6 DEVELOPMENT GOALS AND STRATEGIES

6.1 Core Issues

1) The Challenges of Traffic Congestion and Decreasing Mobility

Transport and mobility is a major community concern affecting the daily lives of millions of citizens in Jakarta with traffic congestion inflicting a high social and economic cost due to wasted time, increased transport cost and loss of productivity. The Transportation Ministry estimates that traffic jams cost Jakarta IDR 28.1 trillion rupiah ($3.2 billion) yearly in fuel costs, lost productivity and health costs. Traffic congestion erodes the benefits of economic growth and development.

Citizen's also raise transport as a strong area of concern, emphasizing that better solutions are needed, involving improvements to the existing public transport network, and for governments to place restrictions on car use.

Congestion impacts on all sectors, in that all, ravel choices are inconvenient; cars, motorcycles, and public transport are all, in varying degrees, inconvenient, time wasting, expensive, and unsafe.

Jakarta's development also faces 21st century challenges; specifically energy cost and security; pollution and carbon emissions and increasingly limited space for car traffic. European cities are leading the way in addressing these issues and actually develop policies to make car travel more inconvenient in favour of to promoting more efficient modes such as public transport, cycling and pedestrian space.

While it is necessary to have an efficient and well connected road network, building road space with the expectation to relieve traffic congestion is often counterproductive, as the extra road space is quickly absorbed by more cars and motorcycles. Flyovers will speed up traffic to the next bottleneck and heavy concrete road structures degrade the ambience of urban living space, and promote car dominance that will choke the city to a standstill.

2) A Transport Network Approach

There are a number of explanations for the traffic conditions of Jakarta city, being firstly the high reliance on private cars made possible by increasing road development and due to the lack of an effective mass transit system. The flexibility of the road network has also caused trip patterns to be extremely diverse allowing decentralization of development and in return resulting in a large range of trip permutations that need to be catered for.

This can be managed in two ways: firstly, by building high quality public transport corridors such as MRT/BRT. A strong public transport corridor will attract business and housing to the corridor, which over time will concentrate development along the corridors, with the effect of creating stronger corridor demand and helping to reduce the random travel patterns. Secondly, is for these corridors to be part of a wider mass transit network, for which BRT is particularly well-suited in that is provides a high capacity mass transit across a wide network at a relatively low cost.

MRT corridor development in itself is unlikely to have any major impact on the wider transport demand. Also the financial challenges of MRT cannot be ignored, and financial sustainability is an important policy decision criterion and any financial support should not be at the expense of the wider network.

The challenge for the city is to take bold and decisive steps to build a high quality and fully integrated mass transit network based around MRT and BRT supported by a range of mobility functions such as cycling and Park and Ride. Only with a comprehensive network and a 'metro' level of service can offer a dignified and convenient service as a viable alternative to private car travel.

Good network coverage will ensure good access; however, access also includes good connectivity across the network, so passengers, once on the system, have a wide choice of destination options and easy connections. This involves both physical and system integration; infrastructure that makes transfers 'seamless' and integrated fares and ticketing.

Quality public transport networks can also compete for market share to improve its sustainability. Winning market share from car travel is achievable as cars, despite their inherent convenience are often at the disadvantage of traffic congestion.

3) Public Transport Sustainability

Equally if not more important than public transport infrastructure is the management of the system. Management that is reliant on loss-compensating subsidy loses focus on developing revenue and therefore loses focus on the customer. Invariably, being starved of funds with a focus on cost -cutting, will see service standards fall, and a service only for the captive market.

For public transport to be commercially viable, and to continuously offer the required standard of service, it must take a commercial and business-like approach, i.e. strive to win market share, maximize revenues, and manage costs. Public transport as a subsidized social service for those without the means private travel is an outdated concept; it must be sustainable business enterprise, strong and capable of becoming the mainstream transport choice for the city.

4) Specific Issues of Transjakarta

(1) Performance of the Busway System

TransJakarta has been a strategic decision to improve bus priority, and while it has made the bus system a faster mode of travel, the level of customer service has declined and it performance is well below its potential capacity as a mass transit mode.

Briefly, its problems can be outlines as:

- It has strong busway corridors but poor network connectivity, causing passengers to experience difficulty with transfers, wasted time, and congestion at stations
- No integrated fares and ticketing
- Busways are operating at over capacity due to poor design, inadequate fleet (in numbers and design) and poor control of the system
- Lack of mechanism to address the wider network issues for Jabodetabek which compromises the cross border network thus inconveniencing passengers
- Design compromises have reduced system effectiveness and service quality including poor station access for passengers, congestion for buses, and slower bus speeds
- Lack of system control impacts on capacity and reliability

• The business model does not incentivize service improvement

Still, Jakarta's busways are a clear competitive advantage in developing a high capacity/ high performance mass transit system. This report will outline in detail the needed improvements.

Figure 6.1.1 TransJakarta Busway

Figure 6.1.2 TransJakarta Busway

(2) Management and Customer Service Delivery

TransJakarta operates as a department within the Jakarta DKI and relies on a loss-compensating subsidy to continue its operations. The business is supply-oriented instead of being demand-oriented resulting in poor customer delivery and passenger complaints not being addressed. Only if it is made reliant on customer revenue and not subsidy will it be able to refocus its attention on customer needs, improving service delivery and developing the business.

Another factor is the regulated fare, which is unable to support an acceptable level of customer service. A fare which is set for the affordability of the poor generally provides a poor service outcome.

The compromised financial situation of the agency also affects its ability to manage the quality standards of the bus operators, with poor enforcement of quality standards stipulated in the contract.

(3) System Speed

Critical to both passenger service levels and fleet efficiency (also impacting on cost of operation) is the commercial speeds of the bus system. Put simply, slower bus speeds lengthen the cycle times for buses to complete a round trip, requiring more buses to maintain service headways; also energy cost increase markedly. Slower system speeds will incur higher costs and require more subsidies. Presently TransJakarta busways operate at an average speed of less than 20 kph.

(4) System Control

System control has a direct bearing on improving bus speed, and increasing system capacity.

Specifically the issues are:

• Lack of monitoring and fleet/driver management to address service failures and deviations from schedule and disruptive events.

- Lack of traffic priority infrastructure to assist the buses to keep schedule. Traffic conflicts and poor intersection control causes random bus arrival at stations resulting in bus congestion and severely lowers the overall capacity of the system.
- Where buses cannot keep schedule, they arrive randomly at stations, causing bus congestion, and passenger overcrowding and longer wait times
- Intersection conflicts due to poor traffic segregation and lack of traffic signal priority for buses

5) Development of a City Transport System

Further than just the bus system, this project will address the wider issue of how the road-based public transport network can address overall transport problems of the city. It is commonly acknowledged that the city cannot be developed around a car culture, but requires a high quality public transport network. Development of a few MRT corridors alone will do little to solve the wider network problems and a full MRT/BRT/Bus network with supporting mobility measures are essential to addressing present and future challenges.

This project will not only outline the necessary design features or such a system but also detail the necessary business structure and institutional management to ensure the system is sustainable and performs well.

Figure 6.1.3 Bangkok – buses stuck in traffic along a Skytrain corridor. Lack of sufficient network means 96% of public transport trips are still by bus

6.2 Goals and Supporting Strategies for Urban Mobility

A Strategic Planning Framework must 1) identify goals supported by objectives that are sufficiently tangible and realistic to enable all stakeholders to understand clearly what needs to be achieved; and 2) develop strategies and actions and to be able to declare success when goals are reached.

This JAPTraPIS study makes a preliminary list of goals and objectives as follows:

(1) To make JABODETABEK a prosperous and livable city

(2) To create a highly efficient transport network

(3) To reduce car use through supply and demand measures

(4) To create efficient urban transport systems

(5) To improve system management supported by a sustainable business model

1) To make JABODETABEK a Prosperous and Livable City

Cities are an important element in the national well-being, and central to improving national productivity performance. The way cities develop determines their resilience to shocks and risks in areas of environment and productivity. In a fast changing and increasingly uncertain world, governments need to take firm action to transition to a less energy and emissions-intensive economy in order to ensure a sustainable future.

Transport is a critical issue in developing cities and to manage the challenges of population growth and to ensure productivity growth, governments must prioritize efficient transport and mobility, improve governance and organization, and make more efficient use of existing infrastructure.

Setting a path to solving Jakarta's transport problems should start with the end in mind; a vision that clearly defines the planning vision for the future; to define policy direction and purpose, for example:

"To develop JABODETABEK as a liveable city that supports quality of life and the health and well-being of its citizens. To build attractive built and natural environments; to be equitable and socially inclusive; providing choices and opportunities for people to live their lives, share friendships and raise their families to full potential."

Car dependant cities face an uncertain future in terms of energy cost and consumption, pollution and greenhouse gas emissions, and available space. The development trajectory of Jakarta over the past 30 years is on a collision course with current and future challenges.

Negative impacts of car use exceed the benefits; Cars that were meant to improve mobility now bring cities to a standstill. Decisive policy and measures are required to reduce car dominance and restore the city to a sustainable balance where environmental quality, economic prosperity and social well-being are upheld.

Transport solutions alone are not sufficient; a more holistic approach is needed. City development and land use decisions must be integrated with mobility strategies, with improved public transport playing a key role.

2) To Create a Highly Efficient Transport Network

Efficient mobility networks are defined as providing easy access, a choice of destinations that can be easily reached, and one that has minimal negative impacts on the environment.

The present road network represents an inefficient and inequitable transport network with serious negative external impacts (congestion and pollution) posing heavy social, economic and environmental costs on society.

The single most important action to solve the transport dilemma in Jakarta is to developing an efficient and integrated transport network.

This will provide a realistic alternative to car and motorcycle use, giving commuters a better (and more efficient) quality travel option that is accessible, convenient and affordable. Furthermore the quality of service of the public transport system must be able to compete with cars and motorcycles to win market share and include a combination of mobility options such as public transport, safe cycling and walking opportunities and park and ride.

The present busway network is a good starting point: the backbone of an integrated road-based public transport system. With political commitment this network can be improved into a high quality full network in a relatively short time.

The full network must offer efficient mobility, with good integration so it is easy to use; the test being whether citizens can make a lifestyle choice to live without owning a car without noticeable disadvantage.

A better balance in road use, with greater equity and efficiency is a step in the right direction for a more sustainable and equitable city. Pedestrians and cyclists have equal right to urban space and represent a far more efficient form of travel. Increasing car dominance has negatively impacted on urban space required by people, to walk, to cycle, to meet and socialize on the street and in public spaces. Presently, users of the busway must negotiate stairs and ramps to reach bus stations, to avoid inconveniencing people who drive cars.

Walking and cycling are affordable and efficient options, both complementing and supporting public transport, but have received little support or consideration in the transport mix.

These policies are gaining traction worldwide, with many developed cities showing declining car use per capita in cities, driven by a suggested set of factors being:

(1) Hitting the Marchetti wall (the principle being that when travel time exceeds 1 hour in each direction, alternatives become more attractive)

(2) Growth of public transport

(3) Reversal of urban sprawl

(4) Aging of cities

(5) Growth of a culture of urbanism

(6) Rise in fuel prices

A good transport network is the key to offering good alternative to private modes of travel, and requires:

- Efficient modal integration; integrated fares and ticketing and seamless passenger transfers.
- Safe cycling networks, well integrated with public transport and local communities.
- Park and ride facilities and integrated community feeder services.

3) To Reduce Car Use Through Supply and Demand Measures

This goal is unequivocal; reducing car use through demand management measures is critical. Road pricing is generally viewed as the main tool in Transport Demand Management (TDM), however, road pricing alone cannot solve traffic issues; it can only act as a tool to ration limited road space but will not solve mobility issues. Creating sufficient supply of alternative mobility is a key component of TDM, equally if not more important as the restrictive measures. In fact, restrictive measures are politically more easily introduced when supported and synchronized with good mobility options.

4) To Develop Efficiency in Transport

(1) Efficiency in Infrastructure

The city cannot just build its way out of the problem; it needs to invest in projects that deliver the best returns in terms of access, capacity and environmental benefits. Housing and commercial developments need to be served efficiently with transport. Roads need to be utilized more efficiently – for example, a dedicated BRT lane potentially has ten times the capacity of a car lane.

(2) Efficiency in Transport Management and Operation

Subsidized transport operations are seldom efficient as there is little incentive to drive efficiency. Being starved of funds does not create efficiency – it reduces quality. A more business-like approach to operating public transport services is required, with a business model driven by revenue growth (not subsidy) that is more likely to identify and develop business opportunities; meet the needs of its customers; develop an efficient passenger network (travel time and destination choice); efficiently manage its fleet utilization and costs and keep fares more affordable.

(3) Efficiency Delivers Sustainability and Equity

Sustainable funding mechanisms (fares and charges) must ensure that services are priced to meet the actual internal and external costs of providing infrastructure and services (user – pays principle). Market mechanisms such a road pricing and parking charges can be used as a tool to influence motorists to more efficient mobility choices, and generate revenue to support efficient modes.

Efficient transport systems are less reliant on subsidy and are more equitable. Inefficient investments are a cost burden to society and even ‘soft-loans’ from supplier countries for infrastructure building may result in a lifetime of local subsidy support.

Technology choices for mass transit also have equity implications. Equity is not served where expensive and high-tech public transport systems exclude the lower income sector, leaving them to use poor quality and inefficient modes of transport. Similarly, government subsidies for high end systems need to be supported by taxpayers who may never use the system.

The advantage of BRT systems are that they have a relatively low development cost with a high passenger capacity, resulting in affordable fare levels being able to financially support the system. While the government may consider some level of ‘user-subsidy’ for vulnerable groups such as the elderly and students as a social benefit, a BRT system can be expected to sustain operations on its fare revenue base.

5) To Improve System Management Supported by a Sustainable Business Model

The key to improving service quality is a sound business model. Transjakarta needs to be redefined as a financially viable autonomous business unit, operating under a commercial business model; revenue- dependant and business-like in its operation. The business model will create the incentives to develop the business, increase revenues, develop, and maintain efficient operations, manage costs, and improve customer service standards.

The improved operating efficiency of an upgraded BRT will underpin the Transjakarta business model to reach financial viability and reduce subsidy dependence.

6.3 Project Approach

1) BRT Improvement Program

Given the situation of the present overcapacity of the present Transjakarta, the first priority is to improve the DKI Jakarta busway system to a full BRT in line with the standard of a mass-transit system. This BRT improvement program is an essential first step to begin the address the current problems of the system as well as to be able to manage the additional passenger loads once the network is extended into the wider Jabodetabek region.

However, the network development program includes early measures to extend to network across city borders.

2) JABODETABEK Integrated BRT Network

A full 2020 route network has been designed from which certain short term priority projects have been identified. These routes form an integrated network across the city border to the adjoining regional cities.

Short and medium term projects have been identified for year 2012 and 2013-14 respectively with the full network planned for implementation prior to 2020.

Developing a fully integrated fare regime and integrated ticketing across the network is an essential step to ensuring a full system network approach. Distance-based fares will ensure better equity for passengers, and reduce the long-distance discounting that erodes the revenue of the system. Within the management and business model, a more sophisticated fare policy and subsidy mechanism will be outlined, aimed at delivering better cost /value outcomes and the incentive for management to build revenue around a customer service approach.

3) Operational Design Scenarios

A comprehensive bus operations model has been prepared to be able to test various options in order to be able to make informed recommendations. Particularly it can estimate fleet requirements by type for each route, determine cost of operation (and therefore fare levels) and will produce outcomes dependant on system speed, type of bus, energy type and any number of scenarios that need further optional analysis. This model has been able to provide some direction for fuel type in light of operational issues and future financial aspects.

4) The Business Model and Management Framework

The sustainability of a public transport system relies primarily on the system being managed by an autonomous and commercial agency i.e. a revenue dependant organization, where efficiency is paramount and where costs are accurately identified and managed. Many public transport systems fail where objectives are blurred and where politically influenced and un-costed social demands are made upon the system. For a business to survive and prosper required a commercial business-like approach.

The approach of this project is to examine ways that this commercial approach can be applied to improve the viability and performance of the BRT network. This will include developing the business model and management framework of the agency that manages the business of public transport. The issue of fare policy and subsidy will be integral to this discussion.

5) Institutional Development

Where the business of public transport is managed by an autonomous and commercial agency free of the hand of politics, there must be an umbrella organization that develops the Strategic Urban Transport Policy that will guide the agency in its operations. A Jabodetabek Transport Authority (JTA) is suggested as such an umbrella organization; a high level body with all key stakeholders represented at Board level, jointly and equally responsible for the development of a Jabodetabek Strategic Urban Transport Policy (SUTP). The JTA will resolve all political issues and also develop, as part of the SUTP the BRT Strategic Service Plan (SSP) that will become the business and operating model for the agency. The JTA will ensure a suitable operating environment free of political issues, so that the interests of the public are well served.

6) Short-term Projects

The Integrated Network Plan has developed a set of projects that can be implemented early as short term measures. These measures are aimed at achievable improvements in the network that can have a large and early impact.

6.4 BRT Operational Design Standards

6.4.1 Developing BRT as a Mass Transit Mode

1) Introduction

While Bus Rapid Transit can be described as anything that improves the speed of buses, it is generally now regarded as a system that provides a ‘metro’ standard of mass transit along the lines of: ‘think rail’ - use buses.

The major advantage and benefit of BRT is a high passenger capacity, a great deal of service flexibility, and a relatively low cost of development. These advantages allow it to provide a highly developed and well integrated network at an affordable cost, explaining why BRT is gaining popularity in many world cities.

In Jakarta, the introduction of busways since 2004 has been a commendable step to improve the operation of the bus system. It is also understood than the concept of ‘bus priority’ was promoted instead of a full BRT to help smooth the introduction of BRT and help the adaptive process. However, while such compromises may have been necessary, experience has shown that such a system is inadequate to provide the mass-transit network needed to manage the traffic situation in the city.

In general some of the following issues, common with BRT planning have been evident in varying degrees with the TransJakarta system.

These include:

- BRT corridors being promoted as ‘cure-all’ for traffic problems with inadequate understanding of the need for a full network at a quality standard that can compete with private travel – consequently there is low modal shift from cars
- BRT not being prioritized sufficiently reducing its appeal, with design compromised to suit situational constraints of space and traffic
- BRT planning has not recognized non-linear travel patterns (cross-suburb travel) and focused mainly on trunk and feeder
- Political expediency has compromised good planning with the quest to ‘get something built’
- Planners have approached BRT with a bus ‘mind-set’
- Lack of attention to operational efficiency which could improve the business model and reduce subsidy dependency
- Falling standards and poor service delivery due to loss of customer focus.

Having outlined these deficiencies in the implementation of BRT, it is worth noting that BRT still represent the best opportunity for cities to offer a high quality expansive network that can change travel behaviour and reshape the way city transport operates.

2) Planning Principles for a BRT System

These principles are essential to ensure the success of a BRT system, and how it performs in the context of a city as follows:

Build Quality into public transport, both in infrastructure and fleet to ensure a quality image, able to attract passengers, and an attractive feature of the city.

Build for system performance and efficiency – system viability and business performance relies on sufficient average bus speeds; reducing travel times and reducing fleet costs.

Develop a full network to deliver access and connectivity: Access and seamless connectivity across the network makes the system efficient and a realistic alternative to private means of travel.

Without apology for reducing road space for cars: A BRT lane can carry 8-10 times the passengers of a car lane. Roads operating at beyond design capacity can improve their carrying load with the introduction of a BRT.

Capitalize on the benefits of BRT: BRT establishes a highly defined trunk/feeder route pattern that allows supporting services to be developed around the BRT system. BRT also absorbs a high level of demand, allowing cities to reclaim space for walking, cycling, and improving inner city public space. Once BRT is in place, pricing mechanisms such as road pricing can be used to balance traffic, and provide revenue to support public transport.

The business model is the key to sustainability: A commercial and business-like approach creates the necessary incentives to deliver good customer service and ensure business development and continuity.

Integrate and coordinate urban transport policy: BRT does not operate in isolation; it is an integral part of the city's transport economy and requires a high level of coordination with the operating environment.

6.4.2 Essential Design Elements for Improving BRT

This section covers the specific design of BRT design infrastructure as it influences capacity efficiency and performance. Wider network issues are discussed in the next Section.

1) System Capacity and Performance

The capacity and performance of the BRT system is a direct result of the following elements:

- The capacity of the bus
- Quality of busway design
- Passing lanes at shelters that allow express and limited stop services
- Priority treatment to reduce traffic conflicts at intersections including signal priority and intersection design
- Adequate bus berths (platforms length and doorways) to reduce bus queuing at shelters
- Short dwell time for buses at shelters, dependant on:
  - multiple wide doors to speed up boarding and alighting
  - adequate for No. passenger s boarding & alighting
  - the level of system monitoring and control to ensure accurate schedules are kept.

These design factors directly impact upon fleet efficiency, directly and significantly influencing operating costs and passenger efficiency which affects the level of service, thereby directly influencing revenues. This interrelationship emphasizes the importance of 'getting the design right' for a successful outcome.

The following discussion highlights the essential design features to maximize efficiency, as efficiency will deliver sustainability and performance.

(1) Shelter Capacity

For single lane BRT systems the capacity of the bus shelters to serve buses is the key constraint; reducing the effective number of buses per hour (and therefore passengers per hour). Traffic control however influences this, as the ability to keep bus arrivals on-time at shelters, assists the efficient use of shelter platforms. Building more shelter platforms however is not the simple solution it appears to be as platform efficiency reduces with more berths due to bus interference (a 2 bus berth platform has only 1.83 the capacity of a single berth platform[1].

Managing intersections is a constant challenge for BRT systems; however of bus priority is essential to ensure the commercial speed of the system (maintaining efficiency) but also gives priority to efficient public transport. System speed and time efficiency is an incentive

[1] Source: TCRP Report 26, St. Jacques, K. & Levinson, H. Operational Analysis of Bus lanes on Arterials Transportation Research Board- NATIONAL ACADEMY PRESS Washington D.C. 1997

for passengers to switch to public transport.

The ability of shelters to efficiently service the bus fleet is dependent on a number of design features, namely the capacity of the bus, the number of doors for boarding and alighting, the dwell time at shelters and the extent to which schedules are interrupted by traffic conflicts. Maximum efficiency is developed with articulated buses carrying 120 passengers [2] with 3 wide doors simultaneously alighting and boarding passengers with a short dwell time of 20-30 seconds depending on the number of passengers boarding or alighting at each shelter. Traffic control (bus priority treatments) is also essential to ensure buses are equally spaced along the route. If bunching occurs the failure rate increases, thus reducing shelter system capacity.

In the case of a single lane corridor system, Table 6.4.1 shows varying capacity according to the percentage of traffic light green time encountered by buses (60% assumes no traffic light priority while 90% assumes traffic priority with a 10% failure rate). It shows that with traffic priority and 3 berth shelters (3 buses able to dock at a shelter at one time) the line capacity can reach 239 buses per hour (4 buses per minute) carrying 28,000 passengers. There is no Jakarta line with such an estimated demand, and most shelters are expected to offer 2 berth spaces [3] which will cater for 18,000 to 21000 passengers per hour depending on traffic priority.

Where passing lanes are provided, capacity and level of service can be greatly improved as some services can be designed as express or limited stop services. This not only increased passenger capacity, it also has a large impact on fleet efficiency as bus turnaround time reduces.

Table 6.4.1 Line Capacity based on Traffic Priority and Size of Station Platform

With 60% green time	30 sec dwell	Passengers pr hour	20 sec dwell	Passengers per hour
1 Berth platform	65	7,855	80	9,600
2 Berth platform	120	14,374	146	17,568
3 Berth platform	159	19,087	194	23,328
With 90% green time	**30 sec dwell**	**Passengers pr hour**	**20 sec dwell**	**Passengers per hour**
1 Berth platform	77	9,257	98	11,782
2 Berth platform	141	16,941	180	21,561
3 Berth platform	187	22,495	239	28,630

Source: JAPTraPIS

(2) Traffic Signal Priority

BRT signal priority is often assumed to involve the bus automatically triggering a green priority signal upon approaching the traffic light. While this is technically possible, it interferes with balanced signal phasing and under a high frequency can be very disruptive to cross traffic flows.

[2] While many BRT advocate articulated buses carrying 150 passengers, it is determined to maintain dignity for travel that a 120 passenger load is more suitable and this figure is used on all calculations.

[3] While 2 berth stations are sufficient for most stations, interchange stations or terminus stations will need addition berths to accommodate a large number of bus routes and designated doors for certain routes. Also where stations have space constraints, a longer platform may be required allowing additional bus bays.

Bus priority can be managed through a number of options:

Negotiating longer green phase for BRT: A simple method is to hold longer green phases to favour the BRT corridor (increasing the chances of a green signal).

Additional green light intervals for buses only – in the case of 4 phase signals, the addition of a short green phase for buses after the second and fourth cycle will provide additional opportunity to reduce bus queues at signals. It is possible to enhance this technologically by programming the signals to offer this additional bus-only phase when the system detects that a bus is actually waiting.

Managing the green signal timing to solve late running - As the control centre is alerted that a bus is running late, the controller can instigate an action that holds the next green light longer for the bus to regain schedule.

Green-wave signaling – As the automatic vehicle location system knows the location of each bus, it can synchronize the bus schedule in time with the progressive green phases along the route. This requires a way of signaling the individual bus so its departure is timed to reach the next natural green phase in time. Green wave signalization is common traffic management practice, and small adjustments to the bus schedule to reduce red light occurrence can be effective as well as reducing impacts on cross traffic.

Criteria based programming – where bus information is transmitted to the traffic control centre and if it meets a certain set of criteria (such as periods when the green signal can be extended or initiated early) the traffic signal control can prioritize the bus through on a green signal or reduce the waiting time at a red signal.

It is suggested that for the improvement to the TransJakarta system that options 1 to 3 be used as they are easily implementable. Option 4 could be trialled on a medium density corridor and when proven effective, rolled out to other corridors.

(3) Intersection Design

Where there is no signalization (e.g. roundabouts) it is more difficult to manage BRT priority. The solution to this dilemma requires a more defined BRT infrastructure (beyond the red carpet) to more clearly define and segregate the BRT.

Figure 6.4.1 shows a Johannesburg example of slicing the BRT through a roundabout, so the BRT does not join the mixed traffic flow, and cars cannot encroach on the BRT lane. Making BRT operate perpendicular to the flow in the roundabout helps to separate its movement from other traffic. The intersection is managed by traffic lights (or a ‘Give way to Buses’ sign).

Another possible design solution for an un-signalled intersection (e.g. a monument preventing roundabout redesign, or a side access street), is a design that raises the BRT lane from surrounding traffic lanes by say 10 cm (perhaps use red concrete pavers) tapering to the adjoining traffic lanes. This is a similar treatment to the raised pedestrian crossing often used to create definition, identification and awareness of a specific use.

Using this idea on a BRT lane will allows traffic to cross the BRT lane, (see Figure 6.4.2) but be acutely aware that it is a BRT laneway and not part of the regular roadway. Enforcement of the principle may require signage such a ‘No Stopping on Bus Lane’ and even enforcement by penalising motorists who disregard the BRT lane priority.

Figure 6.4.1 Johannesburg Example on BRT Treatment at a Roundabout

Figure 6.4.2 Brisbane example off paving a BRT only carriageway

2) Developing a BRT Lanes on Standard Road Layouts

In developing BRT on a road corridor, road space is a constant issue. Where space is constrained, it is a mistake to try to ‘squeeze-in’ BRT and not remove car lanes, as it results in BRT being compromised in its performance. Alternatively BRT is installed and traffic space is robbed from the pedestrian sidewalks. Figure 6.4.3 and Figure 6.4.4 shows Busway Corridor 6 where sidewalks have been eliminated in the effort to maintain 3 car lanes in each direction.

Widening roads to accommodate a BRT is fraught with difficulty, involving the high cost and social upheaval of resettlement and compensation for landholders.

This then raises the question of how to balance road space to ensure that objectives are met, in a way that is feasible and implementable?

Figure 6.4.3 One BRT lane 3 traffic lanes and no sidewalk

Figure 6.4.4 Traffic lanes robs sidewalks from the community public space

An objective to build BRT without infringing on car space ignores the fact that BRT is far more efficient and therefore entitled to priority. A BRT lane improves passenger carrying capacity easily by 8-10 times, meaning a 6 lane roadway or bridge can see a three-fold increase in passengers. In the case of a bridge (a common bottleneck) it is equal to building 2 new bridges.

Figure 6.4.5 Nantes France – voted Europe's most liveable city has developed a good balance of road use involving BRT, cars cycles and pedestrian walkways.

