AL - III	B.P (Western section of JORR)-City planning road (Route-K)-New route-City planning road along Tangerang line-Jl.Zainul Arifin-Jl.sukarjo Wiryopranoto-Jl.Samanhudi-Jl.angkasa-Jl.Landasan Barat/Timur-Jl.Sunter Jaya-City planning road-Jl.Taman Sunter Indah-Jl.Danau Indah Raya-Raya Barat/Timur Boulevard-Jl.Pegangsaan Dua-Jl.Pulogadung-City planning road (Route A-A)-E.P (Eastern section of JORR)	Road cum rail scheme

The road priority scheme is developed to make full use of existing road right-of-way and eventually it follows existing roads to the possible extent.
The urban betterment scheme is based on a potential route presented by the masterplan of Jakarta 2005, in which new road development is designated to initiate urban betterment in Kota. The road cum rail scheme has the same route as the proposed LRT in its entire stretch in Kota. These three alternatives are set to meet the designated role and function of East-West Axis, that is to stimulate the development of planned primary centers, to enhance the road capacity and to support through traffic in the central urban area in Jakarta.

9.2.4 Evaluation of Alternatives

1) Comparison Items

For the purpose of comparison of each alternatives, these aspects are taken into account;

a) Traffic Demand
b) Technical Feasibility
c) Environment

2) Evaluation

The comparison and comprehensive evaluation of each alternative are summarized in Tables 9.2.1 and 9.2.2.
The selected route is combined with each segment which is deliberated on technical feasibility and selected among further alternatives on segments through its comparison and evaluation. However, it is noted that comprehensive evaluation of each segment is merely made to select one of alternative routes but it is still indispensable to examine practical countermeasures from technical and functional viewpoints to cope with severe physical constraints.

ALTERNATIVE		AL-IIIa : WESTERN ROUTE	AL-IIIb : ADDITIONAL WESTERN ROUTE	AL-IV : CENTRAL ROUTE	AL-V : EASTERN ROUTE
Route Location		Jl. Gajah Mada/Hayam Wuruk-Jl. Abdul Muis-Jl. Jati Baru-Jl. Pejompongan-Pondok Pinang (Simpruk Bypass)-Jl. Metro Pondok Indah	Jl. Gajah Mada/Hayam Wuruk-Jl.Abdul Muis-Jl.Jati Baru-Jl. Pejompongan-Pondok Pinang (Simpruk Bypass)-City Planning Road	Jl. Gajah Mada/Hayam Wuruk-Jl. Abdul Muis-Jl. Jati Baru-Jl. Pejompongan-Pondok Pinang (Simpruk Bypass)-Jl. Gelora-Jl. Asia Afrika-Jl. Pattimura-Jl. Sultan Iskandarsyah-Jl. Prapanca-Jl. Pangeran Antasari	Kali Krukut-Jl. Tanah Sereal-Jl. Cideng Timur/Barat-Jl. Fakhrudin-Jl. Mas Mansyur-Kali Krukut
Salient Features	Terrain Length (km) Proposed No. of Lane Land Acquisition Area Cost Index	Flat 17.7 4 (62%) : 6 (38%) 6.7 ha 0.97	Flat 18.9 4 (64%) : 6 (36%) 18.4 ha 1.07	Flat 17.7 4 (62%) : 6 (38%) 13.8 ha 1.00	Flat 18.0 4 (62%) : 6 (38%) 26.8 ha 1.14
	Physical Constraint	- Jl. Gajah Mada/Hayam Wuruk is located in the CBD with 60 m ROW and has the 15 m wide Kali Ciliwung in the center. - Jl. Abdul Muis is 4-lane undivided road and has the 10 m wide Kali Krukut and 20 m wide frontage road in the east. - In the vicinity of intersection between Jl. Fakhrudin and Jl. Jati Baru, there are several plans of grade separation structure, such as Jl. Fakhrudin underpass and Jl. Jati Baru flyover. - In the west of Jl. Jati Baru, the Western Banjir Kanal, high power transmission line and Western Railway Line disrupt community and densely urbanized area with low cost housing are found along its corridor. - The existing half cloverleaf type Pejompongan IC which Jl. Gatot Subroto and the South-West Arc overpass the railway has presently at-grade railway crossing and a railway flyover will be provided by DKI's improvement plan. - In the west of Jl. Gatot Subroto, Simpruk Bypass runs southward in both sides of the railway and the toll road will be strictly controlled by severe physical constraints such as Parliament Complex and relevant facilities. - Jl. Pejompongan-Pondok Pinang (Simpruk Bypass) has been developed recently to connect Jl. Metro Pondok Indah with Jl. Pejompongan. - Pondok Indah housing and commercial complex are almost completed in one of the most largest scale development. - Cilandak IC between Jakarta Outer Ring Road and Jl. Metro Pondok Indah is planned to be Diamond type interchange with On and Off ramps.	- The same physical constraints as AL-IIIa are found in between Jl. Gajah Mada and Jl. Metro Pondok Indah. - Densely populated housings encompass a golf course in Pondok Indah housing and commercial complex where 20 m high cliff disrupt these two landuses. - Jakarta International School having 12 ha premises exists on the hill. - On and Off ramps of Cilandak IC and On and Off ramps of Pondok Pinang IC are planned in the vicinity of terminus. - High-rise buildings such as Aminta House, Beverly Tower, State Bldg. and the Parkway exist along JORR in the vicinity of terminus.	- The same physical constraints as AL-III are found in between Jl. Gajah Mada/Hayam Wuruk and Jl. Pejompongan-Pondok Pinang (Simpruk Bypass). - The firing range has a plan to expand their field toward Graha Pemuda and it will make Jl. Gelora underpass. - Statue Senayan is located in the center of the intersection between Jl. Jend. Sudirman and Jl. Senopati. This intersection is of seven connecting road links. Furthermore, a new link is planned to connect this intersection with Simpruk Bypass. - Kebayoran Baru is established as Subcenter in Jakarta South, having Blok-M commercial center encompassed by residential area. However, land use conversion from residence to business and commercial building is ceaselessly in progress. - Jl. Pangeran Antasari has future ROW of 30 m wide where the land use along the road is few developed. - At the terminus, the Kali Krukut flows northward and its river side forms depressed wide area where open space remains undeveloped.	- The beginning points located on Jl. Perniagaan in Kota where the Kali Krukut flows northward and along both riversides low cost housing exist densely. - Jl. Cideng Timur/Barat and the Kali Krukut have been improved in the same ROW as the circumferential road in the CBD of Jakarta. - In the vicinity of intersection between Jl. Fakhrudin and Jl. Jati Baru, there are several plans of grade separation structure, such as Jl. Fakhrudin underpass and Jl. Jati Baru flyover. - Jl. Mas Mansyur recently has been improved and Sudirman Flyover is constructed above Jl. Sudirman to form Diamond type interchange. - There are many high-rise buildings along Jl. Mas Mansyur, Jl. Sudirman and Jl. Gatot Subroto, which severely control the route location. - The Kali Krukut meanders in the south of Jl. Gatot Subroto and housing complex are developed along both riversides. The route cannot follow the river space exactly and resulting land acquisition and property compensation will be necessary. - At the terminus, the Kali Krukut flows northward and its river side forms depressed wide area where open space remains undeveloped.
Comparison	Technical Feasibility	- The space above the Kali Ciliwung seems available provided that the consent is obtained from the agencies concerned. - A reconstruction of Jl. Abdul Muis will be able to create the space for elevated toll road and at-grade arterial road with On and Off ramps within the existing ROW. - A reconstruction of Jl. Kebon Sirih will be able to provide additional space for On and Off ramps, provided that the consent to utilize space above the Kali Cideng is obtained from the agencies concerned. - Though more detailed information on Jl. Jati Baru flyover are still required, the North-South Axis should manage to pass this complicated area because of severe physical constraints in its surrounding. - A planned railway flyover at Pejompongan will create open space adjoining railway and make it available for On and Off ramps with the south bound of Jl. Gatot Subroto. - A Y type junction with toll barrier between Jakarta Outer Ring Road and North-South Axis will be located nearby the planned Cilandak IC on Jakarta Outer Ring Road at the terminus. It is to concentrate successive ICs in a short stretch and it will make traffic maneuvering hard.	- The same technical feasibility as AL-IIIa are found in between Jl. Gajah Mada and Jl. Metro Pondok Indah. - Many public facilities and planned office buildings around the intersection between Jl. Metro Pondok Indah and Jl. Marga Guna will make it hard to follow city planning road without any demolition of such buildings. A Y type junction with toll barrier between JORR and North-South Axis will be located nearby the planned Cilandak IC and Pondok Pinang IC on JORR at the terminus. High-rise buildings and established Pondok Club Villas housing complex will be affected by these junction and toll barrier. Furthermore, successive ICs will make complicated traffic maneuvering to deteriorate function and to aggravate traffic safety.	- The same physical constraints as AL-III are found in between Jl. Gajah Mada/Hayam Wuruk and Jl. Pejompongan-Pondok Pinang (Simpruk Bypass). - The North-South Axis will go together with Jl. Gelora and underpass the extended firing range and successive at-grade intersection, provided that construction works are done together in the nick of time. - The North-South Axis will avert the statue to pass behind the statue so that these rampways will neither deteriorate aesthetic view nor aggravate adverse effect of social issue. - A Y type junction with toll barrier between Jakarta Outer Ring Road and North-South Axis will be formed nearby the existing intersection.	- The improvement of Jl. Perniagaan and the Kali Krukut in Kota is deemed necessary to create the space for the toll road and frontage roads in both sides. - Existing Jl. Cideng Timur/Barat with the Kali Krukut has enough wide and the space above the Kali Krukut seems available, provided that the consent is obtained from the agencies concerned. - Though more detailed information on Jl. Jati Baru flyover and Jl. Fakhrudin underpass are still required, the North-South Axis should manage to pass this complicated area because of severe physical constraints in its surrounding. - Intersecting points with Jl. Sudirman and Jl. Gatot Subroto will be severely controlled and it will affect the route location in its behind and ahead. Resulting land acquisition and property compensation will increase significantly. - Only 16% of the space above the Kali Krukut are made available due to its meandering, that is to acquire land and compensate properties along the river pertaining to 84% of required space for the toll road. - A Y type junction with toll barrier between Jakarta Outer Ring Road and North-South Axis will be formed nearby the existing intersection without any serious traffic maneuvering.
	Traffic	The converted traffic from the projected arterial roads in the southern area is much less compared with AL-IV route. The user of North-South Axis in this route is estimated 85% of AL-IV users.	The converted traffic from the projected arterial roads in the southern area is much less compared with AL-IV route. The user of North-South Axis in this route is estimated 85% of AL-IV users.	The user of this route in Year 2010 is forecasted as 170,000 PCU per day and 150,000 PCU per day if the number of interchanges is reduced to several (six or seven)	The converted traffic in the southern area is most few for this alternatives and the user of this route is 80% of AL-IV users.
	Environment	- Present inhabitants along the route will be affected rather lower level because of the smallest land acquisition area. Thus resettlement problems are also in lesser degree. On the contrary, substantial impact on social environment will be brought in established housing and commercial complex in the southern part. - Public facilities such as hospital, school, mosque/church and cemetery exist a few and direct adverse effects are estimated scarcely, provided if suitable countermeasures are taken. - No remarkable memorial and historical monument is found along the route. - Environmental changes such as air pollution, noise, water quality and vibration will be brought a little but it seems negligible level, considering potential impact on the present situation. - Storm water run-off remains unchanged due to passing on existing road with almost the same run-off coefficient.	- Present inhabitants along the route will be affected and rather high level, compared with AL-IIIa. Serious impact on social environment is found in the southern part because land use along city planning road remains densely population area. - Public facilities such as schools, mosque and governmental offices exist and direct adverse effects will be taken place. - Environmental changes such as air pollution, noise water quality and vibration will be brought a little but it seems negligible level, considering potential impact on the present situation. Storm water run-off will increase significantly - due to increase of run-off coefficient caused by new road development on the hillside.	- Present inhabitants along the route will be affected but still low level, compared with AL-V. No serious impact on social environment is found in the southern part because land use along Jl. Pangeran Antasari remains relstively undeveloped. - Public facilities such as hospital, school, mosque/church and cemetery exist a few and direct adverse effects are estimated scarcely, provided if suitable countermeasures are taken. - Senayan Statue is a remarkable memorial and historical monument located at Senayan round-about. An appropriate measure is deemed necessary in case of new presence of viaduct and ramps. - Environmental changes such as air pollution, noise, water quality and vibration will be brought a little but it seems negligible level, considering potential impact on the present situation. Storm water run-off remains unchanged due to - passing on existing road with almost the same run-off coefficient.	- Relatively high impact on social environment will be taken place, especially for resettlement of inhabitants by land acquisition caused by road and river improvement. - No public facilities except high-rise buildings along Jl. Sudirman and Jl. Gatot Subroto is found along the route. The route will avert these facilities to keep distance. - No remarkable memorial and historical monument is found along the route. - Environmental changes such as air pollution, noise, water quality and vibration will be brought a little. - Storm water run-off remains unchanged due to passing on existing road and river with almost the same run-off coefficient.
Evaluation		Step - 1 : It is obvious that AL-V and AL-IIIb are inferior to AL-IIIa and AL-IV in the aspect of environment, especially for resettlement problem. Step - 2 : AL-IIIa has adverse effects on traffic maneuvering at the junction with JORR. Step - 3 : AL-IV has more or less similar advantages and disadvantages to AL-IIIa. However, it is superior to AL-IIIa in the aspect of traffic demand, especially for diverting long distance trips from from the existing north-south thoroughfare. Step - 4 : It is reasonable that AL-IV is proposed as the optimum route for the North-South Axis, provided that required countermeasures are taken and necessary consents are obtained.			

