Implementation of Electronic Road Pricing (ERP)/ *Jalan Berbayar Elektronik* (JBE) System in Jakarta

February 2025

Table of Contents

1 Introduction

Along with rapid economic growth, Jakarta faces increasingly complex issues, especially in the urban mobility sector. The high number of people and activities in Jakarta has led to traffic congestion, negatively impacting individuals and the entire society in Jakarta. Over the years, the DKI Jakarta Provincial Government has been working to address this issue, starting with developing public transportation infrastructure and improving pedestrian and cycling accessibility.

Public transportation infrastructure alone is insufficient to create an efficient urban transportation system. The city government can implement policies that shift private vehicle users into public transportation users. The DKI Jakarta Provincial Government has implemented vehicle restriction policies on several main roads to reduce congestion. However, the measures taken are still ineffective in reducing congestion and have not even been able to shift private vehicle users to public transportation users. More stringent measures in limiting traffic volume need to be taken, one of which is implementing a road pricing scheme on major roads to reorganize the use of road space in a fair and efficient manner.

2 Transportation System Issues in Jakarta

Based on a study from Jabodetabek Urban Transport Policy Integration (JUTPI) II (2019), the number of people moving in Jabodetabek reached 100 million/day. According to data from the DKI Jakarta Provincial Transportation Agency (2024), the movement of people in Jakarta still relies on the use of private vehicles, which accounts for around 80% of the total movement in Jakarta, with private motorbikes accounting for 56% of total trips and private cars for 21%. Meanwhile, the movement of people by public transportation is still small, with 12.3% of movements in Jakarta using mass public transportation, such as buses, MRT, LRT, and KRL.

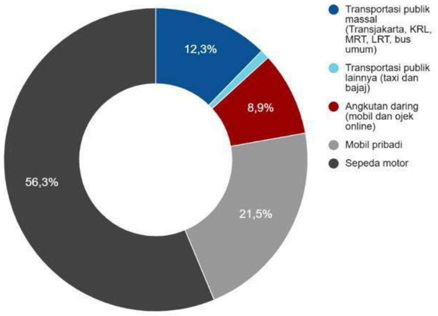

Figure 1 Proportion of Transportation Mode Use in Jakarta 2024

(Source: DKI Jakarta Provicial Transportation Agency)

Based on the data above, it can be concluded that there is an imbalance between the capacity of the transportation system (supply) and the need for movement of people (demand) in Jakarta. This imbalance causes various transportation issues in the Jakarta area, such as traffic congestion. Traffic congestion does not only occur at peak hours, but also has begun to occur frequently outside peak hours. The derivative impacts of traffic congestion include increased air pollution in Jakarta and decreased levels of traffic safety.

So far, the solution to this imbalance has been intervening in capacity (supply), such as widening road lanes, adding new access points, or building new public transportation services. However, these solutions alone cannot efficiently manage the movement of people within the transportation system. Another solution that can be implemented is the Transportation Demand Management (TDM) approach.

> Transportation Demand Management (TDM) is a strategy for influencing people's movement behavior with the aim of improving the efficiency of the transportation system or other specific objectives, such as reducing air pollution.

The DKI Jakarta Provincial Government has taken several TDM measures since 2003, namely vehicle restrictions based on vehicle occupancy or the “3-in-1 policy”, as stated in DKI Jakarta Governor Decree No. 4104 of 2003. However, the emergence of unintended consequences, such as the widespread use of '3-in-1 jockeys' (paid passengers hired to meet the occupancy requirement), prompted the DKI Jakarta Provincial Government to change the policy into an odd-even vehicle restriction policy through DKI Jakarta Governor Regulation No. 164 of 2016. However, a study from JICA Travel Speed Survey (2019)[1] showed that the implementation of this system triggered an increase in private vehicle use. The number of cars traveling on odd-even roads increased by 22%, followed by a 43% increase in private vehicle use on non-access roads.

3 Road Pricing Concept

The term road pricing has varied meanings, but generally, but generally, it refers to paid road access, where motorists are charged for using certain lanes or corridors. In Indonesia, road pricing is only found on toll roads. Motorists make payments upon entering and/or exiting a toll road segment. The tariff paid can be either a fixed price or a distance-based price. The toll road concept is used on new highways[2] that are constructed through public-private partnership (PPP) scheme as an instrument to return the investment costs provided from the private sector.

