Study of Road Utility Planning as an Effort to Create an Environmentally Friendly Area on the Jalan Ampera Medan Corridor

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| Submitted: September 20, 2023 | Revised: December 17, 2023 | Accepted: May 19, 2024 |

| Published: May 21, 2024 |

ABSTRACT

In designing the utility planning concept for the Ampera Medan road corridor, it starts with identifying the condition of the drainage system, traffic signs, road markings, public road lighting and road user safety devices. Furthermore, a study of changes to road utility requirements is carried out in accordance with road management guidelines and road environmental conditions in the form of improving skidness on the road surface, installing signs and warning devices, installing flashing lights, removing roadblocks and installing noise tape based on certain distances. This research aims to produce a design concept for road utility planning that is environmentally friendly and sustainable (sustainable road) in accordance with the guidelines of the Ministry of PUPR while still paying attention to basic human needs and economic growth. Research and knowledge related to the concept of environmentally friendly road utility planning on the Jalan Ampera Medan corridor is a contribution to scientific work that can provide benefits to the Muhammadiyah University of North Sumatra and the Medan City Government as material for consideration and decisions in the construction of environmentally friendly roads (green roads) in the city Medan.

Keywords: utility; road corridor; environmentally friendly.

INTRODUCTION

Fulfillment of road infrastructure and facilities as well as utility networks is a basic and vital need for people in urban areas. Fulfilling road infrastructure is the government's responsibility through established policies and regulations (Widhiyanasari, 2017). However, existing regulations need to be analyzed and implemented by comparing current road conditions to produce a solution or a guideline for structuring road utilities that is environmentally friendly and sustainable.

In the Government Regulation of the Republic of Indonesia Number 34 of 2006 concerning roads, an explanation is regulated regarding the determination of road status, road parts which include road use space (rumaja), road property space (rumija) and road monitoring space (ruwasja). This Government Regulation stipulates that the use of parts of the road can include utility buildings, tree planting and other transportation infrastructure. Road utilities can be placed in road use space or road-owned space provided that road utilities that are above ground are placed on the outermost edge of the road shoulder or sidewalk to avoid side obstacles for road users, while road utilities that are underground are placed embedded in the outermost edge of the road shoulder or sidewalk to maintain the safety of road construction.

Road construction planning that refers to spatial planning, meets road safety standards and is environmentally friendly will have a good impact on sustainable road conditions. Therefore, through road utility planning with specifications that are in accordance with social, cultural, geographic culture and Ministry of Public Works guidelines, it will provide added value for the comfort and safety of road users passing along the Jalan Ampera Medan corridor. In general, road construction will have impacts on the environment, road infrastructure, accessibility and safety of road users. Actions that can be taken to minimize these impacts are by providing utilities in the form of road facilities that are more environmentally friendly. Road operators, in this case the Government, need knowledge regarding environmentally friendly road facilities and regulations/guidelines related to environmentally friendly road facilities so that they can realize environmentally friendly road utilities. Handling of road safety infrastructure deficiencies in Indonesia is carried out by 2 (two) government agencies, namely the Directorate General of Highways and the Directorate General of

pISSN 2302-4240
eISSN 2655-2086

Volume 13, Issue 2, June 2024, pp.484-498
DOI: http://dx.doi.org/10.32832/astonjadro.v13i12 http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO

Land Transportation. As the road organizer and manager, the Directorate General of Highways has the main authority and responsibility for planning road designs according to standards and repairing accident-prone locations.

Efforts that can be made to minimize safety deficiencies in road infrastructure that serves vehicle traffic are road utility deficiency audits based on direct measurements in the field of road geometric deviations, pavement damage conditions and disharmony of road equipment utilities with road function. The Jalan Ampera corridor with a length of 1.1 kilometers and a width of 6.5 meters is one of the collector roads in Medan City which has safety deficiencies and requires an audit to reorganize road utilities.

Road maintenance, drainage and management of cables on the left and right of the road are important aspects in transportation infrastructure management. Sustainability, safety and comfort of road users depend heavily on good maintenance of these elements (Yusuf M, 2020; Naufal A et.al, 2020; Imamuddin M, Cahyanto D, 2020).

Road maintenance begins with regular monitoring of road conditions to detect damage such as cracks, holes and deformation. Visual inspections as well as advanced technology such as the use of sensors and drones help in early identification of problems. Once damage is detected, corrective steps are taken immediately to prevent further damage. This process can involve patching potholes, replacing the road surface, or full rehabilitation of badly damaged sections. Preventive maintenance is also important, such as adding protective coatings to increase the longevity of roads and reduce the frequency of major repairs (Imamuddin M, Prasetyo ATW, 2021; Ashari RJ, Heryansyah A, 2021; Yanto FH et.al, 2021).

