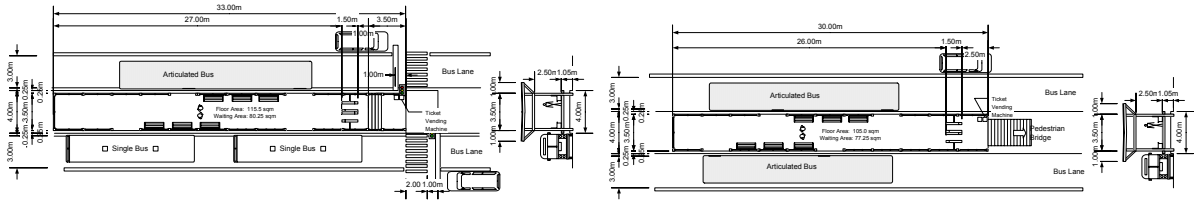
Table 2.3.6 Standard Floor Space by Volume of Passengers

Waiting Passenger (pax)	Floor Space (m2)
0-20	25
-40	50
-80	100
-150	150

Note: 1.2 square meters is used for a passenger and this is minimum space not to interfere between entering and waiting passengers.



(Ic2) (Ip2)

Figure 2.3.15 Example of the Bus Shelters

2.3.4 Related Issues on Busway Facility Plan

(1) Development of Feeder Bus Service

Busway is upgraded system, characterized by exclusive lane, high operating speed, and long interval between bus stops, in comparison with current ordinary bus system. In this context, overall public transportation system can be re-categorized into the following three major groups:

- Railway and busway
- Ordinary large, regular and medium buses
- Angkot, taxi, ojek and bajaj

Railway and busway have dominant position from a viewpoint of carrying capacity and operating speed. On the other hand, ordinary bus system plays an intermediate role. The last category undertakes immediate access to destinations such as home and office.

It is required to establish a comprehensive public transportation service network to serve customers. In line with busway development, establishment of feeder bus network becomes important. Figure 2.3.16 shows an example of feeder bus service to support busway system. Although some vacant areas still remain, these are expected to be covered by taxi and others.

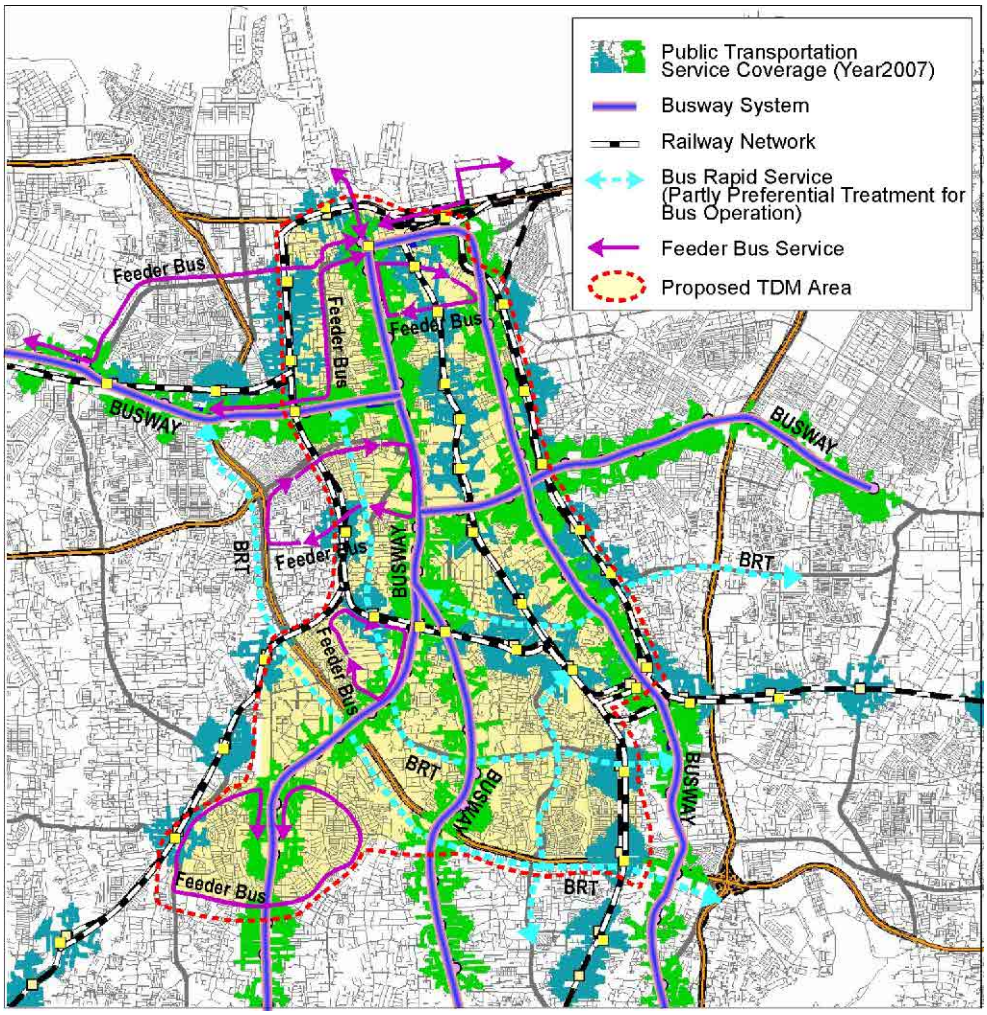


Figure 2.3.16 Example of Feeder Bus Service

(2) Restructuring Current Conventional Bus Route

1) Competing Route with Busway

After the operation of busway on the proposed routes, competitive existing bus routes should be restructured to integrate the proposed busway.

2) Shift to Feeder Bus

On the other hand, these restructured buses are expected to shift to the feeder bus to establish hierarchical public transportation services.

(3) Travel-lane Rearrangement

One of the problems of introduction of busway is reduction of travel-lane capacity for general traffic. Public transportation cannot be regarded as an alternative mode of transportation for some people. Extreme traffic congestion and the one-sided advantage to the busway should be avoided. In this context, travel-lane rearrangement would be effective in case of wide road having slow travel-lane separated by side-median strip, like Jl. Sudirman. Figures 2.3.17 and

2.3.18 illustrate an example of land rearrangement. This improvement can also create broader sidewalk for pedestrians.

Figure 2.3.17 Example of Travel-lane Rearrangement by Removal of Side Separator

Figure 2.3.18 Example of Travel-lane Rearrangement by Removal of Side Separator

(4) Issues on Road Widening

Installation of exclusive bus lane will lead to reduction of road capacity for general traffic. Road widening is not planned but rearrangement of travel-lane is proposed for road stretches having three lanes and more.

On the other hand, road widening to at least three lanes is required for the road sections with two lanes in one direction, of which location was already shown in the previous section. As land acquisition is, however, difficult, implementation may be deferred in the worst case. In such a case, the following measures are proposed:

- Widening is a minimum requirement for the introduction of busway, so that immediate necessary actions including property survey and negotiation with landowners and building owners should be taken;
- Market price should be applied for land acquisition and compensation;
- In the event that it takes time to widen the related roads, mingled operation of busway with other general vehicle traffic, for the time being, is one of realistic measures in order to open immediate busway operation; and
- If directional split is large, tidal flow arrangement could be applied to provide an exclusive bus lane. In a tidal flow system, one lane is allocated for exclusive use of bus operation usually towards the CBD in the morning and to the other direction in the afternoon as illustrated in Figure 2.3.19.

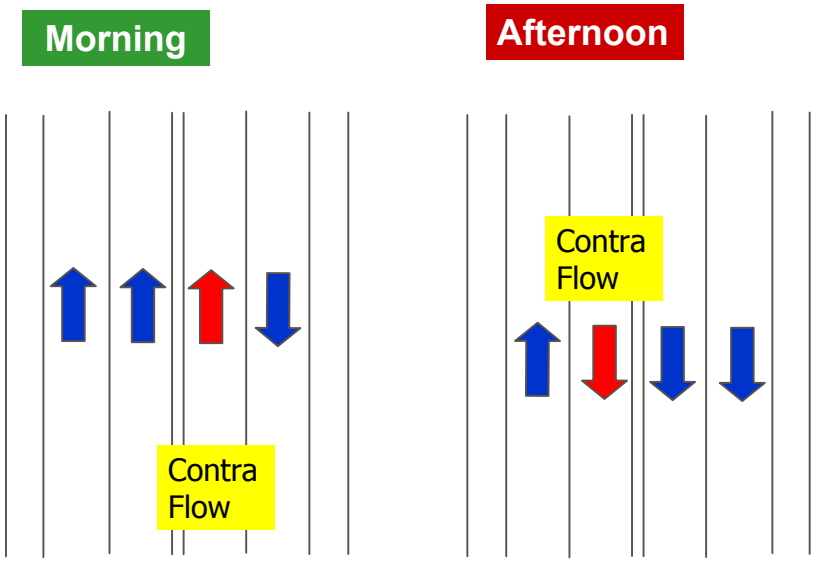


Figure 2.3.19 Tidal Flow Lane System

(5) Parallel Road Development

Alternatively development of the parallel road could supplement the road capacity for general traffic and provide a detour for private passenger cars. Examples of this kind of arrangement are development of the planned arterial road along the Railway Tangerang Line to provide a detour for the western section of PB04 on Jl. Daan Mogot of and construction of the missing link between Jl. I. Gusti Ngurah Rai and Jl. Sultan Agung, which functions as a diverging route for the eastern part of PB04.

(6) Parking Restriction

Although it may be a matter of enforcement of current traffic regulation, on-road parking is tremendously reducing the road capacity. It is necessary to remove illegal on-road parking to increase road capacity for vehicular traffic passing through stretches where the busway will operate.

(7) Relationship with MRT

MRT has been planned between Kota and Ciputat and implementation is scheduled in the study as follows:

- Monas – Blok M : the year of 2010
- Blok M – Ciputat : the year of 2015
- Monas – Kota : the year of 2020

The routes of PB01 overlapping with MRT will be removed after the completion of MRT.

2.4 TRAFFIC MANAGEMENT AT INTERSECTION

2.4.1 Principle of Traffic Management at Intersections

(1) Current Signal Phasing at Major Intersection

As for signal phase at four-leg intersection, two-phase sequence is commonly applied when traffic flow is dominant on approaches facing each other, though another green time in additional phase is allocated to right-turn traffic. This signal pattern is used at a roundabout as well. On the other hand, in case traffic on all approaches is equally heavy, each approach has an exclusive green phase in order.

(2) Measures to Avoid Conflict

There are many large intersections and roundabouts on the routes of planned busway in Jakarta. In case of four-lane road for both directions, a busway has to run on the road mingled with other ordinary traffic without an exclusive busway lane. As the busway system usually runs its own

exclusive lane alongside a median trip, a conflict occurs between the busway and other ordinary traffic in case of ordinary traffic turning to right, and the busway turning to left. The following measure should be taken at major intersections:

(3) In Case of Bus Turning to Left

Additional measure is usually not necessary for buses turning to right on the exclusive bus lanes installed alongside median-strips because of no conflict with ordinary traffic, though preemption signal control on demand is desirable to keep a smooth operation. However, buses turning to left must be separated from other ordinary traffic to avoid conflict. Practically, it is necessary to provide the preemption signal phase for buses. This gives green-time for buses turning to left prior to the ordinary traffic passing straight at the intersections.

(4) Ordinary Traffic Turning to Right

The busway going straight at intersections has a conflict with ordinary traffic turning to right. The preemption signal phase for buses gives, as mentioned before, a solution to the problem as it separates the busway from the other ordinary traffic.

(5) U-turn Movement by Ordinary Traffic

1) Countermeasures

Several U-turn openings are found along the roads, on which busway is planned, particularly along those streets with wide median such as Suprapto or Daan Mogot. Site survey found a total of 16 U-turn points along the Pulogadung – Kalideres busway route east of Monas and 23 U-turn points west of Monas. These U-turn points are located at either intersection or mid-block section. The number of U-turn points does not include the intersections where U-turn is prohibited but actually U-turn is observed. It is desirable to close U-turn openings to avoid conflict with busway operation; however, some of the existing U-turn openings are still necessary and will be retained if no alternate route is found.

There are three options for U-turning at mid-block U-turn opening as shown in Figure 2.4.1. Type 1 is more efficient if volume of ordinary traffic is small. However, if U-turn traffic volume is large and bus operation is frequent, interference between U-turn traffic and buses will be a problem. On the other hand, Types 2 and 3 need installation of traffic signals, thus it is more expensive but it will provide much safer traffic situation than Type 1.

Use of innermost lane by vehicles other than bus must be allowed for a certain distance for U-turn opening to function. Such section must be clearly indicated in different pavement color and traffic sign. Types 2 and 3 are to separate U-turn traffic from busway and control U-turn movement by signal. The merits and demerits of these three options are listed in Table 2.4.1.

In summary, these three options have their merits and demerits and one is not superior to others for all traffic conditions. The selection will be made depending on the road geometry, total traffic volume, percentage of U-turn traffic volume and bus frequency.

