### 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.

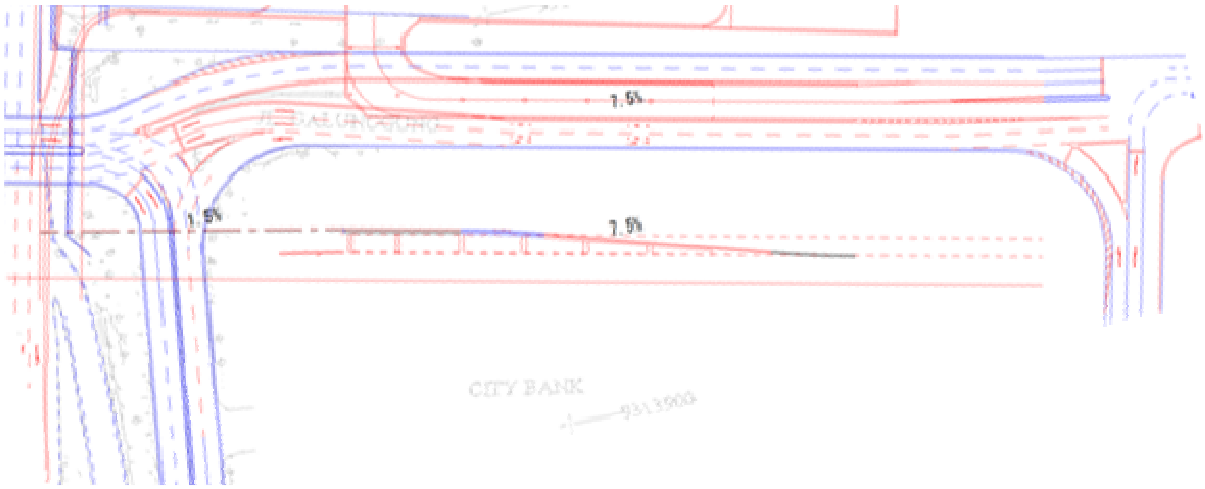
➢ As heavy machinery cannot be used for the piles due to the nature of the site, use of the caisson pile method using manual operation is being considered. In that case, spring water is anticipated because the pile locations will be on the side of the canal, so work to inject a waterproofing chemical 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.

