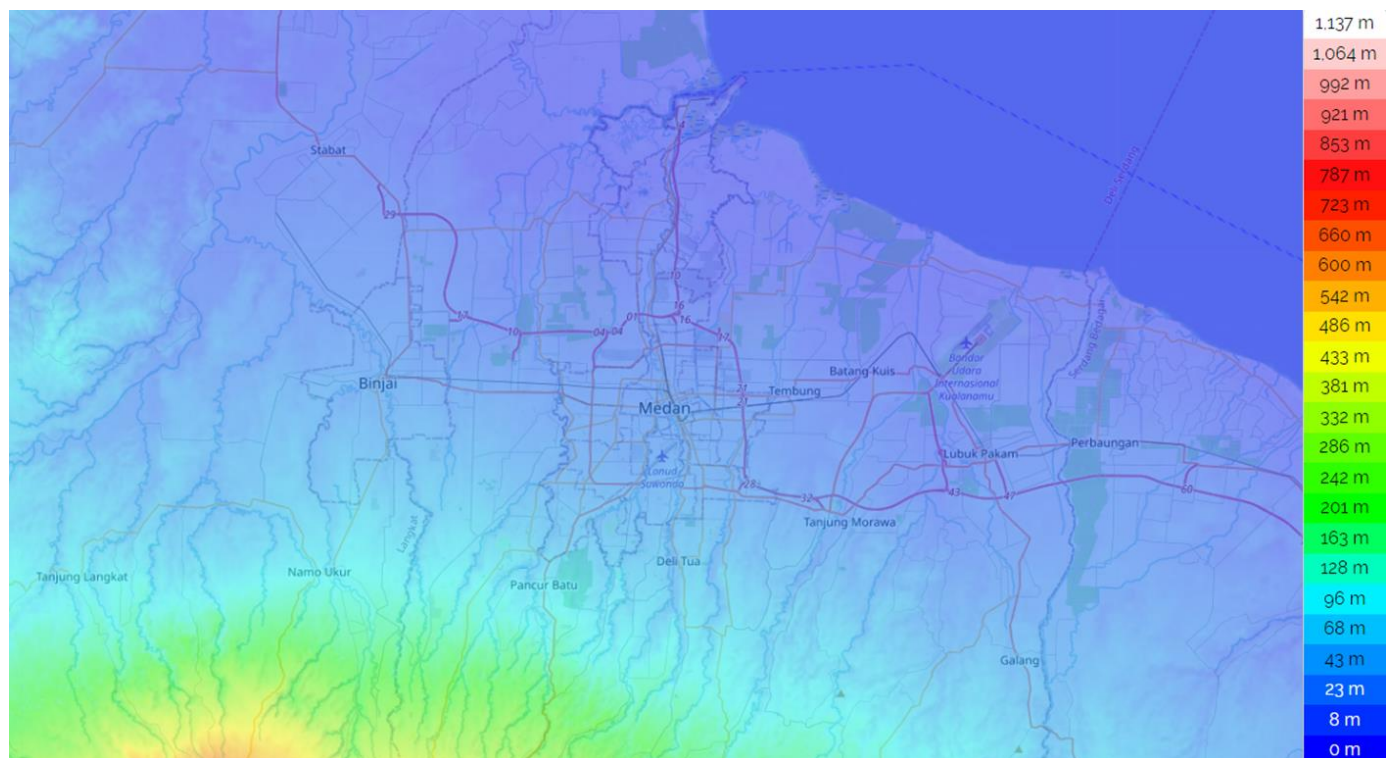
Sustainable transport campaign for public engagement

### III. Diagnosis Appendices

#### III.1. North Sumatra comparison against other territories



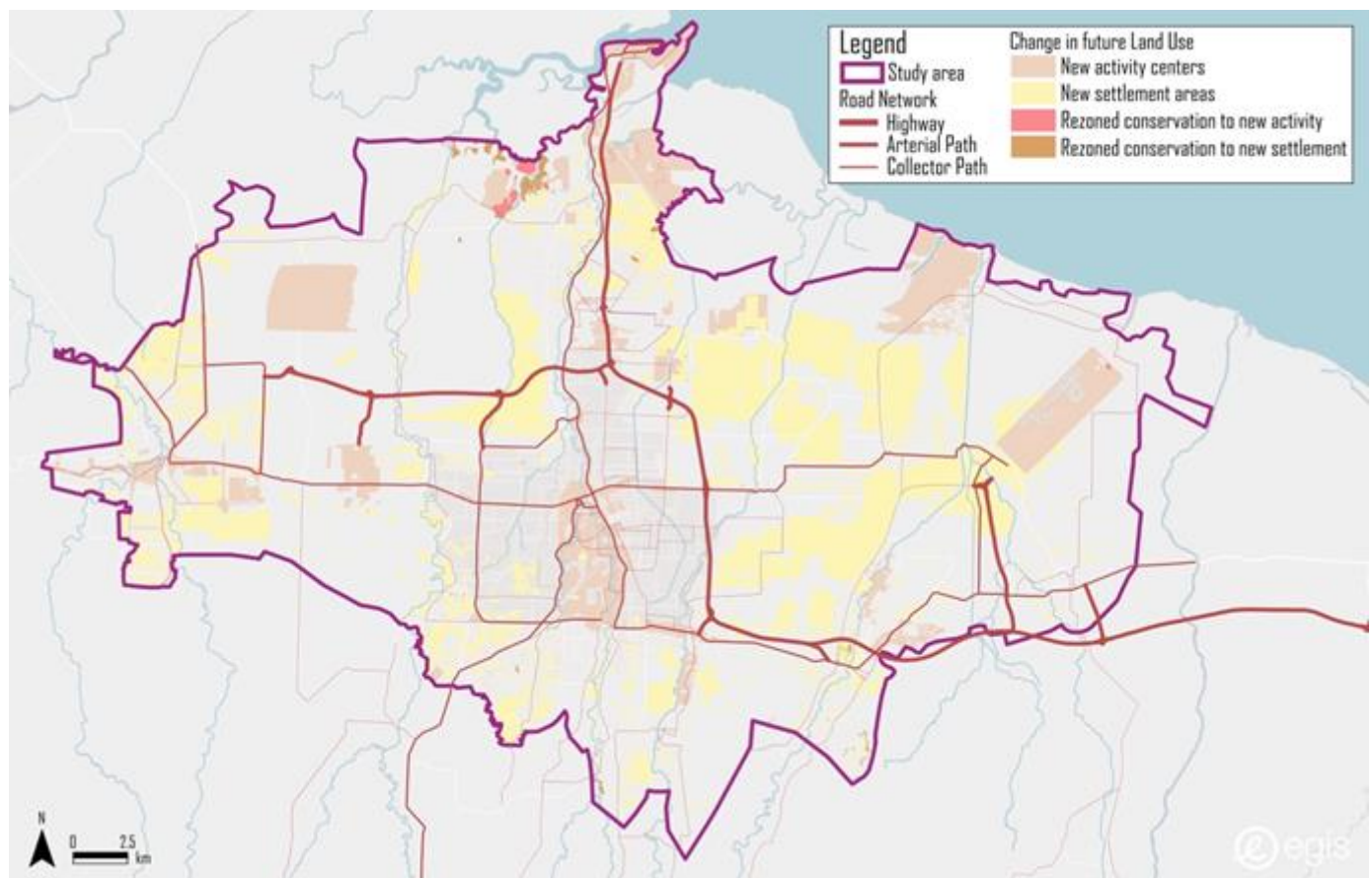
#### III.2. Medan area topography



### III.3. Projected spatial change: comparison of existing land use and spatial plan

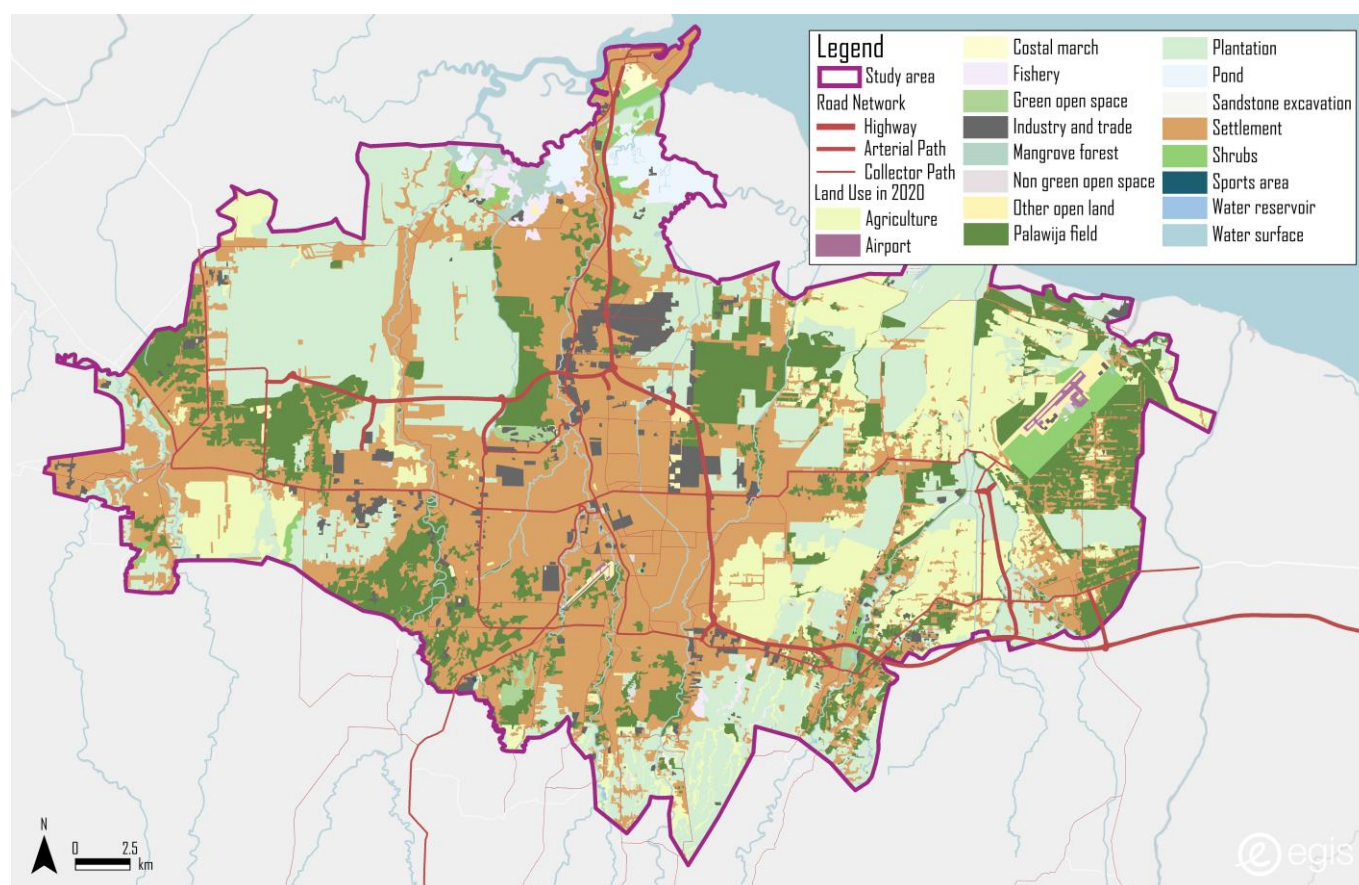
Category	Existing	Plan	Notes
No change in future land-use			
Existing settlement area	Settlement	Settlement	No change
Existing activity centres	Built, other than settlement	Built, other than settlement	No change
Conservation areas	Conservation	Conservation	No change
Open spaces and agriculture	Open space	Open space	No change
Change in the future land use (from open spaces to built-up areas)			
New settlement areas	Non-built-up	Settlement areas	New mobility generators
New activity centres	Non-built-up	Activity centres	
Change in future land use (incongruity changes)			
Rezoned areas (change function)	Built	Built	Change function
Rezoned areas (from built to non-built)	Built	Non-built	Incongruity change
Rezoned areas (conservation to built)	Conservation	Built	Incongruity change

### III.4. Mapping of projected spatial change





### III.5. Land use



### III.6. Public transport fares

Service Area	Vehicle Type	Fares
Mebidangro	Intercity within provincial public transport (AKDP)	Basic fares: IDR 122/pass/km Upper limit: IDR 159/pass/km Lower limit: IDR 98/pass/km
	Medan – Tanjung Balai Train	PSO: IDR 24.000 (0 – 131 Km) and IDR 27.000 (>131 Km)
	Medan – Siantar Train	PSO: IDR 22.000/trip
	Medan – Binjai	PSO: IDR 5.000/trip
	Medan – Rantau Prapat	IDR 110.000 – 170.000/trip
Medan	Urban Angkot (car and/or bus)	General: IDR 4.500/10 Km Student: IDR 3.000/10 Km
	Trans Metro Deli	Still free/Still being Subsidized by Ministry of Transport
Deli Serdang	Rural Angkot	General: IDR 3.350/10 Km Student: IDR 2.500/10 Km
Binjai	Urban Angkot	General: IDR 2.800/trip Student: IDR 1.700/trip
	AKDP Binjai - Medan	IDR 7.000/trip
	Trans Mebidang	IDR 7.000/trip
	Transbinjai	Free, subsidised by Binjai Government
Karo	Urban Angkot	IDR 3.000/trip
	Rural Angkot	Minimum IDR 3.000/trip

### III.7. Past growth of private vehicles

Regency / City	Years	Number of vehicles		Average yearly growth (%)		Total growth	
		Cars	Motorcycles	Cars	Motorcycles	Cars	Motorcycles
Medan City	1999	103.063	431.869	7,80%	13,14%	111%	241%
	2009	217.836	1.471.956				
Binjai City	2001	3.565	19.041	6,96%	15,09%	168%	402%
	2013	9.539	95.532				
Deli Serdang Regency	2008	4.726	57.370	11,96%	4,91%	224%	30%
	2019	15.335	74.328				
Karo Regency	2006	1.076	5.772	6,14%	13,47%	60%	169%
	2014	1.718	15.525				