Management of cables on the left and right of the road, whether electricity, telecommunications or fiber optic cables, also requires special attention. These cables must be located and installed safely to avoid interference with traffic and the safety of road users. Placing cables underground is often an option to improve aesthetics and protect cables from damage due to weather and human activities. This installation must be carried out in accordance with applicable safety standards and regulations, and be properly documented to facilitate future maintenance and repairs (Yanyo FH et.al, 2021; Hijah SN, Kendimansyah M, 2023; Widyaningsih N, Adawiya A, 2023).

Road Utilities

Sustainable road implementation according to (The European Union Road Federation (ERF) and Brussels Program Center, 2009) is a road that is planned effectively and efficiently, designed, built, operated, improved and maintained with the aim of providing mobility and safety for road users. This implementation needs to consider the environment, social and economic. From a social aspect, roads must meet the needs of mobility, safety and accessibility. From an economic aspect, roads must be cost effective and continuously change according to needs. The principles of sustainable road development according to (Litman, 2008) are grouped according to social, economic and environmental (ecological) aspects.

The existence of transportation has significant economic, social and environmental impacts, and is also an important factor in sustainability. Sustainability supports the paradigm shift occurring in transportation planning. In the criteria for sustainable roads, the principles of comfort and safety are in the social aspect. There are 5 (five) government regulations related to the principles of comfort and safety, namely regarding road maintenance, technical requirements for roads, provision of infrastructure, provision of functioning roads, and improving the function of plant paths in road space. To realize environmentally friendly road construction, several stages are needed, starting from reviewing the policy level that supports the creation of ideal road conditions. Apart from that, the criteria for a green road are divided into main requirements and sustainable practices that can be carried out voluntarily. The main requirements for green roads are the selection of environmental and economic related activities, community participation, long-term design for environmental performance, construction planning, monitoring and maintenance type planning.

Environmentally Friendly Road Utilities (Green Road)

Environmentally friendly road utilities (green roads) are road management activities that apply

environmental principles starting from the planning, design, construction and road maintenance stages. and handling the impacts of climate change. Meanwhile, environmental principles are principles that prioritize and pay attention to elements of environmental preservation, such as the effective and efficient use of road areas.

Criteria for environmentally friendly road utilities always optimize the area around the road as a catchment and water absorption area. Apart from that, utilizing recycled materials to minimize wasted materials and reduce energy in road construction is also a green road criterion. The green road movement is also synonymous with sustainability, which prioritizes a balance between short-term profits and long-term risks, with current forms of business that do not damage the environment, health, security and future prosperity. With regard to these criteria, inadequate maintenance and repair of road utilities, both routinely and periodically, results in more severe road damage, so prevention is needed and knowing the causes of damage (Rahardi, 2020).

RESEARCH METHODS

The research was carried out using a "rationalistic method" which was supported by qualitative data and prioritized the suitability of field observation results regarding the existence of road utilities in the Jalan Ampera corridor.

Research data

The planning process carried out in this research consists of the following stages:

1. Prepare tools and equipment for collecting data in the field
2. Retrieve geometric data on roads and road utilities based on type and location
3. Classify the types of road utilities based on their function and location on the Ampera road.
4. Identify road utility conditions that have the potential to cause road damage and disrupt the safety of road users
5. Analyze the need for environmentally friendly and sustainable road utilities.
6. Create a concept for road utility procurement and selection of placement locations referring to the Department of Transportation Guidelines
7. Create 3D design drawings for environmentally friendly and sustainable road utility arrangements using CAD and Sketchup applications

ASTONJADRO

pISSN 2302-4240
eISSN 2655-2086

Volume 13, Issue 2, June 2024, pp.484-498
DOI: http://dx.doi.org/10.32832/astonjadro.v13i12 http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO

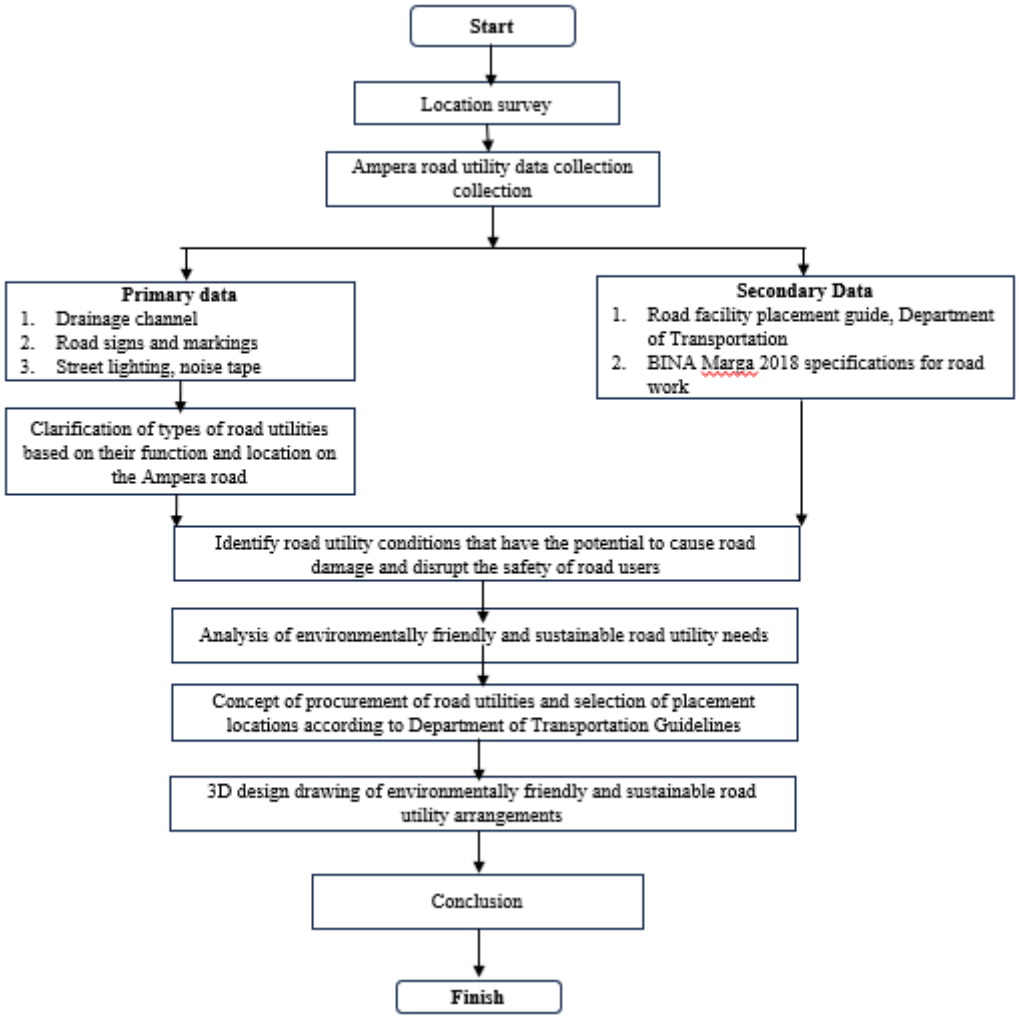

Figure 1. Research flow diagram

RESULTS AND DISCUSSION

Study of the Ampera Road Utility Management System

The road infrastructure and utility systems that serve residential centers in the Ampera Medan road corridor area include transportation network systems, electricity networks, telecommunications systems, drinking water systems and other infrastructure systems. The maintenance of roads at the research location has so far been the authority of the Medan City government, including the use of space on the road and the installation of utility networks. Handling of road utilities in the Ampera road corridor has been carried out by each agency according to the planned program and location. The road pavement repair program was carried out without synergy with other programs that also utilize this part of the road. This sometimes results in road repairs that have just been completed, having to be dismantled again due to the installation or repair of new utilities. This resulted in the road repairs damaging the utilities that had been embedded and installed on the road section in Figure 2.

Figure 2. Road damage due to Ampera road utility work

The permit recommendation given by the Medan City government to applicants for installing utility pipes from the Regional Drinking Water Company (PDAM), State Electricity Company (PLN) cables, Telephone and Communication (Telkom) cables and other fiber optics is difficult to avoid. Installation of various types of utilities sometimes requires dismantling existing roads. However, returning road conditions to their original condition often cannot be done optimally, causing road damage faster than the calculated design life.

Ampera Road Utility System Analysis

Regarding control of the construction of utility networks in this road corridor, there are problems arising from the construction/restoration of utility networks by damaging the road. It is often found that roads that have just been resurfaced (overlay) have to be dismantled again because of construction or restoration of utility networks. Restoring the condition of the road due to the utility network work, apart from requiring quite a lot of money, also greatly disrupts the aesthetic comfort of the road area. Based on field observations, the types of road damage (Shahin, 1994) on the Ampera road corridor caused by poor road maintenance and utility conditions.

In accordance with Article 7 Part Three of Medan Mayor Regulation Number 46 of 2021, construction of utility networks in the ground or above the ground must be placed in integrated utility network facilities provided by the Medan City Government. In this regard, this regulation is not yet accompanied by technical instructions that specifically explain the model and design of the integrated utility network as intended, so there is no technical document that can be used as a guide for stakeholders in its implementation. Taking into account the Medan City Government program, it is necessary to design a model for an integrated underground utility network that prioritizes the concept of sustainable and environmentally friendly development. There are several advantages of integrated utility network design if it can be implemented in the Medan City area, namely

1. Installation of an integrated underground utility network will provide a neat, orderly and clean impression along the Jalan Ampera Medan corridor so that the beauty and comfort of the environment can be maintained.
2. Maintenance of an integrated underground utility network system will be easier than the aerial utility network model which consists of cables hanging along the road and across the road.
3. Conflicts over damage or work disruption from third parties can be avoided, even with an integrated utility network system, it is easier to provide information if damage is seen from each network.
4. This integrated underground utility network system is environmentally friendly because the utility network planting activities that have been digging holes to cover holes and the presence of dangling overhead cables no longer disturb the public as can be seen in Figure 3.