[1] Japan International Cooperation Agency (JICA). 2019. *JICA Travel Survey 2018: JABODETABEK Urban Transportation Policy Integration Project Phase 2 in the Republic of Indonesia*. ALMEC Corporation. Retrieved from: https://openjicareport.jica.go.jp/pdf/12356390.pdf

[2] It is an expressway.

In addition to toll roads, other road pricing mechanisms are employed to manage traffic volume. The government may impose a tariff on roads to control traffic volumes on congested roads. This concept is known as congestion pricing[3]. In congestion pricing, the tariff charged to motorists is part of the external costs that motorists do not consider, such as the cost of delay from congestion or the health costs due to the impact of air pollution.

Table 1 The Differences between Toll Road and Congestion Pricing Concepts

Road Pricing		
Aspects	Toll Road	Congestion Pricing (including electronic road pricing/ERP)
Destination	Recover the investment and maintenance costs of roads provided by the private sector	Reduce traffic volumes by road pricing schemes to regulate traffic volumes across the road network
Use of Tariff Revenue	Return on investment, operation, and maintenance of toll roads within a certain period	Operation and maintenance of congestion pricing infrastructure. In general practice, the revenue surplus revenue can be earmarked operate other transportation infrastructure, especially for public transportation.
Basis for Setting Rates	Road segment length	Traffic volume
Implementation Location	Inner city toll roads or intercity toll roads	Roads in urban areas that have high traffic density
Tariff Flexibility	Generally, the tariff is fixed for a certain period and adjusted periodically.	Fixed or dynamic rates can be applied. Dynamic rates depend on traffic volume.

[3] It is also known as congestion charging.

Until now, no city in Indonesia has implemented a congestion pricing scheme. This scheme has been popular in DKI Jakarta since 2014 because the 3-in-1 traffic restriction policy was no longer effective in limiting the volume of private vehicle traffic on major roads in Jakarta. At that time, the DKI Jakarta Provincial Government used the term *electronic road pricing* (ERP), the same term as the road pricing scheme used in Singapore.

As the term *road pricing* has evolved in Indonesia, there are several Indonesian equivalents, such as *pengaturan lalu lintas secara elektronik* or *jalan berbayar elektronik* (JBE). For simplicity, this publication uses the term ERP.

4 Initial Perceptions of Electronic Road Pricing

ITDP, with support from the United Kingdom (UK) government through the UK Partnering for Accelerated Climate Transitions (UK PACT) program, conducted an ERP perception survey from February 27, 2023, to March 11, 2023. The sample size was 511 respondents consisting of public and non-public transportation users, including private vehicle users and ride-hailing services. The survey's main objective was to understand respondents' travel and mobility patterns, as well as their perceptions of public transportation services and the mobility environment in Jakarta.

In the non-public transport user segment, respondents were aware of and agreed with the main urban issues in Jakarta, namely traffic congestion, air pollution, and the lack of housing availability.

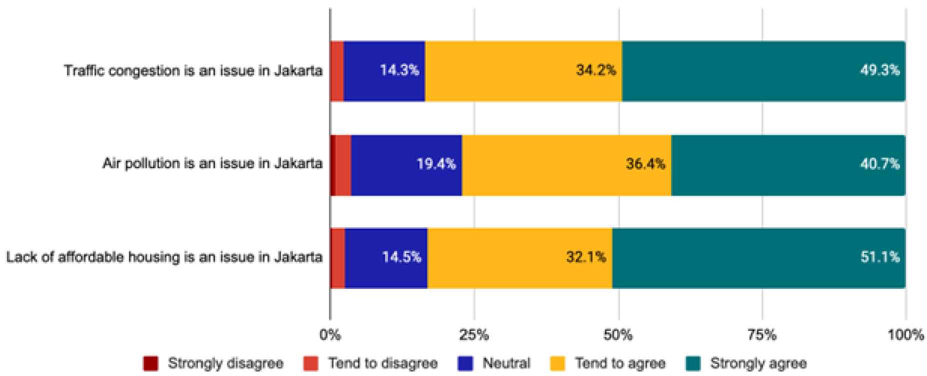

Figure 2 Non-Public Transportation Users' Perceptions of Urban Issues
Source: ITDP

Furthermore, respondents showed a high awareness of the relationship between motorized vehicle use and Jakarta's rampant traffic problems and the importance of implementing push-and-pull policies to address these issues. While private vehicle use is still prevalent, more than 75% of non-public transportation users in Jakarta agree that motor vehicles are a major contributor to problems such as air pollution in the city.