Policymakers and planners that cite the lack of corridor road space as being a reason to dismiss a BRT option should realize that BRT is probably their best option; the lack of road space being the very reason that supports BRT. The alternative is a weak bus system (that most likely will fail) and growing traffic, as motorists see no better alternative than using a car. Modal switch from cars and motorcycles to BRT is greater when the BRT option is better. The objective should therefore be to improve road space efficiency, and BRT is an obvious policy choice.

On the other hand, maintaining adequate road space for cars is also a reasonable objective as not all traffic is able to use BRT (trades and service, emergency response vehicles included). So while maintaining a high priority for BRT and ensuring a fully integrated public transport network, there needs to be action to balance and regulate the remaining road space so that mobility is maintained, with mechanisms such a road pricing, parking charges and road designs to slow traffic. It is clear that balancing road space is not only an infrastructure issue but a management issue also.

The planning principles need to include prioritizing BRT by the reason of its efficiency. Figure 6.4.6 to Figure 6.4.9 show examples of clear BRT priority to enhance efficiency. In cases where the road is only two lanes in each direction, and widening is not possible, a single lane roadway lane per direction for cars in an acceptable solution. In this case the 50% of road space assigned to BRT will carry 84% of total passenger traffic. In this event there is only road widening required at shelter locations.

It should also be noted that assigning public transport to a single orderly BRT lane (removing existing stop-start operations from the kerbside) will assist to speed up the flow of cars in the mixed traffic lane.

Figure 6.4.6 Victoria Bridge Brisbane. BRT tripled passenger capacity with one bus lane and one car lane in each direction

Figure 6.4.7 An example of a BRT only Bridge with cycleway and pedestrian walkway linking the University to the BRT network.

Figure 6.4.8 Kaliabang Rd. 2 lanes per direction gives a 2400 passenger p.h. capacity

Figure 6.4.9 With BRT taking 50% of road space the directional capacity is increased to 7200 passengers p.h.

3) Busway Design

The running ways for buses must ensure clear segregation, to ensure less conflict for buses and also to ensure safety of motorists and pedestrians. Figure 6.4.10 shows a concrete barrier design that makes it difficult for cars to enter the busway, but allows the buses to exit the busway if necessary. The low side of the barrier faces inward to the busway.

Passing lanes at shelters are a major factor in improving line capacity, by being able to provide limited stop and express services for passengers wishing to travel point to point. Bus turnaround time is greatly reduced improving fleet efficiency.

Figure 6.4.10 Concrete Barrier

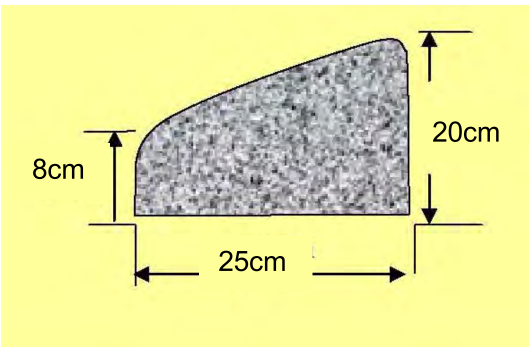


Figure 6.4.11 Fencing

The pavement of the busway must also be smooth to ensure a comfortable ride. The practice of concreting busways, while essential for structural integrity has also produces a rough and irregular running surface. These concrete surfaces must be paved in bitumen and rolled to a smooth surface.

Fencing should also be used in areas prone to pedestrian and cart vendor traffic. Figure 6.4.11 shows fencing along a Beijing Busway.

It is recommended that passing lanes be implemented on all high demand BRT corridors. It is also suggested the option of AC Patas services using the bus lanes (but not access BRT shelters) to provide them faster express travel as part of the overall transport network which helps to achieve greater utilization of the busway.

4) BRT Stations and Passenger Infrastructure

(1)Station Features

Shelters are the main focus of passenger interaction with the system, requiring careful attention to design and functionality. Shelters should form an attractive part of the streetscape and present a quality image, strongly branded and identified with the system. High quality building materials should also be used to ensure a long life and that standards are maintained with little maintenance required. Facilities such as ticketing equipment, ticket sales counter, disabled access, clear signage, and beautification are all important elements that need skilled design. Figure 6.4.12 to 6.4.15 show quality design aspects of modern BRT systems.

Figure 6.4.12 Johannesburg – well integrated into the cityscape

Figure 6.4.13 Brisbane – a strong emphasis on convenience and a sense of safety and security

Figure 6.4.14 Brisbane - attractive BRT design

Figure 6.4.15 Brisbane BRT has quality mass transit infrastructure

(2)Station Access

Good integration into surrounding areas is an essential part of shelter design as the access to shelters is an important part of the overall public transport experience. The present Transjakarta design of long walkways is a distinct deterrent especially to the elderly, and mothers with children who will choose Kopaja or Angkot who offer easy access from the sidewalks. Good lighting and safe walking paths are also essential design elements.

Figure 6.4.16 Johannesburg uses signalized level crossings at every station for easy access

Figure 6.4.17 Shared pedestrian and car space in Sydney designed to slow cars

Access to BRT shelters is not only a design issue is essentially an equity issue; where car motorists are favoured at the expense of the public transport user. Designing equity into road use and access is an important design element. Where the situation permits, level crossing access to shelters should be provided. This would include city streets where car traffic already stops regularly for traffic intersections. Slowing traffic is also a good measure to improve safety and reduce noise in the city environs.

Where BRT operates on wide arterial roads with speeds in excess of 60 kph, escalators to BRT overpasses should be provided. Figure 6.4.18 and Figure 6.4.19 show a Bangkok BRT example of escalators to overhead concourses and wheelchair lifts on staircase handrails.

Figure 6.4.18 Bangkok BRT uses escalators to the overhead concourse

Figure 6.4.19 A wheelchair lift attached to the handrail

(3)Designing Stations for width Constrained Locations

While Jakarta is well accustomed to designing BRT shelters in constrained areas, there are numerous examples where design has compromised passenger amenity. Creating standard shelter designs for particular situations helps to standardize designs and also use a modular approach for building (where standard modules can be manufactured off-site and transported to site for installation. This can reduce costs as well as construction time. Figures 6.4.20 to 6.4.23 show some platform options for situational constraints using level boarding access.

Figure 6.4.20 Wide platform (5M) for single berth with two way entry exist (low volume)

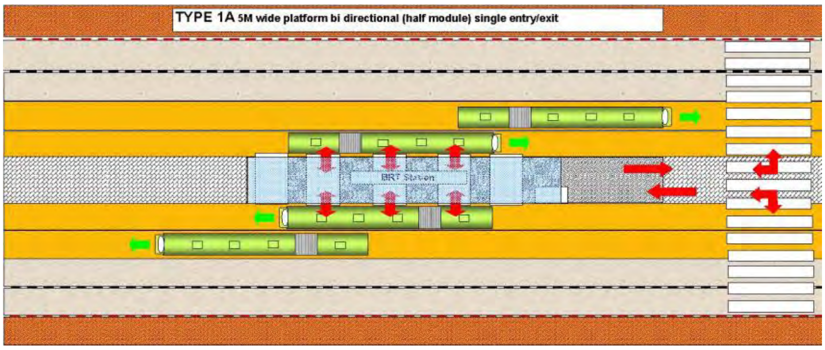


Figure 6.4.21 Wide platform (5m) high volume separate entry/exit with passing lanes

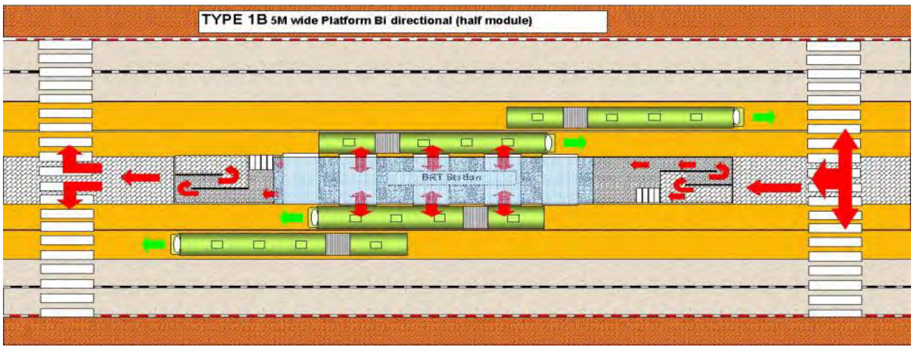


Figure 6.4.22 Platform 3.5M wide with offset directional loading to distribute passengers

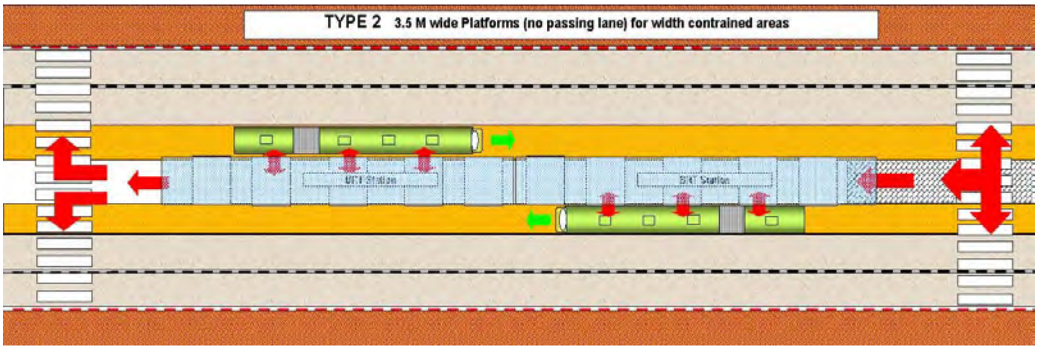
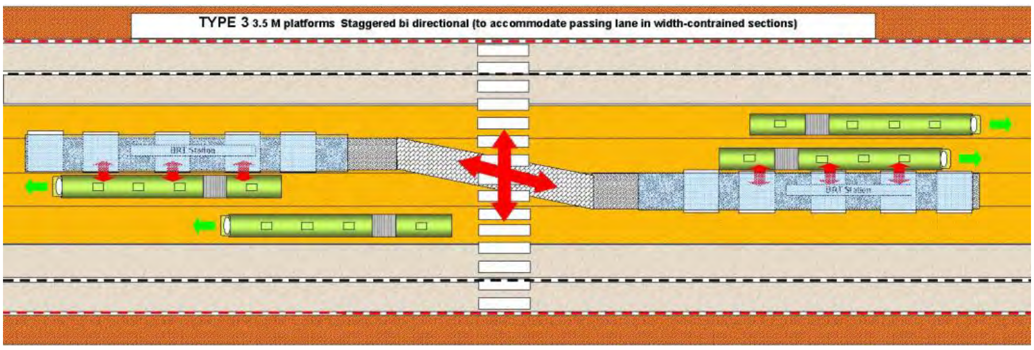


Figure 6.4.23 Staggered platform (3.5M) to provide passing lane in width constrained area



(4)Guided Bus System

To enable fast and predictable bus docking at platforms, and eliminating risk of collision with the platform, a guided docking system can be used. A low-technology guide wheel as shown in Figure 6.4.24 guides the bus accurately to the shelter platform. This also allows a narrowing of lane width at shelters where space is most restricted. Entry points to the guide rail need to be built with a long angle approach so buses adjust smoothly when entering the guided section. Buses must be equipped with air suspension so they can be adjusted accurately to the standard height of platforms (90 cm) and maintain this floor height regardless of passenger load (the bus automatically adjusts air pressure to load variances). Disabled access is guaranteed by managing the gap at the platform for boarding.

Figure 6.4.24 Guide wheel for predictable docking at stations

5) The Control Centre

A major issue with the present Transjakarta system is the lack of central control of operations.

Control is decentralised to dispatchers and the staff on the bus who decide loadings etc. There is some management by way of a service plan, but relies on dispatchers to control headways, instructing drivers manually at shelters. This results in a poor service level and frustration and irritation for passengers as there is no public information, and long waiting times are endured.

Figure 6.4.25 Dispatcher

(1)Objectives of the Control Centre

The objective of a control centre is both to monitor, and to control the operation of buses. When buses enter the BRT system they are under the direct control of the system, not the bus owner.

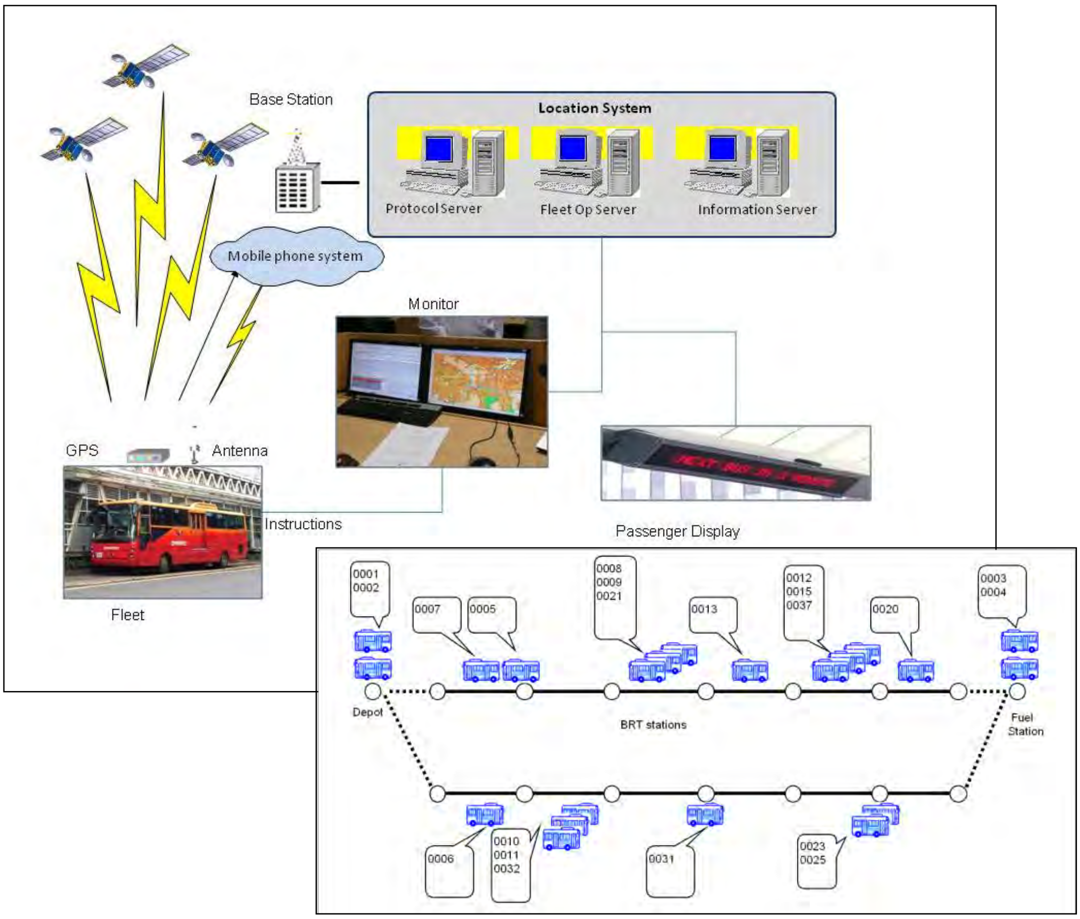
The system uses GPS tracking to inform bus location and this is constantly monitored by the control centre on a graphic display showing each bus along the route. Varying levels of technology can be applied, from the controller keeping a general overview of operations and correcting any deviations by contacting the driver, to a high level system where the system automatically monitors operations, alerting the controller where a problem occurs.

Control effectiveness is not based on the level of technology but whether it serves the purpose. Higher technology systems however are able to store more data of bus operations accurately. Bus location can inform the traffic priority system, and also the passenger information system (minutes to next bus). The control centre also manages special events and incidents to ensure reliability and safety standards are maintained.

(2)System Description

The GPS system mounted on the bus continually updates the automatic vehicle location system informing the control centre of its location along the route. Figure 6.4.26 shows the components of the system and the graphics of bus location screen.

Figure 6.4.26 Schematic of Control Centre Operation



(3) Data Retrieval and Recording

Higher technology systems are able to keep records of daily service performance to assist in monitoring system performance indicators. It can record individual bus data as well as the overall service performance along a bus route, including the cumulative totals according to fleet or service type. This assists in accurate billings and payments with contractors as well as investigating complaints or service failures.

Figure 6.4.27 gives an example of various reports that can be generated to assist in data collection and record keeping.

Figure 6.4.27 Performance of each bus logged in the system

【Bus Number: 0006】

OP/Non OP	Origin	Departure	Destination	Arrival	Operation Time	Operation Mileage(km)
Non OP	Depot A	6:00	Kota	7:00	1:00	12.9
OP	Kota	7:15	Blok M	8:00	0:45	12.9
OP	Blok M	8:10	Kota	9:00	0:50	12.9
OP	Kota	9:20	Blok M	10:20	1:00	12.9
Non OP	Blok M	10:25	Fuel St. C	11:00	0:35	6.0
Non OP	Fuel St. C	11:20	Blok M	12:00	0:40	6.0
OP	Blok M	12:10	Kota	(Tosari) On going	—	—
			Total	OP	2:35	38.7
				Non OP	2:25	24.9

Figure 6.4.28 Cumulative total of buses for each contractor

【Route No: 1】

Car No.	Origin/Dest	Frequency	Origin/Dest	Frequency	OP km	Non OP km
0001	Kota/Blok M	8	Blok M/Kota	7	193.5	40.0
0002	Kota/Blok M	10	Blok M/Kota	9	245.1	50.0
…	…	…	…	…	…	…
0080	Kota/Blok M	10	Blok M/Kota	10	245.1	50.0
Total (80 buses)	Kota/Blok M	740	Blok M/Kota	730	18,963.0	4200.0

Figure 6.4.29 Service performance by route

【Contractor A】

Car No.	Origin	Departure	Headway	Dest.	Arrival	Headway	OP Time
0001	Kota	5:00	—	Blok M	5:45	—	0:45
0010	Kota	5:03	0:03	Blok M	5:50	0:05	0:47
0005	Kota	5:05	0:02	Blok M	5:53	0:03	0:48
…	…	…	…	…	…	…	…

6) Fare Collection and Ticketing Technology

(1) Improving the Present Situation

Current ticketing systems can trace only the approximate numbers of passengers at each bus shelter, but there is no way to identify origin/destination, boarding/alighting time. Without this information, management cannot evaluate system performance.

Presently all passengers must purchase a ticket for every trip often requiring them to queue in peak hours. It also causes cash handling risk at the ticket counter. The flat fare system is easy to administer but gives a large discount to longer travel and reduces the revenue potential of the system thus necessitating more financial support.

Improving the technology for cash collection and ticketing will allow better management of fare collection and enable a more sophisticated fare policy providing benefits that include:

- Easily manage a more equitable distance-based system that charges for distance travelled even over a number of separate trips ‐ this eliminates the cost penalty of bus transfers

- Can offer a continuous journey fare across different modes of travel (bus to rail)
- Can be designed to offer discounts to higher volume users, to build customer loyalty
- Can target discounts and concessions more accurately to target groups and specific users, helping to managing the affordability issue
- Can limit free travel entitlements to time of day or a certain amount of free travel(no blanket discounts)
- Can be used to maximize revenue while offering ancillary benefits, (adding value instead of just discounting)
- Stores travel data and passenger behaviour to assist in system planning and targeting of services
- Automated vending machines can be used for card recharge as well as using outside vendors as 'point of sale' locations so card top up is easily managed.

(2) E-ticketing Proposal

E-ticketing uses a stored-value card for which the passenger pays an initial deposit and then can top up value as required. It uses a 'swipe-by' system upon entry and exit to the system charging only for total distance travelled. The system recognises bus transfers and allows 15-20 minutes for the passenger to board the next trip before charging a new fare as a new trip. E-ticketing technology interchangeable with other transport systems.

This system requires extensive security, accurate operations and a maintenance protocol for management of electronic money. One key issue for interchangability with other modes is the matter of how to share revenue. Typically fares are made up of flag fall and then a distance-based component and therefore the formula for splitting travel between operators is not straightforward. Establishing a Special Purpose Company (SPC) for this type of system is a commonly used approach. It acts as a central company responsible for the revenue, managing financial administration and back office functions and distributes revenue according to an established protocol.

(3) Concept Design of E-ticketing in Jakarta

It is noted that Bank DKI, intends to implement an E-ticketing system in 2012 for TransJakarta, however caution is recommended as E-ticketing is an area of operation fraught with difficulties in the implementation process. It is therefore recommended to proceed with caution and secure a highly experienced party to design the system through a concept design project. Such a project should be established to ensure the design of the system is functional and suitable for the operation. Such a project will design the functionality of the system according to 'rules of operation' to identify requirements, and the likely passenger demand to scope the capacity of the system (passenger flows).

It is expected that the system operates as a closed system with turnstiles at shelter entrance and exit as shown in Figure 6.4.30. For exit points, in order to save shelter space, a turnstile is not required as passengers can swipe on exit without a turnstile (see Figure 6.4.31). Passengers forgetting to swipe out are charged the maximum fare, so there is an incentive to comply that does not require a barrier. However the placement of an exit without a barrier should be designed to ensure it is not an easy entry point.

Figure 6.4.30 Closed system of ticketing turnstiles

Figure 6.4.31 Contactless card reader

Figure 6.4.32 Automated Ticket Vending machine Brisbane

(4) Fare Policy and Rules of Operation

The starting point for developing an E-ticketing system is to clearly establish the fare policy and protocols which informs software and hardware design.

The rules of operation include:

- The fare matrix –fare stages by section point or zones and how the fare is charged to the card
- Swipe on/swipe off methodology to capture the trip distance to capture boarding and alighting passenger data
- Define methodology for ticketing – user features to be included to manage:
  - discounts and concessions (students etc)
  - time based travel incentives (such as cheaper off-peak travel or weekend travel)
  - Whether personal ID is applied to the card (in case of loss)
  - Tally amount of trips to be able to discount after a set number of trips over a period
- Safeguard against misuse and fraud.

The concept design project must liaise with the BRT system manager and any special purpose vehicle (SPV) set up to manage the automated fare system to prepare the concept design of the front end system (the equipment at the passenger interface) and establish the 'back office 'support and central control systems for the ticketing system, including the office facilities at shelters and central clearing house.

This responsibility of the concept design project will include:

- Develop a functional description of how the fare collection and ticketing system will operate and how it relates to the remainder of the automatic fare collection (AFC) system
- Determine the type of equipment (turnstiles, validators, ticket vending machines at shelters and Point of Sale (POS) equipment)
- Exact function of vending machines –do they give change? Can they sell a single trip? Do they take credit card?
- Prepare design, specifications and tender documents for the procurement of the

Ticketing/Fare Collection System

- Recommend approach for the deployment of the system
- Develop the operational design which includes:
  - System administration
  - System security
  - Operation of gates and turnstiles (entry & exit)
  - Staffing and management of the system including inspection
  - Protocol for lost tickets and penalties for misuse
  - Bus transfer protocols
  - Incorporating fare cards with other use (e.g. car parking fees)
  - Concessions options
  - Ticket point of sale (POS) locations and methodology
- Hardware specifications and evaluate various technologies
- Integration Plan with Rail in terms of compatible and interoperable technology and an integration plan subject to their cooperation

Once this project is complete, the tender can be called on the concept design and a clear outline of functionality (what the system is expected to be able to provide). The detailed design is best done by the successful tenderer who can apply the most suitable and up to date technology to fulfil the stated requirements.

However it is strongly recommended to buy an ‘off-the-shelf’ system from an experienced supplier with a proven record to avoid implementation problems.

7) System Branding and Image

Public transport planners should devise ambitious market share objectives, with high profile image and branding to create awareness and provide system information. Strong brand identity and user-friendly information develops customer relationships; with customer help lines, easy to navigate web information and customer support.

The system should be highly recognizable and be identified as a reliable and convenient system. Being part of the community is an important system objective, through promotions, community events etc.

Figure 6.4.33 Doncaster Victoria –identifies itself with technology driven improvements to capture market share

Figure 6.4.34 Making the BRT system a lifestyle choice, identified with reliability, convenience and treating passengers with respect

8) Fleet Design

(1) Fleet Type

Jakarta's BRT trunk routes require high capacity articulated buses to provide sufficient capacity and reduce bus congestion. As buses are a key component of service design the quality and efficiency of buses will have a large impact on passenger service levels and fleet costs. The capital cost of buses is not the only cost criteria, as a small seemingly insignificant increase in operating costs can wipe out any saving in capital costs over the term of the vehicle life.

Buses should be of a modern design, air-conditioned and feature modern equipment such as air suspension (to ensure accurate level boarding), automatic transmission with hydraulic braking, and driver monitoring equipment.

(2) High Passenger Capacity Design

Buses must have an appropriate ratio of seating verses standing in the interior floor plan, balancing the comfort of longer distance travellers with the capacity gain of standing passengers who travel short distances. The interior access space inside the bus is also important as passengers need to be able to access doorways easily when alighting.

It is worthwhile to specify additional seating (even coach style seating for buses) on longer routes such as from Serpong or Depok). A quality fit-out to a mass transit standard will provide an appropriate mass transit service level, as well as providing long life in a good serviceable condition. Additional investment to ensure this occurs will be a good investment.

Articulated buses must be fitted with 3 wide access doors at platform level (90cm floor height) with the air suspension being adjusted to maintain that exact height for easy access for wheelchairs. Buses should also be equipped with communications equipment for passenger address, such as a microphone/public address system and automated next bus information.

Figure 6.4.35 Bus designs showing mass transit standard

9) Vehicle Emission and Fleet Propulsion Systems

The decision on energy type and bus propulsion system has an impact on community health, the operational efficiency and the cost of operation. The latter items are discussed in Chapter 9 which models the propulsion options to determine the financial impacts on the cost of operation.

This section discusses the impact of fleet technology decisions on their social and environmental impacts.

The choice of energy source and engine technology is best made with a complete view of a city/ country context and on each option's economic and financial viability and the social and environmental considerations. It must also take into account government policies which may be guided by larger strategic concerns.

CNG has been heavily promoted as a 'green' alternative and is a main platform in the Indonesian government's 'blue sky' policy. Such policy is often underpinned by sufficient local natural gas supply (which cannot be ignored as a driver of policy) but also set against the background of old diesel buses well known for black smoke emission. It also took into account that refitting old buses with CNG conversions solved the dirty emission problem.

Such reasoning however may not be s applicable to a new BRT fleet. Modern 'clean diesel' (meaning Euro standard engines using premium low sulphur fuels) are more technologically advanced, and are more environmentally friendly than CNG as diesel fuel is highly refined (in contrast to varying and unreliable quality of gas).

Governments often select CNG as 'green alternative' and to demonstrate their environmental credentials but there are a number of factors which must be considered:

- Both CNG and Diesel are fossil fuels which emit greenhouse gases.
- The low operation efficiency of CNG in the Jakarta fleet, (high consumption and extra refilling trips) adds 20% to the operating kilometres of the fleet; wasting kilometres, energy and increasing emissions.
- Alternative fuels (like bio-fuel) can have unintended consequences for society or the environment, for example where food crops are diverted to fuel manufacture, or where rainforests are destroyed to grow oil crops.
- All internal combustion engines emit toxic gases (both diesel and CNG). The California Air Research board conducted research on buses in service and concluded that while CNG was marginally better in most cases, results varied according to type of service the bus operated[4] and CNG delivered a less consistent result.
- There is a concern with CNG containing toxic chemicals not present in diesel, and for CNG and diesel a concern on ultra fine particulate matter (PM2.5) being a complex mixture of very small solid particles and liquid droplets 2.5 microns in diameter or smaller, which asthma, bronchitis, and heart attack rates.[5]

[4] ARB's Study of Emissions from "Late-model" Diesel and CNG Heavy-duty Transit Buses: Preliminary Nanoparticle Measurement Result. Britt Holmén, Alberto Ayala†, Norman Kado, and Robert Okamoto 2001 Source: California Air Research Board: Source: http://www.arb.ca.gov/research/veh-emissions/cng-diesel/eth-zurich-2001-ayala1.pdf

[5] Source: http://www.iaenvironment.org/airQuality/Fine_Particulate_Matter.htm and : http://www.sciencedaily.com/releases/2008/01/080117102119.htm

(1) Diesel Fuel

Diesel engines have been traditionally used for bus systems as it is a robust technology although it is becoming more technically sophisticated to meet clean emission standards. Modern Euro 4 or 5 diesel engines use low sulphur fuel and are regarded as 'clean' technology, comparable (if not better than a gas engine). The quality of Diesel fuel required for a Euro 4 or 5 clean diesel engines is less than 50ppm sulphur content.[6]

However, regardless of it environmental efforts, diesel fuels are a non-renewable resource, and will become increasingly expensive. The risk of energy price and security in the future is a large risk facing any transport enterprise. It is therefore worthwhile to consider whether there are alternative technologies for a large new transport investment such as a bus fleet for Jakarta.