pISSN 2302-4240
eISSN 2655-2086

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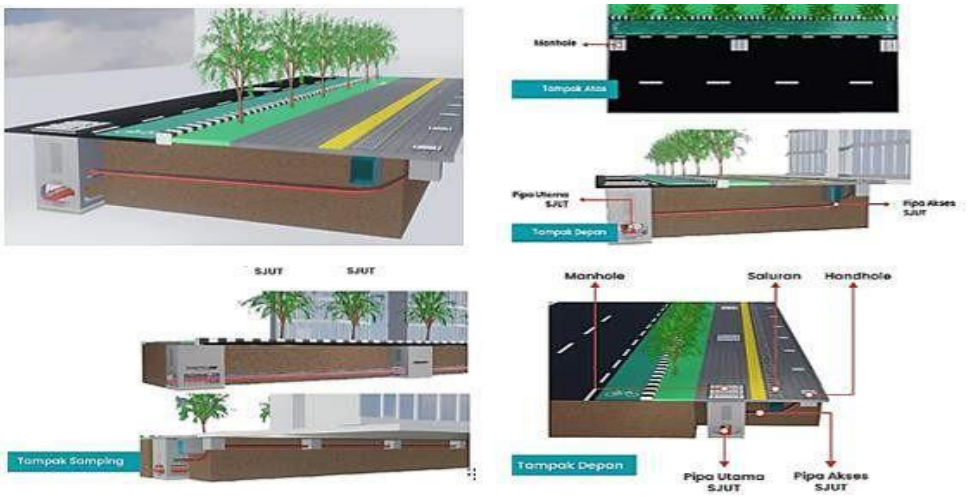

Figure 3. Underground Integrated Utility Network System Design

Study of the Utility of Electrical Networks and Public Street Lighting

Existing Ampera Electric Utility and Street Lighting Network

Utility pole construction on the Jalan Ampera Medan corridor is generally made of concrete or steel. These concrete pillars are installed with the aim of ensuring they last for a long time and are easy to maintain or replace. The existence of this utility pole is very close to a busy road with vehicle traffic. This is very dangerous for motorists on this road. Placing concrete poles near the shoulder of the Ampera road carries a high risk of causing traffic accidents for passing motorists, including causing infrastructure damage to the utility. Accidents or damage due to improper placement of utility infrastructure will be emotionally traumatic and result in significant financial losses (Yohanes, at all., 2012).

Placement of poles no further than the edge of the pavement before the highway is widened

This is often done by stakeholders so that this creates problems for the safety and comfort of motorists on the Ampera Medan road corridor. Light poles located in the western road utility area are very dangerous for road users. The road utility space should function as a space for vehicular traffic movement, not as a road utility area. To minimize the risk of danger to road users caused by improper placement of utility poles, the planning and placement of utility poles uses a sustainable concept.

Figure 4. Utility pole equipment in the Jalan Ampera Medan corridor

If we refer to SNI-04-6262-2000, public road lighting is a lamp that functions as road lighting at night so that road users, including pedestrians, cyclists and motorists, can see more clearly the road they are going to travel at night, thereby improving traffic safety. traffic and safety of road users. Street lighting in the Jalan Ampera Corridor is placed/installed on the left/right of the road and is used to illuminate the road and the environment around the Jalan Ampera Medan corridor, including at the intersection of Jalan Karantina Medan. The layout of street lighting in the Jalan Ampera Medan corridor includes straight street lighting with a one-sided pattern as can be seen in Figure 5.

Figure 5. Ampera Medan street lighting layout pattern

Analysis of the Electric Utility Network on Jalan Ampera Medan

The electricity network utility model proposed for the Jalan Ampera Medan corridor is in the form of an integrated underground utility network together with other utility network systems. This is in line with the Medan City Government Program which prioritizes sustainable development where the development must be environmentally friendly and integrated with various parties, including the government, private and public. The culvert box model that can be used for the underground integrated electricity utility network on Jalan Ampera can be seen in Figure 6.