### III.8. Brief on the motorcycle use

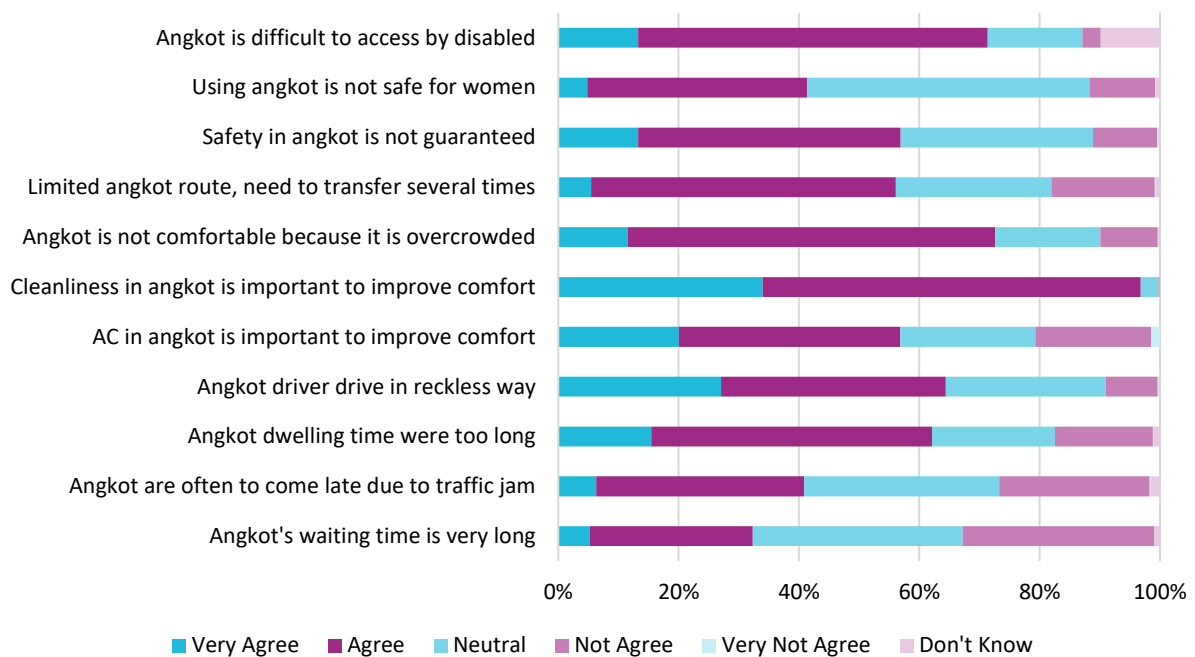
In many developing countries, especially in Indonesia which is one of the country with the highest motorcycle usage, motorcycle can provide both problems and solutions for the urban transport. Motorcycle can provide mobility that no other modes can match in many developing countries. On motorcycle users point of view, there are several benefits that can be achieved by using this mode of transportation, such as travel time, ease of parking, low cost maintenance, etc. However, the unstoppable growth of motorcycle usage in the area can results in many challenges, such as congestion, noise, emissions, and negative impacts on non-motorized transport and pedestrian spaces.

- ✓ Flexibility (21%), travel time (18%), and low cost (18%) are the top three factors that influence people to select motorcycle as their main mode of transportation;
- ✓ For 1.000 inhabitants, the SUMP area has an average of 485 motorcycle. It is on par with other metropolitan areas in Indonesia such as Jabodetabek and Kedungsepur with 478 and 434 motorcycles per 1.000 inhabitants respectively
- ✓ Flexibility:
  - ✓ Using a private vehicle (motorcycle in this case), shall not only raised the flexibility of the travel location, but also void the dependency of a schedule (schedule punctuality of public transport)
- ✓ Shorter travel time and travel distance:
  - ✓ The majority of the motorcycle users (40%) shows that they are travelling to work;
  - ✓ Motorcycle is used to cover short-distance trip, with 42.9% of motorcycle users used their motorcycle to travel within the 1 km distance;
  - ✓ There is a slight difference between motorcycle travel time and private car for short-distance travelling.
- ✓ Cost savings:
  - ✓ 67% of the household have an average income of up to 5 million IDR, which shows a low level of buying power. This showcases that a motorcycle is a choice that is more affordable when it comes to private vehicle instead of private car.
  - ✓ Cheaper taxes, fuel consumption, and parking price for motorcycle then private car.
- ✓ Safety and comfort:
  - ✓ There are 9% of the motorcycle users in Mebidangro that are below the age of driving in Indonesia (17 years+).
  - ✓ 24% of motorcycle users in Mebidangro riding their motorcycle without the ownership of a driving license (SIM C).

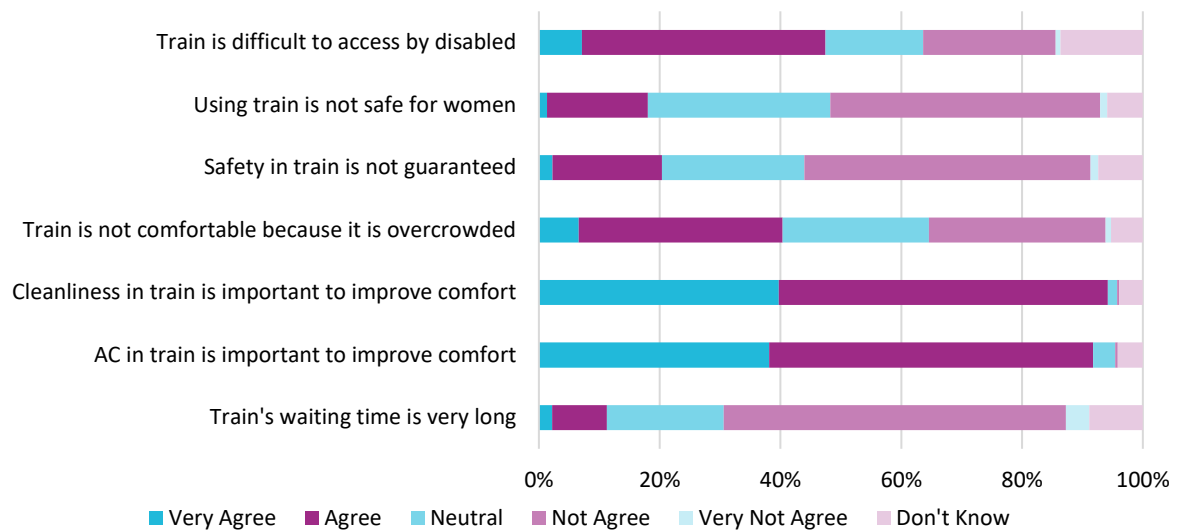
### III.9. Blackspots details

No	Blackspot location	Type	City/Regency
1	Jalan T.A Hamzah - Jl. Kl. Yos Sudarso	Junction	Binjai City
2	Jalan T.A Hamzah - Depan SPBU	Segment	Binjai City
3	Jl. Soekarno – Hatta - Km 20,5 - Jl. Ikan Hiu	Junction	Binjai City
4	Jl. Soekarno – Hatta - Km. 19,5 - Km 20 Dekat Mako Brimob	Segment	Binjai City
5	Jl. Medan – Binjai - Km. 13 – 14	Segment	Deli Serdang Regency
6	Jl. Medan – Binjai - Km. 13 – 18	Segment	Deli Serdang Regency
7	Jl. Sisimangaraja - Km. 7	Segment	Medan City
8	Jl. Jamin Ginting - Km. 39 -40	Segment	Deli Serdang Regency
9	Jl. Umum Nasional Sultan Serdang - Kualanamu Desa Buntu Bedimbar	Segment	Deli Serdang Regency

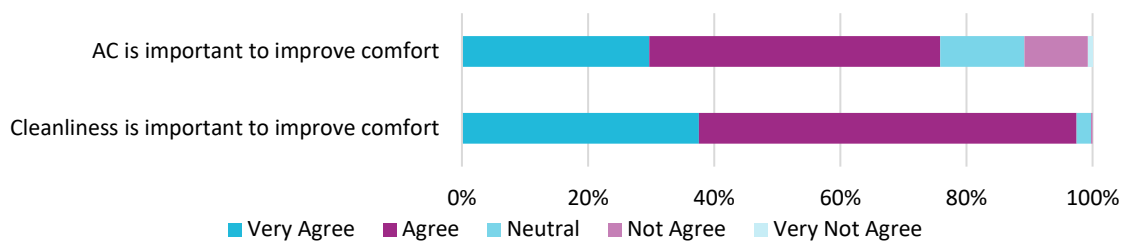
### III.10. Inhabitant perception of minibuses



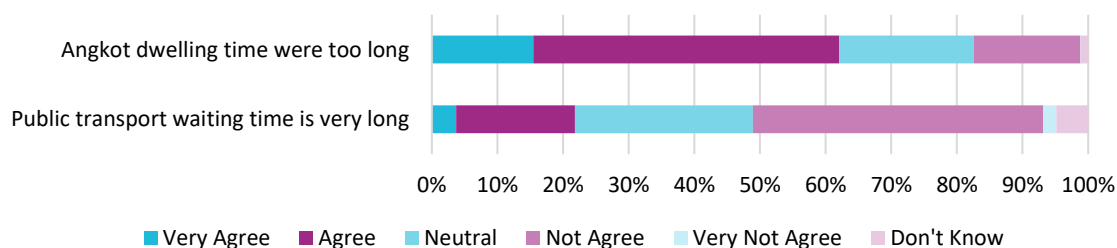
### III.11. Inhabitant perception of trains



### III.12. Preferred ways to improve comfort in public transportation



### III.13. Perceived punctuality and dwelling times of public transport





### III.14. Indonesian regulation related with climate change

No	Regulation	Type	Title
1	Presidential Regulation No. 18/2020	Development planning	RPJMN ( <i>Rencana Pembangunan Jangka Menengah Nasional</i> ) 2020 - 2024
2	Act No.32 of 2009	Environmental management	Environmental Protection and Management
3	Government Regulation No. 46/2016	Environmental management	Procedures for the Implementation of Strategic Environmental Assessment
4	Act No.6 of 1994	Environmental – climate	Ratification of United Nations Framework Convention on Climate Change
5	Presidential Regulation No. 61/2011	Environmental – climate	National Action Plan to Reduce GHG Emissions
6	Presidential Regulation No. 71/2011	Environmental – climate	National GHG Inventory
7	Act No.16 of 2016	Environmental – climate	Ratification of Paris Agreement to the UNFCCC
8	Environmental Ministry Regulation No. P.9/PPI/SET.8/REN.2/9/2020	Environmental – climate	Climate change RENSTRA 2020 - 2024
9	Government Regulation No. 22/2021	Environmental – air quality	Implementation of Environmental Protection and Management – Ambient air quality standard
10	Environmental Ministry Regulation No. 12/2010	Environmental – air quality	Air Pollution Control in the Regions
11	Environmental Ministry Regulation No. P.14/MENLHK/SETJEN/KUM.1 /7/2020	Environmental – air quality	Air Conditioning Standard Index

### III.15. Regional action plan implementation status for transportation sector

Program	Status			Expected Emission Reduction Target in 2020 (tCO <sub>2</sub> .eq)
	Finished	Implemented	No Information	
Development of ITS (Intelligent Transport System) and traffic management system	-	X	-	903.830
Parking management	-	X	-	179.000
The development of BRT/Semi-BRT system	-	X	-	85,56
Rejuvenation of angkot (micro-bus) vehicles	-	X	-	30.000
Smart eco driving training	-	X	-	12.840
Development of Non-Motorized Transport (NMT)	-	X	-	45.000
Development of Intercity train in Medan Area (Medan- Binjai – Deli Serdang – Delitua –Pancur-batu)	-	X	-	1.140.000
Development of double track in Kualanamu airport	X	-	-	9.500

Program	Status			Expected Emission Reduction Target in 2020 (tCO <sub>2</sub> .eq)
	Finished	Implemented	No Information	
Development of bus routes to Kualanamu airport	X	-	-	-
Implementation of car free day	-	X	-	10.000
Installation of converter kit in passenger car	-	-	X	4.500
Development of campus bus throughout all dense college student area to the designated campus area (USU and Unimed)	X	-	-	-
Implantation of trembesi trees in the pavement	-	-	X	560.000
Addition of non-emitter fuel	-	-	X	1.560.000
Integration of the Regional Action Plan to the students' curriculum.	-	-	X	-

### III.16. Short-term measures against the COVID-19 pandemic in public transit per operator

Short-term measure	Trains & stations	Angkots	Buses
<b>Equipment:</b> Provision of protection gear and hygiene equipment to staff (drivers, officers, sales) to secure health	Implemented	To do	Implemented
<b>Training:</b> staff to be trained to disinfect facilities and surfaces properly. Furthermore, staff shall be trained on how to communicate with and react to passenger's concerns about measures taken to prevent the virus spread (e. g. disinfection measures).	Implemented	To do	To do
<b>Health check-up:</b> Regular health check-ups can support and ensure that the employees feel safe and comfortable at work as well as identify any potential infections in an early stage.	Implemented	To do	To do
<b>Closed of front door/e-ticketing:</b> avoid repetitive passenger contacts and risks for the driver	N/A	Not adequate	To do
<b>Separation of drivers/ticket sellers and passengers:</b> Drivers and ticket sellers as well as any other staff should be separated from passengers by Plexiglas or other means	N/A	Implemented, however passengers seat close together	To do
<b>Wear of face masks:</b> operators to make mandatory the wear of face masks for passengers using their services to limit spread among passengers and staff	Implemented	To do	Implemented

<b>Temperature checking:</b> staff at facilities to check the body temperature of passengers to verify absence of signs of illness and contraction of virus, and limit risk of infection of other passengers and staff	Implemented	To do	To do
--	-------------	-------	-------

### III.17. Data collection methods

The surveys conducted for the SUMP Mebidangro are gathered in two groups: the traffic surveys, with direct presence of the surveyors in the transit locations (roads, PT), and the household, stated preference and perception surveys, interviews which cover fields beyond transportation.

#### III.17.1. Traffic surveys

To capture volumes, patterns, of road, rail, private and public vehicles, the following surveys are proposed in accordance to the TOR minimums and additional surveys judged necessary for a complete dataset creation. Below are the description of survey activities done during the preparation of SUMP

##### ■ OD – Interception of public transport type (on board PT)

- Origin-Destination interviews of on-board passengers give a direct insight on PT users and their trips.
- Goals: profiling of public transport users, their origin and destination, as well as desire for inter- modality.
- Method of collection: interviews are conducted by surveyors onboard public transportation vehicles, and answers are collected on the surveying mobile application (which presents the questionnaire).

Figure 1. On-board survey activity



##### ■ OD – Interception of public transport type (at PT hubs)

- Origin-Destination interviews of passengers at transportation hubs give a direct insight on PT users and their trips, especially their inter-modality, and complements the OD onboard survey.
- Goals: complement the OD onboard survey, by providing additional passengers profiling especially on inter-modality, and control group.
- Method of collection: passenger interviews are conducted by surveyors at rail stations and bus terminals main exits, and answers are collected on the surveying mobile application (which presents the questionnaire).