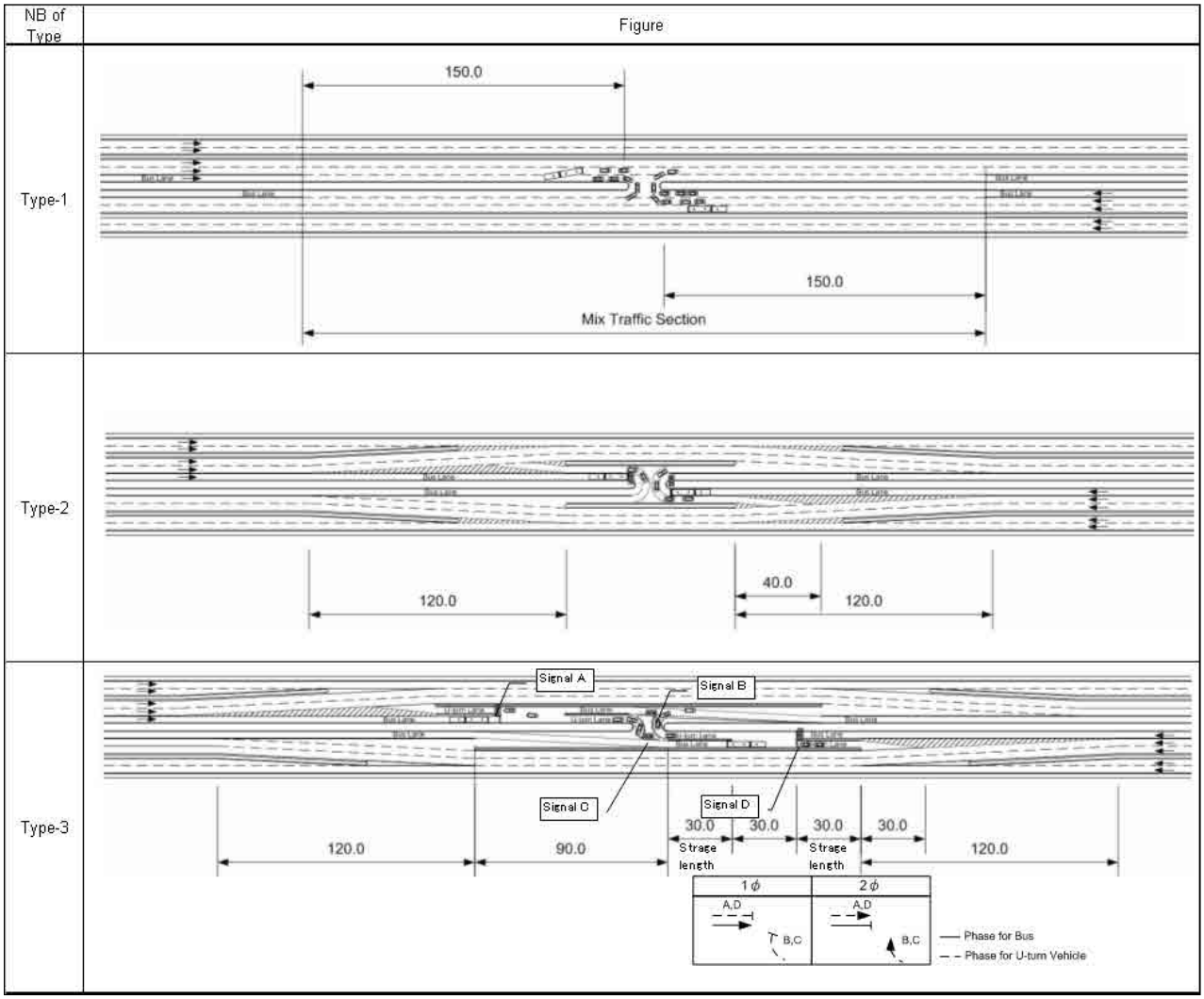


Figure 2.4.1 Comparison of U-Turn Measures

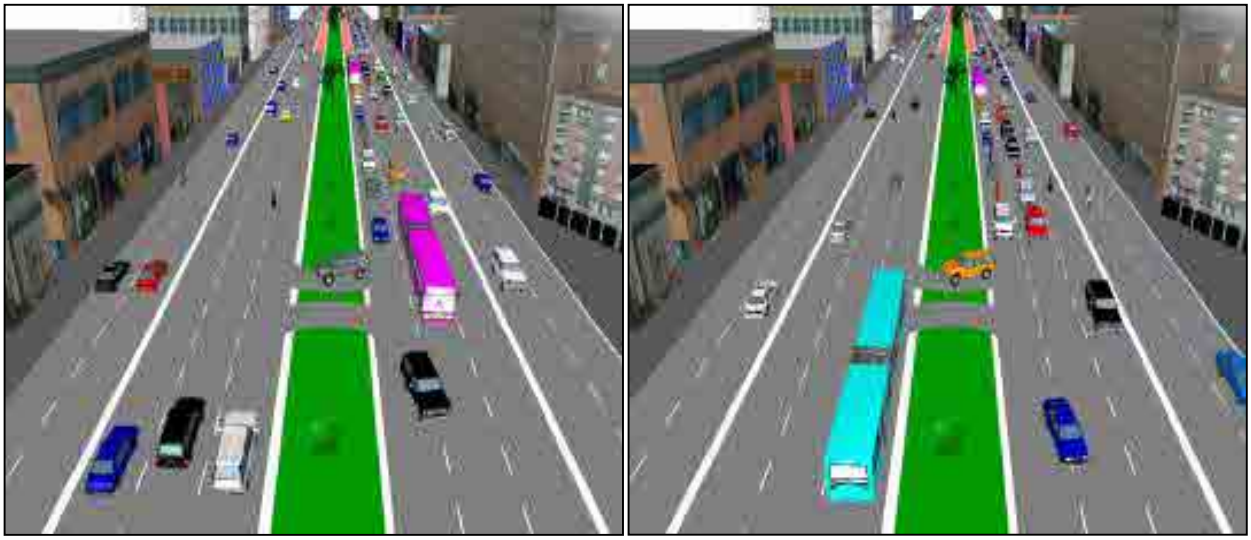


Figure 2.4.2 U-Turn Measure Type 1

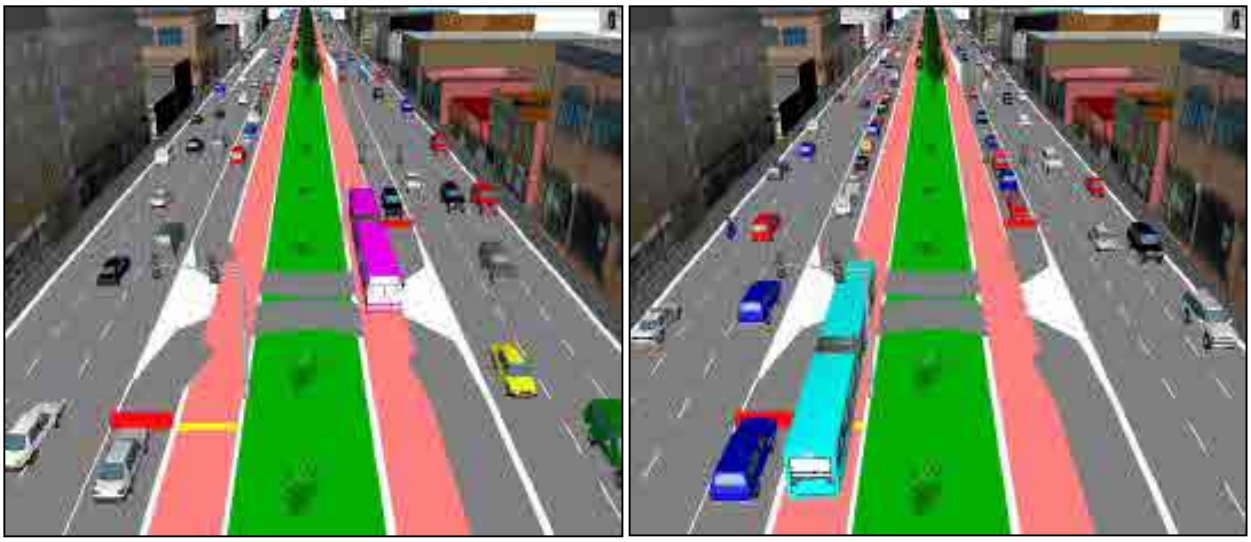


Figure 2.4.3 U-Turn Measure Type 2

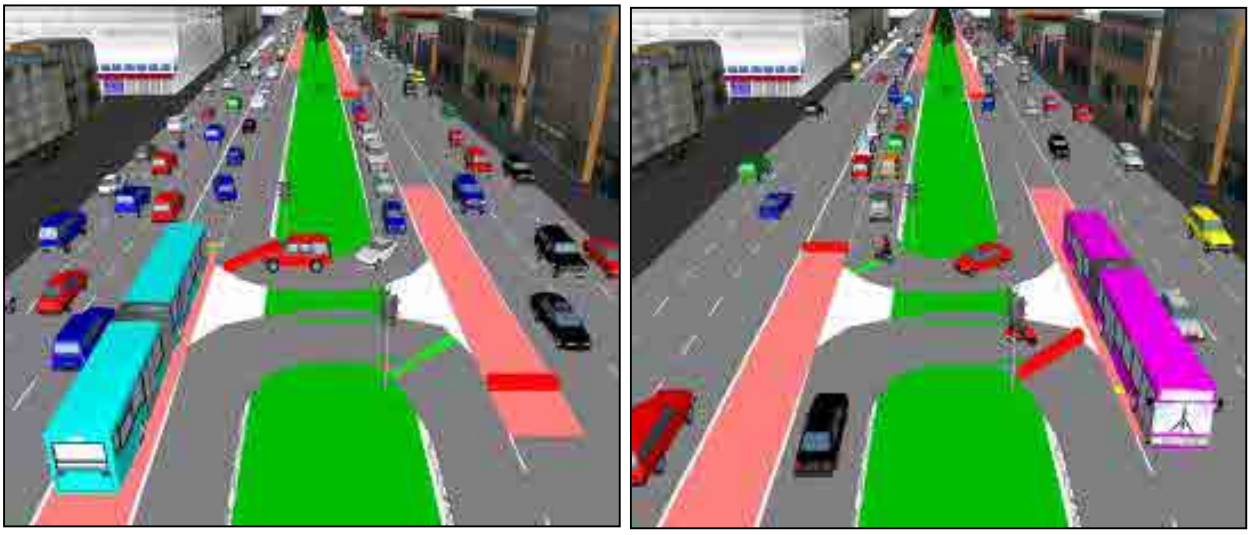


Figure 2.4.4 U-Turn Measure Type 3

Table 2.4.1 Characteristics of U-Turn Measures

Type	Outline	Merit	Demerit	Remarks
Type-1	Set Mixed Traffic Section. No traffic signal will be installed.	Easiest option to construct if the U-turn traffic is small. No influence on the slow lane traffic.	Most reduced bus travel speed among three types due to the weaving traffic and the container vehicles.	-
Type-2	Exclusive bus lane is installed continuously without opening. U-turn vehicle will turn from/to outside of bus lanes. Two traffic signals will be installed (their phasing must be synchronized).	Highest bus travel speed will be secured. This type can be adopted even in the narrow median section, since the outer radius of the turning-pass will be kept more than 12 m *1.	If the bus frequency is high, green time ratio for the U-turn traffic must be small. Road capacity of slow lanes will be reduced *2.	Container vehicle length will be determined according to the U-turn traffic volume and green time ratio.
Type-3	U-turn vehicles turn from/to inside of bus lanes. Interchange of the "bus lane" and the "U-turn lane" is required. Four traffic signals will be installed.	Even in the large bus traffic volume section, U-turn traffic will be secured.	Largest scale of construction works will be required. Road capacity of slow lanes will be reduced *2. If the median width is less than 3 meters, this type cannot be adopted due to restriction of the minimum turning radius of passenger cars.	Container vehicle length will be determined according to the U-turn traffic volume and green time ratio.

*1: Normally, for the outer curve radius of a passenger vehicle, 7 meters is used as minimum.
*2: If the road widening of around 5 m for both sides is possible, the number of lanes will not be reduced.

Insufficient road network is observed at the back side of arterial roads even in DKI Jakarta. This inevitably allows ordinary traffic to make a U-turn at some intersections and even at main sections of roads because vehicles on an arterial road come back to the same road by making three left turns due to the non-grid-pattern road. However, as U-turn traffic will, without doubt, disturb smooth busway operation, U-turn movement should be allowed to a minimum.

2) Improvement Criteria

The Study Team performed dynamic simulation analysis on U-turn behavior by ordinary vehicles with a view to examining numerical improvement criteria. The following are the results of analysis:

- Type 1 can cope with around 300 vehicles / hour / direction for u-turn traffic;
- Type 2 can meet more than 300 vehicles but less than 600 vehicles; and
- Type 3 has almost the same capacity as that of type 2. However, it is better to adopt this type 3, in case ordinary traffic is around 4,000 and more vehicles / hour / direction from a viewpoint of safe traffic management.

(6) Signal Control

In order to realize smooth and comfortable BRT operation, the frequency of BRT services must be increased. In this context, installation of bus priority signal is required at every signalized intersection with the preemption signal-phase at intersections where busway makes a left turn.

Detectors located upstream of signalized intersections will detect a bus, and green signal phase for buses will be extended based on pre-set time to allow the buses to proceed without stopping.

(7) Signal for Pedestrian

Passengers of busway are mainly boarding and alighting at bus stops installed on median strips located at the center of roads. They have to cross the roads to do this. The following three measures, in this case, are considered:

- Constructing new pedestrian bridges or installing bus stops at existing ones;
- Marking pedestrian crossings near signalized intersections; and
- Marking pedestrian crossings at non-signalized road sections.

It is, however, necessary to install pedestrian crossing signals for the passengers to safely cross the roads in the last case above.

(8) Introduction of Bus Location System

As high frequency service is expected for the BRT operation, a constant interval between buses will not be kept without an adequate bus operation management. In other words, buses tend to form a platoon under the high frequency service. Constant bus operation is one of important factors to accommodate passenger demand. Introduction of bus location system will give a solution to this issue. Buses have to be equipped with GPS (Global Positioning System) equipment so that an operation center can know the bus location and its operation speed based on the location of buses on routes.

2.4.2 Extension from Blok M to Lebak Bulus (PB 01)

(1) Outline of the Route

DKI Jakarta initiated the busway service on 15 January 2004 between Kota and Blok M. Extension of the busway to Lebak Bulus has been proposed for a short-term plan in SITRAMP. After the completion of MRT, which has been planned for a long time between Kota and Fatmawati, the busway will be removed and integrated into MRT.

(2) Measures for Traffic Management

1) Blok M Bus Terminal

Although traffic management around Blok M bus terminal is one of key issues in this route, it is better to follow the way by DKI Jakarta with a view to unifying both routes into one system.

2) Intersection at Jl. Kramat Pela and Panglima Polim

This intersection is located at the south side of Blok M and is one of the most congested ones in Jakarta. The intersection has five legs but one of the legs has nothing to do with traffic flow at the interchange due to physical constraint. In addition, contra bus flow has been introduced on Jl. Panglima Polim. As every approach has its own green time in order, signal phases are rather simplified. In addition, busway runs a straight direction at the intersection so that the right-turn movement by ordinary traffic has to be separated from the busway. A rough layout is found in Figure 2.4.5.

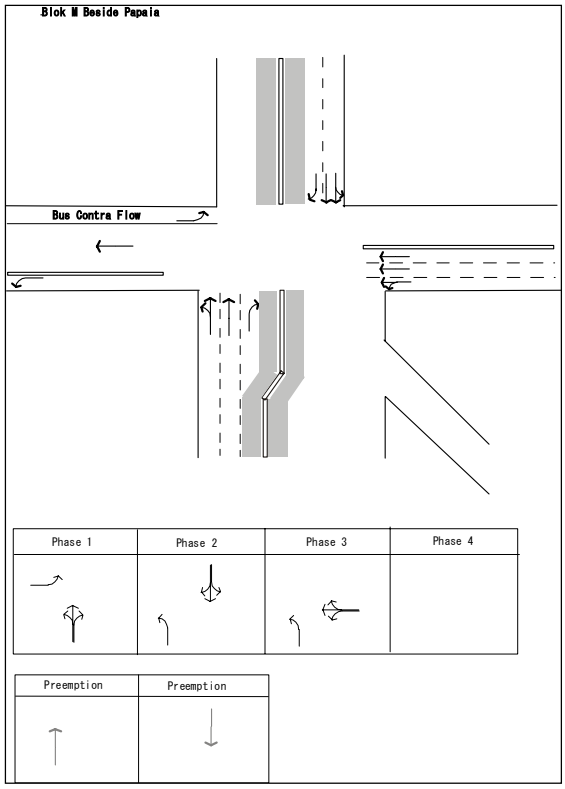


Figure 2.4.5 Rough Layout at Jl. Melawai and Panglima Polim Intersection

3) Intersections on Jl. Fatmawati

There are some signalized intersections on Jl. Fatmawati. In addition, one-way regulation during certain hours is applied except buses to some part of Jl. Fatmawati.

As all intersections are minor ones and any special signal phases cannot be observed at this moment, the layout of the intersections can follow the general principle.

4) Intersection at JORR

This intersection has been elevated over the JORR (Outer Ring Road) but still a large grade-intersection has remained. The layout of the intersection is still complicated but all approaches have their own green signal-phases in order. A rough layout is found in Figure 2.4.6.

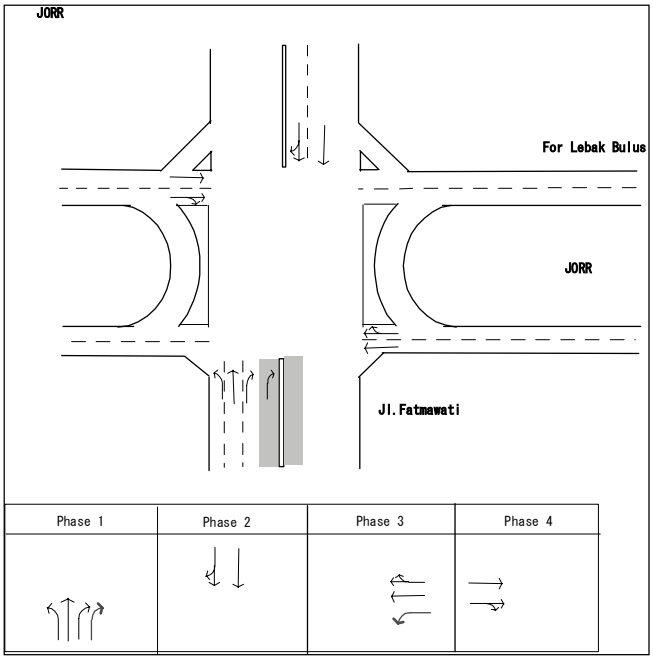


Figure 2.4.6 Layout of Intersection at JORR (Jl. Kartini)

5) Between JORR and Lebak Bulus Bus Terminal

Buses run on the frontage road of JORR (Jl. Kartini) and Jl. Pasar Jumat toward Lebak Bulus Bus Terminal mingling with ordinary traffic. Therefore, any special signal control has nothing to do with this section.

6) Lebak Bulus Bus Terminal

Minor improvement inside Lebak Bulus Bus Terminal is required from a viewpoint of mainly ensuring a bus berth for busway.

2.4.3 Route on Jl. Rasuna Said (PB 02)

(1) Outline of the Route

This route is between Selamat Datang Monument and Ragunan Bus Terminal. The route consists of diverting route from Jl. Sudirman and Thamrin, on which the busway between Kota and Blok M has been initiated by DKI Jakarta. Moreover, the route has a two-lane road section such as Jl. Imam Bonjol, the flyover on Jl. Sultan Agung, and the western railway line.

(2) Measures for Traffic Management

1) Roundabout of Hotel Indonesia

The route between Kota and Blok M, which has been planned by DKI Jakarta, is going to pass through the roundabout ahead of the Rasuna Said route. Therefore, basic signal control system has to follow the plan by DKI Jakarta. A rough layout is found in Figure 2.4.7.

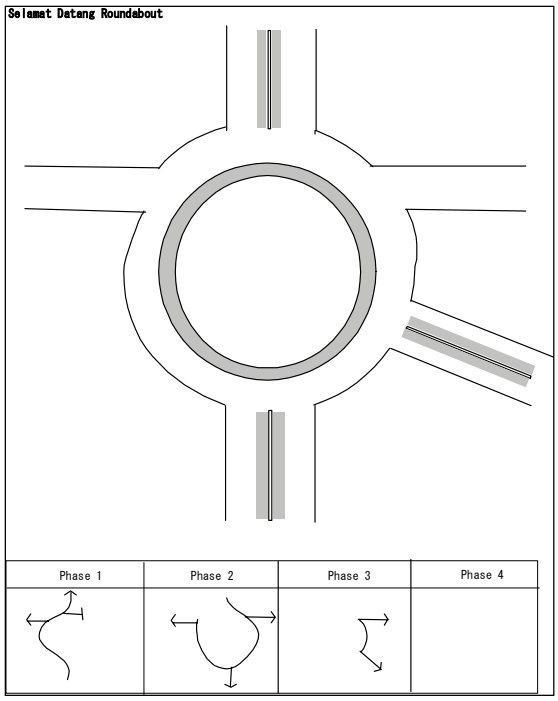


Figure 2.4.7 Rough Layout at Roundabout

2) Intersection at Jl. Imam Bonjol and Pamekasan

As right-turn traffic is not dominant at the intersection, any special consideration for signal control is not required.

3) Intersection at Jl. Imam Bonjol and Jl. Hos Cokroaminoto

As only buses and taxis coming from the Monument roundabout to Jl. Rasuna Said are allowed, no special measures for signal control and management are required except a preemption signal phase for the buses.

4) Intersection at Jl. Casablanca

This intersection is elevated over the Jl. Casablanca and a right turn from Jl Rasuna Said cannot be allowed due to a physical barrier on Jl. Rasuna Said. Furthermore, no traffic light is installed at this intersection. Therefore, any special measures need not be taken.

5) Intersection at Jl. Gatot Subroto

Toll road itself is elevated from Jl. Rasuna Said. In addition, a flyover of Jl. Gatot Subroto, ordinary frontage road of the toll road, in direction from west to east was completed in August 2003. Despite the improvement of this intersection, still heavy traffic volume can be seen. According to the current signal control method, every approach has its own green phase in order. The general principle mentioned before can be applied and a rough layout is found in Figure 2.4.8.

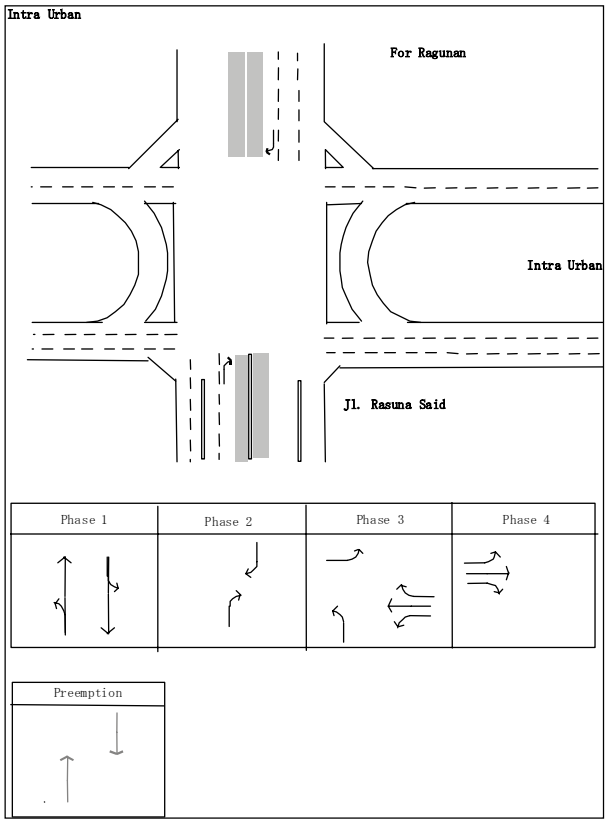


Figure 2.4.8 Layout at Jl. Gatot Subroto

6) Intersection at Jl. Kapten Tendean

This intersection has five legs, though main traffic on Jl. Kapten Tendean is separated by elevated structure from the ground level. However, Jl. Kuningan Barat is a narrow path connecting only to the ground level of Jl. Kapten Tendean under traffic control. According to the current signal control method, every approach has its own green phase in order. The general principle mentioned before can be applied and a rough layout is found in Figure 2.4.9.

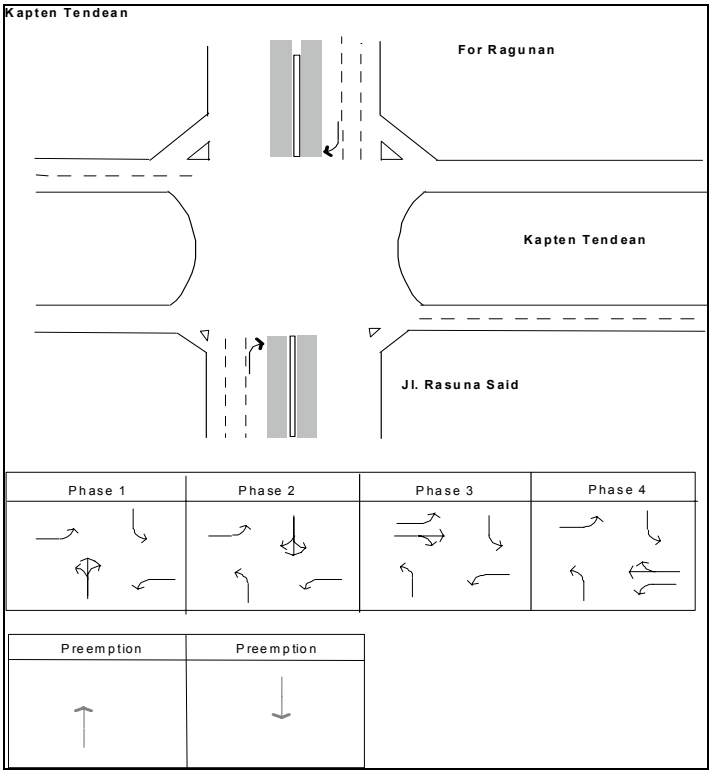


Figure 2.4.9 Layout at Kapten Tendean

7) Section at Jl. Kapten Tendean and Jl. Pejaten Raya

There are some minor signalized or non-signalized intersections in this section. However, traffic volume is not so heavy so that the general principle can be applied to the intersections. One issue is U-turn movement. U-turn is allowed at some sections and intersections as well due to insufficient road network configuration in the backside area of this road section. These U-turns have to be allowed even after introduction of busway, though this will most likely obstruct the busway. Otherwise, vehicles may not find any places for a long distance to make a U-turn.