pISSN 2302-4240
eISSN 2655-2086

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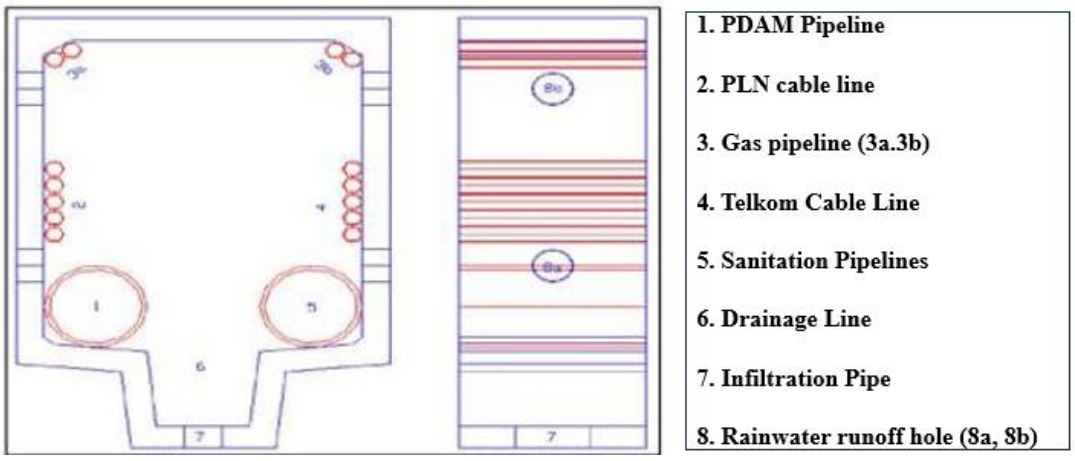

Figure 6. Culvert Box Underground Integrated Utility Network

In the concept of an integrated electricity network, it is necessary to take into account the dimensions of the box culvert used, the dimensions of the utility network to be installed in the box culvert, the need (number) of utility networks to be installed, and the safe distance permitted according to applicable regulations. It is necessary to pay attention to the safe distance between ground cables and other utilities to ensure the safety of the box culvert which is used as a medium for installing integrated utility networks. The safe distance between ground cables and other utility networks can be seen in Table 1 below:

Table 1. Distance of ground cables to other utilities

Cross with from	Distance is not lacking
Low voltage cable (TR)	>30cm
Telkom Cable	>50cm
State Gas Pipeline	>50cm
Water pipe	>10cm

(Source: PT. PLN (Persero), 2010

Analysis of the Placement of Ampera Street Lighting Lamps

Road conditions and traffic flow are one aspect of consideration in the placement of public street lighting. The Jalan Ampera corridor, which is classified as a collector road, does not require as much lighting as an arterial road. Based on the BSN SNI 7391 standard concerning the Layout of Street Lights, it can be seen in Table 2 below:

Table 2. Location of Street Lighting Lamps

Place	Layout Settings
One way street	Left or right of the road
	On the left or right the road alternates
	On the left or right, face the road
	In the middle/separator of the road
Two-way street	In the middle or median of the road
	The combination of left and right faces the middle/median of the road
	Katensi (in the middle of the road with a hanging system)
Junction	This can be done by using a tower light with several lights, generally placed on road

	median islands, outside intersection areas

(Source: BSN SNI 7391, 2008)

In accordance with the applicable provisions that the Ampera Road Corridor is a two-way road, the layout of street lights in this area is more appropriate if you use a combination pattern of left and right facing each other. Street lighting lamps are installed on the left and right sides of the road using single-arm lamp poles as in Figure 7.

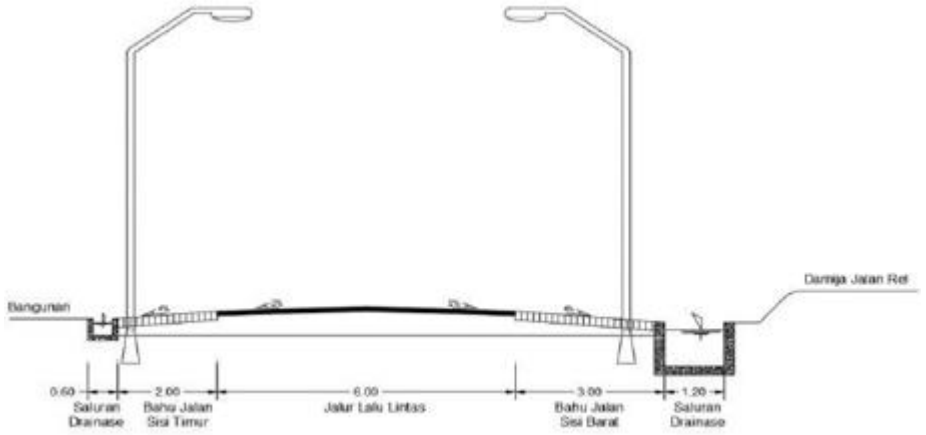

Figure 7. Pattern of placement of street lighting lights facing each other

Study of Drainage Channel Utility on Jalan Ampera Medan

Existing Drainage Channel Network

The drainage channel which is part of the Ampera Medan road utility is not functioning optimally, only on the west side of the road corridor there is a permanent drainage system but it is not functioning optimally. The shape of the drainage channels along this road area consists of open channels and closed channels with an average depth of more than 50 cm, so this condition makes the drainage channels filled with sediment and rubbish because they do not function as they should. The existing drainage channels only function to discharge rainwater from roads and residential buildings. This condition causes problems in the Ampera Medan road corridor area, such as being prone to waterlogging and flooding when rainfall is high, even during the rainy season, this area often experiences puddles of water.