##### ■ OD – Interception of private vehicle and/or pedestrian (Road-side interviews)

- Origin-Destination interviews of private vehicles users a direct insight on PV users and their trips, especially their patterns, and complement the household survey.
- Goals: complement the household survey, by providing additional private vehicle users.
- Method of collection: private vehicle drivers are conducted by surveyors at main road axes, and answers are collected on the surveying mobile application (which presents the questionnaire).

Figure 2. Road side interview activity



#### ■ Longitudinal vehicle counts (periodical)

- Longitudinal vehicle counts are particularly challenging for the video recording, since it requires a constant spot to be used for all shootings. For the day-long survey, important logistics must be prepared to insure adequate video recording.
- Goals: identify traffic profile and composition on main axes, as well as potential saturation points.
- Method of collection: traffic is recorded on video tape by surveyors for all directions, without obstruction. The video is a more reliable material than direct live surveys, for the counters to later count in back-office the vehicles for each type and in each direction.

#### ■ Longitudinal vehicle counts (20-hour)

- In addition to the terms of reference (TOR) requirements, longitudinal vehicle counts of 20 hours are implemented in order to observe day-long variations of traffic on the main axes of the SUMP area, for the different vehicle types observed.
- Goals: identify traffic day-long variations and composition on main axes.
- Method of collection: traffic is recorded on video tape by surveyors for all directions, without obstruction. The video is a more reliable material than direct live surveys, for the counters to later count in back-office the vehicles for each type and in each direction. Three surveyors per spot are mobilized in order to divide the 20 hours into 1-hour videos and allow rotations, as well as avoiding recording errors and cameras malfunctions. The spots are selected within buildings wherever possible, to provide for a safe (from criminals and weather) and resourceful space (charging stations, video transfers to laptops).

Figure 3. Longitudinal vehicle count (20hr) data collection activity



#### ■ Directional vehicle counts at intersections

- Directional vehicle counts at intersections or junctions aim at observing traffic flows at main junctions of the SUMP area, and thus present the challenge of adequate observation (covering all legs of the intersection) and counting (covering all flows in all directions).
- Goals: identify traffic situation and directions on main intersection of the SUMP area. The junction surveys also allow for the observation of drivers incivilities
- Method of collection: traffic at junctions is recorded on video tape by surveyors for all directions, without obstruction, ideally from high points (building rooftops). Large intersections require two surveyors recording videos simultaneously



from different points of view. The video is a more reliable material than direct live surveys, for the counters to later count in back-office the vehicles for each type and in all direction.

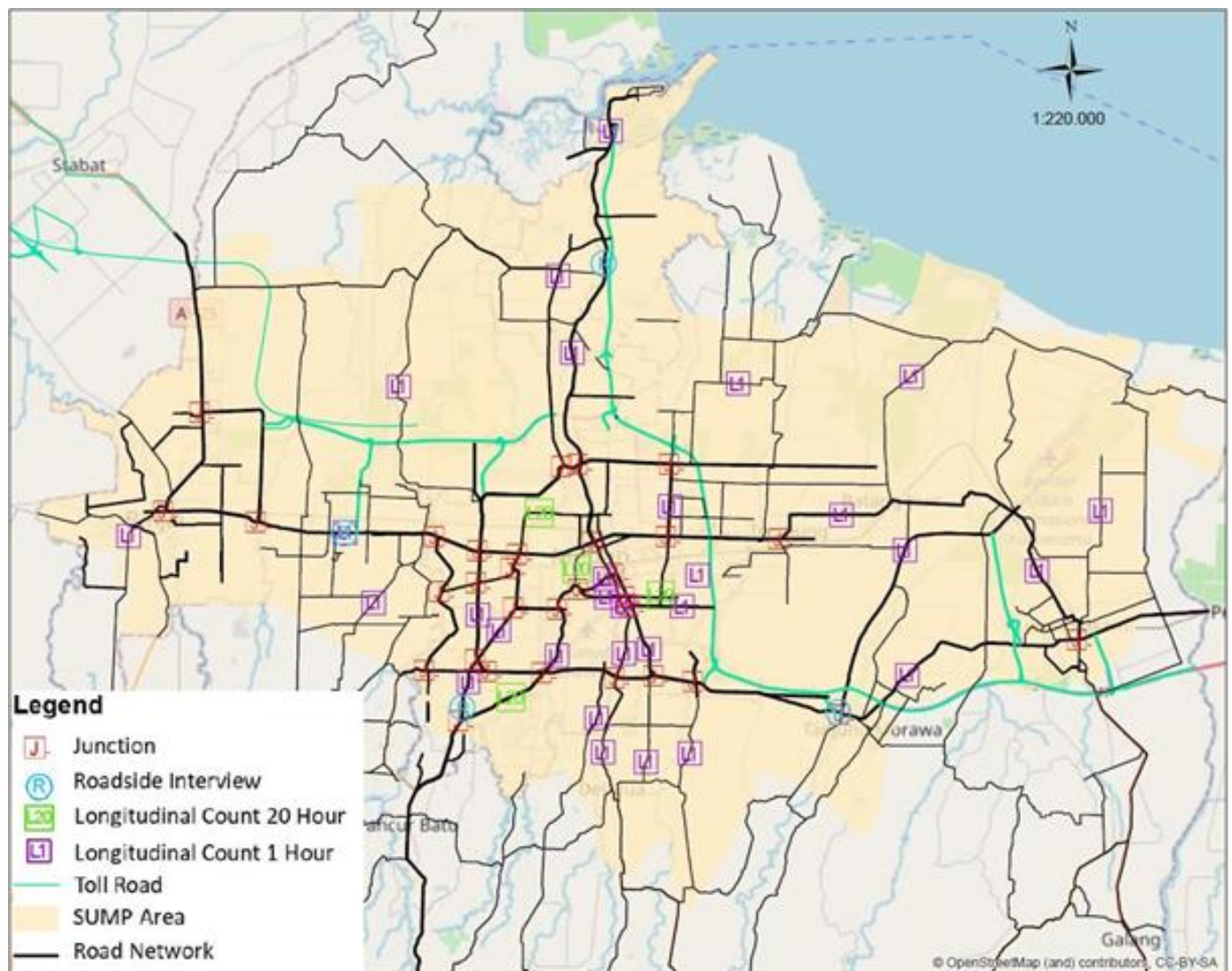
#### ■ Count NMT (Non-Motorized Transport)

- All longitudinal and directional counts already take into account NMT modes used for the main road axes of the SUMP area. In addition to those, ad-hoc NMT surveys on main walkable (with adequate NMT infrastructure) locations in the SUMP area, to provide for control groups to compare against for the NMT modal share from other surveys.
- Goals: provide control samples for NMT users with ideal NMT infrastructure.
- Method of collection: surveyors visually identify NMT users and the sub-mode on the field, and record on paper the number of travelers. Location and time of surveys are recorded on the mobile application.

#### ■ Frequency Volume Occupancy

- FVO surveys are conducted along PT routes to measures road-based public transportation routes capacities and occupancies in the SUMP area.
- Goals: provide maximum capacities and occupancies of road-based public transportation routes.
- Method of collection: surveyors visually identify road-based public transportation routes, their capacity and their occupancies (number of passengers) on paper-based forms. Two surveyors are needed, for identifying routes and noting down information, due to the high frequency of minibuses in the area.

Figure 4. Map of traffic survey data collection sites



#### ■ Questionnaires

- ✓ OD onboard, at hubs and roadside interview questionnaires

SURVEY FORM ON-BOARD PUBLIC TRANSPORTATION LINES ORIGIN-DESTINATION			
No	Item	Question	Answer
		Survey start time	

1	Survey Information	Surveyor Code	TS-	
		Mode	Angkot (Minibus)	Rail
			Bus	Other
		Route	ODB01 - RMC 103	ODB13 - KPUM 32
			ODB02 - Medan Bus 135	ODB14 - RMC 121
			ODB03 - Morina 81	ODB15 - Wampu 123
			ODB04 - MRX 51	ODB16 - Mitra 30
			ODB05 - Wampu 108	ODB17 - KPUM 7
			ODB06 - KPUM 65	ODB18 - KPUM 4
			ODB07 - RMC 125	ODB19 - KPUM 64
			ODB08 - DM 12	ODB20 - Wampu 110
			ODB09 - RMC 104	ODB21 - Commuter Lines (Medan - Binjai)
			ODB10 - Morina 122	ODB22 - Intercity Lines (Medan - Tebing Tinggi)
			ODB11 - KPUM 8	ODB23 - Airport Lines (Medan - Kualanamu)
			ODB12 - KPUM 51	Other
2	Respondent Data	Alone or group	Alone	Group
		Sex	Male	Female
		Age		
		Only using 1 mode	Yes	No
		If not, which order is this mode		
3	Origin	Where is your origin ? (landmark/street)		
		Type of Origin	Home	Market
			Office/Working Place	Mall
			School	Others
			Housing/Hotel	
		Origin City/Regency	Medan	Karo
			Binjai	Other
			Deli Serdang	
		District of Origin		
		Sub-district of Origin		
		Transport modes used before this mode	Pedestrian	Minibus (Angkot)
			Bicycle	Bus
			Skateboard, scooter	BRT
Wheelchair	Long Distance Train			
Private Car	Intercity Train			
Formal Taxi	Metro			
Motorcycle (Personal/taxi without pax)	Other			
Motorcycle (Gojek/Grab with pax)				
4	Destination	Where is your destination ? (landmark/street)		
		Type of Destination	Home	Market
			Office/Working Place	Mall
			School	Others
			Housing/Hotel	
		Destination City/Regency	Medan	Karo
			Binjai	Other
			Deli Serdang	
		District of Destination		
		Sub-district of Destination		
		Transport modes used after this mode	Pedestrian	Minibus (Angkot)
			Bicycle	Bus
			Skateboard, scooter	BRT
Wheelchair	Long Distance Train			
Private Car	Intercity Train			
Formal Taxi	Metro			
Motorcycle (Personal/taxi without pax)	Other			
Motorcycle (Gojek/Grab with pax)				

✓ Formulaire for junction surveys, longitudinal 1H and longitudinal 20H surveys

General information		JUNCTION TRAFFIC COUNT FORM																								
Surveyor	:																									
Location ID	:																									
Date	:																									
Day	:																									
Start time	:																									
End time	:																									
<b>Type of junction</b>																										
Name of junction	:																									
Number of arms (3, 4, 5)	:																									
Name of road (Arm A)	:																									
Name of road (Arm B)	:																									
Name of road (Arm C)	:	If junction has 3 arms, use A, B, C.																								
Name of road (Arm D)	:	If junction has 4 arms, use A, B, C, D.																								
Name of road (Arm E)	:	If junction has 5 arms, use A, B, C, D, E.																								
		<b>From A</b>					<b>From B</b>					<b>From C</b>					<b>From D</b>					<b>From E</b>				
Hour (hour:minute)	Vehicle category	To B	To C	To D	To E	U-Turn	To A	To C	To D	To E	U-Turn	To A	To B	To D	To E	U-Turn	To A	To B	To C	To E	U-Turn	To A	To B	To C	To D	U-Turn
	Private car																									
	Individual taxi																									
	Motorcycle																									
	Motorcycle taxi																									
	Minibus																									
	Bus																									
	BRT																									
	Long distance train																									
	Urban train																									
	Metro																									
	Very light LCV																									
	LCV																									
	Solo truck																									
	Articulated truck																									
	Freight train																									
	Other																									
	Private car																									
	Individual taxi																									
	Motorcycle																									
	Motorcycle taxi																									
	Minibus																									
	Bus																									
	BRT																									
	Long distance train																									
	Urban train																									
	Metro																									
	Very light LCV																									
	LCV																									
	Solo truck																									
	Articulated truck																									
	Freight train																									
	Other																									

Add blocks if necessary.

Schematic/Map of junction  
Insert here



Surveyor	Location ID	Start time	End time	Date	Day	Name of road	Direction

			Type of Non-Motorized Transport					Total
No	Hour	Quarters	Pedestrian	Bicycle	Small Wheeled	Wheelchair	Others	
			Count the number of people walking		(skates, skateboards, push scooters and hand carts)		If possible, note what other mode of NMT is used (hoverboard, etc.)	To be processed after survey
		0						
		15						
		30						
		45						

## FREQUENCY VISUAL OCCUPANCY (FVO) SURVEY FORM

```

Surveyor      : .....
Location ID   : .....
Date          : .....
Day           : .....
Start time    : .....
End time      : .....
Name of road  : .....
Direction     : .....

```

[illegible][illegible]



### III.17.2. Household, stated preference and perception surveys

#### ■ Household survey

- **Goals:** The household survey aims to provide an in-depth perspective of how inhabitants of the study area live their daily lives, provide a composition of the typical household, capture any existing mobility issue to be used as consideration in the preparation of the SUMP.
- **Methods of collection:**
  - ✓ **Physical interviews / digital entry:** Face to face interviews is still the recommended method to gather necessary information. This allows surveyors to clarify and repeat questions, as well as adapt the interview method depending on expressions and reactions of respondents. The interview recorded with the surveyors mobile applications and uploaded directly online, for Egis teams to monitor.
  - ✓ **Coverage of the study area:** All units or transport macro-zones are covered by the survey (155 units). Surveyor teams are assigned units, and for units that include several sub-districts (kelurahan), each sub-district of a unit is covered. The proportion of respondents per sub-district of a single unit follows the weight of their population. All four sub-districts of Karo that are part of Mebidangro are included in the household survey.

