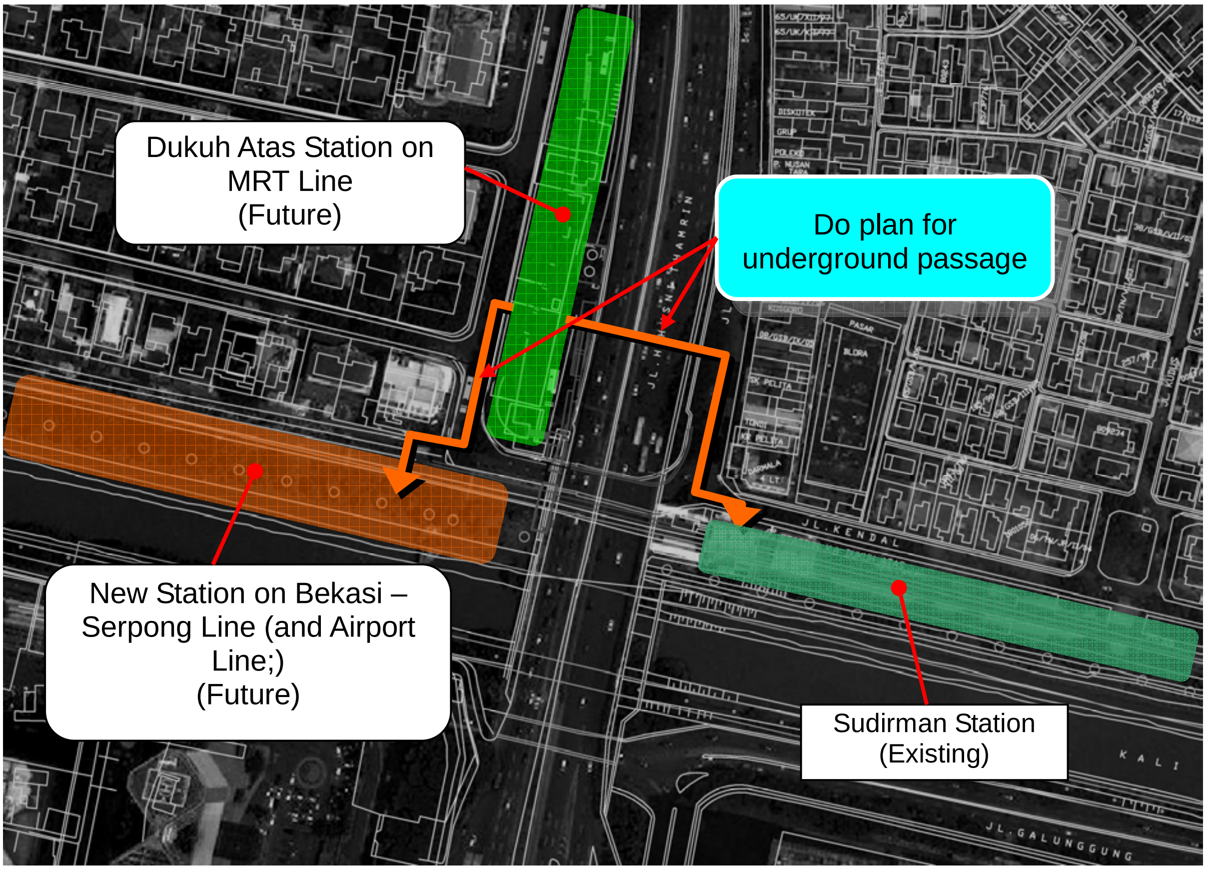
4.3.3 Planning of Underground Passageways

1) Planning Conditions

- Since Dukuh Atas Station on the MRT North-South Line will be constructed underground, the connecting passageway will pass under Thamrin Street and emerge aboveground at Blora Street. From there, it will connect to the 2nd floor of the existing Sudirman Station.
- For the underground passageway, sections connecting the MRT Dukuh Atas Station with the existing Sudirman Station, and connecting the MRT Dukuh Atas Station with the Serpong-Bekasi Line, will be constructed.
- In the planning, consideration will be given to the use of the road area.
- In general, the planning will ensure that there are no major changes to the subway stations and the like that have already been designed.
- Underground buried objects and other obstructions will be re-arranged in advance.

2) Planning Policy

- The area beneath Thamrin Street will be excavated in underpass fashion and only the passageway will be constructed. The reason is that the possibility of constructing an underground pavilion and underground shopping mall beneath Thamrin Street, etc., was studied, but it was determined that the construction costs would be extremely high and a PPP scheme could not be established, so this idea was abandoned.
- Phased construction of basic infrastructure in parallel with railway construction will be taken into consideration, but facility planning for the underground passageway will be conducted based on the demand estimates for the year 2030.
- Consideration will be given to lighting, ventilation and air conditioning for the passageway. Consideration will be given to waterproofing measures for stairs and other entrances.



Source: Study Team

Figure-4.3.16 Planned Locations of Underground Passageways

3) Planning of Underground Passageways

(1) Width setting

A total width of approximately 12 meters will be needed for the passageways connecting the MRT Dukuh Atas Station and the eastern side of Thamrin/Sudirman Street.

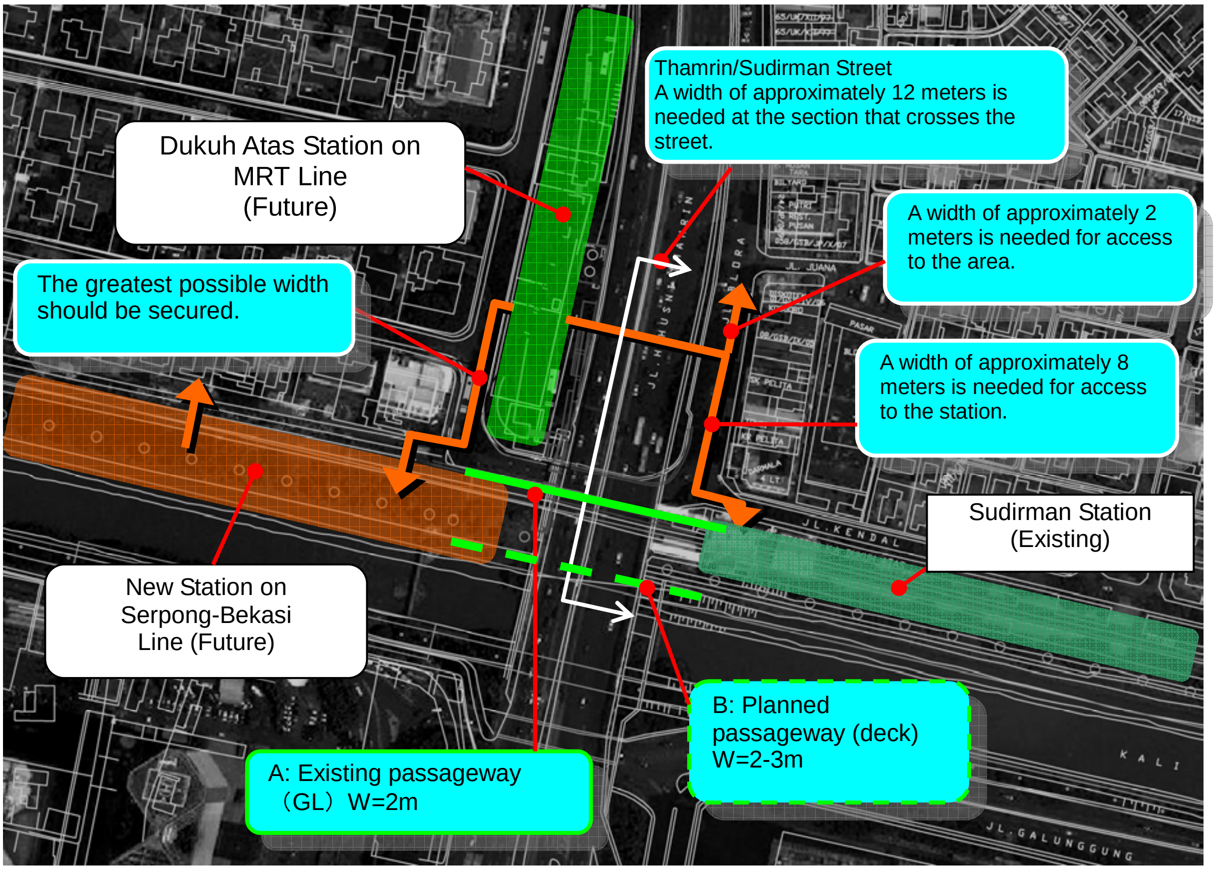
With regard to the passageways that cross Thamrin/Sudirman Street, there is a pedestrian corridor (A in the Figure below) measuring 2 meters in width along the railway leading from the existing Sudirman Station.

Moreover, the current plan envisions the construction of a passageway leading east to west on the bridge along Dukuh Atas Street on the artificial ground (transport node construction) that will be constructed above the Banjir Kanal (B in the Figure below). This passageway will be constructed as an ancillary facility at the time of the construction of the Airport Line (railway) that is being studied separately. The construction of this passageway is expected to improve the convenience of the transport node. In that event, it is considered that in structural terms a width of approximately 2-3 meters could be provided. This would secure a pedestrian passageway of approximately 4-5 meters in width in addition to the underground passageway.

As a result, an effective width of approximately 7-8 meters would be secured for the underground passageway connecting the MRT Dukuh Atas Station and the existing Sudirman Station, and to provide leeway in the lateral direction, a passageway width of approximately 10 meters would be secured for the section that crosses Thamrin/Sudirman Street.

On the east side of Thamrin/Sudirman Street, stairs with a width of approximately 2 meters will be secured for access to the area. Consideration will be given to improving the convenience of access to the MRT station and enabling the stairs to also function as evacuation stairs. In addition, as a passageway with a width of approximately 8 meters will be needed for access to the existing Sudirman Station, this will be planned as a passageway with a width of 8 meters.

With regard to the passageway connecting the MRT Dukuh Atas Station and the new station for the Serpong-Bekasi Line, it would be desirable to secure a width of approximately 12-13 meters. However, as the structural body for the MRT station will be constructed in advance on the east side and there is privately owned land on the west side, a width that is as great as possible will be secured.



Source: Study Team

Figure-4.3.17 Width Setting

(2) Planning for underground passageway between MRT Dukuh Atas Station and existing Sudirman Station

(a) *Floor planning*

*A passageway connecting the MRT D*ukuh Atas Station concourse with the existing Sudirman Station will be provided.