Table 9.2.2 Alternative Comparison and Evaluation on East-West Axis

ALTERNATIVE		AL-I : ROAD PRIORITY SCHEME	AL-II : URBAN BETTERMENT SCHEME	AL-III : ROAD CUM RAIL SCHEME
Route Location		B.P (Western section of JORR) - City planning road (Route-K) - New route - City planning road along Tangerang line - Jl. Pangeran Tubagus Angke - Jl. Perniagaan - New route - Jl. Pangeran Jayakarta - Jl.Dr. Suratmo - Jl. Industri - Jl. Landasan Barat/Timur - Jl. Sunter Jaya - City planning road - Jl. Taman Sunter Indah - Jl. Danau Indah Raya - Raya Barat/Timur Boulevard - New route - City planning road (Route E-E) - City planning road (Route A-A) - E.P (Eastern section of JORR)	B.P (Western section of JORR) - City planning road (Route-K) 0- New route - City planning road along Tangerang line - Jl. Jelambar Utama Sakti - Jl. Jelmabar Selatan - City planning road - Jl. Mangga Besar - Jl. Industri - Jl. Landasan Barat/Timur - Jl. Sunter Jaya - City planning road - Jl. Taman Sunter Indah - Jl. Danau Indah Raya - Raya Barat/Timur Boulevard - Jl. Pegangsaan Dua - City planning road - City planning road (Route A-A) - E.P (Eastern section of JORR).	B.P (Western section of JORR) - City planning road (Route-K) - New route - City planning road along Tangerang line - Jl. Zainul Arifin - Jl. Sukarjo Wiryopranoto - Jl. Samanhudi - Jl. Angkasa - Jl. Landasan Barat/Timur - Jl. Sunter Jaya - City planning road - Jl. Taman Sunter Indah - Jl. Danau Indah Raya - Raya Barat/Timur Boulevard - Jl. Pegangsaan Dua - Jl. Pulogadung - City planning road (Route A-A) - E.P (Eastern section of JORR).
Salient Features	Terrain	Flat	Flat	Flat
	Length (km)	30.5	30.3	29.9
	Proposed No. of Lane	10	10	10
	Land Acquisition Area	110.95 ha	136.95 ha	133.1 ha
	Cost Index	1.31	1.00	0.98
	Physical Constraints	- Future Taman Permata Buana housing complex will have ROW for the city planning road (Route K) in the north of existing Taman Permata Buana housing complex. - As future ROW of Route K is supposed to be of 26 m wide, widening of future ROW to incorporate the scheme of East-West Axis is deemed necessary. - Although Route K comes to an end at Jl. Kedoya Raya, the East-West Axis should find its own route to avert number of established housing complex in Kec. Kebon Jeruk. - Thr city planning road along Tangerang Line is to necessitate considerable land acquisition and resettlement of inhabitants and it is unlikely practical to apply conventional acquisition method to create necessary space - Jl. Pangeran Tubagus Angke and the Kali Angke has 70 m wide ROW in Kec. Grogol Petamburan but only 20 m wide in Kec. Tambora. - Jl. Perniagaan and its eastern extension are to pass the most crowded Glodok area where historical and monumental old buildings are reserved around Kota railway station. - The elevated Central line railway overpasses Jl. Pangeran Jayakarta - A flyover is under construction at the intersection between Jl. Gunung Sahari and Jl. Industri. - Ex-Kemayoran Airport has very high development potential with enough wide arterial roads and its east-westward arterial road is to consist of a part of the East-West Axis - Jl. Taman Sunter Indah and Jl. Danau Indah Raya have 36 m wide ROW, which have been partially completed and the remaining section is in densely populated area - At the intersecting point between Jl. Yos Sudarso and Raya Barat Boulevard, elevated North-South Link and its On/Off ramps exist and the Kali Sunter flows beside Jl. Yos Sudarso - Raya Barat/Timur Boulevard in Kelapa Gading housing complex have enough wide ROW and commercial buildings along the road have been set back. - The route is to run parallel to the Cakung river in the east and to pass built-up industrial estate. - Route E-E is planned on existing Jl. Swadaya where industrial landuse is predominant along the road. - Route A-A consisting of two city planning roads have 20 m wide ROW each and are located 40 m apart each other because east-westward high voltage transmission lines exist in the center. - New bus terminal that is planned nearby the interchange with JORR shall be incorporated in the design of interchange	- Future Taman Permata Buana housing complex will have RoW for the city planning road (Route K) in the north of existing Taman permata Buana housing complex - As future ROW of Route K is supposed to be of 26 m wide, widening of future ROW to incorporate the scheme of East-West Axis is deemed necessary - Although Route K comes to an end at Jl. Kedoya Raya, the East-West Axis should find its own route to avert number of establsihed housing complex in Kec. Kebon Jeruk - The city planning road along Tangerang Line is to necessitate considerable land acquisition and resettlement of inhabitants and it is unlikely practical to apply conventional acquisition method to create necessary space. - There are many severe physical constraints in Kec. Gogol Petamburan and Kec. Tambora, in which only Mangga Besar Extension as well as city planning road in Jelmbar are found practical - Ex-Kemayoran Airport has very high development potential with enough wide arterial roads and its east-westward arterial road is to consist of a part of the East-West Axis. - Jl. Taman Sunter Indah and Jl. Danau Indah Raya have 36 m wide ROW, which have been partially completed and the remaining section is in densely populated area - At the intersecting point between Jl. Yos Sudarso and Raya Barat Boulevard, elevated North-South Link and its On/Off ramps exist and the Kali Sunter flows beside Jl. Yos Sudarso. - Raya Barat/Timur Boulevard in Kelapa Gading housing complex have enough wide ROW and commercial buildings along the road have been set back. - High voltage transmission line and its pylons are located along Jl. Pegangsaan Dua where the plan of new freight railway line presented in RBWK of Kec. Cakung has been set aside. - Route A-A consisting of two city planning roads have 20 m wide ROW each and are located 40 m apart each other because east-westward high voltage transmission lines exist in the center - New bus terminal that is planned nearby the interchange with JORR shall be incorporated in the design of interchange	- Future Taman Permata Buana housing complex will have ROW for the city planning road (Route K) in the north of existing Taman Permata Buana housing complex. - As future ROW of Route K is supposed to be of 26 m wide, widening of future ROW to incorporate the scheme of East-West Axis is deemed necessary. - Although Route K comes to an end at Jl. Kedoya Raya, the East-West Axis should find its own route to avert number of establsihed housing complex in Kec. Kebon Jeruk. - The city planning road along Tangerang Line is to necessitate considerable land acquisition and resettlement of inhabitants and it is unlikely practical to apply conventional acquisition method to create necessary space. - Uncertain LRT development makes the scope of E-W Axis such as traffic demand at station plaza and construction economy ambiguous. - Ex-Kemayoran Airport has very high development potential with enough wide arterial roads and its east-westward arterial road is to consist of a part of the East-West Axis. - Jl. Taman Sunter Indah and Jl. Danau Indah Raya have 36 m wide ROW, which have been partially completed and the remaining section is in densely populated area. - At the intersecting point between Jl. Yos Sudarso and Raya Barat Boulevard, elevated North-South Link and its On/Off ramps exist and the Kali Sunter flows beside Jl. Yos Sudarso. - Raya Barat/Timur Boulevard in Kela Gading housing complex have enough wide ROW and commercial buildings along the road have been set back. - High voltage transmission line and its pylons are located along Jl. Pegangsaan Dua. - Jl. Pulogadung has 40 m wide ROW and is designated as a trunk road in built-up industrial estate. - Route A-A consisting of two city planning roads have 20 m wide ROW each and are located 40 m apart each other because of east-westward high voltage transmission lines in the center. - New bus terminal that is planned nearby the interchange with JORR shall be incorporated in the design of interchange.
Comparison	Technical Feasibility	- 70 m wide ROW should be subdivided in future Taman Permata Buana housing complex in the nick of time when they will submit their development plan for approval. - Future ROW along Tangerang line seems to be available, provided that no implementation conflict between LRT and road is issued. - The space above the Kali Angke seems to be available, provided that the consent is obtained from the agencies concerned. - It is too serious to construct 1.3 km new link in Glodok, it is likely possible that Pasar Pagi flyover and Jl. Mangga Dua will be able to substitute the linkage. - It is rather difficult to provide interchanges at designated access points in Kota area. - It is still possible to construct 100 m long span overpass at Sunter IC by contilever erection but costly. - New link in Kel. Rawa Terat and the northern extension of Route E-E will require coordination with on-going Jl. Buaran Indah Raya extension because of different ROW width. - It seems excessive that the E-W Axis shall keep 20 m apart from pylon i because of 3.5 m high headroom limit in spite of 6.18 m high in Japan.	- 70 m wide ROW should be subdivided in future Taman Permata Buana housing complex in the nich of time when they will submit their development plan for approval - Future ROW along Tangerang line seems to be available, provided that no implementation conflict between LRT and read is issued. - District plans claim public space and facilities so much in Kec. Grogol Petamburan and Kec. Tambora that is is very necessary to create such land area not by conventional acquisition method but by certain land readjustment techniques to mitigate technical and environmental issues. - It is still possible to construct 100 m long span overpass at Sunter IC by contilever erection but costly. - It seems practical that the route follows city planning road since a new freight line presented in the District plan in Kec. Cakung has been set aside. - It seems excessive that the E-W Axis shall keep 20 m apart from phylon because of 3.5 m high headroom limit in spite of 6.18 m high in Japan.	- 70 m wide ROW should be subdivided in future Taman Permata Buana housing complex in the nich of time when they will submit their development plan for approval. - Future ROW along Tangerang line seems to be available but necessary area is considerable. It will cause serious social problem if conventional alnd acquisition method is applied. - There exist many public facilities and office buildings along the route such as Jiwa Grogol hospital and Fire brigade which will be affected by necessary widening. Conventional land acquisition will make additional social issues to uncertain LRT development. - It is still possible to construct 100 m long span overpass at Sunter IC by contilever erection but costly. - It seems practical to follow Jl. Pulogadung even though present landuse is of established industrial estate. - It seems excessive that the E-W Axis shall keep 20 m apart from pylon because of 3.5 m high headroom limit in spite of 6.18 m high in Japan.
	Traffic	- It is so close to Jakarta Harbour Road which has the similar function that it shall impair the viability of toll road. - One of the designated roles and functions, to support through traffic in CBD, is achieved in lesser degree because it runs on existing roads. - It is rather inferior in the aspect of road network to bring about serious adverse affect to traffic management at the terminus of North-South Axis, since no direct connection with North-South Axis is provided.	- It is significantly effective to divert traffic from Jakarta Merak Toll Road which is almost full capacity and resulting chronic traffic congestion take place at the terminus Tomang. - One of the designated roles and functions, to support through traffic in CBD, is significantly achieved because it connects Jl. Mangga Besar with Jl. Daan Mogot. - It is surely superior in the aspect of road network, since direct connection with North-South Axis is provided. - It will be able to offer comprehensive measures to traffic management at the terminus of North-South Axis	- It is significantly effective to divert traffic from Jakarta Merak Toll Road which is almost full capacity and resulting chronic traffic congestion take place at the terminus Tomang. - Planned interchange with Jl. Latumeten is too close to the existing Grogol intersection where chronic traffic congestion take place and adverse impacts on traffic manoeuvring become serious. - It is inferior in the aspect of traffic management at the terminus of North-South Axis in Kota, even if direct connection with North-South Axis is provided.
	Environement	- Present inhabitants along the route will be affected rather lower level because of the smallest land acquisition area. Accordingly, resettlement problems are in lesser degree especially for Kota area - Living environmental changes such as air pollution, noise, water quality and vibration will be brought a little but it seems negligible level, considering potential impact on the present situation. - No remarkably historical and monumental site is directly affected by the route but it exist nearby. Some adverse impacts will remain. - Public facilities such as hospital, school, and mosque/church exist a few but	- Present inhabitants along the route will be affected rather high level because of relatively big land acquisition area. - Living environmental changes such as air pollution, noise, water quality and vibration will be brought a little but it seems negligible level, considering potential impact on the present situation. - No remarkably historical and monumental site is directly affected by the route - Public facilities such as hospital, school, and mosque/church exist a few but	- Present inhabitants along the route will be affected rather high level because of relatively big land acquisition area. - Living environmental changes such as air pollution, noise, water quality and vibration will be brought a little but it seems negligible level, considering potential impact on the present situation. - No remarkably historical and monumental site is directly affected by the route. - Public facilities such as hospital, school, mosque/church and fire brigade

Salient Features	Land Acquisition Area Cost Index	110.95 ha 1.31	1.00	0.98
	Physical Constraints	- Future Taman Permata Buana housing complex will have ROW for the city planning road (Route K) in the north of existing Taman Permata Buana housing complex. - As future ROW of Route K is supposed to be of 26 m wide, widening of future ROW to incorporate the scheme of East-West Axis is deemed necessary. - Although Route K comes to an end at Jl. Kedoya Raya, the East-West Axis should find its own route to avert number of established housing complex in Kec. Kebon Jeruk. - Thr city planning road along Tangerang Line is to necessitate considerable land acquisition and resettlement of inhabitants and it is unlikely practical to apply conventional acquisition method to create necessary space. - Jl. Pangeran Tubagus Angke and the Kali Angke has 70 m wide ROW in Kec. Grogol Petamburan but only 20 m wide in Kec. Tambora. - Jl. Perniagaan and its eastern extension are to pass the most crowded Glodok area where historical and monumental old buildings are reserved around Kota railway station. - The elevated Central line railway overpasses Jl. Pangeran Jayakarta - A flyover is under construction at the intersection between Jl. Gunung Sahari and Jl. Industri. - Ex-Kemayoran Airport has very high development potential with enough wide arterial roads and its east-westward arterial road is to consist of a part of the East-West Axis - Jl. Taman Sunter Indah and Jl. Danau Indah Raya have 36 m wide ROW, which have been partially completed and the remaining section is in densely populated area. - At the intersecting point between Jl. Yos Sudarso and Raya Barat Boulevard, elevated North-South Link and its On/Off ramps exist and the Kali Sunter flows beside Jl. Yos Sudarso. - Raya Barat/Timur Boulevard in Kelapa Gading housing complex have enough wide ROW and commercial buildings along the road have been set back. - The route is to run parallel to the Cakung river in the east and to pass built-up industrial estate. - Route E-E is planned on existing Jl. Swadaya where industrial landuse is predominant along the road. - Route A-A consisting of two city planning roads have 20 m wide ROW each and are located 40 m apart each other because east-westward high voltage transmission lines exist in the center. - New bus terminal that is planned nearby the interchange with JORR shall be incorporated in the design of interchange.	- Future Taman Permata Buana housing complex will have RoW for the city planning road (Route K) in the north of existing Taman permata Buana housing complex. - As future ROW of Route K is supposed to be of 26 m wide, widening of future ROW to incorporate the scheme of East-West Axis is deemed necessary - Although Route K comes to an end at Jl. Kedoya Raya, the East-West Axis should find its own route to avert number of establsihed housing complex in Kec. Kebon Jeruk. - The city planning road along Tangerang Line is to necessitate considerable land acquisition and resettlement of inhabitants and it is unlikely practical to apply conventional acquisition method to create necessary space. - There are many severe physical constraints in Kec. Gogol Petamburan and Kec. Tambora, in which only Mangga Besar Extension as well as city planning road in Jelmbar are found practical - Ex-Kemayoran Airport has very high development potential with enough wide arterial roads and its east-westward arterial road is to consist of a part of the East-West Axis - Jl. Taman Sunter Indah and Jl. Danau Indah Raya have 36 m wide ROW, which have been partially completed and the remaining section is in densely populated area - At the intersecting point between Jl. Yos Sudarso and Raya Barat Boulevard, elevated North-South Link and its On/Off ramps exist and the Kali Sunter flows beside Jl. Yos Sudarso. - Raya Barat/Timur Boulevard in Kelapa Gading housing complex have enough wide ROW and commercial buildings along the road have been set back. - High voltage transmission line and its pylons are located along Jl. Pegangsaan Dua where the plan of new freight railway line presented in RBWK of Kec. Cakung has been set aside. - Route A-A consisting of two city planning roads have 20 m wide ROW each and are located 40 m apart each other because east-westward high voltage transmission lines exist in the center - New bus terminal that is planned nearby the interchange with JORR shall be incorporated in the design of interchange.	- Future Taman Permata Buana housing complex will have ROW for the city planning road (Route K) in the north of existing Taman Permata Buana housing complex. - As future ROW of Route K is supposed to be of 26 m wide, widening of future ROW to incorporate the scheme of East-West Axis is deemed necessary. - Although Route K comes to an end at Jl. Kedoya Raya, the East-West Axis should find its own route to avert number of establsihed housing complex in Kec. Kebon Jeruk. - The city planning road along Tangerang Line is to necessitate considerable land acquisition and resettlement of inhabitants and it is unlikely practical to apply conventional acquisition method to create necessary space. - Uncertain LRT development makes the scope of E-W Axis such as traffic demand at station plaza and construction economy ambiguous. - Ex-Kemayoran Airport has very high development potential with enough wide arterial roads and its east-westward arterial road is to consist of a part of the East-West Axis. - Jl. Taman Sunter Indah and Jl. Danau Indah Raya have 36 m wide ROW, which have been partially completed and the remaining section is in densely populated area. - At the intersecting point. between Jl. Yos Sudarso and Raya Barat Boulevard, elevated North-South Link and its On/Off ramps exist and the Kali Sunter flows beside Jl. Yos Sudarso. - Raya Barat/Timur Boulevard in Kela Gading housing complex have enough wide ROW and commercial buildings along the road have been set back. - High voltage transmission line and its pylons are located along Jl. Pegangsaan Dua. - Jl. Pulogadung has 40 m wide ROW and is designated as a trunk road in built-up industrial estate - Route A-A consisting of two city planning roads have 20 m wide ROW each and are located 40 m apart each other because of east-westward high voltage transmission lines in the center. - New bus terminal that is planned nearby the interchange with JORR shall be incorporated in the design of interchange.
Comparison	Technical Feasibility	- 70 m wide ROW should be subdivided in future Taman Permata Buana housing complex in the nick of time when they will submit their development plan for approval. - Future ROW along Tangerang line seems to be available, provided that no implementation conflict between LRT and road is issued - The space above the Kali Angke seems to be available, provided that the consent is obtained from the agencies concerned. - It is too serious to construct 1.3 km new link in Glodok, it is likely possible that Pasar Pagi flyover and Jl. Mangga Dua will be able to substitute the linkage. - It is rather difficult to provide interchanges at designated access points in Kota area. - It is still possible to construct 100 m long span overpass at Sunter IC by contilever erection but costly. - New link in Kel. Rawa Terat and the northern extension of Route E-E will require coordination with on-going Jl. Buaran Indah Raya extension because of different ROW width. - It seems excessive that the E-W Axis shall keep 20 m apart from pylon i because of 3.5 m high headroom limit in spite of 6.18 m high in Japan.	- 70 m wide ROW should be subdivided in future Taman Permata Buana housing complex in the nich of time when they will submit their development plan for approval - Future ROW along Tangerang line seems to be available, provided that no implementation conflict between LRT and read is issued. - Distrct plans claim public space and facilities so much in Kec. Grogol Petamburan and Kec. Tambora that is is very necessary to create such land area not by conventional acquisition method but by certain land readjustment techniques to mitigate technical and environmental issues. - It is still possible to construct 100 m long span overpass at Sunter IC by contilever erection but costly - It seems practical that the route follows city planning road since a new freight line presented in the District plan in Kec. Cakung has been set aside. - It seems excessive that the E-W Axis shall keep 20 m apart from phylon because of 3.5 m high headroom limit in spite of 6.18 m high in Japan.	- 70 m wide ROW should be subdivided in future Taman Permata Buana housing complex in the nich of time when they will submit their development plan for approval. - Future ROW along Tangerang line seems to be available but necessary area is considerable. It will cause serious social problem if conventional alnd acquisition method is applied. - There exist many public facilities and office buildings along the route such as Jiwa Grogol hospital and Fire brigade which will be affected by necessary widening. Conventional land acquisition will make additional social issues to uncertain LRT development. - It is still possible to construct 100 m long span overpass at Sunter IC by contilever erection but costly. - It seems practical to follow Jl. Pulogadung even though present landuse is of established industrial estate. - It seems excessive that the E-W Axis shall keep 20 m apart from pylon because of 3.5 m high headroom limit in spite of 6.18 m high in Japan. -
	Traffic	- It is so close to Jakarta Harbour Road which has the similar function that it shall impair the viability of toll road. - One of the designated roles and functions, to support through traffic in CBD, is achieved in lesser degree because it runs on existing roads. - It is rather inferior in the aspect of road network to bring about serious adverse affect to traffic management at the terminus of North-South Axis, since no direct connection with North-South Axis is provided.	- It is significantly effective to divert traffic from Jakarta Merak Toll Road which is almost full capacity and resulting chronic traffic congestion take place at the terminus Tomang. - One of the designated roles and functions, to support through traffic in CBD, is significantly achieved because it connects Jl. Mangga Besar with Jl. Daan Mogot. - It is surely superior in the aspect of road network, since direct connection with North-South Axis is provided. - It will be able to offer comprehensive measures to traffic management at the terminus of North-South Axis	- It is significantly effective to divert traffic from Jakarta Merak Toll Road which is almost full capacity and resulting chronic traffic congestion take place at the terminus Tomang. - Planned interchange with Jl. Latumeten is too close to the existing Grogol intersection where chronic traffic congestion take place and adverse impacts on traffic manoeuvring become serious. - It is inferior in the aspect of traffic management at the terminus of North-South Axis in Kota, even if direct connection with North-South Axis is provided.
	Environement	- Present inhabitants along the route will be affected rather lower level because of the smallest land acquisition area. Accordingly, resettlement problems are in lesser degree especially for Kota area - Living environmental changes such as air pollution, noise, water quality and vibration will be brought a little but it seems negligible level, considering potential impact on the present situation. - No remarkably historical and monumental site is directly affected by the route but it exist nearby. Some adverse impacts will remain. - Public facilities such as hospital, school, and mosque/church exist a few but negative impacts are estimated scarcely, provided that suitable countermeasures are taken. - Storm water run-off remains unchanged due to passing on existing road with almost the same run-off coefficient but significant loss of discharge area in the Angke river is inevitable. - No positive impact on urban betterment is expected.	- Present inhabitants along the route will be affected rather high level because of relatively big land acquisition area. - Living environmental changes such as air pollution, noise, water quality and vibration will be brought a little but it seems negligible level, considering potential impact on the present situation. - No remarkably historical and monumental site is directly affected by the route. - Public facilities such as hospital, school, and mosque/church exist a few but negative impacts are estimated scarcely, provided that suitable countermeasures are taken - Storm water run-off remains unchanged due to passing on existing road with almost the same run-off coefficient. - Some positive impact on urban betterment is expected.	- Present inhabitants along the route will be affected rather high level because of relatively big land acquisition area. - Living environmental changes such as air pollution, noise, water quality and vibration will be brought a little but it seems negligible level, considering potential impact on the present situation. - No remarkably historical and monumental site is directly affected by the route. - Public facilities such as hospital, school, mosque/church and fire brigade exist not a few and negative impacts are estimated sufficiently, even if suitable countermeasures are taken. - Storm water run-off remains unchanged due to passing on existing road with almost the same run-off coefficient.
	Evaluation	Step-1 : Though AL-I has the smallest land acquisition area, almost of all affected area along existing roads are of built-up landuse. Therefore it is hard to find out superiority in this aspect. Step-2 : AL-II and AL-III have similar level of land availability in Kec. Grogol Petamburan and kec. Tambora but AL-III surely has inferior in the traffic aspect at interchanges with Jl. Latumeten and Jl. Gajah Mada/ Hayam Wuruk. Step-2 : AL-II and AL-III have the same level of achieving designated roles and functions of East-West Axis. However, it is superior to AL-II from the reason why buses as public transport will be able to be operated in AL-II efficiently because the route is located apart from that of LRT. Step-3 : Though it is practical to follow Jl. Pulogadung in Pulogadung Industrial Estate, it is more preferable that AL-II is designated as major arterial road as an east-westward thoroughfare and Jl. Pulogadung is maintained as a trunk road in the industrial estate as it works. Step-4 : It is recommended that AL-II is selected as optimum route for the East-West Axis.		