8) Intersection at Jl. Pejaten Raya

This intersection is signalized but all left-turn movements are separated from other traffic flow. Current signal phases consist of basically two-phase pattern for the main traffic on Jl. Warung Jati Barat though there are some additional signal phases for right-turn movements. A rough layout is found in Figure 2.4.10.

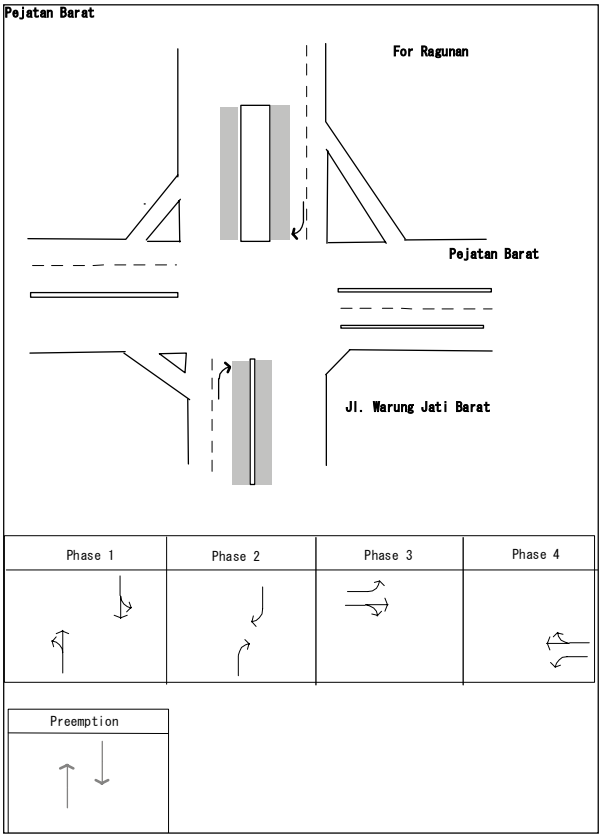


Figure 2.4.10 Layout at Jl. Pejaten Raya

9) Intersection at JORR

JORR (Outer Ring Road) is already elevated from the ground level and intersection at grade still remains. Every approach has its own green signal phase in order and left turn is always allowed through left-turn paths separated from main traffic flow. A rough layout is found in Figure 2.4.11.

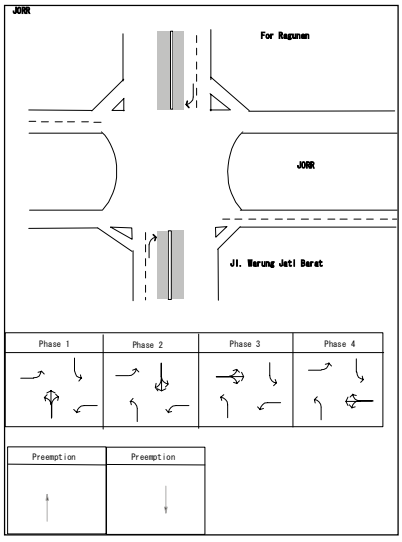


Figure 2.4.11 Layout at JORR

10) Ragunan Bus Terminal

Ragunan Bus Terminal is located at the end of Jl. Harsono R. M. The improvement of bus terminal has to be required with a view to introducing busway.

2.4.4 From Kota to Kampung Rambutan Bus Terminal (PB 03)

(1) Outline of the Route

This busway consists of two routes, Jl. Mangga Dua route and Jl. Gunung Sahari route. Jl.Mangga Dua route has a role to connect DKI-planned route (Kota to Blok M) with Jl. Gunung Sahari route. The road near Kota Railway station is one of the most notorious places for traffic jam and is always congested by car and buses.

Jl. Gunung Sahari route runs on one of the important arterial roads in Jakarta, running from the north to south. All the east-west arterial roads are connected to this road at the east side of Jakarta. Moreover, this route connects to Jl. Bogor Raya in the outside area of Intra Urban in the southern region. Jl. Bogor Raya has only two-lane width for both directions at present and is required to widen to six lanes in the future.

(2) Measures for Traffic Management

1) Around Kota Railway Station

This is a terminus point of busway route planned by DKI Jakarta and circulation layout has been designed. Jl. Mangga Dua route will be making good use of the DKI's circulation plan and follow it.

2) Intersection at Jl.Pangeran Jayakarta

This intersection is signalized and has typical three legs. Any special signal phases will not be required and the general principle can be applied.

3) Intersection at Jl. Mangga Dua and Jl. Gunung Sahari

The approach road on Jl. Mangga Dua is divided into two parts crossing the waterway and connecting to Jl. Gunung Sahari. As the intersection has large size and traffic flow pattern is complicated, every approach has its own green phase in order. A rough layout is found in Figure 2.4.12.

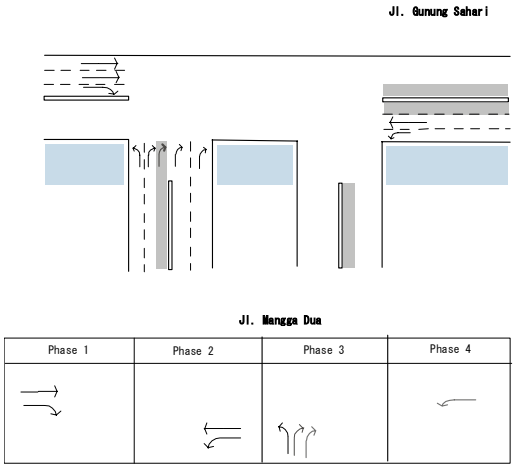


Figure 2.4.12 Rough Layout at Jl. Mangga Dua and Jl. Gunung Sahari

4) Intersection at Jl. Dr. Suratmo

This intersection is similar to that of Jl. Mangga Dua and Jl. Gunung Sahari but its size is rather small. The general principle can be applied.

5) Intersection at Jl. Mangga Besar

This intersection is also similar to that of Jl. Mangga Dua and Jl. Gunung Sahari. The same signal phasing pattern as the intersection at Jl. Mangga Dua and Jl. Gunung Sahari can be applied.

6) Intersection at Jl. KH. Samanhudi

This intersection is also similar to that of Jl. Mangga Dua and Jl. Gunung Sahari. Right turn from the south to the north on Jl. Gunung Sahari is prohibited. The general signal phasing pattern can be applied, however.

7) Intersection at Jl. Dr. Sutomo

This intersection has four legs but one of the legs, named Jl. GN Sahari 5, is a narrow street and under one-way regulation. Therefore, current signal phases are for the three legs only. A rough layout is found in Figure 2.4.13.

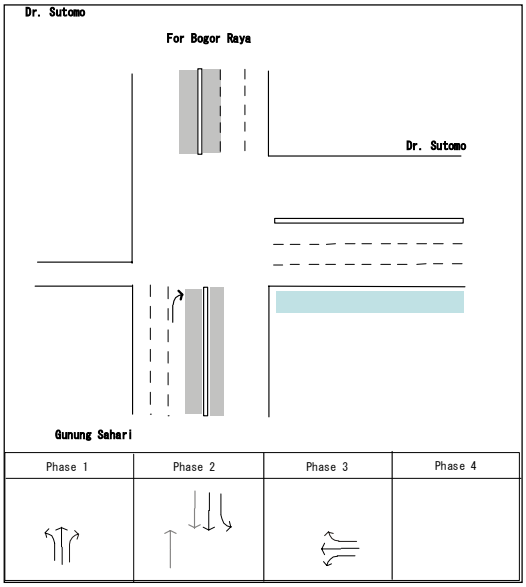


Figure 2.4.13 Rough Layout at Jl. Dr. Sutomo

8) Intersection at Jl. Dr. Wahidin

This intersection has three legs but Jl. Dr.Wahidin is currently used as one-way.

9) Intersection at Jl. Prapatan

The main line of Jl. Kramat Raya is already elevated and the remaining intersection at grade has five legs. The east-west busway (PB 04) is planned to pass through this intersection and detailed layout is analyzed in the east-west busway.

10) Intersection at Jl. Pramuka

Main line on Jl. Pramuka is already elevated and right-turn way from Jl. Pramuka to Jl. Salemba Raya is also elevated. These situations make the intersection at grade rather complicated resulting in provision of green phases for every approach in order. A rough layout is found in Figure 2.4.14.

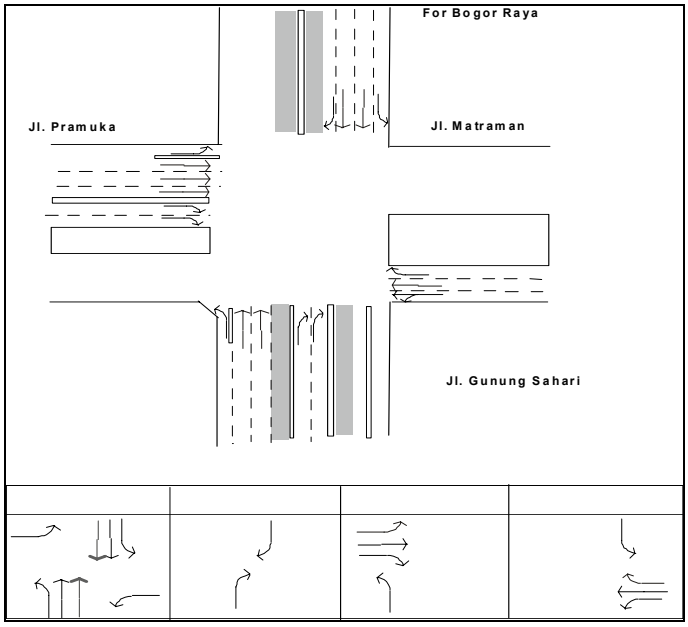


Figure 2.4.14 Rough Layout at Jl. Pramuka

11) Intersection at Jl. Matraman Raya and Jl. Jatinegara Barat

This intersection is located near Pasar Jatinegara and not signalized. This has three legs in Y type. Jl. Matraman Raya and Jl. Jatinegara Barat are operated under one-way regulation, respectively. Therefore, any special method in signal control will not be required.

12) Intersection between Jl. Matraman and Bekasi Barat Raya

As this intersection is very similar to that of at Jl. Matraman Raya and Jl. Jatinegara Barat, the same signal phasing and layout can be applied.

13) Intersection between Jl. Jatinegara Timur and Jl. Kp. Melayu Besar

The intersection is located alongside Melayu Bus Terminal. The main line of Jl. Kp. Melayu Besar is already elevated but still congestion remains. As one-way regulation is applied to Jl. Jatinegara Timur and left-turn way from Jl. Jatinegara Timur is separated from the main traffic flow, there is no signal control at the interchange.

14) Interchange at Intra Urban at the West of Cawang I/C

This intersection shows a similar shape to those at toll road illustrated in previous sections. Every approach has a green phase in order. A rough layout is found in Figure 2.4.15.

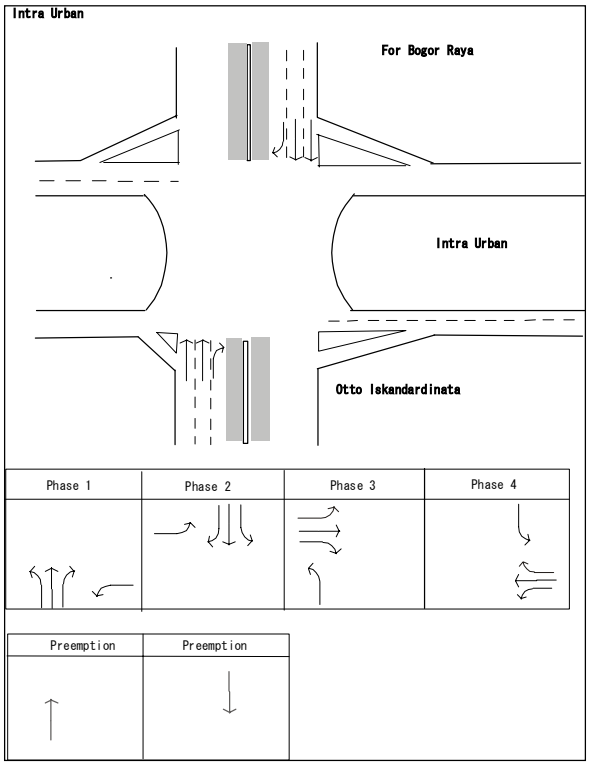


Figure 2.4.15 Rough Layout at Intra Urban

15) Intersection at Jl. Dewi Sartika and Jl. Jend. Sutoyo

The intersection is located alongside pasar near Cililitan Bus Terminal and is always in chaos. Although the shape of intersection is distorted, arrangement of well-channelized islands is minimizing defects of the intersection. A rough layout is found in Figure 2.4.16.

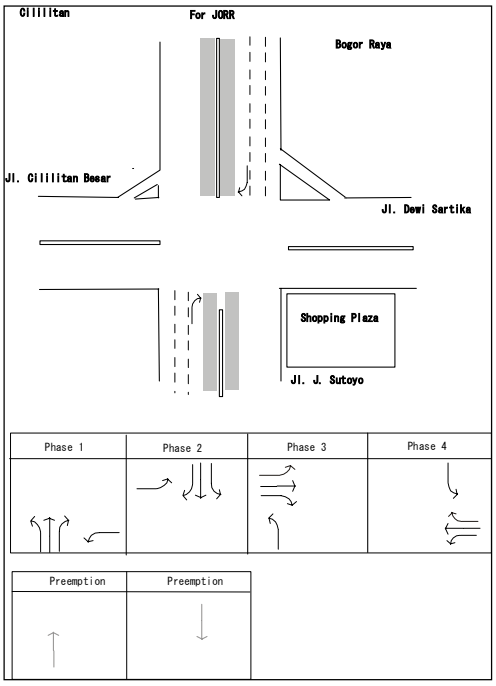


Figure 2.4.16 Rough Layout at Jl. Jend. Suyoto

16) Intersection at JORR

The main line of JORR (Outer Ring Road) is elevated by underpass. Construction work of flyover has been underway for the main line on Jl. Bogor Raya, but the remaining intersection is still at grade. Left-turn from Jl. Bogor Raya is separated from other traffic flow and right turn from JORR to Bogor Raya is also separated from ramp traffic to JORR. A rough layout is found in Figure 2.4.17.

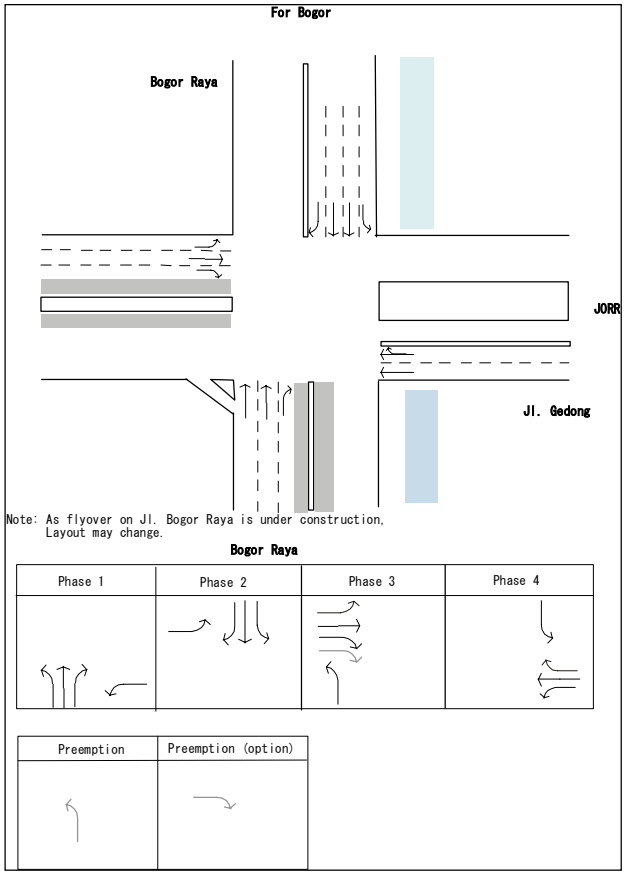


Figure 2.4.17 Rough Layout at JORR

(3) Kampung Rambutan Bus Terminal

Entrance and exit ways to Rambutan Bus Terminal are rather complicated and improvement may be required to accommodate a busway berth inside the bus terminal.

2.4.5 Kalideres – Pulogadung Busway (PB04)

(1) Outline of the Route

This route is between Kalideres Terminal and Pulogadung Terminal. It is the only route connecting east and west continuously. The route has a two-lane section at the east end of Jl. Kemerdekaan.

(2) Measures for Traffic Management

1) Pulogadung Bus Terminal

The site is chaotic and congested due to concentration of buses to narrow road, buses waiting on the road, street vendors and jaywalkers. Entry/exit points and circulation plan in and around the bus terminal must be reviewed, operational procedure must be established and enforcement must be strengthened in the area. The layout of busway and loading and unloading zone will be designed in conjunction with the countermeasures against these issues.

2) Perintis Kemerdekaan – Blvd. Kelapa Gading Intersection

At Perintis Kemerdekaan – Blvd. Kelapa Gading intersection, right turn from the west approach of Perintis Kemerdekaan is allowed and two right turn lanes are provided by narrowing the median. These right turn lanes will be retained and busway will be constructed along the median separated by mountable curb as shown in Figure 2.4.18. The separator separating fast and slow vehicles may be removed for certain distance from the stop line to increase discharging capacity.

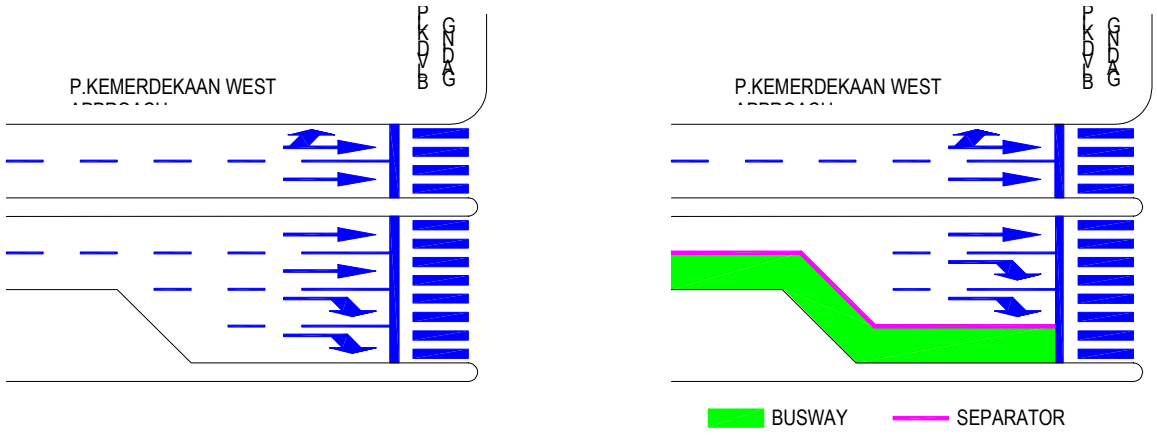
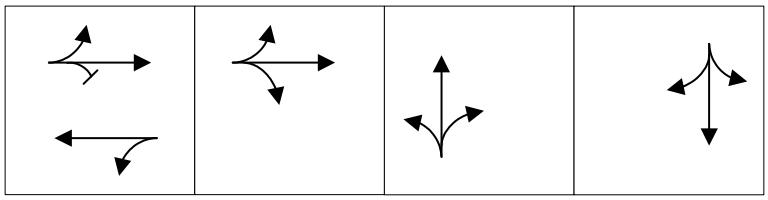
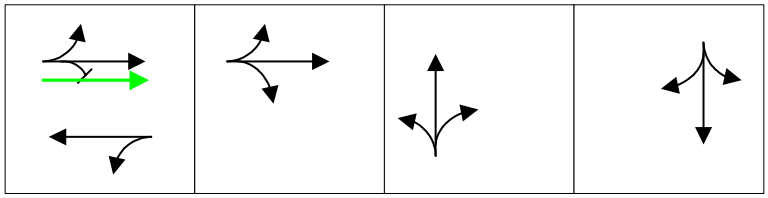


Figure 2.4.18 Lane Assignment at Perintis Kemerdekaan – Kelapa Gading Intersection

Two sets of three-aspect vehicle lantern, which controls movement of eastbound buses, will be added to the signal and local controller with bus priority signal function will be installed at the intersection. The signal phase sequence will be modified as shown in Figure 2.4.19.