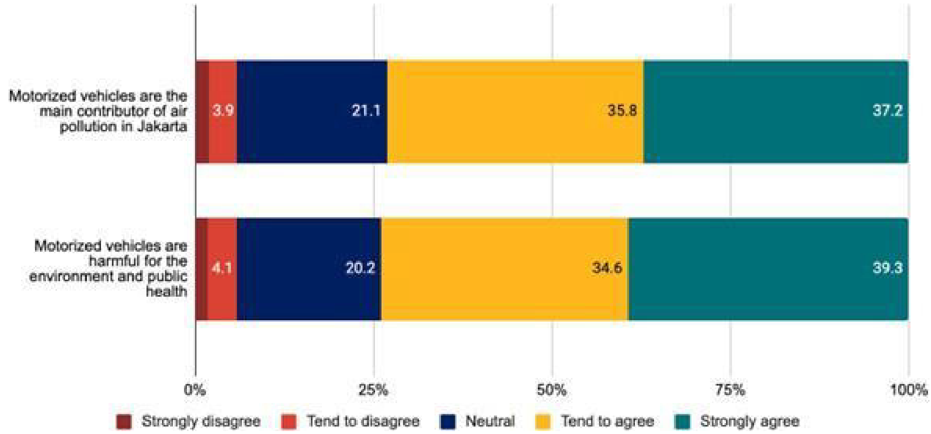

Figure 3 Non-Public Transportation Users' Perception of Motor Vehicles as a Contributor to Air Pollution
Source: ITDP

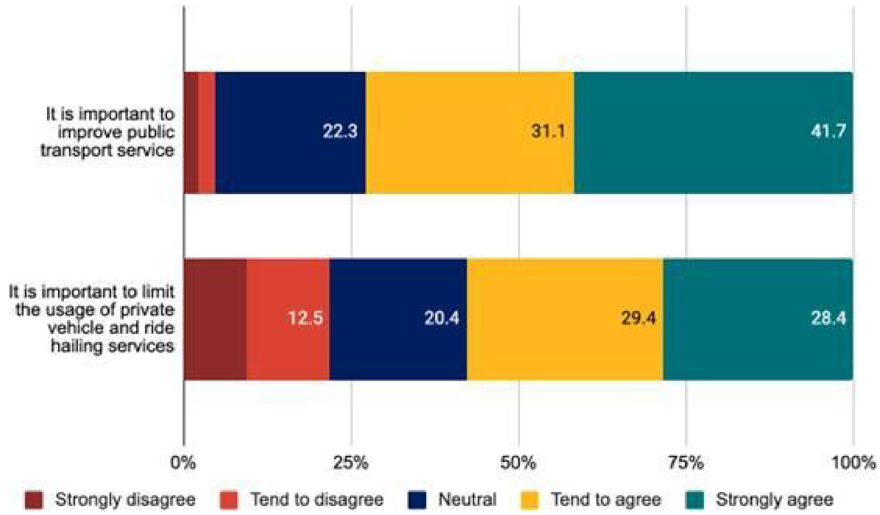

Figure 4 Non-Public Transportation Users' Perceptions of The Importance of Public Transportation Development and Restrictions on Private Vehicles
Sources: ITDP

Respondents from the non-public transportation user segment support transportation improvements (pull policy) more than restrictions on using private vehicles and online motorcycle taxi services (push policy). As many as 72.8% of respondents think that public transportation improvements are needed, while only 57.8% support the implementation of vehicle restrictions.

In addition to measuring perceptions of ERP implementation, respondents who are non-public transportation users were also asked to respond to the implemented ERP policy. A total of 46.6% of respondents expressed their preference for finding alternative routes that do not require ERP. Only 13.3% of respondents indicated a willingness to pay road fees. In this survey, respondents were not given the parameters of the tariff amount to be paid in the ERP scheme, so their perception of each respondent's tariff will vary. Another response was to change the travel time if the ERP system applies at certain hours, for example, the implementation of ERP during peak hours only. In addition, as many as 22.7% of non-transportation user respondents stated that they were willing to switch to public transportation if the service had improved and intermodal integration was running well.