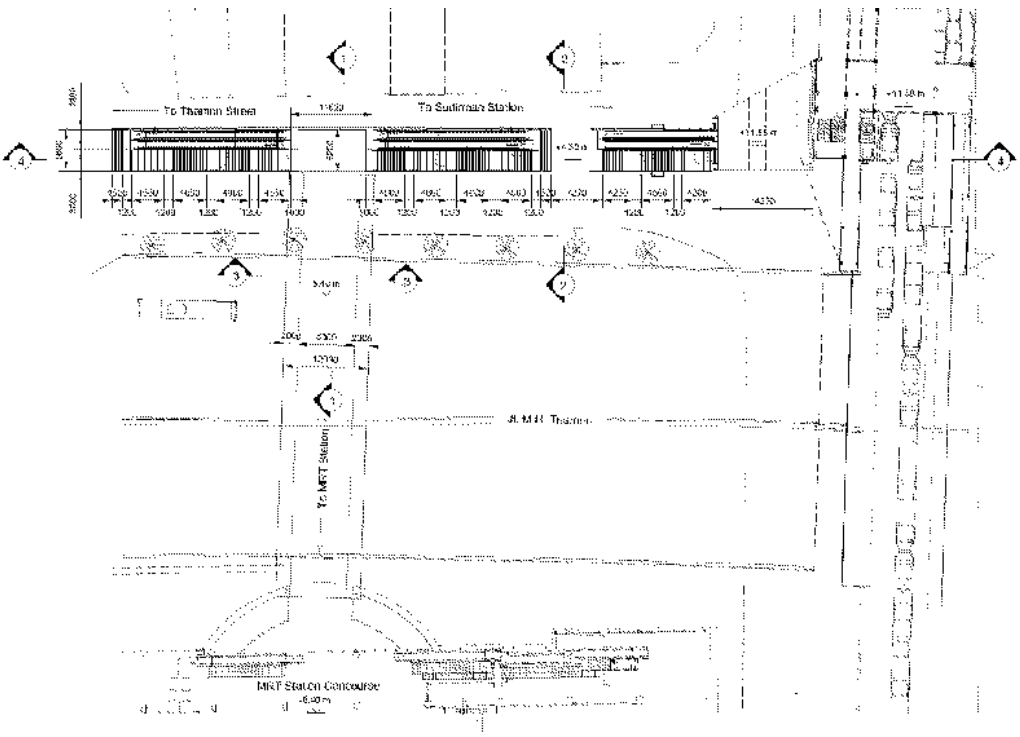
In the floor planning, in order to minimize the impact of the construction, etc., on Thamrin/Sudirman Street, the intersection will be made perpendicular to the street.

Blora Street is a four-lane street approximately 16 m in width. Traffic is one-way in the southern direction. During the morning rush hours when traffic is heavy, however, the west half is closed to traffic, so only two lanes are used. For this reason, effective use will be made of the half side of this street to construct a ramp leading from the corridor beneath the MRT up to ground level and connecting to Sudirman Station.

In addition, out of consideration for the convenience of local residents, the plan calls for an entrance to the MRT North-South Line to be constructed on the north side as well. This can also be used as an evacuation route in the event of a disaster.

Demand is approximately 12,900 persons/hour (48,900 persons/hour anticipating maximum scale development of the area around the station), so two escalators (upward and downward) will be needed. The placement of stairs for evacuation will also be considered. The level of service in this case will be 22 persons/meter • minute, which is equivalent to level A level on the Fruin scale. Even if maximum scale development is anticipated in the future, freedom will be restricted in terms of overtaking other pedestrians and selecting walking speeds, but commuting to and from work or school and other purposeful behavior will be held to the acceptable level E, so a width of 10 meters will be secured. In addition, it would be best to plan for separation in the future by having a private company in the north secure an access route from the north at its own expense.

Provision of lighting, ventilation and air conditioning equipment will be taken into consideration. Air supply and exhaust ports for ventilation and air conditioning equipment will be placed in the passageway ceiling or side walls. In addition, adjustment of the ventilation air supply and exhaust ports in accordance with the air pressure of the subway concourse will be needed.



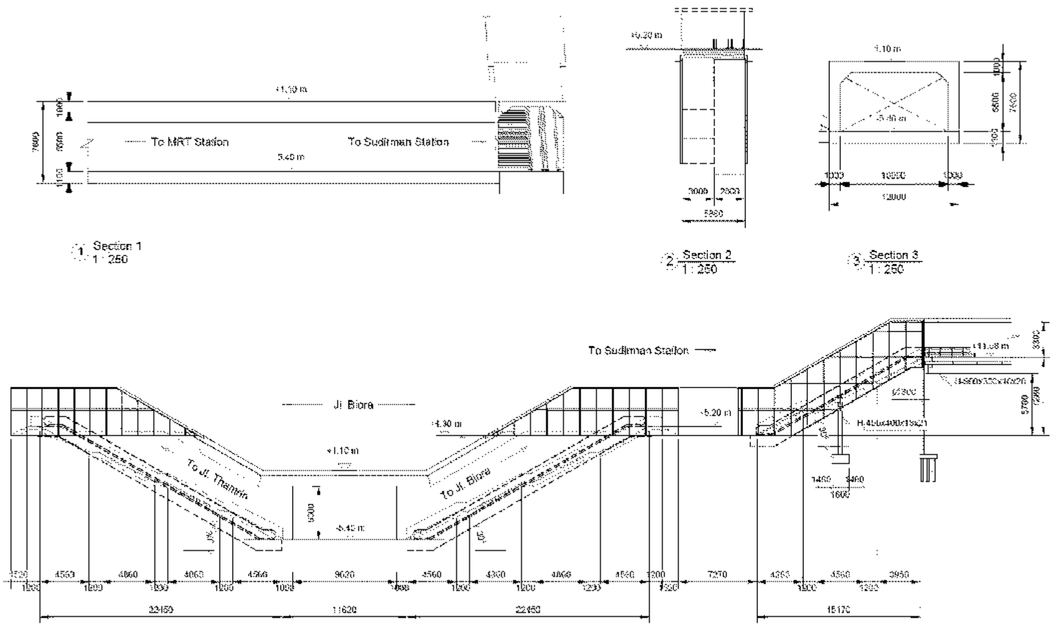
Source:Study Team

Figure-4.3.18 Plan for Underground Passageways (Area Between MRT Dukuh Atas Station and Existing Sudirman Station)

(b) Longitudinal Planning

To connect to the existing Sudirman Station, connection to ground level and from ground level to the existing station concourse is being considered.

The planned effective height for the road crossing will be at least 5.2 m, based on the results of discussions with road administrators. In addition, as a flood control measure for the rainy season, a tide wall for the entrances will be constructed that is the same height as the entrances to the MRT North-South Line (+5.2: a height of 0.9 m from ground level).



Source: Study Team

Figure-4.3.19 Longitudinal Plan for Underground Passageways
(Between MRT Dukuh Atas Station and Existing Sudirman Station)

(c) Disaster Prevention and Evacuation Planning

Currently in Indonesia the standards for disaster prevention and evacuation planning for underground structures are in the process of being created. Accordingly, this will be studied using BS standard or Japanese standards.

The placement of evacuation stairs requires that evacuation exits and the width needed for evacuation within a set period of time be secured. Stairs with an interval of approximately 100-120 meters leading to ground level must be provided.

The total length of the underground passageway in question is approximately 120 meters, and it is considered that this can be satisfied by providing stairs and escalators at each exit.

Moreover, since this might also be used as an evacuation route in the event of a fire, etc., in the subway station, discussions regarding operation should be held with the subway operator to prepare disaster prevention plans and the like.

As in the case of the MRT Dukuh Atas Station, the entrances to the underground passageway will be raised at least 90 cm from the ground level as a flood control measure.

(3) MRT Dukuh Atas Station-New Serpong-Bekasi Line Station

(a) Cross-section planning

For the connecting passageway between MRT Dukuh Atas Station and the new Serpong-Bekasi Line station, it would be best to secure a width of approximately 12-13 meters. However, due to the fact that the MRT structural skeleton will be constructed in advance on the east side, and the fact that there is privately owned land on the west side, as great a width as possible will be secured.

Out of consideration for the space, etc., needed for the construction of stairs and a connecting passageway leading from the subway to ground level in the subway planning, the width will be approximately 7 meters.

Users of the subway connecting passageway will include users of the BRT scheduled for construction on the east side, buses, taxis and so on.

These users will be able to use the passageway (width of approximately 2-3 meters considered to be possible) connecting the east and west sides of the Dukuh Atas Bridge on the artificial ground (transport node facility) to be constructed over the Banjir Kanal in this plan.

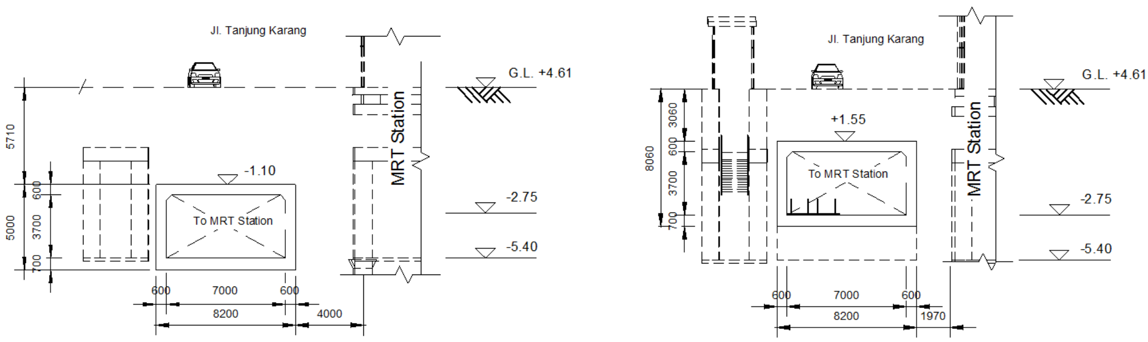
The pedestrian transit capacity of the passageway leading east to west on the bridge along Dukuh Atas Street (for which it is considered that a width of approximately 2-3m can be provided) is expected to be approximately 8,500 persons/hour in 2030 (10,300 persons/hour anticipating maximum scale development of the area around the station).

The demand for the subway connecting passageway is estimated at approximately 17,800 persons/hour in 2030 (37,800 persons/hour anticipating maximum scale development of the area around the station).

The service level in this case is 43 persons/meter • minute, which is equivalent to service level C on the Fruin scale. With this level of service, freedom will be restricted in terms of overtaking other pedestrians and selecting walking speeds, but it is expected to accommodate commuting to and from work or school and other purposeful behavior, so construction of a feasible width is planned.

Provision of ventilation and air conditioning equipment will be taken into consideration. Lights and air supply and exhaust ports will be placed in the passageway ceiling or side walls. In addition, adjustment of the ventilation air supply and exhaust ports in accordance with the air pressure of the subway concourse will be needed.

In accordance with the above, the cross-section will be planned as shown in the Figure below.