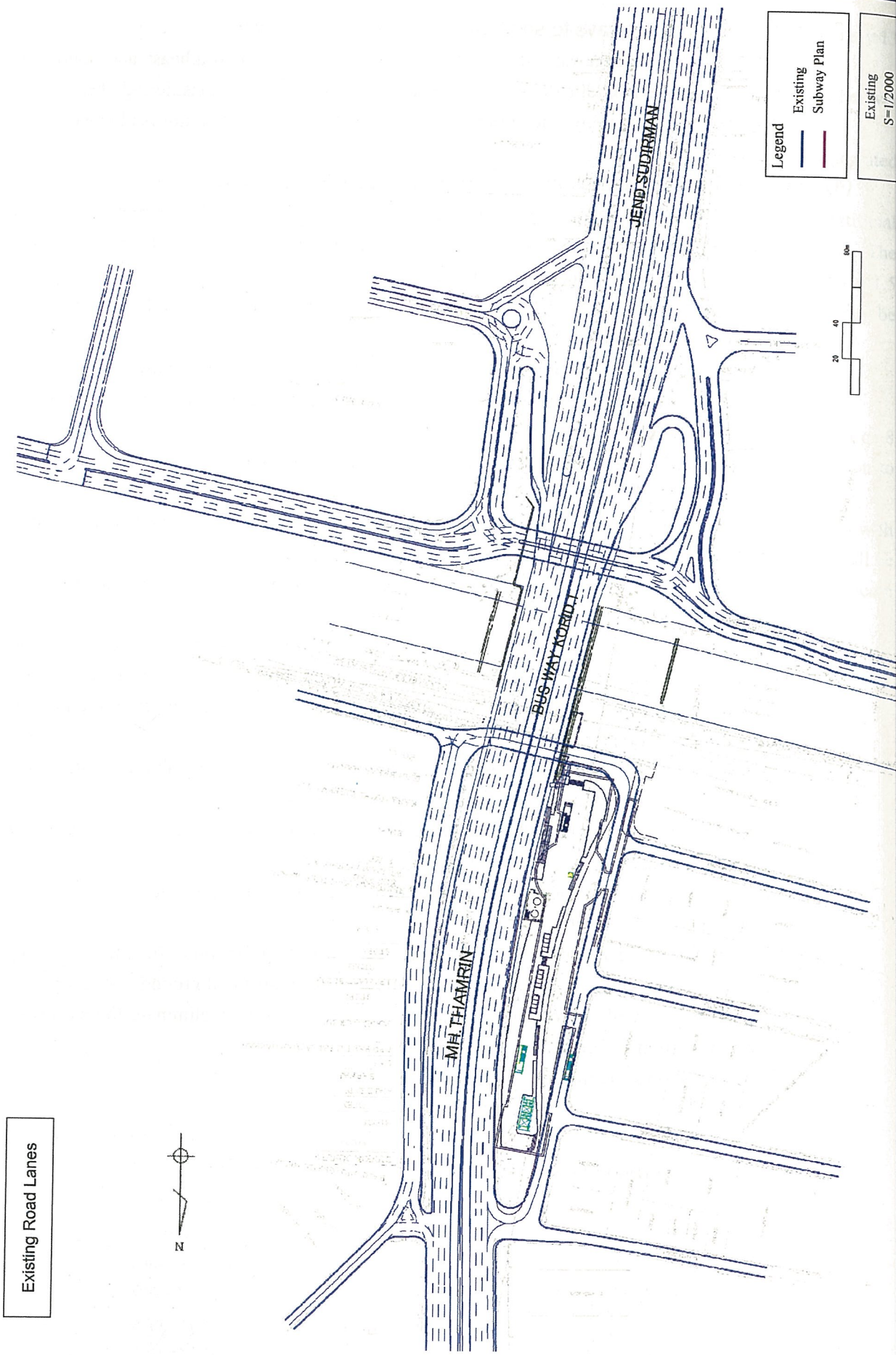



Figure-4.3.31 Existing Road Lanes (Source: Study Team)