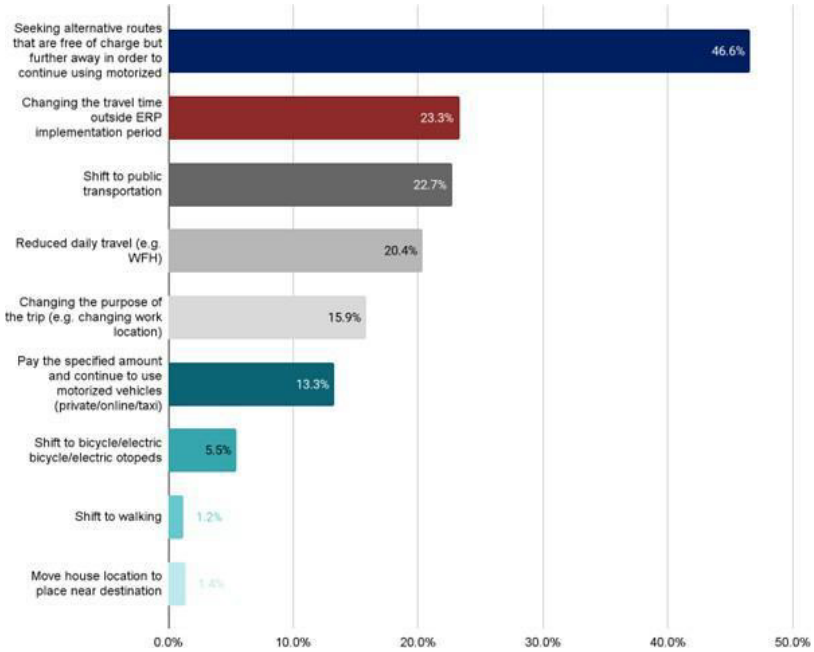

Figure 5 Willingness to Pay for Electronic Road Pricing
Sources: ITDP

Based on the survey findings above, it can be concluded that DKI Jakarta residents already understand the urgency of the traffic congestion problem, which needs to be addressed immediately. However, the concept of ERP is still not widely accepted. Almost half of the residents would decide to find alternative road routes rather than switch to using public transportation if ERP is implemented. To increase public acceptance of the ERP policy, the government must set clear objectives and continuously communicate the ERP system before and during its operation. In practice, public acceptance of ERP tends to be low, but will gradually increase along with the public's benefits[4]. In addition, the government must focus and be consistent in improving public transportation services to ensure a shift from the use of public vehicles to the use of public transportation.

[4] Goodwin, P. (2006). *The gestation process for road pricing schemes*. Local Transport Today, 444

5 Case Study of Electronic Road Pricing Implementation

Several cities worldwide have implemented road pricing schemes to limit the volume of private vehicle traffic in urban areas. These cities include Stockholm, Gothenburg, Singapore, London, and Milan.

Table 2 Operation of Road Pricing Schemes in Various Cities

Location	Year of Implementation	Pricing Scheme	General Fees for Cars (as of June 2023)	Technology
Stockholm, Sweden	2007	Area-based payment (cordon), fees are calculated once entering and exiting the zone, fees vary by time of day	kr9.75—40, max. kr120 (Rp15,000—63,000 per passing, max. Rp189,000/day)	Automatic number plate recognition (ANPR)
Gothenburg, Sweden	2013	Area-based payment (cordon), fees are calculated once entering and exiting the zone, fees vary by time of day	kr7.8—20 per pass, max. kr55 (Rp12,000—30,000 per pass, max. Rp84,000/day)	ANPR
Singapore, Singapore	1975: started with area licensing scheme (ALS), updated to ERP in 1998	A combination of area-based payments (cordon) and corridor, per-day fees, varying by time and location	$0.5—6 per pass (Rp5,500—55,000 per pass)	Paper licenses on ALS (1975) were replaced by 2.4 GHz Dedicated Short-Range Communication (DSRC) on ERP in 1998
London, UK	2003	Cordon-based payment, where motorists register and pay before entering a congestion charging (CC) area	£15 per day (Rp218,000 per day)	ANPR
Milan, Italy	2008 started with ECOPASS, then replaced with Area C in 2012	Cordon-based rate: payment/day	€5 per day (Rp84,000 per day)	ANPR, DSRC