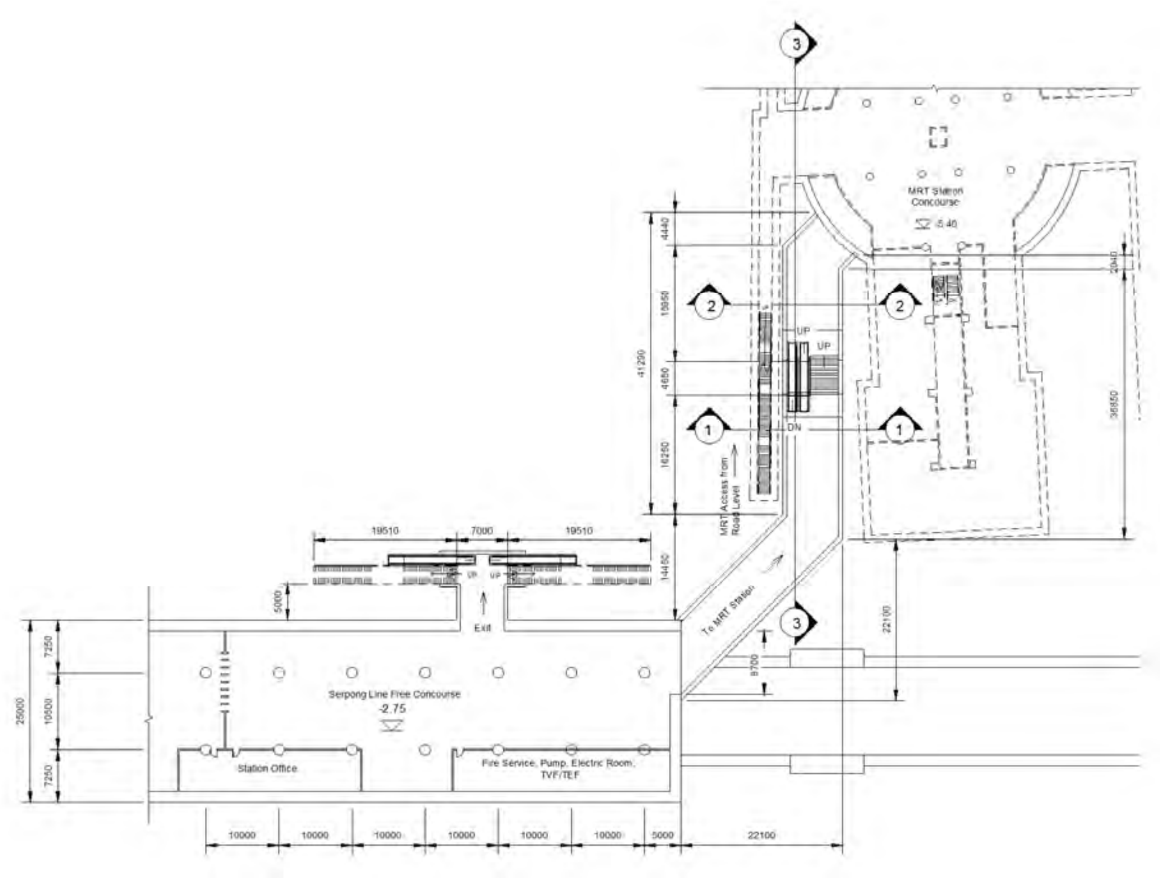
Source: Study Team

Figure-4.3.20 Planned Cross-section of Underground Passageway
(Between MRT Dukuh Atas Station and new Serpong-Bekasi Line Station)

(b) Floor planning

A passageway connecting the new Serpong-Bekasi Line Station with the MRT Dukuh Atas Station concourse will be provided.

As the space in which this passageway can be provided is limited, the floor planning will be as shown in the diagram below.

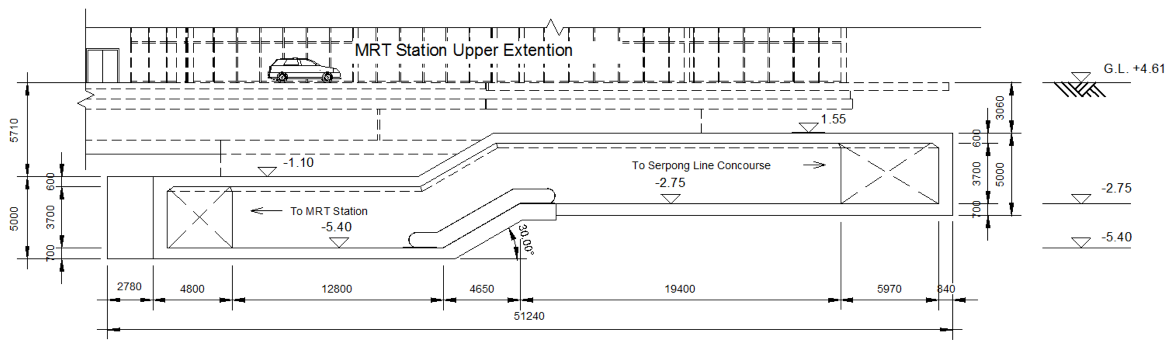


Source: Study Team

Figure-4.3.21 Floor Planning Diagram for Underground Passageway
(Between MRT Dukuh Atas Station and new Serpong-Bekasi Line Station)

(c) Longitudinal planning

As there is a possibility that level differences may be produced between the level of the MRT Dukuh Atas Station concourse and the level of the new Serpong-Bekasi Line Station concourse, stairs and escalators will be placed in the middle of the connecting passageway to eliminate the height differences.



Source: Study Team

Figure-4.3.22 Longitudinal Planning Diagram for Underground Passageway
(Between MRT Dukuh Atas Station and new Serpong-Bekasi Line Station)

(4) Disaster Prevention and Evacuation Planning

As this underground connecting passageway is for connection between railway stations, it would be best to study disaster prevention and evacuation planning in an integrated manner with the evacuation planning for the railway stations.

With regard to flood control measures, it is considered appropriate to include these in the subway measures.

4.3.4 Artificial Ground Planning

1) Planning Conditions

Consideration will be given to the following matters in constructing the artificial ground.

The scale needed for the artificial grounds is being planned with these grounds based on the realities of operations at the site, using the scale calculated with the 1998 version of the station square planning guidelines in Japan.

- ➢ Securing canal Overhead clearance : Overhead clearance of more than 1.5m from high water level, more than 5.0m from regular water level.
- ➢ Maintenance measures: The artificial ground will cover a long section of the Banjir Kanal, so it is necessary to propose dredging methods and other maintenance methods that can be used under these restrictions.
- ➢ Securing waterway: Consideration for ensuring waterway transport in the future is needed.
- ➢ Flood control: Safety must be ensured even in the event of a flood.
- ➢ Placement of columns, etc., in canal: Canal will be widened toward the peripheries in order to secure current cross-sectional area of canal.
- ➢ A park on south side of canal: It would be best to not construct buildings here in order to use this area for widening of canal cross-sectional area.
- ➢ Artificial ground: Greening of artificial ground, letting in natural light to canal and so on will be considered.
- ➢Reconstruction work for Thamrin/Sudirman highway bridge: In order to secure the future height clearance limit for the Banjir Kanal, reconstruction (raising) of the highway bridge is being planned, so this fact must be taken into consideration.
- ➢ Pending issues include what to do about telephone cables and water pipes (ø 900) and so on that are to be constructed across the canal.

2) Planning Policy

(1) The target area is in the center of the city and is divided into four sections by Thamrin/Sudirman Street and the canal.

In constructing a transport node in anticipation of transit-oriented development (TOD) in future urban development, access to these four sectors and the station needs to be improved. Use of the area above the canal as public land is considered to be the most effective means of connecting these four sectors and improving the convenience of public transport.

Placing an artificial ground above the canal will enable interchange in the north-south direction that is currently fragmented by the canal, and at the same time it will make bus, taxi and other transport smoother.

Particularly out of consideration for the elimination of the TransJakarta line between Block M and Dukuh Atas due to the construction of the subway north-south line, and for the convenience of transferring between the TransJakarta No. 4 and No. 6 lines and MRT Dukuh Atas Station, it would be best to route the No. 4 and No. 6 lines to the artificial ground to the east.

（2） Planning Area / Volume

The BRT koridor 4,6 individual elevated passage from the ground level Galunggung street to the artificial ground is shown in the Figure under. The artificial ground for PHASE1 is to be planned in this area, also the flyover walkway to the south side area (Landmark building side) is also to be constructed in Phase1.

(a)PHASE1 Year 2017 Artificial Ground Volume Estimation

Table-4.3.19 PHASE1 2017 Traffic Terminal Volume Estimation under Formula98 (Source : Study Team)

D/O	Destination	Railway(West Line)		MRT	BRT		Mediumbus, etc	walk NW	NE	SW	SE	total
Origin		0	0	0	0	0	0	0	0	0	0	0
Railway(West Line)	0		0	500	300	0	2,496	735	808	846	415	6,100
	0	0		0	0	0	0	0	0	0	0	0
MRT	0	400	0		500	0	141	42	46	48	24	1,200
BRT	0	200	0	800		0	141	42	46	48	24	1,300
	0	0	0	0	0		0	0	0	0	0	0
Mediumbus, etc	0	143	0	0	95	0						238
walk NW	0	41	0	0	28	0						69
NE	0	45	0	0	30	0						76
SW	0	48	0	0	32	0						79
SE	0	23	0	0	16	0						39
total	0	900	0	1,300	1,000	0	2,779	818	899	941	462	9,100

PHASE1 2017 EASTSIDE MINIMAL

Road Area

	BRT			Total Cc	Road Length Lc	Road Width Wc	Road Area Lc×Wc
Peak Time Passenger	2,300						
Average Passenger	90						
Peak Time Vehicle	26			43	53	5.5	294
Calculated Cars	43						

Pedestrian Area

Pedestrian Volume (Cw	12,480 p／h
Without Pede (A0)	898 ㎡
Avg Walking Dist (Lw)	90 m
Density (Dw)	27 p／m・min
Pedestrian Area	697 ㎡

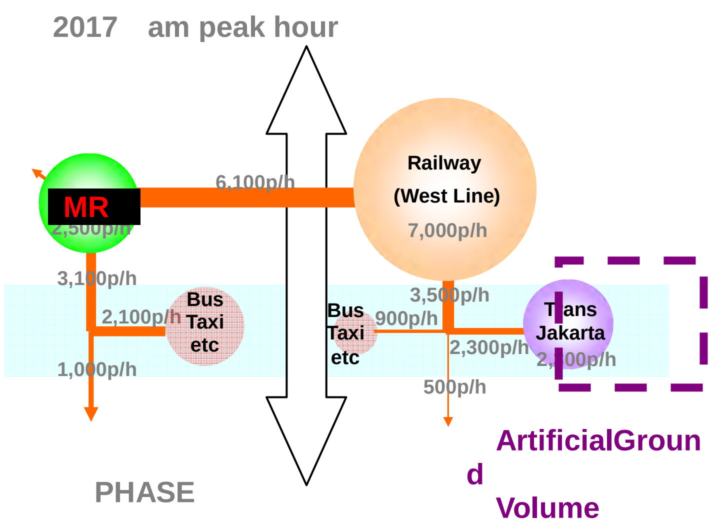


Figure-4.3.23 PHASE1 2017 Artificial Ground Volume
(Source : Study Team)

Traffic Area

BRT berth	140 ㎡
BRT Passenger Area	50 ㎡
	㎡
	㎡
	㎡
	㎡
	㎡
Road Area	294 ㎡
Pedestrian Area	697 ㎡
TOTAL	1,181 ㎡

TOTAL AREA

Traffic Area	1,200 ㎡
Common Area	1,200 ㎡
Total Area	2,400 ㎡

For Phase1, the current feeder traffic volume from the Sudriman station is still limited, and can be basically handled within the current linier space of the Sudirman Bridge, so the artificial ground terminal volume is to be estimated only from the volume of BRT koridor 4,6 ridership under “Japanese station traffic terminal guideline formula 98”.

Under this formula, the needed space for PHASE1 artificial ground is to be estimated to be over 2,4000m2, but considering structure condition and safety over the canal area, the appropriate size is to be proposed as apx 4,000m2.