9.2.5 Proposed Route and Interchanges

1) North-South Axis

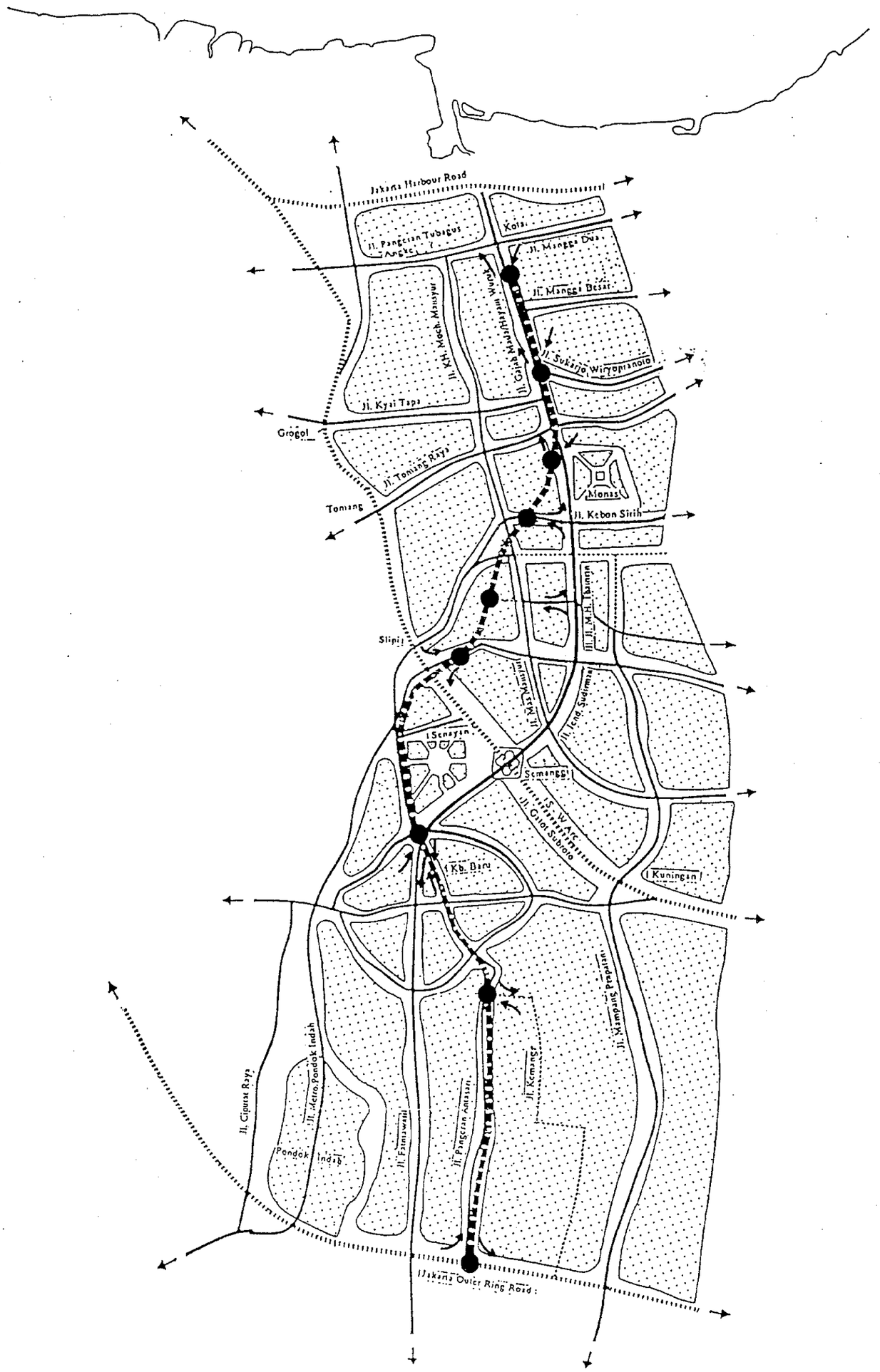
The proposed route for the North-South Axis is presented in Fig. 9.2.10. This route still has uncertain Jl. Gelora underpass. If ROW of Jl. Gelora is not available for the North-South Axis, the North-South Axis will run parallel to the Serpong railway line upto Putri Hijau Flyover and will pass on a new link to connect Jl. Pejompongan-Pondok Pinang with Jl. Sudirman by an elevated road on viaduct.

Finally, the route of the North-South Axis is as follows :

Jl. Gajah Mada/Hayam Wuruk -
Jl. Abdul Muis -
Jl. Jati Baru -
Jl. Pejompongan - Pondok Pinang (Simpruk Bypass) -
Jl. Gelora -
Jl. Asia Afrika -
Jl. Pattimura -
Jl. Sultan Iskandarsyah -
Jl. Prapanca -
Jl. Pangeran Antasari

The location of junctions and interchanges as shown in Fig. 9.2.12 are selected as follows :

1) The northern terminus on Jl. Gajah Mada/Hayam Wuruk in the north of Jl. Mangga Besar
2) On/Off ramp on Jl. Mangga Besar and Mangga Besar Extension
3) On/Off ramp on Jl. Gajah Mada/Hayam Wuruk in the south of Jl. Sukarjo Wiryopranoto
4) On/Off ramp on Jl. Abdul Muis
5) On/Off semi-directional ramp on Jl. Kebon Sirih
6) On/Off semi-directional ramp on Jl. Kebon Kacang
7) On/Off ramp on Jl. Pejompongan
8) On/Off semi-directional ramp on Jl. Singamangaraja
9) On/Off ramp on Jl. Pattimura (note : 8) and 9) are combined)
10) On/Off ramp on Jl. Prapanca in the north of Jl. Kemang
11) On/Off ramp on Jl. Pangeran Antasari in the north of Jakarta Outer Ring Road
12) Y-type junction with Jakarta Outer Ring Road



FEASIBILITY STUDY ON URBAN ARTERIAL ROAD SYSTEM DEVELOPMENT PROJECT IN JAKARTA METROPOLITAN AREA	Fig. 9.2.10 Proposed Route and Interchanges on North - South Axis

2) East-West Axis

The proposed route for the East-West Axis is presented Fig. 9.2.11

The development concept of the East-West Axis is to introduce a east-westward thoroughfare to stimulate the relocation of urban function from Jakarta toward the eastern and western urban fringes and concurrently raise their own development potential. In the light of its role and function, the Axis is to develop a high standard arterial road with high traffic capacity like existing Jl. Thamrin/Sudirman in the north-south direction to support through traffic in the central urban area and to enhance the road capacity in the new development area, including planned east and west primary centers.

The route location is to be selected among city planning roads in the selected corridor. However, future ROW will be proposed not based on DKI's ROW but based on the study. The proposed ROWs are of 70 m wide in desirable condition and of minimum 40 m wide in the condition of severe physical constraints respectively.

The East-West Axis shall have through traveled lanes for fast-moving vehicles and separated lanes for slow-moving vehicles as designated requirement of secondary arterial road.

70 m wide ROW will have a typical cross section of level or elevated highway on embankment with frontage roads in both sides as shown in Fig. 9.1.7. On the other hand, 40 m wide ROW will have an elevated highway on viaduct with at-grade frontage road as shown in Fig. 9.1.9.
Consequently, minimum ten (10) lanes two ways will be kept in the whole stretch.

Taking present land use and physical constraints into consideration, 40 m wide ROWs are proposed in between Raya Barat/Timur Boulevard in Kelapa Gading Housing Complex and Jl. Mangga Besar.

Since established housing complex and office and commercial buildings exist in these sections, additional land acquisition will bring about serious social issues to cause various objections to the development of the Axis.

On the contrary, though the Axis is planned to pass densely populated areas in Kec. Tambora on Mangga Besar Extension and Kec. Grogol Petamburan on city planning road where it is designated as urban betterment with the first priority in Jakarta 2005, it is recommended that 70 m wide ROW is kept to induce its redevelopment as well.

70 m scheme can provide access to crossing roads through frontage road anywhere. On the other hand, 40 m scheme necessitates rampways before and after intended access points.

Among many crossing roads, type of interchange will be examined at the following location of major interchanges as shown in Fig. 9.2.12 due to its functional classification of road and traffic volume.

1) IC with frontage roads of JORR Eastern Section, including U-turn flyovers
2) IC with the northern extension of Jl. Buaran Indah Raya (Route E-E)
3) IC with Jl. Bekasi Raya
4) IC with Jl. Pegangsaan Dua
5) IC with Jl. Yos Sudarso
6) IC with Jl. Sunter Raya
7) No additional ICs in Ex-Kemayoran Airport
8) IC with Jl. Gunung Sahari
9) IC with the North-South Axis
10) IC with Jl. Gajah Mada/Hayam Wuruk
11) IC with Jl. Latumeten
12) IC with Jl. Daan Mogot
13) IC with Jl. Perjuangan (Panjang)
14) IC with Jl. Kembangan Utama (Route F)
15) IC with frontage roads of JORR Western Section, including U-turn flyovers.

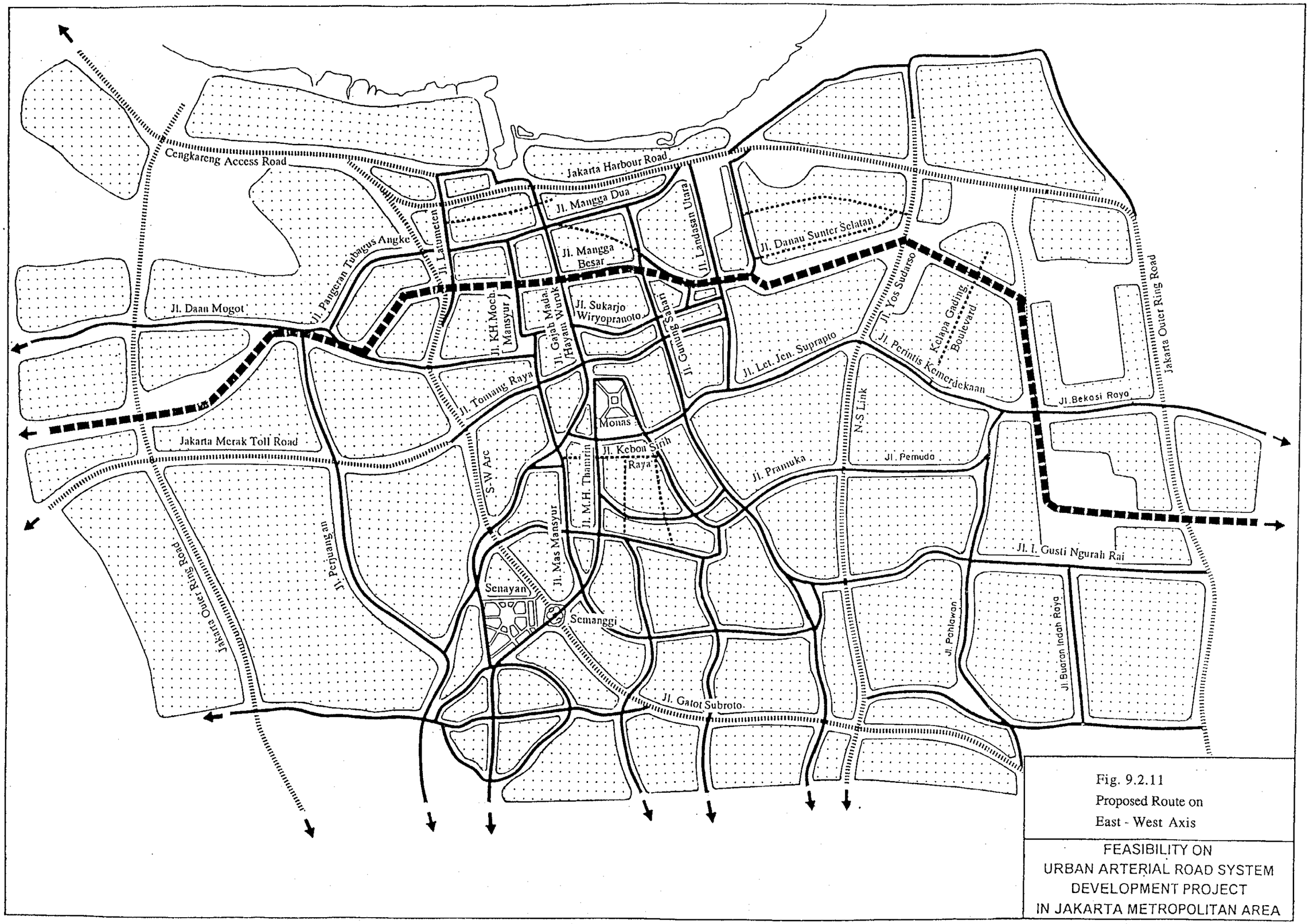


Fig. 9.2.11
Proposed Route on
East - West Axis

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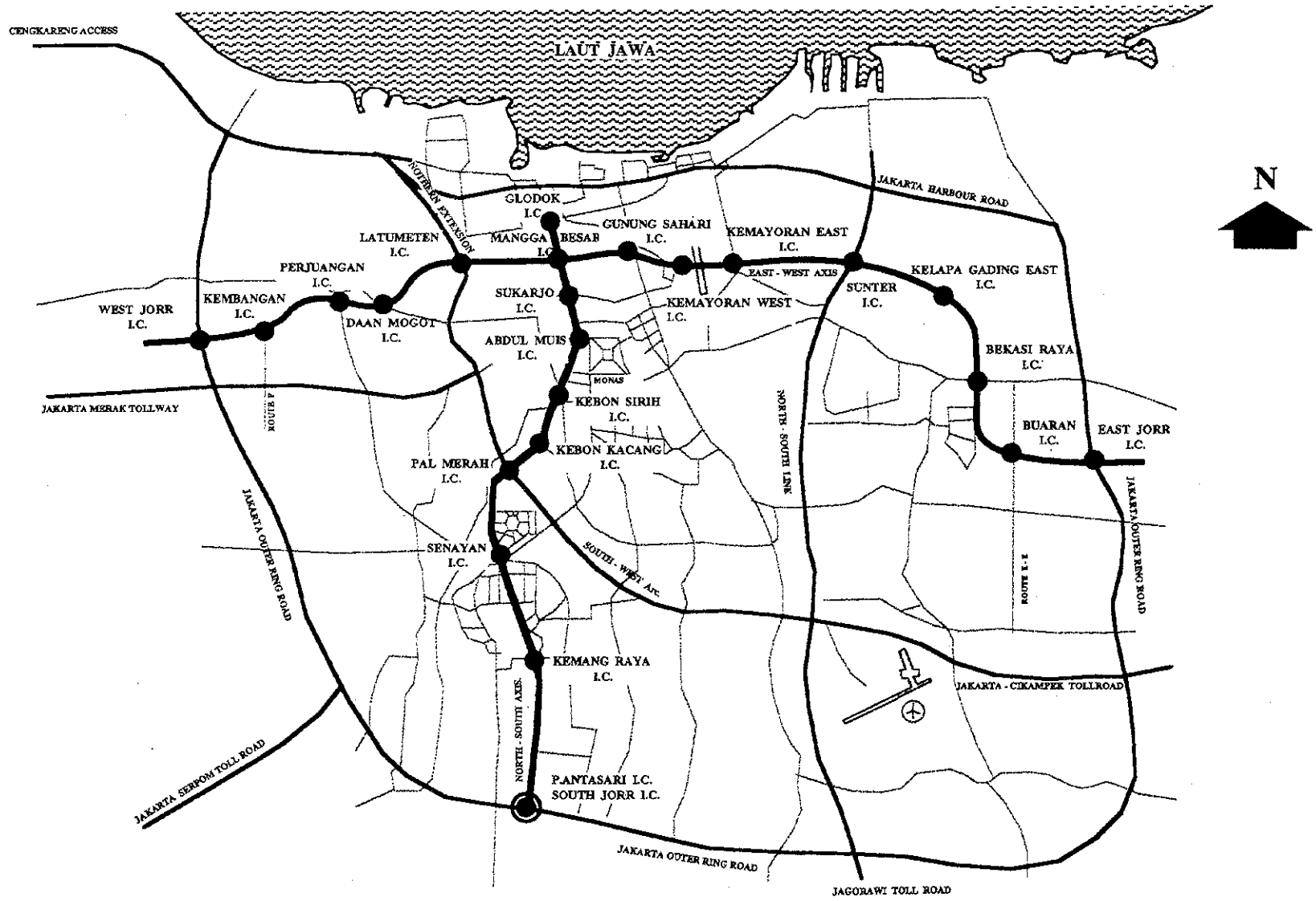

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Fig. 9.2.12 Proposed Location of Interchange

CHAPTER 10 PRELIMINARY ENGINEERING DESIGN

CHAPTER 10 PRELIMINARY ENGINEERING DESIGN

10.1 Basic Data

10.1.1 Aerial Photographs and Photo Mosaics

1) Introduction

The purpose of taking aerial photographs is to conduct a topographic survey by means of photogrammetry works regarding the study. The works consist of the following items;

(1) Aerial photography for 1/5,000 scale uncontrolled Photo Mosaic covering the proposed North-South Road Axis and East-West Road Axis in DKI Jakarta with a total flight length of 100 km in a scale of 1:20,000.

(2) Uncontrolled Photo Mosaic for along the selected North-South Road Axis and East-West Road Axis with an approximate coverage of 100 km^2 in scale of 1:5,000.

2) Collection of Available Photographic Maps and Data

Prior to the commencement of the actual photogrammetry works existing maps, survey data and information were collected from DKI and BAKOSURTANAL. The following aerial photos, maps and other information have been used for the photogrammetry works, engineering studies, and so forth;

(1) Existing Aerial Photographs

(a) Aerial photos at a scale of 1:15,000 in 1990 covering DKI Jakarta 282 contact prints in total.

(2) Existing Topographic Maps

(a) Graphic paper copy of topographic maps at a scale of 1:5,000 with contour intervals of 1 m prepared in 1985 covering DKI Jakarta, 146 sheets in total.

(b) Dyeline paper copy of topographic maps at a scale of 1:10,000 with contour intervals of 2 m prepared in 1982 covering DKI Jakarta, 40 sheets in total.