Table 3 Benefits of Implementing a Road Pricing Scheme

Location	Traffic Volume	Travel Time	Environmental Impact	Operational Costs	Gross Revenue	Economic Cost-Benefit
Stockholm, Sweden	20% reduction in traffic volume within the boundary line and 14% reduction in vehicle miles traveled within the boundary line	Delay time is 33% compared to traffic prior to 2006	A reduction in emissions of CO_2 (15%), NOx (8%), and PM10 (13%) in the zone	kr184.6 million (Rp284 billion/year)	kr1.1 billion (Rp1.7 trillion/year)	kr715 million (Rp1.1 trillion/year)
Gothenburg, Sweden	10% reduction in traffic volume within the boundary line and 2.5% reduction in vehicle miles traveled in the Gothenburg region	Travel time reduction of 10—20% on road corridors within the boundaries of the region	2.5% reduction in CO_2 emissions in the Gothenburg region	kr221.65 billion (Rp341 billion/year)	kr910 million (Rp1.4 trillion/year)	kr14.82 million (Rp22.8 billion/year)
Singapore	44% reduction in traffic volume since the implementation of ALS and additional 10—15% reduction when ALS is updated to ERP	Speed maintained between 45—60 km/h (highway) and 20—30 km/h (other roads)	-	$14.87 million (Rp182 billion/year)	$179 million (Rp2.2 trillion/year)	$58 million (Rp718 billion/year)
London	16% reduction in traffic volume of all vehicles entering the zone -30% paid vehicle +6% bus +66% bike	30% reduction in travel time	Reduction in emissions of CO_2 (15—20%), NOx (10%), and PM10 (10%) in the zone	£91.83 million (Rp1.9 trillion/year)	£241.7 million (Rp5 trillion/year)	£77.3—101.5 million (Rp1.6—2.1 trillion/year)
Milan	-34% of all vehicle segments (-49% of bad polluters)	30% reduction in travel time, a 7% increase in bus speed, and a 4% increase in tram speed	A reduction in emissions of CO_2 (35%), NOx (18%), and PM10 (18%)	Rp387 billion/year	Rp399 billion/year	Rp228 billion/year

Source: Asian Development Bank, 2015[5]

[5] Asian Development Bank. 2015. *Introduction to Congestion Charging: A Guide for Practitioners in Developing Cities*.

https://www.adb.org/publications/introduction-congestion-charging-guide-practitioners-developing-cities

6 Principles of Road Pricing Implementation

6.1 Regulation and Institution Preparedness

Implementing the ERP system requires a solid legal and institutional foundation to ensure compliance, enforceability, and an effective operational system. The legal foundation establishes the regulatory basis governing the ERP system, while the institutional framework defines the roles and responsibilities of the various public and private entities involved in planning, enforcing, and managing this system.

A strong legal basis is essential for ERP implementation to provide the necessary authority to regulate components, such as road pricing, enforcement, sanctions, and revenue allocation management. Countries successfully implementing ERP, such as Singapore, London, and Stockholm, have established comprehensive legal frameworks. In general, ERP policies may include:

- National and regional regulations;
- Technology standards;
- Operational mechanism (zones, tariffs, vehicle classifications, and exemption criteria);
- Financial policies, including utilization of ERP revenue (revenue earmarking);
- Data protection and privacy regulations, particularly for systems that use GPS tracking or vehicle license plate recognition; and
- Enforcement of sanctions and dispute resolution to define procedures for fines for late payment or non-payment violations, appeals of fines, and enforcement of vehicle restrictions.

Reflecting on the implementation of ERP abroad, the lead transportation authority, such as the Land Transport Authority (LTA) in Singapore or Transport for London (TfL), is generally responsible for policy planning, system oversight, and public communication. These agencies ensure that ERP aligns with broader transportation and environmental goals, such as reducing congestion, improving public transportation, and reducing emissions. To achieve these goals, key transport authorities also have an important role in allocating revenue from ERP fares to programs that can further improve the quality of urban mobility.

Law enforcement agencies play an important role in ensuring compliance with ERP regulations. In many ERP system implementations, traffic police or local law enforcement units monitor violations, such as unauthorized vehicle entry, fare payment non-compliance, and handling fake vehicle registrations.

In addition, private sector involvement is often required in ERP implementation, especially in the operational aspects of system infrastructure, technology management, and payment processing. Many cities are contracting private technology companies to develop and operate the ERP system, including gantry equipment, fare collection software, and vehicle tracking mechanisms.

6.2 Area Coverage and Fees for Road Pricing

The scope of ERP is determined by a combination of transportation policy aims, the nature of the road network, and the pricing strategies in place. The fare system in ERP is designed to control traffic demand and reduce congestion through mechanisms tailored to the region's road conditions and driver behavior. In general, the determination of area coverage is based on three basic principles in determining ERP tariffs, namely:

- Border crossing fares, which is charged each time a vehicle passes through a specific area;
- Time-based fares, where vehicles are charged as long as they are within the ERP zone; and
- Distance-based fares, which calculate the cost based on the total kilometers traveled within a designated zone.