Figure 5. Household survey activity

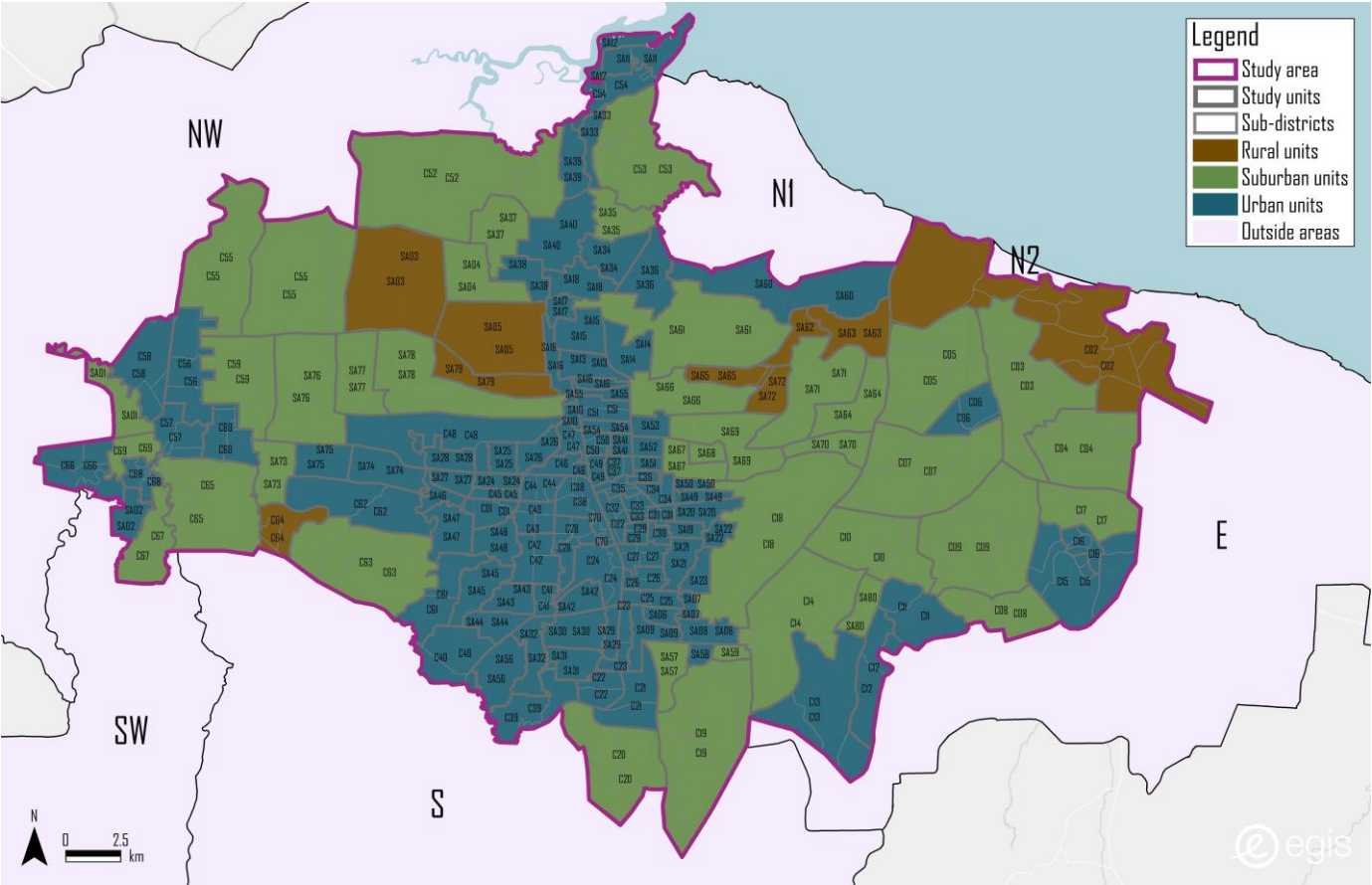


#### ■ Stated preference & Perception surveys

Stated preference and perception surveys are gathered together in the form of a unique questionnaire covering opinion on current transportation infrastructure and services (roads, buses, minibuses and trains), as well as readiness to pay and other various topics.

- **Goals**
  - ✓ **Stated preference:** to observe what are the preferences of the SUMP area inhabitants regarding the aspect of public transport services. In order to catch input on how people are willing to shift to or keep using existing public transport.
  - ✓ **Perception:** to record the perception of inhabitants on existing public transport in the study area, to provide input for transit improvement and planning.
- **Method of collection:** Respondents are called for both surveys to answer a unique questionnaire by phone. The contact numbers are those collected in the household questionnaires. While asking the stated preference and perception surveys questions, surveyors fill questionnaire forms online that are recorded simultaneously in the database put in place by Egis.

Figure 6. Disaggregation of study units



## ■ Questionnaires

- ✓ Household, individual, trips questionnaires

1 of 4

HOUSEHOLD FORM			
Surveyor Code: Sur-			
vey Unit Code:			
House Hold ID:			
No	Question	Answer	
A01	Respondent Name		
A02	Mobile Phone		
A03	City/Regency	Medan	Deli Serdang
		Binjai	Karo
A04	District		
A05	Sub-district		
A06	Address (Street)		
A07	Building No		
A08	Postal Code		
B01	How many people do PERMANENTLY LIVE in this HH?		
B02	Type of property the HH reside in	House	Company Housing
		Apartment	Commercial House
		Flats / Rented Room	Other
B03	Ownership status of the property	Owned	Provided by Company
		Rented	Other
B04	How many people are PRESENT during the visit?		
B05	Type of vehicles available to the HH for personal use	Car	Motorcycle
		LCV	Bicycle
		Truck	Other
B06	Detail Information of the Vehicles		
	Type of Motorized Vehicles (1)	Car	Motorcycle
		LCV	Other
		Truck	
	Type of Fuel (1)	Gasoline	Natural Gas
		Diesel	Other
		Electric	
	Vehicle Ownership (1)	Owned	Rented
		Provided by Company	Other
	Type of Motorized Vehicles (2)	Car	Motorcycle
		LCV	Other
		Truck	
	Type of Fuel (2)	Gasoline	Natural Gas
		Diesel	Other
		Electric	
	Vehicle Ownership (2)	Owned	Rented
		Provided by Company	Other
	Type of Motorized Vehicles (3)	Car	Motorcycle
		LCV	Other
		Truck	
	Type of Fuel (3)	Gasoline	Natural Gas
		Diesel	Other
		Electric	
	Vehicle Ownership (3)	Owned	Rented
		Provided by Company	Other
	Type of Motorized Vehicles (4)	Car	Motorcycle
		LCV	Other
		Truck	
	Type of Fuel (4)	Gasoline	Natural Gas
		Diesel	Other
		Electric	
	Vehicle Ownership (4)	Owned	Rented
		Provided by Company	Other

INDIVIDUAL FORM			
Surveyor Code: Survey Unit Code: House Hold ID:			
No	Question	Answer	
	How many persons in this HH do mobility independently (by him/herself)?		
	Person ID		
D01	Present during interview?	Yes	No
D02	Name		
D03	Sex	Male	Female
D04	Age		
D05	HH status	Head of Family	Sibling
		Wife	Other relatives
		Son/Daughter	Other (specify)
		Parent	
D06	Education	Elementary School	Bachelor
		Junior High School	Master/Doctor
		Senior High School	
D07	Nationality	Indonesian	Alien
D08	Religion	Islam	Buddhist
		Christian	Khonghucu
		Catholic	Other
		Hindu	
D09	How long have you been staying in HH?		
D10	Disability	None	Speaking
		Sight	Movement
		Hearing	Mental
D11A	Current main occupation	Public/Military/Police	Student (elementary-high school)
		Private/SOE	University student
		Self Employment/Business Owner	Housewife
		Lecturer/Teacher	Retired
		Doctor/Medical Staff	Unemployed
		Labour Worker	Other
D11B	Occupation status	Full Time (> 40 hour/week)	Unemployed
		Full Time (< 40 hour/week)	
D11C	Field of work	Agriculture	Retail
		Forestry	Service
		Fishing	Transportation
		Mining	Logistic
		Manufacturing	Education
		Construction	Health
		Government	Other
D11D	Working sector	Formal	Informal
D11E	Is the current occupation is same as pre-Covid	Yes	No
D12A	(If not) What is your main occupation pre-Covid	Public/Military/Police	Student (elementary-high school)
		Private/SOE	University student
		Self Employment/Business Owner	Housewife
		Lecturer/Teacher	Retired
		Doctor/Medical Staff	Unemployed
		Labour Worker	Other
D12B	Status of work pre-Covid	Full Time (> 40 hour/week)	Unemployed
		Full Time (< 40 hour/week)	
D12C	Field of work pre-Covid	Agriculture	Retail
		Forestry	Service
		Fishing	Transportation
		Mining	Logistic
		Manufacturing	Education
		Construction	Health
		Government	Other
D13	Driving License	Yes	No
D14	Driving License Type	SIM A (Private Car)	SIM B2 (Heavy equipment)
		SIM B1 (Bus/Truck)	SIM C1 (Motorcycle ≤ 250 cc)
D15	Vehicle Availability	C1-Personal car (driver)	M3-Common motorcycle (passenger)
		C2-Common car (driver)	M2-Common motorcycle (driver)
		C3-Common car (passenger)	T1-Personal truck (driver)
		M1-Personal motorcycle (driver)	
D16	Main vehicle used	Pedestrian	Angkot / minibus
		Car (driver)	Company bus
		Car (passenger)	School bus
		Public Bus	Online Taxi
		Motorcycle Taxi	Online Motorcycle Taxi
		Taxi	Motorcycle
		Bicycle	Motorized Rickshaw
		Train	Truck
		LCV/Van	
D17	Reason to use the main vehicle	Cost effective	Service availability
		Short travel time	Certain schedule
		Flexibility	No other options
		Shorter distance	Other
		Safe and comfortable	
D18	Main reason why you not choose public transportation (bus, minibus, dll) to do daily trip	Difficult to access	Dissatisfaction
		No available service	Expensive
		Not safe and comfortable	Lateness
		Long travel time	Other



Reported date			
Reported day			
E01	Do you go outside the home on the reported day	Yes	No
E02	If not, what is the reason you don't go outside the home on the reported day?	Having disability	Work from home
		No reason to leave the home	WFH due to Covid
		Feeling sick on the reported day	
E05	If you don't go outside, would you do a routine trip normally?	Yes	No
E06	Do you want to share the information of your normal routine trip?	Yes	No
E03	Do you start the trip from your home?	Yes	No
E04	If not, where do you start your routine trip?		
	Location/Building		
	Street		
F01	Trip no.		
F02	Starting hour		
F03	Destination		
	Location/Building		
	Street		
	City/Regency		
	District		
	Sub-district		
F04	Purpose of the trip	Working	Recreation
		Business	Religion Affair
		Education/School	Taking the child
		Private Matter	Back to home
		Grocery/Shopping	Other
F04A	Specific purpose of the trip		
F05	Estimated Trip Duration (min)		
F06	Estimated Total Distance (km)		
F07	Transport Mode used		
	Transport Mode 1	Pedestrian	Truck
		Car (driver)	Company Bus
		Car (passenger)	School Bus
		Public Bus	Online Taxi
		Motorcycle Taxi	Online Motorcycle Taxi
		Taxi	Motorcycle
		Bicycle	Motorized Rickshaw
		Train	Minibus (Angkot)
		LCV/Van	No. and Route:
	Transport Mode 2	Pedestrian	Truck
		Car (driver)	Company Bus
		Car (passenger)	School Bus
		Public Bus	Online Taxi
		Motorcycle Taxi	Online Motorcycle Taxi
		Taxi	Motorcycle
		Bicycle	Motorized Rickshaw
		Train	Minibus (Angkot)
		LCV/Van	No. and Route:
	Transport Mode 3	Pedestrian	Truck
		Car (driver)	Company Bus
		Car (passenger)	School Bus
		Public Bus	Online Taxi
		Motorcycle Taxi	Online Motorcycle Taxi
		Taxi	Motorcycle
		Bicycle	Motorized Rickshaw
		Train	Minibus (Angkot)
		LCV/Van	No. and Route:

RESPONDENT TRIP PATTERN			
F01	Trip no.		
F02	Starting hour		
F03	Destination		
	Location/Building		
	Street		
	City/Regency		
	District		
	Sub-district		
F04	Purpose of the trip	Working	Recreation
		Business	Religion Affair
		Education/School	Taking the child
		Private Matter	Back to home
		Grocery/Shopping	Other
F05	Estimated Trip Duration (min)		
F06	Estimated Total Distance (km)		
F07	Transport Mode used		
	Transport Mode 1	Pedestrian	Truck
		Car (driver)	Company Bus
		Car (passenger)	School Bus
		Public Bus	Online Taxi
		Motorcycle Taxi	Online Motorcycle Taxi
		Taxi	Motorcycle
		Bicycle	Motorized Rickshaw
		Train	Minibus (Angkot) No. and Route:
		LCV/Van	
	Transport Mode 2	Pedestrian	Truck
		Car (driver)	Company Bus
		Car (passenger)	School Bus
		Public Bus	Online Taxi
		Motorcycle Taxi	Online Motorcycle Taxi
		Taxi	Motorcycle
		Bicycle	Motorized Rickshaw
		Train	Minibus (Angkot) No. and Route:
		LCV/Van	
	Transport Mode 3	Pedestrian	Truck
		Car (driver)	Company Bus
		Car (passenger)	School Bus
		Public Bus	Online Taxi
		Motorcycle Taxi	Online Motorcycle Taxi
		Taxi	Motorcycle
		Bicycle	Motorized Rickshaw
		Train	Minibus (Angkot) No. and Route:
		LCV/Van	

## ✓ Stated preference and perception questionnaires

<b>STATED PREFERENCE AND PERCEPTION SURVEY</b>	
<b>SURVEY INFORMATION</b>	
Survey Unit Code	
Surveyor Code	
Household ID	
Index	
Sex	<input type="checkbox"/> Male <input type="checkbox"/> Female
<b>A. TRANSPORT PREFERENCE SURVEY</b> <b>A01. Have you ever been using public transportation?</b> <div style="display: flex; justify-content: space-around;"> <input type="checkbox"/> Yes           <input type="checkbox"/> No         </div> <b>A02.1 What kind of public transportation have you been using?</b> <div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <input type="checkbox"/> 1. Bus  <input type="checkbox"/> 2. Train  <input type="checkbox"/> 3. Minibus  <input type="checkbox"/> 4. Taxi           </div> <div style="width: 48%;"> <input type="checkbox"/> 5. Online Taxi  <input type="checkbox"/> 6. Online Motorcycle Taxi  <input type="checkbox"/> 7. Motorized Rickshaw           </div> </div> <b>A02.2 If you have to, what kind of public transportation will you use?</b> <div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <input type="checkbox"/> 1. Bus  <input type="checkbox"/> 2. Train  <input type="checkbox"/> 3. Minibus  <input type="checkbox"/> 4. Taxi           </div> <div style="width: 48%;"> <input type="checkbox"/> 5. Online Taxi  <input type="checkbox"/> 6. Online Motorcycle Taxi  <input type="checkbox"/> 7. Motorized Rickshaw           </div> </div> <b>A03. What do you think is the most important aspect to be improved for public transportation?</b> <div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <input type="checkbox"/> 1. Safety  <input type="checkbox"/> 2. Convenience  <input type="checkbox"/> 3. Punctuality           </div> <div style="width: 48%;"> <input type="checkbox"/> 4. Trip Duration  <input type="checkbox"/> 5. Cleanliness           </div> </div> <b>A04. For a 10 minutes faster trip, how much are you willing to pay?</b> <div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <input type="checkbox"/> a. up to IDR 5000,-  <input type="checkbox"/> b. IDR 5000,- to IDR 10.000,-  <input type="checkbox"/> c. IDR 10.000,- to IDR 15.000,-  <input type="checkbox"/> d. IDR 15.000,- to IDR 20.000,-           </div> <div style="width: 48%;"> <input type="checkbox"/> e. IDR 20.000,- to IDR 25.000,-  <input type="checkbox"/> f. IDR 25.000,- to IDR 30.000,-  <input type="checkbox"/> g. more than IDR 30.000,-           </div> </div> <b>A05. For a 15 minutes faster trip, how much are you willing to pay?</b> <div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <input type="checkbox"/> a. up to IDR 5000,-  <input type="checkbox"/> b. IDR 5000,- to IDR 10.000,-  <input type="checkbox"/> c. IDR 10.000,- to IDR 15.000,-  <input type="checkbox"/> d. IDR 15.000,- to IDR 20.000,-           </div> <div style="width: 48%;"> <input type="checkbox"/> e. IDR 20.000,- to IDR 25.000,-  <input type="checkbox"/> f. IDR 25.000,- to IDR 30.000,-  <input type="checkbox"/> g. more than IDR 30.000,-           </div> </div>	

A06. For a clean and air-conditioned public transportation, how much are you willing to pay?