(c) Topographic maps at a scale of 1:25,000 with contour intervals of 12.5 m published by BAKOSURTANAL in 1990 covering the whole project area, 6 sheets in total.

(3) Others

(a) Peta Wilayah Kota at a scale of 1:20,000 covering the whole project area, 10 sheets in total.

(b) Peta Kecámatan at scales of 1:5,000 and 1:10,000 covering the whole project area.

(c) Peta digital DKI Jakarta at a scale of 1:20,000 covering the whole project area.

(d) Peta Batas Adm. DKI Jakarta in 1980, 1985 and 1990 covering the whole project area, 3 sheets in total.

(e) 9 th Edition of Jakarta Sheet Atlas & Names Index published by PT. DJAMBATAN in 1992 covering the central area of Jakarta city.

3) Photogrammetry Works

(1) General

Photogrammetry works aim at preparing 1:5,000 scale uncontrolled photo mosaic to be used for the engineering study. The works consist of the aerial photography and aerial photo mosaicking. The Final products of the works are as listed in Table 10.1.1.

(2) Aerial Photography

The field work of aerial photography for 1:20,000 scale vertical photos is in progress. The area of aerial photography is as shown in Fig. 10.1.1.

(3) Aerial Photo Mosaicking

Aerial photo mosaicking was made immediately after taking aerial photographs.

Areas of aerial photo mosaicking was determined during Phase I study.

4) Sketch Survey and Correction of Existing Maps

(1) Sketch Survey

Sketch survey for 19 road cross sections were carried out for the purpose of preliminary engineering study.

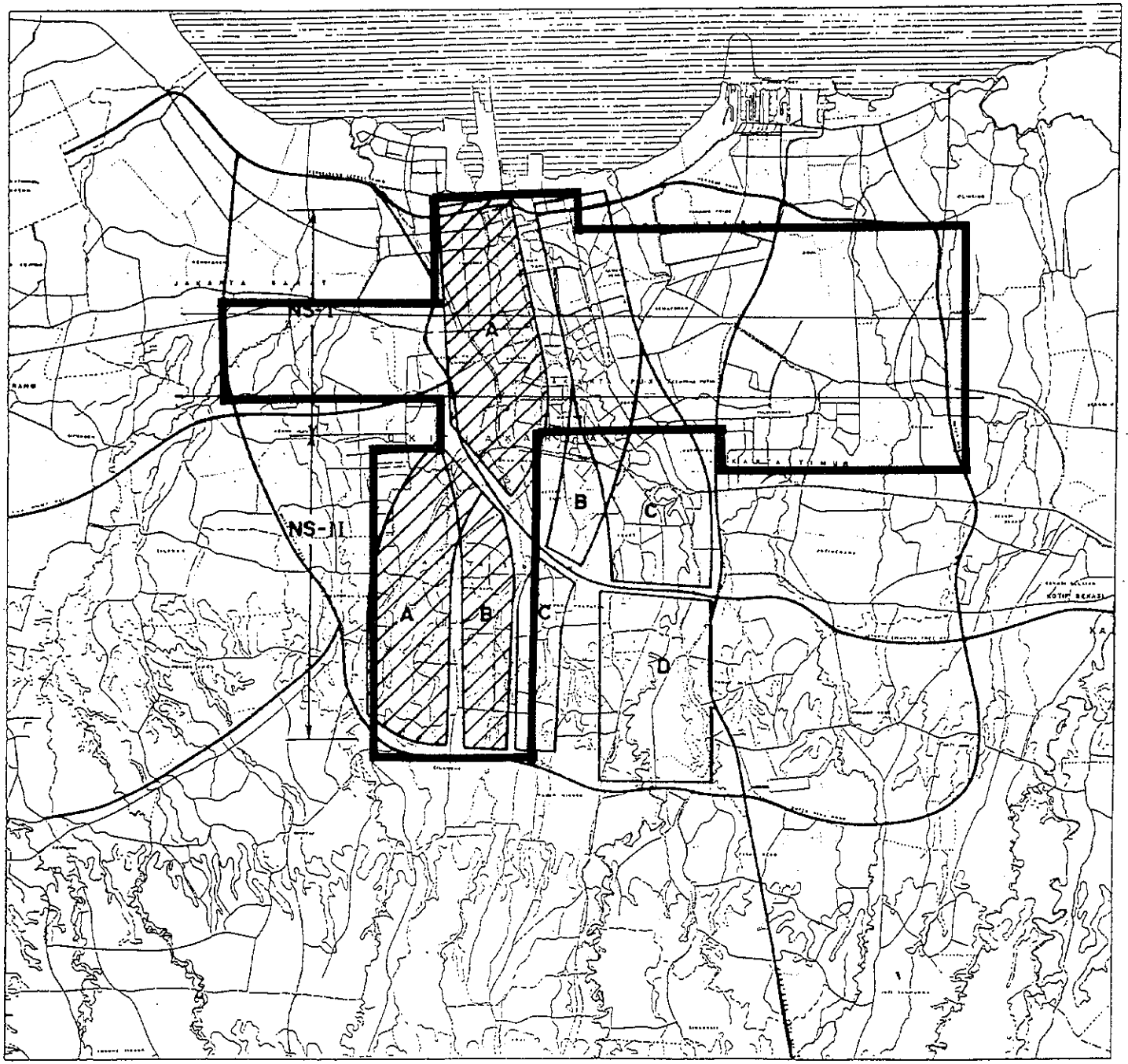

Fig. 10.1.1

Plan of Aerial Photography
(Scale : 1 : 20,000)

Area for Aerial Photography

Draft Plan of Flight/Run

N

0 1 2 3 4 5 Km

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(2) Correction of 1/5,000 Scale Maps

Correction of existing 1:5,000 scale maps prepared in 1985 was made locally by Aerial Photo Interpretation (API) using 1:15,000 scale aerial photos.

Table 10.1.1 List of Final Products

No.	Description	Quantity
1.	Aerial photography	
	(a) Contact prints (S=1:20,000)	Two sets
	(b) Diagram of aerial photos (S=1:40,000)	One set
2.	Aerial photo mosaic production	
	(a) Uncontrolled photo mosaic sheets (S=1:5,000)	Two sets
	(b) Uncontrolled photo mosaic on polygraphy	Three sets
	(c) Four (4) times enlargement photo positives (S=1:5,000)	Two sets

10.1.2 Soil Investigation

1) Introduction

The purpose of the Soil Investigation is to sound the soil condition along the planned urban arterial road axis for the preliminary designing.

The Soil Investigation comprised the following items :

1) Field Boring Work
2) Laboratory Soil Test
3) Reporting

PT. WIRA NUSANTARABUMI was selected as the sub contractor for the execution of the works through the evaluation of both technical and price about their proposals offered from several potential contractors. The contract agreement between JICA Study Team and PT. WIRA NUSANTARABUMI was made on January 4th, 1994 after the consumption of due procedure.

All the works have been completed on schedule.

2) Investigation Items and Quantities

The items of soil investigation and work quantities of each item are shown below:

Table 10.1.2 The Items of Soil Investigation and Work Quantities

Investigation Items	Schedule Quantities	Actual * Quantities
I. Field Investigation		
- Machine boring	25 holes, 675.00 m	25 holes, 675.41 m
- Standard Penetration Test (SPT)	640 each	639 each
- Thin-Walled tube sampling	35 each	37 each
II. Laboratory Test		
- Specific gravity test	70 tests	70 tests
- Natural water content test	70 tests	70 tests
- Particle size gradation test	70 tests	70 tests
- Liquid limit test	70 tests	70 tests
- Plastic limit & index test	70 tests	70 tests
- Unconfined compression test	35 tests	35 tests
- Consolidation test	35 tests	35 tests
- Triaxial compression test (UU)	35 tests	35 tests

* Laboratory tests in progress at the time of March 26th, 1994

3) Location of Soil Investigation

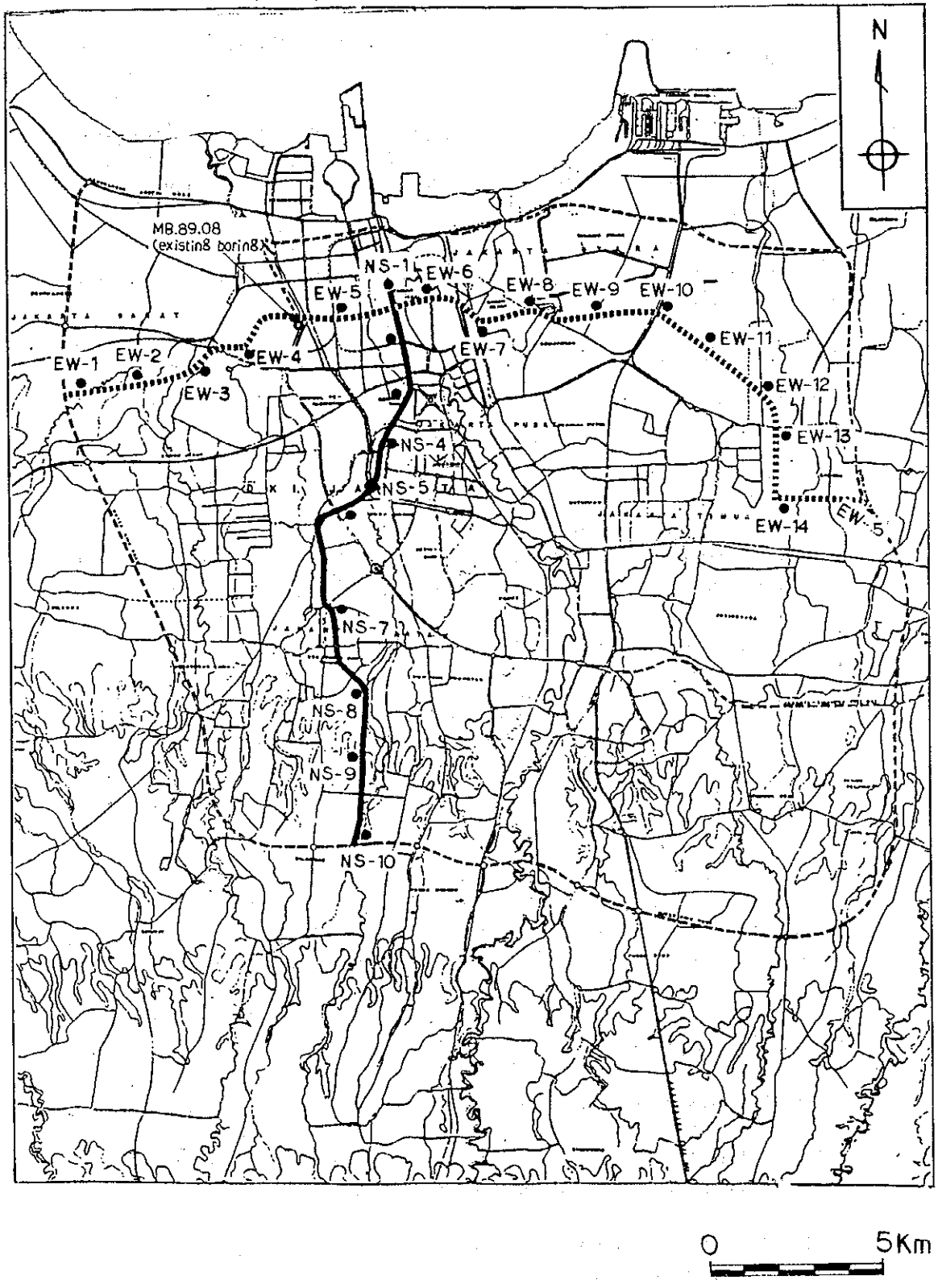
The locations of borings were selected prior to the commencement of the soil investigation taking consideration of the planned arterial road axis, the planned layout of facilities, the accessibility to the boring sites, the working space availability, the existing underground facilities and etc.
The locations of borings are shown in Fig. 10.1.2.

4) Initial Findings

Findings based on the results of the field boring works are as follows:

a. The rigid bearing strata (sandstone layer, N-Value more than 50) is encountered at the depth of 5 m in general.

b. Along the E-W Axis, the depth to the rigid bearing strata generally gets deeper toward west.



FEASIBILITY STUDY ON URBAN ARTERIAL ROAD SYSTEM DEVELOPMENT PROJECT IN JAKARTA METROPOLITAN AREA	**Fig. 10.1.2 Boring Location Map**

c. Along the N-S Axis, the depth to the rigid bearing strata generally gets deeper toward North.

d. The surface alluvial soft clay layer abruptly gets thick (around 25 m) and the sandstone layer as a rigid bearing strata is lacked in the boring EW-3 located in the western part of the E-W Axis.
It is considered that there might be buried ancient river course or creek around the boring point of EW-3.

10.1.3 Topographic Survey

1) General

The purpose of topographic survey is to obtain topographic data and information concerning the project such as terrain, elevation, road, river, railway and other urban facilities for the preliminary engineering in Phase III study.

The topographic survey comprised the following works:

- Installation of six (6) bench marks in two project roads
- Spot height survey, 50 km in length
- Cross section survey and auxiliary profile survey, totaling sixty eight (68) locations
- Editing profile along two project roads

PT. INDEC was selected as the subcontractor for the execution of the works through the evaluation of both technical and price about their proposals offered from several potential contractors. The contract agreement between JICA Study Team and PT. INDEC was made on January 13, 1994 after the consummation of due procedure.

All the works have been completed on schedule.

2) Installation of Bench Marks (BMs)

Prior to topographic survey, six (6) BMs were established in the project site. The location of BMs is shown in the aerial photo mosaics. The height of BMs is tabulated in Table 10.1.3.

3) Spot Height Survey

Spot height survey (Leveling) was carried out to determine elevation of BMs and spot heights along project roads. Total distance of leveling was 50 km long. The leveling was carried out as follows:

(1) Datum Check Survey

TTG BMs established by BAKOSURTANAL in 1992 were employed. The result of survey are tabulated in Table 10.1.4.
It is concluded that these BMs are enough reliable because the closure error is within the allowable values.

(2) Equipment

Wild NA2 automatic level was used for leveling.

(3) Spot Height Survey

Spot heights along two project roads were surveyed at 100 m interval and every major slope changing point as well. Public facilities such as crossing roads, transmission lines, railway crossings and rivers are also measured. Total points of spot heights are of 500.

(4) Method and Accuracy

Closure adjustment method was employed for the examination of accuracy. Allowable closure error is calculated by ± 20 mm$\sqrt{\text{km}}$ for BMs, ± 20 cm for ground survey and ± 5 cm for wet ground surface.

(5) Plotting and Drawing

Planimetric position of TBM, BM and spot height were plotted on aerial photo mosaics. All spot heights were also plotted on dyeline paper copy of topographic map at a scale of 1 to 5,000.

4) Cross Section and Auxiliary Profile Survey

Cross section and auxiliary profile survey were conducted at sixty eight (68) locations as designated by the study team. The survey was carried out as follows :

(1) Cross Section Survey

Ground heights along cross section line were surveyed by direct or indirect leveling at 10 m interval and major slope changing points as well. Distance between two points were measured by EDM or tape.

(2) Auxiliary Profile Survey

Auxiliary profile survey was conducted to obtain detailed data and information for a preliminary engineering design at major intersecting points such as cross roads, railways, rivers and transmission lines. The survey was carried out the same manner as that of cross section survey.

(3) Plotting and Drawing

The survey results were plotted on drawings at a scale of 1 to 200 vertically and 1 to 400 or 1,000 horizontally.

5) Profile Section Editing

The results of leveling were plotted on drawings at a scale of 1 to 200 vertically and 1 to 5,000 horizontally. The survey results of cross section and auxiliary profile survey were incorporated in the drawings.

6) Fair Drawing

After compiling, plotting and editing the survey results on drawings, the fair drawings were prepared by inking. The fair drawings were produced by transparent polyester film basis, with the size of 60 cm x 80 cm.

Table 10.1.3 The Results of Survey for Six (6) BMs

TBM No.	Elevation (m)	Difference in Height		Difference (Mis-closure) (mm)	Distance (km)	Allowable Closure Error (mm)
		by the Contractor (m)	by JICA Export (m)			
TBM1	2.380					
		9.032	9.036	+4	9.2	±60
TTG 262A	11.412					
		1.427	1.422	-5	0.5	±14
TBM 3	12.839					
		0.646	0.645	+1	1.0	±20
TBM 4	12.193					
		2.472	2.465	-7	2.0	±28
TBM 5	14.665					
		18.274	18.267	-7	7.1	±53
TBM 8	32.939					

Note : Allowable closure error is computed based on ±20 mm$\sqrt{}$km.

Table 10.1.4 The Results of Survey for TTG BMs

TTG BM No.	Elevation (m)	Difference in Height		Difference (Mis-closure) (mm)	Distance (km)	Allowable Closure Error (mm)
		by the BAKOSURTANAL (m)	by the Contractor (m)			
TTG 257	1.836					
		+9.576	+9.597	+21	14	±74
TTG 262A	11.412					
		-8.304	-8.294	+10	32	±56
TTG 242	3.108					

Note : Allowable closure error is calculated based on ±20 mm$\sqrt{}$km.

10.2 Highway Capacity and Number of Lanes

10.2.1 Highway Capacity

To determine the required number of traffic lanes, the capacity of each project road is analyzed based on future traffic characteristic factors. The concept and methodology used for the analysis are based on the "Indonesian Highway Capacity Manual" issued by Bina Marga in 1993.

Some adjustments are made to reflect local conditions based on the results of studies accomplished by "Road Design Standard" of Japan, and "Highway Capacity Manual" of the Highway Research Board, USA. The design capacity of each project road is presented in Table 10.2.1.

Table 10.2.1 Design Capacity of Each Road Section

Items	North-South Axis	East-West Axis		
		Throughway	Frontage Road	Frontage Road
Design Speed (km/h)	80	60	40	40
Terrain	Flat	Flat	Flat	Flat
Number of Lane	6	6	6	4
Road Type	Motorway	One-way Road	One-way Road	One-way Road
Design Capacity (PCU/day)	100,500	82,500	63,500	47,500

10.2.2 Design Sections

1) North-South Axis

The North-South Axis will be divided into the following two design sections;

(a) The Northern terminus of Glodok IC to Kebon Sirih IC
(b) Kebon Sirih IC to Pangeran Antasari IC

The design capacity of 6-lane motorway is calculated to be 100,500 PCU/day, and that of 4-lane is assumed 80,000 PCU/day. Fig. 10.2.1 shows traffic demand in 2010 and the capacity of proposed cross sections in each design section.
Traffic demand at the section of Kebon Kacang IC to Kemang Raya IC is higher than the design capacity of 6-lane motorway, while that at the section of Kemang Raya IC to Pangeran Antasari IC is slightly higher than the capacity of 6-lane. The proposed 6-lane toll road at the section between Kebon Kacang IC and Pangeran Antasari IC is warranted by the road configuration and the viewpoint of tollway network. It is noted that it is very difficult to widen tollway on viaduct after opening and the demand forecast concerning traffic diversion is apt to become modest, not to mention quoting the case of Jakarta Intra Urban Tollway.