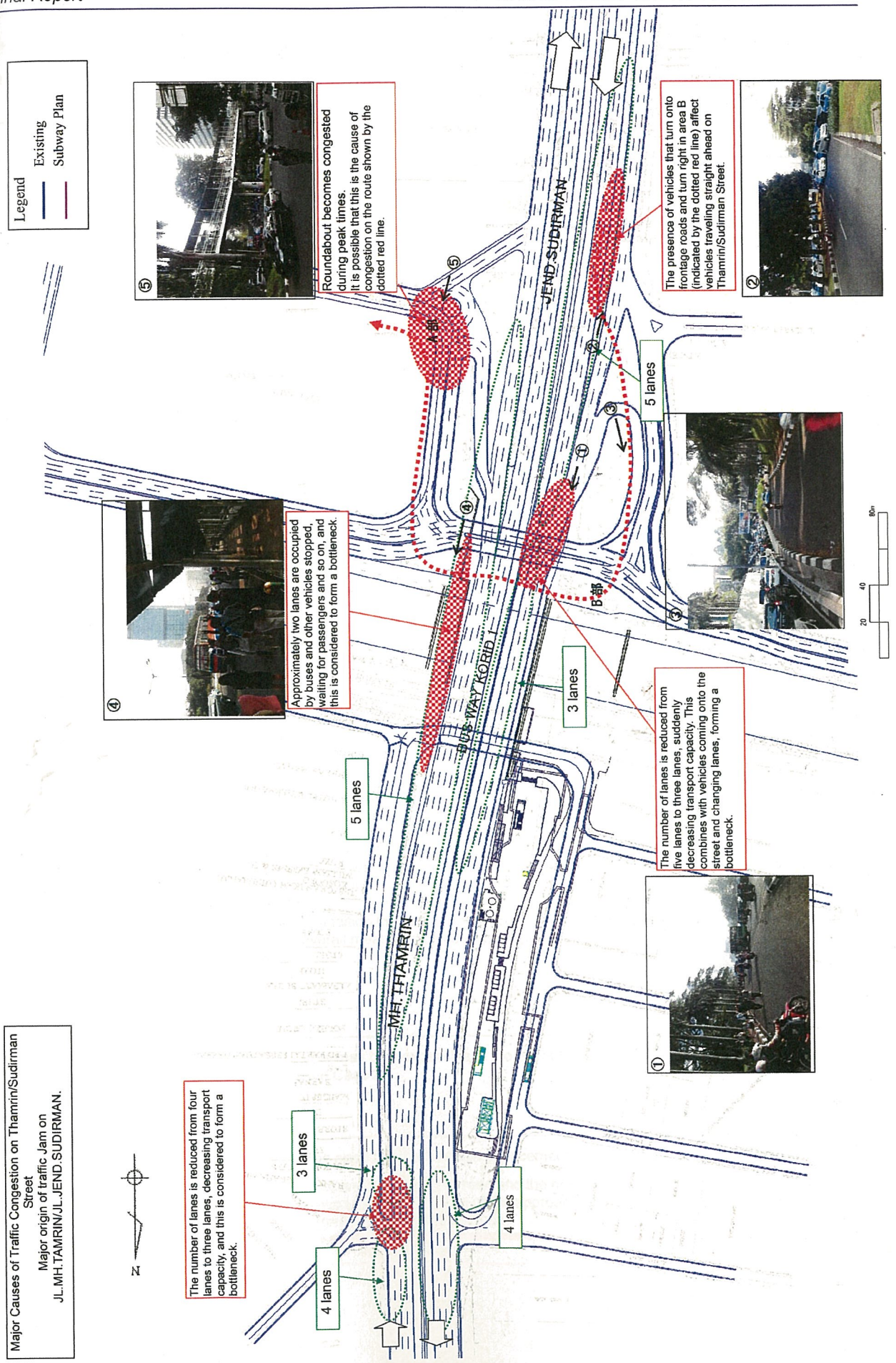
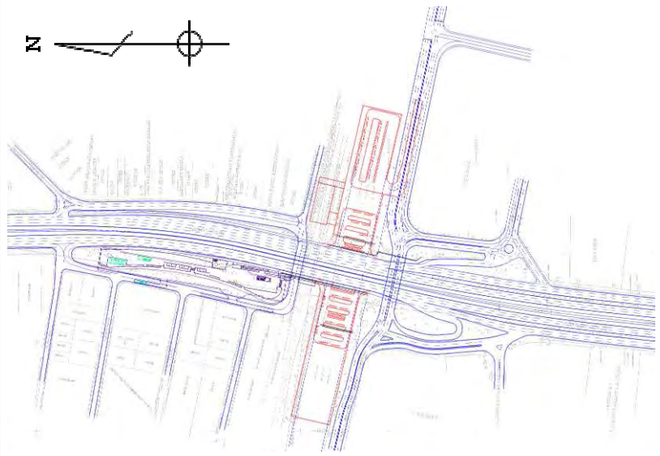
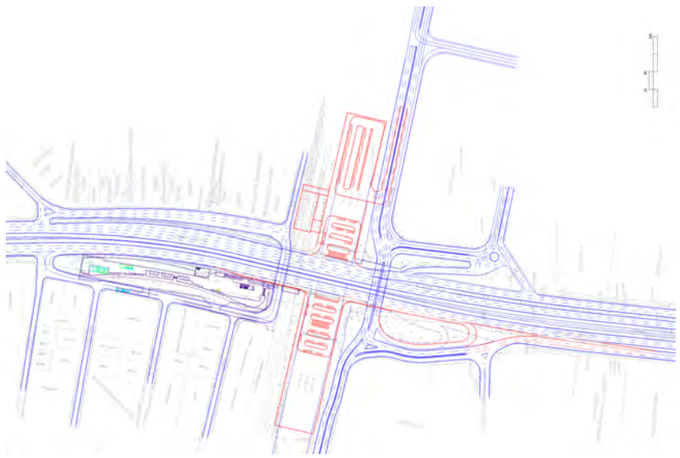
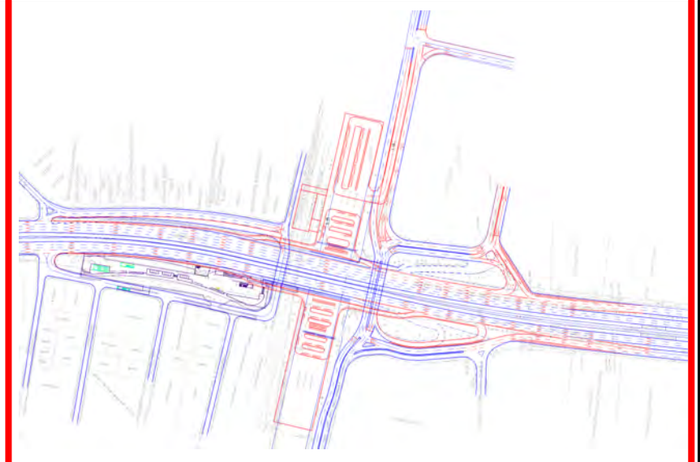