(2) Compressed Natural Gas (CNG)

Natural gas (NG) is a mixture of hydrocarbons, mainly methane (CH4). It is stored onboard a vehicle in a compressed gaseous state (CNG). CNG is promoted as a good alternative to diesel for urban transport fleets and represented as a 'green fuel'. This has become an accepted viewpoint based on successful examples like the Delhi bus fleet conversion to CNG.

However, while CNG is a useful option to economically convert old diesel engines, or as an economical alternative fuel source where natural gas can be locally sourced in place of imported oils, CNG has some constraints which should be considered:

- While generally accepted as clean burning, CNG engines use spark ignition engines and require more maintenance to keep engines performing at high efficiency.
- CNG quality may vary depending on source. While diesel fuels are highly processed, the content of Natural Gas may vary with varying emission results. The varying proportions of methane in natural gas must be taken into account with regard to the processing of the gas, in order to ensure a standard product.[7]
- Technical considerations must be taken into account,[8] such as higher standard of technical support (such as gas fitting technicians are required for maintenance) and gas supply and dispensing needs a large investment.
- Some inefficiency occurs such as extra vehicle weight to carry large cylinders which store the compressed gas, requiring added vehicle strength and consequently a heavier vehicle. CNG also has a lower fuel efficiency as it contains less energy that an equivalent amount of diesel (15-20% less).

While there is extensive favourable reporting of CNG as opposed to Diesel, a study of the New York City Transit [9] leet (in-service cycles) between standard diesel buses, low sulphur 'clean' diesel buses (Diesel Particular Filter fitted) and CNG buses found:

- A high impact of low sulphur diesel in reducing regulated emissions (PM,HC,NOx &

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[6] http://www.shell.com.sg/home/content/sgp/products_services/on_the_road/fuels/shell_diesel/faq/

[7] Source: http://www.cleanairnet.org/infopool/1411/propertyvalue-17753.html

[8] When CNG buses were introduced in Brisbane Australia, the lack of gas fitting technicians presented an unexpected problem as well as the heavy gas tanks roof mounted on a low floor bus caused excessive body roll.

[9] DEER Conference 2003. Source: http://www1.eere.energy.gov/vehiclesandfuels/pdfs/deer_2003/session5/deer_2003_lowell.pdf

CO);

- Clean diesel vs. CNG showed a significantly better result for clean Diesel except for NOx;
- A worse result for CNG for unregulated toxic emissions (Benzene, Carbonyl, PAH) except for NO2PAH which was worse for Diesel.
- PM particle concentrations similar for both Diesel and CNG with a high concentration of ultra fine particles for both.

The cost factors of CNG vs. Diesel were a very significant factor with the capital cost of CNG being higher for bus purchase, fuel station installation, depot safety modifications and operating cost being higher. Also higher fuel cost (lower fuel economy & cost of compression), increased bus maintenance and fuel station maintenance added costs to the CNG option.

The bus operations model discussed in Chapter 7 which tests fuel and fleet propulsion option has shown that the CNG option suffers from and operational efficiency disadvantage.

Note: The CNG vs. diesel argument is complex and presented here without prejudice. It does however, demonstrate that CNG should not be regarded as the automatic environmentally better option. Policymakers must evaluate and balance a number of sometimes competing factors.

(3) Electric Trolleybuses

Electric Trolleybuses are a re-emerging option as cities make greater investment in public transport infrastructure in the light of climate change concerns and increasing energy prices influencing their decision. China is becoming a recognized manufacturer and supplier of electric vehicle technology and may play an increasing role in both the use and efficient manufacture of trolley buses.

Trolleybuses are a well tested technology as the electrical architecture has been used in tram systems worldwide for decades. Modern solid state control equipment and innovations (like regenerative braking [10]) and improved electrical technology make Trolleybuses an efficient, reliable and long life vehicle.

Electric Trolleybuses have advantages in having lower operating costs but incur higher initial capital outlays for infrastructure and the ongoing cost of electrical infrastructure maintenance. Concerns regarding the reduced fleet flexibility are unwarranted where a strong corridor of BRT infrastructure exists.

The clear benefit of Trolleybuses is the economical energy costs throughout the entire service life. The higher capital cost of the initial fleet purchase is also offset by a longer vehicle life. While diesel buses are depreciated over 7-10 years, Trolleybuses can expect a 15-20 year life. The decision for trolley buses must consider the availability of a reliable electricity supply in Jakarta, however standby electrical generation is an option.

Trolley buses have a number of specific advantages which include:

- No roadside exhaust pollution and especially suitable in pedestrianized areas such as

[10] Regenerative braking is an electric braking system which returns power to the electric grid when the bus is slowing, saving 30% of energy costs.

downtown city area and NMT transit corridors

- Quiet operation and fast smooth acceleration highly suited to a passenger transit vehicle
- Longer service life due to less mechanized parts and easy vehicle maintenance
- In the Jakarta 2020 network model the Electric Bus option had half the energy cost of CNG and less than 1/3 the cost of unsubsidized diesel
- Bus servicing costs are approximately 50% of diesel bus equivalent
- BRT corridor suitable for overhead wiring infrastructure

(4) Summary of Bus Propulsion Options

The energy and technology options for the bus fleet depends on a range of factors. CNG may have a strong case in Jakarta on account of local supply; however the operational efficiency issues may loom large for a 2020 network.

The trolleybus option should not be discounted as the economic argument (and future energy risk) may support the investment into what is most likely the best environmental option.

Figure 6.4.36 BRT Trolley bus in Quito Ecuador showing integration into inner city area

Figure 6.4.37 Beijing Trolleybuses demonstrate China's emerging role in Electric Vehicle technology

Figure 6.4.38 The multicar set of a bi-articulated bus with electric propulsion resembles an LRT system

(5) Developing BRT to a LRT Standard

Electric bi-articulated buses using electric propulsion via overhead catenary wires (trolley bus system) and duo diesel gives a metro-style image rivalling LRT with the added flexibility that buses are able to deviate short distances from the system.

Figure 6.4.39 shows a CIVIS electric trolley bus at a station platform with style that strongly resembles an LRT system. Similarly, Figure 6.4.40 shows a rubber tyred tram which is similar to an electric BRT vehicle.

Figure 6.4.41 Developing BRT to a LRT Standard

Figure 6.4.39 CIVIS electric trolley bus

Figure 6.4.40 Rubber tyred tram

7 INTEGRATED PUBLIC TRANSPORT NETWORK AND SERVICES

7.1 Network and Service Design

7.1.1 Introduction

The present busway system in Jakarta does not operate as a network, being a collection of 10 corridors that operate individually, requiring passengers to walk to another shelter to transfer to a connecting service. These walking transfers can be time consuming especially in peak time when shelters and buses are overcrowded, and significantly slows the passenger journey.

Planning a network requires a design that provides better 'through connections' where sufficient demand exists - reducing the number of transferring passengers at shelters and giving passengers more direct travel options. This is a major step in making the network more convenient.

This also allows management to adjust bus numbers to more accurately meet demand, as the present system provides a static number of buses along a route even though demand may vary between sectors.

7.1.2 Service Type

There are a number of service types that comprise the network operation. They are classified as BRT or non-BRT and fare integrated with BRT or not.

(1) **Type 1 – Full BRT Services:** These routes operate as a 'full BRT' along exclusive and segregated bus lanes along the road median and operate only on trunk corridors.

(2) **Type 2 – Modified BRT along Expressway Corridors:** These services operate as a full BRT in every respect but operate along service roads or curbside lanes, where a median design is not possible (such as along elevated roads and tollways). The present Corridor 9 is an example of such a system.

Median BRT should always be the preferred choice, as the Type-2 design requires 2 shelters per location, increasing cost of operation. The BRT along Casablanca will most likely require a Type 2 design as the elevated road dominates the median and it is preferable to keep BRT closer to passenger access. However, some tollways such as the Serpong Tollway or Jagorawi Tollway can be designed as a Type 1 BRT where space on the median exists, using a design similar to the Bangkok BRT design (with escalators to the overhead concourse).

(3) **Intermediate Bus Priority Routes:** Intermediate bus priority services are integrated with BRT trunk lines and operate on standard roadways. They act as feeders to the BRT and also provide cross suburb services. These services are fully fare-integrated with on-bus ticketing equipment, allowing passengers to alight directly to the paid side of the BRT platform creating a seamless transfer.

These services carry the same branding as BRT, extending the BRT network into suburban areas. To be efficient, they require various measures of bus priority such as traffic light priority, separated lane markings and queuing lanes at traffic lights.

As ticketing is integrated, the BRT agency collects the fares and pays operators for services provided, under a similar contract arrangement as the BRT trunk line operators.

For high demand BRT corridors where platform space is limited alternative docking facilities for intermediate buses should be provided, so that BRT trunk services are not interrupted.

(4) Feeder Bus and Local Community Services: Short distance feeder services (neighborhood services) operate smaller buses or Angkot/Microlet type vehicles to either the BRT or to the Intermediate bus priority routes. These are local services that penetrate into local community areas. The main role of these services is to act as feeders to the main bus network.

It would be advantageous for the trunk operator (the BRT agency) to formalize these para-transit operators as feeders to the trunk system by way of a formal partnership.

The benefits are mutual, as network access for the passenger is improved; the trunk operator benefits from extra passengers it can carry at marginal cost, and para-transit benefits by operating shorter, more profitable routes with shorter cycle times permitting faster turnaround to collect more passengers. They can also avoid traffic jams typical of trunk route operation.

These services are not fare integrated as they charge a small access fee to the system and the buses operate only short distances. Master plan proposed the methodology as to how these feeder buses are organized and how to develop the business model to ensure a viable and sustainable operation (refer to chapter 9).

(5) Para-transit Services: Smaller paratransit vehicles as such as Bejaji, Kancil, Bemo and Ojek do not operate along designated routes, instead providing services on-demand. As they are highly fragmented and often informal, they are difficult to regulate, yet they can respond well to individual travel demand in both availability (access) and flexibility. In many suburbs under-served by formal transport they may be the only 'public' transport mode, other than using a private car.

It is clear that there is an excess of Bejaji vehicles operating in the city, many of the vehicles being old and polluting. These life expired vehicles should be removed from service as they cause congestion and pollution.

The remainder of these smaller paratransit should be located alongside or as part of the local neighbourhood services to offer feeder services to the trunk route under a local area arrangement.

(6) Supporting Line-haul Routes (non-fare integrated): Line-haul routes such as the AC Patas services operate on a commercial basis, under regulated fares where the operator takes the business and patronage risk.

The type of service they offer is distinct from the BRT in that they tend to provide express services over longer routes clearly meeting a point to point demand for longer journeys. As such it is not direct competition for the BRT as it serves a different market.

As these services operate in mixed traffic, increasing traffic congestion will affect their efficient operation causing pressure for price increases or service standards to decline.

Consideration should therefore be given for AC Patas buses to use the BRT where there are passing lanes provided. They do not compete with BRT as they operate longer routes with minimal stops. Consequently, thought should be given to accommodating them, even to the extent of constructing BRT corridors with passing lanes at shelters. This will allow express or limited stop services on BRT and can also allow AC Patas buses to use sections of the BRT corridor without servicing the BRT shelters, instead provide a point to point full distance service. Where an AC Patas bus requires an intermediate stop it would divert off the busway, or a specific bus stop facility could be built on the centre median where space permits.

Strict monitoring of this arrangement would be needed to avoid compromising safety and avoid irregular boardings along the BRT.

7.1.3 Supporting Mobility Networks

(1) Supporting the Network with Park & Ride: Park and Ride facilities are an essential part of the public transport network as it allows motorists to access the system from a wider collection area. The Park & Ride must be designed as a formal part of the system providing safe and secure parking (for vehicles) as well as safe access for passengers (good lighting/ security).

(2) Options for Safe Cycling and Walking: Access to the network is also improved where good cycling and walking facilities exist both at the outside suburban areas, and the inner city areas where passengers can use a cycle to complete their journey to work. Cycling is a low cost, efficient and environmentally-friendly mode that should be encouraged. BRT increases the options for cycling to be part of the commute and improvements to cycling infrastructure can significantly improve access to the system.

(3) Pedestrian Access, Disabled and Special Needs Access: Public transport starts at the front door and quality public transport must consider access from home to the BRT as of equal importance to the actual ride. Good pedestrian access also improves conditions for vulnerable sectors of society; the elderly and disabled and mothers with children.

7.2 Proposed 2020 BRT Network

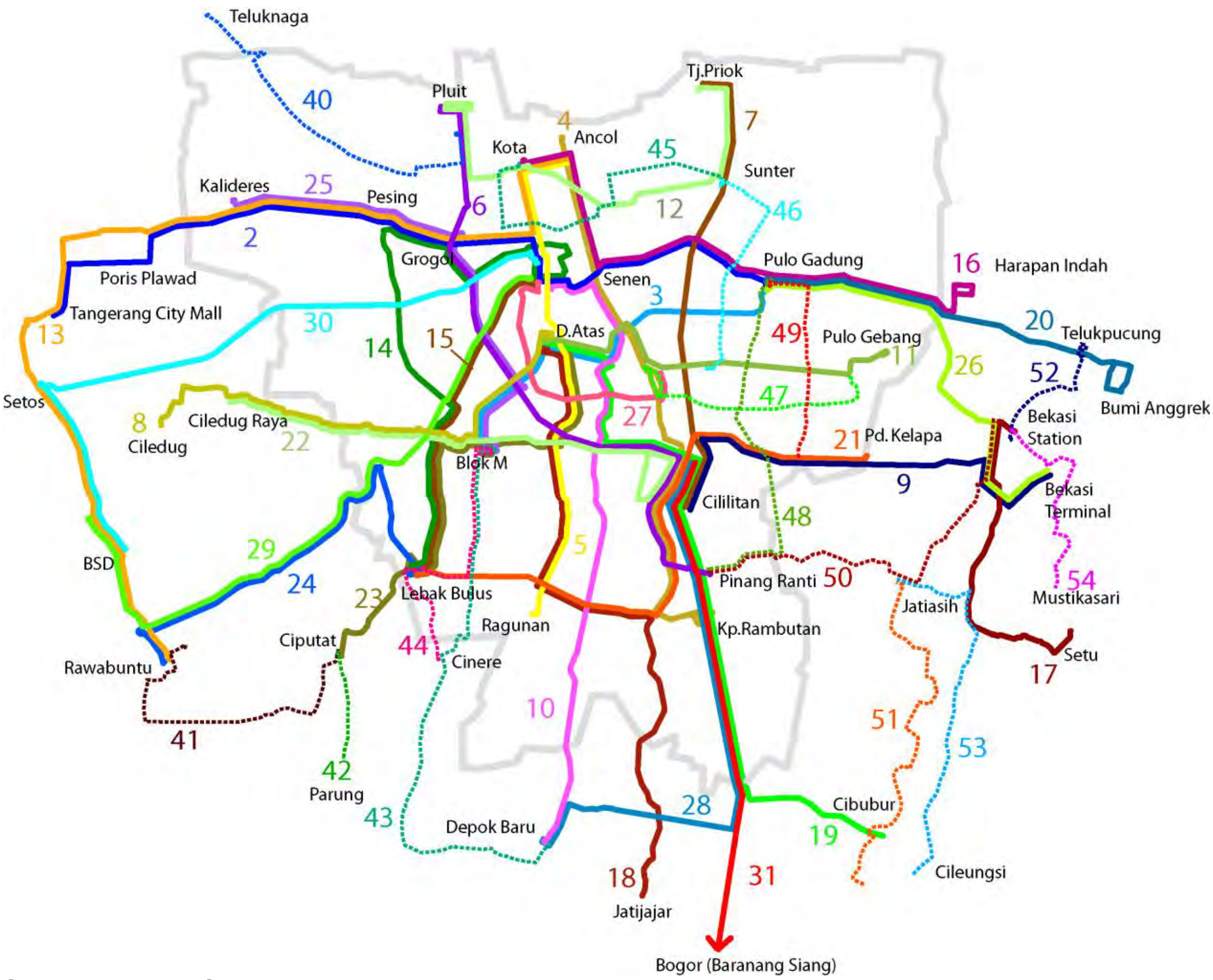
7.2.1 Network Design

Figure 7.2.1 shows an integrated BRT route network for the year 2020, including routes into surrounding municipalities and also showing intermediate routes.

The network has been designed to offer a more direct travel across the city with less need to transfer to other services. Where more complex trips are made a single transfer may be necessary. Only in the case of a long trip or an unusual trip combination will more than one transfer be necessary.

The network has been developed for the year 2020 based on the forecasted demand under the intensive public transport growth scenario adopted by JUTPI. It includes a north south and east west MRT line implemented and upgrading of Jakarta’s rail lines.

Figure 7.2.1 2020 BRT Route Network



Source: JAPTraPIS

Table 7.2.1 2020 BRT Route Network

	No. of routes	Route km	Corridor km
Full BRT route	30	683	429
Intermediate route	15	193	188

Source: JAPTraPIS

7.2.2 Logic of Network Development

Table 7.2.2 and Table 7.2.3 list for every planned route the design objectives and how each route connects into the network in 2020. Route design aimed at ensuring most destinations can be reached minimal if any transfer.

Table 7.2.2 Description and Rationale of 2020 BRT Routes

BRT Route No.	Description	Rationale	Possible connection to other BRT routes in 2020 network
1	**Kota – Blok M**	This is a main route in the current network but will be abolished its operation once the MRT start its operation.	-
2	**Pulo Gadung - Tangerang City Mall via Harmoni**	This is a main east west route made continuous to reduce transfers, however routes can operate less than the full route to suit demand as long as it is well identified to passengers	Connect to routes 4, 6, 7, 27, 46 & station transfer to routes 3, 5, 10, 13, 14, 15, 16, 20, 25, 26, 30, 48, 49
3	**Pulo Gadung - Blok M via Dukuh Atas**	This route provides a direct route to avoid transfer at Dukuh Atas	Connect to routes 4, 5, 6, 7, 22, 27 & station transfer to routes 2, 8, 10, 11, 16, 18, 19, 20, 23, 25, 26, 43, 44, 48, 49
4	**Kp. Rambutan – Ancol via Kp. Mulayu**	This is a direct route to eliminate the need for all passengers to transfer at Kp. Melayu	Connect to routes 2, 3, 12, 18, 45 & station transfer to routes 5, 6, 7, 9, 10, 11, 13, 16, 19, 21, 22, 27, 28, 31, 47
5	**Ragunan - Ancol via Dukuh Atas**	This is a direct route to eliminate transfers at Dukuh Atas	Connect to routes 3, 6, 11, 19, 21, 22, 45 & station transfer to routes 2, 4, 10, 12, 13, 14, 15, 16, 18, 23, 27, 29, 30
6	**Pluit - Pinang Ranti**	This is an existing route (corridor 9 – unchanged)	Connect to routes 2, 3, 5, 8, 10, 13, 15, 18, 23, 29, 30 & station transfer to routes 4, 7, 9, 12, 14, 19, 21, 22, 25, 28, 31, 40, 48, 50
7	**Tj Priok - Cililitan**	This is an existing route (corridor 10 – unchanged)	Connect to routes 2, 3, 11, 16, 47 & station transfer to routes 4, 6, 9, 12, 19, 21, 22, 28, 31, 45, 46
8	**Ciledug – Dukuh Atas via Blok M**	A direct route from Ciledug to the Central Business Area and connecting to eastern routes at Dukuh Atas	Connect to routes 6, 14, 15, 27, 29 & station transfer to routes 3, 11, 18, 19, 22, 23, 25
9	**Bekasi Bus Terminal - Cililitan**	This is a direct route between Bekasi bus terminal and Cililitan.	Connects to route 48 & station transfer to routes 4, 6, 7, 17, 19, 21, 22, 26, 28, 31, 49, 50, 54
10	**Depok Baru - Bank Ind. Via Manggerai**	A direct route with station platform transfers to route 3, 4 and 19. Other cross-route connections require a walking transfer.	Connect to routes 6, 16, 18, 21, 22 & station transfer to routes 2, 3, 4, 5, 11, 14, 15, 19, 27, 28, 29, 43
11	**Pulo Gebang - Dukuh Atas**	The new Corridor 11 connected to Dukuh Atas with station transfers to route 4	Connect to routes 5, 7, 27, 48, 49 & station transfer to routes 3, 4, 8, 10, 18, 19, 23, 46, 47
12	**Pluit - Tj Priok**	Direct route with station transfers to route 5,13 and 16 at Mangga Dua and route 7 at Yos Sudarso	Connect to route 4 & station transfer to routes 5, 6, 7, 13, 16, 40, 45, 46
13	**Ancol - BSD via Tangerang City Mall**	BSD viaTangerang City Mall to Ancol will start as a first stage 13a from Tangerang City Mall	Connect to route 6 & station transfer to routes 2, 4, 5, 12, 14, 16, 24, 25, 29, 30, 41, 45
14	**Lebak Bulus – Bank Ind. via Grogol**	Same as existing Corridor 8 route	Connect to routes 8, 22 & station transfer to routes 2, 5, 6, 10, 13, 15, 21, 23, 24, 25, 27, 29, 30, 44
15	**Lebak Bulus – Bank Ind. via Tentarapelajar**	Connects Lebak Bulus (corridor 8) more directly to Bank Indonesia via Tn.Abang	Connect to routes 6, 8, 22, 25 & station transfer to routes 2, 5, 10, 14, 21, 23, 24, 27, 29, 44
16	**Kota - Harapan Indah via Ancol**	Designed to reduce transfers at Harmoni, travelling direct to Kota via Ancol. Will start as a first stage 16a from Pulo Gadung	Connect to routes 7, 10, 46 & station transfer to routes 2, 3, 4, 5, 12, 13, 20, 26, 45, 48, 49
17	**Bekasi Station - Setu**	Future route to Setu. Consider other alignments as this route needs extensive widening. A more direct route with some new road links may be possible.	Station transfer to routes 9, 26, 50, 52, 53, 54
18	**Dukuh Atas – Jatijajar via Fatimawati**	A direct route with possible station transfers and also connecting to routes at Dukuh Atas	Connect to routes 4, 6, 10, 22, 27, 28 & stations transfer to routes 3, 5, 8, 11, 19, 21, 23
19	**Dukuh Atas - Cibubur via Cililitan**	A direct route via Tol, connecting Cililitan and Cawang Uki	Connect to routes 5, 27, 51 & stations transfer to routes 3, 4, 6, 7, 8, 9, 10, 11, 18, 21, 22, 28, 31
20	**Pulo Gadung – Bumi Anggrek**	It operates along Kaliabang just over the Bekasi border (Taman Anggrek)	Stations transfer to routes 2, 3, 16, 26, 48, 49, 52
21	**Pondok Kelapa - Lebak**	A direct route connecting Pondok Kelapa to Lebak	Connect to routes 5, 10, 43, 48, 49 &

	Bulus via Cililitan	Bulus	stations transfer to routes 4, 6, 7, 9, 14, 15, 18, 19, 22, 23, 24, 28, 31, 44
22	**Ciledug - Cililitan via Blok M**	This is an East-West cross suburb route	Connect to routes 3, 5, 10, 14, 15, 18, 29 & stations transfer to routes 4, 6, 7, 8, 9, 19, 21, 23, 25, 28, 31, 43, 44
23	**Dukuh Atas - Ciputat via Kuningan**	This is an Southwest route cross suburban area	Connect to routes 6, 27 & stations transfer to routes 3, 5, 8, 11, 14, 15, 18, 21, 22, 24, 25, 41, 42, 43, 44
24	**BSD - Lebak Bulus via Tol Serpong**	A direct route via Tol Serpong from BSD to Lebak Bulus cross suburb area	Stations transfer to routes 13, 14, 15, 21, 23, 29, 41, 44
25	**Kalideres to Blok M**	A direct route from Kalideres to Blok M cross suburb area	Connect to routes 15, 29, 30 & stations transfer to routes 2, 3, 6, 8, 13, 14, 22, 23, 43, 44
26	**Bekasi Bus Terminal - Pulo Gadung**	This is an East route provided to cover passenger demand from Bekasi to Pulo Gadung	Stations transfer to routes 2, 3, 9, 16, 17, 20, 48, 49, 50, 54
27	**Kp. Mulayu - Bank Ind. via Inner Toll Road**	This is a direct route connect Kp. Mulayu to Bank Ind. via Tanah Abang taking Inner Toll Road.	Connect to routes 2, 3, 8, 11, 18, 19, 23 & stations transfer to routes 4, 5, 10, 14, 15, 29, 47
28	**Depok Baru - Cawang Uki via Tol Jagorawi**	A direct route via Tol Jagorawi connect Depok Baru to Cawang UKI	Connect to route 18 & stations transfer to routes 4, 6, 7, 9, 10, 19, 21, 22, 31, 43
29	**BSD - Bank Ind. via Tol Serpong**	A direct route from BSD to Bank Indonesia via Tol Serpong and Jl. Tentara Pelajar	Connect to routes 2, 6, 8, 22, 25 & stations transfer to routes 5, 10, 13, 14, 15, 24, 27, 41
30	**BSD - Harmoni via Tol Kb. Jeruk**	A direct route via Tol Kb. Jeruk connect BSDto Harmoni	Connect to routes 6, 25 & station transfer to routes 2, 5, 13, 14
31	**Bogor (Baranang Siang) – Cililitan via Tol Jagorawi**	A direct route via Tol, connecting between Bogor City to DKI Jakarta via Tol Jagorawi	Station transfer to routes 4, 6, 7, 9, 19, 21, 22, 28

Source: JAPTraPIS

Table 7.2.3 Description and Rationale of 2020 Intermediate Routes

Intermediate Route No.	Description	Rationale	Possible connection to other routes
40	**Puluit - Teluknaga**	A north west intermediate route provide connection along side the sea from Teluknaga to Pluit.	Station transfer to routes 6, 12
41	**BSD - Ciputat**	A south west intermediate route connecting BSD to Ciputat cross suburb area	Station transfer to routes 13, 23, 24, 42
42	**Parung - Ciputat**	Connecting south area Parung to Ciputat cross suburb area	Station transfer to routes 23, 41
43	**Blok M - Depok Baru**	Intermediate route provide to connect Blok M and Depok Baru	Connect to route 21 & station transfer to routes 3, 10, 22, 23, 25, 28, 44
44	**Cinere - Blok M**	Intermediate route provide to connect Blok M and Cinere via Lebak Bulus	Station transfer to routes 3, 14, 15, 21, 22, 23, 24, 25, 43
45	**Tambora - GayaMotor**	Provide a good intermediate route connection in industrial area Gaya Motor to Tambora area	Connect to routes 4, 5 & station transfer to routes 7, 12, 13, 16, 46
46	**GayaMotor - Cipinang**	Intermediate route connecting BRT corridors	Connect to routes 2, 16 & station transfer to routes 7, 11, 12, 45
47	**Kp.Melayu – Klender Baru**	Operating via Jl. Kolonel Soegiono	Connect to routes 7, 48, 49 & station transfer to routes 4, 11, 27
48	**Pulo Gadung - Pinang Ranti**	Operates south as intermediate route from Pulo Gadung	Connect to routes 9, 11, 21, 47 & station transfer to routes 2, 3, 6, 16, 20, 26, 49, 50
49	**Kalimalang – Pulo Gadung**	Intermediate route connecting BRT corridors	Connect to routes 11, 21, 47 & station transfer to routes 2, 3, 9, 16, 20, 26, 48
50	**Pinang Ranti – Bekasi Station**	Via Jatiasih	Station transfer to routes 6, 9, 17, 26, 48, 51, 53
51	**Cibubur - Jatiasih**	Acts as feeder to 19 and connects to Intermediate route to Bekasi	Connect to route 19 & station transfer to routes 50, 53
52	**Bekasi Station - Teluk Pucung**	Intermediate route connecting BRT corridors	Station transfer to routes 17, 20, 54
53	**Cileungsi - Jatiasih**	Feeder to BRT from Cileungsi	Station transfer to routes 17, 50, 51
54	**Mastikasari – Bekasi Station**	Feeder to BRT in Bekasi City	Station transfer to routes 9, 17, 26, 52

Source: JAPTraPIS

7.3 Future Traffic Demand of 2020 Public Transport Network

7.3.1 Future Traffic Demand and BRT Ridership

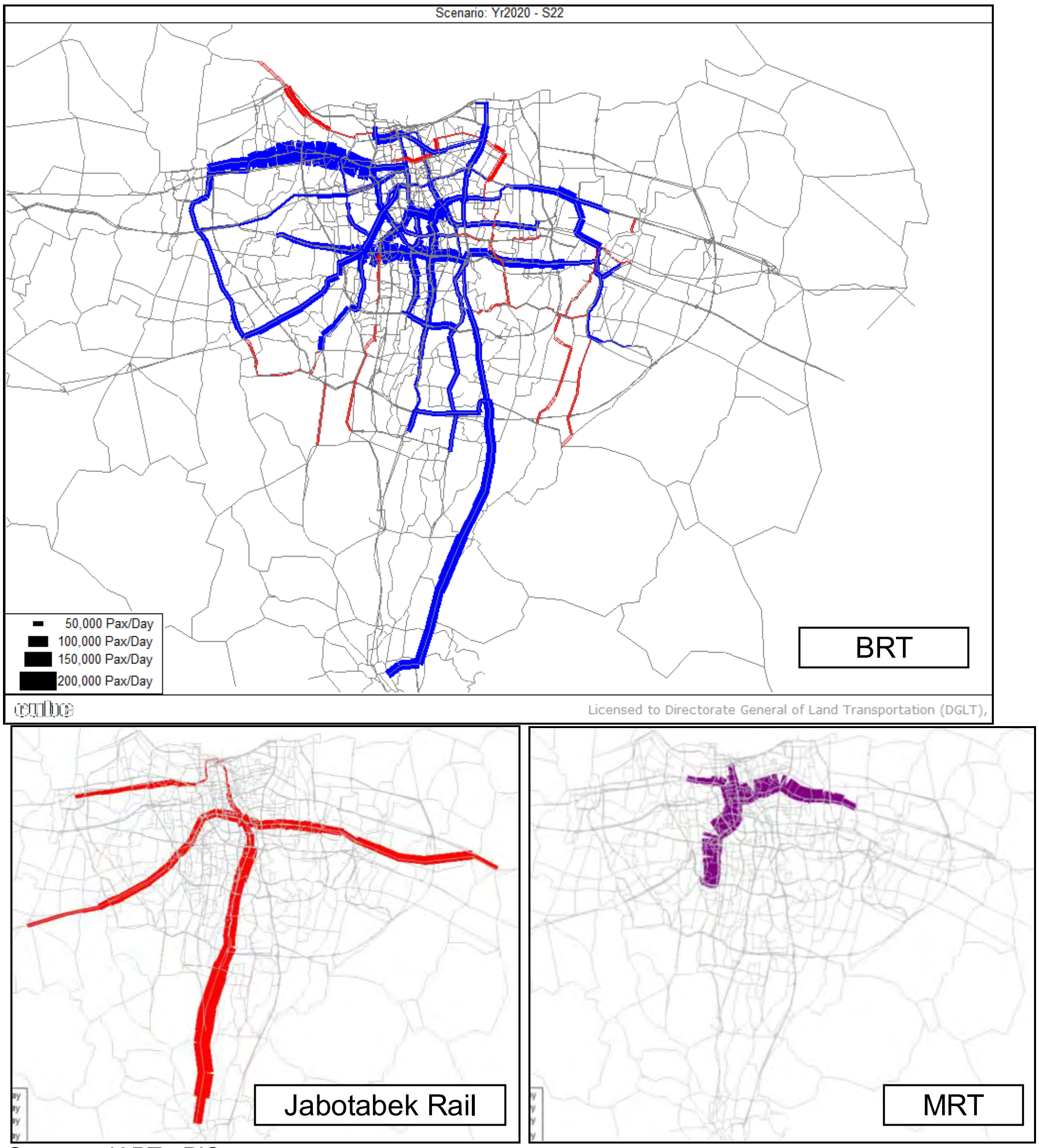
Table 7.3.1 and Figure 7.3.1 shows the result of traffic demand forecast and assignment on the proposed 2020 public transport network. The proposed BRT network will transport about daily 2.7 million passengers (2.3 million for full BRT and 0.4 million for intermediate route).