Most of the drainage networks in this area are not well connected to each other, Some drainage channels have been built in varying conditions and have not been properly integrated. For this reason, it is necessary to build and improve an integrated and integrated environmental drainage network with the construction of the city drainage network so that it can effectively channel rainwater and standing water to the final waste channel. Improving the quality of this road corridor can be done through a drainage infrastructure development program by the Medan City government, so that it can overcome the problem of the drainage network which is still chaotic as can be seen in figure 8.

ASTONJADRO

pISSN 2302-4240
eISSN 2655-2086

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Figure 8. Existing Condition of the Ampera Road Drainage Network in Medan Analysis of the Drainage Network System in Ampera Road in Medan

The condition of the drainage channels on Jalan Ampera Medan is in direct contrast to the Regulation of the Minister of Public Works Number 12/PRT/M/2014 concerning the implementation of urban drainage systems, where city drainage channels are the primary channels for channeling waste water from areas to receiving water bodies. Therefore, it is necessary to plan a drainage channel that functions as a drainage route for dirty water and rainwater as well as clarity regarding the application of the form of the drainage channel. The existence of this drainage channel will provide an image of Medan City's environment that is healthy and comfortable and the roads are free from puddles of water.

In line with Dr. Ir. Suripin, M. Eng. (2004; 7) that drainage means flowing, draining, throwing away or diverting water. In general, drainage is defined as a series of water structures that function to reduce and/or remove excess water from an area or land, so that the land can be used optimally. In this regard, there are problem solving concepts that can be offered for the arrangement of drainage channels on Jalan Ampera Medan, namely:

1. Repair and increase the depth dimensions of the drainage channel on the west side of Jalan Ampera to a depth of 1 meter.
2. Design infiltration well points under drainage channels with dimensions of 1 meter depth and 0.4 meter width.
3. Create a permanent drainage channel on the east side of the Ampera Medan road corridor for the disposal of dirty water from residential areas in that area.
4. If we refer to the SNI technical design and the suitability of the conditions of the Ampera road corridor area

Terrain, the appropriate shape and size of a rainwater absorption well is rectangular or circular with a minimum cross-sectional size or diameter of 0.80 m, a maximum cross-sectional size or diameter of 1.40 m while the size of the inlet pipe that can be used is 110 mm in diameter, pipe size The spillway is 110 mm in diameter with a maximum depth of 3.00 m as can be seen in Figure 9.

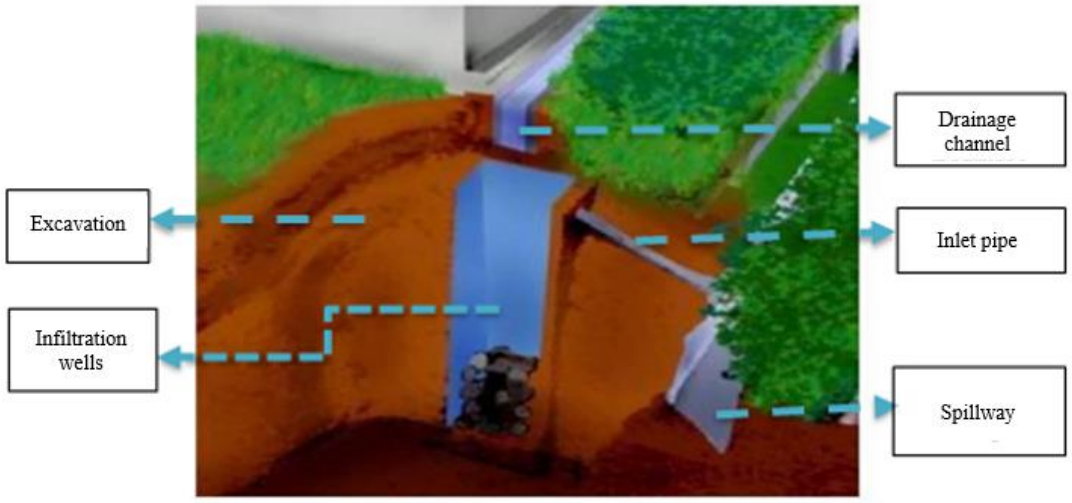

Figure 9. Rainwater absorption well design concept

Environmentally Friendly Road Utility Planning Concept (Green Road)

In line with the Medan City Government's program to carry out city planning as outlined in Medan Mayor Regulation Number 46 of 2021 concerning the Utilization and Use of Road Parts in the Context of Implementing Utility Networks, there are several problems that must immediately receive priority handling, namely controlling the construction of utility networks and efforts to placing the utility network in a box culvert which is used as an integrated utility network, not just for drainage channels.