<input type="checkbox"/> a. up to IDR 5000,-	<input type="checkbox"/> e. IDR 20.000,- to IDR 25.000,-
<input type="checkbox"/> b. IDR 5000,- to IDR 10.000,-	<input type="checkbox"/> f. IDR 25.000,- to IDR 30.000,-
<input type="checkbox"/> c. IDR 10.000,- to IDR 15.000,-	<input type="checkbox"/> g. more than IDR 30.000,-
<input type="checkbox"/> d. IDR 15.000,- to IDR 20.000,-	

D08. If all of the aspects are improved (see A03), how much are you willing to pay?

<input type="checkbox"/> a. up to IDR 5000,-	<input type="checkbox"/> e. IDR 20.000,- to IDR 25.000,-
<input type="checkbox"/> b. IDR 5000,- to IDR 10.000,-	<input type="checkbox"/> f. IDR 25.000,- to IDR 30.000,-
<input type="checkbox"/> c. IDR 10.000,- to IDR 15.000,-	<input type="checkbox"/> g. more than IDR 30.000,-
<input type="checkbox"/> d. IDR 15.000,- to IDR 20.000,-	

D09. If all aspects are improved, are you willing to use public transportation?

<input type="checkbox"/> 1. Yes, always	<input type="checkbox"/> 3. Yes, rarely
<input type="checkbox"/> 2. Yes, more often	<input type="checkbox"/> 4. No

**B. OPINION SURVEY: ROAD NETWORK**

**Road Network:**

B01. The streets are congested in the morning and evening

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea

B02. The streets around the school are congested at 7-8 in the morning

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea

B03. Motorized rickshaws are the cause of traffic congestion

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea

B04. Vehicles parked on the side of the road are the cause of traffic congestion

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea

B05. Vehicles taking u-turn are the cause of traffic congestion

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea

B06. Narrow road is the cause of traffic congestion

<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea



B07. Road narrowing or heterogenous road is the cause of traffic congestion

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

B08. Vehicle that goes self-contra flow creates traffic congestion

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

B09. Broken roads is not comfortable

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

**C. OPINION SURVEY: PUBLIC TRANSPORTATION**  
**Public Transportation: Minibus (Angkot)**

C01. Need to wait long time for minibus to come

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C02. Minibus is often late due to traffic congestion

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C03. Minibus idle time is too long in waiting passengers aboard

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C04. Minibus driving is not safe

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C05. AC is important to improve the comfort of minibus

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C06. Cleanliness is important to improve the comfort of minibus

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C07. Minibus is not comfortable due to overcapacity

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C08. Limited route of minibus: need to transit several times

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C09. Minibus is not safe

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C10. Minibus is not safe for woman

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C11. Minibus is not accessible for disabled people

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

**Public Transportation: Train**

C12. Need to wait a long time for train

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C13. AC is important to improve the comfort of train

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C14. Cleanliness is important to improve the comfort of train

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C15. Train is not comfortable due to overcapacity

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C16. Train is not safe

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C17. Train is not safe for women

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C18. Train is not accessible for disabled people

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

**Public Transportation: Miscellaneous**

C19. It is difficult to go to train station using minibus

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C20. Mobile based ride sharing application is more convenient

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

C21. Mobile based ride sharing application is safer

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

**D. OPINION SURVEY: PEDESTRIAN CONDITION**

**Pedestrian condition:**

D01. It is difficult to be a pedestrian due to poor condition of the pavement

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

D02. It is difficult to be pedestrian due to many motorized vehicles

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

D03. It is difficult to cross a road

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

D04. The distance to a public transportation is too far

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

D05. Street vendors and motorcycle reduce the comfort of pedestrian

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

D06. Cleanliness is important to improve the comfort of pedestrian

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

D07. Most of the roads do not have pavement

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

D08. Street lighting is still lacking

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

D09. The streets are not safe (criminality, harassment)

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

D10. It is not safe for a woman to be pedestrian

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

D11. Lack of facilities for disabled people in public space (ramp, guiding block, lift, dll)

☐ ☐ ☐ ☐ ☐ ☐

Highly Agree	Agree	Neutral	Disagree	Highly Disagree	No idea
--------------	-------	---------	----------	-----------------	---------

**E. SATISFACTION WITH THE QUALITY OF THE ENVIRONMENT**

**How is your satisfaction with**

E01. Access to healthcare facilities

☐ ☐ ☐ ☐

Satisfied	Quite satisfied	Not satisfied	No idea
-----------	-----------------	---------------	---------

E02. Quality of the residence

☐ ☐ ☐ ☐

Satisfied	Quite satisfied	Not satisfied	No idea
-----------	-----------------	---------------	---------

E03. Job opportunity

☐ ☐ ☐ ☐

Satisfied	Quite satisfied	Not satisfied	No idea
-----------	-----------------	---------------	---------



## E04. Quality of park and public spaces

☐ ☐ ☐ ☐

Satisfied	Quite satisfied	Not satisfied	No idea
-----------	-----------------	---------------	---------

## E05. Waste management

☐ ☐ ☐ ☐

Satisfied	Quite satisfied	Not satisfied	No idea
-----------	-----------------	---------------	---------

## E06. Clean water

☐ ☐ ☐ ☐

Satisfied	Quite satisfied	Not satisfied	No idea
-----------	-----------------	---------------	---------

## E07. Electricity

☐ ☐ ☐ ☐

Satisfied	Quite satisfied	Not satisfied	No idea
-----------	-----------------	---------------	---------

## E08. Safety

☐ ☐ ☐ ☐

Satisfied	Quite satisfied	Not satisfied	No idea
-----------	-----------------	---------------	---------

## E09. Access to a market &amp; commercial area

☐ ☐ ☐ ☐

Satisfied	Quite satisfied	Not satisfied	No idea
-----------	-----------------	---------------	---------

## E10. Access to public transportation

☐ ☐ ☐ ☐

Satisfied	Quite satisfied	Not satisfied	No idea
-----------	-----------------	---------------	---------

## E11. Recreational facilities (park, marina, restaurant, mall, dll)

☐ ☐ ☐ ☐

Satisfied	Quite satisfied	Not satisfied	No idea
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## E12. Other socializing needs (religious, meeting, etc)

☐ ☐ ☐ ☐

Satisfied	Quite satisfied	Not satisfied	No idea
-----------	-----------------	---------------	---------

### III.18. Telkomsel data use: cellular data on mobility in the context of COVID-19

The pre-COVID19 mobility data was obtained from the main mobile operator, Telkomsel – the state-owned nationwide cellular services provider. These are the general methodologies that were used in acquiring mobility from cellular data:

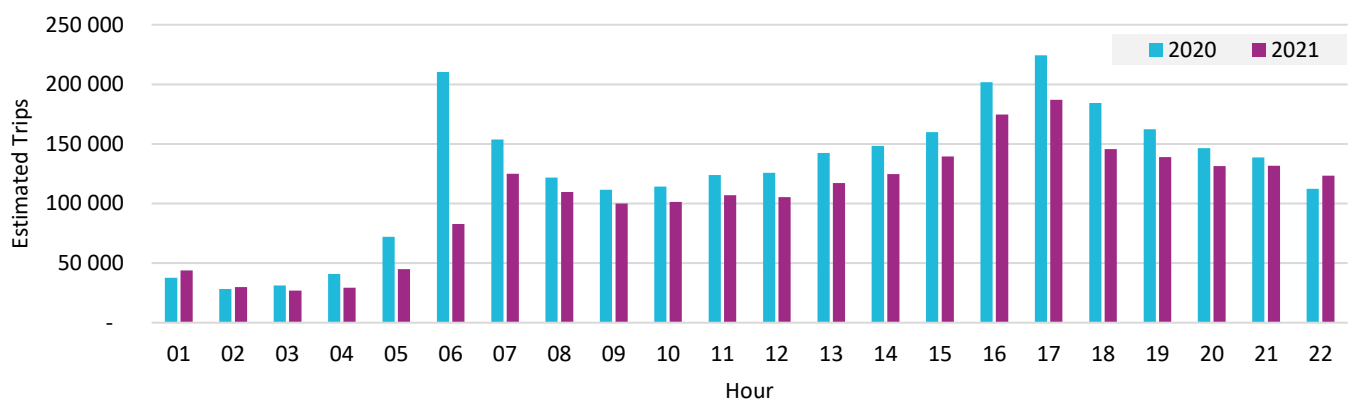
- ✓ Determine area granularity (zone grouping)
- ✓ Observe daily stop points data: Daily stay points are location data that describes a person stopping at a certain point with a minimum duration of 30 minutes, with the aim of capturing a person's location when not moving.
- ✓ Create Origin-Destination from recorded data: Based on the satellite and mobile positioning data, the Origin-Destination information of each movement is recorded. Volume of trips with origin or destination outside the study area (external trips) are also recorded.
- ✓ Extrapolate the Telkomsel data to total population: The extrapolation process was done based on the calculation of multiplier per zone from BPS total population and Telkomsel population ratio.

Since the SUMP is conducted during the pandemic condition, the collected primary data might not represent the normal mobility before the pandemic. Thus, having mobility data before and after the pandemic is essential to understand the mobility change due to the pandemic outbreak. Thanks to these data, the primary data that were collected during pandemic condition could be adjusted to the pre-pandemic condition.

The information stored by their systems allows to compare the mobility of users before the pandemic and during the pandemic (at the time of the physical surveys of the SUMP). A sample of 2 full weeks during January 2020 and another sample of 2 full weeks during January 2021 represent both periods.

An important drop of -13,2% is observed in the number of trips undertaken in the study area. This variation is stronger on the weekends (-17,6%) than on weekdays (-13,2%), showing the highest effect of the closure of leisure and commercial activities.

#### Hourly departures during an average working day, in Jan 2020 and Jan 2021



The drop is observed in every hour of the working day, but most importantly early morning and late afternoon, between 06:00 – 08:00 and 16:00 – 19:00, hinting at less work related departures. However, it shall be noted that after 22:00, more trips are recorded during the pandemic compared to before, according to Telkomsel.

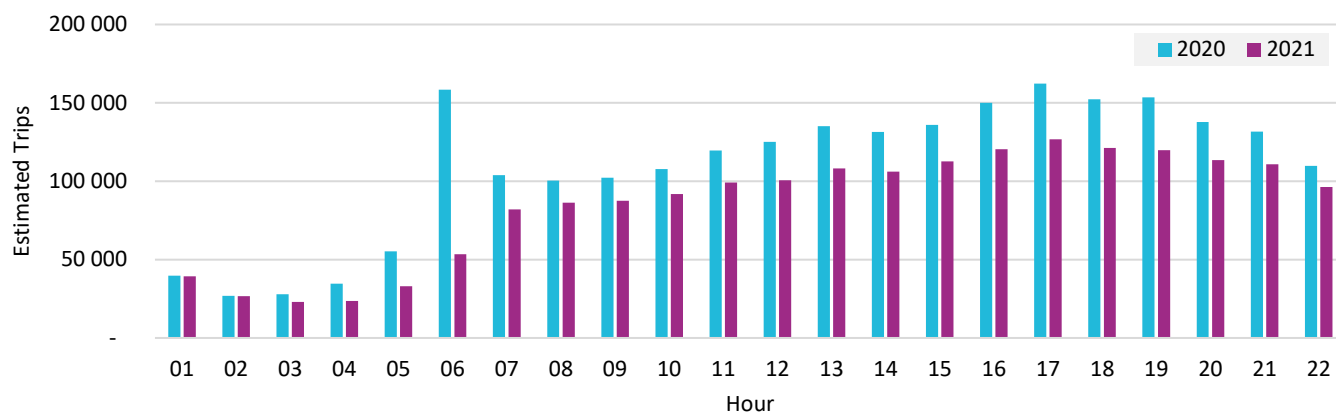
**Peak hour.** The morning peak hour is shifted from 06:00 – 08:59 in 2020 to 07:00 – 09:59 in 2021, this shift comes along the reduction of trips during the peak hour where 436.082 trips (16% of total trips) in 2020 to 252.526 trips (12,5% of total trips) in 2021. The closures of offices and work from home policies have impacted formal jobs that usually start before informal ones later in the morning.

**Shorter working hours.** The change in morning peak hour was not replicated in the evening peak hour as this phenomenon was observed during the same time period 16:00 – 18:59 in both years. This may indicate shorter working hours for worker classes represented in morning peak hours.

**Trips in active hours:** During the active hours 05:00 – 22:00 of the day, a -18,6% decrease of trips is observed. When crossed with data surveys, it is equivalent to more than half a million of trips, which can be taken as the reference for the COVID19 impact.

**On the weekend, the observations are similar to those of a working day.** The morning and afternoon peaks of formal working hours are flatter, and all hours present a lower number of departures compared to the pre-COVID19 situation. While the relative total number of trips is also lesser.