The type and location of ERP zones depend mainly on the chosen implementation strategy, which is tailored to the level of congestion and distribution of trips in the road network. Based on this approach, ERP is generally implemented in three main forms: cordon-based ERP, corridor-based ERP, and distance-based ERP.

Cordon-based ERP[6] is most effective in congested city centers where congestion is frequent, road space is limited, and access to public transportation—such as buses, trains, and metro systems—is widely available. Depending on the policy implemented, restrictions can apply during peak hours or throughout the day. The size of the cordon plays an important role in the effectiveness of this system. A small cordon may cause drivers to seek alternative routes, potentially increasing road congestion around the ERP area. Conversely, oversized cordons cover more trips and reduce rerouting, but require more extensive monitoring and enforcement systems as well as the provision of reliable and adequate public transportation alternatives.

Corridor-based ERP is more suitable for managing congestion on major roads, expressways, and major arterial roads that experience frequent congestion. It does not charge vehicles for entering a wide area but charges them as they pass through gantries[7] at strategic points along the road network. In contrast to cordon-based ERP, this approach allows for more targeted intervention, ensuring that only the most congested roads are charged.

Distance-based ERP is the most flexible option, as charges are levied on vehicles based on the kilometers traveled within a designated zone, not just for crossing a cordon or passing through a gantry. This method ensures that a vehicle will pay the higher rate as long as it is on the roadway. Distance-based ERP is well suited to handle larger areas with dispersed congestion patterns, where traffic is not confined to a single corridor or central zone, but is spread across multiple districts. However, the implementation of distance-based ERP requires significant investment in digital infrastructure and regulatory framework to ensure compliance and data security, especially in monitoring real-time vehicle movements.

[6] *Cordon is a term used for the boundaries of an area controlled by a specific policy.*

[7] Gantry is a door/gate that marks the start/end of the ERP scheme. The gantry in question can also be analogized to a toll road gate used to make payment transactions on the toll road.

6.3 Infrastructure and Technology

Various technologies are used in vehicle detection schemes. The most commonly used in ERP are below:

ANPR (Automatic Number Plate Recognition)

ANPR is an electronic tolling technology that reads vehicle license plates using digital cameras and optical character recognition (OCR) technology without needing an on-board unit (OBU). Its advantage lies in the flexibility of vehicle detection under various traffic conditions. However, its performance may degrade due to lousy weather; dirty, damaged, or non-standardized license plates; and visual obstacles in heavy traffic. In addition, ANPR systems rely heavily on the quality of the vehicle registration database, making them less than ideal for distance-based tolling schemes that require high accuracy.

DSRC (Dedicated Short-Range Communication)

DSRC is an electronic toll collection system technology that enables two-way data transfer between vehicles and roadside detection equipment. Unlike GNSS, DSRC uses OBUs with long-life batteries (up to seven years). DSRC OBUs are compact, easy to install, and support additional services, such as automated parking systems. However, the scope of this technology provider is still limited, and the system is more suitable for point-based detection rather than continuous vehicle tracking, making it less ideal for distance-based toll collection. In some practices, ERP enforcement using DSRC is also supported by using ANRP technology.

RFID (Radio Frequency Identification)

RFID uses passive tags (sticker tags) attached to vehicles and interacts with readers at detection points, such as toll gates or entrances, to collect tariffs according to a predetermined scheme. This technology is widely used in electronic tolling systems due to its low cost (US$1—3 per tag) and not requiring internal power sources such as OBUs. However, RFID only detects vehicles at any given point; it does not support continuous tracking; and unsecured tags are vulnerable to counterfeiting and durability issues.

GNSS (Global Navigation Satellite Systems)

GNSS technology utilizes a network of satellites (e.g., GPS, GLONASS, Galileo, Beidou) to determine the position of vehicles in real-time to calculate road usage based on distance. Each vehicle will be equipped with an OBU that sends location data to a center for fare calculation. In this case, GNSS is most suitable for ERP schemes on highways with large areas to support flexibility in tariff changes.