(a) Existing phase sequence



(b) Proposed bus preemption/priority signal phase

Figure 2.4.19 Signal Phasing at Kelapa Gading Intersection

Right turn from the east approach is prohibited so that no shifting of busway is required.

3) Suprapto – A. Yani Intersection

Right turn from Suprapto west approach to A. Yani southbound and Perintis Kemerdekaan east approach to A. Yani northbound is allowed at the intersection and right-turn lanes are provided. Like Kelapa Gading intersection, busway will be constructed along the median right side of right-turn lane as shown in Figure 2.4.20.

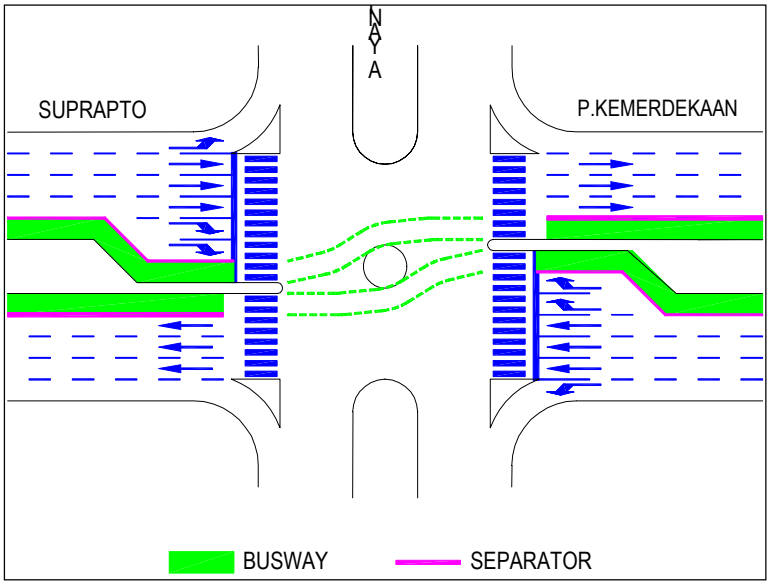
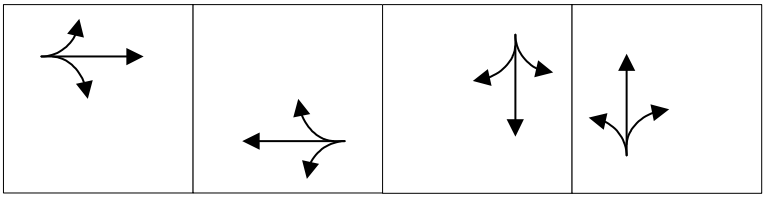


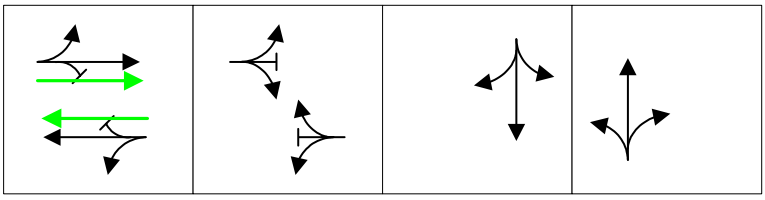
Figure 2.4.20 Suprapto/Perintis Kemerdekaan – A. Yani Intersection

Currently right turn is allowed from all approaches and signal phasing adopts simultaneous through- and right-turn movements as shown in Figure 2.4.21. Vehicle lanterns will be added to control bus movement and local controller with bus priority function will be installed. The phase

sequence will be modified to simultaneous through-movement followed by right-turn movements for east-west direction as shown in Figure 2.4.21.



(a) Existing phase sequence



(b) Proposed bus preemption/priority signal phase

Figure 2.4.21 Phase Sequence at Suprapto/Perintis Kemerdekaan – A. Yani Intersection

4) Suprapto – Tanah Tinggi Intersection

A two-lane flyover is constructed for eastbound traffic and at-grade eastbound through movement is not possible at Suprapto – Tanah Tinggi intersection. U-turn lane is provided under the flyover on both sides of the intersection. The existing intersection layout is shown in Figure 2.4.22.

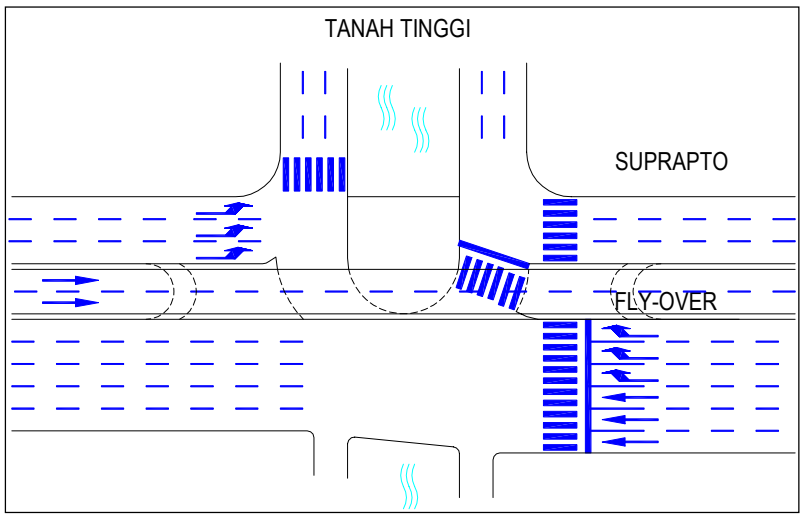


Figure 2.4.22 Existing Layout at Suprapto – Tanah Tinggi Intersection

There are three options for busway layout at this intersection;

- Exclusive Bus lane on flyover
- Mix-Traffic Lanes on flyover

- At-grade busway with through movement allowed at intersection

The first and second options require no geometric change at the intersection.

The first option is to install an exclusive bus lane on the flyover. The second option is not to install an exclusive bus lane on the flyover, i.e., the lanes will be used for mixed traffic (shown in Figure 2.4.23). And the first option will allocate only one lane for the ordinary traffic.

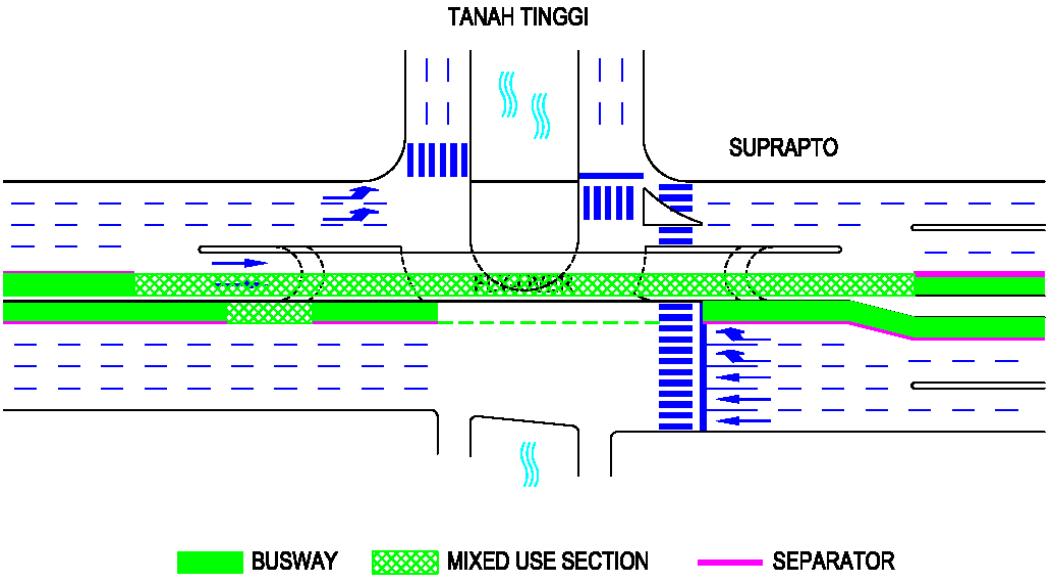


Figure 2.4.23 Busway Layout Using the Second Option

On the other hand, the third option is to install the bus lane on the frontage road. This option requires modifying the intersection geometry, as shown in Figure 2.4.24, and installing the preemption signal at the intersection. In this option, weaving traffic must be taken into consideration, i.e., it should not disturb the bus operation.

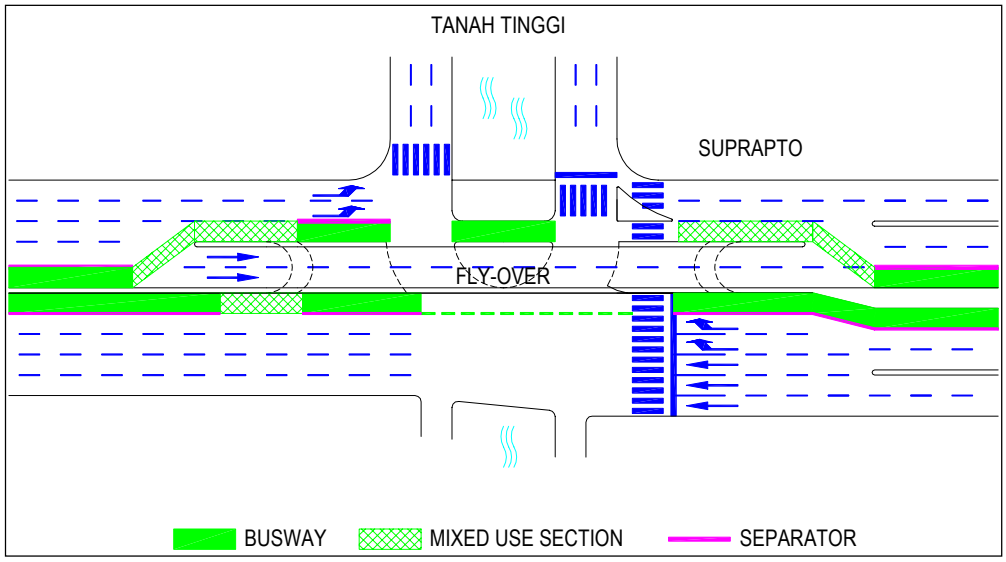


Figure 2.4.24 New Layout at Suprapto – Tanah Tinggi Intersection

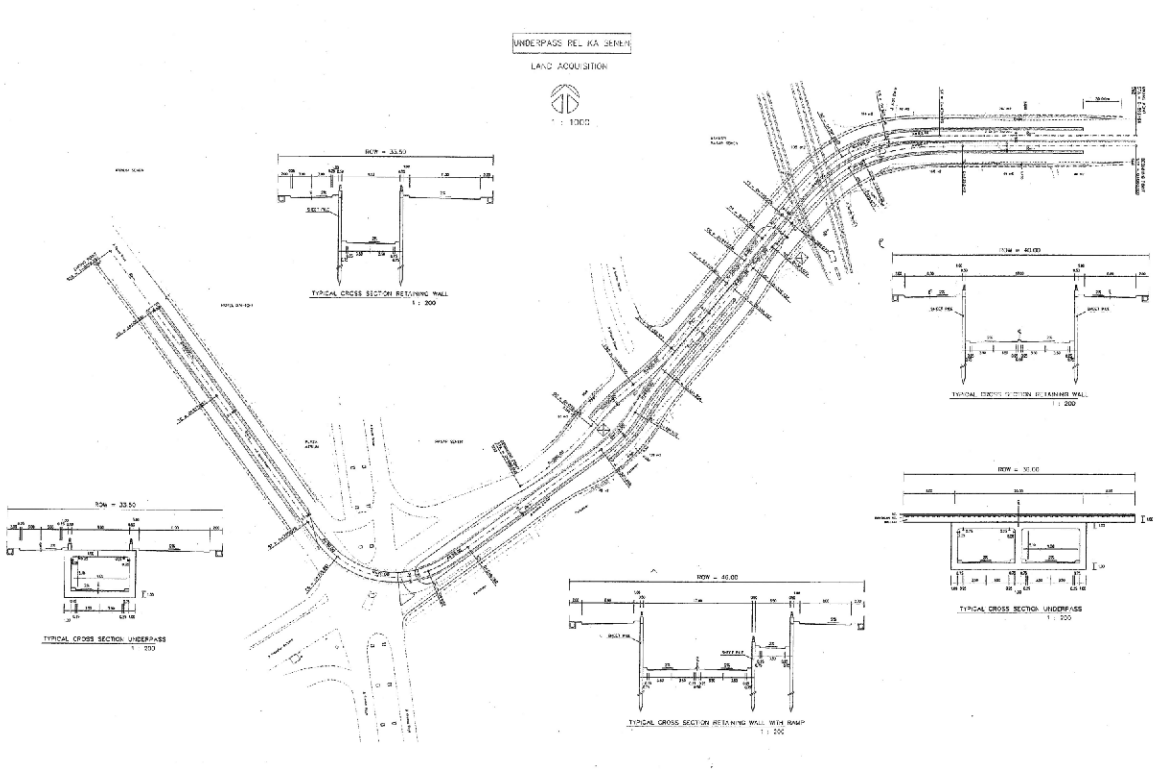
In the third option, the existing signal at the intersection will be replaced with a bus preemption/priority signal.

In this project, a new bus stop nearby the intersection would be set up at the east approach section of the flyover where the existing bus stop is. Hence, the second option was adopted.

5) Senen Railway Crossing

An underpass is being constructed at the railway crossing along Suprapto south of Station Senen (see Figure 2.4.25). The stage construction method was adopted in this underpass construction. Only the rail-crossing section will be completed in the first stage, and the section will be extended up to Senen Raya in the second stage.

Busway will be provided to either at-grade level or to underpass. At-grade level busway has a merit that bus stop will be able to set near the railway crossing for the transferring. But according to the plan shown in the figure below, it seems difficult to keep a space for the bus stop in this section. Therefore, there might be no merit providing busway to the at-grade level. Therefore, it is recommended that buses pass through under mixed traffic condition on the underpass.



Source: DKI Jakarta

Figure 2.4.25 Senen Underpass Plan

6) Kramat Bunder – Stasiun Senen Intersection

This is a T-shaped intersection, and currently the right turn from east approach of Kramat Bunder toward Stasiun Senen is allowed. The right-turn traffic will be treated like the same movement at other intersections. However, the underpass for Senen railway crossing being constructed will start at this intersection and intersection layout will be modified. The location of busway will be decided after the details of the underpass become available.

7) Senen Intersection

Senen intersection is a five-leg intersection. But Senen Raya is one-way out going toward north so that there are four incoming flows and Pasar Senen is one-way southbound so there is no outgoing flow. Moreover, flyover is constructed over Pasar Senen and Kramat Raya for southbound traffic so that at-grade traffic volume in this direction is small.

From west approach of Prapatan, movements in all directions are allowed. Two separators segregate left-turn, through and right-turn traffic on the approach. Like other intersections with right-turn lane, busway will be provided along the median on the innermost lane as shown in the Figure 2.4.26.

From east approach of Kramat Bunder, only right turn and left turn are allowed and westbound through movement to Kwitang is physically prohibited by island. Vehicles proceeding toward

west may make a right turn at the intersection toward north and then a left turn to Kwini 1 and follow the small road back to Prapatan/Kwitang at a signalized intersection west of Senen intersection. The busway going directly into Kwitang will be provided by bypassing the center column of flyover.

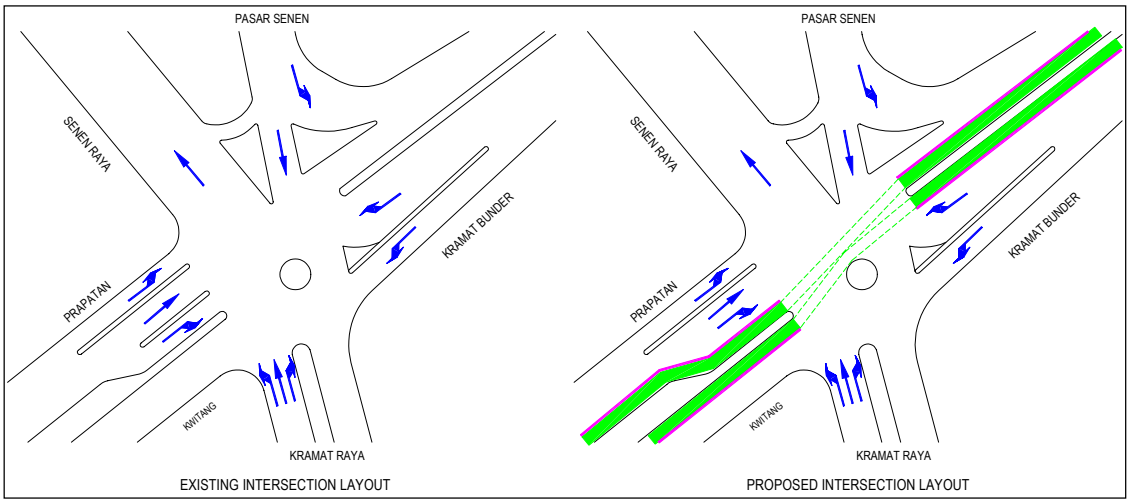
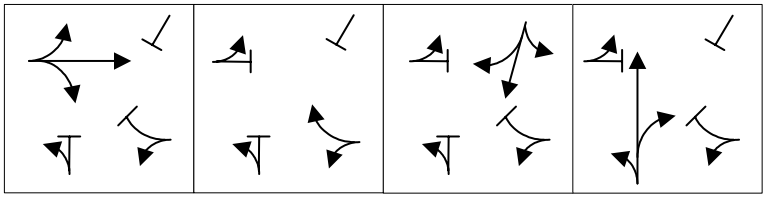
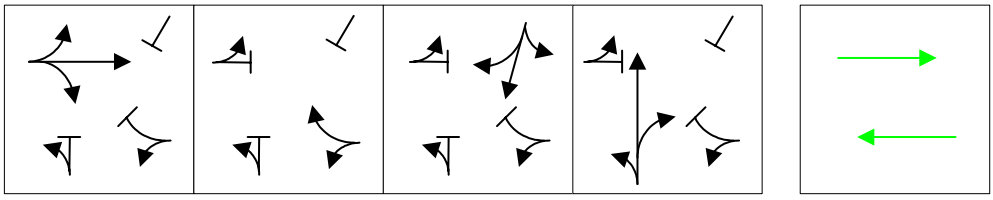


Figure 2.4.26 Intersection Layout at Senen Intersection

The existing signal operates with four phases as shown below. When busway is introduced, local controller with bus preemption function will be installed at the intersection. Upon detection of approaching bus on either side of the intersection, the local controller will terminate the phase in display and jump to the bus phase. When the preset time elapses, the local controller returns to the next phase before the jump. Description about priority and preemption functions is given later.