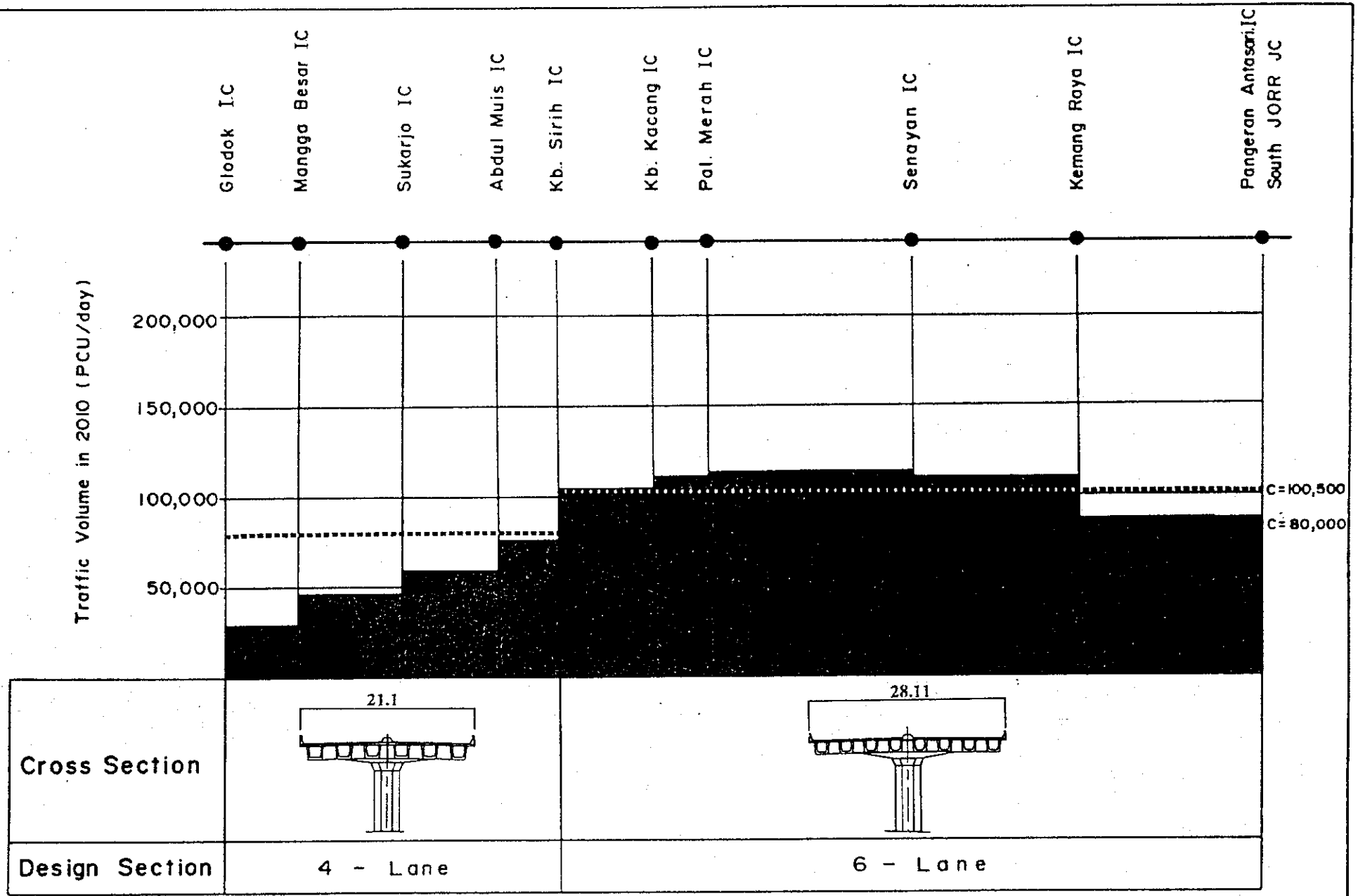


Fig. 10.2.1 Design Section on North-South Axis

2) East-West Axis

The East-West Axis will be divided into two design sections;

(a) West JORR IC to Mangga Besar IC and Kelapa Gading East IC to East JORR IC
(b) Mangga Besar IC to Kelapa Gading East IC

The capacity of each design section is determined to be combined motorway with frontage roads. 4-lane viaduct is assumed to be a motorway because of full access controlled road. Accordingly, the design capacity of each section is obtained as follows :

i) 10-lane At-grade : 130,000 PCU/day
ii) 6-lane At-grade, 4-lane Viaduct : 143,500 PCU/day

Fig. 10.2.2 shows traffic demand in 2010 and the capacity of proposed cross sections in each design section.
As for the East-West Axis, design section is to be divided not only by traffic demand but also by physical constraints and the targeted roles and functions. It is noted that it is possible to secure traffic function even though the capacity is saturated since the East-West Axis consists of throughway with high mobility and at-grade frontage roads with good accessibility.

10.2.3 Number of Lanes for Interchange Ramps and Toll Plaza on the North-South Axis

Table 10.2.2 presents the number of lanes for interchange ramps. To decide the number of lanes for toll plaza, the following equation for queue is used:

$$\text{Average waiting time } W = \frac{P^S}{S.S!} \times \frac{b}{(1-U)^2} \times K$$

$$\text{Average number of waiting cars } q = \frac{1}{(1-U)^2} \times \frac{Ps}{S!} \times K = \frac{w}{b} . S$$

$$\text{where } K = \frac{1}{1 + P + \frac{P^2}{2!} + \ldots + \frac{P^{S-1}}{(S-1)!} + \frac{P^S}{S!} \times \frac{1}{1 - \frac{P}{S}}}$$

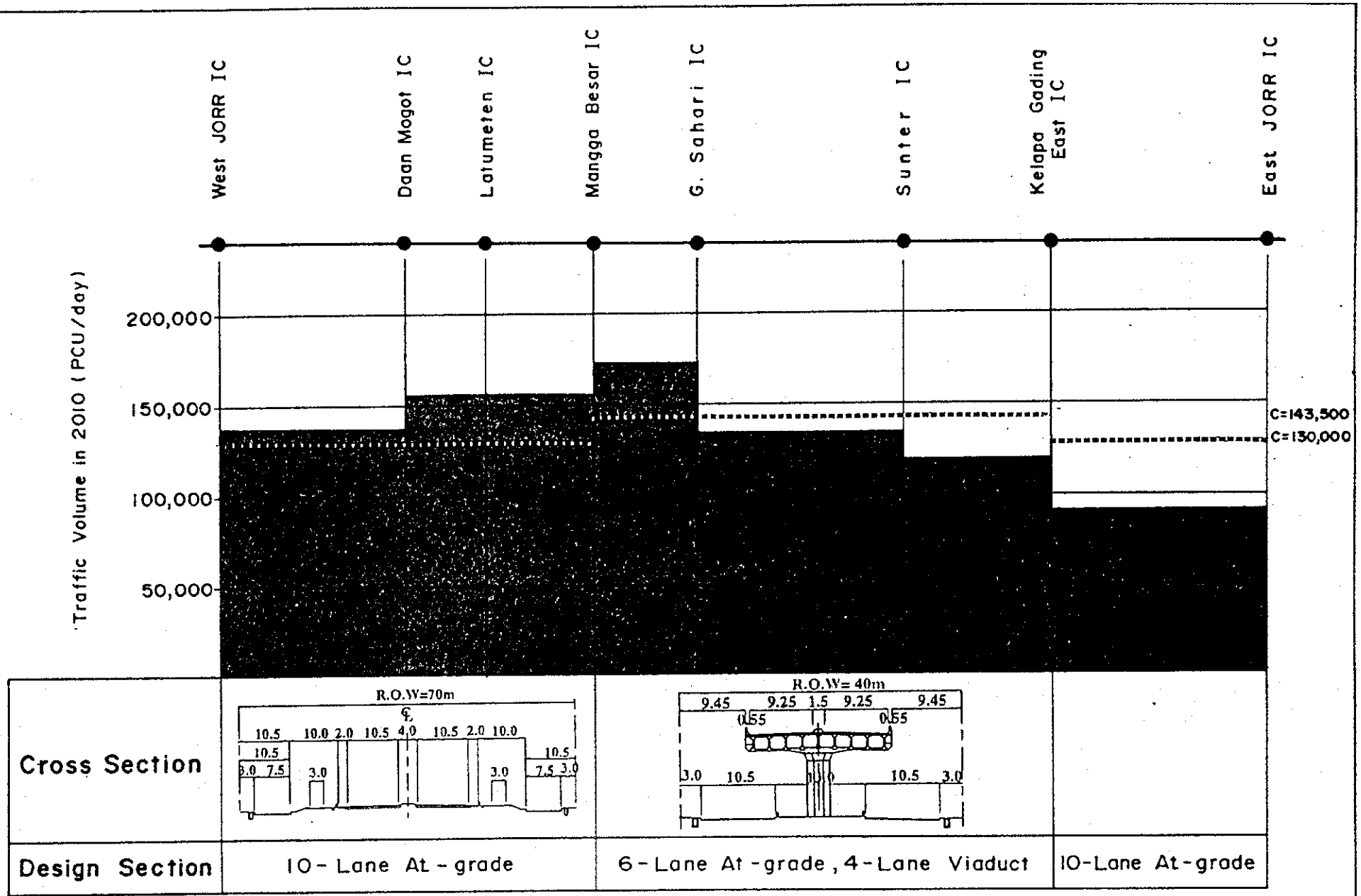


Fig. 10.2.2 Design Section on East-West Axis

P : traffic intensity = b/a
U : traffic intensity per lane = b/s.a
a : average interval of car arrival (sec)
b : average service time (sec)
S : number of lanes

The average number of waiting cars and service time are key factors to determine the number of lanes, namely the number of booths.

On ramp toll levy system which is adopted on the North-South Axis warrant the service time of 8 seconds.

An average of one (1) cars are assumed to wait at a toll booth during a peak hour since the area of the toll plaza is wide enough for this. Table 10.2.2 presents the required number of lanes at On ramp toll plaza and barrier type toll gate between the North-South and Jakarta Outer Ring Road.

Table 10.2.2 Number of Lane at Interchanges

Name of IC	Traffic Demand in 2010			Traffic Demand at Peak Hour (PCU/h)	Design Daily Capacity on Ramp (PCU/day)	No. Of Lane on Ramp	No. Of Lane on Toll Plaza
	ON	OFF	Total				
South JORR East Bound	23,253	22,018	45,271	2,173	16,000	2	12
West Bound	8,491	7,096	15,587	748	16,000	1	
Pangeran Antasari	17,266	9,826	27,091	1,300	16,000	2	4
Kemang Raya	8,530	14,307	22,837	1,096	16,000	1	3
Senayan I (Pattimura)	1,607	1,324	2,931	141	16,000	1	2
II (Asia Afrika)	1,637	1,735	3,372	162	16,000	1	2
Pal Merah	900	1,100	2,000	96	16,000	1	2
Kebon Kacang	3,823	3,897	7,720	371	16,000	1	2
Kebon Sirih	12,768	14,533	27,301	1,310	16,000	1	4
Abdul Muis	8,087	9,308	17,395	835	16,000	1	3
Sukarjo IC	5,666	6,479	12,145	583	16,000	1	2
Mangga Besar	9,358	9,552	18,910	908	16,000	1	3
Glodok	13,487	13,759	27,246	1,308	16,000	1	4

10.3 Preliminary Geometric Design

10.3.1 Geometric Design Policies

1) General

The design policies applied to the study are established after careful study of the surrounding conditions and experience on geometric design obtained through the previous designs of Jakarta Intra Urban Tollway, Jakarta Harbour Road, Jakarta Outer Ring Road and Northern Extension of South-West Arc, concerning not only with tollway but also with arterial street.

The policies are described as follows;

(1) The targeted roles and functions of project roads should be realized through a tailor-made design to make full use of the state-of-the-art engineering technique;

(2) Careless use of the maximum or minimum values from the design criteria should be avoided because these figures are considered as limits rather than desirable figures;

(3) Since sudden change in geometric design criteria would result in impairing traffic safety, consistent design criteria should be kept as far as land availability is confirmed;

(4) Special attention should be made to designing a fluent alignment by providing good coordination of vertical and horizontal curves;

(5) The alignment should be designed to make structural designs simple yet practical, considering pier location and construction method; and

(6) The required ROWs based on the geometric designs are deemed necessary because the ROW enables to realize project roads in conjunction with the minimum requirements stemmed from engineering studies.

2) Special Considerations for North-South Axis

The following important points are revealed through the geometric design;

(1) Further Considerations about Tollway Network

It is necessary to examine whole system of combined tollway network and arterial road network from technical and functional viewpoints. It is also considered imperative to examine whether or not any other options in future or extension of route are possible.

The following facts are found through the alternative route study;

a) The existing 3 km long arterial road ex-Kemayoran Airport has both interchanges of tollway and arterial road in the north end and it also has 50 m wide road use area and 100 m wide road proprietary area. Therefore, it is very sure that this 3 km long arterial road be a part of combined network of E-W Axis and N-S Axis. Furthermore, it will enable to complement the proposed N-S Axis in Kota area which has no direct access to Jakarta Harbour Road to connect with Jakarta Harbour Road by additional minimal cost.

b) A certain potential traffic will divert from Jl. Gunung Sahari - Jl. Otista corridor to N-S Axis if the arterial road at ex-Kemayoran Airport becomes a part of N-S Axis.

c) The proposed branch route up to Jl. Marga Guna will facilitate to efficiently divert considerable traffic from Jl. Ciputat Raya and Jl. Fatmawati and then it will contribute to make N-S Axis more viable in any case.

d) The proposed elevated road on viaduct of E-W Axis between Kota and ex-Kemayoran Airport will be justified not by physical constraint but from tollway network viewpoint.

Considering all the possibilities of road development in Jabotabek, particularly in Jakarta, the proposed network of E-W Axis and N-S Axis as shown in Fig. 10.3.1 are formulated alternatively in the future.

(2) Modification of Design on Jakarta Outer Ring Road

The North-South Axis terminates at Cilandak on Jakarta Outer Ring Road (JORR) where a tollway to tollway interchange (junction) and toll barrier are formed. The toll road portion of this section is scheduled to be constructed by 1996 under the BOT scheme. The name of investor is PT. Marga Nurindo Bhakti and they possess the concession of development and operation for South Section (S) and East-1 Section (E-1), totaling 28.1 km in length. There will be two interchanges on Jakarta Outer Ring Road in the vicinity of the terminus, namely Fatmawati East IC and Ampera West IC. Both ICs are planned to be Half Diamond type interchange. In between these ICs, the Y-type junction is formed to overpass toll road and frontage road. Therefore, it is necessary to modify the JORR, which is mostly in the embankment section, to incorporate the scheme of North-South Axis.

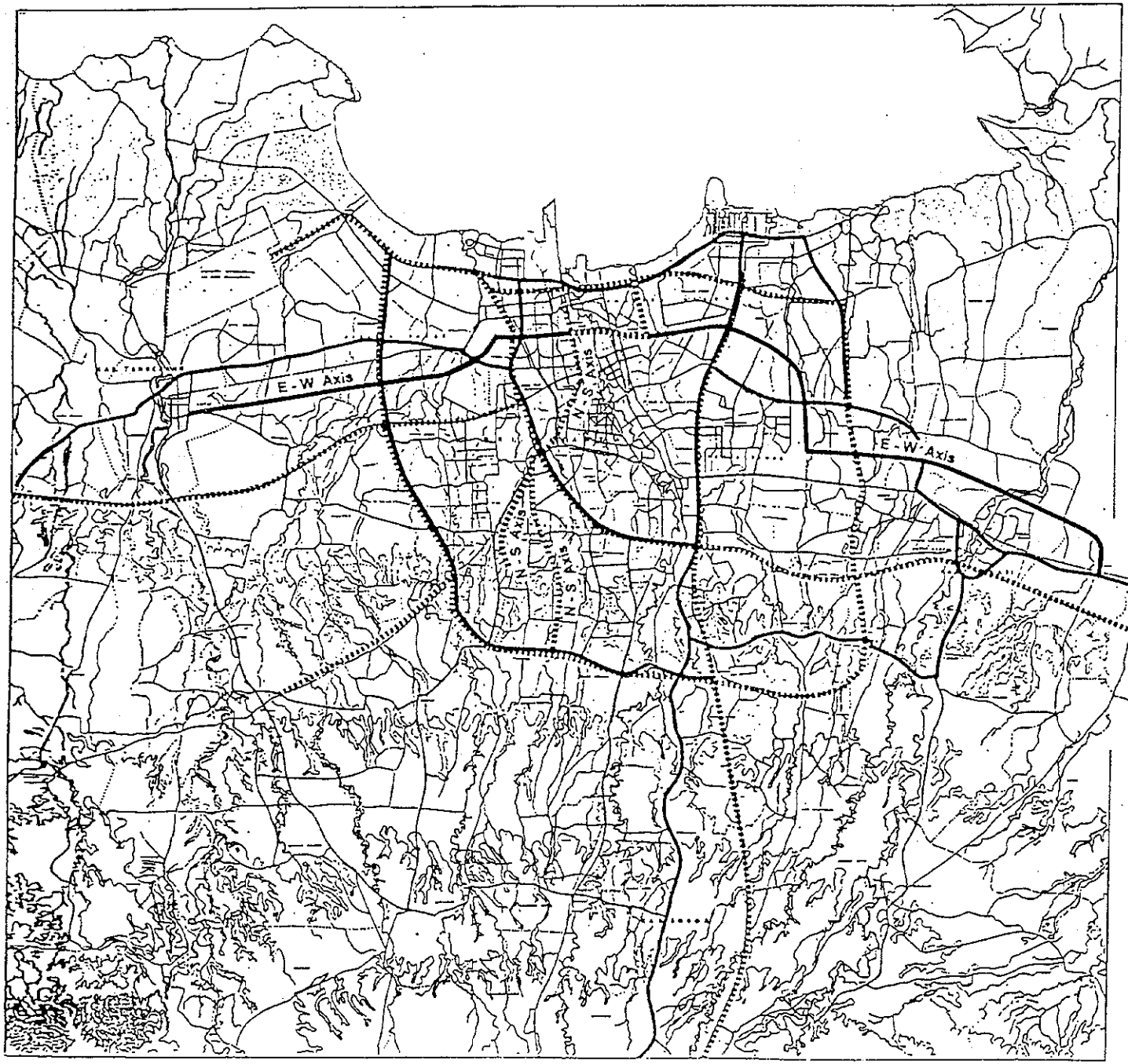


Fig. 10.3.1
Optional E-W Axis and N-S Axis Route Location

LEGEND :

TOLL ROAD

ARTERIAL ROAD

N

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(3) Land Acquisition at Brawijaya

Jl. Prapanca has sharp turn (R=100 m) at Brawijaya. The area where it is encompassed by Jl. Prapanca was originally residential but high-rise apartment buildings with department store are under construction. To secure geometric design standard, the North-South Axis cannot follow the existing road alignment and will have to pass beside the buildings in the west. Thirty (30) residences and one school will be affected by new toll road and they are to be relocated.