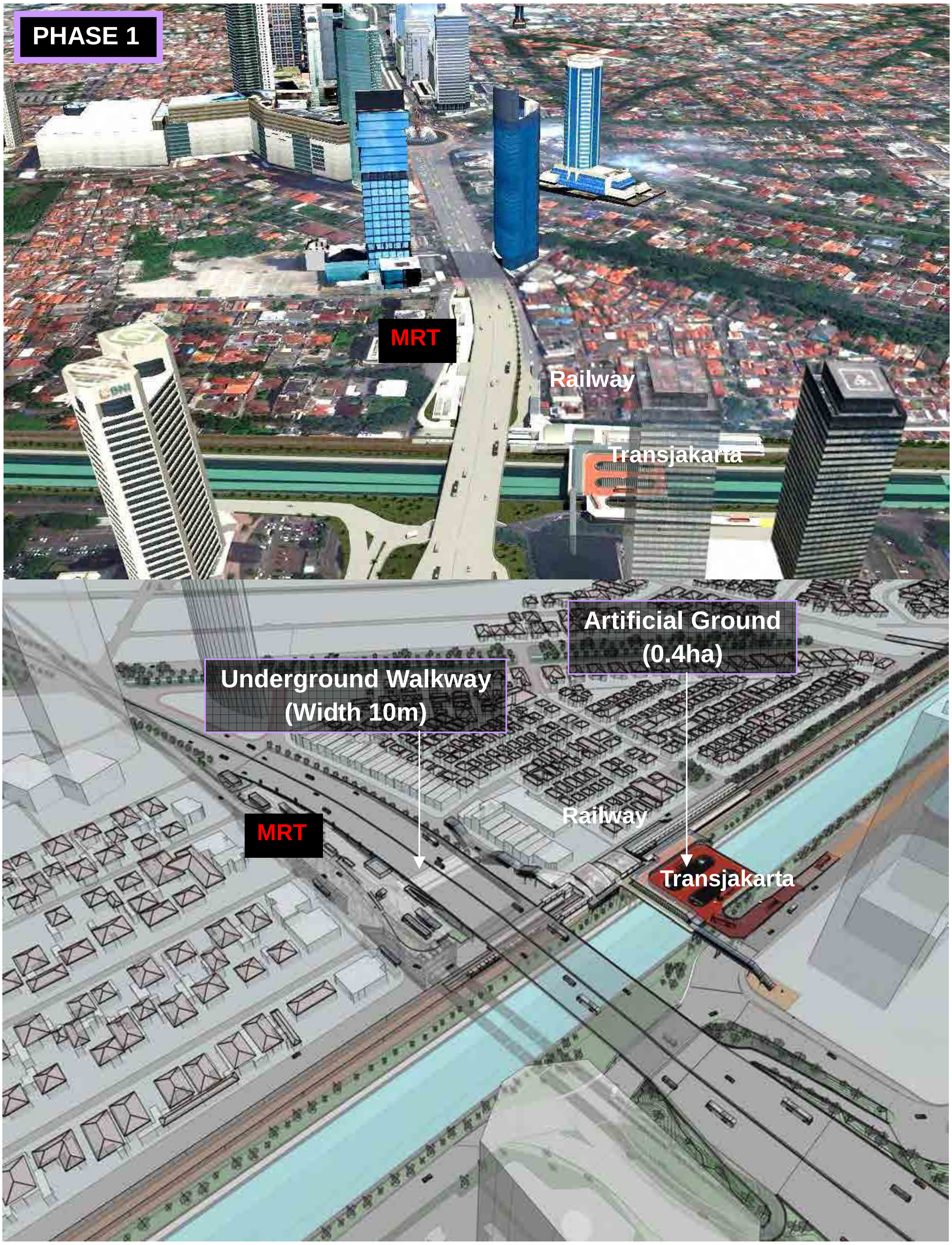


Fig-4.3.24 PHASE1 2017 Artificial Ground image (Source : Study Team)

For the next Phase2, when new transport facilities would be built, the artificial ground is to be expanded, and having a direct access from the Thamrin/Sudirman boulevard and also for the west side artificial ground having connection to the airport line should be constructed.

For both the expanding artificial ground on the east and west side should have feeder traffic terminal including taxi and mini-bus considering the growing ridership volume from Phase 1. Also a pedestrian passage to connect to the south side (BNI town side) should be constructed on the west side.

(b)PHASE 2 Year 2030 Artificial Ground Volume Estimation

Table-4.3.20 PHASE2 2030 Traffic Terminal Volume Estimation Under Formula98 (Source : Study Team)

	D/O	Destination							walk				
		Railway(Bekasi Line)	Railway(Loop Line)	Airport	MRT	BRT	GreenLine	Mediumbus, etc	NW	NE	SW	SE	total
Origi	Railway(Bekasi		0	0	10,900	1,800	3,700	5,888	1,734	1,905	1,995	980	28,900
	Railway(Loop Line)	0		0	100	100	200	283	83	91	96	47	1,000
	Airport	0	0		0	100	200	188	55	61	64	31	700
	MRT	4,700	0	0		4,700	3,500	754	222	244	255	125	14,500
	BRT	500	100	100	4,500		300	895	264	290	303	149	7,400
	GreenLine	300	100	100	1,100	200		377	111	122	128	63	2,600
	Mediumbus, etc	808	95	48	333	190	190		0	0			1,663
walk	NW	234	28	14	96	55	55			0	0	0	482
	NE	257	30	15	106	60	60		0		0	0	529
	SW	269	32	16	111	63	63						554
	SE	132	16	8	54	31	31						272
	total	7,200	400	300	17,300	7,300	8,300	8,384	2,469	2,712	2,840	1,395	58,600

PHASE2 2030 WESTSIDE

Road Area

	BRT	TAXI	Bus	Total	Road Length	Road Width	Road Area
Peak Time Passenger	0	1,640	6,557	Cc	Lc	Wc	Lc×Wc
Average Passenger	90	1.2	50.0				
Peak Time Vehicle	0	1367	131	2956	1219	5.5	6,702
Calculated Cars	0	2733	223				

Pedestrian Area

Pedestrian Volume (Cw)	11,591 p／h
Without Pede (A0)	10,145 ㎡
Avg Walking Dist (Lw)	174 m
Density (Dw)	27 p／m・min
Pedestrian Area	1,243 ㎡

Traffic Area

BRT berth	0 ㎡
BRT Passenger Area	0 ㎡
TAXI berth	160 ㎡
TAXI pool	2460 ㎡
TAXI Passenger Area	98 ㎡
Bus berth	2,558 ㎡
Bus Passenger Area	350 ㎡
Road Area	6,702 ㎡
Pedestrian Area	1,243 ㎡
TOTAL	13,571 ㎡

TOTAL AREA

Traffic Area	13,600 ㎡
Common Area	13,600 ㎡
Total Area	27,200 ㎡

PHASE2 2030 EASTSIDE

Road Area

	BRT	TAXI	Bus	Total	Road Length	Road Width	Road Area
Peak Time Passenger	14,700	703	2,810	Cc	Lc	Wc	Lc×Wc
Average Passenger	90	1.2	50.0				
Peak Time Vehicle	163	586	56	1545	654	5.5	3,597
Calculated Cars	278	1172	96				

Pedestrian Area

Pedestrian Volume (C	19,880 p／h
Without Pede (A0)	6,215 ㎡
Avg Walking Dist (Lw	138 m
Density (Dw)	27 p／m・min
Pedestrian Area	1,698 ㎡

Traffic Area

BRT berth	700 ㎡
BRT Passenger Area	365 ㎡
TAXI berth	80 ㎡
TAXI pool	1050 ㎡
TAXI Passenger Are	42 ㎡
Bus berth	1,092 ㎡
Bus Passenger Area	210 ㎡
Road Area	3,597 ㎡
Pedestrian Area	1,698 ㎡
TOTAL	8,834 ㎡

TOTAL AREA

Traffic Area	8,900 ㎡
Common Area	8,900 ㎡
Total Area	17,800 ㎡

Area needed to serve the traffic function under estimation, considering only the traffic space, according to the Japanese Traffic Terminal Guideline Formula 98, are for the west side 13,600m2, east side 8,900m2. But for the limitation of area and structure, and also for the individual access road already provide individually from the Thamrin/Sudirman Boulevard, the road area can be excluded, as a result, the final estimation for the needed artificial ground space would be west area over 7,000m2, east area over 6,000m2, all together over 13,000m2 should be provided.

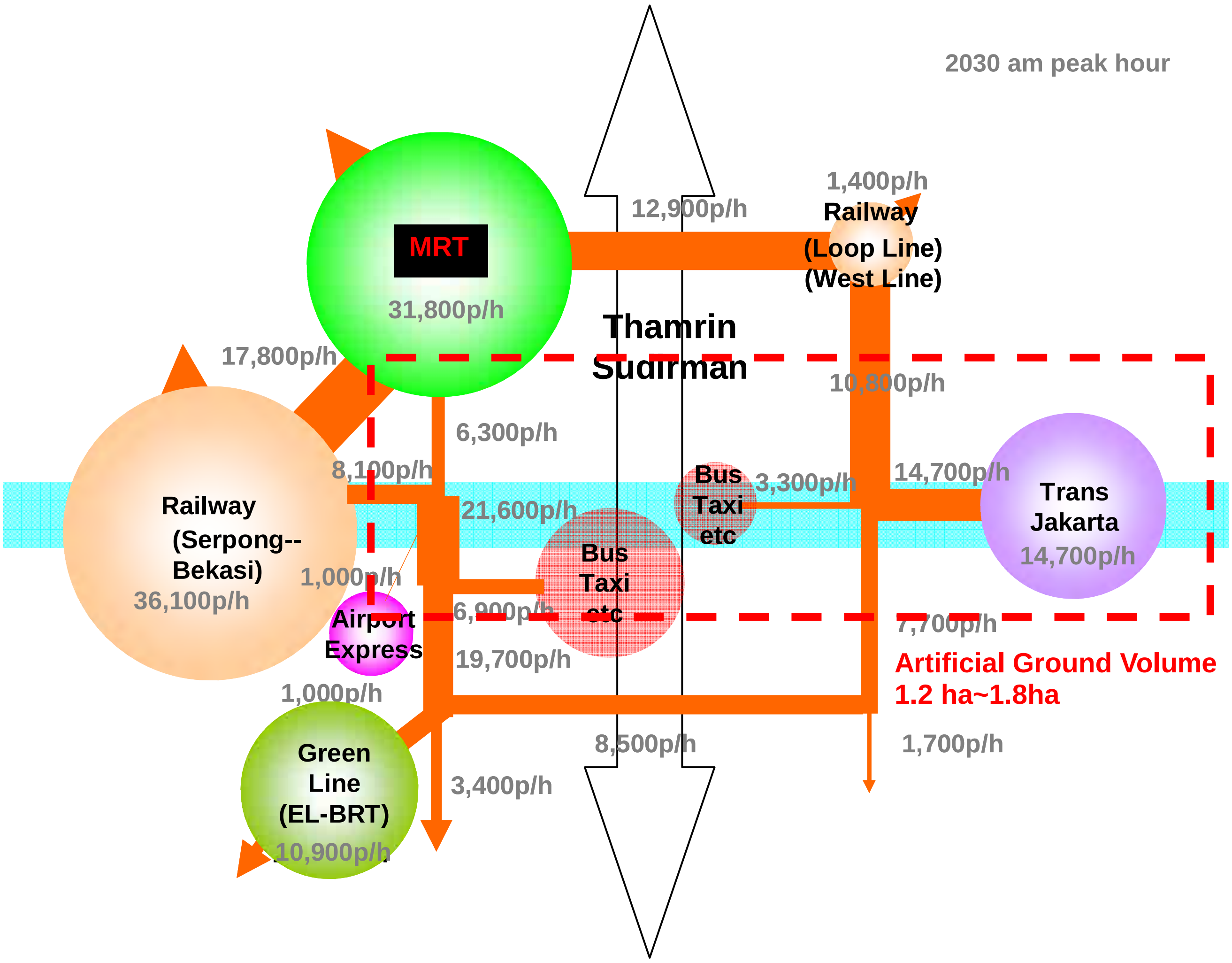


Figure-4.3.25 PHASE2 Year 2030 Artificial Ground Volume (Source : Study Team)