## Hourly departures during an average weekend day, in Jan 2020 and Jan 2021. (Telkomsel)

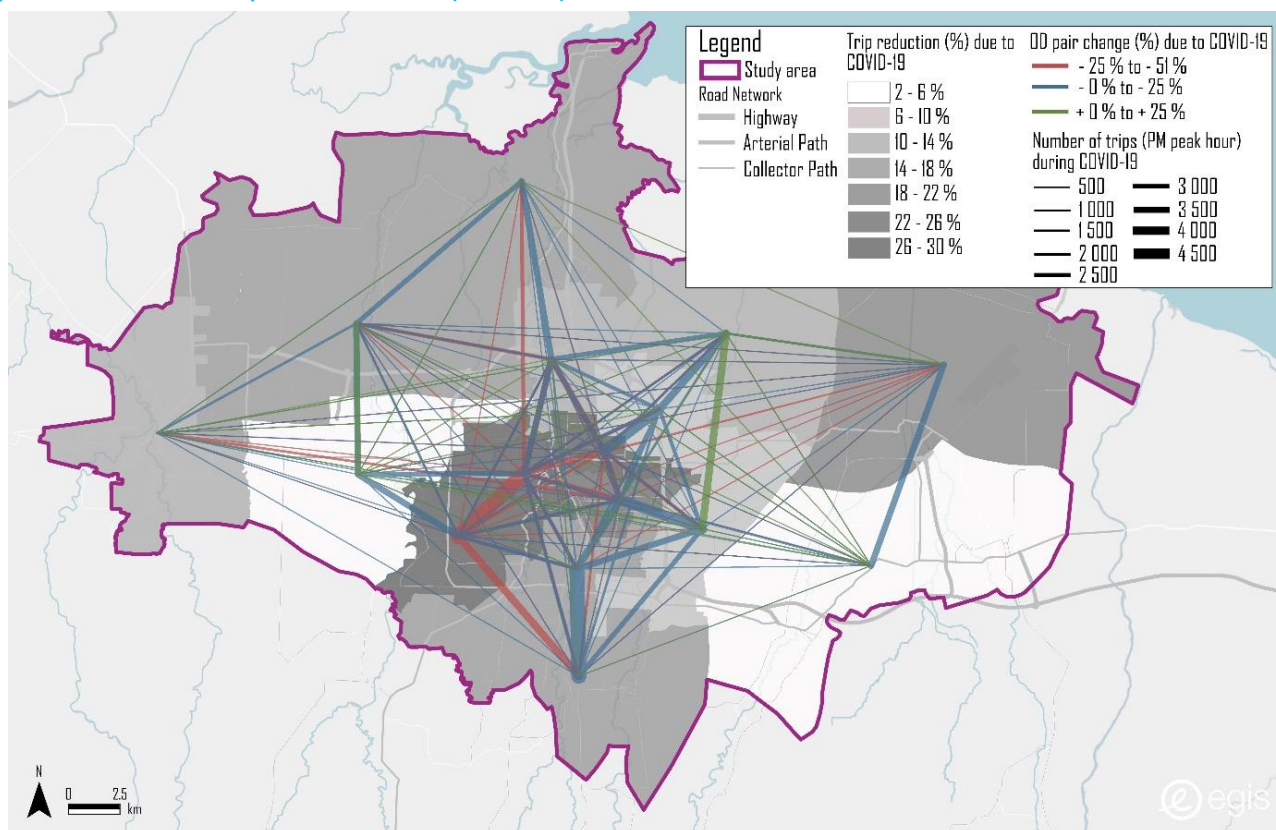


■ The pandemic also impacted the spatiality of trips

The cellular users movements information enables the analysis the spatial variations of trips in the area between the periods prior and during the COVID19 pandemic (pre and in). The strongest reduction of trips due to the pandemic occurs in the center of the area, in Medan center. This area shows a total 30% trip reduction during COVID19. There are several possible explanations to this phenomenon.

Mobility restrictions are more enforced in this administrative and business area. Majority of activities are classified as non essential and non critical, such as retail business. These sectors are highly restricted to operate during the pandemic.

## OD pairs variations between pre and in COVID19 (Telkomsel)



The impact of the pandemic on mobility is lower in peripheral areas. Lesser impacts are observed in areas such as Lubuk Pakam, Sunggal, Binjai, and Percut Sei Tuan due to high agriculture and industrial activities in these areas (vital functions). It shall be noted that these areas also have a high share of internal trips (within the area itself). The inter-districts trips are increasing east and west of Medan, in Sunggal and Percut Sei Tuan, where new trips might have been formed during the pandemic, reflecting new habits and perhaps new professional activities.

The strong mobility generator of Kualanamu Airport has a great impact on the trips of the region: the decrease of flights, as described before, lowers the mobility generation of its area greatly (approx. 20%), and even more for trips towards the urban poles of Lubuk Pakam and Medan city.

Strong drop of mobility emerging from Setiabudi district. The area of Setiabudi, with its commerces and restaurants, sees a great drop in trips from neighbouring areas (-25 to -51%) as well as internal trips.

## IV. Vision, Goals and Mobility Scenarios Appendices

### IV.1. Example of measure evaluation

				Theme: Road Network and Private Vehicles		
				Measure 11. Traffic calming measures		
Criteria	No	Sub-criteria	Weight	Evaluation	Score	Comment
Technical feasibility	1	Availability of solution	1,00%	Very positive	3	No particular technological challenge expected.
	2	Technical risks	4,00%	Very positive	3	No technical risk expected.
	3	Operability	4,00%	Very positive	3	No operational effort required.
	4	Promotion of innovative tools	1,00%	Very positive	3	Opportunity to use innovative tools for traffic calming.
Financial and institutional feasibility	5	Capital expenditure	15,00%	Adverse	-2	Relatively important capital expenditure at region level.
	6	Operations & maintenance expenditure	5,00%	Adverse	-2	Maintenance costs for continuous efficacy of measures.
	7	Financial profitability	5,00%	Very adverse	-3	No revenue possible to generate.
	8	Definition of institutional structure	5,00%	Positive	2	Clear responsibility of transportation agencies, interfaces between cities and province to manage.
	9	Adequacy with existing policies	10,00%	Very positive	3	In line with calming directions, increased road safety.
Economic costs and benefits	10	Economic costs (externalities)	5,00%	Very positive	3	High impact on pollution, noise and casualties expected.
	11	Transport accessibility	5,00%	Slightly positive	1	Slower PV travel speed might push towards PT use.
	12	Modal split	2,50%	Positive	2	Increase PT modal share from previous sub-criteria.
	13	Speed gains	2,50%	Slightly adverse	-1	Lower overall travel speed.
	14	Road safety	10,00%	Very positive	3	Increase safety due to lower travel speeds, for road users and pedestrians.
	15	Quality improvement of transport	5,00%	Very positive	3	Increased safety, comfort, and reliance on PT.
Environmental and social impacts	16	Communities settlements impact	5,00%	Very positive	3	Lower pollution and noise in implementation environments.
	17	Land use impact	2,50%	Slightly positive	1	Long term effect to densify activities.
	18	Improvement of economic opportunities	5,00%	Slightly positive	1	Creation of jobs for implementation and maintenance.
	19	Accessibility to vulnerable groups	5,00%	Neutral	0	No effect expected.
	20	Gender inclusion	2,50%	Positive	2	Lower road traffic hazards due to speed and flows geometries.
Total			100,00%	Score	36,7	

IV.2. Example of scenario block evaluation

SUMP Mebidangro Mobility scenarios and measures  Evaluation and Multi-Criteria analysis (MCA)			Technical feasibility				Financial and institutional					Economic costs and benefits						Environmental and social					Measure score	Scenarios					
			Availability of solution	Technical risks	Operability	Promotion of innovative tools	Capital expenditure	Operations & maintenance expenditure	Financial profitability	Definition of institutional structure	Adequacy with existing policies	Economic costs (externalities)	Transport accessibility	Modal split	Speed gains	Road safety	Quality improvement of transport	Communities settlements impact	Land use impact	Improvement of economic opportunities	Accessibility to vulnerable groups	Gender inclusion		Conventional	Ambitious	Conventional	Ambitious	Conventional	Ambitious
Theme	No	Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		Definition		Scoring		Average scores per block/theme	
Urban Planning and NMT	1-A	Car free zones: Permanent closure																					18,8	Medium 2028		18,8		39,9	37,3
	1-B	Car free zones: Temporary/Periodical closure																					24,3		Short 2023		26,8		
	2	Comfortable and safe sidewalks																					43,5	Medium 2028	Short 2023	43,5	47,9		
	3	Mixed-use zones in secondary urban centers																					37,5		Medium 2028		37,5		
	4	Law to restrict urban sprawl																					28,2	Long 2035	Medium 2028	25,4	28,2		
	5	Framework for TOD developments																					22,7		Short 2023		24,9		
	6	Land Value Capture tax law																					16,5		Medium 2028		16,5		
	7	Safe NMT and bicycle lanes																					72,0	Medium 2028	Short 2023	72,0	79,2		



## V. Action Plan Appendices

### V.1. Traffic Modelling

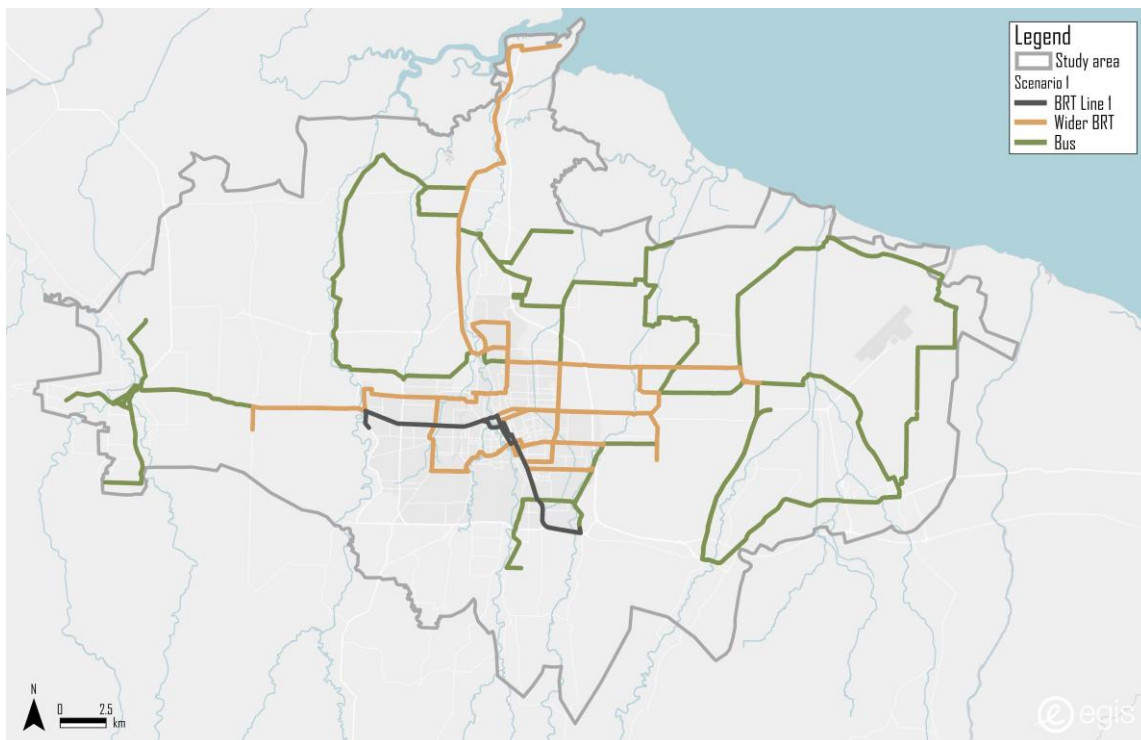
#### V.1.1. Scenario 1: Conventional development

Scenario 1 depicts a conventional growth of mobility in Mebidangro with measures that are believed possible within the current institutional context and that do not require intensive capital.

With a status quo organization, the mobility measures that are part of the conventional growth scenario and that are possible to integrate - and measure the effects of, within the traffic model at this stage of the SUMP preparation, are:

- ✓ BRT line 1: committed project in the medium term (2028)
- ✓ Wider BRT network: as per the definition below, in the long term (2035)
- ✓ Wider city buses network: as per the definition below, in the short term (2023)

Figure 7. New Public Transport Lines for Scenario 1



With this conventional growth of scenarios and measures, in 2035, the VKT will be reduced by 10% compared to the reference case in the same horizon year. In line with the VKT, the vehicle hours in 2035 will be reduced by 10% compared to the reference case in the same horizon year.

These results imply that the mobility and congestion will be better compared to the reference case, thanks to the implementation of BRT Line 1, Wider BRT network, and wider city buses. This implementation will attract 15% addition in mode share of total passenger trips.

The standard traffic indicators for Scenario 1 for each horizon years are summarized in Table 1.

Table 1. Standard traffic indicators for Scenario 1

Scenario 1	VKT		Passenger.km	Vehicle hours		Passenger.hr
	Motorcycles	Cars	PT	Motorcycles	Cars	PT
2028	2.205.552	578.226	789.328	50.382	13.183	38.625
2035	2.376.639	605.684	1.106.047	58.681	14.897	53.894
	Trips			Mode share		
	Motorcycles	Cars	PT	Motorcycles	Cars	PT
2028	335.997	125.001	120.558	57,8%	21,5%	20,7%
2035	355.169	127.042	157.071	55,6%	19,9%	24,6%

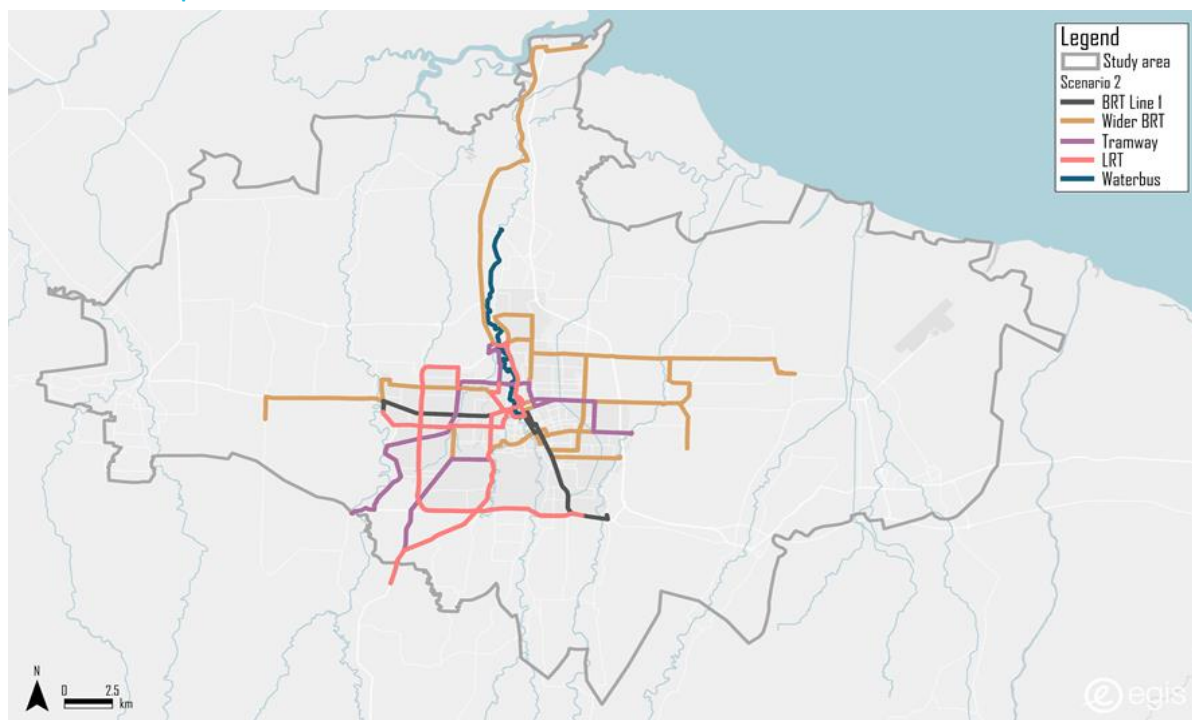
## V.1.2. Scenario 2: Ambitious development

Scenario 2 depicts an ambitious set of measures to be implemented rather quickly, in a disruptive way with and thanks to organizational changes in the institutional context, and reforms. It will be possible to implement capital intensive projects only with important changes in the institutional and development structures of the sub-national administration, for regulation as well as funding.