Figure 10. Integrated underground utility network design concept

In accordance with this policy, the construction of utility networks on the Ampera Medan road can be designed using the following concepts and provisions:

1. Providing integrated utility network facilities in the ground or above the ground surface.
2. The existence of the utility network does not interfere with the safety and security of road users and pedestrians
3. The placement of road utility networks does not interfere with the driver's free view and driver concentration.
4. Providing road utilities does not have to damage city facilities and infrastructure by paying attention to spatial and aesthetic aspects.
5. The addition or placement of new utilities on the road corridor must not disturb drainage function and construction
6. The layout of utilities must not interfere with the building owner/manager's entry and exit access.

pISSN 2302-4240
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7. The placement of utility networks built on land must be at an elevation of at least 5 (five) meters from the highest road surface.
8. For utility networks built in the ground, it is at a minimum depth of 1.5 meters from the lowest road surface in the excavation area or from the subgrade of the embankment area with an excavation width of 0.5 meters.
9. For high voltage electrical utility networks located in the Ampera road corridor, they are placed at a minimum of 2.5 meters from the road surface to the top cable surface.

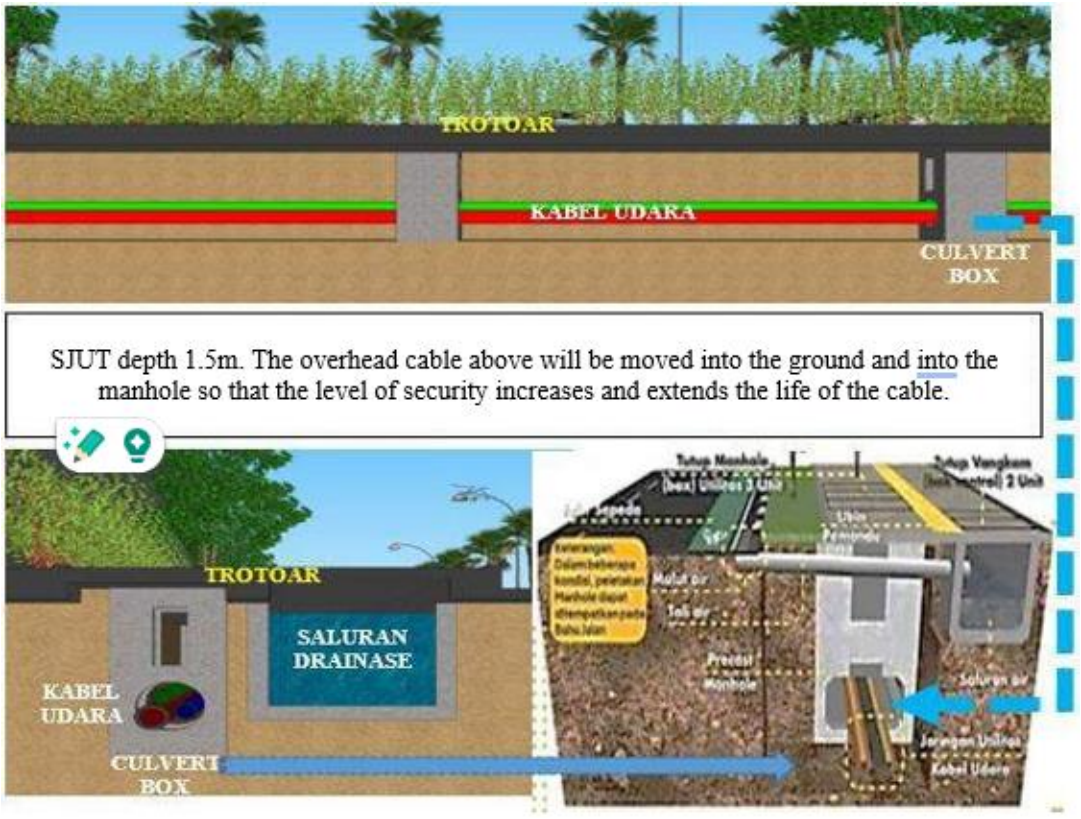

Figure 11. Integrated Utility Network Arrangement Concept for Jalan Ampera Design Concept

Environmentally Friendly Drainage System

Environmentally friendly drainage planning in the Jalan Ampera Medan corridor is intended as an effort to manage excess water (rainwater) by storing it through artificial reservoirs or natural water bodies, absorbing and flowing it into the nearest channel without increasing the load on the primary channel concerned and always maintaining the system. so that it can be used sustainably. Through the concept of environmentally friendly drainage, excess rainwater is not immediately dumped into the nearest river, but the rainwater can be stored in various locations in the area concerned so that it can be used to replenish/conserve groundwater and to improve the quality of the environmental ecosystem and can be used as a means for reduce inundation and flooding on the Ampera road corridor. With environmentally friendly drainage, the possibility of flooding or inundation and drought in this area can be reduced.