(a) Existing phase sequence

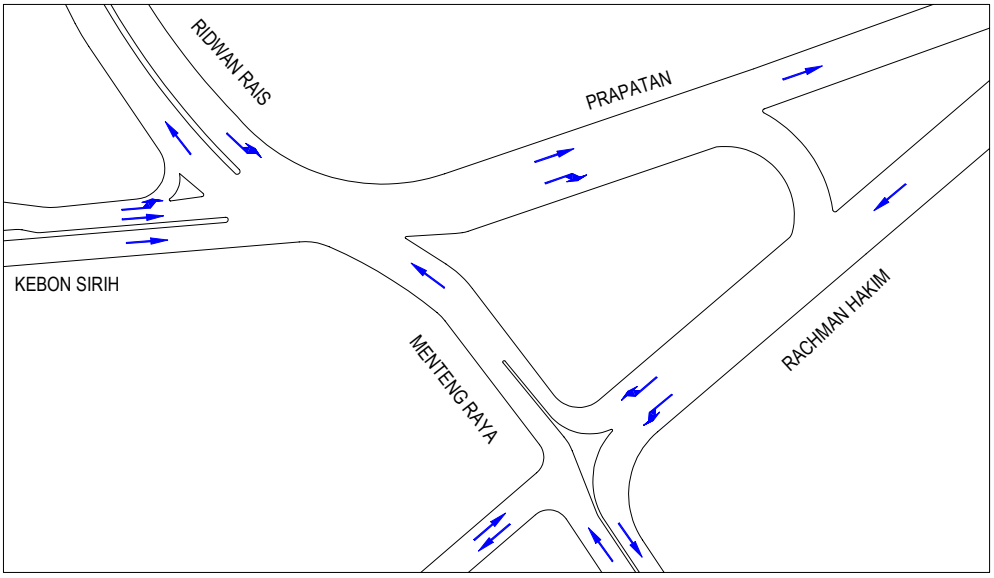


(b) Proposed bus preemption/priority signal phase

Figure 2.4.27 Phase Sequence at Senen Intersection

8) Prapatan – Arief Rachman Hakim– Menteng Raya Triangle

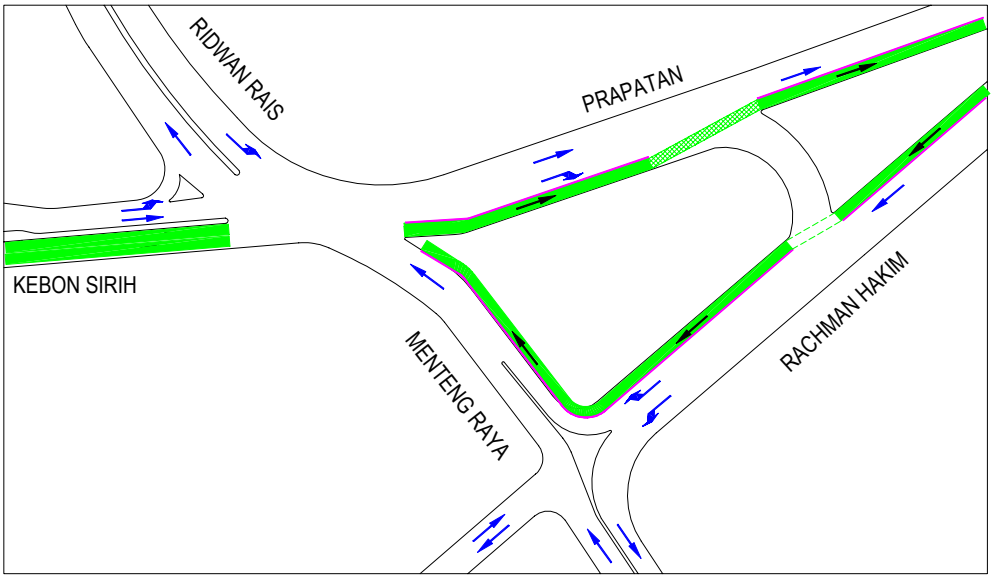
A one-way triangle is formed by three streets (Prapatan, Arief Rachman Hakim and Menteng Raya) in front of Aryaduta Hotel. U-turn lanes from Prapatan are provided with a signal at the merging point with Arief Rachman Hakim.



EXISTING CIRCULATION LAYOUT

Figure 2.4.28 Existing Circulation Layout at Prapatan – A Rachman Hakim – Menteng Raya

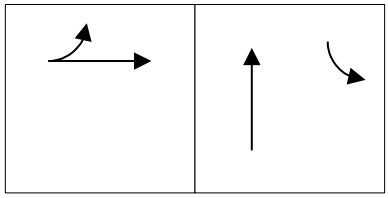
Busway will be constructed along rightmost lane (inner lane) around the triangle as shown in the figure. As there is not a signal, a transition section is necessary on Prapatan before the U-turn opening to allow U-turning vehicles to make a right turn. Menteng Raya will be widened on the west side of triangle to accommodate the busway.



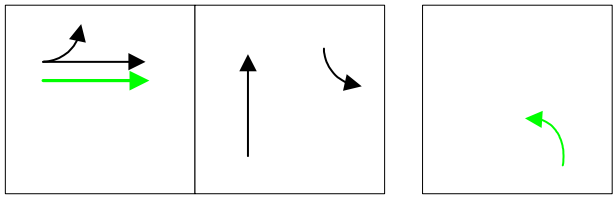
PROPOSED BUSWAY LAYOUT

Figure 2.4.29 Proposed Busway Layout at Prapatan – Hakim – Menteng Raya

There are two signals in the area, one at Kebon Sirih/Prapatan – Menteng Raya intersection and another at Kwitang – U-turn opening. Busway takes Kebon Sirih for both directions so that westbound bus has to make a left turn from Menteng Raya into Kebon Sirih. Therefore, bus preemption function is required for the signal at the intersection. Simple bus priority function will be provided to the signal at Arief Rachman Hakim – U-turn opening.



(a) Existing phase sequence



(b) Proposed bus preemption/priority signal phase

Figure 2.4.30 Phase Sequence at Kebon Sirih – Menteng Raya

9) Kebon Sirih – Agus Salim Intersection

Kebon Sirih is one-way eastbound on the east side of Kebon Sirih – Agus Salim intersection, while two-way on the west side. Likewise, Agus Salim is one-way northbound south side of the intersection, while two-way on the north side.

The proposed busway takes Kebon Sirih for both directions. It runs on the south side of the road for one-way section while along the center for two-way section so that it has to shift from the south side to center at the intersection.

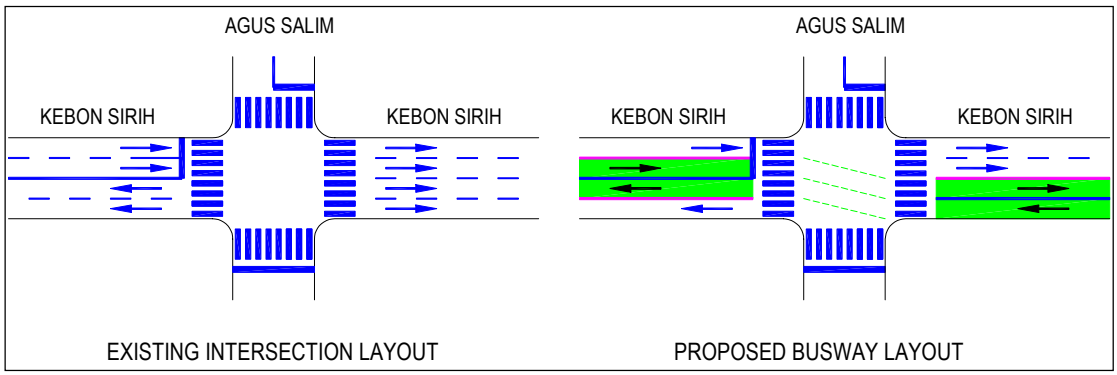
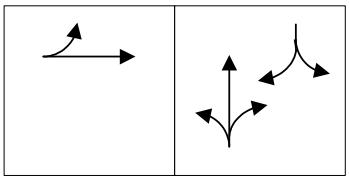
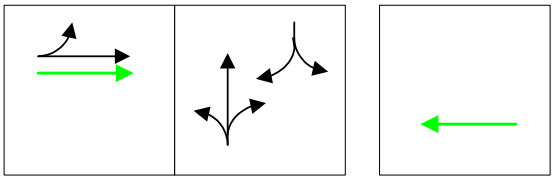


Figure 2.4.31 Intersection Layout at Kebon Sirih – Agus Salim Intersection

Only bus runs in westbound direction; a signal with both priority and preemption function will be installed at the intersection and the phase sequence will be as shown in the figure below.



(a) Existing phase sequence



(b) Proposed bus preemption/priority signal phase

Figure 2.4.32 Phase Sequence at Kebon Sirih – Agus Salim

10) Thamrin – Kebon Sirih Intersection

Two busways, Pulogadung – Kalideres route (PB04) and Kota – Lebak Bulus route (PB01), merge and diverge at this intersection. Pulogadung – Kalideres route turns from north-south direction to east-west direction into Kebon Sirih. Thus eastbound bus has to cross the flow of southbound through-traffic. Kota – Lebak Bulus route runs in north-south direction and there is no crossing. The added lane must be installed to the entry from north considering the signal phase that is discussed later.

Right turn of vehicles from Thamrin is prohibited from both approaches while right turn from Kebon Sirih into Thamrin is allowed during night time. There is a small tower at the center of intersection making right turn difficult due to sight restriction. The tower must be removed when busway is introduced.

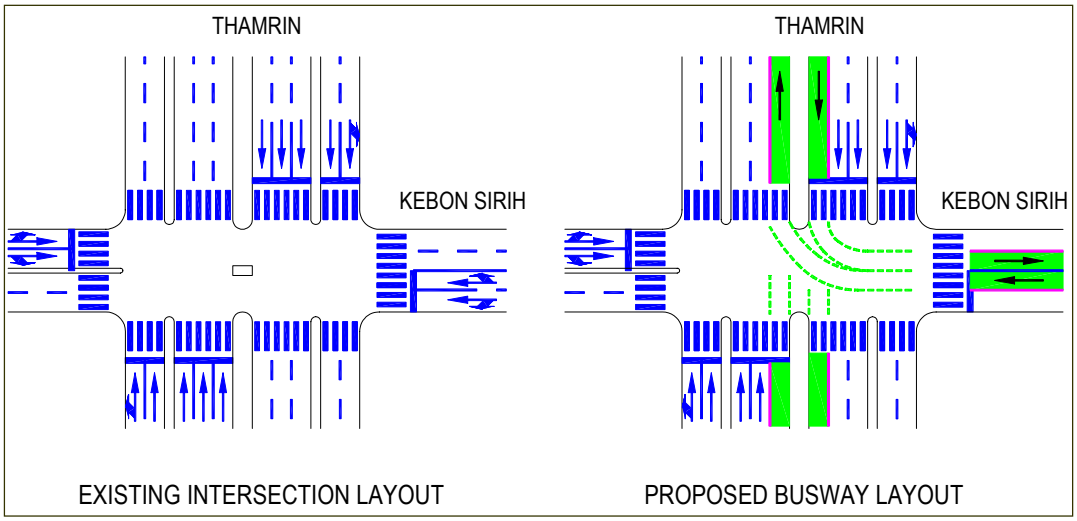
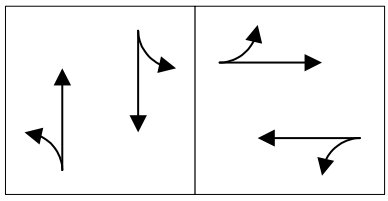
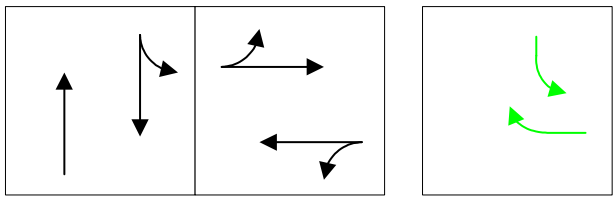


Figure 2.4.33 Intersection Layout at Thamrin – Kebon Sirih

Currently the signal at the intersection operates with normal two-phase sequence, north-south green followed by east-south green. When east-west busway is introduced, preemption is required to allow the bus to make a left turn. As the road is also the route for Kota – Lebak Bulus busway, the signal must be capable of distinguishing the route and display left turn bus phase when the bus is heading for Pulogadung. The existing and proposed phase sequences are shown below.



(a) Existing phase sequence



(b) Proposed bus preemption/priority signal phase

Figure 2.4.34 Phase Sequence at Thamrin – Kebon Sirih

11) Gajah Mada – Hayam Wuruk – Hasyim Asyhari intersection

Gajah Mada and Hayam Wuruk are parallel roads separated by a small canal. Currently, no intersection exists at this location. Hasyim Asyhari is connected to Gajah Mada and only a left turn from both Gajah Mada and Hasyim Asyhari is possible. When busway is introduced, a new intersection connecting Hasyim Asyhari with Hayam Wuruk must be constructed over the canal to allow eastbound buses to make a right turn here. And additional lane must be installed to the entry

from south considering the signal phase that is discussed later. The proposed intersection layout is shown below.

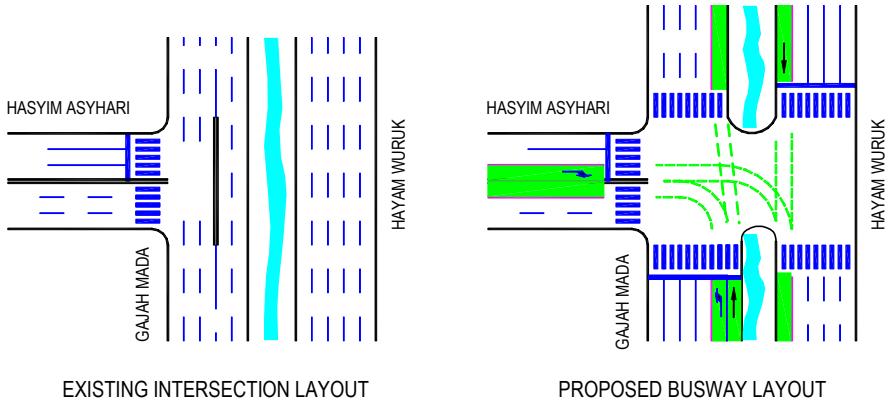


Figure 2.4.35 Intersection Layout at Gajah Mada – Hayam Wuruk – Hasyim Asyhari

There are two options as to the movement at this intersection. One option is to allow only bus to make a right turn and another option is to allow right turn by other traffic also. To be exact, the latter option is further divided into three cases as there are two right turns, one from Hasyim Asyhari and another Hayam Wuruk. The signal phasing will be as shown in Figure 2.4.36 (a) for bus only case and Figure 2.4.36 (b) for the case when both right turns are allowed from both roads. The signal will operate with four phases to accommodate two right turns.

Merit of allowing right turn is to lessen the U-turn volume along Gajah Mada and Hayam Wuruk currently made at Hayam Wuruk – Juanda intersection by southbound and Gajah Mada – Batu Ceper intersection by northbound. If U-turn traffic becomes small, merging and diverging volume on the busway will also decrease. Therefore, four-phase operation was recommended in the study, even though the four-phase operation will be less efficient.

The selection of option will be made after a quantitative analysis based on the traffic volume has been conducted.

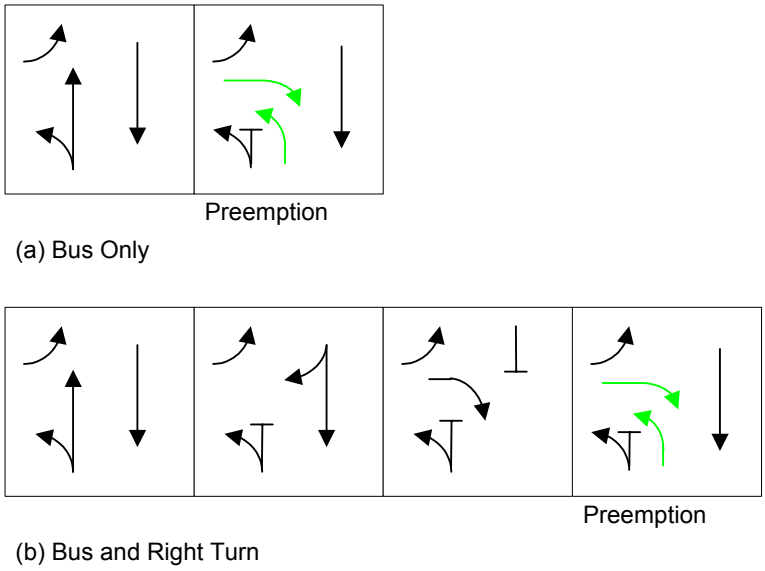


Figure 2.4.36 Signal Phasing at Gajah Mada – Hasyim Asyhari

12) Hasyim Asyhari – Biak intersection

This is a relatively small intersection where Hasyim Asyhari, which has three lanes in each direction, and Biak, which has only one lane for each direction, cross each other. Physical condition around the intersection is not good. The edge of the pavement is damaged and sidewalk is narrow so that effective intersection capacity is lower than the capacity determined by geometric conditions of the intersection. Another factor that contributes to the congestion at the intersection is U-turning public transport (angkot and medium size bus). Right turn and U-turn from Hasyim Asyhari are allowed at this intersection and buses on west approach can make a U-turn. Officially designated route of these buses is not clear but they apparently end their trip at this intersection after dropping-off passengers at Roxy Mas Shopping Mall located some 500 meters west of the intersection.

When busway is introduced, the number of lanes will be reduced to two lanes. The traffic condition is surely expected to worsen and the intersection will become a bottleneck point with right turn and U-turn allowed. It is desirable to partially widen Hasyim Asyhari for 50 meters on each side to create right turn pocket.

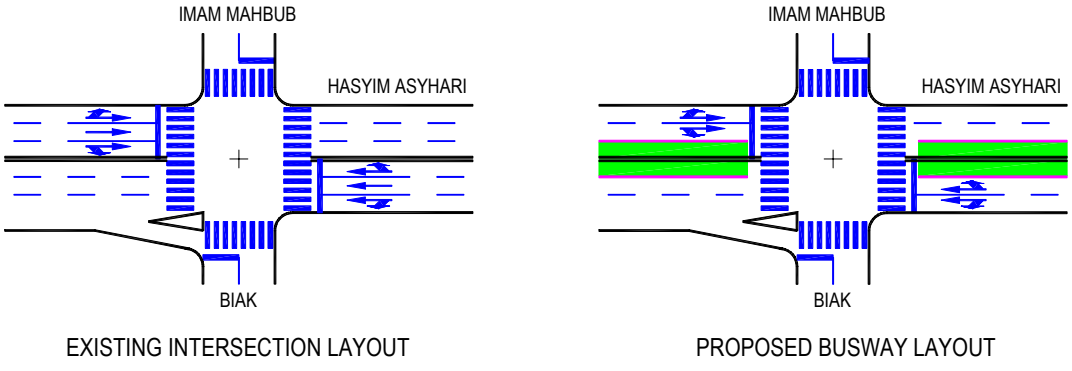
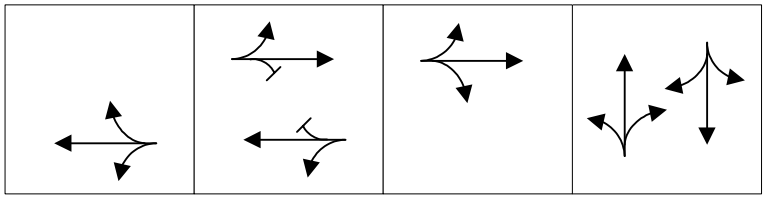
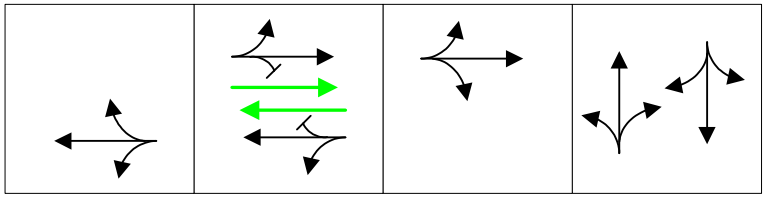


Figure 2.4.37 Intersection Layout at Hasyim Asyhari – Biak

The existing signal adopts overlapping phase as shown in Figure 2.4.38 (a). The bus phase will be accommodated in the through movement phase as shown in the figure. Separate sets of signal lantern are required for bus control because the bus phase is different from the through phase.