Figure-4.3.32 Major Causes of Traffic Congestion

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<br>• 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<br>• There are five lanes for the approach to the artificial ground on the east side, so these will be maintained in the current state.<br>• 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<br>• 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.<br>• 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. | • The east side of the bridges is the same as in Case 1.<br>• Additional lanes will be secured on the west side of the bridge, enabling the impact on the main route traffic to be reduced | • Additional lanes will be secured, enabling the impact on the main route traffic to be reduced.<br>• 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.<br>• No measures are implemented for the other causes of traffic congestion. | • Same as left.<br>• 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.<br>• 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.<br>• 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.<br>• The need (or lack of need) for bridge retrofitting will have to be confirmed.<br>• The need for future bridge replacement must be taken into consideration. | • Some traffic congestion measures will need to be conducted separately.<br>• The need (or lack of need) for bridge retrofitting will have to be confirmed.<br>• The need for future bridge replacement must be taken into consideration. | • The need for future bridge replacement must be taken into consideration.<br>• 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

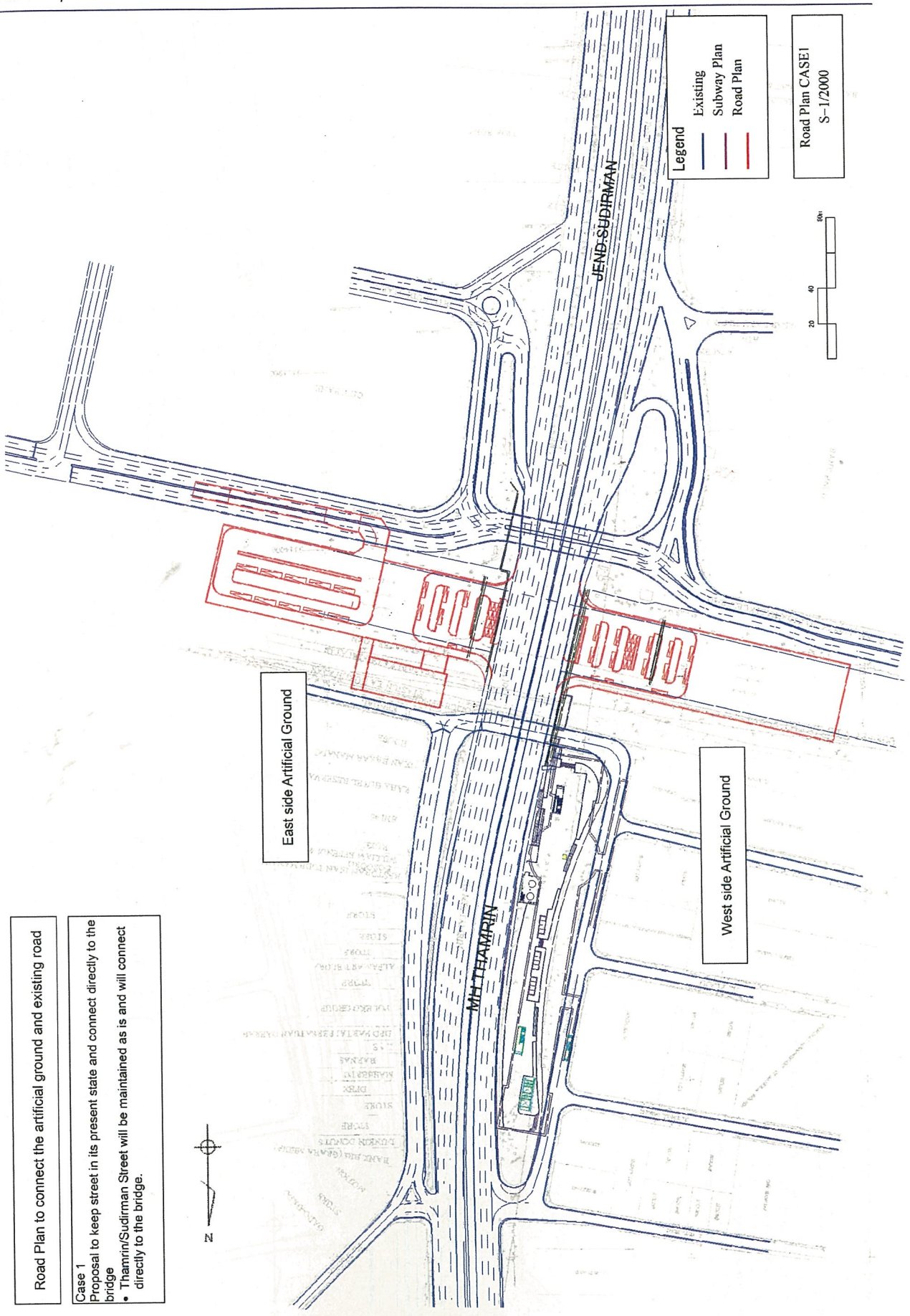



Figure. 4.3.33 Proposed Connection with Artificial Ground: Case 1

(Source: Study Team)

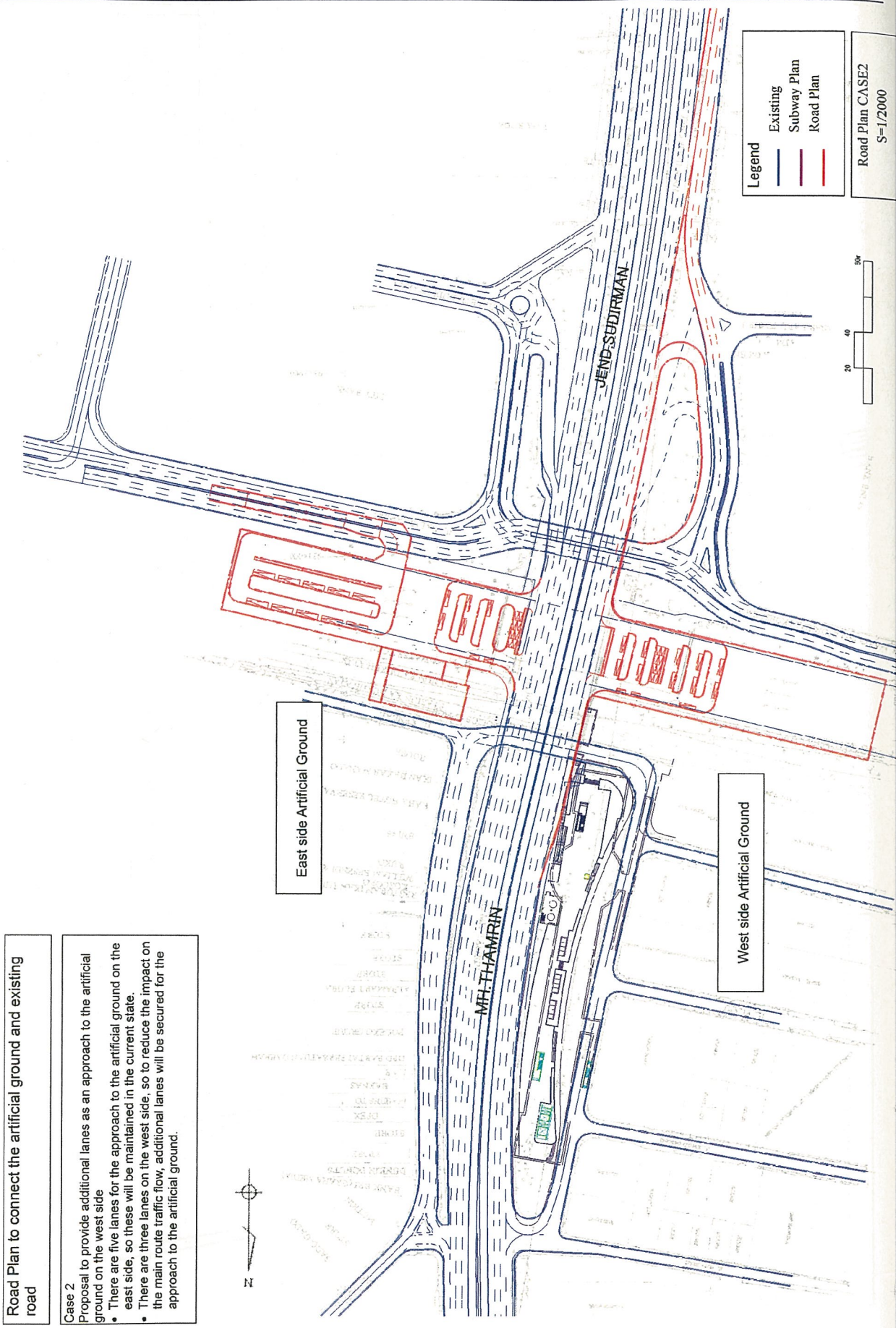



Figure. 4.3.34 Proposed Connection with Artificial Ground: Case 2

(Source: Study Team)