The environmentally friendly drainage concept consists of placing a concrete bus with a diameter of 60 cm with several holes or water inlets on the concrete surface covering the absorption holes. Infiltration holes are placed at intervals of 15 meters between one water absorption hole and another water absorption hole. With this concept, surface runoff water can still seep into the ground before being channeled immediately to the primary channel. In this way, this water infiltration can become a groundwater reserve around the Jalan Ampera Medan Corridor area as a conservation effort and reduce the burden on drainage channels when water overflows due to high rainfall intensity.

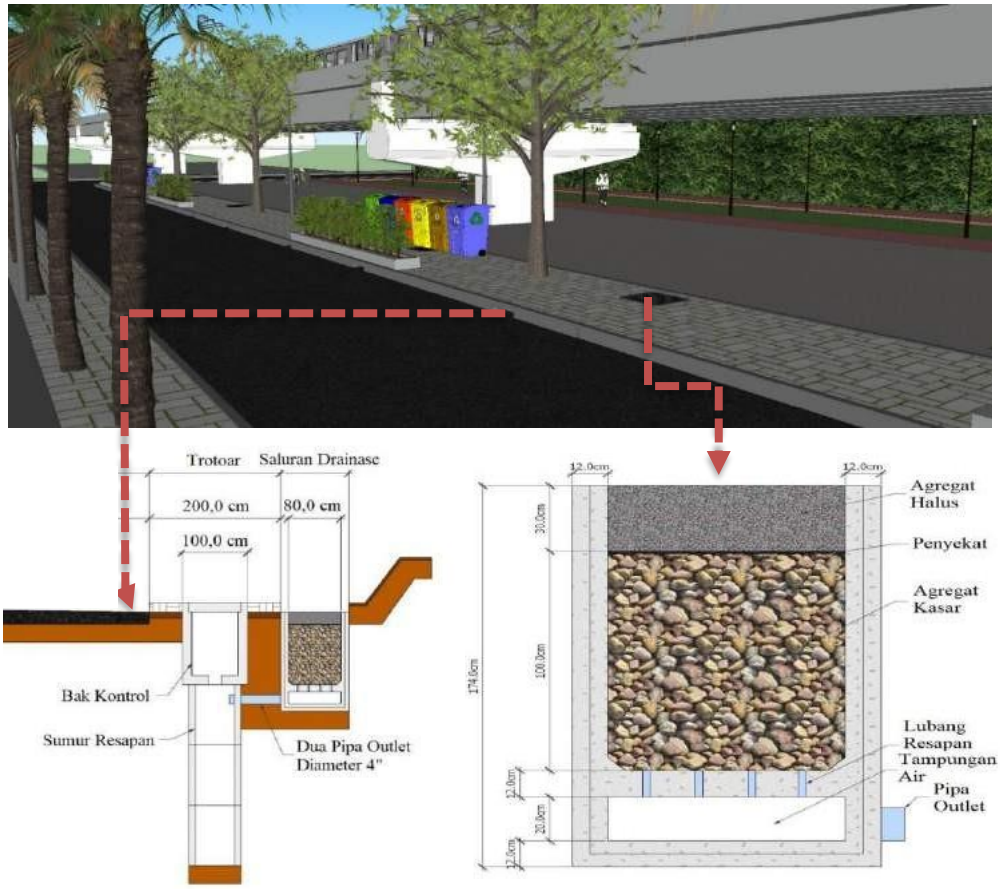

Figure 12. Environmentally friendly drainage and infiltration system concept Design Concept

Arrangement of Public Street Lighting Utility Systems

The Jalan Ampera corridor is a two-way road, so the layout of street lights in this area is more appropriate if you use a combination pattern of left and right facing each other. Street lighting lamps are installed on the left and right sides of the road using single arm lamp poles (BSN SNI 7391, 2008). The Public Street Lighting System on the Jalan Ampera corridor is designed to use a single arm pole with a standard height of 9 meters. These light poles are placed on the left and right sides of the road with a distance of 30 meters between each other. Initially, the public street lighting on the Jalan Ampera corridor was placed on electricity poles which still used overhead cables. In line with the design concept that the electricity network has been designed in an integrated underground utility network system, the public road lighting utilities are located on the sidewalk according to their function as lighting for road users passing through this area.

pISSN 2302-4240
eISSN 2655-2086

Volume 13, Issue 2, June 2024, pp.484-498
DOI: http://dx.doi.org/10.32832/astonjadro.v13i12 http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO

Figure 13. Public Street Lighting Utility System Design Concept

CONCLUSION

Road safety is an issue that tends to arise as a global problem and is not just a transportation problem but a social problem. The growth in the number of motorized vehicle owners has resulted in increasingly worsening road safety problems because it is not balanced with improvements in road safety services. Road construction should refer to spatial planning, meet road safety standards and be environmentally friendly. Therefore, through road utility planning with specifications that suit social, cultural, geographic and PUPR Ministry guidelines, it will provide added value for the comfort and safety of road users passing along the Jalan Ampera Medan corridor.

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