(a) Existing phase sequence



(b) Proposed bus priority signal phase

Figure 2.4.38 Signal Phasing at Hasyim Asyhari – Biak Intersection

13) Daan Mogot – Satria intersection

Satria is a road running along both sides of the toll road. The southbound section of Satria is grade separated and no through movement is possible at the intersection. Only right and left turn movements are allowed at intersection. For the northbound traffic on Satria, all directions are allowed at the intersection and right turn volume is high. Right turn from east approach (Kyai Tapa) is possible and three lanes are assigned for right turn, while on the opposite side, right turn from Daan Mogot is not allowed. (See Figure 2.4.39)

Busway will be set up along the innermost lane. There is no conflict for eastbound busway, while westbound busway is located on the right side of right-turn lane. Movement of bus and right turn traffic must be controlled as shown in the proposed signal phase in Figure 2.4.40.

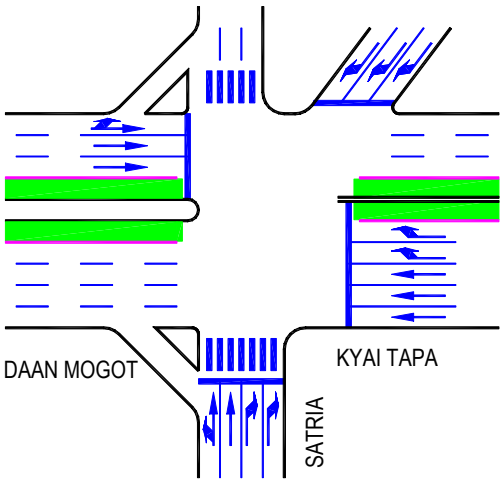


Figure 2.4.39 Intersection Layout at Daan Mogot – Satria

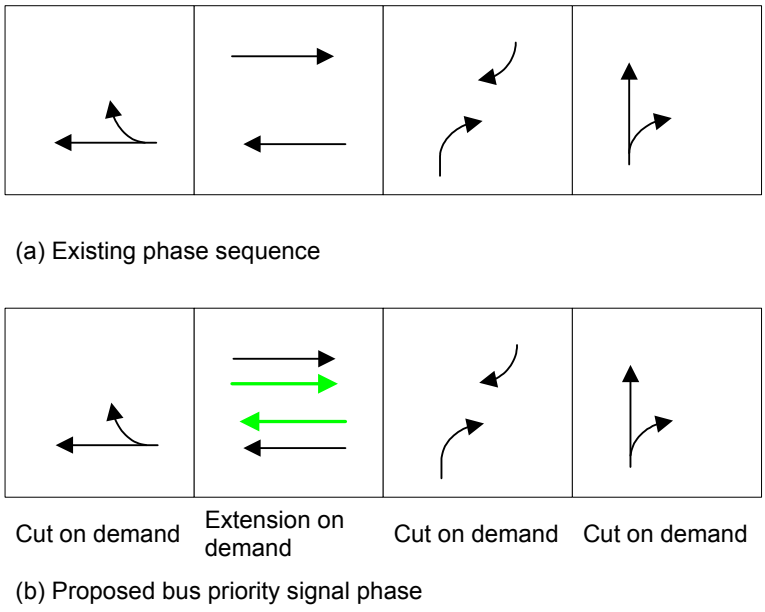


Figure 2.4.40 Signal Phasing at Daan Mogot – Satria Intersection

14) Daan Mogot – Angke Flyover

A flyover is being constructed along Daan Mogot at the section between Pesing railway station and Jalan Panjang. It crosses over Tangerang – Jakarta railway, Daan Mogot – Tubagus Angke intersection, Kali Angke, Daan Mogot – Panjang intersection. Even after the flyover is completed, busway will stay at-grade for passenger access. Location of busway and associated traffic management issues will be studied after the details of flyover become available.

15) Daan Mogot – Outer Ring Road intersection

This intersection is an intersection of Daan Mogot and of two one-way service roads along the side of Jakarta Outer Ring Road. Thus it is actually two intersections with one-way road closely separated. Right turn from Daan Mogot to the service road is allowed from both directions. When busway is introduced, the innermost lane will be converted to busway and right turn lanes

will setup next to busway. The existing lane assignment of two lanes for right turn and three lanes for through movement at the middle section for both directions may be modified to two lanes each for right turn and through.

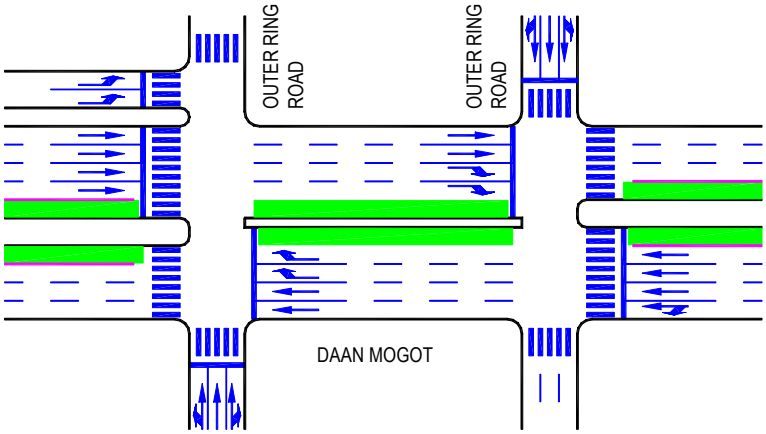
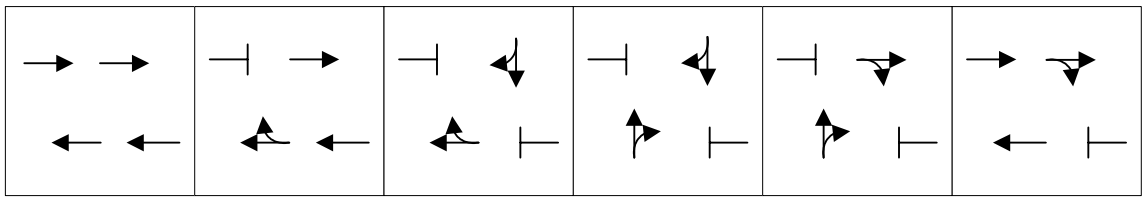
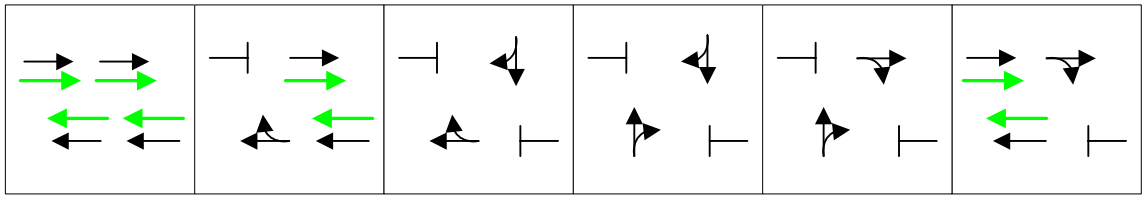


Figure 2.4.41 Intersection Layout at Daan Mogot – Outer Ring Road

Because of the peculiar intersection layout in which Daan Mogot crosses two one-way road along Outer Ring Road in short distance, the existing signal operates with six phases as shown in Figure 2.4.42 (a). Bus signal will be added to through movement phase as shown in the figure. No priority function will be adopted at the signal as there are already many phases and timing adjustment flexibility is small.



(a) Existing phase sequence



(b) Proposed bus priority signal phase

Figure 2.4.42 Signal Phasing at Daan Mogot – Outer Ring Road Intersection

16) Daan Mogot – Tampak Siring intersection

This is a T-shaped intersection where Tampak Siring connects Daan Mogot Shopping Center with Daan Mogot. Right turn lanes are provided on east approach of Daan Mogot for the access to the shopping center. Busway has to cross these right turn lanes, which will be made through merging. No right turn is possible from Tampak Siring to Daan Mogot and all traffic must make a left turn.

Bus priority function is not necessary at this intersection as the split for Daan Mogot is large enough and much reduction is expected by such function.

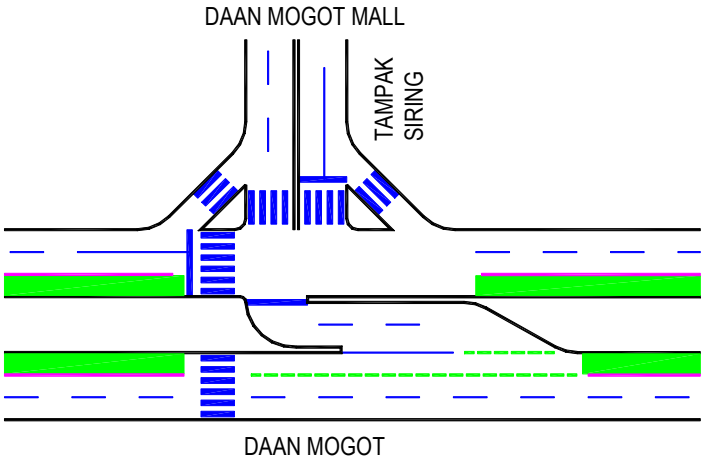


Figure 2.4.43 Intersection Layout at Daan Mogot – Tampak Siring Intersection

17) Kalideres Bus Terminal

Kalideres Bus Terminal is connected with Daan Mogot with a short access road. There is an opening of median and a T-shape intersection is formed. The area is chaotic and full of loading and unloading angkots, waiting ojeks, and pedestrians. Sidewalk is not provided on the south side of Daan Mogot and people walk on the carriageway.

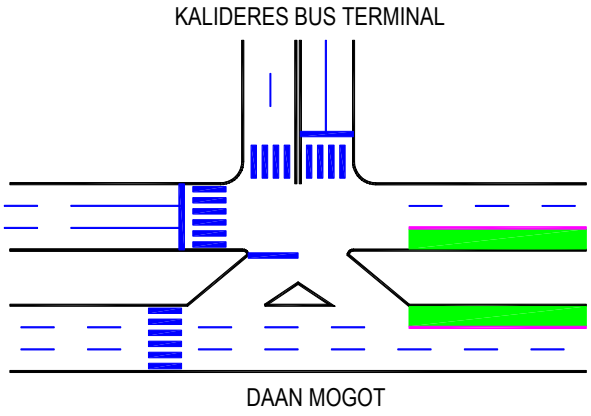


Figure 2.4.44 Intersection Layout at Daan Mogot – Kalideres Bus Terminal

A traffic signal is installed at the intersection but it is not operating. Instead, the intersection is manually managed. When bus enters into or exits from the terminal, a traffic enforcer stops the traffic on Daan Mogot and guides the bus. The manual operation seems to be better because of irregular entry and exit timing of buses and loading and unloading activities of angkot in the area. Even access road is used as parking and loading by buses. When busway is introduced, manual operation will be retained.

2.5 COST ESTIMATES

(1) Precondition

Project costs are estimated under the following preconditions:

Table 2.5.1 Major Preconditions for Cost Estimates

Item		Preconditions	Remarks
1	Exchange Rate	US$ 1 = Rp. 8500; Japanese Yen 1 = Rp. 77.92	As of 31 Oct. 2003
2	Land price	Market land price is used to estimate land acquisition cost, considering current atmosphere on activities of public works. Compensation cost for property on the land such as buildings is estimated at around 20% of the land market price on average, judging from current land use.	Market land price was obtained by a survey, conducted in the course of the study.
3	Unit construction costs	Unit construction costs were determined based mainly on the past construction costs, which the Study Team collected.	
5	Project costs	Project costs were estimated including engineering cost, physical contingency, VAT and land cost with compensation cost.	

(2) Project Cost

1) Category for Project Cost

Project costs assumed to be appropriated by the governmental expenditures are estimated under the following work category:

- Civil works;
- Bus shelter;
- Ticketing system;
- Traffic signal;
- Others such as consulting cost, physical contingency and VAT; and
- Land acquisition cost.

In addition, cost for bus coach procurement is also estimated, though this may be borne by bus companies.

Table 2.5.2 Project Cost of Busway

Unit: Rp. Billion

Item	PB01	PB02	PB03	PB04	Total
Civil Works	33	56	64	37	190
Bus Shelter	26	16	20	30	92
Ticketing System	20	22	51	52	145
Traffic Signal	15	10	18	16	59
Subtotal	94	104	153	135	486
Land Acquisition	678	48	336	111	1,173
Project Cost	772	152	489	246	1,659

Source: SITRAMP

2.6 ENVIRONMENTAL AND SOCIAL CONSIDERATION

2.6.1 Examination of AMDAL Requirement

(1) Criteria for AMDAL Requirement

Construction of busway is not in the "List of Activities Requiring EIA." Accordingly, the DKI's busway project is on-going without AMDAL procedure. BPLHD says that any discussion on AMDAL issue has never been held between DKI, the proponent, and BPLHD, EIA secretariat. The reason is not that its environmental impacts were considered negligible, but that it was not expected at the drafting process of the List. Therefore, it is recommended that its impacts should be assessed; the EIA would not only propose preventive/mitigation measures against negative impacts, but also contribute to the success of the project. Furthermore, the installation of lane dividers, which is an activity of busway construction, is considered as "Improvement of existing road without land acquisition" listed in DKI's criteria shown in Table 2.6.1. Consequently, it could be said that the on-going DKI project required AMDAL.

The busway extension project proposed by SITRAMP consists of four routes; their project scales are shown in Table 2.6.2. All of them need the widening of existing roads with land acquisition, in addition to the installation of lane dividers, which is categorized in "Improvement of existing road with land acquisition" as AMDAL requirement in Table X1. It shows that the project will have more significant environmental impacts than the DKI's. Therefore, AMDAL is required for each route.

The four routes will be undertaken in close succession although they are in different phases of the project. Therefore, it is recommended that the project proponent integrate AMDAL in order to analyze impacts accumulated by all routes.

Table 2.6.1 National and DKI's Criteria for AMDAL Requirement (Road Construction)

Project Type	DKI	National
Construction of New Road with Land Acquisition	Length*: 1 km or Extent Area** 1 ha	Length: 5 km or Extent Area: 5 ha (for Big city/Metropolitan)
Improvement of Existing Road WITH Land Acquisition	Length: 4 km or Extent Area: 2.5 ha	
Improvement of Existing Road WITHOUT Land Acquisition***	Length: 4 km or Extent Area: 3 ha	

* Length means the total length of new road construction and existing road improvement.
** Extent area means road area constructed by new road construction and existing road improvement.
*** Improvement of Existing Road WITHOUT Land Acquisition means existing road improvement in right of way.

Table 2.6.2 Project Scale

Busway Route	Project Scale (Total Length)	Scale of Land Acquisition
PB01: Kota – Lebak Bulus	21.8 km	Length = 5.2 km Extent Area = 6.4 ha
PB02: Kota – Ragunan	19.8 km	Length = 2.4 km Extent Area = 1.7 ha
PB03: Kota – Kp. Rambutan	24.9 km	Length = 7.6 km Extent Area = 9.0 ha
PB04: Kalideres – Pulogadung	25.9 km	Length = 1.5 km Extent Area = 7.5 ha

(2) Project Proponent and Relevant Agencies

The key responsibility for project implementation rests upon Dinas Perhubungan of DKI, and BPLHD of DKI will be the EIA secretariat as shown in Table 2.6.3. BPLHD or BAPEDAL of the surrounding Kabupaten/Kota of DKI should be invited to AMDAL evaluation committee, and people living there should be involved from first public consultation of KA-ANDAL. The reason is that the major passengers of the busway are supposed to live in the surrounding area, and they would be affected by the project.

Table 2.6.3 Project Proponent Proposed and Relevant Agencies

The Proponent	Relevant agencies	Tasks assigned
Dinas Perhubungan (DKI Jakarta)	Dinas PU (DKI Jakarta)	Road widening
	Local Government	Implementation of Land acquisition
	Private bus company	Concessionaire of bus operation
	BPLHD (DKI Jakarta)	EIA Secretariat

(3) Other Stakeholders

In addition to the project proponent and relevant agencies, stakeholders of the project are preliminarily identified as shown in Table 2.6.4.

Table 2.6.4 Preliminary Identification of Stakeholders

Categories	Features of the People/Group
Beneficiaries	- Busway bus users - Busway bus concessionaire and its employees
Negatively Affected Groups	- Public transport users who cannot afford to use busway bus - Bus enterprises which are restricted to operate on the busway routes and their bus drivers & conductors - Individuals/households/business enterprises/public facilities who have to give up a part of their property (land, building) but no need to resettle. - Individuals/households/business enterprises/public facilities who have to give up all of their property and resettle - Users of public facilities mentioned above - Illegal occupants on the project site such as squatters and street vendors
Implementing agencies	- Project Proponent & relevant agencies (see Table 2.6.3)
Funding agencies	- Unknown yet
Local & Community leaders	Following leaders in the project area and its surrounding areas - Head of Kecamatan - Head of Kelrahan / Desa - Head of RT & RW - Leaders of various community groups
Potential Opponents	- Social Groups/NGOs which concern environmental issues - Social Groups/NGOs which concern interests of the negatively affected groups mentioned above
Supporting Groups	- Other vehicle users - People living near the busway routes

(4) Scoping of Natural Environment

Possible impacts of natural environment will differ among the routes as shown in Table 2.6.5 and possible impacts for four routes, namely air quality, noise and vibration, wastes and landscape are scoped as shown in Table 2.6.6.

Table 2.6.5 Possible Impacts by Routes

Busway Route	Possible Impacts Description
PB01: Kota – Lubak Bulus	Most of the roadside buildings are made in solid structure with several floors. Buildings at the roadside will work as wall to mitigate impacts in the area behind them.
PB02: Kota – Ragunan	Residents living along the existing road will be brought closer to traffic by land acquisition.
PB03: Kota – Kp. Rambutan	Residents living behind the buildings facing the existing road will face the new road due to road widening and suffer directly from the project.
PB04: Kalideres – Pulogadung	Possible impact will be smallest among the four routes because land acquisition area will be least though roadsides of the segment to be widened are build-up.

Table 2.6.6 Possible Impacts on Natural Environment

Possible impact		Construction stage	Operational stage
Natural Environment	(1) Air Quality	B	C
	(2) Noise & Vibration	B	C
	(3) Wastes	B	B
	(4) Landscape	B	B

A: Serious impact expected, B: Impact expected, C: Unknown, -: No/Negligible Impact expected

(5) Scoping of Social Environment

It is assumed that different social impacts will take place in different project phases: during preparation and construction stage, and operational stage.

1) Preparation and Construction Stage

At this stage, land acquisition and involuntary resettlement for road widening and temporary traffic jam during construction stage will be critical issues.

The present situation of the roadside whose road needs to be widened for busway is summarized in Table 2.6.7. Since most of the roadsides are already built-up, land acquisition is not easy. Most difficult route is supposedly PB03. The road length for widening on PB03 is the longest (7.6 km) so that project-affected people will also be the most. Then, the route also has a characteristic that small stores and street vendors are very dominant along the road. If the road is widened, most of these small stores entirely fall within the necessary right-of-way. It means that they should give up all land and building and resettle. There is also no doubt that street vendors are obliged to move out (Figure 2.6.1).

Table 2.6.7 Roadside Situation of the Busway Route

Busway Route	Road to be widened (total length of widening)	Situation of the roadsides
PB01: Kota – Lebak Bulus	Jl. Panglima Polim & Jl. Fatmawati (5.2km)	Commercial buildings are dominant on the roadsides. Most of them keep open space in front for parking. They have to be set back as well as to give up present parking space for the project.
PB02: Kota - Ragunan	Jl. Warung Jati Barat & Jl. Harsono R.M. (2.4km)	The roadsides are built up with private houses, commercial buildings, schools and mosques. They have to give up a part of their land or to be set back.
PB03: Kota – Kampung Rambutan	Jl. Dewi Sartika & Jl. Bogor Raya (7.6km)	The roadsides are built-up with various types of buildings such as private houses, commercial buildings, schools, mosques & hospitals. Many small stores and street vendors are distinguished from other routes. Most of them must give up whole of their land & house.
PB04: Kalideres – Pulogadung	Jl. Perintis Kemerdekaan (1.5km)	The roadsides are built up. The other road improvement project with road widening has started already.