Table 7.3.1 Traffic Demand on 2020 Public Transport Network

Mode	Ridership 2020 (million pax)
Full BRT (30 routes)	2.3
Intermediate BRT (15 routes)	0.4
Jabodetabek Rail	1.2
MRT	0.9

Source: JAPTraPIS

Figure 7.3.1 Traffic Assignment on 2020 Public Transport Network



Source: JAPTraPIS

Table 7.3.2 Traffic Demand on 2020 BRT Routes

Route Name	Km	Daily Ridership	Route Name	Km	Daily Ridership
2. P.Gadung – Tang. City Mall	34.0	129,700	40. Pluit – Teluknaga	15.9	60,300
3. P.Gadung – Blok M	15.8	101,400	41. BSD – Ciputat	12.0	16,400
4. Kp.Rambutan – Ancol	21.9	48,300	42. Parung – Ciputat	9.0	4,900
5. Ragunan – Ancol	19.8	69,700	43. Blok M – Depok Baru	22.4	50,300
6. Pluit – P.Ranti	24.0	64,200	44. Cinere – Blok M	12.3	22,500
7. Tj.Priok – Cililitan	17.2	65,100	45. Tambora – Gaya Motor	14.2	46,800
8. Ciledug – D.Atas	16.8	107,100	46. Gaya Motor – Cipinang	10.0	47,900
9. Bekasi Term. – Cililitan	19.2	118,600	47. Kp.Melayu – Klender Baru	10.3	28,700
10. Depok Baru – Bank Ind.	26.9	119,500	48. P.Gadung – P.Ranti	15.0	22,000
11. P.Gebang – D.Atas	16.1	75,300	49. Kalimalang – P.Gadung	8.2	2,600
12. Pluit – Tj.Priok	17.3	110,300	50. P.Ranti – Bekasi Station	18.2	19,500
13. Ancol – BSD	41.4	198,000	51. Cibubur – Jatiasih	15.0	25,500
14. L.Bulus – Bank Ind.	26.5	58,000	52. Bekasi Stat.–TelukPucung	5.5	13,300
15. L.Bulus – Bank Ind.	13.5	43,800	53. Cileungsi – Jatiasih	16.0	12,000
16. Kota – P.Gadung	22.4	22,800	54. Mastikasari – Bekasi Stat.	9.5	14,400
17. Bekasi Station – Setu	13.6	22,800			
18. D.Atas - Jatijajar	27.9	97,700			
19. D.Atas - Cibubur	27.3	20,000			
20. P.Gadung – Bumi Anggrek	16.5	34,600			
21. Pondok Kelapa – L.Bulus	24.5	64,600			
22. Ciledug – Cililitan	18.3	158,700			
23. D.Atas - Ciputat	19.9	132,900			
24. BSD – L.Bulus	17.1	8,600			
25. Kalideres – Blok M	17.9	68,100			
26. Bekasi Term. – P.gadung	17.9	67,400			
27. Kp. Mulayu – Bank Ind.	25.7	30,300			
28. Depok Baru – CawangUKI	23.2	58,600			
29. BSD – Bank Ind.	27.3	70,700			
30. BSD – Harmoni	32.1	55,300			
31. Bogor - Cililitan	40.5	103,500			
Full BRT Total	683.3	2,325,600	Intermediate BRT Total	193.3	386,900

Source: JAPTraPIS

7.3.2 Performance of 2020 Public Transport Network

Traffic demand of the Jabodetabek Area will increase from 66 million trips in 2010 to 74 million trips in 2020. If there is no improvement of urban transport network and services by 2020 (Do-Nothing Case), the modal share of public transport will decrease and traffic situations will be aggravated. However, in the case transport network and services of the proposed master plan is implemented properly, modal share of public transport will increased to 34% by 2020 and traffic situation will be improved.

Table 7.3.3 Traffic Performance of 2020 Master Plan Network

Indicators		2010 (Existing)	2020 (Do Nothing)	2020 (Master Plan)
Total Traffic Demand (trips)		66 mil.	74 mil.	74 mil.
Modal Share 1)	Car	20%	28%	24%
	M/C	53%	50%	42%
	Public Transport	27%	22%	34%
Traffic Load	PCU-km	150 mil.	210 mil.	179 mil.
	PCU-hour	10 mil.	27 mil.	15 mil.
Travel Feature	V/C (daily)	0.85	1.15	0.88
	Travel Speed	23.6 kph	15.2 kph	24.0 kph
Public Transport	Pax-km/trip	9.3 km	9.2 km	9.2 km
	Pax-hour/trip	0.41 hr	0.45 hr	0.40 hr

Source: JAPTraPIS
Note: 1) Excluding the trips by non-motorized modes

7.4 Prioritization of BRT Network Development

7.4.1 Proposed 2012-2013 Network

Early improvement to the network is proposed for 2012-2013 to gain maximum improvements in the immediate term. Table 7.4.1 list the routes nominated for the 2012-2013 route development program, supported by the infrastructure projects.

Table 7.4.1 BRT Route Implementation Schedule (2012-2013)

Existing Corridor No.	New Route No.	Route	Description	Comment
1	1	**Kota – Blok M**	Implement as route 1	On-going Service Improvement Project and Infrastructure Upgrading
2 3	2a	**Pulo Gadung – Kalideres via Harmoni**	Combined route 2&3 operating East –West	Can be achieved quickly with minimal changes and reduces transfers at Harmoni
4	3	**Pulo Gadung – Blok M via Dukuh Atas**	Former corridor 4 extended to Blok M as route 3	Reduces transfers at Dukuh Atas and more direct travel
5 7	4	**Kp. Rambutan – Ancol via Kp. Melayu**	Combined corridor 5&7 operating as new route 4	Eliminates the compulsory transfers at Kp. Melayu
6	5	**Ragunun – Ancol via Dukuh Atas**	Former corridor 6 extended to Kota/Ancol as Route 5	Reduces transfers at Dukuh Atas and more direct travel to Kota/Ancol
8	14	**Lebak Bulus – Bank Ind. Via Grogol**	Former corridor 8	Change of corridor number to route number
9	6	**Pluit – Pinang Ranti**	Former corridor 9	Change of corridor number to route number
10	7	**Tj. Priok – Cililitan**	Former corridor 10	Change of corridor number to route number
11	11	**Pulo Gebang – Dukuh Atas**	Extend route to Dukuh Atas	Extend from Kp Melayu to Dukuh Atas with more direct connection opportunities
	16a	**Kota – Pulo Gadung**	New BRT route	Becomes Route 16 later when extended to Harapan Indah
	2b	**Kalideres – Tangerang City Mall via Poris Plawad**	New Intermediate route	Commences as intermediate bus but later a full BRT as route 2
	25	**Kalideres – Blok M**	New BRT route	Operates via route 6 alongside Tol Jen Gatot Subrato
	26a	**Bekasi Bus Terminal – Pulo Gadung**	New Intermediate route	Commences as intermediate bus but later a full BRT as route 26

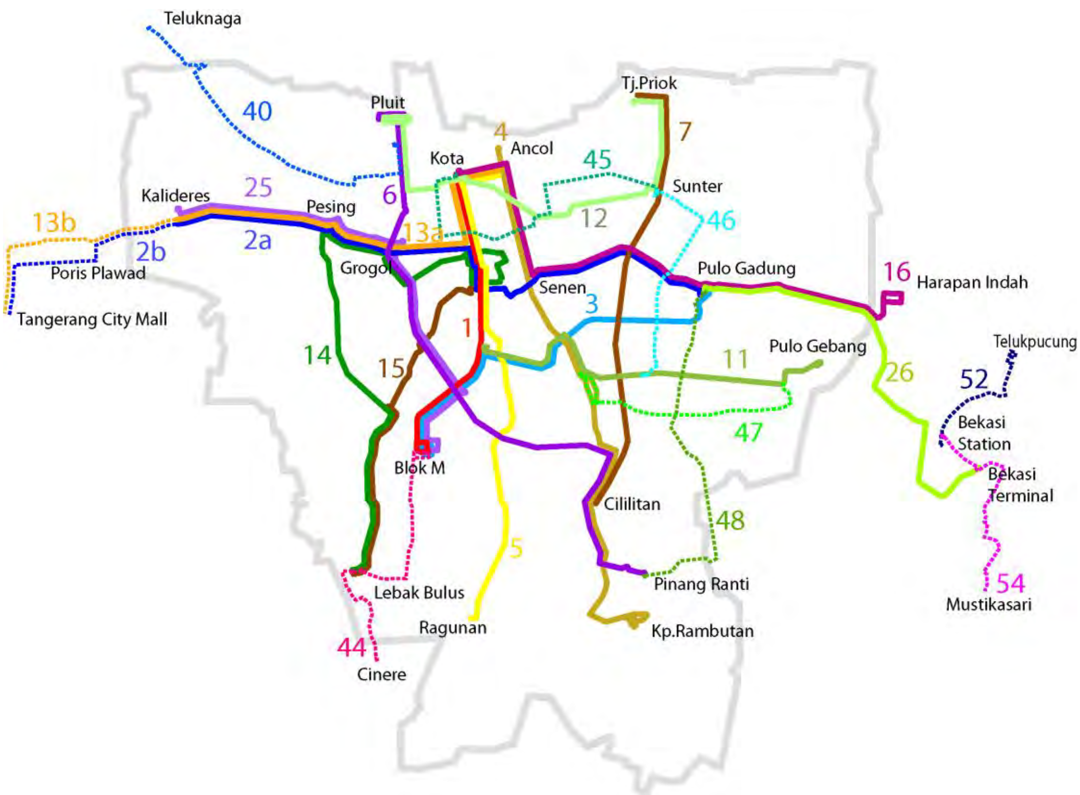
Source: JAPTraPIS

The order of implementation is based on the infrastructure project packages as listed in the BRT infrastructure Project Packages 1-5 to be completed to implement the 2012 route network.

7.4.2 Proposed 2014 Network

Additional routes will be implemented by 2014 as shown in Figure 7.4.1 and Table 7.4.2. These include major corridors into Kota Tangerang and Kota Bekasi. The order of implementation is shown in the BRT infrastructure Project Packages 7-12 to be completed to implement the 2014 route network.

Figure 7.4.1 2014 BRT Route Network



Source: JAPTraPIS

Table 7.4.2 BRT Route Implementation Schedule (2013-2014)

Route Number	Route	Description
12	Pluit – Tj Priok	New full BRT route
40	Pluit – Teluknaga	Implement Intermediate Bus Priority routes to support new BRT routes
44	Cinere - Blok M	
45	Tambora – Gaya Motor	
46	Gaya Motor - Cipinang	
48	Pulo Gadung – Pinang Ranti	
16	Kota – Harapan Indah via Ancol	Extend from P/ Gadung to Harapan Indah (replaces 16a)
26	Bekasi Bus Terminal – Pulo Gadung	Replace 26a to full BRT
47	Kp. Mulayu – Klender Baru	Implement as Intermediate Bus Priority Routes
52	Bekasi Station – Teluk Pucung	
54	Mustikasari – Bekasi Station	
13a & 13b	Ancol – Kalideres (13a) – Tangerang City Mall (13b)	New full BRT route (13a) and intermediate route (13b) - later extended to BSD as route 13
15	Lebak Bulus – Bank Ind. via Tentarapelajar	New full BRT route to provide more direct route from Lebak Bulus

Source: JAPTraPIS

7.4.3 Future Traffic Demand of 2014 BRT Network

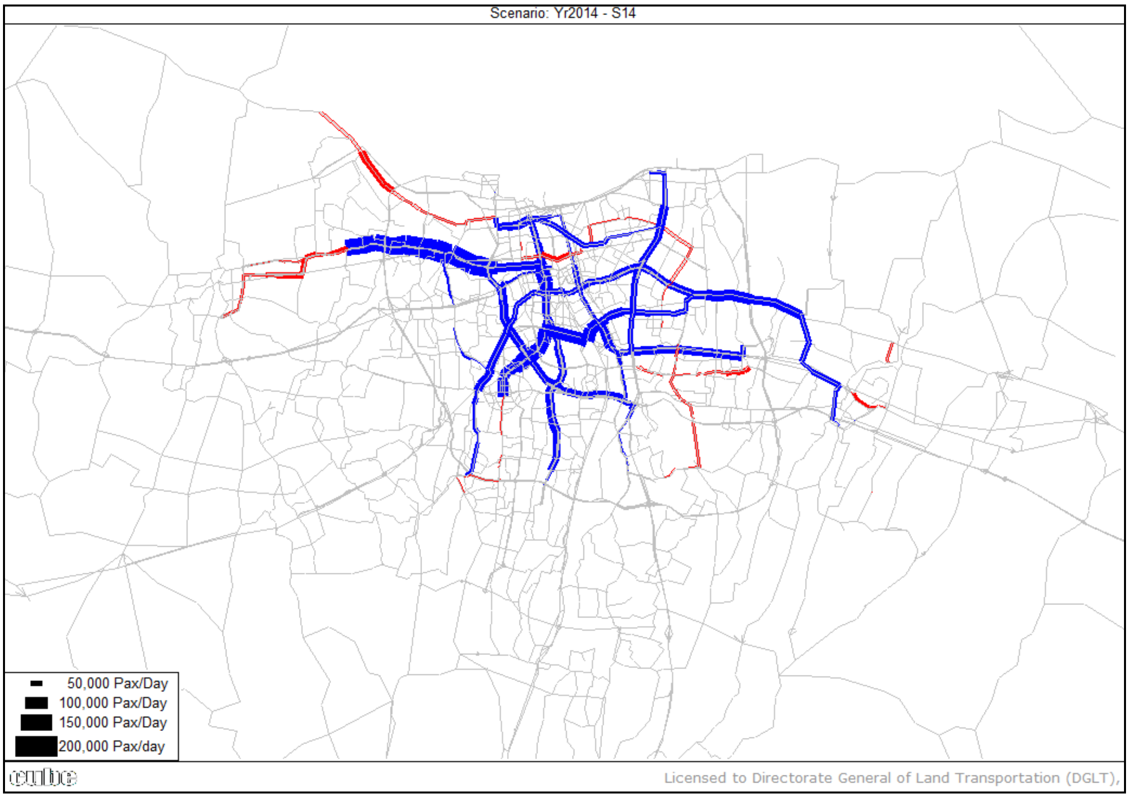
Table 7.4.3 and Figure 7.4.3 shows the result of traffic demand forecast and assignment on the proposed 2014 public transport network. The proposed 2012 BRT network will transport about daily 1.4 million passengers (1.2 million for full BRT and 0.2 million for intermediate route).

Table 7.4.3 Traffic Demand on 2014 Public Transport Network

Mode	Ridership 2014 (million pax)
Full BRT (16 routes)	1.2
Intermediate BRT (8 routes)	0.2
Jabodetabek Rail	1.0

Source: JAPTraPIS

Figure 7.4.2 Traffic Assignment on 2014 BRT Network



Source: JAPTraPIS

Table 7.4.4 Traffic Demand on 2020 BRT Routes

Route Name	Km	Daily Ridership	Route Name	Km	Daily Ridership
1. Kota – Blok M	11.9	60,400		15.9	66,400
2a. P.Gadung – Kalideres	23.4	112,300	40. Pluit – Teluknaga	12.3	18,800
2b. Kalideres – Tang. City Mall	10.6	77,400	44. Cinere – Blok M	14.2	34,000
3. P.Gadung – Blok M	15.8	116,300	45. Tambora – Gaya Motor	10.0	36,600
4. Kp.Rambutan – Ancol	21.9	38,800	46. Gaya Motor – Cipinang	10.3	31,600
5. Ragunan – Ancol	19.8	94,700	47. Kp.Melayu – Klender Baru	15.0	22,100
6. Pluit – P.Ranti	24.0	75,800	48. P.Gadung – P.Ranti	5.5	19,900
7. Tj.Priok – Cililitan	17.2	61,300	52. Bekasi Stat.–TelukPucung	9.5	25,900
11. P.Gebang – D.Atas	16.1	88,000	54. Mastikasari – Bekasi Stat.		
12. Pluit – Tj.Priok	17.3	78,600			
13a. Ancol – Kalideres	16.6	67,600			
13b. Kalideres – Tang.City Mall	11.0	14,700			
14. L.Bulus – Bank Ind.	26.5	51,100			
15. L.Bulus – Bank Ind.	13.5	60,800			
16. Kota – P.Gadung	22.4	60,600			
25. Kalideres – Blok M	17.9	72,900			
26. Bekasi Term. – P.gadung	17.9	61,300			
Full BRT Total	319.9	1,192,700	Intermediate BRT Total	92.6	255,200

Source: JAPTraPIS
Note: Route 2b and 13b is operated as intermediate route in 2014 and later changed to full BRT.

7.4.4 Proposed 2015-2020 Network

Table 7.4.5 shows the BRT routes to be open during the period 2015-2020 to formulate the proposed public transport master plan network in 2020.

The order of implementation is shown in the BRT infrastructure Project Packages 13-28 to be completed to implement the 2020 route network.

Table 7.4.5 BRT Route Implementation Schedule (2015-2020)

Route Number	Route	Description
2	Pulo Gadung – Tangerang City Mall via Harmoni	Replaces 2a and 2b with full BRT
27	Kp. Mulayu – Bank Ind. via Inner Toll Road	New full BRT Route
23	Dukuh Atas – Ciputat via Kuningan	New full BRT Route
41	BSD – Ciputat	New Intermediate routes
42	Parung – Ciputat	
24	BSD – Lebak Bulus via Tol Serpong	New full BRT Route
22	Ciledug – Cililitan via Blok M	New full BRT Route
8	Ciledug - Dukuh Atas via Blok M	New full BRT Route
9	Bekasi Bus Terminal - Cililitan	New full BRT Route
49	Kalimalang – Pulo Gadung	New Intermediate route
19	Dukuh Atas – Cibibur via Cililitan	New full BRT Route
28	Depok Baru - Cawang UKI via Tol Jagorawi	New full BRT Route
43	Blok M – Depok Baru	New Intermediate routes
50	Pinang Ranti – Bekasi Station	
51	Cibibur - Jatiasih	
21	Pondok Kelapa – Lebak Bulus via Cililitan	New full BRT Route
18	Dukuh Atas - Jatijajar via Fatmawati	New full BRT Route
10	Depok Baru – Bank Ind. via Mangerrai	New full BRT Route
13	Ancol – BSD via Tangerang City Mall	Replaces 13a and 13b with full BRT
30	BSD – Harmoni via Tol Kbn.Jeruk	New full BRT Route
29	BSD – Bank Ind via Tol Serpong	New full BRT Route
17	Bekasi Station – Setu	New full BRT Route
53	Cileungsi – Jatiasih	New Intermediate route
20	Pulo Gadung – Bumi Anggrek	New full BRT Route
31	Bogor (Baranang Siang) – Cililitan via Tol Jagorawi	New full BRT Route

Source: JAPTraPIS

7.4.5 Integrated Fares and Ticketing Across the Network

A vital part of the network function is the integration of fares across the network where the fare is based on the distance travelled and not the number of trips made. This eliminates the cost penalty where a passenger pays another fare for the second leg of the journey. By means of an e-ticketing system, the second trip is recognized by the system (if the transfer is made within the allowable time). The purpose of fare integration is firstly to allow accurate and equitable charging according to distance, and also to ensure a seamless transfer, where transfers are unavoidable.

Intermediate buses can be fitted with on-board ticket validation machines so passengers effectively ‘enters the system’ on a local intermediate bus and can transfer directly on to the paid side of the BRT station platform to continue the journey until they exit the system.

7.5 BRT Fleet Development

The acquisition of the bus fleet is progressive according to the implementation of BRT routes. The assignment of buses to each route in the final network plan for 2014 and 2020 is in relation to the rest of the network, as in many cases the routes operate along the same alignment and the combined routes serve the demand of that sector.

During implementation, some of the other supporting routes may not yet be in place requiring extra buses to be assigned to the early routes in order to meet corridor demand, and these extra buses will be reassigned as further routes are added.

Table 7.5.1 shows the estimated number of bus fleets by route to be required during each phase of implementation (as each BRT route network is completed) and estimates the fleet so that most routes are capable of offering a 2-3 minute headway. The bus management unit can adjust the assignment of buses as necessary between routes to ensure that the demand is met. The estimate of fleet numbers are based on a system speed of average 27 kph on BRT routes and 20 kph on intermediate routes.

Table 7.5.1 BRT Fleet Requirement by Route

Phase	Route No.	Description	Articulated Bus	Single Bus	Total
2012-2013	1	Kota – Blok M	38		Articulated: 435 Single: 27
	2a	Pulo Gadung – Kalideres via Harmoni	82		
	3	Pulo Gadung – Blok M via Dukuh Atas	26		
	4	Kp. Rambutan – Ancol via Kp Melayu	35		
	5	Ragunun – Ancol via Dukuh Atas	32		
	14	Lebak Bulus – Bank Ind. Via Grogol	62		
	6	Pluit – Pinang Ranti	38		
	7	Tj. Priok – Cillitan	41		
	11	Pulo Gebang - Dukuh Atas	26		
	16a	Kota – Pulo Gadung	26		
	2b	Kalideres – Tangerang City Mall via Poris Plawad		12	
	25	Kalideres - Blok M	29		
	26a	Bekasi Bus Terminal – Pulo Gadung		15	
2013-2014	12	Pluit – Tj Priok	26		Articulated: 173 Single: 126
	40	Pluit – Teluknaga		17	
	44	Cinere - Blok M		14	
	45	Tambora – Gaya Motor		16	
	46	Gaya Motor - Cipinang		11	
	48	Pulo Gadung – Pinang Ranti		16	
	16	Kota – Harapan Indah via Ancol	36		
	26	Bekasi Bus Terminal – Pulo Gadung	34		
	47	Kp. Mulayu – Klender Baru		12	
	52	Bekasi Station – Teluk Pucung		8	
	54	Mustikasari – Bekasi Station		17	
	13a +13b	Ancol – Kalideres (13a) – Tangerang City Mall (13b)	40	15	
	15	Lebak Bulus – Bank Ind. via Tentarapelajar	37		
2015-2020	2	Pulo Gadung – Tangerang City Mall via Harmoni	30		Articulated: 758 Single: 124
	27	Kp. Mulayu – Bank Ind. via Inner Toll Road	30		
	23	Dukuh Atas – Ciputat via Kuningan	38		
	41	BSD – Ciputat		8	
	42	Parung – Ciputat		13	
	24	BSD – Lebak Bulus via Tol Serpong	11		
	22	Ciledug – Cililitan via Blok M	43		
	8	Ciledug - Dukuh Atas via Blok M	27		
	9	Bekasi Bus Terminal - Cililitan	27		
	49	Kalimalang – Pulo Gadung		11	
	19	Dukuh Atas – Cibibur via Cililitan	43		
	28	Depok Baru - Cawang UKI via Tol Jagorawi	37		
	43	Blok M – Depok Baru		29	

	50	**Pinang Ranti – Bekasi Station**		23	
	51	**Cibibur - Jatiasih**		19	
	21	**Pondok Kelapa – Lebak Bulus via Cililitan**	41		
	18	**Dukuh Atas - Jatijajar via Fatmawati**	53		
	10	**Depok Baru – Bank Ind. via Mangerrai**	63		
	13	**Ancol – BSD via Tangerang City Mall**	86		
	30	**BSD – Harmoni via Tol Kbn.Jeruk**	70		
	29	**BSD – Bank Ind via Tol Serpong**	65		
	17	**Bekasi Station – Setu**	11		
	53	**Cileungsi – Jatiasih**		21	
	20	**Pulo Gadung – Bumi Anggrek**	13		
	31	**Bogor (Baranang Siang) – Cililitan via Tol Jagorawi**	70		
		Total	**1,366**	**277**	

Source: JAPTraPIS

Table 7.5.2 shows the BRT fleet procurement plan in accordance with the implementation of proposed BRT route network. The number of BRT fleets to be procured in each year is estimated in considering the retirement schedule of the existing bus way fleets. The procurement plan required $ 635.2 million to procure 1,681 articulated buses and 277 single buses during the period of 2012-2020.

Table 7.5.2 Fleet Procurement Plan for the Propsoed BRT Network Implememtation

Phase	Articulated Bus		Single Bus	
2012-2014	574	$192.3 mil.	0	-
2015-2020	1,107	$370.8 mil.	277	$72.0 mil.
Total	1,681	$563.1 mil.	277	$72.0 mil.

Source: JAPTraPIS
Note: 1) Bus life time is set for 7 years, 2) assumed fleet capacity of 70 passengers for single bus and 120 passengers for articulated bus, 3) Assumed fleet price of $ 260,000 for single bus and $335,000 for articulated bus.

8 INFRASTRUCTURE DEVELOPMENT

8.1 BRT Infrastructure and Facility Development

To develop the proposed 2020 BRT network new infrastructure and facilities are required. The infrastructure building program includes 31 separate project packages. The reason for grouping number of projects into a package is because in many instances the projects are interdependent with each other and need to be collectively completed to implement the nominated bus routes. With each completed project package, a set of routes can be implemented. Table 8.1.1 summarizes these project packages and lists the routes which can be implemented at each stage.