(4) Jl. Gelora Underpass

There exist senior high school, firing range and other institutional facilities along Jl. Gelora. The firing range has a plan to expand their field toward Graha Pemuda and it will make Jl. Gelora underpass. The toll road will also pass there by either underpass or overpass. It is generally accepted that an underpass structure requires lighting, mechanical drain by power pump and ventilation against exhaust gas. On the other hand an elevated road on viaduct will be free from these costly equipment. Therefore, the elevated tollway on viaduct is recommended in this section. Just in case that an elevated toll road is not allowed, it would be one of practical alternatives that the North-South Axis will go together with Jl. Gelora and underpass the extended firing range and successive at-grade intersection between Jl. Gelora and Jl. Gerbang Pemuda, provided that construction works are done together in the nick of time.

(5) On/Off Ramps at Pejompongan

Under JUDP-1, arterial road between Jl. Matraman and Jl. Pejompongan is being improved. The existing Pejompongan IC has presently at-grade railway crossing and a railway flyover will be provided by DKI's improvement plan. This flyover will create open space adjoining railway and make it available for On and Off ramps in the east of Jl. Gatot Subroto. As minimizing modification of flyover structure, at-grade On ramp will run parallel to railway to underpass the flyover and Off ramp will also run parallel to railway to underpass the flyover, while the throughway of toll road will overpass the flyover.

(6) Viaduct on Jl. Jati Baru

In the vicinity of intersection between Jl. Fakhrudin and Jl. Jati Baru, there are several plans of grade separation structure, such as Tanah Abang flyover, Jl. Fakhrudin underpass and Jl. Jati Baru flyover. The eastern part of Jl. Jati Baru has been widened while the western is widening and Tanah Abang flyover which is overpassing Western Railway Line is under construction. Though any detailed information on these projects are not made available, the North-South Axis should

manage to pass this complicated area by a viaduct because of severe physical constraints in its surrounding.

(7) On/Off Ramps on Jl. Kebon Sirih

Jl. Kebon Sirih is 4-lane undivided road and has the 10 m wide Kali Cideng. This road will become a main access to and egress from Jl. M.H. Thamrin. A reconstruction of Jl. Kebon Sirih will be able to provide additional space for On and Off ramps, provided that the consent to utilize space above the Kali Cideng is obtained from the agencies concerned.

(8) On/Off Ramps on Jl. Abdul Muis

Jl. Abdul Muis is 4-lane undivided road and has the 10 m wide Kali Krukut and 20 m frontage road in the east. The land use along Jl. Abdul Muis is of governmental and institutional offices. A reconstruction of Jl. Abdul Muis will be able to create the space for elevated toll road and at-grade arterial road with On and Off ramps within the existing ROW.

(9) Utilization of Space above the Kali Ciliwung

Jl. Gajah Mada/Hayam Wuruk is located in the CBD with 60 m ROW and has the 15 m wide Kali Ciliwung in the center which is divided the arterial road, namely the north bound is Jl. Gajah Mada and the south bound is Jl. Hayam Wuruk. Since there exist densely developed commercial area along the road and the widening was taken place in a few decades ago, it is rather difficult to acquire additional land for the Project in the whole stretch. However, the space above the Kali Ciliwung seems available provided that the consent is obtained from the agencies concerned. It seems to be possible to acquire a localized area where a toll gate is deemed necessary. Nevertheless, an elevated toll gate would be constructed on viaduct.

3) Special Considerations for East-West Axis

Important points for technical considerations are as follows;

(1) Modification of Design on W1 Section of JORR

The western section (W1) of Jakarta Outer Ring Road (JORR), of which the frontage roads have been completed and are open to the public but the toll road is not constructed yet, is scheduled to be constructed by 1996 under the BOT scheme. The land acquisition has already been completed. The name of investor is PT. Jaya and PT. Mandara Permai and they possess the concession of development and operation for West-Section-1 (W1) 8 km in length. According to the designated role and function of the East-West Axis, a flyover and

diamond type interchange with frontage roads of JORR are planned and no directional connections with toll road of JORR is provided. Accordingly, all access traffic to the toll road are to pass through frontage roads. This system will be simple yet economical but U-turn facilities are indispensable for right turning traffic from E-W Axis as well as road users on frontage roads. Therefore, it is necessary for Bina Marga to notify the investor to make their design to accommodate U-turn facilities with sufficient traffic capacity. Practical design concepts of such U-turn facilities are given in Fig. 10.3.2.

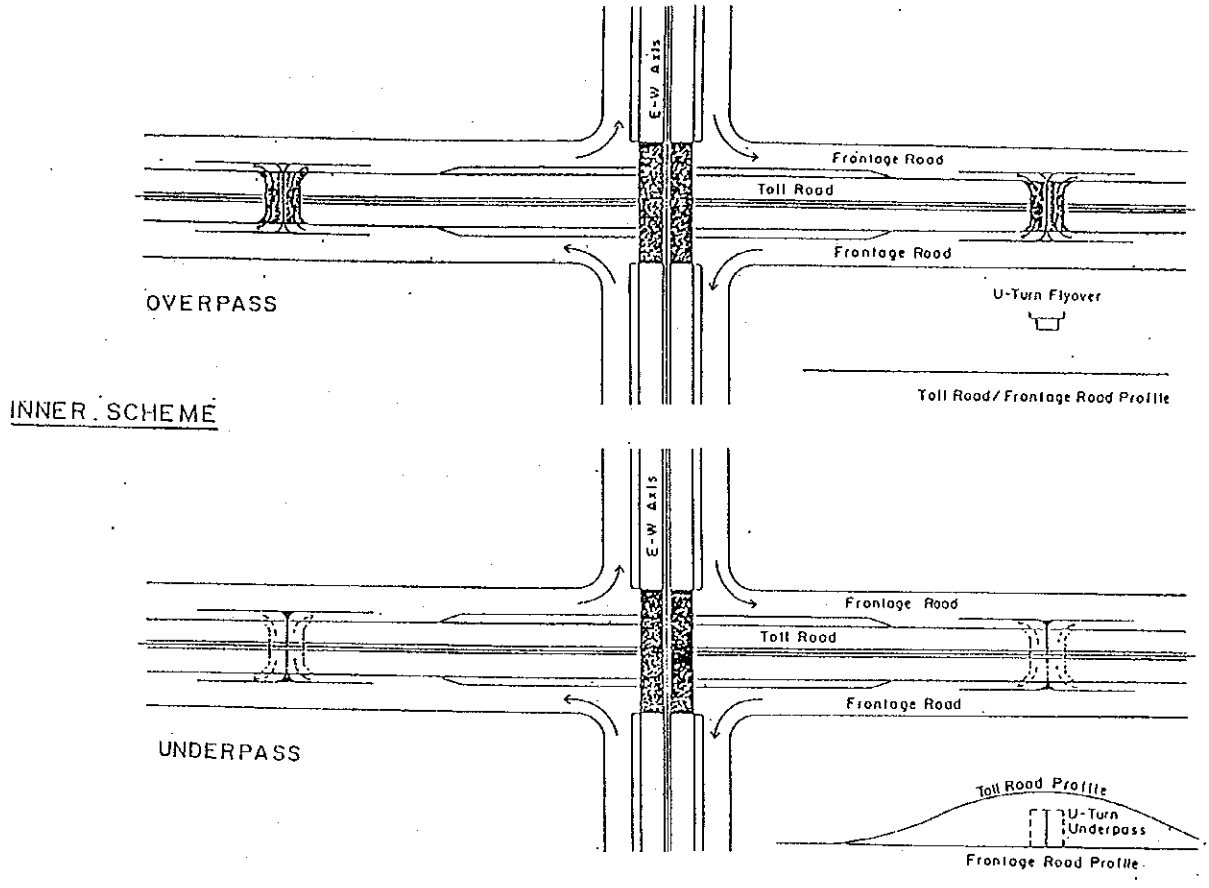
The inner scheme has advantage in the aspect of construction economy but it has disadvantage in the traffic safety, namely diverging from fast-moving lane and merging to fast-moving lane. It is necessary, therefore, to provide sufficient length of auxiliary lanes in both diverging and merging lanes. On the contrary, the outer scheme has advantage of traffic safety but rather expensive structure. Both overpassing and underpassing scheme are practical. Generally, central toll road is elevated on embankment for frontage road to underpass in the inner underpassing scheme, while a depressed rampway is adopted in the outer underpassing scheme.
Either scheme is to be selected depending upon structure of toll road, grade difference between toll road and frontage road, terrain and traffic demand.

(2) Alternatives along the Tangerang Railway Line

There are three schemes in the stretch to run parallel to railway :

a) One side scheme
The E-W Axis is located in one side of railway. Adjacent to the Axis, those who are there can enjoy benefits from road and still they can utilize railway services across road. However, people in another side cannot enjoy benefits from road due to community disruption caused by railway. Station plaza is to face one way traffic controlled road and it makes railway users inconvenient.
The function of road is the highest but it can serve only half of potential coverage area.

b) Both sides scheme
Fast-moving lanes and frontage road of one direction are located in both sides of railway. It will simulate appropriate level of public transportation. However, road is divided by railway and it makes it hard to connect each other, unless otherwise depressed or elevated railway is constructed. This scheme has advantage to serve whole potential coverage area and it will bring development impact to both sides of railway to result in making railway management viable, provided that road-base transports represented by buses collaborate to establish well-organized public transportation system. If it is



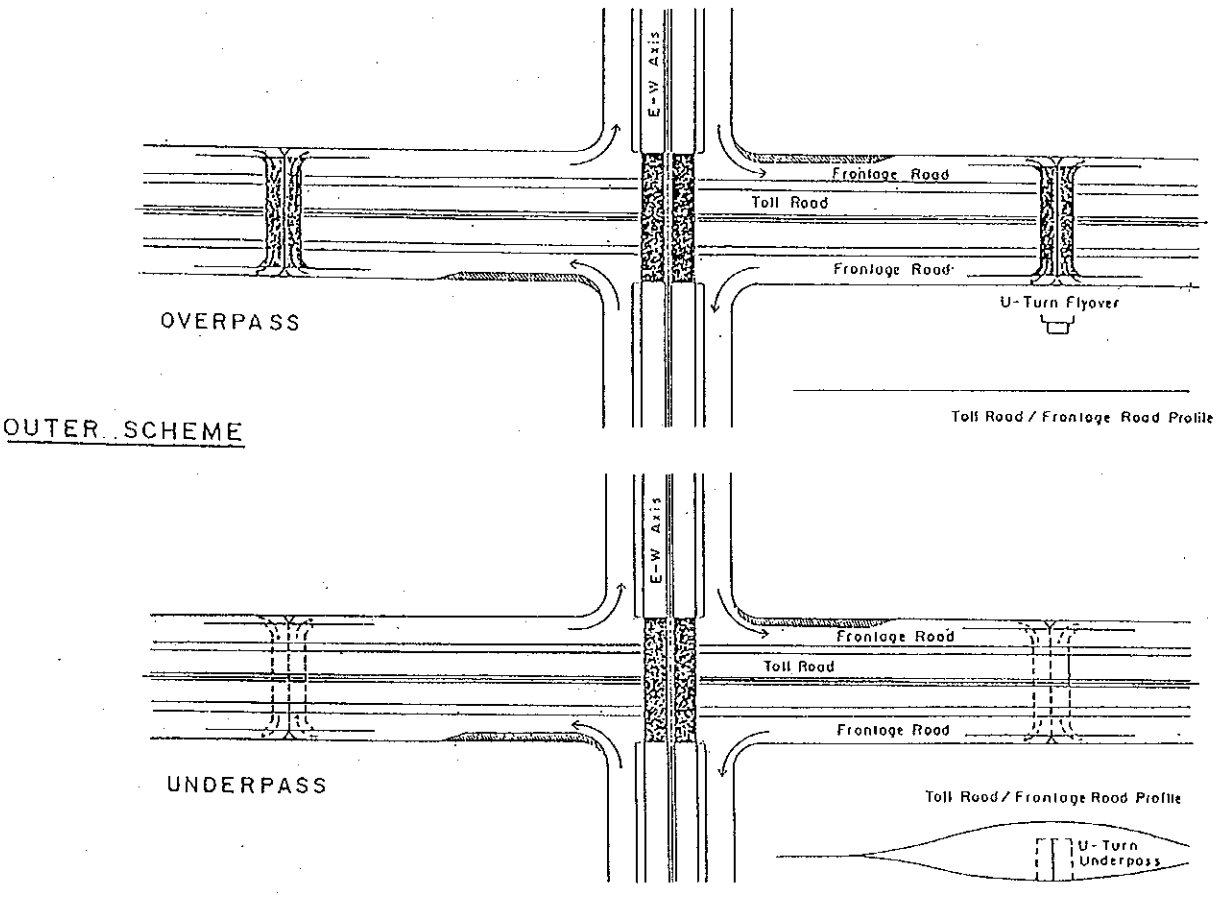


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Fig. 10.3.2 Alternative U-Turn Facilities

possible to provide enough space of parking lots around station, the scheme of park-and-ride is applicable.

c) Separated frontage road scheme
Two ways fast-moving lanes and frontage road of one direction are located in one side and another one way frontage road is located in the other side of railway. The aim of this scheme is to keep accessibility to adjacent area and to confine disruptive railway and fast-moving lanes in the center of the corridor. This scheme has disadvantage to provide poor access to frontage road from fast-moving lanes.
A variation of this scheme is to operate two ways operation of both frontage roads, in which poor accessibility from fast-moving lanes still remains unresolved.

Taking above-mentioned features of each scheme into consideration, the E-W Axis in the western section is planned in both sides of railway.

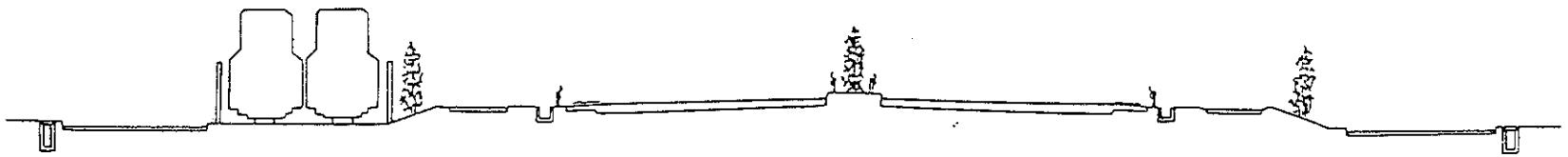
(5) U-turn Facilities at Sunter IC

At the intersecting point between E-W Axis and Jl. Yos Sudarso, elevated N-S Link and its On/Off ramps are located. 20 m wide Kali Sunter flows in the east of Jl. Yos Sudarso and industry and commerce is predominant landuse along the road. Existing at-grade intersection between Jl. Yos Sudarso and Raya Barat Boulevard has no traffic signal and presently has U-turn facilities beneath the viaduct on Jl. Yos Sudarso but its capacity is so insufficient as to cause traffic congestion. In case that the E-W Axis forms a diamond type interchange with Jl. Yos Sudarso, U-turn facilities for right turning traffic will be constructed not on Jl. Yos Sudarso but on the E-W Axis because of severe physical constraints and traffic situation on Jl. Yos Sudarso.

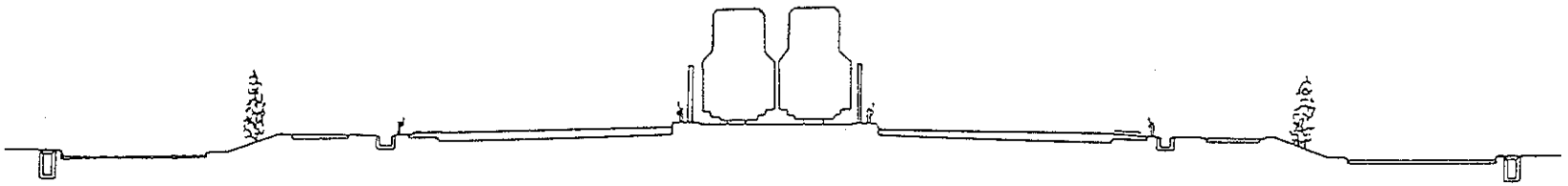
(4) Required Distance from High Voltage Transmission Pylon

The E-W Axis is planned to run parallel to high voltage transmission line along Jl. Pegangsaan Dua and further east section. PLN has general specifications for power installation (PUIL 1987) and instructs to keep certain distance to 3.5 m or higher for 70 KV and 3.0 m or higher for 150 KV adjacent structures as shown in Fig. 10.3.4.

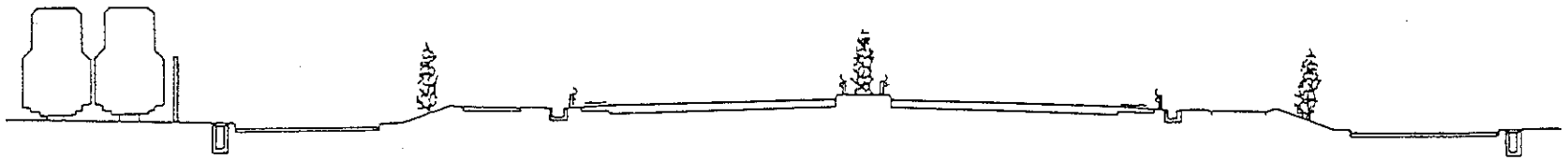
Since the elevated road on viaduct surely is higher than 3.5 m, the E-W Axis should be located approximately 20 m far from pylon. Even though the E-W Axis has at-grade scheme, road structure will have tall lighting poles, grade separation structure and so forth. It will cause to keep the E-W Axis away from pylon. Accordingly, the proposed typical cross section in this stretch is delineated as shown in Fig. 10.3.5.