(PB01: Jl. Fatmawati)

(PB02: Harsono R.M.)

(PB03: Bogor Raya)

Figure 2.6.1 Present Situation of the Busway Routes

Second, engineering works such as establishing exclusive bus lane and rearranging existing lanes will disturb traffic. Since these four routes have quite large traffic volume at present, traffic congestion will get worse.

2) Operational Stage

At operational stage, following impacts are forecasted so alternative or mitigation measures against them should be considered.

- Exclusive bus lane will worsen the traffic jam on the other traffic lanes.
- If the fare of busway bus is too high for people to pay and other public transport is limited to operate on the busway route, people lose access to affordable and reasonable public transport. In this case, the poor suffer the most.
- Public transport enterprises other than busway concessionaires are limited to operate on the busway route so that their profit will decrease. In consequence, bus drivers and conductors will lose their jobs.

- Widened roads will make it difficult for people to access to the opposite side of the road.
- If busway bus users try to cross the road to bus stop without using pedestrian bridge or zebra crossing, traffic accident will increase.

3) Conclusion of Scoping

Influence of the project over the social environment will be significant. Possible impacts and degree of their seriousness are summarized in Table 2.6.8.

Table 2.6.8 Possible Impacts on Social Environment

Possible impact		Construction stage	Operational Stage
Social Environment	(1) Land acquisition & Involuntary resettlement	A	A
	(2) Socio-economic activities of residents	A/B	A/B
	(3) Economic activities of public transport providers	C	A
	(4) Socio-economic activities of public transport users	C	A
	(5) Traffic activities	A/B	A
	(6) Cultural property	C	C

A: Serious impact expected, B: Impact expected, C: Unknown, -: No/Negligible Impact expected

2.6.2 Preliminary Examination of EIA Methodologies

It is recommended to conduct an integrated AMDAL for the whole project consisting of four routes if they are supposed to start within three years while AMDAL allows that the approval can be valid generally. That contributes to comprehensive analysis on accumulated impacts caused by more than one segment, which may be overlooked by fragmental impact analysis.

(1) Natural Environment

Methodology of natural environmental impact assessment in AMDAL is proposed as shown in Table 2.6.9.

(2) Social Environment

Methodology of social impact assessment in AMDAL is proposed as shown in Table 2.6.10.

Table 2.6.9 Methodologies on Natural Environment

Issue	Preliminary Forecasted Impact	Methodology of Data Collection/Analysis	Methodology of Impact Forecasting	Methodology of Evaluation of the Impact
(1) Air Quality	Construction stage: For road widening and bus shelter construction, construction machines would emit exhaust gas and earthwork would cause particulates. Operational stage: The buses for Busway would cause positive impact on the project route since the buses will be of low-emission type and conventional buses shall be eliminated on the Busway routes as the policy and passenger car traffic is expected to shift even partly, while it might cause negative impact on connecting roads.	If continuous monitoring data measured (BPLHD, etc.) at a monitoring station near to project site (Secondary data) were available, they would be most reliable for long-term evaluation. And to confirm the evaluation is appropriate, on-site survey is recommended for air quality as a controversial issue. For evaluation of positive impact in operation stage, traffic volume in pre-construction stage would be effective to estimate total emission amount which could be compared with the amount in operational stage by calculating with relative emission factors.	For forecasting the construction impact, the simple method could be available, which is to calculate the emission from construction machines as compared to the one from total traffic emission at the construction sites. The additional rate of emission due to the construction would be similar to the increase on concentration at the pre-construction stage in the adjacent area.	The concentration estimated should be compared with the standards.
(2) Noise & Vibration	Construction stage: Construction machine would make noise and vibration. Operational stage: The buses for Busway would cause positive impact on the project route since conventional buses shall be eliminated on the Busway routes as the policy and passenger car traffic is expected to shift even partly, while it might cause negative impact on connecting roads.	For Noise & Vibration, secondary data might not be expected; therefore the status in pre-construction stage should be estimated by traffic volume surveyed.	For noise, it could be forecasted by integrating A-weighted noise equivalent level, LAeq, specified from the machines' specs, into the background noise level estimated from traffic volume. For vibration, simulation method requires ground condition besides traffic condition.	The noise/vibration level estimated should be compared with the standards.

Table 2.6.9 Methodologies on Natural Environment (cont.)

Issue	Preliminary Forecasted Impact	Methodology of Data Collection/Analysis	Methodology of Impact Forecasting	Methodology of Evaluation of the Impact
(3) Wastes	Construction stage: Construction wastes, especially construction debris and domestic wastes of workers, would be generated. Operational stage: Domestic wastes would be discharged by the Busway passengers at the bus shelters.	Amount of domestic wastes should be examined in adjacent area to the project site. To determine emission factor of domestic wastes, an amount of domestic wastes and the number of passengers should be surveyed at existing bus terminals.	For construction stage, the amount could be forecasted from the number of man-months required to the construction work plan. For operational stage, the amount could be forecasted from the surveyed emission factors and the number of passengers estimated at each bus shelter.	The impact of the domestic wastes should be evaluated by comparing the additional amount due to the project to the amount in pre-construction stage.
(4) Landscape	Construction stage/ Operational stage: Road widening would reduce green area of median and construction of bus shelter would cut trees planted in median.	View from pedestrian should be observed in pre-construction stage.	Photomontage method is recommended to forecast the view.	The view should be evaluated by the general public through voting.

Table 2.6.10 Methodologies on Social Environment (1/6)

Issue	Preliminary forecasted impact	Methodology of Data Collection/Analysis * Required Data & Information * Method of Data Collection & Source of Data	Methodology of * Impact Forecasting * Evaluation of Forecasted Impact
(1) Land acquisition & Involuntary resettlement *(For those who live or do their business along the roads which require widening)*	1) It will weaken socio-economic situation of households which lost their property (e.g. loss of job opportunities, house, & community relationship, and deterioration of housing condition) 2) People will have difficulty to adjust to the new settlement place (e.g. conflict with other residents, difficulty to get job) 3) Removal of some social facilities will cause inconvenience to their users	Required data & information • Data & information on ***land acquisition area***: - Population, number of households, characteristics of households (housing & land status, living conditions, occupation, income, etc.) - Land use pattern & inventory of existing infrastructure (property/land right status, location & area of houses, local road, social facilities, agricultural field, commercial & business facilities) - Socio-cultural characteristics of community (community history & profile, ethnic & geographical origin, custom & tradition, socio-cultural group & its activities, mutual help, communal property & facilities) Method & Source (Primary data & information) • Household interview (sample HHs, using questionnaire) • Key informant interview (RT/RW leader, leader of various social groups, local government officials) • Direct observation (Secondary data & information) • Relevant maps & statistics obtained from: • Local government (e.g. Camat, Lurah) • Local office of National Land Agency (BPN) • Local office of National Statistics Agency (BPS) • Relevant local government agencies (e.g Dinas Tata Kota)	**(Impact forecasting)** Required data & information • Opinion & perception from project-affected people (PAP) and other relevant stakeholders • Experience of similar projects Method & Source • Household interview (sample HHs, using questionnaire) • Key informant interview ((RT/RW leader, leader of various social groups, local government officials, local NGOs, intellectuals, experts) • Group discussion (by different stakeholders) • Project document & research paper of similar projects **(Evaluation of forecasted impact)** Required data & information • Number of PAP, households • Number of buildings & their function • Project affected area (m^2) • Degree/seriousness of impact • Period of impact continued Method & Source • Empirical knowledge of expert • Analysis of obtained data & information • Project document & research paper of similar projects

Table 2.6.10 Methodologies on Social Environment (2/6)

Issue	Preliminary forecasted impact	Methodology of Data Collection/Analysis * Required Data & Information * Method of Data Collection & Source of Data	Methodology of * Impact Forecasting * Evaluation of Forecasted Impact
(2) Socio-economic activities of residents *(Tthose who live or do business in surrounding areas of the project, especially where the road widening will be carried out)*	1) Impact on their socio-economic activities due to change of traffic flow/volume, road width, and decline of accessibility to other public transport. 2) Widened road will make it difficult for people to access social service facilities located at opposite side of the road.	Required data & information • Data & information on ***surrounding area of the project*** - Population, number of households, characteristics of households (housing & living conditions, occupation, income, etc.) - Land use pattern & Inventory of existing infrastructure (location & area of houses, local road, social facilities, agricultural field, commercial & business facilities) Method & Source (Primary data& information) • Household interview (sample HHs, using questionnaire) • Key informant interview (RT/RW leaders, leaders of various social groups, local government officials, staff of social facilities such as school, hospital, farmers, market traders) • Direct observation (Secondary data & information) • Relevant maps & statistics obtained from: - Local government (e.g. Camat, Lurah) - Local office of National Statistics Agency (BPS) - Relevant local government agencies (e.g. Dinas Tata Kota)	**(Impact forecasting)** Required data & information • Opinion & perception from project affected people (PAP) and other relevant stakeholders • Experience of similar projects Method & Source • Household interview (sample HHs, using questionnaire) • Key informant interview ((RT/RW leader, leader of various social groups, local government officials, local NGOs, intellectuals, experts) • Group discussion (by different stakeholders) • Project document & research paper of similar projects **(Evaluation of forecasted impact)** Required data & information • Number of PAP • Degree/seriousness of impact • Period of impact continued Method & Source • Empirical knowledge of expert • Analysis of obtained data & information • Project document & research paper of similar projects

Table 2.6.10 Methodologies on Social Environment (3/6)

Issue	Preliminary forecasted impact	Methodology of Data Collection/Analysis * Required Data & Information * Method of Data Collection & Source of Data	Methodology of * Impact Forecasting * Evaluation of Forecasted Impact
(3) Economic activities of public transport providers *(The public transport enterprises & their bus operators other than busway bus operator)*	1) If the project limits operation of other public transport on the busway route, some bus enterprises lose their business and decrease their profit. 2) The bus operators (bus drivers & conductors) will suffer reduced income or lose their jobs entirely.	<u>Required data & information</u> • Data explaining current situation of public transport operation on the planned busway routes. - Profile of public transport operated (bus type, number of buses, routes, passengers, bus fare, etc.) - Profile of bus enterprises (capital, type & number of buses owned, number of employees & their wages, operating bus routes, etc.) - Profile of bus drivers & conductors (wage system, actual profit & income, working conditions, etc.) <u>Method & Source</u> (Primary data & information) • Bus transport survey • Questionnaire survey of bus operators (Secondary data & information) • Relevant statistics obtained from: - Relevant government agencies and private organizations (e.g. DLLAJ, Organda)	**(Impact forecasting)** <u>Required data & information</u> • Plan of the bus operation system restructuring accompanied with the busway project (e.g. reorganization of bus route, operational role division among different types of public transport, improvement of concession for bus enterprises, improvement of operational management) <u>Method & Source</u> • Analysis of obtained data & information • Project document & research paper of similar projects **(Evaluation of forecasted impact)** <u>Required data & information</u> • Number of operating buses & passengers reduced • Amount of profit reduced • Number of PAP (operators, their employees) • Period of impact continued <u>Method & Source</u> • Analysis of obtained data • Project document & research paper of similar projects

Table 2.6.10 Methodologies on Social Environment (4/6)

Issue	Preliminary forecasted impact	Methodology of Data Collection/Analysis * Required Data & Information * Method of Data Collection & Source of Data	Methodology of * Impact Forecasting * Evaluation of Forecasted Impact
(4) Socio-economic activities of public transport users *(For those who don't use busway bus)*	1) Decline of accessibility to other public transport will give negative impact on its users (e.g. increase of transport cost and/or travel time) 2) Traffic jam will increase their travel time.	<u>Required data & information</u> • Data explaining current situation of public transport use - Number of passengers, type of public transport used, travel time, fare, etc. • Data obtained in **(3)** & **(5)** <u>Method & Source</u> • Public transport passenger survey • Method & source used in **(3)** & **(5)**	**(Impact forecasting)** <u>Required data & information</u> • Opinion & perception of PAP (= public transport users on the busway routes) • Experience of similar project • Degree of traffic jam, public transport flow & volume forecasted "with the project" case <u>Method & Source</u> • Public transport passenger interview survey • Key informant interview (local government officials, local NGOs, intellectuals, experts) • Analysis of obtained data • Project document & research paper of similar projects **(Evaluation of forecasted impact)** <u>Required data & information</u> • Number of PAP • Degree/seriousness of impact • Period of impact continued <u>Method & Source</u> • Empirical knowledge of expert • Analysis of obtained data & information • Project document & research paper of similar projects

Table 2.6.10 Methodologies on Social Environment (5/6)

Issue	Preliminary forecasted impact	Methodology of Data Collection/Analysis * Required Data & Information * Method of Data Collection & Source of Data	Methodology of * Impact Forecasting * Evaluation of Forecasted Impact
(5) Traffic activities *(Where the busway will be introduced)*	1) Exclusive bus lane will aggravate traffic jam on the other lanes. 2) Traffic accident involving pedestrians, who cross the road to the opposite side, will increase due to road widening. 3) Traffic accident involving busway bus users, who directly cross the road between bus stop and sidewalk, will increase	Required data & information • Data explaining current situation of traffic jam - Traffic volume, travel time (speed) • Data on traffic accident involving pedestrians Method & Source (Primary data & information) • Traffic survey (Secondary data & information) • Relevant statistics obtained from: - Relevant government agencies (e.g. DLLAJ, traffic police)	**(Impact forecasting)** Required data & information • Traffic demand forecast • Opinion & perception of PAP (= public transport users on the busway routes) • Experience of similar project Method & Source • Analysis of obtained data • Public transport passenger interview survey & key informant interview (in **(3)**) • Project document & research paper of similar projects **(Evaluation of forecasted impact)** Required data & information • Degree of traffic jam • Number of accident increase • Period of impact continued Method & Source • Empirical knowledge of expert • Analysis of obtained data & information • Project document & research paper of similar projects

Table 2.6.10 Methodologies on Social Environment (6/6)

Issue	Preliminary forecasted impact	Methodology of Data Collection/Analysis * Required Data & Information * Method of Data Collection & Source of Data	Methodology of * Impact Forecasting * Evaluation of Forecasted Impact
(6) Cultural property	1) Cultural property located along the roads, where the road widening will be carried out, will be damaged.	<u>Required data & information</u> • Location, area, and the profile of cultural property in/along the project area <u>Method & Source</u> (Primary data & information) • Direct observation • Key informant interview (relevant government officials, community leaders, traditional users of the property) (Secondary data & information) • Relevant maps and document obtained from: - Information office at the cultural property - Relevant local government agencies	**(Impact forecasting)** <u>Required data & information</u> • Opinion & perception from relevant stakeholders • Experience of similar projects <u>Method & Source</u> • Key informant interview (local government officials, intellectuals, experts) • Project document & research paper of similar projects **(Evaluation of forecasted impact)** <u>Required data & information</u> • Project affected area (m^2) • Degree/seriousness of impact <u>Method & Source</u> • Empirical knowledge of expert • Analysis of obtained data & information • Project document & research paper of similar projects

2.6.3 Recommendations for Environmental Impact Assessment in F/S

- Most of the negative impacts in operational stage could be avoided if the project is thoughtfully planned and designed. Since busway system is very different from what people have gotten used to, information dissemination is most important to make people understand and cooperate. Effective use of mass media would be considered.
- For some issues of social impacts, which are difficult to be forecasted and evaluated, it is highly recommended to monitor these impacts caused by current Busway project (Blok M - Kota) and learn lessons from its experience for the benefit of the project.
- Some alternatives should be reviewed and analyzed comparatively in combination with traffic demand management (TDM) to minimize land acquisition. And the evaluation committee should weigh the potential environmental impacts against the project costs and effects.
- For the project site where land acquisition and involuntary resettlement are required, land status should be clarified as soon as possible. Then, Land Acquisition and Resettlement Plan (LARAP) needs to be formulated in F/S stage. In addition, some special measures should be considered for illegal occupants such as street vendors to mitigate their loss.

2.7 ECONOMIC AND FINANCIAL ANALYSIS

2.7.1 Implementation Schedule and Bus Operation Cost

(1) Implementation Schedule

1) The project implementation and operation of four routes of Busway Extension is considered as follows.

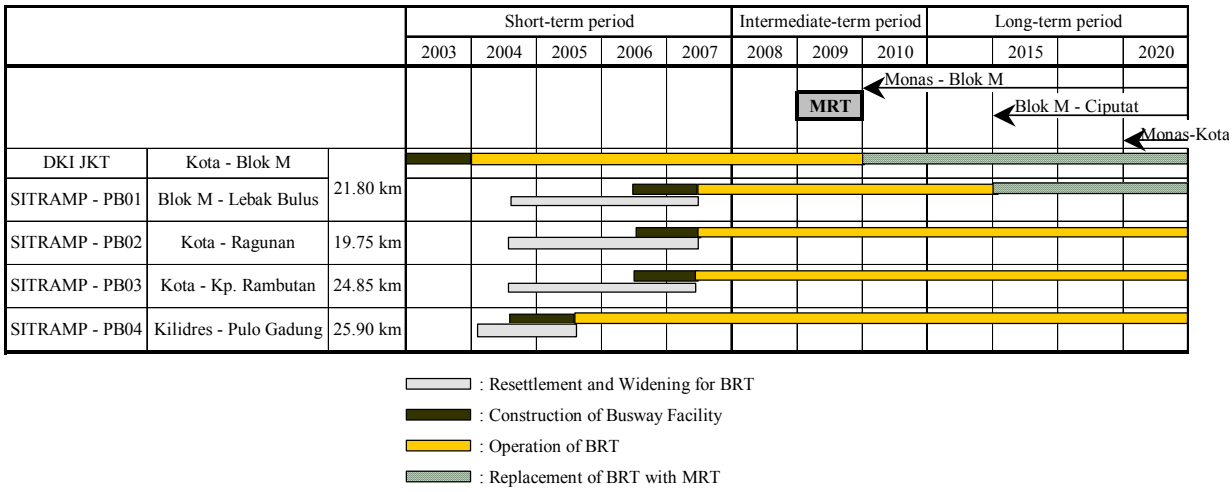


Figure 2.7.1 Implementation and Operation Schedule of Busway

Trans-Jakarta Busway of DKI Jakarta (Kota – Blok M)) started operation from the middle of January in 2004. The implementation of PB04 (Kilideres - Pulogadung) will need to be followed, which is expected to strengthen the accessibility of Jabodetabek's east-west direction. Until year 2007, target year of short-term period, four extensions are scheduled to start operation. It is assumed in the operation schedule that a part of PB01: Monas – Blok M will be replaced with MRT system until the end of the intermediate-term period of the SITRAMP, when sufficient passenger demand generates for MRT operation. As for the rest of the route of PB01: from Blok M to Lebak Bulus, the SITRAMP proposes the conversion to MRT system within the Master Plan Period.

(2) Bus Operation Plan

The bus operation plan of four routes for years 2007 and 2010 is considered as shown in Table 2.7.1.

Table 2.7.1 Bus Operation Plan and Number of Bus-coach Required

		Average Bus Head Way / Peak Hour (second)		Number of Bus Required	
		2007	2010	2007	2010
PB01	Articulated	225	129	32	23
PB02-1	Articulated	1,800	240	4	27
PB02-2	Articulated	900	240	5	17
PB03-1	Single	248	180	34	46
PB03-2	Single	248	90	29	79
PB04	Articulated	138	95	61	88
Total	Single			63	125
	Articulated			102	155

(3) Bus Operation Cost

1) Capital investment

Project cost, which is composed of road widening, earthworks, pedestrian bridges, bus-shelters, ticketing machines and traffic signals, is tabulated in Table 2.7.2. One of the features is high land acquisition cost accounting for around as much as 70% of the total cost. An average investment cost per km is Rp. 20.8 billion (US$ 2.45 million) and Rp. 6.1 billion (US$ 0.72 million) including land cost and excluding land cost, respectively.