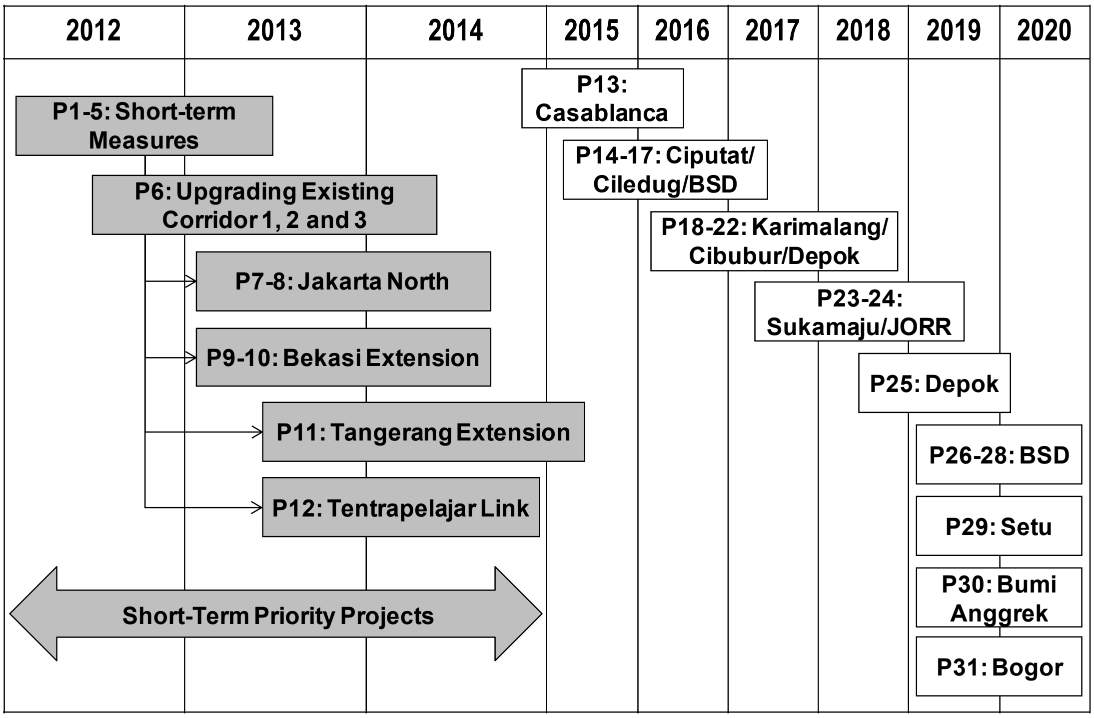
Table 8.1.1 BRT Infrastructure and Facility Deevelopment Projects

No.	Project / Site	Implement Route
P1	A. Traffic operation around Monas B. Bank Indonesia shelter modification C. Integrate BRT with rail at Gambir	1, 2a, 6, 7, 14
P2	A. New shelter at Pessing B. Dukuh Atas modification C. St.Cawan ped. bridge extension	
P3	A. Mangga dua shelter construction B. Kp.Melayu road redesign C. Blok M terminal modification	3, 5, 11, 16a
P4	Kalideres shelter improvement	2b, 25
P5	Kp.Melayu shelter modification	4
P6	Corridor 1,2&3 upgrading	
P7	Route12 (Pluit to Tj. Priok)	12
P8	(IR: Intermediate Routes)	(40, 44, 45, 46, 48)
P9	Harapan Indah Extension	16
P10	Bekasi Extension to Bekasi Terminal (IR)	26 (47, 52, 54)
P11	Tangenarng Extension	13a, 13b, 2 (after 2015)
P12	Tentarapelajar Link	15
P13	Casablanca (T.A.-Kp.Melayu)	27
P14	Kyai Maja Link and Wolter Monginsidi to Kuningan	
P15	Ciputat/Pamulang Ext. (IR)	23 (41, 42)
P16	BRT Tol Serpong	24
P17	Ciledug Corridor and Cililitan Link	22, 8
P18	Cawang UKI Transfer Station	
P19	Kalimarang Corridor (IR)	9 (49)
P20	Jl. Tol Letnan Haryono to Manggarai	
P21	Cibubur to Cawang UKI via Tol	19
P22	Depok Baru to Tol Link (IR)	28 (43, 50, 51)
P23	Jl. Raden Ajeng Kartini	21
P24	Sukamaju to Gedong	18
P25	Depok Baru to Jl. Tol Letnan Haryono	10
P26	Tangerang to BSD	13
P27	BSD to Harmoni via Kbn. Jeruk	30
P28	BSD to Bank Ind. via T/Abang new Toll road	29
P29	Bekasi Station to Setu (IR)	17 (53)
P30	Pulo Gadung to Bumi Anggrek	20
P31	Bogor (Baranang Siang) to Cililitan	31

Source: JAPTraPIS

The projects are also prioritized according to a schedule of implementation as show in the Figure 8.1.1. It is possible to rearrange project packages in a different order of implementation but then project packages themselves should remain intact.

Figure 8.1.1 BRT Project Package and Implementation Schedule



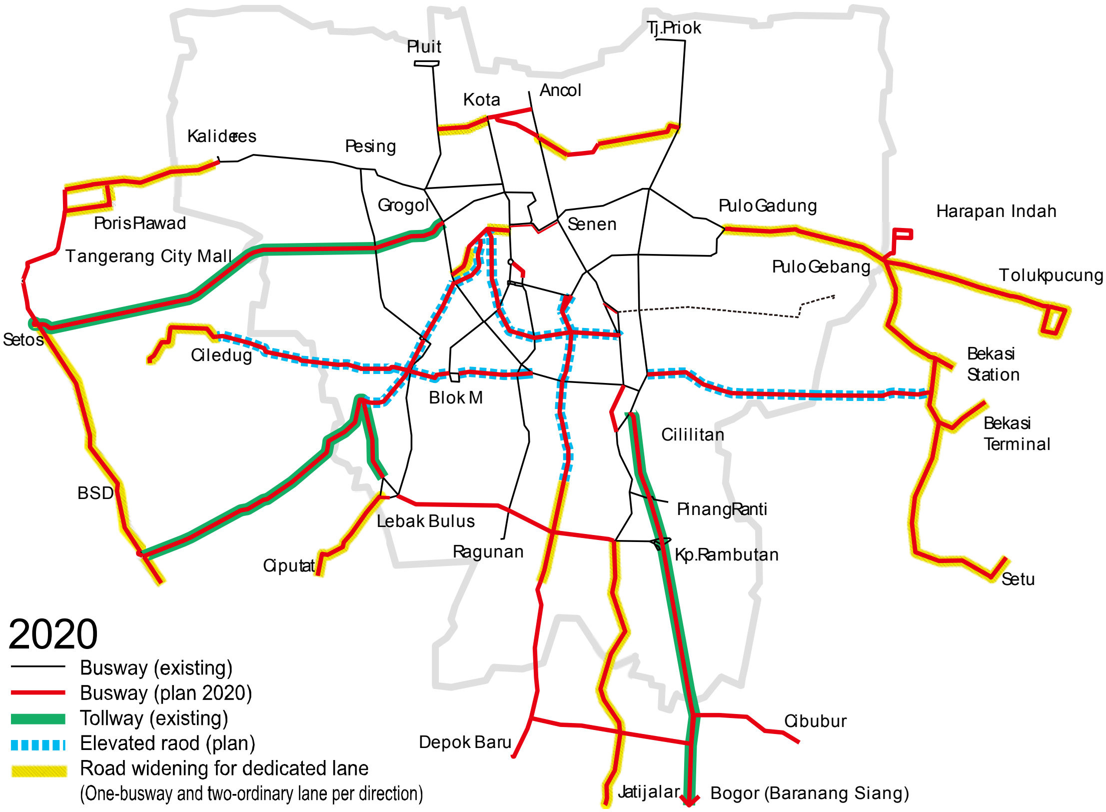
Source: JAPTraPIS

Figure 8.1.2 and Figure 8.1.3 show the identified road section for new BRT corridors by 2020 and by 2014 based on the proposed implementation schedule.

The scale of the proposed BRT network development is summarized by project as show in Table 8.1.2. The proposed 2020 BRT network requires 257 km busway corridor with 233 shelters. In order to develop new full BRT corridor with dedicated bus lane, 92km (36%) of the new busway corridor needs to be widened to accommodate at least one dedicated bus lane and two lanes for private vehicle by direction.

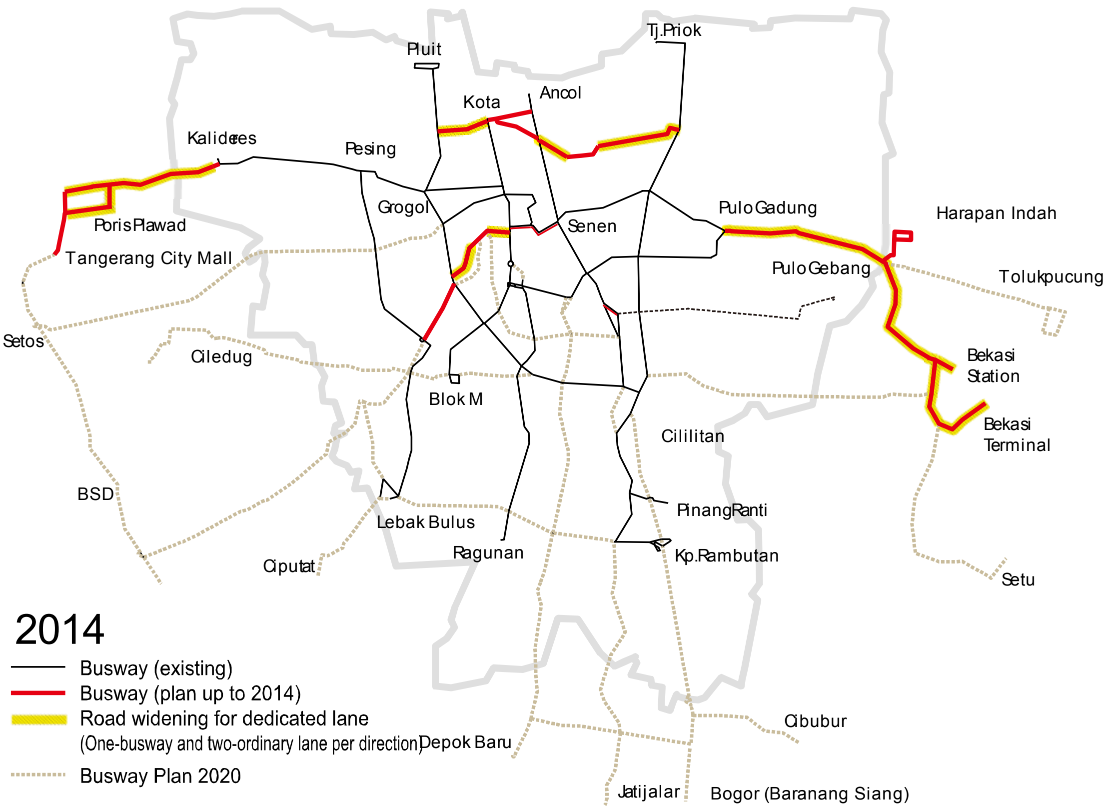
Based on the identified scale of the project, each implementation cost are estimated and summarized by Phase. In order to develop the proposed BRT corridors, the total cost of Rp.2,558 billion (or US$ 284 million) are required by 2020 as shown in Table 8.1.3. Breakdown of the cost by project package is shown in the Table 8.1.4.

Figure 8.1.2 BRT Corridor Development by 2020



Source: JAPTraPIS

Figure 8.1.3 BRT Corridor Development by 2014



Source: JAPTraPIS
Note: Widening for the section of Kalideres – Tangerang City Mall is implemented after 2015

Table 8.1.2 Scale of the Project for BRT Infrastructure and Facility Development

BRT Route Development Project

	Project No.	New corridor (km)	New shelter (unit)	Km Road widening (km)	Cost (mil.Rp.)	Land aquisiton (ha)
2012	1	2.4	2	0.0	13,524	0.0
	2	0.0	0	0.0	0	0.0
	3	2.6	1	0.0	25,921	0.0
	4	0.0	0	0.0	0	0.0
	5	0.0	0	0.0	0	0.0
	6	0.0	0	0.0	0	0.0
2013-14	7	11.3	11	6.6	127,351	3.4
	8	0.0	0	0.0	0	0.0
	9	10.4	11	7.2	117,208	1.4
	10	12.0	10	10.6	135,240	3.4
	11	10.6	11	5.2	119,462	1.4
	12	5.3	4	1.3	43,329	0.8
2015-20	13	9.6	10	0.0	65,088	0.0
	14	4.6	3	0.0	25,086	0.0
	15	5.9	6	4.9	66,493	2.1
	16	17.5	10	0.0	75,950	0.0
	17	17.6	18	3.2	148,513	4.5
	18	0.0	0	0.0	0	0.0
	19	13.0	13	0.0	88,140	0.0
	20	4.0	4	0.0	27,120	0.0
	21	19.8	14	0.3	127,596	0.3
	22	5.3	5	0.0	59,731	0.0
	23	7.2	7	0.0	81,144	0.0
	24	12.9	14	12.9	145,383	10.3
	25	15.8	17	8.3	157,412	2.5
	26	18.9	19	9.7	213,003	7.2
	27	16.0	9	0.0	62,720	0.0
	28	10.0	6	0.0	39,200	0.0
	29	10.9	12	10.9	122,843	11.2
	30	11.3	12	11.3	127,351	13.9
	31	2.5	5	0.0	28,175	0.0
	Total	257.4	233	92.4	2,242,983	62.3

Intermediate Route Development Project

	Project No.	Km Route (km)	New shelter	Cost (mil.Rp)
2012	1			
	2			
	3			
	4			
	5			
	6			
2013-14	7			
	8	66.8	105	27,300
	9			
	10	26.5	40	10,400
	11			
	12			
2015-20	13			
	14			
	15	19.5	30	7,800
	16			
	17			
	18			
	19	9.3	14	3,640
	20			
	21			
	22	51.6	82	21,320
	23			
	24			
	25			
	26			
	27			
	28			
	29	14.5	23	5,980
	30			
	31			
	TOTAL	**188.2**	**294**	**76,440**

Source: JAPTraPIS
Note: Cost for land acquisition is not included.

Table 8.1.3 Estimated Cost for BRT Infrastructure and Facility Development Project

Estimated Cost by Project

Project no.	Cost (mil.Rp)
P1	19,024
P2	9,930
P3	50,201
P4	1,600
P5	2,000
P6	164,078
P7	127,351
P8	27,300
P9	117,208
P10	145,640
P11	119,462
P12	43,329
P13	65,088
P14	25,086
P15	74,293
P16	75,950
P17	148,513
P18	31,500
P19	91,780
P20	27,120
P21	127,596
P22	81,051
P23	81,144
P24	145,383
P25	157,412
P26	213,003
P27	62,720
P28	39,200
P29	128,823
P30	127,351
P31	28,175
Total	2,558,311

Estimated Cost by Project Group

	Project Group	Cost (mil.Rp)
2012	Project 1-5	82,755
	Project 6	164,078
2013-14	Project 7&8	154,651
	Project 9&10	262,848
	Project 11	119,462
	Project 12	43,329
2015-20	Project 13	65,088
	Project 14-17	323,842
	Project 18-22	359,047
	Project 23-24	226,527
	Project 25	157,412
	Project 26&27	275,723
	Project 28	39,200
	Project 29	128,823
	Project 30	127,351
	Project 31	28,175
Total		2,558,311

Estimated Cost by Phase

	Total budget	Ave.annual budget
2012	148,386	148,386
2013-14	678,737	339,368
2015-20	1,731,188	288,531
Total	2,558,311	284,257

Source: JAPTraPIS
Note: Cost for land acquisition is not included.

Table 8.1.4 Cost Breaksown by Project Package

Project No.	Infrastructure work	Description	Quantity	Unit	Unit cost (mil.Rp)	Cost (mil.Rp)
P1	Bank Indonesia to Senen two way BRT	Implement Route 1,2a, 6, 7, 14				13,524
P1	Relocate Gambir 2 shelter	L=30m, W=5m	150	m2	5.0	750
P1	Bank Indonesia	L=120m, W=5m, and footpath(20mx2.5m)	650	m2	5.0	3,250
P1	Relocate Balaikota shelter	L=60m, W=5m	300	m2	5.0	1,500
P2	Pessing shelter	L=60m, W=5m	300		5.0	1,500
P2	New shelter Dukuh Atas 1	L=60m, W=5m	300	m2	5.0	1,500
P2	D.Atas pedestrian underpath	L=40m, W=3.5m, H=2.5m	350	m3	7.0	2,450
P2	D.Atas escalator		1	unit	2,500	2,500
P2	Dukuh Atas 2	L=60m, W=5m	300	m2	5.0	1,500
P2	Stasiun Cawan pedestrian improvement	L=32m, W=2.5m	80	m2	6.0	480
P3	Busway track (Jl.Mattraman and Bekasi)	Implement Route 3, 5, 11, 16a				25,921
P3	Mattraman link new transfer station	L=60m, W=5m	300	m2	5.0	1,500
P3	D.Atas area traffic modification	L=30m, W=10m	300	m2	0.6	180
P3	Blok M terminal Upgrade	L=35m, W=180m	6,300	m2	2.0	12,600
P3	Blok M pedestrian deck	L=400. W=5m	2,000	m2	5.0	10,000
P4	Kalideres shelter improvement	L=40m, W=8m	320	m2	5.0	1,600
P4		Implement Route 2b, 25				
P5	Kp.Melayu shelter modification	L=40m, W=5m (2unit)	400	m2	5.0	2,000
P5		Implement Route 4				
P6	Corridor 1,2&3 upgrading (track)	L=34.9km	34.9	km	2,470	86,203
P6	Corridor 1,2&3 upgrading (shelter)	55 shelters (L=45m, W=5m each)	12,375	m2	5.0	61,875
P6	Corridor 1,2&3 upgrading (bridge floor)	40 bridges (400m2 each)	16,000	m2	1.0	16,000
P7	Pluit to Tj.Priok	Implement Route 12				127,351
P8	Implement Intermediate	Implement Intermediate Route 40, 44, 45, 46, 48				27,300
P9	Harapan Indah extention	Implement Route 16				117,208
P10	Corridor 11 extention to Bekasi Terminal	Implement Route 26				135,240
P10	Implement Intermediate	Implement Intermediate Route 47,52,54				10,400
P11	Extension Tangerang	Implement Route 13a+13b, 2(after 2015)				119,462
P12	Tentarapelajar link	Implement Route 15				43,329
P13	Casablanca, Tn.Abang to Kp.Melayu	Implement Route 27				65,088
P14	Kyai Maja link to Kunigan					25,086
P15	Ciputat extension	Implement Route 23				66,493
P15	Implement Intermediate	Implement Intermediate Route 41,42				7,800
P16	BRT Tol.Serpong	Implement Route 24				75,950
P17	Ciledug link and Cililitan link	Implement Route 22, 8				148,513
P18	Develop Cawan UKI as main Transfer shelter	L=140m, W=5m	6,300	m2	5.0	31,500
P19	Kalimalang corridor	Implement Route 9				88,140
P19	Implement Intermediate	Implement Intermediate Route 49				3,640
P20	Implement Route	Implement Route				27,120
P21	Implement Route	Implement Route 19				127,596
P22	Deok Baru to Tol link	Implement Route 10				59,731
P22	Implement Intermediate	Implement Intermediate Route 43, 50, 51				21,320
P23	Jl. Raden Ajeng Kartini	Implement Route 21				81,144
P24	Sukamajo to Gedung	Implement Route 18				145,383
P25	Depok Baru to Tol. MH Haryonoto	Implement Route 10				157,412
P26	Tangerang to BSD	Implement Route 13				213,003
P27	BSD to Harmoni via Kbn.Jeruk Tol link	Implement Route 30				62,720
P28	BSD to Bank Ind. via Tn.Abang new Tol link	Implement Route 29				39,200
P29	Bekasi Station to Setu	Implement Route 17				122,843
P29	Implement Intermediate	Implement Intermediate Route 53				5,980
P30	Pulo Gadung to Bumi Anggrek	Implement Route 20				127,351
P31	Bogor Extension	Implement Route 31				28175
					Total	2,558,311

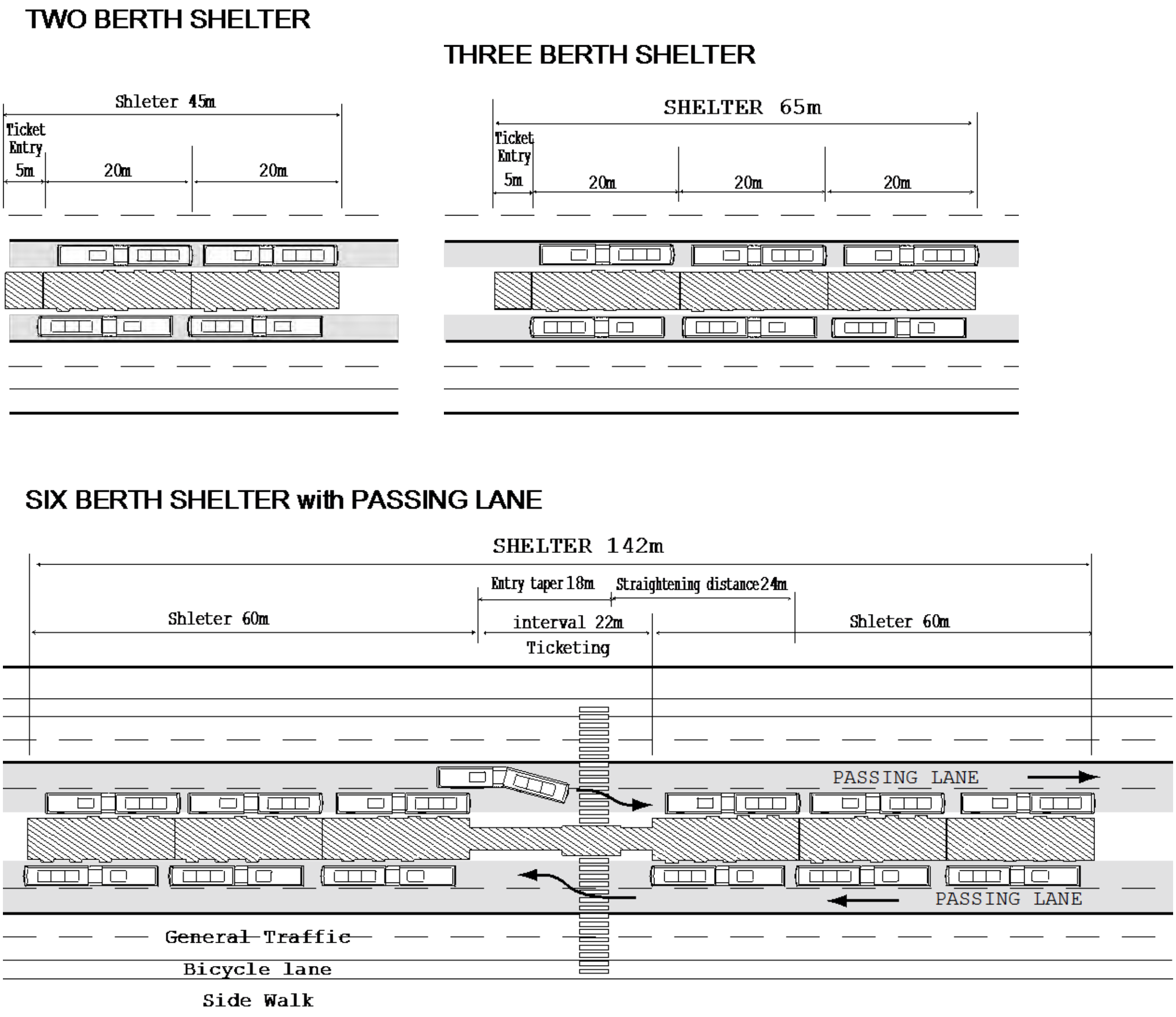
Source: JAPTraPIS

Typical Shelter Design:

The planning of shelter infrastructure has determined shelter sizing according to demand; being number of buses per hour servicing shelters and the correlating number of passengers. Consequently there are two main shelter sizes according to the number of buses that can berth at each platform: a two berth platform and a three berth platform (see Figure 8.1.4).

In the case of some interchange locations with heavy bus traffic, two separated platforms can be used so that buses can more directly access each platform and different platforms can be assigned to particular routes so that passengers are directed to the correct platform. Critical to the separated platform design is that there is sufficient space between platforms for buses to manouvre into line with the platform.

Figure 8.1.4 Typical BRT Corridor Development

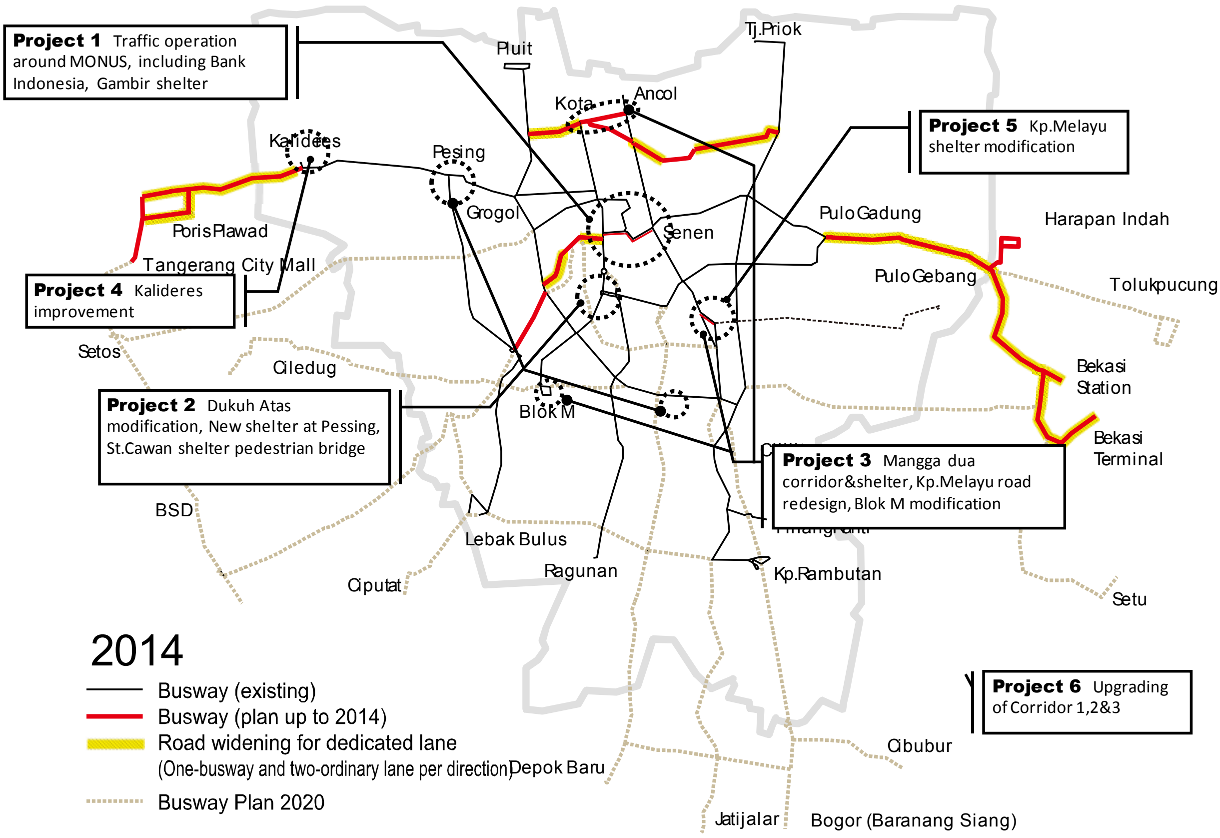


Source: JAPTraPIS

Proposed Plan and Design for the Short-term Projects:

Contents of short-term projects (Project 1-6 to be conducted by 2012) are further examined and identified as described in Figure 8.1.5 and Table 8.1.5. The alternative design to improve the corridor is proposed by project as shown in the following figures.