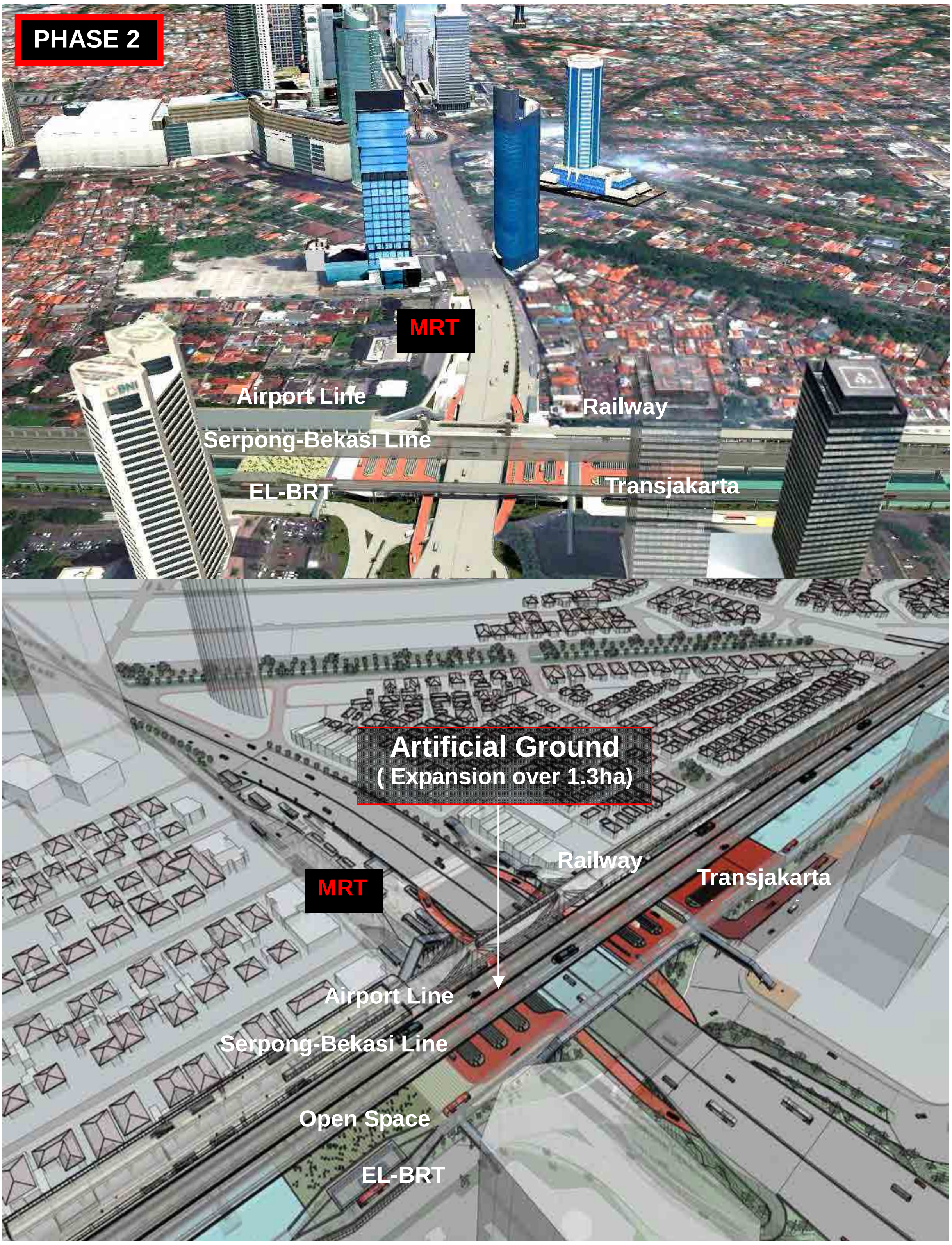


Fig-4.3.26 PHASE2 2030 Artificial Ground image (Source：Study Team)

(c)PHASE 2 Year 2030~ with Maximum Development

Table-4.3.21 PHASE2 2030 + Maximum Development Traffic Terminal Volume Estimation Under Formula98

(Source：Study Team)

D/O — Destination / walk; Origin / walk

		Railway (Bekasi Line)	Railway (Loop Line)	Airport	MRT	BRT	GreenLine	Mediumbus, etc	NW	NE	SW	SE	total
Origin	Railway (Bekasi Line)		0	0	10,900	1,800	3,700	5,888	7,454	11,916	1,995	980	44,632
	Railway (Loop Line)	0		0	100	100	200	283	281	438	96	47	1,544
	Airport	0	0		0	100	200	188	194	303	64	31	1,081
	MRT	4,700	0	0		4,700	3,500	754	3,092	5,267	255	125	22,393
	BRT	500	100	100	4,500		300	895	1,728	2,853	303	149	11,428
	GreenLine	300	100	100	1,100	200		377	626	1,023	128	63	4,015
	Mediumbus, etc	808	95	48	333	190	190		68	124			1,855
walk	NW	5,954	225	152	2,966	1,520	570	68		402	421	207	12,486
	NE	10,269	377	258	5,129	2,624	184	0	636		732	360	20,569
	SW	408	32	16	111	63	63						693
	SE	3,002	16	8	54	31	31						3,142
	total	25,941	944	681	25,193	11,328	8,939	8,452	14,079	22,326	3,993	1,962	123,839

Road Area

	BRT	TAXI	Bus	Total	Road Length	Road Width	Road Area
Peak Time Passenger	0	1,702	6,810	Cc	Lc	Wc	Lc×Wc
Average Passenger	90	1.2	50.0	3068	1263	5.5	6,949
Peak Time Vehicle	0	1418	136				
Calculated Cars	0	2837	232				

Road Area

	BRT	TAXI	Bus	Total	Road Length	Road Width	Road Area
Peak Time Passenger	22,756	730	2,918	Cc	Lc	Wc	Lc×Wc
Average Passenger	90	1.2	50.0	1746	734	5.5	4,039
Peak Time Vehicle	253	608	58				
Calculated Cars	430	1217	99				

PHASE2　2030+Maximum Development WESTSIDE

Pedestrian Area

Pedestrian Volume (Cw)	13,199 p／h
Without Pede (A0)	10,445 ㎡
Avg Walking Dist (Lw)	176 m
Density (Dw)	27 p／m・min
Pedestrian Area	1,437 ㎡

Traffic Area

BRT berth	0 ㎡
BRT Passenger Area	0 ㎡
TAXI berth	180 ㎡
TAXI pool	2490 ㎡
TAXI Passenger Area	99 ㎡
Bus berth	2,589 ㎡
Bus Passenger Area	350 ㎡
Road Area	6,949 ㎡
Pedestrian Area	1,437 ㎡
TOTAL	14,094 ㎡

TOTAL AREA

Traffic Area	14,100 ㎡
Common Area	14,100 ㎡
Total Area	28,200 ㎡

PHASE2　2030+Maximum Development EASTSIDE

Pedestrian Area

Pedestrian Volume (C	31,509 p／h
Without Pede (A0)	7,171 ㎡
Avg Walking Dist (Lw	147 m
Density (Dw)	27 p／m・min
Pedestrian Area	2,858 ㎡

Traffic Area

BRT berth	980 ㎡
BRT Passenger Area	567 ㎡
TAXI berth	80 ㎡
TAXI pool	1080 ㎡
TAXI Passenger Are	43 ㎡
Bus berth	1,123 ㎡
Bus Passenger Area	210 ㎡
Road Area	4,039 ㎡
Pedestrian Area	2,858 ㎡
TOTAL	10,980 ㎡

TOTAL AREA

Traffic Area	11,000 ㎡
Common Area	11,000 ㎡
Total Area	22,000 ㎡

Area needed to serve the traffic function under estimation, considering only the traffic space, according to the Japanese Traffic Terminal Guideline Formula 98, are for the west side 14,100m2, east side 11,100m2. But for the limitation of area and structure, and also for the individual access road already provide individually from the Thamrin/Sudirman Boulevard, the road area can be excluded, as a result, the final estimation for the needed artificial ground space would be west area over 7,000m2, east area over 6,000m2, all together over 15,000m2 should be provided.

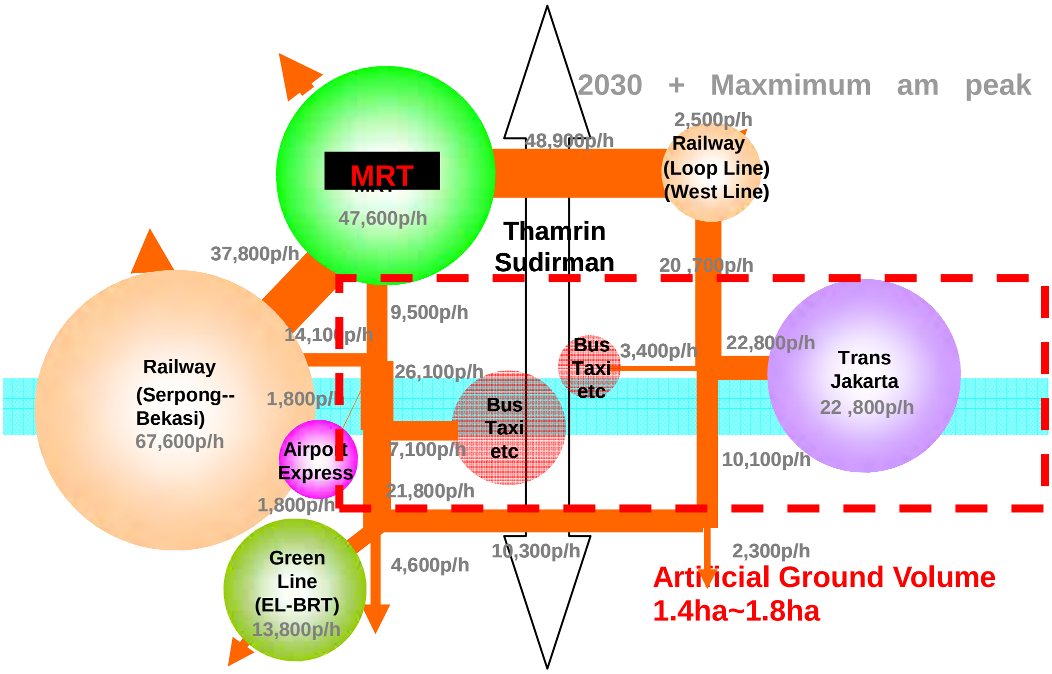


Figure-4.3.27 PHASE2 Year 2030 + Maximum Development Artificial Ground Volume
(Source : Study Team)

The final conclusion of the area size of the artificial ground under consideration of technical, structural, construction point of view, and also considering the individual access roads to the Thamrin/Sudirman Boulevard, the area size of east and west should be equally same, both 9,000m2, altogether 18,000m2.