Table 2.7.2 Project Cost

	Investment cost (Rp. billion)
Land & compensation	1,174
Construction cost	
Civil works for widening	190
Bus shelter	92
Ticketing machine	146
Bus location system/Traffic signal	58
Total construction cost	486
Total investment cost	1,660
Investment cost per km	20.8 (with land cost) 6.1 (without land cost)

1) Bus-coach Purchase

The cost for the bus-coach purchased is estimated as shown in Table 2.7.3.

Table 2.7.3 Bus-Coach Procurement Cost

	Unit cost (Rp.)	Number of purchase		Cost (Rp. billion)		
		2005~2007	2008~2010	2005~2007	2008~2010	Total
Single	650,000,000	63	62	41	40	81
Articulated	1,420,000,000	102	53	145	75	220
Total				186	115	301

2) Unit operating cost

Bus operation cost consists of capital investment cost of infrastructure estimated above, bus-coach procurement cost and bus operation cost. For the calculation of unit bus operation cost per km, basic data is prepared based on the bus operation plan in Table 2.7.4.

Table 2.7.4 Basic Assumption of Bus Operation

	PB01	PB02	PB03	PB04
1) Bus running distance (km per bus)				
Route length	21.80 km 1)	19.75 km	24.85 km	25.90 km
Average running speed	25 km	25 km	25 km	25 km
Service hours per day	19 h	19 h	19 h	19 h
Hours in operation per day per bus	13.6 h per bus	13.6 h per bus	13.6 h per bus	13.6 h per bus
Running distance per day	340 km	340 km	340 km	340 km
Annual running distance	111,300 km	111,300 km	111,300 km	111,300 km
2) Bus-coach				
Type of bus	Articulated	Articulated	Single	Articulated
Passenger capacity	150	150	85	150
Price (Rp.)	1,420 million	1,420 million	650 million	1,420 million
Life period	8 to 10 years	8 to 10 years	8 to 10 years	8 to 10 years
Number of bus	32 (2007) 23 (2010)	911 (2007) 54 (2010)	6367 (2007) 12536 (2010)	61 (2007) 88 (2010)
3) Crew and staff				
Number of drivers per bus	2 (2 shifts per day)	2 (2 shifts per day)	2 (2 shifts per day)	2 (2 shifts per day)
Number of staff at bus shelter	4 per shelter (2 staff /2 shifts)	4 per shelter (2 staff /2 shifts)	4 per shelter (2 staff /2 shifts)	4 per shelter (2 staff /2 shifts)
Salary / wages per month				
- Driver	Rp. 2,000,000	Rp. 2,000,000	Rp. 2,000,000	Rp. 2,000,000
- Staff at shelter	Rp. 1,500,000	Rp. 1,500,000	Rp. 1,500,000	Rp. 1,500,000
4) Variable cost (Rp. per bus per km)				
Fuel cost	Rp.760	Rp.760	Rp.630	Rp.760
Others (maintenance & spare parts)	Rp.1,110	Rp.1,110	Rp.740	Rp.1,110
5) Indirect cost	10% of revenue	10% of revenue	10% of revenue	10% of revenue

Note: 1) 21.8 km includes DKI JKT route and length of extension is 11.1 km.

The investment cost amounting to Rp. 1,660 billion is distributed in the annual allocation based on the implementation schedule as shown in Figure 2.7.1. On the other hand, operation cost consists of two kinds of components. One is bus running cost composed by variable cost such as fuel cost, lubricant cost, tire cost and maintenance cost which vary with running distance of bus. Another is the cost such as crew and staff cost, registration fee, insurance and interest which is usually fixed during a certain period such as monthly and annually base. Unit operation cost is estimated based on the annual allocation of investment cost and the operation cost which is composed by bus running cost and fixed cost.

Unit operating cost per bus-km reaches around Rp. 20,000 / bus / km including infrastructure improvement cost, related facility development cost, bus-coach procurement cost, operation and maintenance cost of bus and interest accruing from borrowing for a short term. It indicates that seven Get-on passengers is required to make a profit during 1 km of bus running distance under a flat tariff at Rp. 3,300 per passenger (Rp. 3,300 x 7 passengers =Rp. 23,100) at minimum. Table 2.7.5 shows the operation cost by composition.

Table 2.7.5 Bus Operation Cost per Vehicle-km

	Bus operation cost per km
Land & compensation	25%
Infrastructure facility	9%
Bus−coach procurement cost	6%
Bus operation cost (Fuel, parts, crew fee, etc.)	21%
Interest	39%
Total	Rp.20,400

Note: Interest cost is estimated based on annual deficit of cash flow and interest rate at 12%.

2.7.2 Economic Analysis

(1) Assumptions

1) General

An economic analysis was carried out to examine the efficiency of the implementation of Busway Extension project (PB01, PB02, PB03 and PB04). Cost-Benefit analysis was employed under several assumptions of economic analysis.

In the Cost-Benefit Analysis, two scenarios, "With Project" and "Without Project" scenarios, are assumed in order to distinguish and compare the benefits and costs of the implementation of the project. In the economic analysis of Busway Extension Project, two scenarios are assumed as follows:

The Busway Extension Project is implemented in the short-term period of the SITRAMP. The implementation of other projects and programs proposed in the short-term plan has effects on the benefits of the Busway Extension Project. Therefore, the network of the short-term period of the SITRAMP is identified as “With Project Case” and the economic efficiency due to the implementation of Busway Extension Project is evaluated within the network. On the other hand, "Without Project Case" is formulated under the scenario that only Busway Extension Project is excluded from “With Project Case”.

The following are the assumptions for general conditions in the economic evaluation.

- Evaluation Period: Evaluation period is assumed from the year 2004 to 2015 considering the life period of the facility.
- Life Period: Life period of facility and equipment is estimated as the following years based on physical life period.

Civil works and structure: 40 years

Signal and bus location system: 10 years

Bus: 10 years

- Replacement cost of facility and equipment as well as bus is estimated based on the life period and the residual value is calculated as a negative cost in the last year of the evaluation period. Depreciation of land is not considered.
- The investment cost of Busway of DKI Jakarta which was invested for existing system of Busway is considered to be a sunk cost and is not identified as the cost of the project in economic analysis.
- Financial and Economic Cost: Financial costs are converted into economic cost using the conversion factor at 0.80 and 0.85 for foreign currency portion and local currency portion, respectively.
- Discount Rate: A discount rate of 12% is used.
- Foreign Exchange Rate: For the purpose of pre-feasibility study of Busway Extension Project the foreign exchange rate is fixed at the following rate as of October 2003 and shadow exchange rate is not considered.
- US Dollar 1.00 is equivalent to Rp. 8,500 and Japanese Yen 109.08
- Inflation is not taken into account both in benefit and cost estimates during the evaluation period.

(2) VOC and TTC

Benefits of Busway Extension are identified as the differences of VOC (Vehicle Operation Cost) and TTC (Travel Time Cost) of all traffic modes in the Jabodetabek area between "With Project Case" and "Without Project Case".

1) Vehicle Operation Cost (VOC) estimate

Unit vehicle operating cost is estimated by the following types of representative vehicles and operating speed. Unit VOC by type of vehicles and vehicle speed as well as the assumptions for VOC estimates are referred to Appendix of "Technical Report 10 Master Plan Evaluation" of SITRAMP Phase 2.

- Passenger car, Motorcycle, Large truck, Medium/small truck and Bus (Patas AC, Patas Non-AC, Regular bus, Medium bus, Small bus and Busway bus)

2) Travel Time Cost (TTC) estimate

Hourly travel time value of passengers is estimated by three income groups based on the results of the Home Visit Survey of the SITRAMP conducted in 2002. Regarding the estimation of the future value of traveling time, it is assumed that income level will increase proportionally to the growth of the GRDP per capita estimated in the socio-economic framework of the SITRAMP.

Table 2.7.6 Average Time Value of Passenger

Unit: Rp. per hour

	Low Income Group	Middle Income Group	High Income Group	Average Time Value of Passenger *1)
	(%): share			
2002	1,270 (48%)	3,110 (45%)	9,930 (7%)	2,710
2007	1,290 (35%)	3,390 (55%)	9,960 (10%)	3,290
2010	1,300 (27%)	3,720 (61%)	10,700 (12%)	3,880
2020	1,510 (7%)	4,410 (56%)	10,590 (37%)	6,510

Note: 1) Income group Low less than Rp. 999,999
Middle Rp. 1,000,000 – Rp. 3,999,999
High Rp. 4,000,000 – above
2) Annual working hour is estimated at 1,980 hours (38 hours x 52.1 weeks)
3) : Indirect cost at 10% is included in time value estimates.
Source: SITRAMP Home Visit Survey

(3) Economic evaluation

1) Evaluation

Savings in Vehicle Operating Cost (VOC) and Passenger Traveling Time Cost (TTC) were regarded as tangible benefits and measured in monetary terms as benefits of the project in economic analysis. Based on the future traffic volume provided by the traffic demand forecast of the SITRAMP and unit VOC and time values of passenger by three income groups, the total value of the VOC and the TTC of two scenarios were calculated and compared for the evaluation period from 2004 to 2015.

The total VOC and TTC savings due to the implementation of Busway Extension Project amount to Rp. 723 billion and Rp. 1,125 billion, respectively, in terms of the present value discounted by 12% throughout the evaluation period (2004 – 2015). Regarding the travel time savings, it is assumed that every income group will have the benefits of the reduction in traveling time and savings of the travel time cost.

Meanwhile, the cost of Busway Extension including investment cost and OM cost, converted in economic prices, is Rp. 785 billion in terms of present value discounted by 12%.

Consequently, the Net Present Value (NPV) discounted by 12% is estimated at Rp. 1,153 billion as shown in Table 2.7.7. The Economic Internal Rate of Return (EIRR) is 31.9%, which is sufficiently high to show the viability of the implementation of the project from a viewpoint of economic analysis.

Table 2.7.7 Evaluation Index of Economic Analysis of Busway Extension

Present Value discounted by 12% (Rp. billion)					EIRR (%)
Costs	Benefits			Net Present Value	
	Cost savings in VOC	Cost savings in TTC	Total Benefits		
785	723	1,215	1,938	1,153	31.9%

2) Sensitivity

The effect of variations in the costs and the benefits on the EIRR is examined, when the cost increase by 20% and the benefits decrease by 20%, simultaneously. Table 2.7.8 examines the sensitivity of the EIRR of Busway Extension project. The EIRR of the project is 21.0%, which is still much higher than the discount rate and shows efficiency of the project implementation when the cost increases by 20% and the benefit decreases by 20%, simultaneously. The switching value of the increase in the cost and the decrease in the benefit is 150% and 60%, respectively. The effect of the increase in the cost of the Busway project is small for the economic analysis.

Table 2.7.8 Sensitivity of EIRR

Cost	Benefit	NPV discounted by 12% (Rp. billion)	EIRR
Base Case		1,153	31.9%
20% Increase	-	996	26.6%
-	20% Decrease	766	25.5%
20% Increase	20% Decrease	608	21.0%
150% Increase *	-	0	12%
-	60% Decrease *	0	12%

Note: * Switching value is one of the tools for assessing risks for the project analysis. The switching value of a variable is the value at which the NPV becomes zero or the EIRR equals the discount rate.

2.7.3 Financial Analysis

(1) Assumptions

Financial analysis is carried out from a viewpoint of bus operating company by considering the condition of cost-sharing between the public and private. Assumption as the followings is employed in the analysis:

1) Evaluation period:

12 years from 2004 to 2015

2) Passenger tariff:

Flat tariff at Rp. 3,300 is considered in the system until 2009. The amount of Rp. 3,300 is the same as the current tariff of Patas AC. After 2010 when the further extension of the routes and new routes start to provide operation services, it is converted to distance tariff system: flag fall Rp. 1,000 and distance portion Rp. 200 per km.

3) Revenue:

Revenue is estimated by number of boarding passengers and passenger-km of busway within four routes provided by the traffic demand forecast. After 2010, the passenger demand is considered to be constant at a level of year 2010 in the analysis, as the capacity of the facility of busway such as shelter and ticketing machine can not afford to meet the demand.

(2) Profitability of Bus Operation Service Business

Financial analysis assessed the viability of Bus Extension Project from a viewpoint of bus operating business.

The results of financial viability analysis based on the above conditions are tabulated in Table 2.7.9.

Table 2.7.9 Profitability of Bus Operation Business

Evaluation Alternative	Revenue	Cost Burden by Bus Operator				FIRR
		Land and compensation	Infrastructure facility	Bus shelter, bus location system	Bus purchase and operation cost of bus	
Case 1	Flat tariff at Rp.3,300 until 2009; distance proportion tariff from 2010 (Flag fall: Rp. 1,000/ distance proportion Rp. 200 per km)	x	x	x	x	10.1%
Case 2			x	x	x	39.4%
Case 3	Decrease of revenue by 20%	x	x	x	x	4.3%
Case 4			x	x	x	28.1%
Case 5	Decrease of revenue by 30%		x	x	x	22.2%

The FIRR shows that bus operation business will be viable for private company when the government provides the land cost for widening of busway (Case 2). The FIRR is sufficiently high at 39.4%; furthermore, it shows viability that the bus operating company can afford to share the cost of the infrastructure facility. The most possible measure is that the government will give concession in busway business to current private bus companies through bidding and recover the costs for infrastructure facility of busway from concession fee for bus operation or user fee of bus route.

Table 2.7.10 shows the cash flow of busway operation of Case 1.

Table 2.7.10 Cash Flow of Busway Extension Project (Case 1)

	Total	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
I Basic data													
1) Number of Get-on passenger (passenger per day)			49,900	64,800	145,500	231,400	368,000	585,200	585,200	585,200	585,200	585,200	585,200
2) Passenger-km per day					2,189,000	2,799,000	3,580,000	4,578,000	4,578,000	4,578,000	4,578,000	4,578,000	4,578,000
3) Number of bus and driver													
Single (total)					63	79	99	125	125	125	125	125	125
Single (additional purchase)					63	16	20	26					
Articulated (total)			39	49	102	128	155	155	155	155	155	155	155
Articulated (additional purchase)			39	10	53	26	27	0					
Total			39	49	165	207	254	280	280	280	280	280	280
Number of driver (1 driver per bus and 2 shifts)			78	98	330	414	508	560	560	560	560	560	560
4) Annual runnning distance per bus (km per year)			111,300	111,300	111,300	111,300	111,300	111,300	111,300	111,300	111,300	111,300	111,300
Total running distance of single bus (1,000 km per year / operation ratio:90%)					6,311	7,913	9,917	12,521	12,521	12,521	12,521	12,521	12,521
Total running distance of articulated bus (1,000 km per year / operation ratio:90%)			3,907	4,908	10,217	12,822	15,526	15,526	15,526	15,526	15,526	15,526	15,526
5) Number of shelter and staff at shelter													
DKI JKT			21	21	21	21	21	21	21	21	21	21	21
PB01					9	9	9	9	9	9	9	9	9
PB02					13	13	13	13	13	13	13	13	13
PB03					29	29	29	29	29	29	29	29	29
PB04			24	24	24	24	24	24	24	24	24	24	24
			45	45	96	96	96	96	96	96	96	96	96
Number of staff at shelter (2 staff per shelter and 2 shifts)			180	180	384	384	384	384	384	384	384	384	384
6) Tariff													
Flat tariff (Rp. per passenger)			3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300	3,300
Distant portion Flag toll (Rp. per passenger)			1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Distance portion (Rp. per km)			200	200	200	200	200	200	200	200	200	200	200
II CASH OUT-FLOW													
1 Land & Infrastructure Development Cost (Rp. billion)													
1) Land & compensation	1,174	268	374	319	212	0	0	0	0	0	0	0	0
2) Construction cost													
Civil work for widdening	38	19	19	77	77	0	0	0	0	0	0	0	-152
Bus shelter	92	0	30	20	42	0	0	0	0	0	0	0	0
Ticketing machine	146	0	52	51	42	0	0	0	0	0	0	0	0
Bus location system	2	0	2	0	0	0	0	0	0	0	0	0	0
Traffic signal	57	0	16	18	23	0	0	0	0	0	0	0	0
Total construction cost	334	19	119	166	184	0	0	0	0	0	0	0	-152
2 Bus Purchase Cost (with on-board bus location system & priority signal system)													
Single Rp. 650,000,000 per bus	81				41.0	10.4	13.0	16.9					
Articulated Rp. 1,420,000,000 per bus	220		55.4	14.2	75.3	36.9	38.3						
Total	301		55.4	14.2	116.2	47.3	51.3	16.9	0	0	0	0	0
3 OM cost													
(1) OM of infrastructure facility													
1) OM cost of infrastrucuture facility (busway, bus stop & signal system)													
Investment cost / % / Annual operation cost													
Center 1.6 5% 0.1	1		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
PB01 91.9 2% 1.8	17				1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
PB02 104 2% 2.1	19				2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
PB03 153.6 2% 3.1	28				3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
PB04 135.7 2% 2.7	30		2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Total 486.8	94		2.8	2.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8
(2) OM for bus operation													
1) Variable cost of bus operation													
Single Rp. 1,370 operating ratio: 90%	136				8.6	10.8	13.6	17.2	17.2	17.2	17.2	17.2	17.2
Articulated Rp. 1,870 operating ratio: 90%	263		7.3	9.2	19.1	24.0	29.0	29.0	29.0	29.0	29.0	29.0	29.0
2) Fixed cost													
Salary/wages for crew & staff (Rp. per month)													
- Driver Rp. 2,000,000 per month	115		1.9	2.4	7.9	9.9	12.2	13.4	13.4	13.4	13.4	13.4	13.4
- Bus stop staff Rp. 1,500,000 per month	68		2.4	3.2	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
3) Other direct cost per year Rp. 3,000,000 per bus	7		0.1	0.1	0.5	0.6	0.8	0.8	0.8	0.8	0.8	0.8	0.8
4) Others (Indirect cost & management cost): 10% of revenue	432		6.0	7.8	17.5	27.9	44.3	54.8	54.8	54.8	54.8	54.8	54.8
Total OM Cost	1,115		20.5	25.5	70.4	89.9	116.6	131.9	131.9	131.9	131.9	131.9	131.9
OM of infrastructure facility	94		2.8	2.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8	9.8
Bus Operation	1,021		17.7	22.7	60.6	80.2	106.8	122.2	122.2	122.2	122.2	122.2	122.2
Total CASH OUT-FLOW	2,924	286.8	568.7	524.0	582.9	137.3	167.9	148.8	131.9	131.9	131.9	131.9	-20.4
III CASH IN-FLOW													
1 Revenue													
Tariff			Tariff System										
			← Flat					→ Distance proportional					
Get-on passenger per day			49,900	64,800	145,500	231,400	368,000	585,200	585,200	585,200	585,200	585,200	585,200
PAX-km per day					2,189,000	2,799,000	3,580,000	4,578,000	4,578,000	4,578,000	4,578,000	4,578,000	4,578,000
1) Fare revenue basaed on flat rate tariff system	1,035		60.1	78.1	175.3	278.7	443.3						
2) Fare revenue basaed on distance proportional tariff system													
Flag fall	1,282							213.6	213.6	213.6	213.6	213.6	213.6
Distance portion	2,005							334.2	334.2	334.2	334.2	334.2	334.2
Total	3,287							547.8	547.8	547.8	547.8	547.8	547.8
Total CASH IN-FLOW	4,322		60.1	78.1	175.3	278.7	443.3	547.8	547.8	547.8	547.8	547.8	547.8
6 NET CASH-FLOW	1,398	-286.8	-508.6	-446.0	-407.6	141.5	275.3	399.0	415.9	415.9	415.9	415.9	568.2
7 FIRR 10.1%													