Table 4 Comparison of ERP Technology based on Pros and Cons

ERP Technology	ANPR	DSRC	RFID	GNSS
Advantages	• Proven reliability as traffic violation detection and road pricing technology • Lower roadside equipment costs compared to DSRC • No OBU required • High adaptability, can be combined with other technologies • Low risk of obsolescence • Can detect high-speed vehicles	• Proven reliable and widely deployed as a road pricing technology • High accuracy and reliability • High interoperability with other toll operators • Lower cost of OBU compared to GNSS • Compliant with Comité Européen de Normalization (CEN) standards • Low risk of obsolescence	• Proven reliable and widely deployed as a road pricing technology • Significantly lower OBU cost compared to DSRC or GNSS (if using passive tags)	• Lower installation cost of roadside equipment • High adaptability • Interoperable with other technologies • Low risk of obsolescence • There is potential to reduce data transmission costs in the near future
Disadvantages	• Lower privacy due to continuous location tracking from cameras • Non-standardized plate numbers, database alignment issues, and poor weather or lighting can cause OCR accuracy issues and increase costs for manual verification	• High installation and maintenance cost of roadside equipment • Potential land availability issues for gantries • Low adaptability of road network • High cost for roads with many intersections • Potential problems detecting high-speed vehicles	• Limited implementation as a road pricing technology • High cost of installing roadside equipment • Problems detecting high-speed vehicles; vehicles must slow down	• Lower privacy due to continuous location tracking from cameras • High overall investment cost • Accuracy is greatly affected by network quality, road typology, signal interference from surrounding buildings • Additional costs required for network service provision • Low interoperability

6.4 Tariff Mechanism

As a scheme that directly targets the general public, the fare mechanism applied under ERP should be set at a level that is affordable but high enough to influence travel behavior and reduce traffic congestion. In setting these fares, several key concepts can be considered:

- Value of time (VOT) and delay time: ERP tariffs can be adjusted to reflect the economic costs incurred by private vehicle users due to congestion-induced travel delays.
- Socio-economic costs: This approach bases tariffs on the marginal social cost of congestion by charging each driver for the additional costs incurred, such as increased travel time, environmental impacts, and public health costs. One way to calculate such marginal costs is to add the derivative of the travel time function to the route cost function, then convert the marginal time increase into additional costs using an appropriate VOT.
- Charges based on prevailing transportation tariffs: The fares should be higher than conventional tolls and other existing policy costs, thus providing a real incentive to reduce private vehicle use.
- Ability-to-pay and willingness-to-pay (ATP-WTP): This approach sets fares by assessing users' financial capacity and subjective value on transportation services. Estimates of ATP and WTP are usually obtained through surveys or econometric analysis.

ERP fare setting needs to pay attention to fairness, especially for groups that face difficulties in switching to public transportation by providing fare exemptions and discounts. This strategy also aims to reduce public resistance to the implementation of ERP. However, the implementation of exemption and discount schemes must be carefully regulated.

If too many groups are incentivized, the primary objective of ERP in managing traffic demand may be compromised. In addition, the application of varying tariffs adds a level of complexity to the detection and enforcement process. In this context, ERP relies heavily on the accuracy of vehicle registration and population databases to ensure that special benefits are provided only to those who fall into the targeted groups.

The user groups and vehicles that typically qualify for ERP exemptions or rebates can be broadly grouped into the following categories:

- Local users and vulnerable groups: These include residents who reside in the ERP zone and vulnerable groups who face obstacles in switching to alternative modes of transportation, such as people with disabilities.

- Operational and emergency vehicles: These include emergency service vehicles, such as ambulances, firefighting vehicles, and other public service operational vehicles, such as garbage collection vehicles.

- Specialized and specified category vehicles: These include vehicles with high passenger capacity, such as buses or other public vehicles, and low-emission vehicles.

- Commercial vehicles: These vehicles are used for logistics and commercial purposes. Special tariffs can be adjusted based on their operational characteristics and strategic role in supporting economic activity.

6.5 Revenue Management

ERP is implemented as a push policy to reduce dependence on private vehicles and shift people's preferences to more efficient mobility options, namely public transportation. However, this policy faces public resistance due to the additional cost burden, especially for drivers who already bear various operational costs, such as fuel, parking, vehicle registration, and vehicle taxes. The implementation of ERP will increase the costs that motorists must bear.

To reduce resistance to the road pricing scheme, transparent measures are needed in the financial management of the ERP system. In this case, the government must ensure that the revenue generated from ERP is managed transparently and accountably and that it provides tangible benefits to the community. Therefore, revenues from ERP are generally reallocated through earmarking schemes to support pull strategies that focus on providing alternative transportation, congestion management, and sustainable development so that people can feel the positive impact of these policies directly. This mechanism is used in many cities that have implemented ERP systems. For example, TfL uses congestion charging revenues to improve public transportation services and pedestrian and bicycle infrastructure.