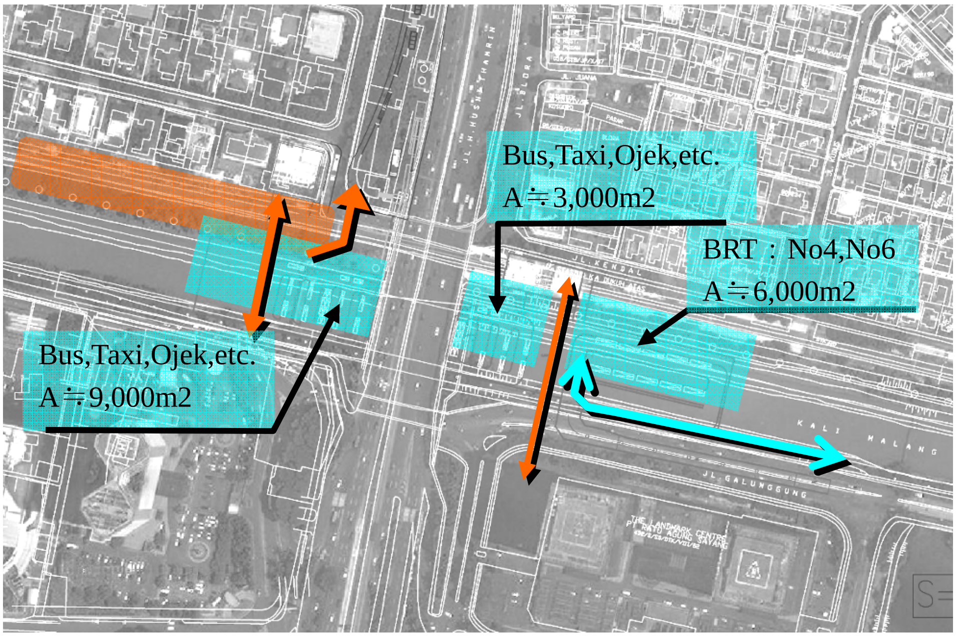


Figure. 4.3.28 Scope of Artificial Ground Construction (Source : Study Team)

Fig-4.3.29 PHASE2 2030+Development Artificial Ground image (Source：Study Team)

3) Structural Planning

➢Clearance from the Banjir Kanal:

The height of the lower edge of the artificial ground will be established based on the water level indicated in the section drawings of the Banjir Kanal obtained from the Ministry of Public Works (PU), the administrator of the Banjir Kanal. The Banjir Kanal flows from east to west, and P61A is the point on the artificial ground that is furthest upstream. The high water level (H.W.L.) at this point is +8.90 m and the normal water level (N.W.L.) is +5.00 m. Accordingly, the necessary clearance level is (H.W.L.) +8.90 + 1.5 = 10.4 m and (N.W.L.) +5.00 + 5.00 = +10.00. To the larger of these two Figures, a margin height of +0.10 is added to establish the artificial ground girder height level as +10.50 m.

➢Inside the Banjir Kanal:

Piles and columns will not be arranged inside the Banjir Kanal so as to avoid reducing the cross-sectional area of the canal, and to secure a waterway and enable dredging and other maintenance. In addition, as piles and columns are arranged on the outside of the freeboards provided as a planned flood control measure, the span of the artificial ground will be approximately 45 - 47 m.

➢Artificial Ground Level:

The level is established by adding the height of the artificial ground bolstering girders and ground thickness to the aforementioned girder height level.

➢ Design Load:

The T load and L load in Japan's Specifications for Highway Bridges are used.

➢ Structure Material:

The structure of the artificial ground will use steel members that are easy to handle and facilitate the construction process. Although steel members normally require painting and other maintenance, here weather-resistant steel will be used so no maintenance is required.

➢Upper surface of artificial ground:

For environmental considerations, greenery will be provided on top of the artificial ground, in the highly rigid sections at the edges. The placement of apertures is also planned in order to bring light into the Banjir Kanal, and for maintenance use.

4) Structural Type

(1) Artificial Ground

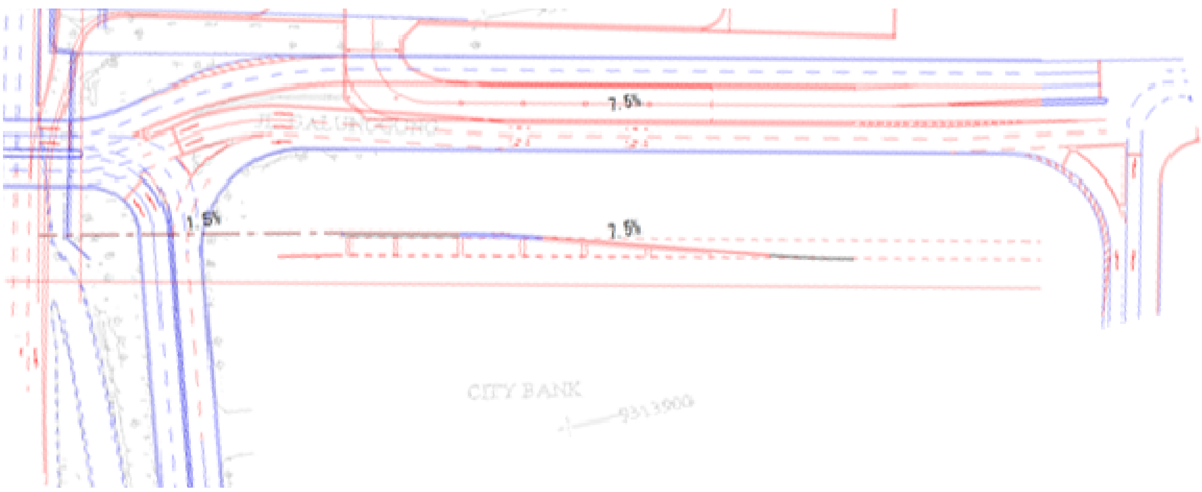
➢ With regard to the planning and design standards, as the “Structural Design Standards for (Low-rise) Structures Above Railway Tracks, Railway Technical Research Institute Edition” (Association of Railway Architects, 2009) that are applied to locations where underground beams cannot be used under Japanese standards will be applied mutatis mutandis. The structural form will be a single column per pile type structure, with support piles and columns placed on both banks of the canal and another short span row placed on the north side.

➢ As heavy machinery cannot be used for the piles due to the nature of the site, use of the caisson pile method using manual operation is being considered. In that case, spring water is anticipated because the pile locations will be on the side of the canal, so work to inject a waterproofing chemical is being considered. The pile diameter will be ø 1.5 m and 1.0 m for the single row on the north side. Based on the results of the soil survey, the piles will be placed down to a depth of approximately GL-10 m, so the length of the piles will be approximately 13 m. Piles will be placed at intervals of 8.0 m.

- Footings will be placed at the top of the piles and underground beams will be placed wherever possible in the outer areas in order to increase the rigidity of the Banjir Kanal.
- The columns will be steel pipe columns with a diameter of ø 1,000. They will be integrated with the girder bolstering girders and fabricated at the factory and transported to the site.
- The bolstering girders will be placed so the girder height is 2.2 m for the east side artificial ground on Thamrin/Sudirman Street and 2.8 m for the west side artificial ground. The bolstering girders will be fabricated at the factory, and the current plan is to arrange them at 1.5 m intervals. The use of a steel plate deck (effective in supporting steel weight), etc., may be considered as a result of further study.

(2) BRT Access Road

- The road width will be 4.0 m per lane to match the current bus road, for a total width of 8 meters. The road gradient will be approximately 7.5% out of consideration for connection to surface level roads and connection with the artificial ground.
- Access roads from local roads will have ramp U-shaped retaining walls for the interfaces with the road, with single-column footings placed at 15-meter intervals. The foundation piles will be ø 600 precast concrete piles with concrete column bases. The upper girders will use I-beam steel that can be constructed quickly.
- An effective height of 4.7 m will be secured for local road intersections.



Source: Study Team

Figure-4.3.30 BRT Access Road Plan Drawing

(3) Connecting passageways to southeast and southwest blocks

The connecting passageways from the artificial grounds to the southeast and southwest blocks will have a width of 4 m. The use of steel is planned considering the ease of construction and economy, and at present the use of stairs and an escalator is planned.

(4) Access Road to artificial ground from Thamrin/Sudirman Street

Thamrin/Sudirman Street is one of the main roads in Jakarta and has a high volume of traffic. Consideration is needed to ensure that buses, taxis and other vehicles accessing the artificial ground do not affect the main flow of traffic.

Three cases can be considered for access road connection of Thamrin/Sudirman Street and the artificial ground.

➢ Case 1: Proposal to keep street in its present state and connect directly to the bridge

As the road will be directly connected to the Dukuh Atas Bridge, there will be a major impact on the flow of traffic on the main road.

Moreover, the bridge is old and may require considerable retrofitting for connection, and the impact of the construction on traffic is a concern.

This case can be considered in the event that the west side of the bridge is enlarged and overall bridge reconstruction is conducted.

➢ Case 2: Proposal to provide additional lanes as an approach to the artificial ground on the west side

The west side has few lanes, and in the event that the bridge is connected directly to the Dukuh Atas Bridge, there will be a major impact on the flow of traffic on the main road. For this reason, lanes will be added to the west side to eliminate the impact on the flow of traffic on the main road.

However, as in Case 1, the bridge is old and may require considerable retrofitting for connection, and the impact of the construction on traffic is a concern.

This case, too, can be considered in the event that the west side of the bridge is enlarged and overall bridge reconstruction is conducted.

➢ Case 3: Proposal to place as little burden as possible on the bridge structure on Thamrin/Sudirman Street

As the bridge is old and may require considerable retrofitting for connection, the impact of the construction on traffic is a concern. For this reason, an artificial ground that is separate from the bridge will be constructed and phases will be taken to eliminate the causes of traffic congestion before and after the bridge.

Table 4.3.24 shows a comparison study of each of these cases.