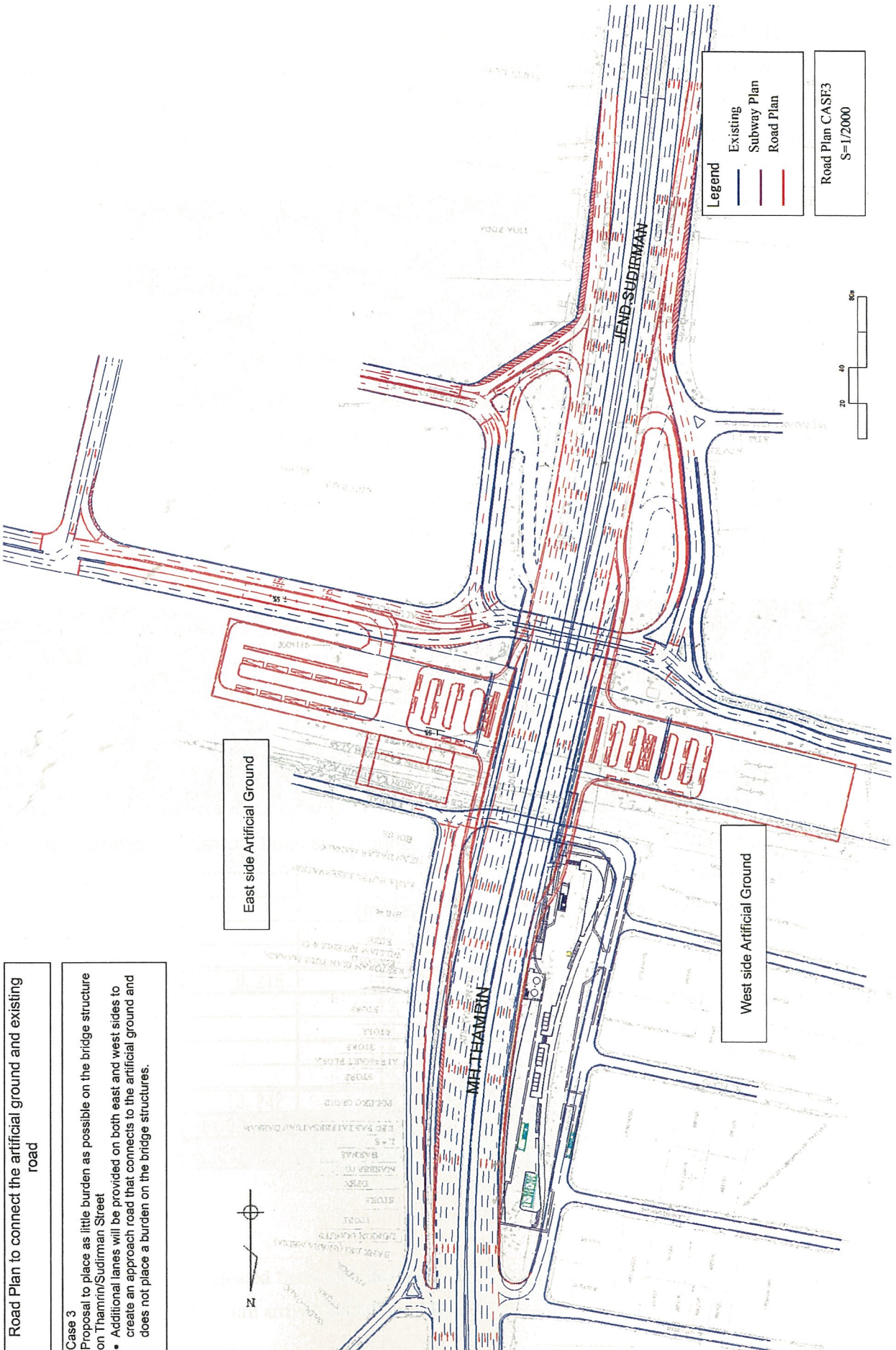



Figure. 4.3.35 Proposed Connection with Artificial Ground: Case 3

(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)