6.6 Supporting Measures

To fulfill the role of ERP in limiting the use of private vehicles and promoting the development of public transportation and infrastructure, comprehensive and integrated supporting policies are required. These technically developed supporting policies serve as operational guidelines for ERP implementation and ensure that strategic measures for transportation system development are holistically integrated. In addition to key supporting policies such as the development of transportation planning documents, additional strategies significantly support the successful implementation of ERP. These supporting strategies can be subdivided according to the push and pull concept.

The push strategy focuses on reducing demand for private vehicles through measures that disincentivize their use. Implementation includes the following considerations:

- Parking management: Regulate and limit the availability of parking facilities in city center areas that are well-served by public transportation modes to reduce dependence on private vehicles. This strategy can be implemented by adjusting parking tariffs to higher levels in congestion-prone zones.
- Low emission zones (LEZ): Imposing access restrictions for high-emission vehicles in certain areas to encourage the use of more environmentally friendly vehicles and reduce traffic load.
- Land use and spatial planning policies: This is done to control the growth of commercial and residential areas based on the road network's capacity, thereby reducing long-distance trips that contribute to congestion. This strategy can be carried out in accordance with the concept of transit-oriented development (TOD), which is the development of high-density areas by combining residential and commercial functions within walking distance of major transit points to increase pedestrian attraction and public transport use and trigger land and property gains that can be monetized through land value capture (LVC) schemes.

On the other hand, the pull strategy aims to attract people to switch to more sustainable modes of transportation by improving the quality and accessibility of public transportation services. Implementation may include the following considerations:

- Public transportation infrastructure improvement: Develop and improve mass transportation systems, such as buses, trains, and other modes, to increase the reliability of public transportation services.

- Integration between transportation modes: This can be done through three forms of implementation, namely physical, information, and fare integration:
    - Physical integration: Connect intermodal spaces through interconnected station or shelter designs, such as bridges between MRT stations and BRT shelters, taxi waiting areas outside terminals, and integrated bicycle lanes along BRT corridors.
    - Information integration: Statically synchronize scheduling systems and maps and provide real-time service information, so passengers can easily determine routes and arrival times between modes.
    - Fare integration: Optimize ease of payment through multi-purpose cards, free or discounted transfer systems, and unified ticketing that allows a single fare covering travel by multiple modes of transport to reduce barriers to the use of the overall public transport network.
- Pedestrian and cycling facilities and feeder services: Improve facilities that support first-mile and last-mile connectivity of public transportation users.

6.7 Monitoring and Evaluation

Monitoring and evaluation plan activities are needed to obtain the results and benefits of ERP policies that will be informed to the public. Establishing key performance indicators (KPIs) for regulators and minimum service standards (MSS) for implementers will help communication with the public before and during ERP implementation. This can further support policy adjustments to achieve the appropriate goals and objectives. Below are some of the key recommendations for ERP monitoring and evaluation:

1. Monitoring and evaluation should start before the actual implementation of ERP runs. Some cities failed to implement ERP because there was no monitoring and evaluation of conditions prior to ERP implementation. The results of this pre-monitoring and pre-evaluation will be an important part of future ERP policy adjustments.

2. Monitoring and evaluation is an ongoing process. On the first day after the introduction and implementation of ERP, the mass media will be talking about this topic continuously. Therefore, transparent reports should be made public through available mass media channels in the early stages. The initial impacts to be focused on are traffic impacts, travel time, and the performance of the technical service system. After the first week, month, and year, the government can focus on other topics related to social impacts and economic benefits.

3. A dedicated monitoring and evaluation team is needed to provide comprehensive analysis and recommendations of ERP policy performance.

6.8 Communication Strategy

Communication efforts with the public are significant in providing the correct information to the public regarding the results and benefits of ERP policies. Below are the follow-ups that must be prepared to develop the ERP policy communication strategy:

1. Strengthening the relationship between the Road Pricing System Operator Unit (UP SJBE) and the Data and Information Center (Pusdatin) of the DKI Jakarta Provincial Transportation Agency regarding communication strategies to the public.
2. Strengthening the Pusdatin of the DKI Jakarta Provincial Transportation Agency as the person-in-charge in implementing the public communication of the DKI Jakarta Provincial Transportation Agency’s Electronic Traffic Regulation (PL2SE: Pengendalian Lalu Lintas Secara Elektronik) program. This includes preparing data banks and processing information to the public.
3. The inter-regional apparatus of the DKI Jakarta Provincial Government actively collaborates in organizing activities and providing public service information regarding ERP policies.