With a new transport authority and important short-term efforts, the mobility measures that are part of the ambitious growth scenario and that are possible to integrate - and measure the effects of, within the traffic model at this stage of the SUMP preparation, are:

- ✓ BRT line 1: committed project in the short term (2023), as previously defined
- ✓ Wider BRT network: as per the definition below, in the medium term (2028), as previously defined
- ✓ Implementation of waterbuses in the medium term (2028), as defined below
- ✓ Implementation of urban rapid rail transit lines in the medium term (2028).

Figure 8. New Public Transport Lines for Scenario 2



With this ambitious growth of scenarios and measures, in 2035, the VKT will be reduced by 22% compared to the reference case in the same horizon year. In line with the VKT, the vehicle hours in 2035 will be reduced by 26% compared to the reference case in the same horizon year.

Table 2. Standard traffic indicators for Scenario 2

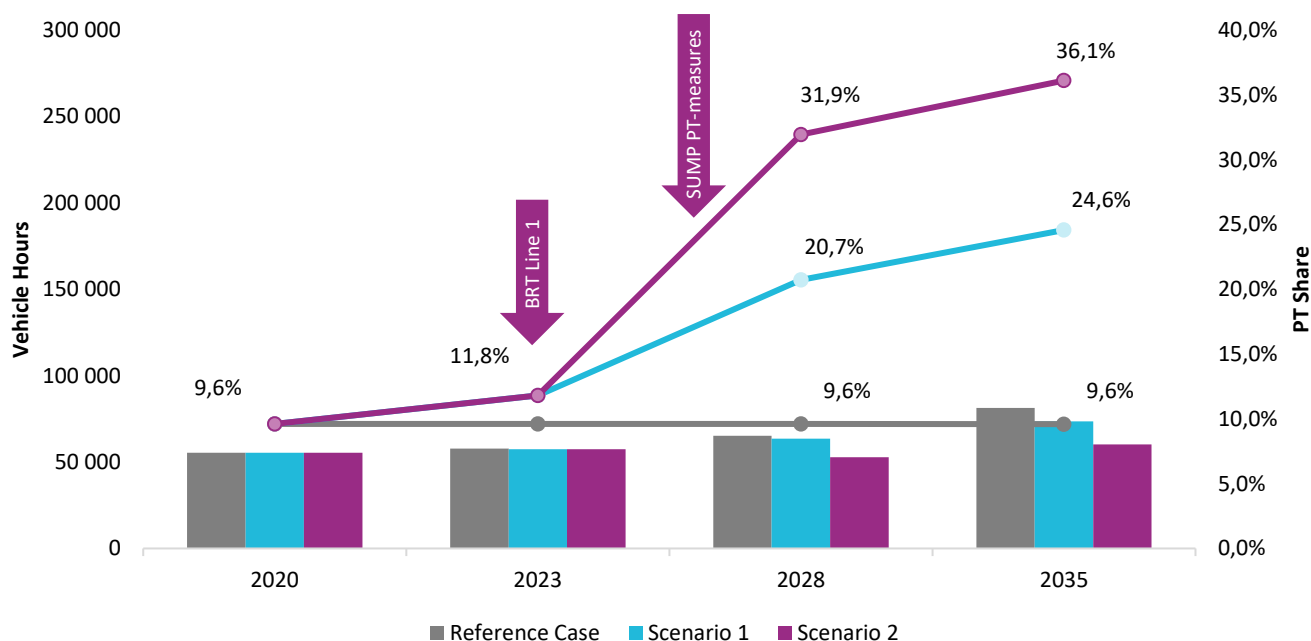
Scenario 2	VKT		Passenger.km	Vehicle hours		Passenger.hr
	Motorcycles	Cars	PT	Motorcycles	Cars	PT
2028	1.933.556	518.251	1.268.878	41.852	10.891	47.345
2035	2.043.122	535.544	1.719.683	48.044	12.138	65.073
	Trips			Mode share		
	Motorcycles	Cars	PT	Motorcycles	Cars	PT
2028	288.476	107.322	185.758	49,6%	18,5%	31,9%
2035	300.869	107.619	230.794	47,1%	16,8%	36,1%

These results imply that the mobility and congestion will be significantly better compared to the reference case, thanks to the implementation of BRT Line 1, Wider BRT network, waterbus, and urban rail transit lines. This implementation will attract 27% addition in mode share of total passenger trips.

### V.1.3. Scenario comparison

- Congestion is predicted to be 47% higher by the year 2035, if neither action nor intervention is made to prevent it. This is implied by the surge of VKT and vehicle hours from modelling results in the Reference Case.
- Current public transport share is relatively low, with only 9.6% from all passenger trips in the SUMP area. With the implementation of Scenario 1 (conventional), the public transport share will be increased to 25%. With the implementation of Scenario 2 (ambitious), the public transport share will be 36% in 2035.
- Aside from the traffic indicators which are mainly discussed in this report, the implementation of scenarios will have much larger impact on other aspects, e.g. emissions, safety, sustainability, accessibility, gender inclusion, and others.

Figure 9. Vehicle.Hours and PT share comparison between scenarios



### V.1.4. Modelling for the SUMP Action Plan

#### ■ Method adopted for the mass transit definition

The mass transit lines stem from the Origin-Destination and urban assessment of Mebidangro. Corridors are defined upon the analysis of commuting volumes in the pre-pandemic period (computing of the pre-COVID19 situation from the in-COVID19 mobility data collected). The corridors are assigned, service levels defined depending on the needs (demand forecast), possible operational speeds and insertion (urban constraints). The different levels of services hint at the technologies adapted to the mobility demand in the corridors, and are defined as such:

- ✓ Level 1: a medium level of demand (3.000 to 6.000 pphpd) is present on the corridor which does not allow for heavy infrastructure (curves, right-of-way...). It is adapted for example for BRT, trolleybus, automated shuttles or people movers, aeromoval, cable-pulled modes.
- ✓ Level 2: the travel demand of the corridor is medium to high (6.000 to 8.000 pphpd) and allows for more demanding modes to be implemented (curves, right-of-way). Modes such as BRT, tramway and light metro (LRT) can be adequate.
- ✓ Level 3: high demand (8.000 to 15.000 pphpd) corridors with important physical allowance, which enables important infrastructure and modes to be implemented, such as tramway and metro (LRT) to heavy metro (MRT).

To estimate the potential demand of mass transit, a 4-step transport model was used. Several parameters (vehicle kilometers travelled, vehicle hours, modal share for main modes and number of trips for each mode) are evaluated to help the decision-making for the selection of scenarios of mobility growth and related measures. This transport model is essential to identify the most impactful mass transit lines and to prioritize the operational sequence of mass transit lines.

#### ■ Proposed mass transit lines and prioritization

Stations and depots are identified thanks to urban conditions, line alignment and typical interstation distances for a given mode. The analysis results in 10 lines of mass transit totaling 152 km. The specifics of each corridor are given in the following

section. The different mass transit lines identified constitute a network – a vision for the future landscape of urban transport for Mebidangro. However, it is unrealistic to expect the lines to be ran simultaneously in the short-term.

The limited financial, organizational and technical resources of the Mebidangro authorities do not allow for the direct implementation of the 152 km of PT infrastructure. Hence, it is proposed to prioritize lines by their expected operability, social impacts and costs. Consideration is also given to the distribution of costs and coherence of the implementation schedule.

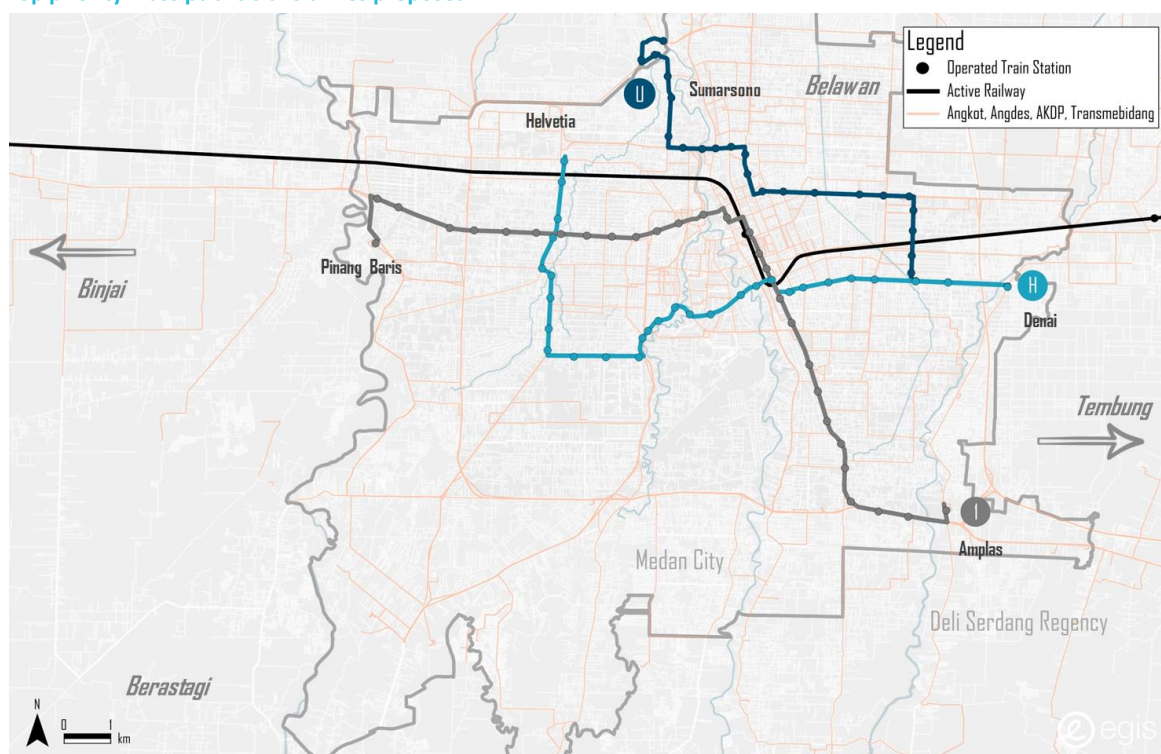
**Figure 10. Priority lines and packages for mass transit lines**

Mass transit corridor	Route	Level of service	Length (km)	Mode identified	Daily boardings (pax/day)	OPEX (IDR billion per year)	CAPEX (IDR trillion)	Priority / Rank
BRT Line 1	Pinang Baris - Amplas	-	18	BRT	210 000			
Corridor H	Helvetia - Denai	Level 1	15,4	BRT	202 000	214,4	1,7	82%
Corridor U	Sumarsono - Denai	Level 2	13,8	TRAMWAY	187 000	146,2	3,7	78%
Corridor B	Simalingkar - Jl. T. Amir Hamzah	Level 3	15,5	LRT	260 000	181,1	10,9	74%
Corridor G	Bunga Sakura - Jl. T. Amir Hamzah	Level 2	21,8	TRAMWAY	222 000	162,6	3,9	72%
Corridor T	Denai - Batang Kuis	Level 1	13,8	BRT	197 000	185,5	1,6	72%
Corridor N	Sunggal - Sumarsono	Level 1	22,3	BRT	324 000	320,7	2,3	68%
Corridor A1	Amplas - West Setiabudi	Level 3	9,29	LRT	255 000	134,6	6,5	63%
Corridor A2	West Setiabudi - Helvetia	Level 3	10,4	LRT	192 000	128,7	7,0	63%
Corridor J	Pinang Baris - Sumarsono	Level 2	15,4	TRAMWAY	128 000	115,8	2,7	59%
Corridor W	Simalingkar - Dr. Mansyur	Level 3	13,8	LRT	226 000	169,1	9,1	59%

#### ■ Top priority mass transit lines

The resulting prioritization proposes the corridors H and U to be planned and implemented first, as the ones to carry most passengers and having the most acceptable OPEX and CAPEX. After the implementation of committed BRT Line 1, Lines H and U cover the dense districts of Tegal Sari Mandala, Denai, towards the Medan City center and Sidorame Barat, Perjuangan. These communal neighbourhoods, where motorcycles heavily represent the main mode currently in use, shall benefit from the priority lines.

**Figure 11. Top priority mass public transit lines proposed**





The lines are estimated to be ran in parallel of bus, minibus and conventional railways operations. They also assume inter-connections with those modes at identified overlapping stations.

It is primarily identified that Corridor H could be serviced by a BRT and corridor U by a tramway. However, these modes shall be later confirmed in further studies.