AL-III: SEPARATED FRONTAGE ROAD SCHEME



AL-II : BOTH SIDES SCHEME



AL-I: ONE SIDE SCHEME

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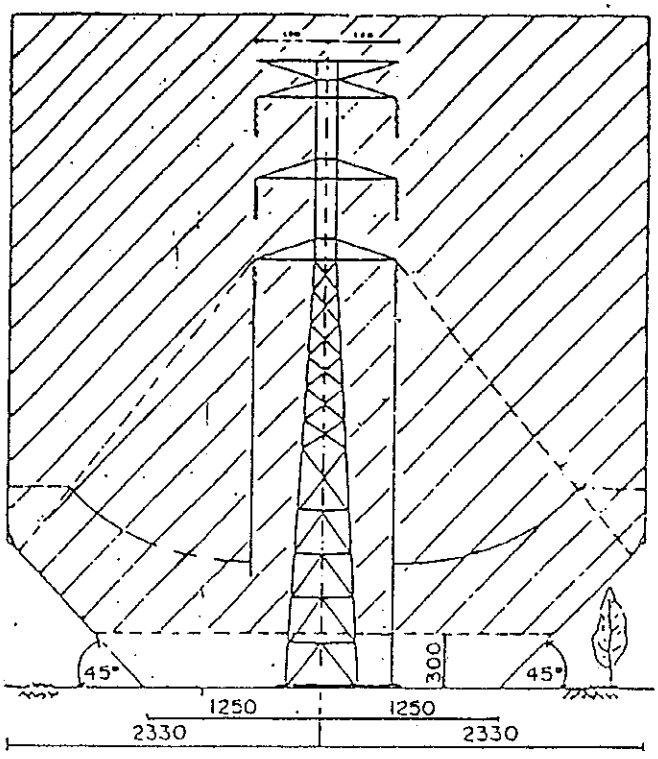
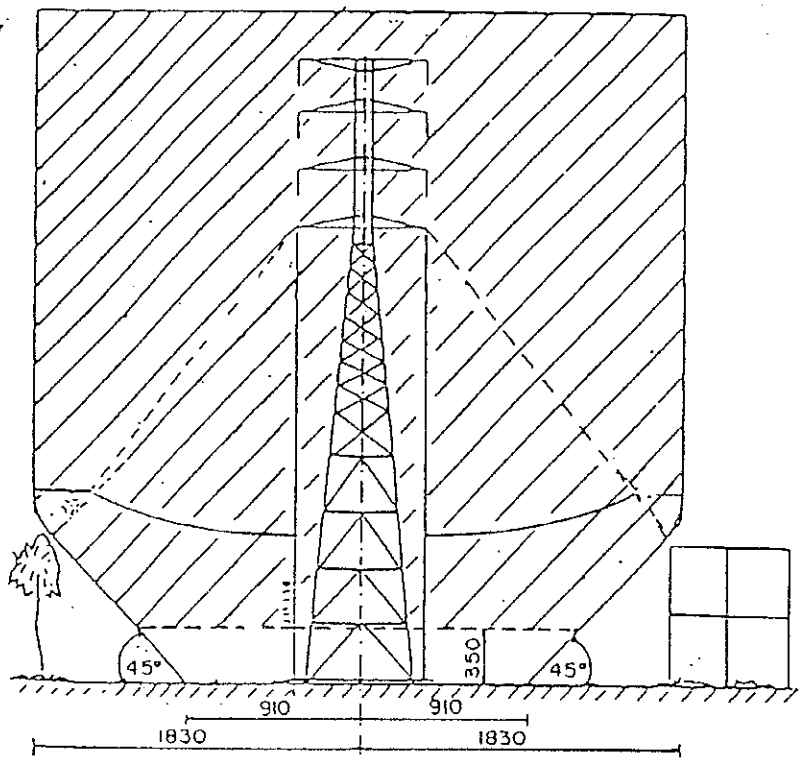
Fig. 10.3.3 Alternatives along the Tangerang Railway Line

150 KV



70 KV



Source: Peraturan Umum Instalasi Listrik Indonesia, 1987 (PUIL 1987)

FEASIBILITY STUDY ON URBAN ARTERIAL ROAD SYSTEM DEVELOPMENT PROJECT IN JAKARTA METROPOLITAN AREA	**Fig. 10.3.4 Clearance Limits of Pylons of Electric Power Transmission Lines**

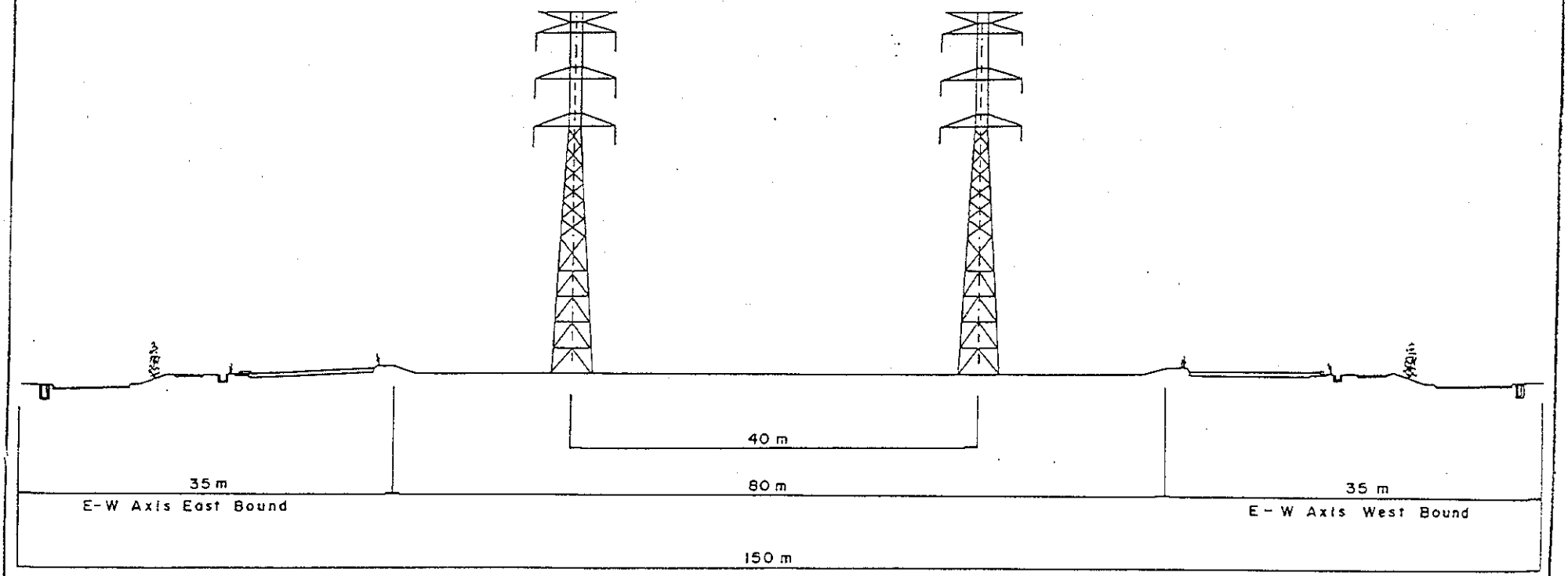


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Fig. 10.3.5 Typical Cross Section for E-W Axis and Transmission Pylon

According to Japanese specification, the distance from the pylon is 40 cm for 70 KV and 90 cm for 160 KV respectively, which seem to be more realistic, observing the present situation in Jakarta. For the study, the East-West Axis is designed to be located along pylons.

An intensive utilization of 40 m wide open space will prevent from illegal use, especially for squatters. Park, playground and market garden are likely common utilization.

(5) Modification of Design on the East Section (E2)) of Jakarta Outer Ring Road.

The eastern section (E2) of Jakarta Outer Ring Road (JORR), of which the north bound toll road has been completed and are operated two ways but the south bound toll road and frontage roads are not constructed yet, is scheduled to be constructed by 1994 for frontage road and by 1998 for south bound toll road under the BOT scheme. The land acquisition has already been completed. The name of investor is PT. Citra Lamtoro Gung Persada and they possess the concession of development and operation for East Section-2 (E2), East Section-3 (E3) and the section between Tg. Priok IC and Cilincing IC of Jakarta Harbour Road, totaling 18.5 km in length.

According to the designated role and function of the East-West Axis, a flyover and diamond type interchange with frontage roads of JORR are planned and no directional connections with toll road of JORR is provided. Accordingly, all access traffic to the toll road are to pass through frontage roads. This system will be simple yet economical. However, U-turn are indispensable for right turning traffic from E-W Axis as well as road users on frontage roads as discussed in W1 of JORR. Furthermore, a new bus terminal is planned to relocate the existing Pulogadung bus terminal.
Therefore, it is necessary to modify the JORR to accommodate U-turn facilities with sufficient traffic capacity. Simultaneously, it is necessary to coordinate the design team of the new bus terminal to incorporate the scheme of E-W Axis.

Important points for coordinative measures are as follows;

(1) Future Expansion of Taman Permata Buana Housing Estate

The E-W Axis is planned to run along the northern boundary of existing Taman Permata Buana Housing Estate where undeveloped open space is widely spread in the south of Kali Angke. However, it seems to be developed soon by a future expansion of Taman Permata Buana Housing Estate. Just the same procedure as Kosambi Baru Housing Estate in the other side of JORR, future ROW in this area shall be secured by a land

subdivision development method in the nick of time when a developer submits its application for approval.

(2) Urban Betterment in Kec. Tambora and Kec. Grogol Petamburan

Though the E-W Axis is planned to pass densely populated areas in Kel. Keagungan, Kerendang and Jembatan Besi on Mangga Besar Extension and Jelambar Baru on city planning road where it is designated as urban betterment with the first priority in Jakarta 2005, it is recommended that 70 m wide ROW is kept to induce its redevelopment as well.
The district plans (RBWK) of these Kecamatan claim public space and facilities so much that it is very necessary to create such land area not by conventional land acquisition method but by certain land readjustment techniques.

Motive of urban betterment is to provide necessary public space with high demand for development of public facilities and building sites with a pleasant environment as increasing income and improving living standards, where the projects are of multi-purposes designated to both improving a city and promoting the urban redevelopment.

However, there are many causes to take these measures afterwards. Generally rapid population movement into urban areas makes it hard to prevent unplanned urbanization and to stimulate appropriate conversion of land use.

Since the urban betterment requires considerable area of land for public facilities, conventional land acquisition method will bring about crucial problems of enormous costs of land acquisition and property compensation as well as social problems of evicting number of inhabitants. If such problems are taken place, which is quite often taken place, the introduction of mitigation measures such as land readjustment techniques should be considered before resorting to the expropriation procedure.

An Area Development Plan brought by urban betterment, which sometimes converts spacious redevelopment from present ribbon development along major arterial roads, will create following benefits;

- improvement in living environment
- development of public facilities
- increase in land value as well as increase in tax revenue from real estate tax
- reduction in public investment
- preservation of local community

- provision and installation of public utilities in an integrated manner

Therefore, it is necessary to consider the land use plan within the framework of masterplan to create new land on a large scale through land readjustment.

Land readjustment techniques basically aim at ameliorating the problematic areas by readjusting land parcels and tenures horizontally or vertically or both.

There are several concepts to procure land for urban betterment:

(a) Conventional Acquisition Method
A widely-used method whereby public entities purchase land for public facilities and develop but usually irregularly shaped building sites remain.

(b) Land Subdivision Development Method
A method whereby the private sector submits an application for an urban area development project and is controlled by its approval.

(c) Replotting Method
A method to develop public facilities and land through the exchange, division or consolidation of land.
It is an achievement of effective land use as a whole to make determination and preservation of land titles and to remain a local community as before.

(d) New Urban Area Development Method
A comprehensive implementation technology centering on "replotting" and "contribution". Lot area decreases due to contribution, while land price increases due to the improvement of urban facilities. Land owners and leaseholders share development cost and benefit fairly where public utilities are provided in an integrated manner.

(e) Integrated Land Readjustment Method
A method to redevelop a certain area by land readjustment project for procuring a land by substituting the lands owned by local governments where housing and infrastructure development can be conducted simultaneously.
First, to acquire land in the area in advance for procuring land for houses, public facilities and project facilities and land acquired in advance is concentrated to the project facility area by substitution later on.

Though the development of the East-West Axis will require a combination of above-mentioned methods, it is sure that the Axis will stimulate urban betterment with better living environment and preventing disaster. Taking this occasion, public facilities such as crossing roads, spaces for public utilities and so forth will be created.

In order to succeed land readjustment project, it is indispensable to increase the revenue by various means as a collaborating body of infrastructure development and town developer can capture the development gains.

Even though it is difficult to determine a range of beneficiaries to receive development gains and amount of the gains, it is sure that part of the gains is absorbed in a form of fixed assets tax and tax for business entity located in urban area. The return of development benefits such as increase of revenue shall be considered as specific source of progressive fund for land readjustment or urban betterment.

(3) Scheme of New Railway Line of Tg. Priok-Cibinong

The original purpose of new railway line between Tg. Priok and Cibinong was solely for cement transport and the original location of route was located in the eastern end of Pulogadung Industrial Estate and ran parallel to Jl. Pegangsaan Dua northward. However, the revised scheme of this railway aims to be multipurpose operation such as commuting, inter regional traveling and freight transporting because the capacity of existing Bogor and Bekasi lines in Jabotabek is saturated by the commuter train operation. Simultaneously, the route location is revised to be located along JORR in order to avert industrial and residential development along the original route. Though the present district plans (RBWK) of Kec. Cakung and Kec. Cilincing present the scheme of this new railway, it is reasonable that the E-W Axis is able to select its own route in this area on the assumption that the route location of new railway presented in the district plans has already been set aside.

10.3.2 Route Description

1) North-South Axis

(1) Route Location

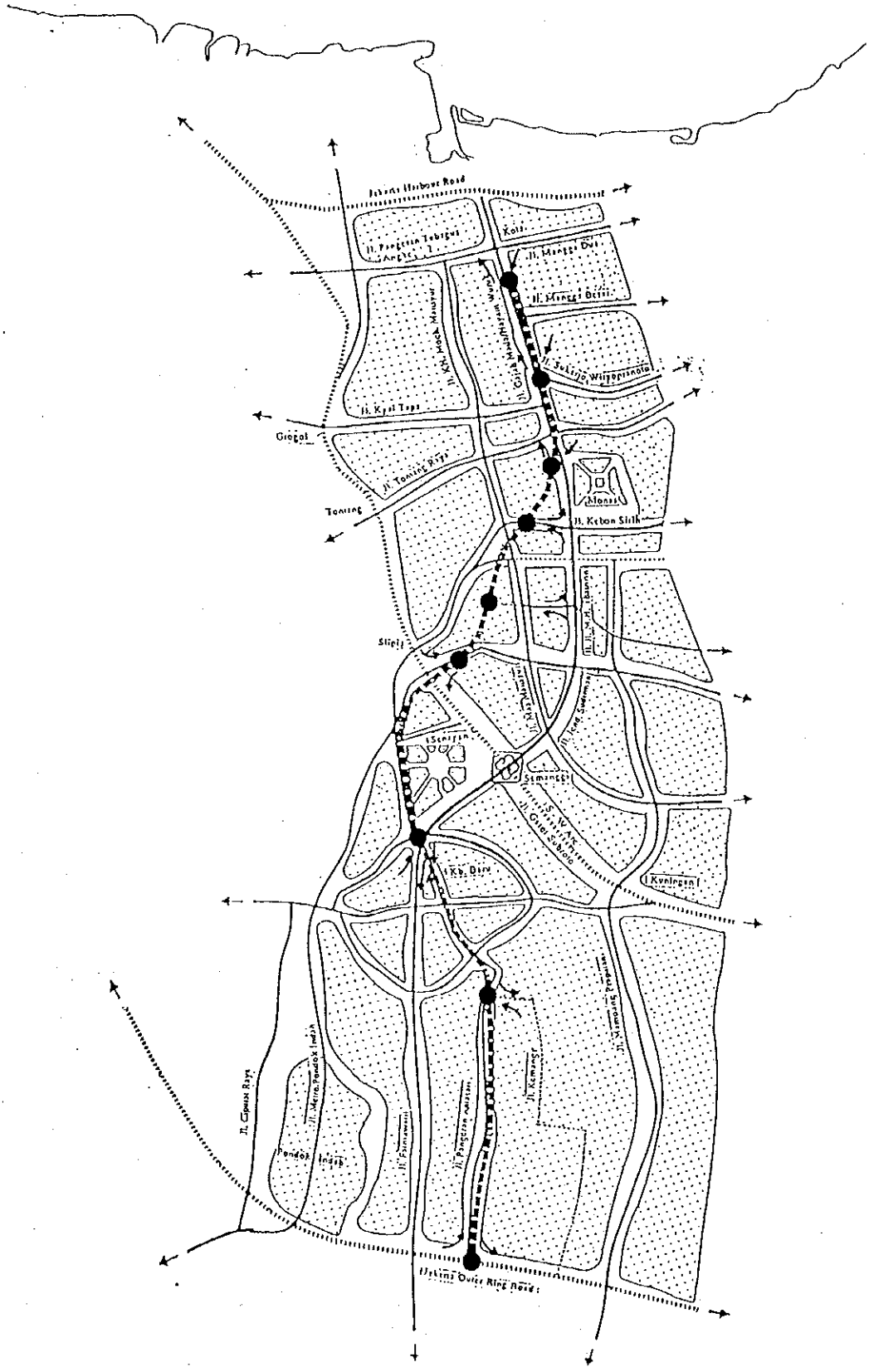
The proposed route of the North-South Axis as shown in Fig. 10.3.6 is as follows:

Jl. Gajah Mada/Hayam Wuruk -
Jl. Abdul Muis -
Jl. Jati Baru -
Jl. Pejompongan - Pondok Pinang (Simpruk Bypass) -
Jl. Gelora -
Jl. Asia Afrika -
Jl. Pattimura -
Jl. Sultan Iskandarsyah -
Jl. Prapanca -
Jl. Pangeran Antasari

(2) Location of Interchanges

The location of junctions and interchanges as shown in Fig. 9.2.12 are selected as follows :

1) Glodok IC	:	The northern terminus on Jl. Gajah Mada/Hayam Wuruk in the north of Jl. Mangga Besar
2) Mangga Besar IC	:	On/Off ramp on Jl. Mangga Besar and Mangga Besar Extension
3) Sukarjo IC	:	On/Off ramp on Jl. Gajah Mada/Hayam Wuruk in the south of Jl. Sukarjo Wiryopranoto
4) Abdul Muis IC	:	On/Off ramp on Jl. Abdul Muis
5) Kebon Sirih IC	:	On/Off semi-directional ramp on Jl. Kebon Sirih
6) Kebon Kacang IC	:	On/Off semi-directional ramp on Jl. Kebon Kacang
7) Pal Merah IC	:	On/Off ramp on Jl. Pejompongan in the north of Pal Merah
8) Senayan IC	:	On/Off semi-directional ramp on Jl. Singamangaraja and On/Off ramp on Jl. Pattimura
9) Kemang Raya IC	:	On/Off ramp on Jl. Prapanca in the north of Jl. Kemang
10) P. Antasari IC	:	On/Off ramp on Jl. Pangeran Antasari in the north of Jakarta Outer Ring Road
11) South JORR IC	:	Y-type junction with tollway of Jakarta Outer Ring Road



FEASIBILITY STUDY ON URBAN ARTERIAL ROAD SYSTEM DEVELOPMENT PROJECT IN JAKARTA METROPOLITAN AREA	**Fig. 10.3.6 Proposed Route and Interchanges on North-South Axis**

(3) Number of Lanes

4 lanes : from Glodok IC to Kebon Sirih IC
6 lanes : from Kebon Sirih IC to P. Antasari IC

2) East-West Axis

(1) Route Location

The proposed route for the East-West Axis is presented in Fig. 10.3.7.