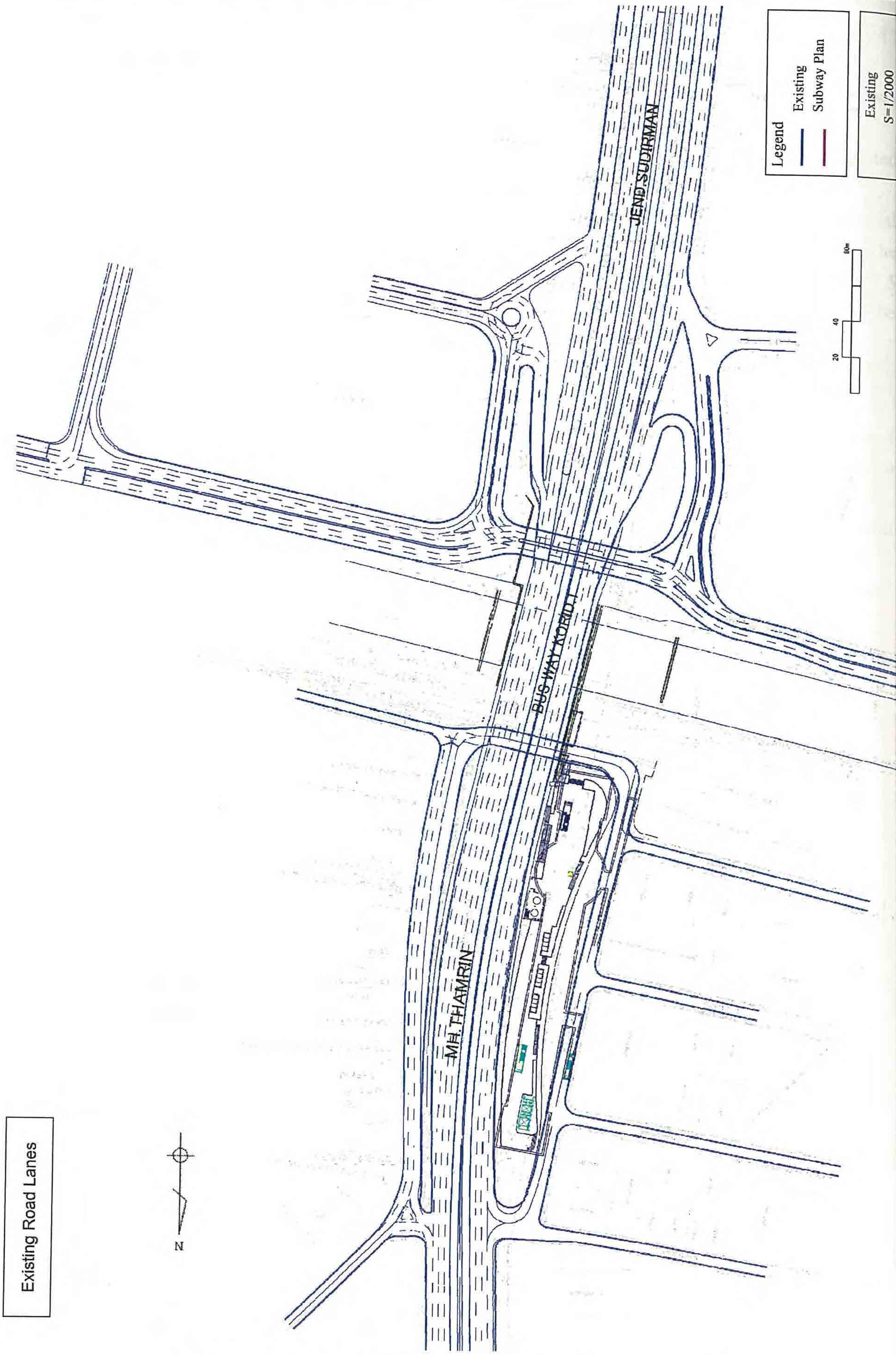


Figure-4.3.31 Existing Road Lanes (Source: Study Team)

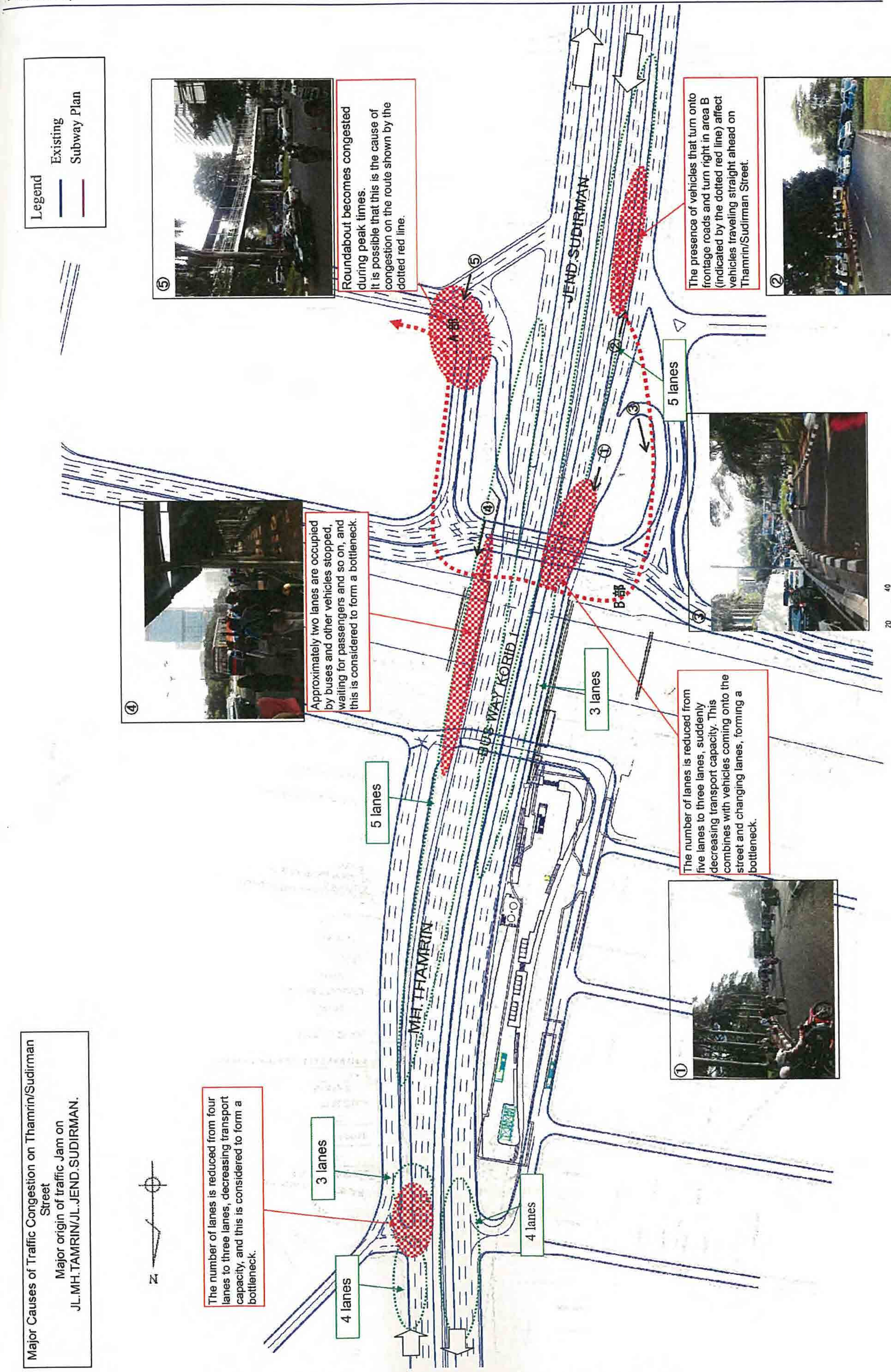
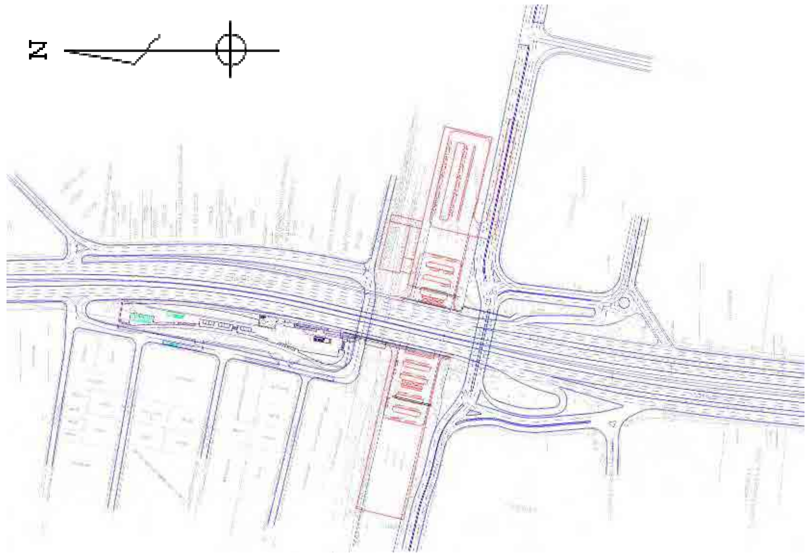


Figure-4.3.32 Major Causes of Traffic Congestion

By the comparison table shown below, the study is to recommend case 3 as a best option from its minimum effect to the main traffic, minimum interference with the existing infrastructure pipes around the Sudirman bridge, and the outcome of minimum cost from all three cases.

Table 4.3.22 Comparison of Access to Artificial Ground from Thamrin/Sudirman Street

Case	Case 1	Case 2	Case 3
Overview	Proposal to keep street in its present state and connect directly to the bridge • Thamrin/Sudirman Street will be maintained as is and will connect directly to the bridge.	Proposal to provide additional lanes as an approach to the artificial ground on the west side • There are five lanes for the approach to the artificial ground on the east side, so these will be maintained in the current state. • There are three lanes on the west side, so to reduce the impact on the main route traffic flow, additional lanes will be secured for the approach to the artificial ground.	Proposal to place as little burden as possible on the bridge structures on Thamrin/Sudirman Street • Additional lanes will be provided on both east and west sides to create an approach road that connects to the artificial ground and does not place a burden on the bridge structures.
Plan			
Impact on main route traffic	• The number of lanes has been secured on the east side of the bridge, so impact is considered to be limited.	• The east side of the bridges is the same as in Case 1.	• Additional lanes will be secured, enabling the impact on the main route traffic to be reduced.
	• There are only three lanes on the west side of the bridge, and the impact on the main route traffic of the traffic entering and leaving the artificial ground is considered to be comparatively great.	• Additional lanes will be secured on the west side of the bridge, enabling the impact on the main route traffic to be reduced	• Same as above.
Impact on bridge structure	• As it is possible that overall bridge reinforcement will be needed, overall reinforcement work will be produced.	• Same as left.	• At present, there is considered to be almost no burden on the bridge, so there will be no impact.
Resolution of causes of traffic congestion	• The places for boarding and getting off buses and other means of transport on the east side of the bridge will be accommodated by the artificial ground, easing traffic congestion resulting from embarking and disembarking. On the west side as well, similarly, impact on the main route from people boarding and getting off buses and the like will be avoided. • No measures are implemented for the other causes of traffic congestion.	• Same as left. • Measures to prevent traffic congestion on the northbound route will be implemented by providing additional lanes and improving the diverge and merge sections on the south side of the bridge.	• In addition to providing additional lanes and improving areas around bridge-head, overall measures can also be implemented.
Relative comparison of work costs	• As no retrofitting will be conducted on the bridge, this method is the least expensive in comparison to the other cases. • In the event that bridge retrofitting is needed, both Case 1 and Case 2 will become more expensive.	• In the event that no bridge retrofitting is conducted, this will be less expensive than Case 3. • Same as left.	• This may be inexpensive in the event that bridge retrofitting is needed for Case 1 and Case 2.
Notes	• Separate traffic congestion measures will be needed. • The need (or lack of need) for bridge retrofitting will have to be confirmed. • The need for future bridge replacement must be taken into consideration.	• Some traffic congestion measures will need to be conducted separately. • The need (or lack of need) for bridge retrofitting will have to be confirmed. • The need for future bridge replacement must be taken into consideration.	• The need for future bridge replacement must be taken into consideration. • On the west side of the road and the north side of the canal, the structure of the MRT station and the structure of the approach road to the artificial ground will need to be coordinated with one another.