Figure 8.1.5 Short-term BRT Corridor Development Projects



Source: JAPTraPIS

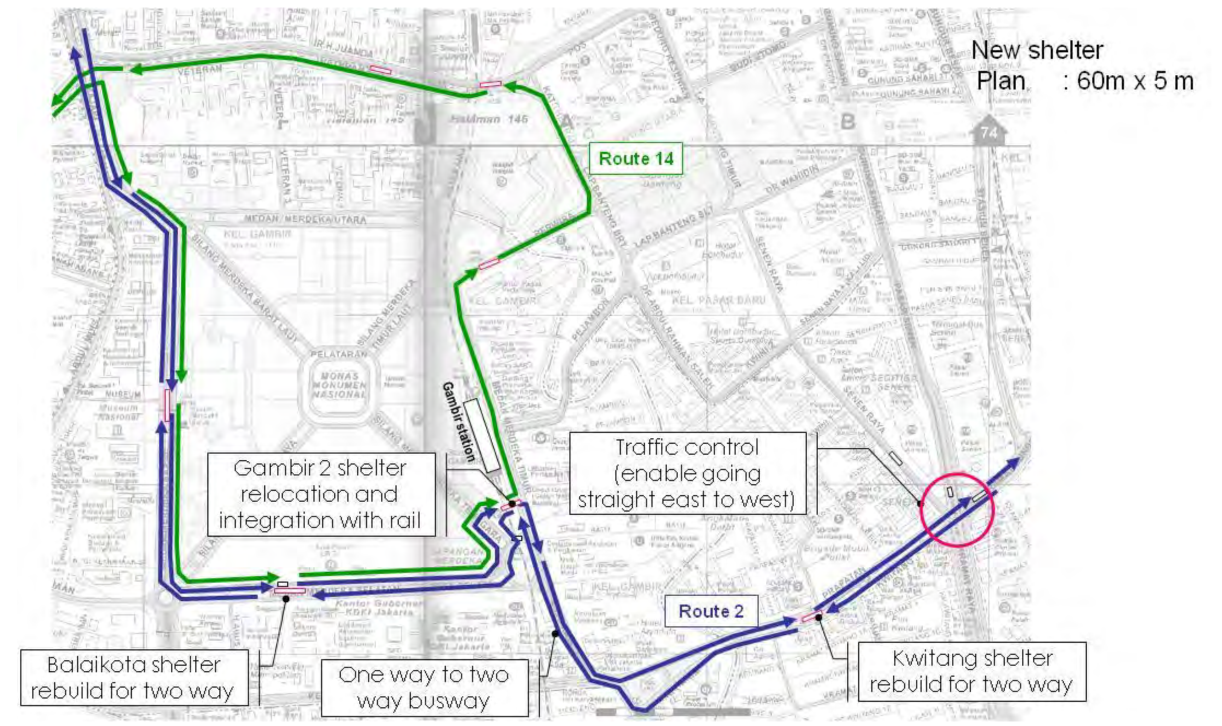
Table 8.1.5 Short-term BRT Corridor Development Projects

Project		Project / Site	Plan	Related Busway
P1	A	Traffic operation around Monus	Bank Indonesia to Senen two way BRT, Relocate Balaikota shelter	BRT 2, 10, 14
	B	Bank Indonesia shelter modification	Bank Indonesia as major transfer station	Terminus: BRT 10,14,15,27,29 Through: BRT 1,5
	C	Integrate BRT with rail at Gambir	Relocate Gambir 2 shelter	BRT 2, 10, 14
P2	A	New shelter at Pessing	Pessing shelter	Through BRT 2,13,14,25
	B	Dukuh Atas modification	New shelter Dukuh Atas 1 closer to Surdiman station., pedestrian underpath and escalator, Dukuh Atas 2 extention	D.Atas 1: Through BRT 1 D.Atas 2: Terminus BRT 8, 11,18,19,23, Through BRT 3
	C	St.Cawan shelter pedestrian bridge extension	St. Cawan pedestrian improvement	Through BRT 6, 9, 22
P3	A	Mangga dua shelter construction	Busway track, Two new shelters for new corridors	BRT 5,13,16
	B	Kp.Melayu road redesign	Redesign to dual direction on Jl.Bekasi Barat Raya, Kebon Pala shelter modification as a transfer station	BRT Route 4,11,27 Intermediate 47
	C	Blok M terminal modification	Increase Blok M busway capacity , Blok M pedestrian deck	Terminus: BRT 1,3,25, Intermediate 43, 44 Through BRT 8,22,23
P4	A	Kalideres shelter improvement	Increase boarding space for Transjakarta and Tangerang	Terminus: BRT 25 Through: BRT 2,13
P5	A	Kp.Melayu shelter modification	Build new shelters to north-south alignment	Terminus: BRT 27, Intermediate 47 Through BRT 4,11
P6	A	Corridor 1,2&3 upgrading	track, shelter for articulated and bridge	Corridor 1,2&3

Source: JAPTraPIS

Figure 8.1.6 Project 1-A Traffic Operation around Monas

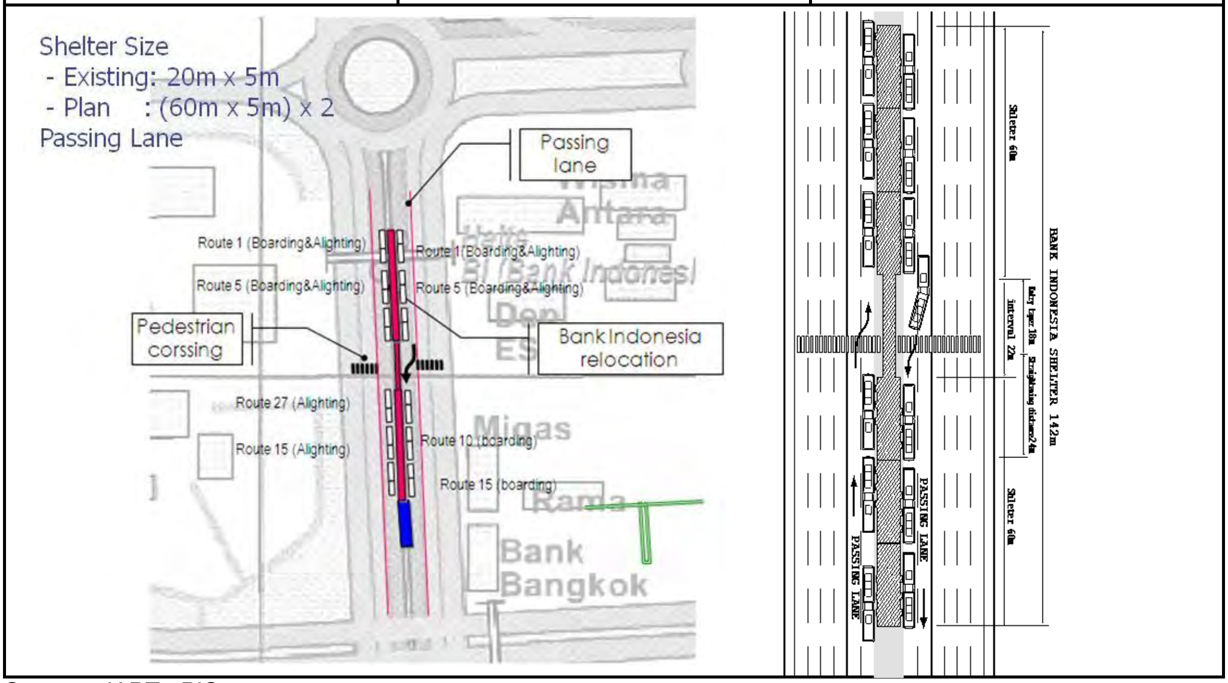
Project / Site	Plan	Related Routes
Traffic operation around Monus	Bank Indonesia to Senen two way BRT, Relocate Balaikota shelter	BRT 2, 10, 14



Source: JAPTraPIS

Figure 8.1.7 Project 1-B Bank Indonesia Shelter Expansion

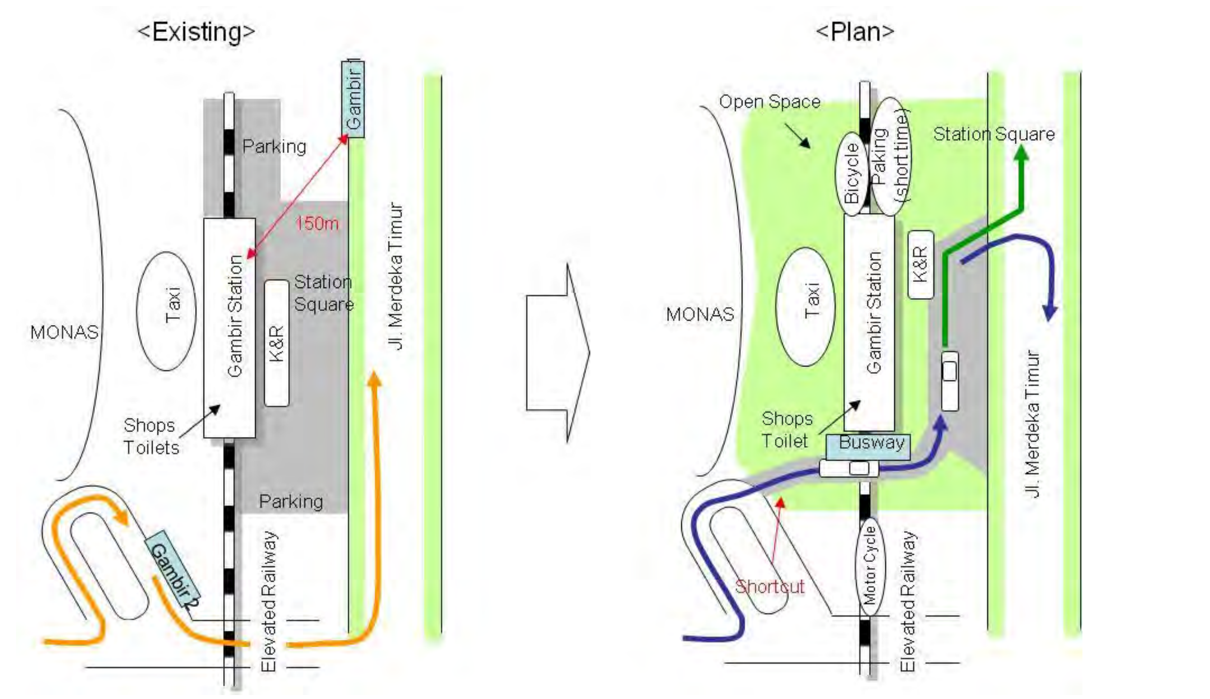
Project / Site	Plan	Related Routes
Bank Indonesia shelter modification	Bank Indonesia as major transfer station	Terminus: BRT 10,14,15,27,29 Through: BRT 1,5



Source: JAPTraPIS

Figure 8.1.8 Project 1-C Gambir Shelter Modification to Integrate with Rail

Project / Site	Plan	Related Routes
Integrate BRT with rail at Gambir	Relocate Gambir 2 shelter	BRT 2, 10, 14



Source: JAPTraPIS

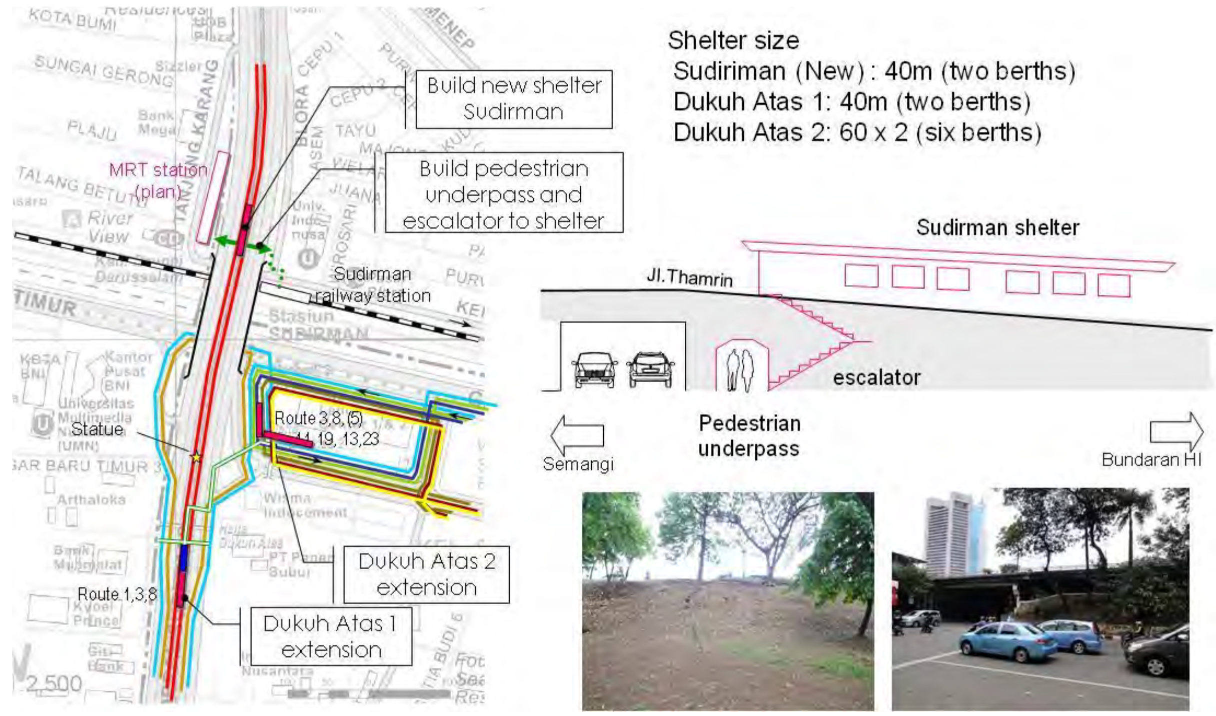
Figure 8.1.9 Project 2-A New Shelter at Pessing

Project / Site	Plan	Related Routes
New shelter at Pessing	Pessing shelter	Through BRT 2,13,14,25

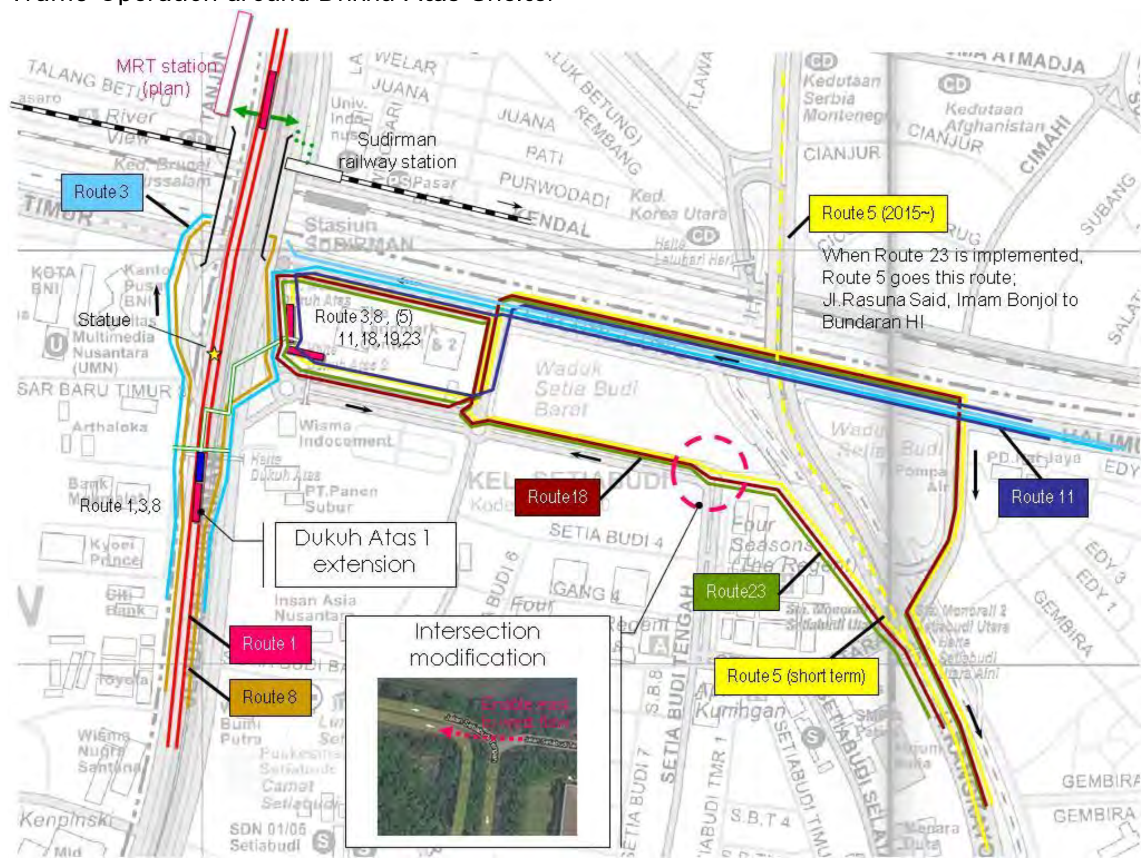
Source: JAPTraPIS

Figure 8.1.10 Project 2-B New Dukhu Atas Shelter

Project / Site	Plan	Related Routes
Dukuh Atas modification	New shelter Dukuh Atas 1 closer to Surdiman station., pedestrian underpath and escalator, Dukuh Atas 2 extention	D.Atas 1: Through BRT 1 D.Atas 2: Terminus BRT 8,11,18,19,23 Through BRT 3



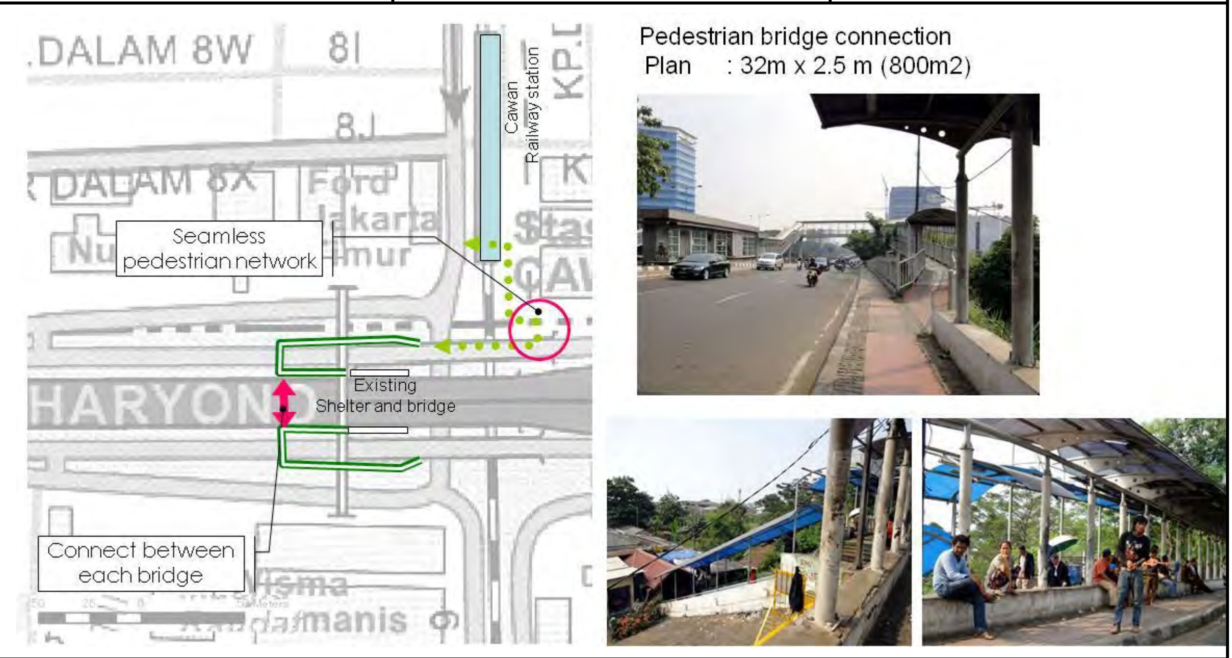
Traffic Operation around Dhkhu Atas Shelter



Source: JAPTraPIS

Figure 8.1.11 Project 2-C Cawang Shelter Pedestrian Bridge Extension

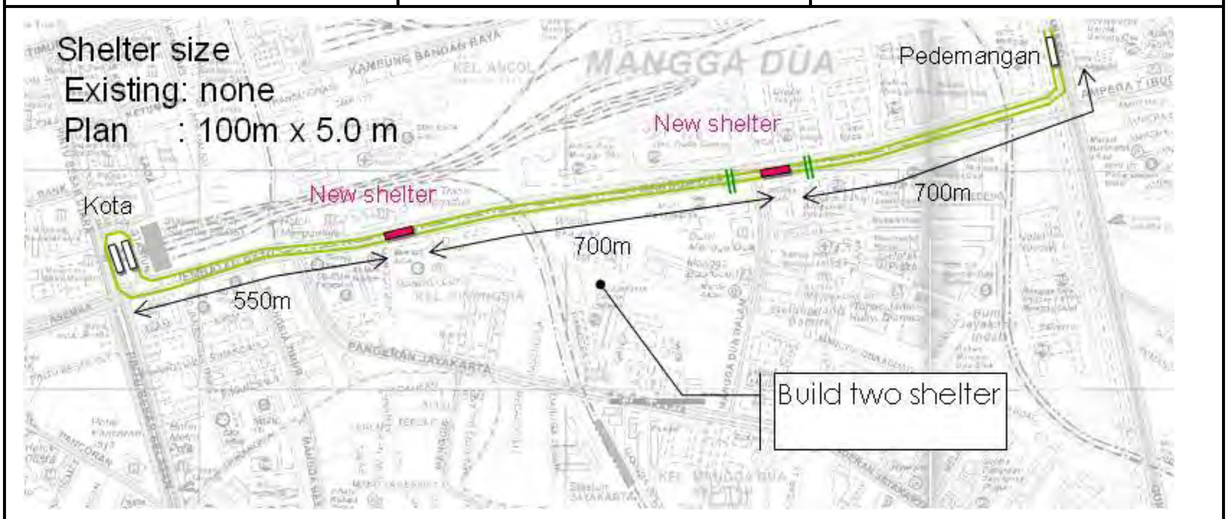
Project / Site	Plan	Related Routes
St.Cawan shelter pede-bridge extension	Stasiun Cawan pedestrian improvement	Through BRT 6, 9, 22



Source: JAPTraPIS

Figure 8.1.12 Project 3-A Mangga Dua Shelter Construction

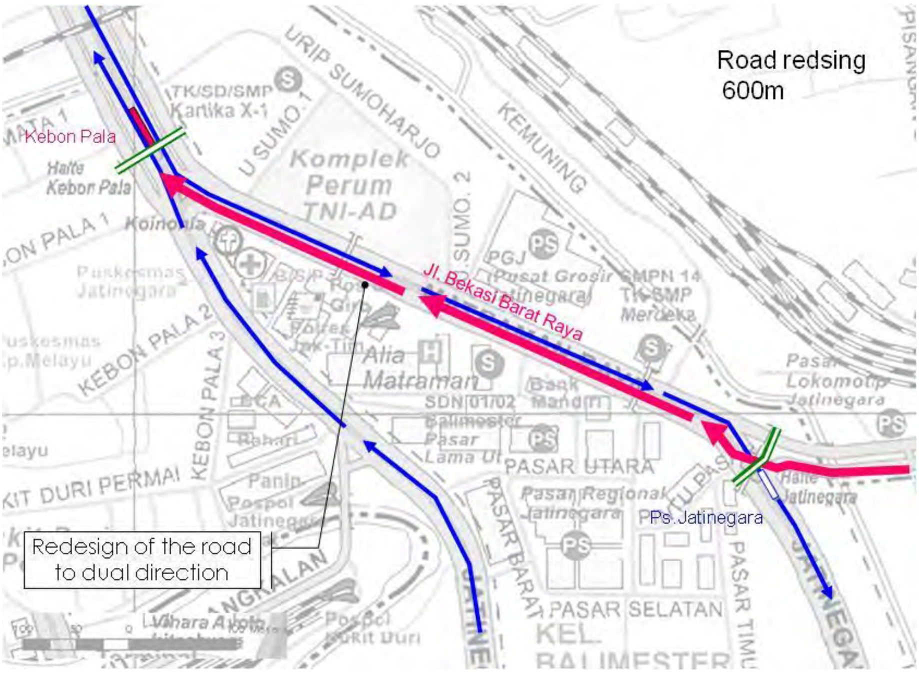
Project / Site	Plan	Related Routes
Mangga dua shelter construction	Busway track, Two new shelters for new corridors	BRT 5, 13, 16



Source: JAPTraPIS

Figure 8.1.13 Project 3-B Kp.Mulayu Road Redesign

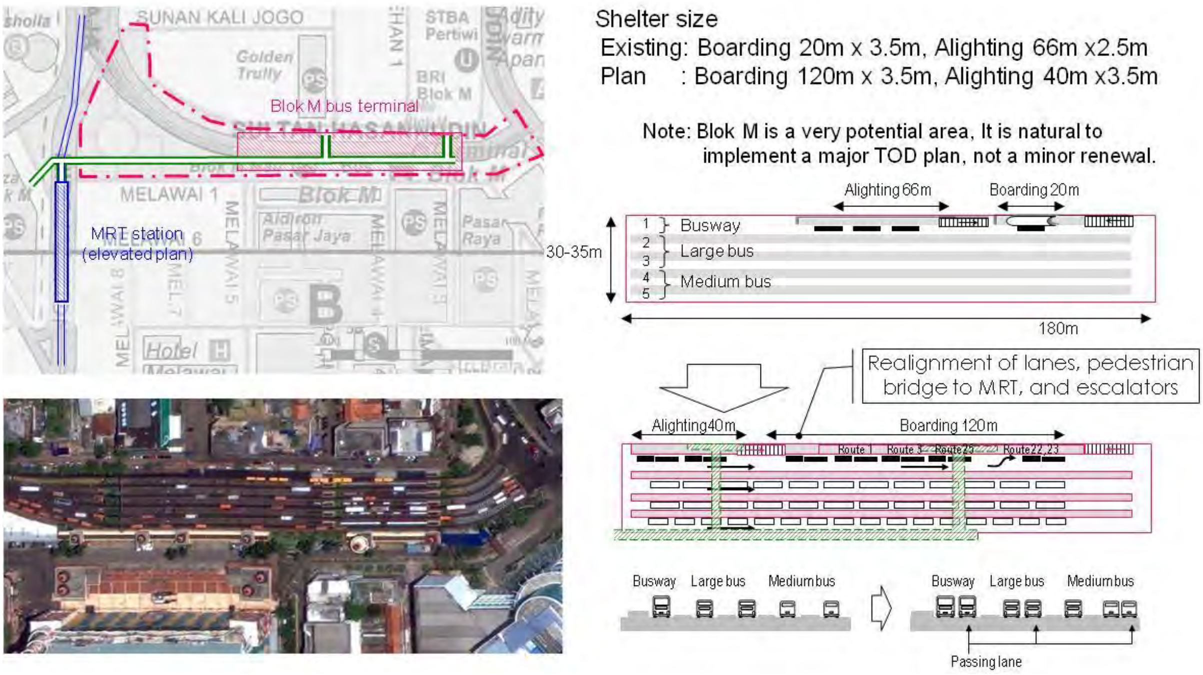
Project / Site	Plan	Related Routes
Kp.Melayu road redesign	Redesign to dual direction on Jl.Bekasi Barat Raya, Kebon Pala shelter modification as a transfer station	BRT Route 4,11,27 Intermediate 47



Source: JAPTraPIS

Figure 8.1.14 Project 3-C Blok M Terminal Modefication

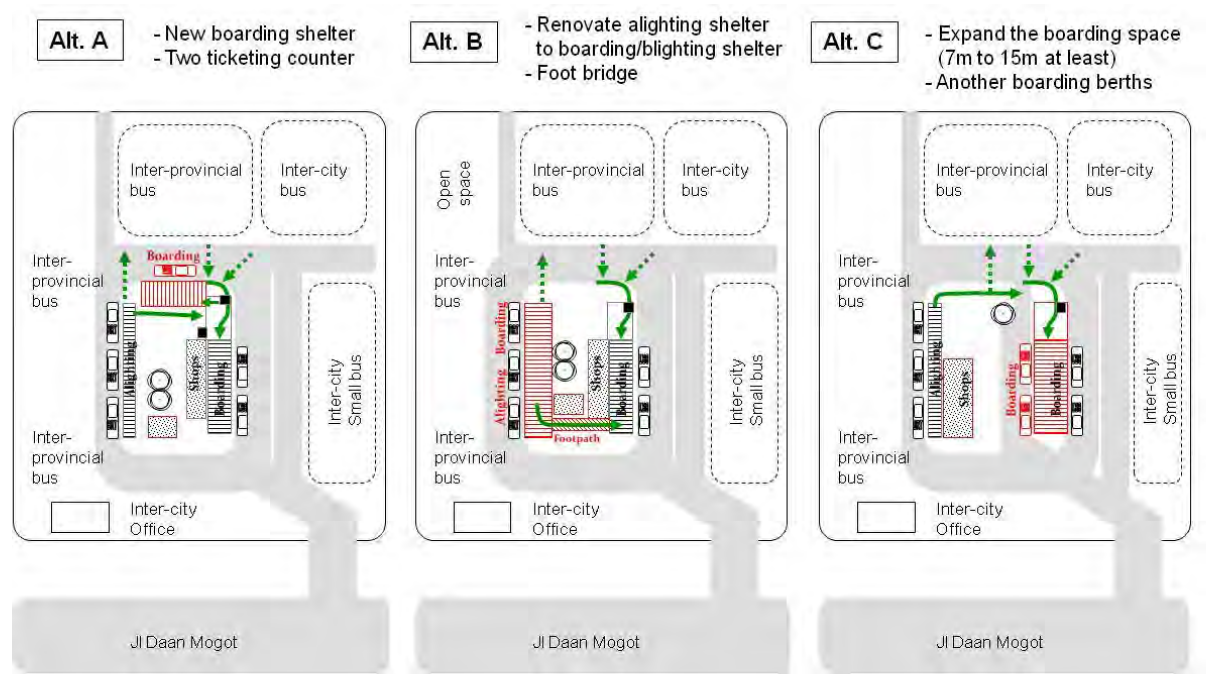
Project / Site	Plan	Related Routes
Blok M terminal modification	Increase Blok M busway capacity , Blok M pedestrian deck to MRT station	Terminus: BRT 1,3,25, Intermediate 43,44 Through BRT 8,22,23