### ■ Secondary priority mass transit lines

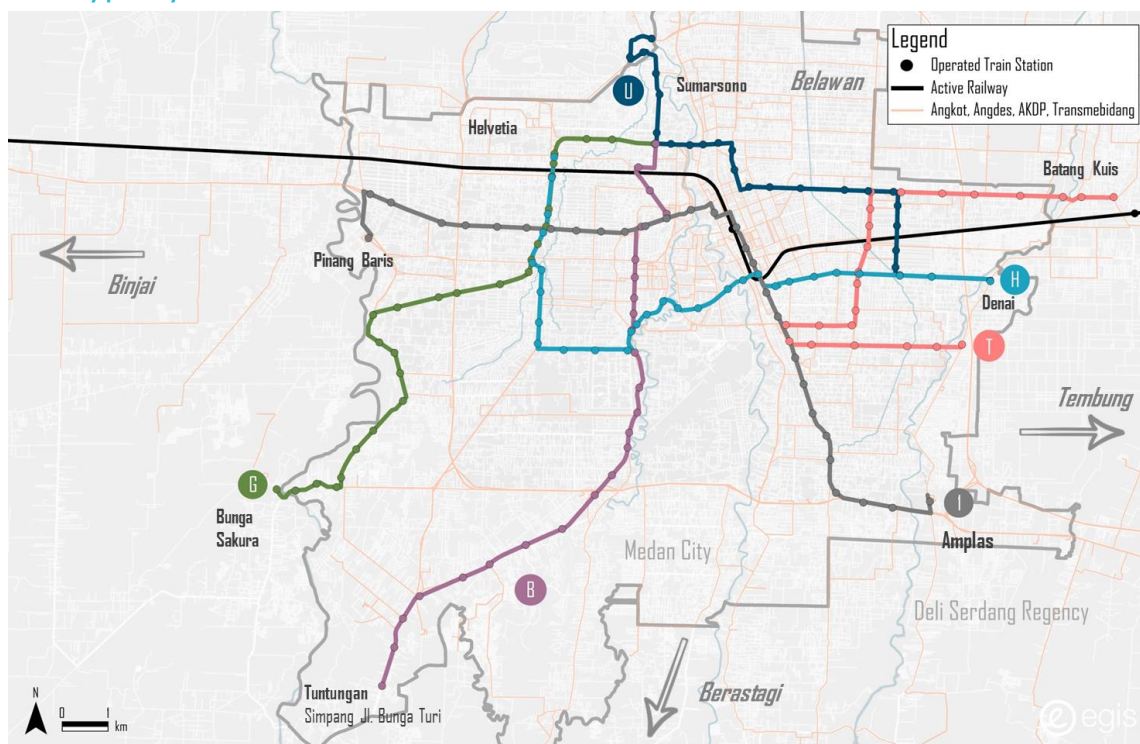
A second package is proposed on the long-term: it is made of corridors B, G and T. With important demand, these corridors come to complement the first implemented lines. Corridor T complements the top priority corridors H and U in the East of Medan City by covering the district of Sudirejo. It also extends the public transport network towards Batang Kuis, which is likely to receive the future national sports complex of North Sumatra.

Corridors G and B expand the reach of the network crossing the Medan core city center from Amir Hamzah towards the South and East (Tuntungan and Bunga Sakura). It can be noted that this follows the direction of organic growth of urban developments observed. Hence, potential extensions are taken into account.

The corridors B and G could be associated with tramway and/or LRT modes. Corridor T can be serviced by a BRT. These modes shall be confirmed in later studies.

At this stage of the network, after the second phase of mass transit lines implemented, location for potential hubs can be identified in the northern part of the city (Jl. Pertempuran, east of Helvetia district). This way the centrality of the existing railway stations is confirmed.

Figure 12. Secondary priority mass transit lines



Communal districts are covered with important lines and radial corridors extend towards the densely populated and lively southwestern parts of Medan City, following the urbanization trend observed in the past decades. These give way to a proposed wider network considered for the long term.

### ■ Last mass transit lines and for later consideration

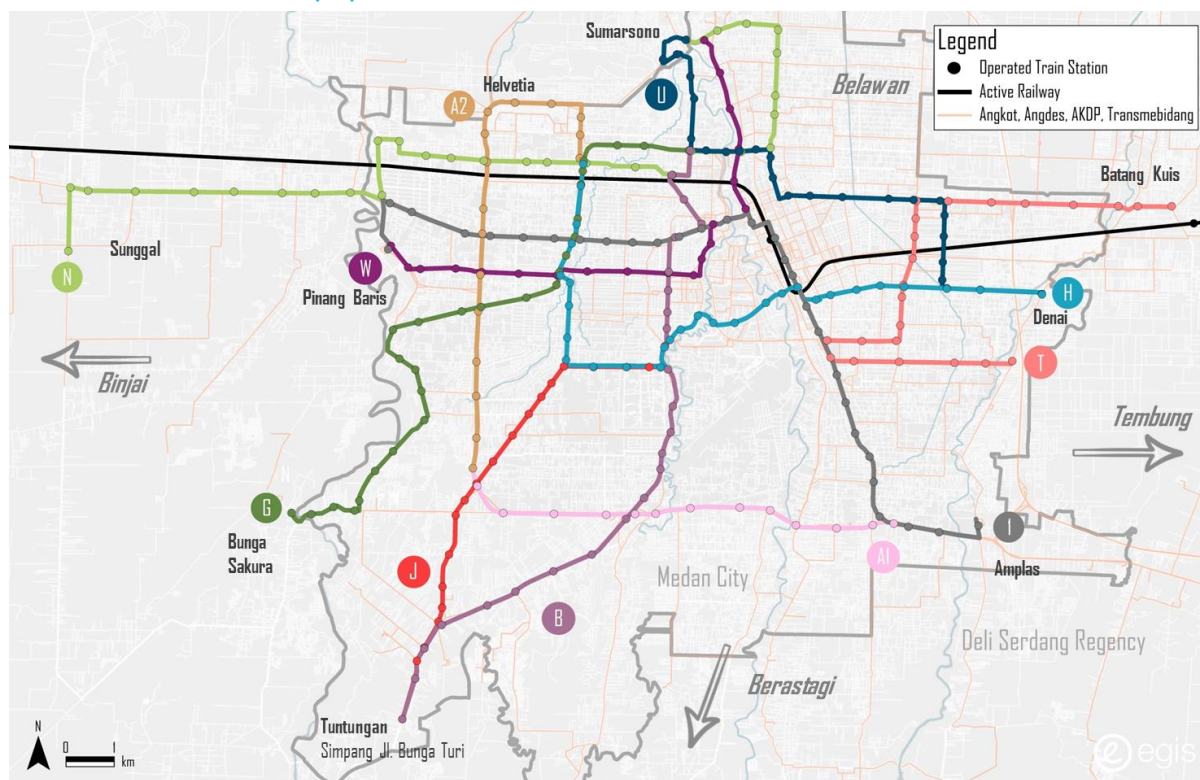
The lines coming in lower priority are the N, A1+A2, J and W, which by their nature complete the network. Corridors S, C and D shall be considered at a later stage and can be further prioritized in the later updates of the SUMP. This third phase of the network development has several objectives:

- ✓ Consolidate hypercenter heavy transit with Corridor W (suggested LRT), linking Pinang Baris with Sumarsono.
- ✓ Address Medan-Sunggal-Binjai demand with structuring Corridor N (suggested BRT), supporting line 1.
- ✓ Reinforce the offer along strategic axis Setiabudi-Tuntungan with Corridor J (suggested tramway).
- ✓ Loop network with Corridors A1+A2 (suggested LRT) along Ring Road, between Amplas and Helvetia.

This last phase is the most likely to evolve with SUMP updates given the long-term nature and assumption of previous phases implemented.



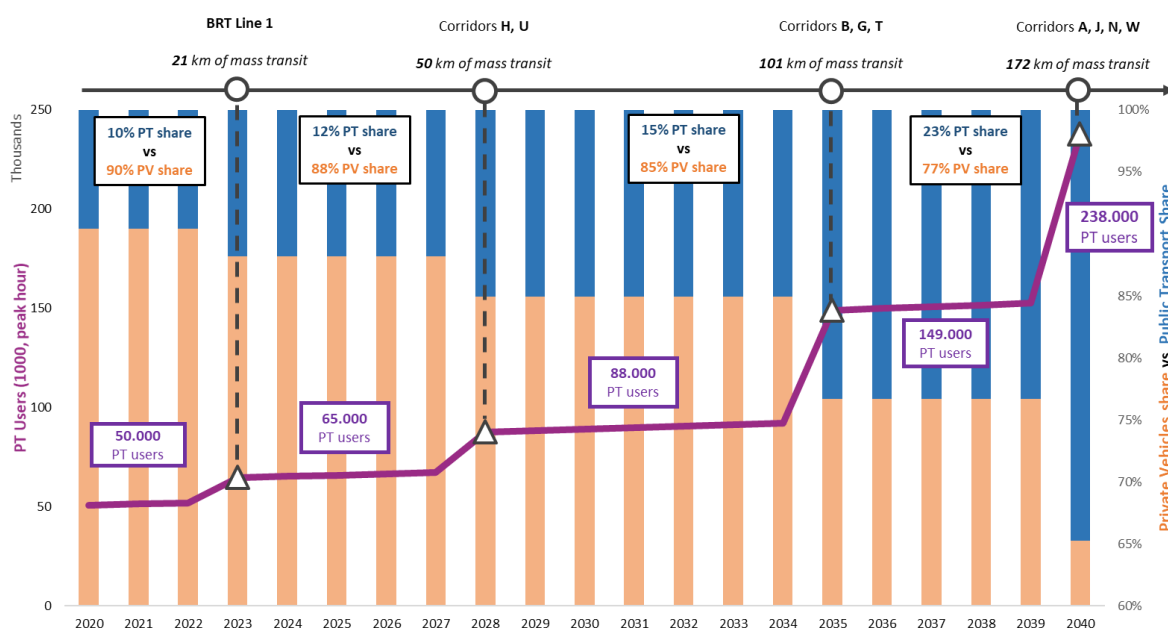
Figure 13. Additional mass transit lines proposed



### ■ Mass transit expected impacts and the “network effect”

The mass transit network is a structural heavy action for Mebidangro. It aims at massively triggering a modal shift from private vehicles to public transportation, the first step for increasing collective mobility.

Figure 14. Impacts of the mass transit network development



Given these features and although the lines are adapted to the field conditions, their maximum positive effect is expected only when implemented altogether. The impacts of each isolated line is not optimal. Indeed, the analysis of effect on modal shift shows that the BRT line 1 and corridors H and U (committed and top priority) only trigger a 5% increase in modal share in 2028, from the 10% observed in 2021.

This modal share increases to 23% upon the second phase, and close to 35% with the global network. This shows that the impacts on modal share are limited for each isolated mass transit line, and that a “network effect” is expected. Upon its growth: ridership increases more rapidly with new lines as mass transit becomes more attractive and relevant.

Hence, strong efforts in the development of the first lines and following ones is required from the authorities to induce a true change of paradigm with mass transit. It is nonetheless confirmed to be the right direction, given the important drop in private vehicles modal share on the long-term horizon, upon implementation of the full network.

## VI. Urban Mobility Observatory Appendices

### VI.1. Outline of yearly Observatory report

Section	Title	Content
-	<b>Executive summary &amp; Dashboard</b>	Overview of the report. Observatory dashboard for a given year.
<b>1</b>	<b>Introduction</b>	
1.1	MRV progress	A brief description regarding SUMP ex-post implementation.
1.2	Goals	Indicating the targets for each year.
1.3	Approach and key principles	A brief description of approach and key principles of indicators.
<b>2</b>	<b>Institutional and procedural arrangements</b>	
2.1	Main actors	Remind who are the main actors for each indicators.
2.2	Procedural arrangement	Indicating the procedural arrangement of updating the indicators.
<b>3</b>	<b>Methodology</b>	
3.1	Data collection	Data collection methodology (perception survey, traffic surveys, etc.)
3.2	Mobility observatory calculations	A complete guide of indicators calculation
<b>4</b>	<b>Analysis per indicator</b>	
4.1	Transportation Projects in Official Plans	Value of each indicator and, if available, evolution trends and forecasts. Each result shall be analyzed and improvement measures identified accordingly.
4.2	Accessibility to Public Transport	
4.3	Road Safety	
4.4	Affordability of Public Transport	
4.5	Modal split of PT and NMT	
4.6	Multimodal Integration of PT at Hubs	
4.7	Comfort and Bliss of Mobility	
4.8	Security of Collective Mobility	
4.9	Commuting Travel Time	
4.10	Road Congestion and Delays	
4.11	Energy Efficiency of Overall Mobility	
4.12	Reduction of GHG Emissions from Mobility	
4.13	Reduction of Air Pollution from Mobility	
4.14	Quality and Livability of Public Space	
4.15	Mobility Facilities Space Usage	
4.16	Mass Transit Studied	
4.17	Off-Street Parking Hubs	
4.18	Bicycle Lanes	
4.19	Sidewalks and Pedestrian Facilities	
4.20	Financing for Mobility	
<b>5</b>	<b>Verification</b>	Validation of indicators values
<b>6</b>	<b>Conclusion</b>	Final insights and justifications
<b>7</b>	<b>Plan of improvement</b>	Assessment of each indicators and next year plan for improvement

## VI.2. Schedule of Observatory updates

NoActivity		Data Source	Max man.days	Month 01				Month 02			
				Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Data collection and analysis											
	Secondary data collection	-									
01.	Transportation projects mentioned in official plans	Secondary data from SU, Mebidangro and central authorities	5,0	x							
02.	Accessibility to public transport services	Secondary data from SU, Mebidangro and central authorities	10,0	x	x						
06.	Multimodal integration of PT at hubs	Secondary data from SU, Mebidangro and central authorities	5,0	x							
03.	Road safety	Secondary data from BPS	4,0	x							
15.	Mobility facilities space usage in the urban area	Secondary data from SU, Mebidangro and central authorities	10,0	x	x						
16.	Urban mobility project	Secondary data from SU, Mebidangro and central authorities	16,0	x	x	x					
20.	Financing for mobility	Secondary data from SU, Mebidangro and central authorities	10,0	x	x						
	Primary data collection										
04.	Affordability of public transport services	Surveys	14,0		x	x	x				
07.	Comfort and bliss of individual and collective mobility	Surveys	14,0		x	x	x				
08.	Security of collective mobility	Surveys	14,0		x	x	x				
09.	Commuting travel time	Surveys	14,0		x	x	x				
14.	Quality and livability of public space in the urban area	Surveys	14,0		x	x	x				
05.	Modal split of PT and NMT	Surveys	15,0		x	x	x				
10.	Road congestion and delays	Surveys	15,0		x	x	x				
13.	Reduction of air pollution related to mobility	Surveys	5,0					x			
12.	Reduction of GHG emissions related to mobility & energy efficiency	Surveys	15,0					x	x	x	
Reporting											
Analysis on urban mobility observatory improvement planning										x	

MRV tools: dashboard links and updates input									x	
Deliverables: Annual report of Mebidangro urban mobility observatory									x	x

### VI.3. Team composition and pricing of Observatory updates

No	Position	Quantity (man.days)	Cost from INKINDO SUMUT 2021	Unit price (IDR/day, incl. Tax)	Price (IDR, incl. Tax)
1	Project coordinator	60,0	1.620.181,8	2.673.300,0	160.398.000,0
2	Transport and mobility engineer	102,0	1.701.190,9	2.806.965,0	286.310.430,0
3	Environment engineer	36,0	1.782.200,0	2.940.630,0	105.862.680,0
4	Analyst	113,0	1.861.077,3	3.070.777,5	346.997.857,5
5	Surveyor	293,0	1.942.086,4	3.204.442,5	938.901.652,5
				<b>Total</b>	<b>1.838.470.620,0</b>