Source: Study Team

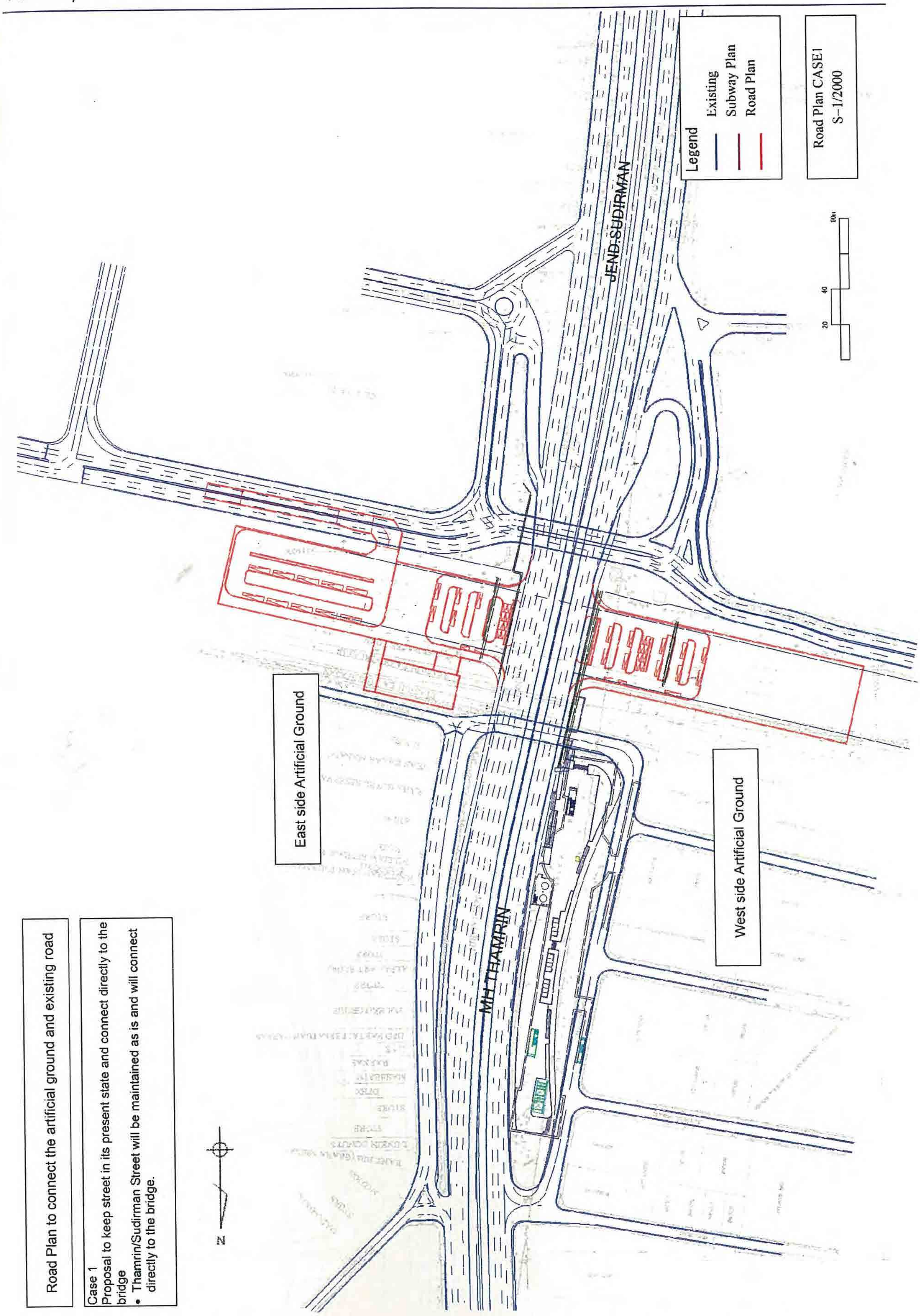


Figure. 4.3.33 Proposed Connection with Artificial Ground: Case 1

(Source: Study Team)

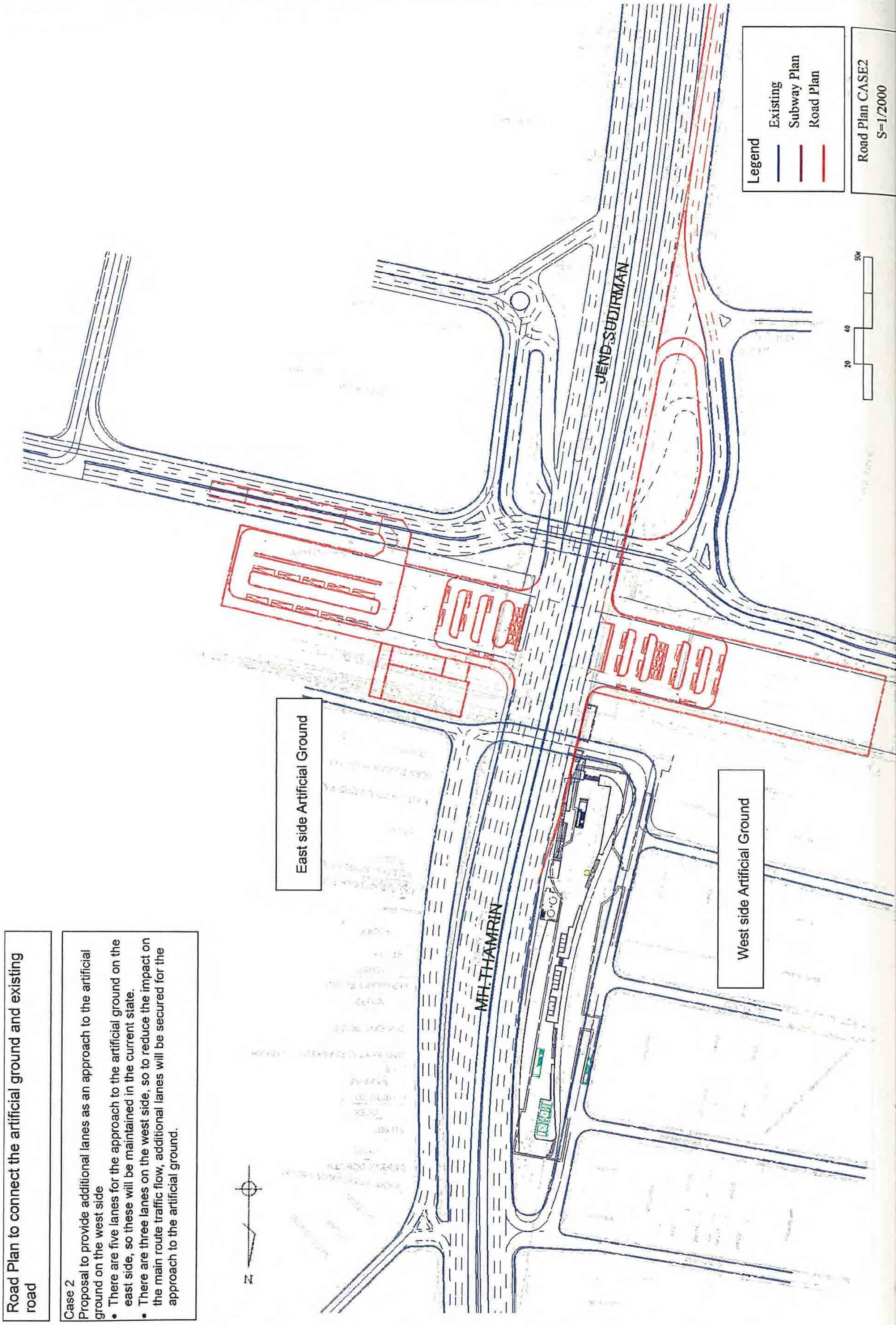


Figure. 4.3.34 Proposed Connection with Artificial Ground: Case 2

(Source: Study Team)

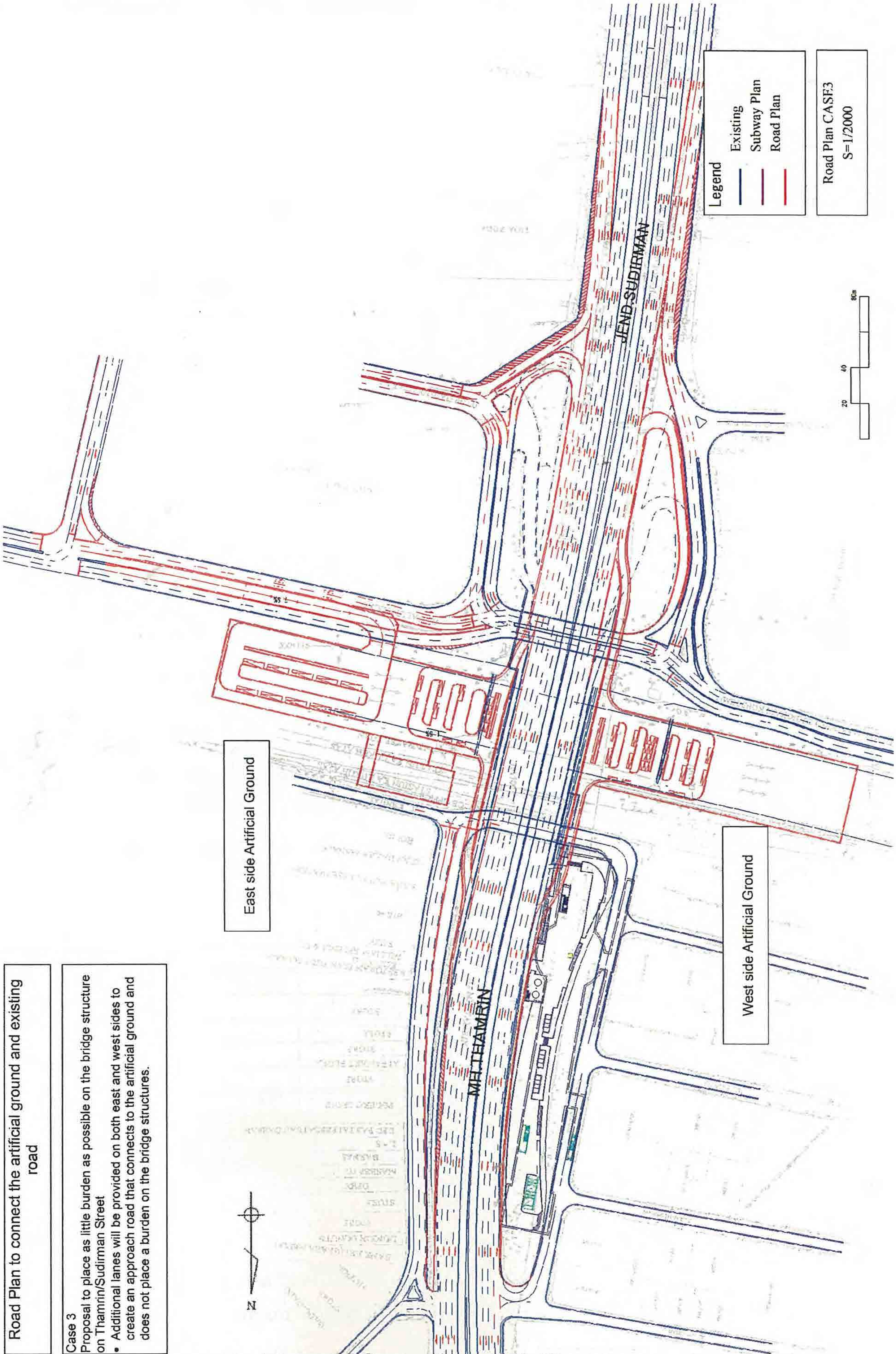


Figure. 4.3.35 Proposed Connection with Artificial Ground: Case 3

(Source: Study Team)

5) Maintenance method

The bottom of the artificial ground is at least 5.0 m below the normal water level, so if a barge can be used, a small crane and backhoe will be placed on the barge to conduct dredging operations (see Figure. 4.3.36).

Figure-4.3.36 Dredging with a crane (left) and backhoe (right) placed on a barge

When the water level is low, the heavy equipment will be placed directly on the bottom of the Banjir Kanal for dredging work (see Figure. 4.3.37).

Figure. 4.3.37 Dredging with an amphibious soft terrain backhoe (left) and dredging with a sand pump (right)

(Source: New Technology Information System)