Source: JAPTraPIS

Figure 8.1.15 Project 4 Kalideres Terminal Impovement

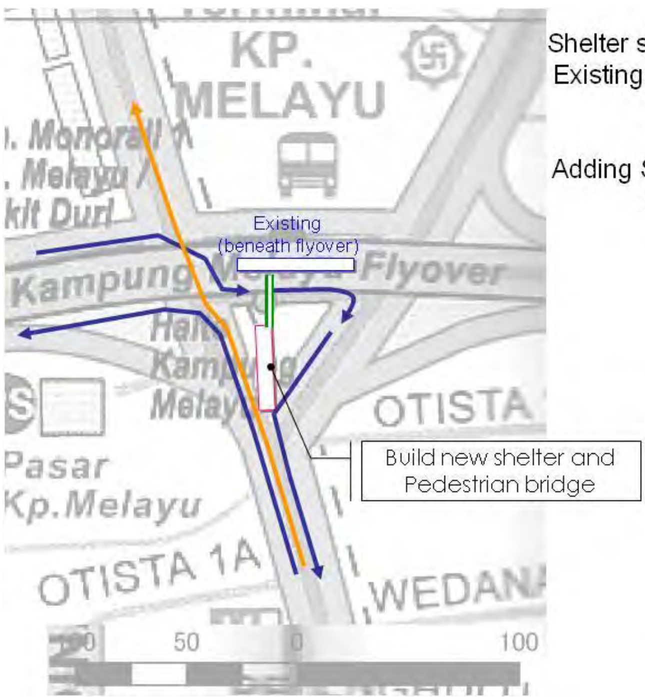
Project / Site	Plan	Related Routes
Kalideres shelter improvement	Increase boarding space for Transjakarta and Tangerang	Terminus: BRT 25 Through: BRT 2,13



Source: JAPTraPIS

Figure 8.1.16 Project 5 Kp. Melayu Shelter Modefication

Project / Site	Plan	Related Routes
Kp.Melayu shelter modification	Build new shelters to north-south alignment	Terminus: BRT 27, Intermediate 47 Through BRT 4,11



Shelter size
Existing: Boarding 20m x 3.5m, Alighting 66m x2.5m used for Route 27

Adding Shelter
: 40m x 5m (two berths)

Source: JAPTraPIS

Figure 8.1.17 Project 6 Upgrading of Corridor 1,2 and 3

Project / Site	Plan	Related Routes
Corridor 1,2&3 upgrading	track, shelter for articulated and bridge	Corridor 1,2&3

Busway Track
- Pavement refresh for the smoother track
- High separator to prevent the entering cars and motor cycles, for safety

Shelter
- Extension for articulated bus
- Priority boarding space where the space allows (e.g. Harmoni)
- Renewal or rebuilt for more comfortableness
- Aluminum floor to more stable materials
- Management improvement for well maintenance (floor, ceiling and platform doors)
- Sign improvement
- BRT/Transit information

Pedestrian bridge
- Aluminum floor to more stable materials
- Reoperation the existing elevators (Kota, Sarina, Tosari)
- Docking to the neighboring buildings (Sarina, Semanggi)
- Management improvement for well maintenance (floor, ceiling and platform doors)
- Escalators for high demand shelters.

Source: JAPTraPIS

8.2 Bus Location System and Control Center

In order to improve the operational efficiency of BRT system by strengthening the function of control center, effective bus location system is to be introduced.

Mounted GPS equipment will send the location information to base station with every few minutes. This data would be utilized at Bus Location System to calculate estimate time of arrival (ETA) to each bus stops and destinations, and inform it to customers by PC, Mobile phone or on top monitors at bus stations.

It can help to identify the real time location of all buses and delayed information. If system sends this information to customers, it can avoid customers' irritation and complains about "When my bus will be arrived?" The customers can check the real time information by PC or mobile phone at any time anywhere, and we can put real time monitor at each bus station to show the information.

On the other hand, BRT Agency (including real operators) would be able to receive not only same data, but also all operational data such as Operation mileage, operational time, operational frequency, etc. through the system.

Assisting Operational Instruction: With this system, ground officers of control center can receive real time location data, and they instruct appropriate headways, timing of re-fueling, resting, or the timing to return to the depot.

Management of Operation: BRT Agency and real operators can capture and manage all operational data automatically, which now they are recording manually. It is essential for operator to manage accurate and real time operational data. It also helps ground officer and driver who will not have to write the operational mileage by hand at the moment.

Information to Customers: The system would be able to send real time location data of fleets by using their mobile phones, PC through internet before they arrive at bus station, which helps to reduce irritation of customers. Also it is necessary to set monitors to each shelter to show the real time location of upcoming fleets and estimate time of arrival. If traffic accidents or the other events happen, control center should input such events to be seen at PC, mobile phone, or monitors at station. It is also important that LED display in their fleet should be utilized as their Destination/Next Stop indicators.

The development of bus location system will be in accordance with the development of BRT route network. The table below shows the component of the system development, phasing and estimated cost. The development of system requires about US$13.8 million to cover entire BRT network by 2020.

Table 8.2.1 Bus Location System Decelopment

Item	Unit Price (US$)	Qty	Phase	Cost (US$) (2012-2014)	Cost (US$) (2015-2020)
Equipment in Bus	@2,000	1,100	2012-2014	2,200,000	-
		1,400	2015-2020	-	2,800,000
LED Indicator inside Bus	@1,000	1,100	2012-2014	1,100,000	-
		1,400	2015-2020	-	1,400,000
Radio system	@1,000	1,100	2012-2014	1,100,000	-
		1,400	2015-2020	-	1,400,000
Information Monitor at Bus Station	@5,000	260	2012-2014	1,300,000	-
		180	2015-2020	-	900,000
Monitor at Control Center	@2,500	20	2012-2014	50,000	-
PC sets	@1,300	30	2012-2014	39,000	-
System Development and Server				1,500,000	-
Total				7,289,000	6,500,000
				13,789,000	

Source: JAPTraPIS
Note: Excluding cost of the space for control center and required LAN establishment.

8.3 Bus Ticketing System

As it is described in the design elements for improving BRT, Rechargeable Contactless IC Card system which has commonly been used in many countries, is proposed. The system should include following basic functions.

- Grasp the accurate passengers’ activities
- Recharging system and equipment should be placed at each station and major points within the network.
- Accommodate various fare systems
- Interchangeability with the other public transportation

The system should be implemented in entire network in same time. The system will need huge investments, however, it should be regarded as one of the most important and fundamental factors for operators’ efficient operation and management, therefore it is better to be implemented as soon as possible.

System outline: Usage of the card involves passing it over a card reader on Auto Gate or Touching Devices. The technology allows for the card to be read at some distance from the reader, so physical contact between card and touch device is not required. The card is passed over the card reader when the passenger enter the origin station, which is not deducted the fare at that time. A travel record is stored on the card, then on exit, the card is again passed over the card reader. At this time, the fare is deducted from the remaining balance from the card.

Each bus station should install the sales terminal to cater following functions, 1) issuing the new card, 2) recharging, 3) cancellation and 4) repayment

The information about Revenue, Card usage, and negative data will be transferred to Center system for their data management. Center system also sends master data such as fare information, bus stop information, and negative data to all sales terminal to synchronize the system network.

The installation places for sales terminal wouldn't only be at bus stations, but also at convenience shops or the other convenient places to enhance the customer satisfaction.

The development of the system will be in accordance with the development of BRT route network. The table below shows the component of the system development, phasing and estimated cost. The development of system requires at least US$20.5 million (excluding optional functions) to cover entire BRT network by 2020.

Table 8.3.1 Bus Ticketing System Decelopment

Item	Unit Price (US$)	Qty	Phase	Cost (US$) (2012-2014)	Cost (US$) (2015-2020)
Automatic Gate at shelter (2 gates/ shelter)	@7,500	520 360	2012-2014 2015-2020	3,9 00,000 -	- 2,700,000
Sales Terminal at Shelter	@5,000	260 180	2012-2014 2015-2020	1,300,000 -	- 900,000
System Development and Server			2012-2014	10,000,000	-
Handy Terminal in Intermediate Bus	@4,000	160 120	2012-2014 2015-2020	800,000 -	- 600,000
Software Development for intermediate bus			2012-2014	250,000	
Wireless LAN Equipment and Server for Intermediate Bus			2012-2014	30,000	-
Optional:					
Auto Recharging Machine	@35,000				
Auto Issuing Machine 1/	@13,000				
Simplified Touching Device 2/	@15,000				
Total 3/				16,280,000	4,200,000
				20,480,000 + optional	

Source: JAPTraPIS
Note: 1/ selling encoded IC card with fixed price
2/ require minimum 2 devises per shelter for entrance/exit
3/ excluding the cost of required LAN establishment

8.4 Park & Ride Facility Development

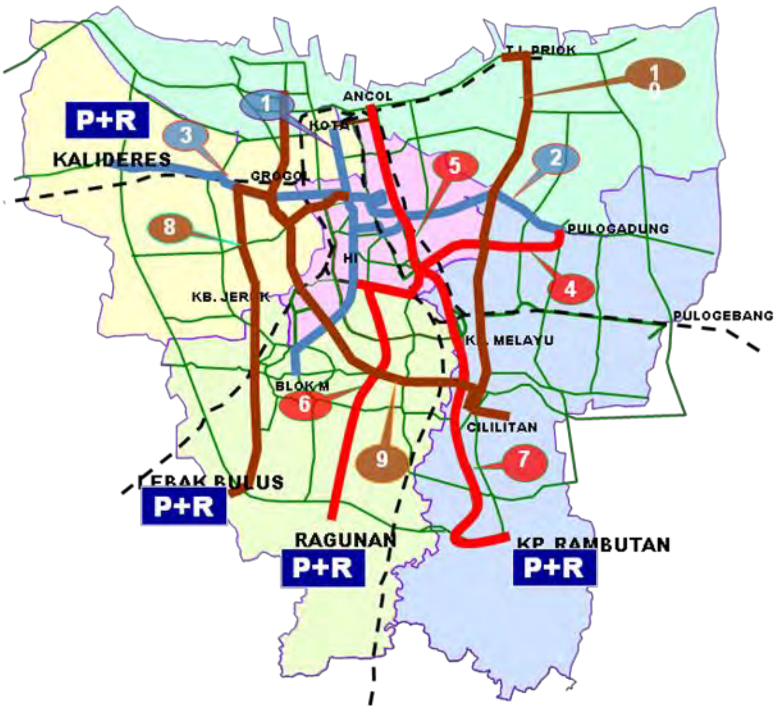
1) Current Status of Park & Ride

Park and ride is used at the railway stations in Jabodetabek, and at stations outside of DKI Jakarta along the Serpong line and Bogor line. Rawa Buntu Station in Serpong line has the parking lot of 250 cars which is heavily used as shown in Figure 8.4.1. This shows a preference by some to commute by train instead of private car and motorcycle and avoiding traffic stress. The parking lots at the stations are usually operated by the railway company (PT.KAI), using their land near by the stations. However, one of the problems is that stations do not have enough access roads for cars.

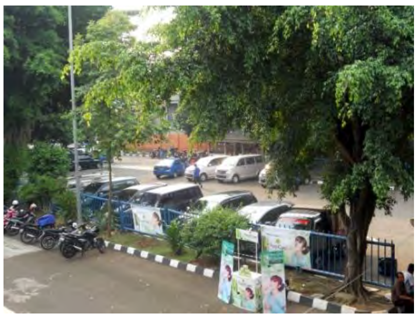
Figure 8.4.1 Park & Ride at Rawa Buntu Railway Station

There are also park and ride facilities at busway terminals; Kalideres, Lebak Bulus, Ragunan and Kp. Rambutan. The sizes of the lots are mostly below 50 car capacity except for Ragunan which use the parking space at Ragunan Zoo.

Figure 8.4.2 Existing Park & Ride Facility at Busway Terminals



Parking space at Lebak Bulus Terminal



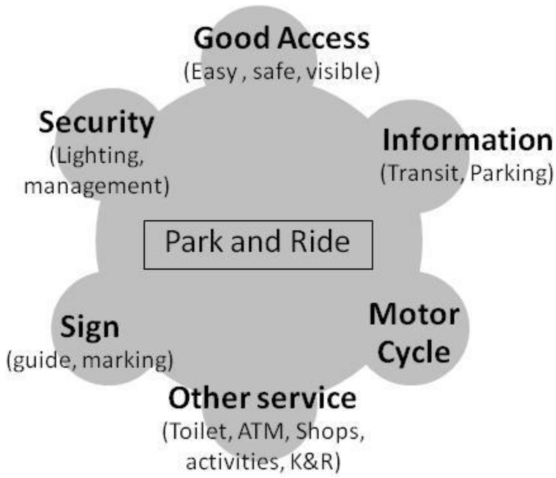
Source: JAPTraPIS

2) Recommended Functions and Facilities

The purpose of Park and Ride stations is to extend the reach of public transport into areas that may not yet have adequate public transport or do not have the level of demand necessary to support services. Providing Park and Ride facilities is aimed at encouraging the motorist from these areas to park the car and motorcycle and use public transport, reducing the volume of private vehicles entering the city.

To effectively perform this function, park and ride stations need to be convenient and be recognizable as part of the transport system. Park and Ride facilities need to be designed and equipped with the following features:

- A secure facility in which a motorist can confidently leave their car and motorcycle
- Good and safe access to the train/bus station
- Good lighting to create a safe environment of evening use and discourage malicious behaviour
- Variable signage information showing next train/bus departure
- Emergency numbers for safety concerns or issues requiring mechanical assistance (flat tire/flat battery)
- Clean toilet facilities
- Good passenger information signage branding to connect the parking facility with the transport system
- Parking charge (if applied) integrated with the transport fare to provide discount to public transport travellers
- In busy locations, variable signs showing parking lot availability (free spaces) to reduce the time searching for a space



Of course, Park and Ride facilities cannot be viewed in isolation. People will use a Park and Ride facility if it meets their total travel need, not just as a place to park the car. Providing a first rate facility to transfer the passenger to a third rate system would not be a successful approach. Travel routes should provide good and efficient connections and the system should not be overcrowded. Providing convenient parking facilities to access an efficient transport system is likely to attract motorists, and reduce traffic impacts on arterial roads.

An example is the pilot project of JUTPI, park and railway ride is carried out using the existing parking facility of the shopping mall (Depok Town Center) at Pondok Cina station of Bogor line. The result of the project's survey shows that the important factors whether to use the park and ride system are "quality of mass transportation" and "quality of walkway from the parking lot to the station" beside the location.

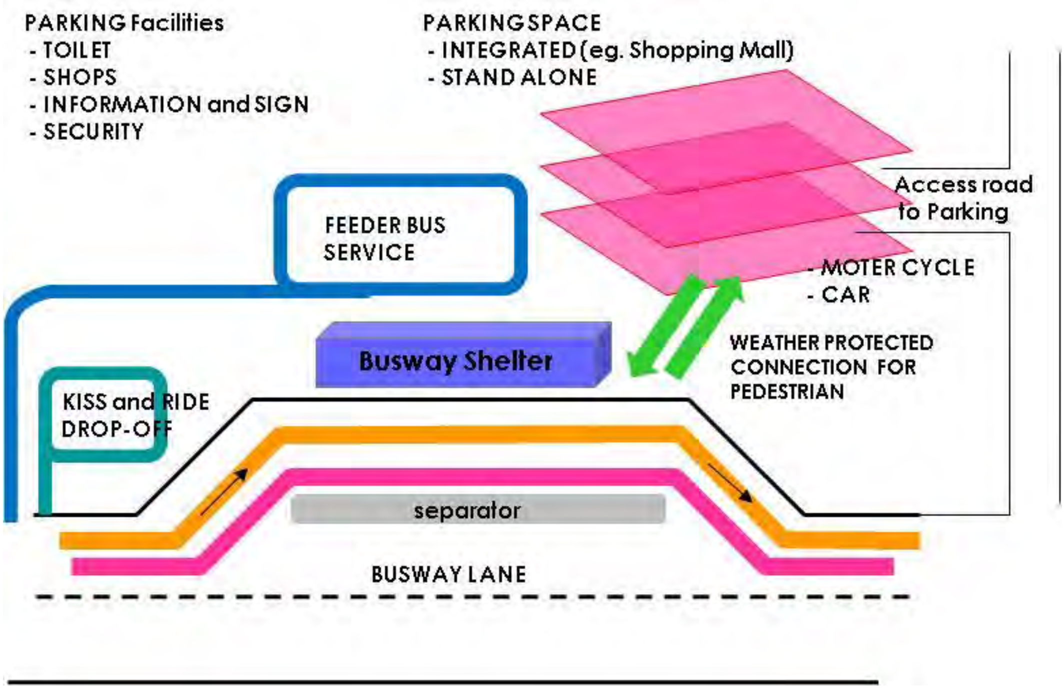
The project budget has improved the walkway from the parking lot to the station with further improvements of the walkway carried out by the owner of the shopping mall as a result of the revenue of the additional parking lots and increase of the customers.

3) Conceptual Design

Facilities for park and rides can be varied depend on the actual site and include motorcycle users. Figure 8.4.3 is a conceptual design for park and ride.

The size of a parking lot should be based on the needs and the constraint of the site. Figure 8.4.4 is an example of park and ride facilities at Fairfax county (suburb of Washington D.C.), there are different type and size of parking lots.

Figure 8.4.3 Conceptual Design for Park & Ride Facility



Source: JAPTraPIS

Figure 8.4.4 Example of Park & Ride Facility in Washington Metropolitan Area, USA

SMALL SIZE

Name	Sully Station Park and Ride
Location	Fairfax county, VA 36km from Washington D.C. Near the I.C. of highway
Transit Availability	Bus
Parking Space	38 spaces Part of Govt. office Parking
Parking Fee	Free
Maintenance	Local Government

MIDIUM SIZE

Name	Springfield Plaza Park and Ride
Location	Fairfax county, VA 18km from Washington D.C. Near the I.C. of highway
Transit Availability	Bus and Metro Part of Shop parking
Parking Space	258 spaces
Parking Fee	Free
Maintenance	Shop company

LARGE SIZE

Name	Hendon-Monroe Park and Ride
Location	Fairfax county, VA 32km from Washington D.C. Near the I.C. of highway
Transit Availability	Bus and Metro
Parking Space	1,745 spaces Parking Building
Parking Fee	Free
Maintenance	Metro company

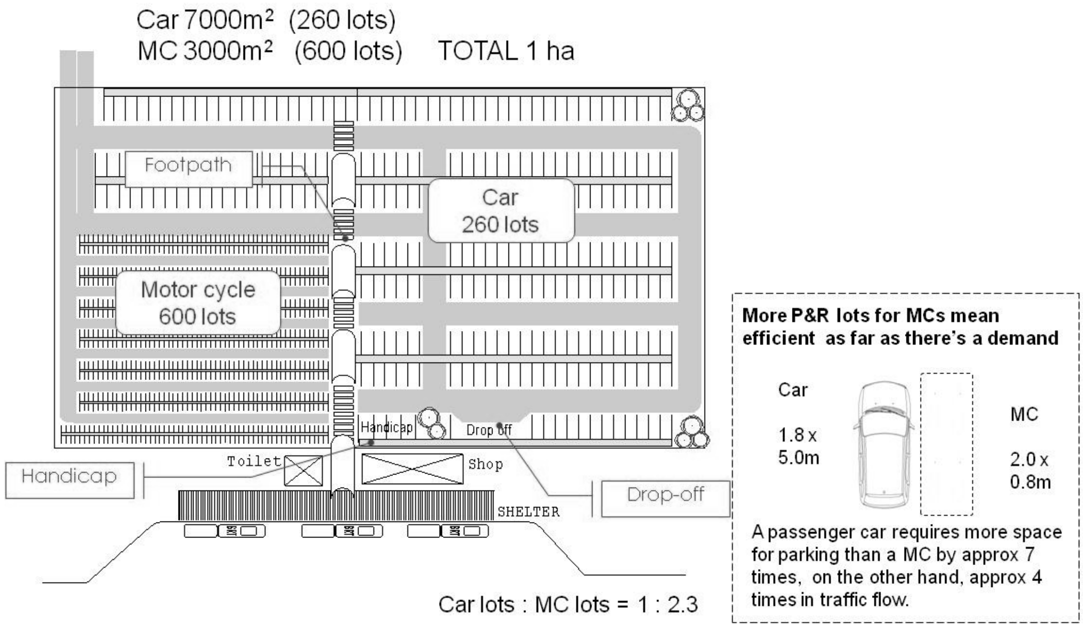
Source: JAPTraPIS

Typical Facility Layout (suburban area):

Basic considerations of planning facility layout are follows:

- The traffic flow of the passenger cars is approx 400 thousand, and that of MCs is 900 thousand per day (16 hours) at the DKI cordon; the ratio is 1:2.25.
- The number of lots for MCs should be more than twice that of passenger cars, as MC are more efficient in terms of traffic congestion.

Figure 8.4.5 Typical Layout Plan

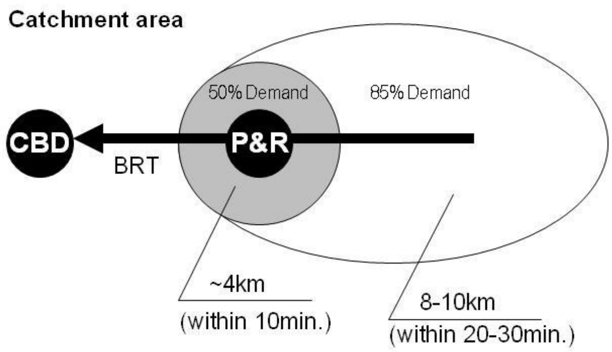


Source: JAPTraPIS

4) Proposed Site Locations

Criteria for Site Selection: Park and Ride system is one of the supporting measures to promote people to use more public transportation and reduce private vehicle traffic, which helps to alleviate traffic congestion. The following criteria should be used as general guidelines to help where to locate the facilities.

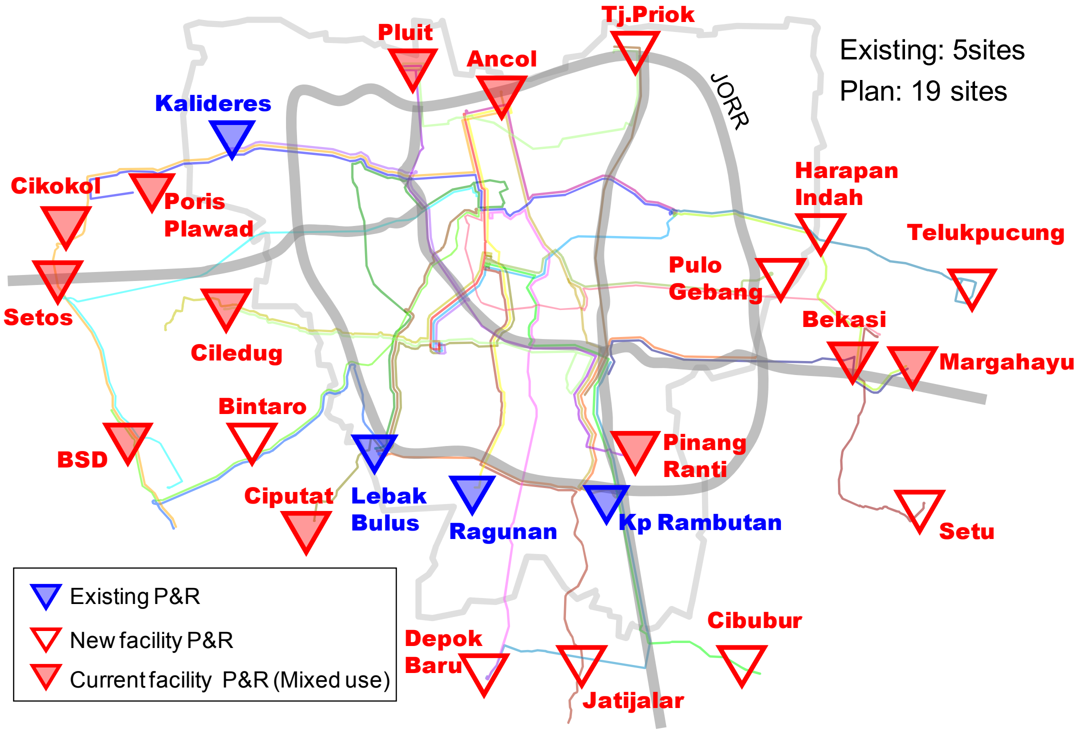
- Outside/around of JORR
- Good public transport service (BRT)
- Easy access to/from residential areas
- Utilization of existing facilities
- Available space adjacent to the shelter
- Consideration of catchment area



Proposed Site Location:

Based on the proposed BRT network and criteria set above, 19 site locations are identified for the development of park & ride facility.

Figure 8.4.6 Proposed Site Locations for Park & Ride Facility Development



Source: JAPTraPIS
Note: At Poris Plawad and Kalideres terminals the P&R facility is available but not utilized yet.

Table 8.4.1 List of Proposed Park & Ride Facilities with Current Conditions

No.	Shelter	Outside JORR	Access to Residential	Public Transport	Existing Parking Facility	
					P&R	Parking facility
1	Kalideres	X	X	BRT(3)	2,500m2	Yes, Inside terminal (not utilized)
2	Lebak Bulus	X	X	BRT(4), MRT	700m2	Yes, In the bus terminal
3	Ragunan	X	X	BRT(1)	7,500m2	Yes, Zoo parking lot (highly utilized)
4	Kp.Rambutan	X	X	BRT(1)	800m2	In the bus terminal
5	Poris Plawad	X	X	BRT(1), Rail	2,000m2	Yes, Bus terminal (not utilized)
6	Pluit	X	X	BRT(2)	-	Yes, Shopping mall
7	Tj.Priok	X	X	BRT(2)		NO, Bus terminal
8	Ancol	X	X	BRT(4)		Yes, Shopping mall
9	Pinang Ranti		X	BRT(1)	-	No, Utilization of Inter-city bus terminal
10	Pulo Gebang	X	X	BRT(1), MRT	-	No, Bus terminal is under construction
11	Bekasi	X	X	BRT(2)	-	Yes, Shopping mall
12	Margahayu	X	X	BRT(3)	-	No, Bus Terminal
13	Telukpucung (Bekasi)	X	X	BRT(1)	-	No, Residential Development
14	Harapan Indah	X	X	BRT(2)	-	No, Residential Development
15	Setu	X	X	BRT(1)	-	No, Residential Development
16	Setos	X	X	BRT(1)	-	Yes, Developed Area
17	Cikokol	X	X	BRT(1)	-	Yes, Shopping mall
18	Ciledug	X	X	BRT(2)	-	Yes, Shopping mall
19	BSD	X	X	BRT(3)		Yes, Some activites
20	Bintaro	X	X	BRT(1)	-	No, Residential Development
21	Ciputat	X	X	BRT(1)	-	Yes, Shopping Center
22	Cibubur	X	X	BRT(1)	-	No, Residential Development
23	Jatijalar	X	X	BRT(2)	-	No, Residential Development
24	Depok Baru	X	X	BRT(1)	-	NO, Bus terminal

Source: JAPTraPIS

5) Implementation Schedule

The implementation schedule of park and ride should be synchronized with the implementation of the mass transportation, particularly with BRT network development. Also, consultations with owners of current facilities and review of existing development plans (bus terminal, residential development etc.) needs to be conducted.

Table 8.4.2 Implementation Schedule of Park & Ride Development

Park&Ride site		Existing	2012	2013-14	2015-20	P&R type	Candidates for the parking lots
1	Kalideres	Existing	90			Bus terminal	not utilized, need good access road
2	Lebak Bulus	Existing	25			Bus terminal	Integration with MRT terminal is needed
3	Ragunan	Existing	280			Bus terminal	Highly utilized
4	Kp.Rambutan	Existing	30			Bus terminal	
5	Poris Plawad	Existing	75			Bus terminal	not utilized, Busway is not operated yet
6	Pluit			200		Mixed use	Parkings of Pluit village
7	Tj.Priok			200		Bus terminal	New development adjacent to bus terminal
8	Ancol			200		Mixed use	Parkings of current activities
9	Pinang Ranti		100			Bus terminal	Inside Pinang Ranti terminal and depo
10	Pulo Gebang		100			Bus terminal	Bus terminal is under construction
11	Bekasi			300~		Bus terminal	New development adjacent to bus terminal
12	Margahayu			300~		Mixed use	Parkings of Metropolitan mall
13	Telukpucung				300~	Suburban	New development along the corridor
14	Harapan Indah		300~			Suburban	New development along the corridor
15	Setu				300~	Suburban	New development along the corridor
16	Setos				300~	Mixed use	Parkings of building complex
17	Cikokol			200		Mixed use	Parkings of Tang City Mall
18	Ciledug				300~	Mixed use	Parkings of Ciledug plaza
19	BSD				300~	Mixed use	Parkings of ITC BSD and others
20	Bintaro				300~	Suburban	New development along the corridor
21	Ciputat				200	Mixed use	Parkings of Ps.Ciputat
22	Cibubur				300~	Suburban	New development along the corridor
23	Jatijajar				200	Suburban	New development along the corridor
24	Depok Baru				300~	Bus terminal	New development adjacent to bus terminal

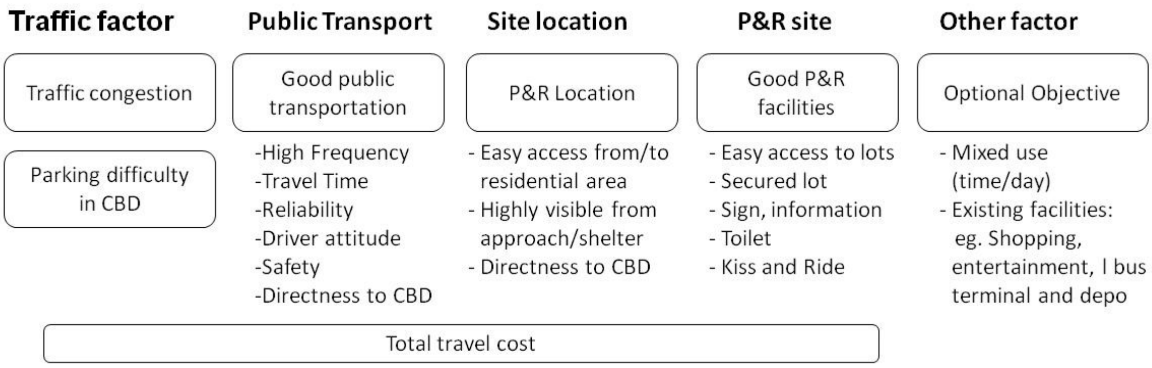
Source: JAPTraPIS
Note: pcu: passenger car unit, Required space is set: 500 pcu (Existing), 2,500 pcu (2014), 5,000 pcu or more (2020)

6) Key Factors for Success

Park and ride users are a different type of passenger to the normal bus user. They are car oriented and expect a standard of service that is normally higher. They want reliability, cleanliness and a good driver attitude.

Park and ride is not a ‘stand alone’ measure, it is part of a Transport Demand Management Strategy, in addition to the coordination of traffic restraints, parking policy in the CBD, and public transport availability and quality. In Jabodetabek, motorcycle users are also a large target market of park and ride strategy. The level of demand for P&R for MCs and passenger cars will depend on the characteristics of the area, so to assignment of the portion of lots should be balanced accordingly.

Figure 8.4.7 Key Factors to be Considered



Source: JAPTraPIS

7) Management and Operation

Park and ride facilities can be implemented by government, private and under the scheme of public-private partnership depending on the characteristics of the site conditions.

As for the parking fee, it should be inexpensive so as to attract personal vehicle users and can be integrated with the public transport fare. The fee of the proposed parking lots should be decided considering the total expense of a whole trip compared to the existing mode of transportations. The existing fares of park and ride lots are around Rp.5000-7000 for a time/day.

Table 8.4.3 Park & Ride Management and Operation

Items	Implementer		
	Government (Gov't)	Private	PP Partnership
Area Characteristic	• Bus Terminals • Gov't Buildings • Public Parks • Public Facilities (Hospitals, Schools, Religious Facilities) • Public Vacant Lands • Gov't Parkings (Off-street and on-street)	• Commercial Shopping Malls and Complexes • Private Lands/Buildings • Private Facilities (Hospitals, Schools) • Private Residential Area	• Public and private lands and buildings
Planning	• Transportation Agency plan for the area location, capacity, and type of service • Planning and Development Agency (BAPPEDA) design the Detail Engineering Design (in some cases handled by Public Works Agency)	• Private company in coordination with the public transport/local transport agency	• Gov't plan the site, and private company construct the parking • Private company plans the business, including design and construction, Gov't support the land and permit. • Gov't plan the site, and construct the buildings, but involve third party (company) to do operation and maintenance
Construction	• Transportation Agency construct the buildings and supporting facilities	• Company	
Operation & Maintenance	• Parking Management Unit under Transportation Agency	• Company	• Company
Investment	• Gov't Revenue and Expenditure Budget (APBD)	• Private Investment	• Private Investment in Gov't land • Gov't investment support in private land

Management (Revenue and Expenditure)	• Gov't Revenue and Expenditure Budget (APBD) from Transportation Agency	• Private Investor	• Private Investor
Gov't Revenue	• To City/District Gov't Cash as a Parking Levy Revenue	• Indirectly via Business Revenue Tax / Land Ownership Tax / Land Utilization Tax	• Using contract agreement between Gov't and Private Company
Parking Charge	• Gov't decide using Local Regulation	• Company and following the provision provided by Gov't	• Company and following the provision provided by Gov't
Promotion Strategy	• Integrated with other modes (integrated fares) • Parking charge subsidy / discount • Total Loss / Disaster and Accident Insurances • Promotion Package (with Banners / Signs / Advertisements)	• Same as left	• Same as left
Business Incentive		• Electricity and Water Cost Subsidy/Discount • Land Tax/Business Tax Subsidy/Discount • Easiness to propose the permit • Public Facilities provided by Gov't (Promotion Package) • Additional revenue opportunity for current activities for the weekday.	• Discount rate for rent of Gov't Land • Electricity and Water Cost Subsidy/Discount • Land Tax/Business Tax Subsidy/Discount • Easiness to propose the permit • Public Facilities provided by Gov't (Promotion Package)
Suggested Area from JAPTraPIS	• Bus Terminal P&R • Where there is a government lands/buildings	• Mixed-use P&R • Suburban P&R • Where high	• Mixed-use P&R • Suburban P&R

Source: JAPTraPIS

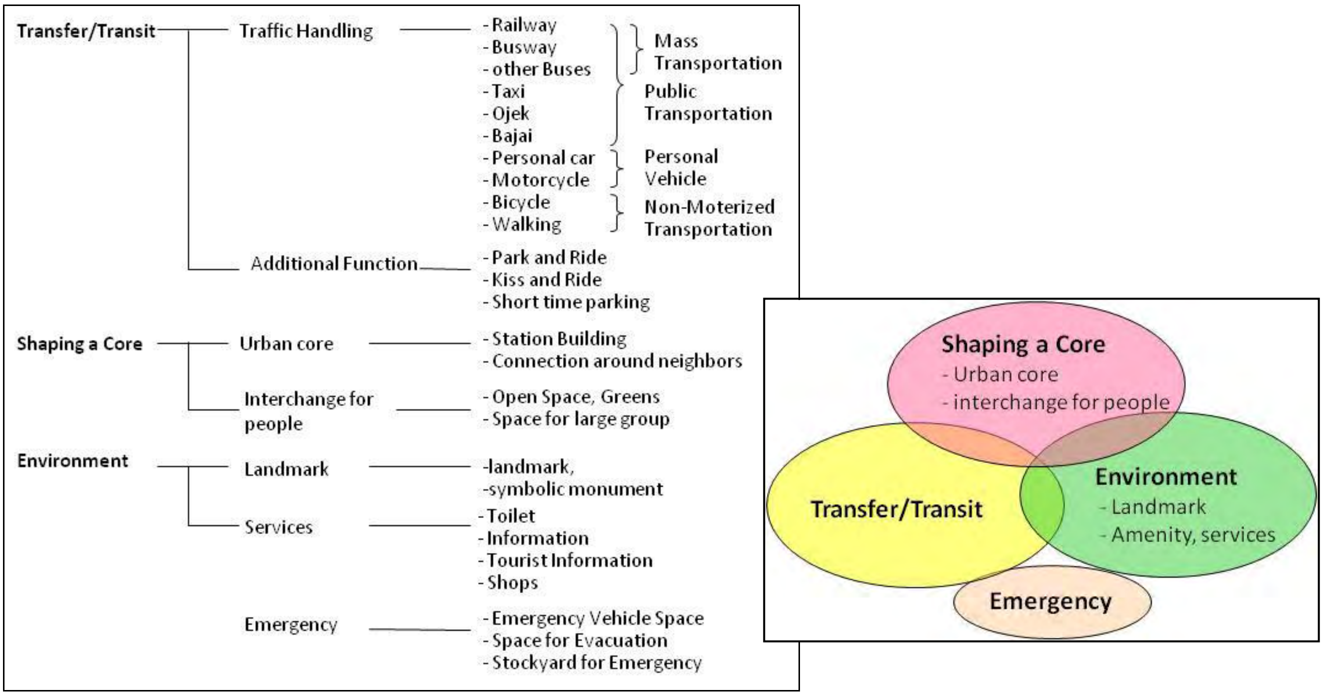
8.5 Integrated/Multimodal Terminal Development

1) Concept and Functions

Integrated/Multimodal Terminal is the place where transfer/transit between deferent transport mode. (e.g. train to bus) Terminals with traffic functions and urban functions can also be integrated terminals (refer to Figure 8.5.1).

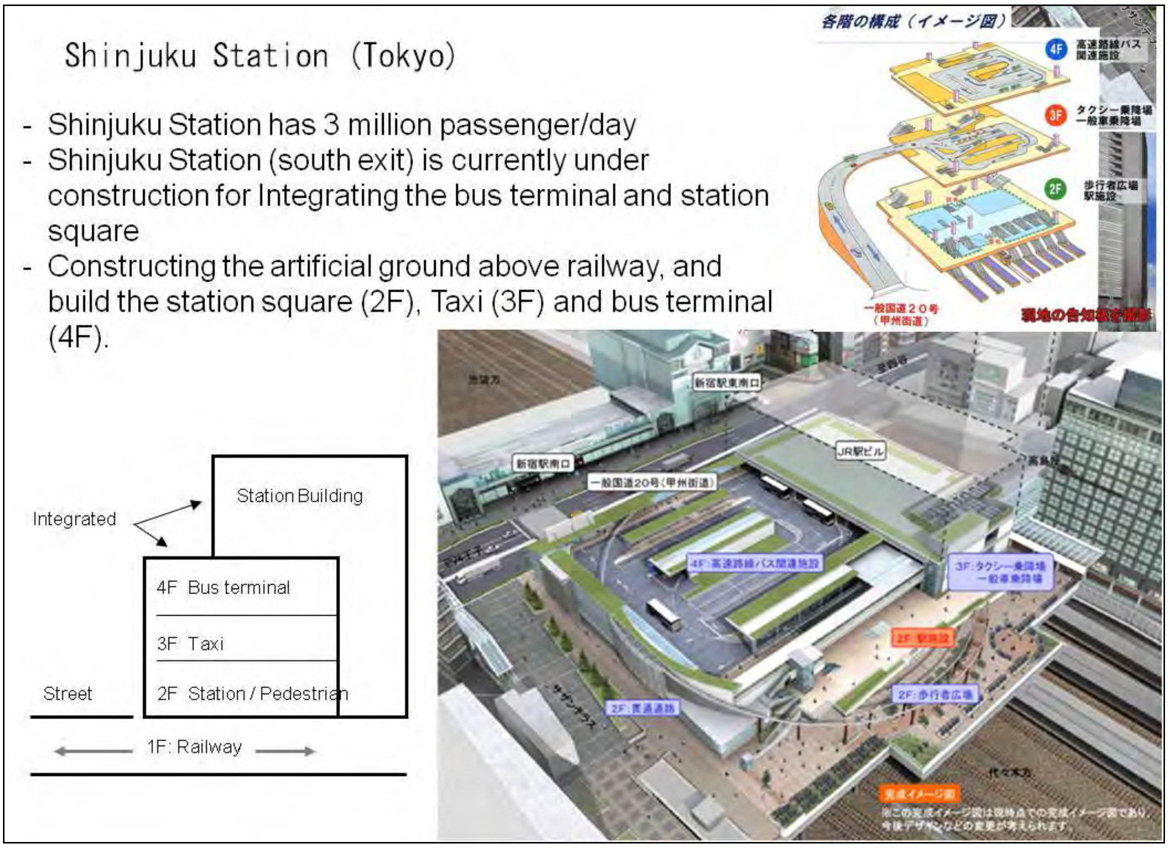
Terminals integrated with MRT/railway and busway is the highest potential in terms of urban development/Transit Oriented Development (TOD) (refer to Figure 8.5.2 to Figure 8.5.4).

Figure 8.5.1 Functions of Integrated/Multimodal Terminal



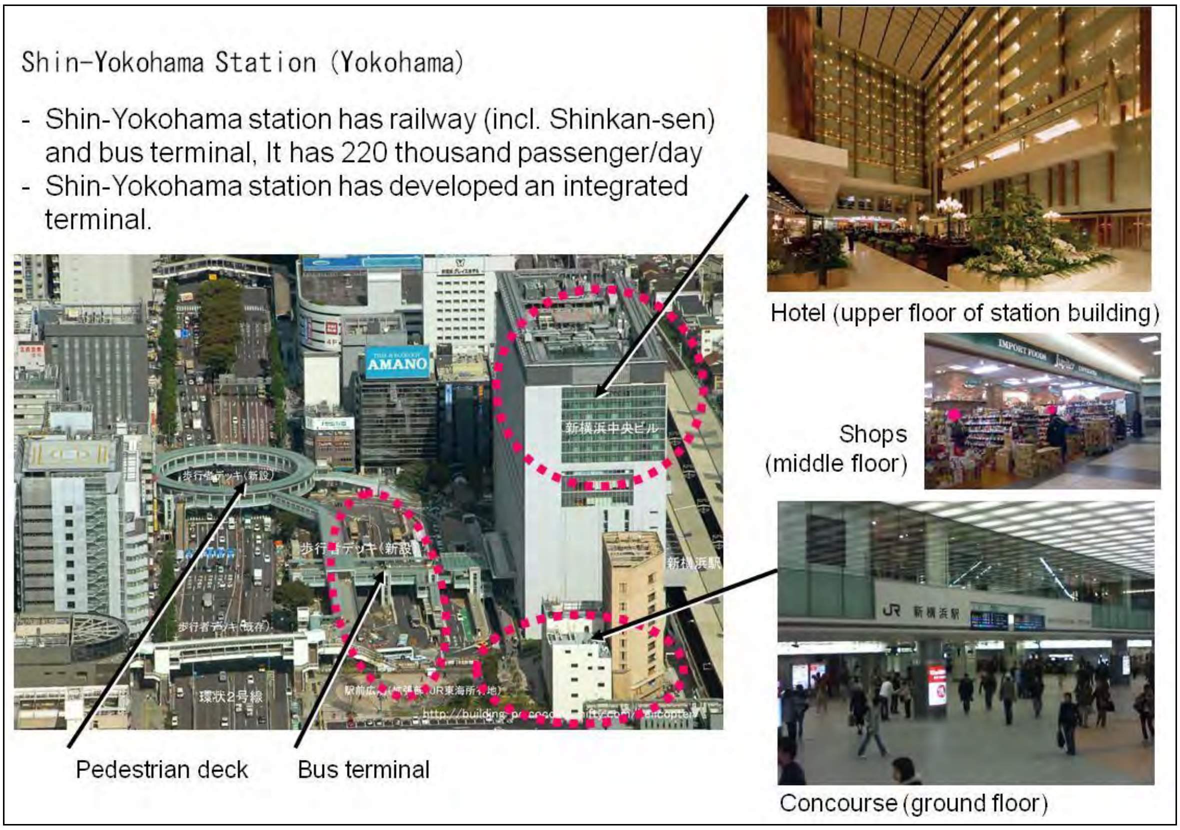
Source: JAPTraPIS

Figure 8.5.2 Example of Integrated Terminal/TOD (Sinjuku, Tokyo)



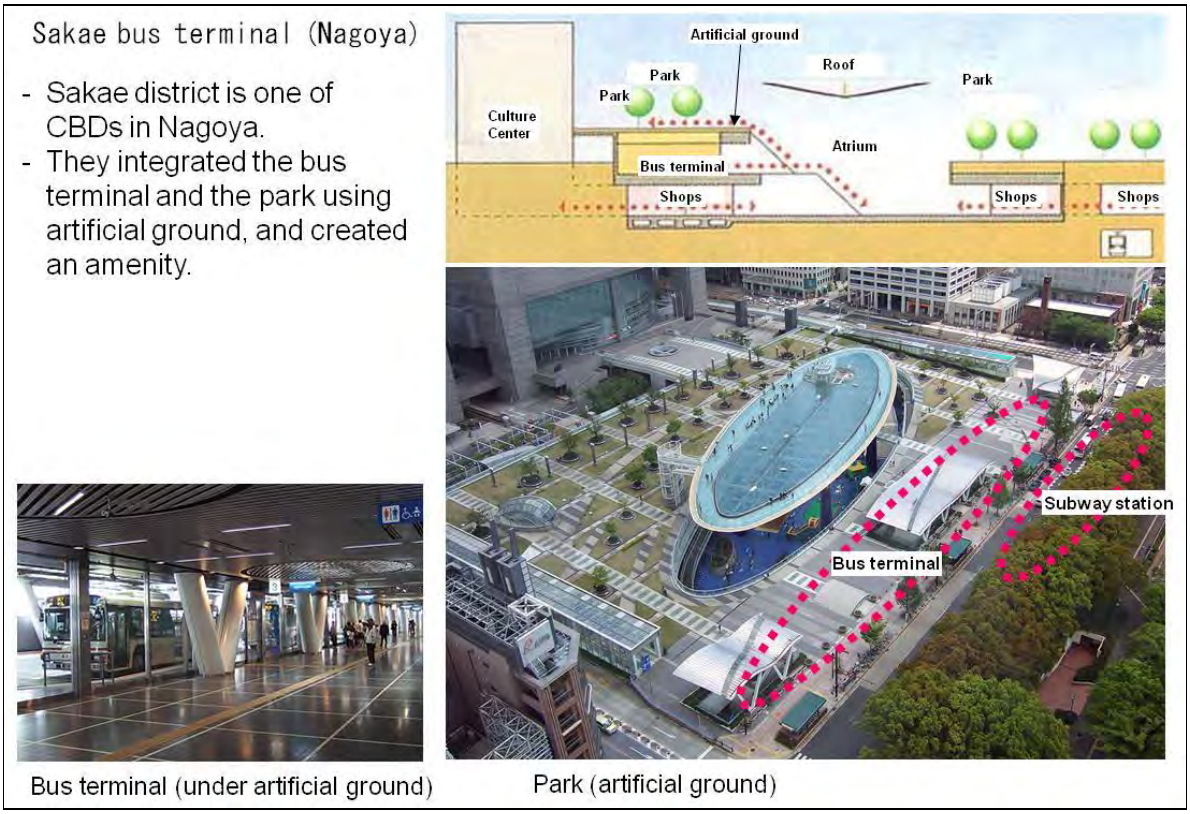
Source: JAPTraPIS

Figure 8.5.3 Example of Integrated Terminal/TOD (Shin-Yokohama, Yokohama)



Source: JAPTraPIS

Figure 8.5.4 Example of Integrated Terminal/TOD (Sakae, Nagoya)

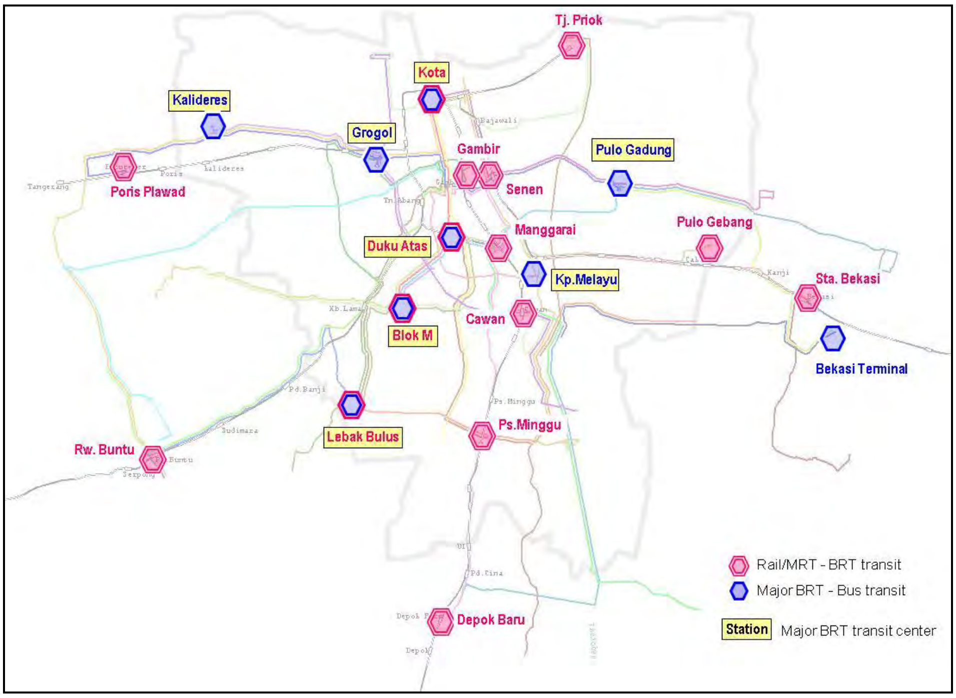


Source: JAPTraPIS

2) Proposed Site Locations

In accordance with the proposed BRT network and other public transport network such as MRT and Jabodetabek Railway, 20 site locations are identified for the development of future integrated / multimodal terminal as shown in Table 8.5.1 and Figure 8.5.5. The proposed development for the major terminals is described in Table 8.5.2.

Figure 8.5.5 Proposed Site Locations for Integrated/multimodal Terminal



Source: JAPTraPIS

Table 8.5.1 List of Proposed Integrated/Multimodal Terminals with Current Conditions

Integrated/Multimodal Terminals

	Bus Shelter	Existing			Plan				Ordinary Bus Frequency / day				Ordinary Bus Pax (assumption)	remarks
		Railway (station)	BRT (shelter)	Bus Terminal	MRT	BRT Route (# of route)	BRT Route (# of T'ml route)	Intermediate (# of route)	Patas	Reg. Med.	Small	total		
1	**Kota**	✔	✔	✔	NW (2020)	**1 → 5**	**1 → 2**	-	0	349	3,531	3,880	24,635	BRT 'n railway station: neighboring
2	**Dukuh Atas 1&2**	✔	✔		NW (2016)	**3 → 7**	**2 → 5**	-	-	-	-	0		BRT 'n Surirman station: 300m PPP proposal, Airport link is planned
3	**Blok M**		✔	✔	NW (2016)	**1 → 5**	**1 → 3**	3	479	3,845	64	4,388	91,590	Many medium+small buses stop on the road
4	**Lebak Bulus**	✔	✔	✔	NW (2016)	**1 → 5**	**1 → 4**	1	73 (88)	1,003 (113)	2,427 (468)	4,172	41,625	*( ) number is outside of BT, along the street.
5	Tj. Priok	✔	✔	✔		1 → 2	1 → 2	3	579	1,090	2,710	4,379	52,720	BRT 'n railway station: neighboring
6	Gambir	✔	✔			3 → 4	0 → 0	-	-	-	-	0		BRT 'n railway station: 150m
7	Senen	✔	✔	✔		3 → 3	0 → 0	-	242	1,683	1,721	3,646	49,525	BRT 'n railway station: neighboring
8	Manggarai	✔	✔	✔		3 → 4	0 → 0	-	-	-	-	0		BRT 'n railway station: 350m Airport link railway is planned
9	Pasar Minggu	✔	✔	✔		0 → 1	0 → 0	-	49 (22)	68 (1,574)	4,025 (3,702)	9,440	73,605	*( ) number is outside of BT, along the street.
10	Pulo Gebang		under construction		EW (2020)	0 → 1	0 → 1	-	-	-	-	0		1km to planned Cakung station
11	Kp.Melayu		✔	✔		1 → 3	2 → 1	1	24	1,412	4,207	5,643	49,995	
12	Sta.Bekasi	✔				0 → 3	0 → 3	2	-	-	-	0		
13	Terminal Bekasi			✔		0 → 2	0 → 2	2	440	91 (39)	2,923 (1,032)	4,525	35,575	*( ) number is outside of BT, along the street.
14	**Pulo Gadung**	✔	✔	✔		2 → 5	2 → 4	1	164	901	4,156	5,221	43,720	
15	**Grogol**	✔	✔	✔		3 → 5	0 → 0	-	133 (88)	244 (1,278)	358 (878)	2,979	43,250	BRT 'n railway station: 800m *( ) number is outside of BT, along the street.
16	Cawan	✔	✔			3 → 5		-	-	-	-			BRT is on the flyover
17	Poris Plawad	✔		✔	EW (2020)	0 → 1	0 → 1	-	430	170	1,710	2,310	24,850	BRT is opposite side of the road (200m) Shelter Installation completed at P.Plawad
18	Rw.Buntu	✔				0 → 3	0 → 0	2	-	-	-	0		
19	Depok Baru	✔		✔		0 → 2	0 → 2	2	128	201	8,715	9,044	51,435	BRT 'n railway station: 250m
20	**Kalideres**		✔	✔		2 → 3	1 → 1	-	238	1,016	1,390	2,644	34,410	BRT 'n railway station: 250m

Source: JAPTraPIS

Table 8.5.2 List of Proposed Integrated/Multimodal Terminals with Current Conditions

Shelter	Transportation	No of BRT route	Proposed function/improvement	TOD potential
Kota	Rail/MRT/BRT/Bus	5	At grade crossing from railway station to busway shelter	X
Dukuh Atas	Rail/MRT/BRT	7	Build a new shelter closer to Sudiruman railway station and improve the footpath. One of the major TOD potential sites integrating Rail, MRT and BRT	X
Blok M	MRT/BRT/Bus	5	Expand the busway berths, and Taxi berths. One of the major TOD potential sites.	X
Lebak Bulus	MRT/BRT/Bus	5	Need to rebuild the bus terminal accompanied by MRT depot/workshop. It need to use artificial ground to maintain its bus terminal function.	X
Gambir	Rail/MRT	4	Build the busway shelter in the railway station area for the better connection	
Pulo Gadung	MRT/BRT/Bus	5	Expand the capacity of the shelter, distributing inter-city and inter-province buses to Pulo Gebang terminal where now it is under construction.	
Grogol	BRT/Bus	6	Grogol 2 shelter needs to expand the space for the passengers (especially width) and bus berths.	
Kalideres	BRT/Bus	3	Increase boarding space for busway from Tangerang in the terminal.	

Source: JAPTraPIS

8.6 Cycling and Walking Facilities

Clearly the balance of road use in Jakarta favours cars at the expense of more efficient modes such as walking and cycling. There are many places where walking space has been displaced entirely by car lanes and in some cases roadside business.

Cycling is a highly efficient and environmentally friendly form of mobility and is experiencing a worldwide renaissance in developed cities. It is also an affordable option providing the opportunity for low cost transport and is a good option for school students if safe conditions exist to ride bicycles.

However, cycleways should be more than token projects to show 'green' credentials; they need to be safe and connected networks that are easy to access, and are protected from traffic conflicts and safety threats.

Cycling Enthusiast in Jakarta

Rent a Bike Velo Lyon France

Dedicated Cycle Path