The western section of JORR (W1)
The City Planning road Route K
The City Planning road along the Tangerang Railway Line
Jl. Utama Sakti
Jl. Jelambar Selatan 2
The City Planning road Mangga Besar Extension
Jl. Mangga Besar
Jl. Industri
Jl. Landasan Barat/Timur
Jl. Sunter Jaya
The City Planning road in the north of Sunter Mas
Jl. Taman Sunter Indah
Jl. Danau Indah Raya
Raya Barat/Timur Boulevard
Jl. Pegangsaan Dua
The City Planning road in the east of Pulogadung Industrial Estate
The City Planning road Route AA
The eastern section of JORR (E2)

(2) Location of Interchanges

Among many crossing roads, type of interchange will be examined at the following location of major interchanges as shown in Fig. 9.2.12 due to its functional classification of road and traffic volume.

1) IC with frontage roads of JORR Eastern Section, including U-turn flyovers
2) IC with the northern extension of Jl. Buaran Indah Raya (Route E-E)
3) IC with Jl. Bekasi Raya
4) IC with Jl. Pegangsaan Dua
5) IC with Jl. Yos Sudarso
6) IC with Jl. Sunter Raya
7) No additional ICs in Ex-Kemayoran Airport
8) IC with Jl. Gunung Sahari
9) IC with the North-South Axis
10) IC with Jl. Gajah Mada/Hayam Wuruk

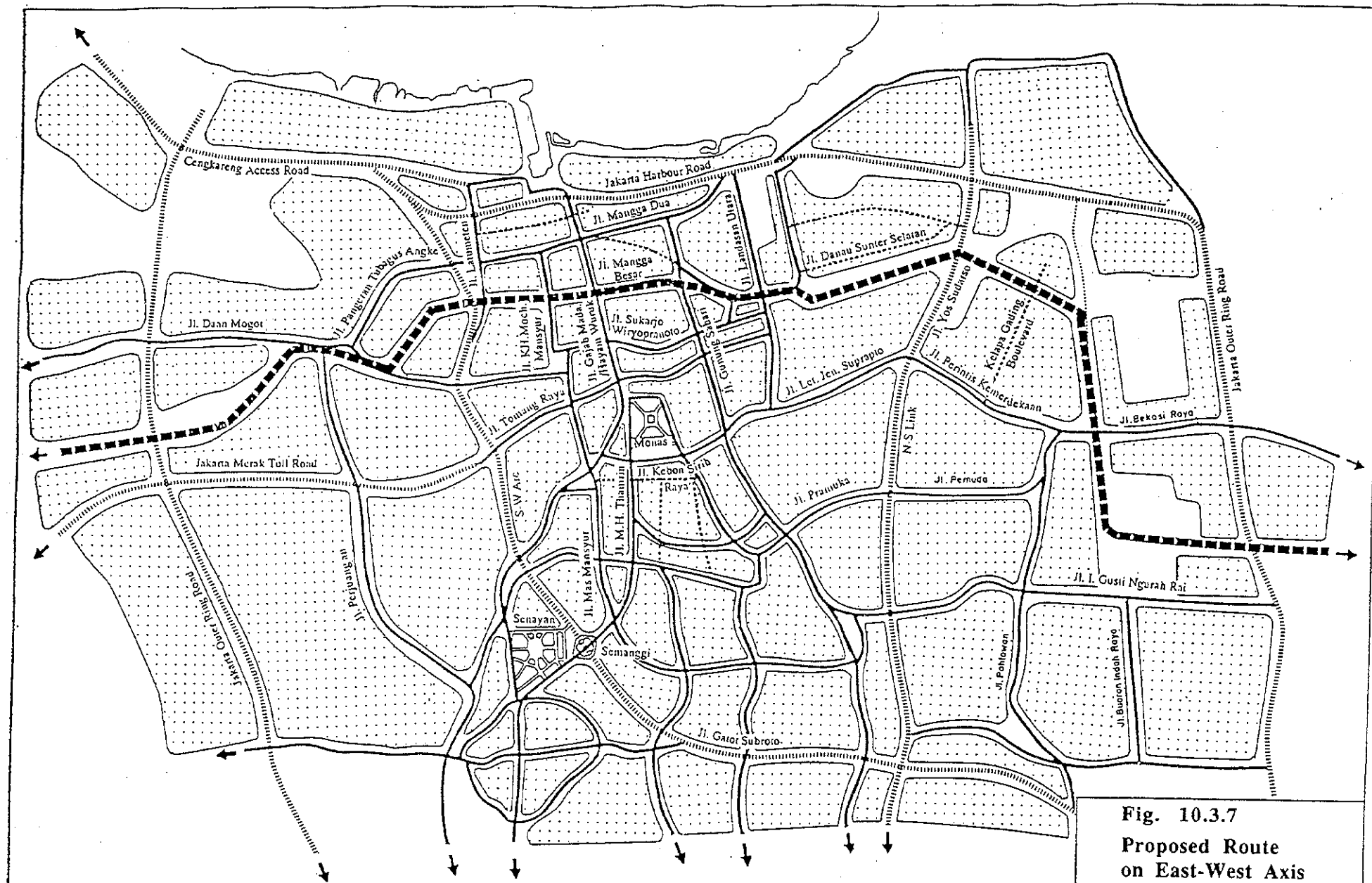


Fig. 10.3.7
Proposed Route on East-West Axis

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11) IC with Jl. Latumeten
12) IC with Jl. Daan Mogot
13) IC with Jl. Perjuangan (Panjang)
14) IC with Jl. Kembangan Utama (Route F)
15) IC with frontage roads of JORR Western Section, including U-turn flyovers.

(3) Number of lanes : 10 lanes

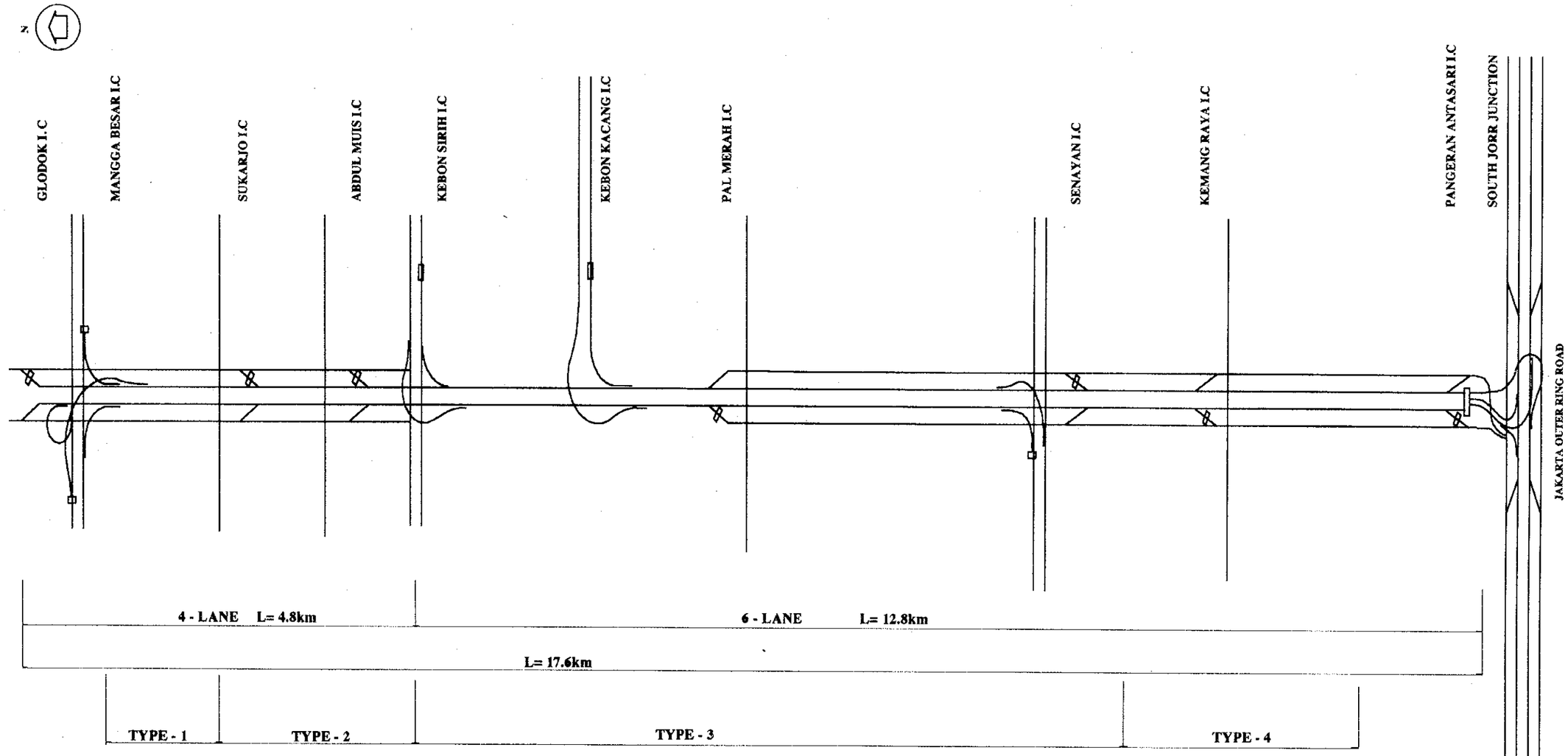
ROW = 70 m : from West JORR IC to Mangga Besar IC and from Kelapa Gading East IC to East JORR IC
ROW = 40 m : from Mangga Besar IC to Kelapa Gading East IC

10.3.3 Layout of Project Roads

The North - South Axis is designed as a full access controlled road to pass built-up area in its entire stretch. In order to make it practical and realistic, the route is selected to pass in public spaces such as the spaces above roads and rivers. Even steel structure of double deck with racket type pier is adopted where severe land conditions are found.

Since the East-West Axis is planned to be a new arterial road it requires considerable land acquisition and property compensation. Where the East-West Axis passes built-up area, 40 m wide ROW is proposed to avert adverse social impacts by excessive demolition. On the other hand, 70 m wide ROW is proposed in an undeveloped area and areas designated as urban betterment. In an undeveloped area, the future ROW will be reserved by a subdivision method during development, while in the areas designated as urban betterment it is necessary to introduce land readjustment techniques in order to acquire land successfully to create considerable public spaces for urban betterment including roads as well as to avert resettlement problems.

The schematic layout of each project road is presented in Fig. 10.3.8 thru 10.3.10, combining number of lane, road length by design sections and typical cross sections.



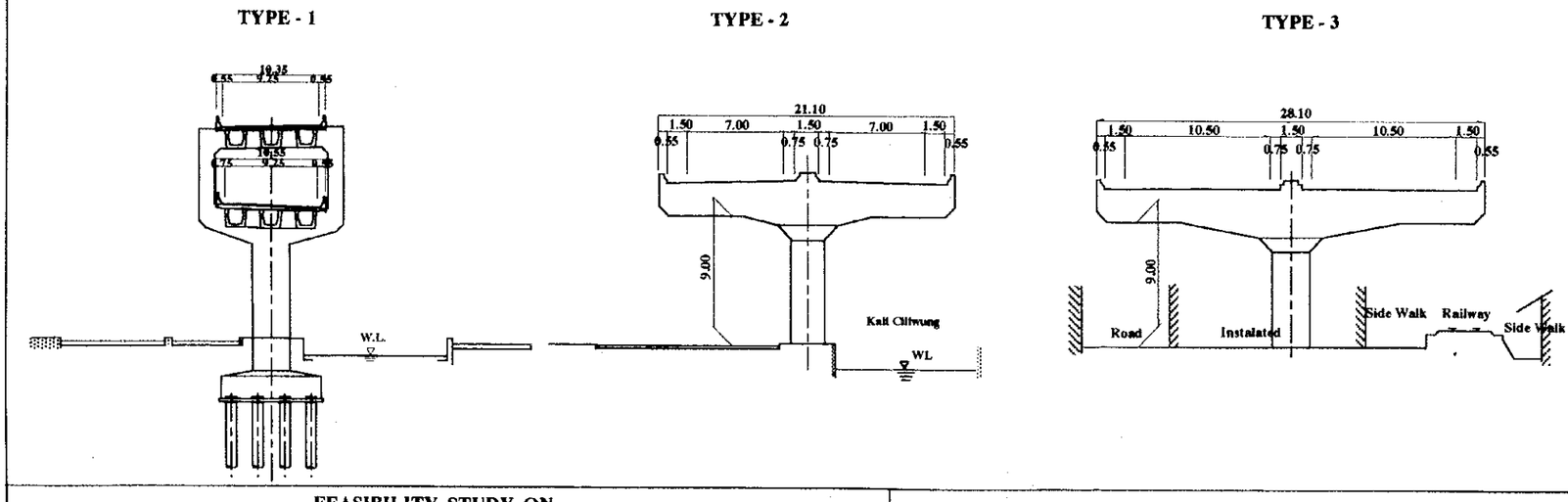


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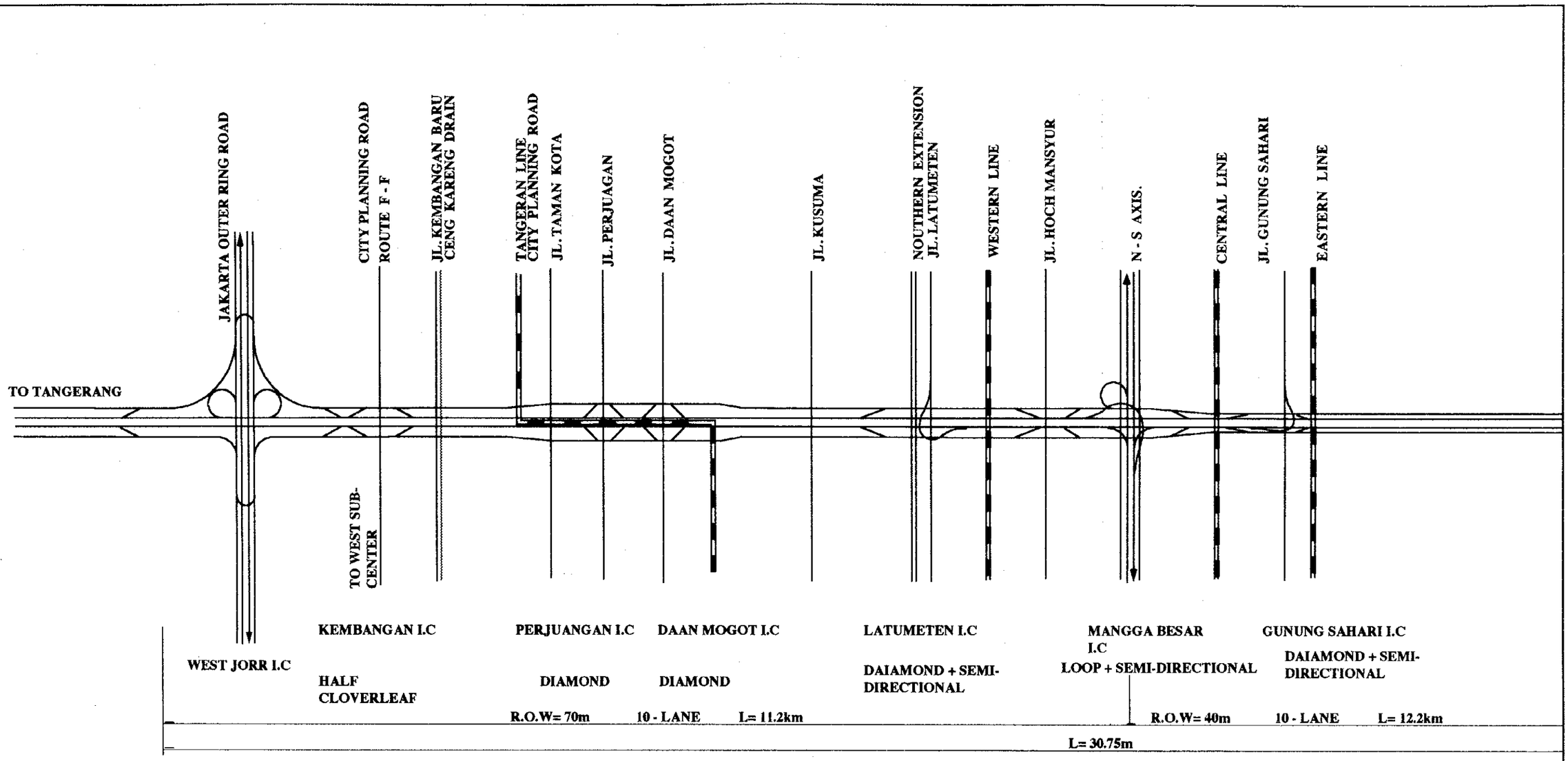
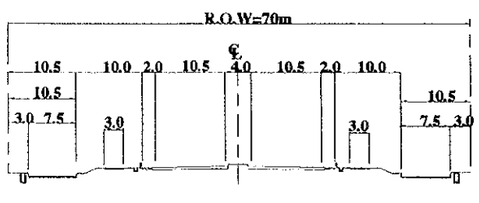
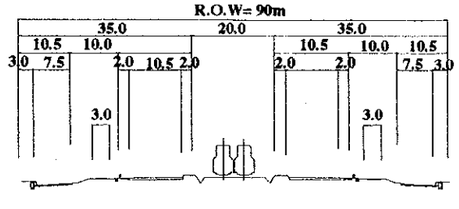
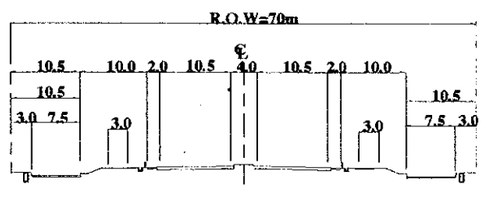
Fig. 10.3.8 Layout of the North-South Axis









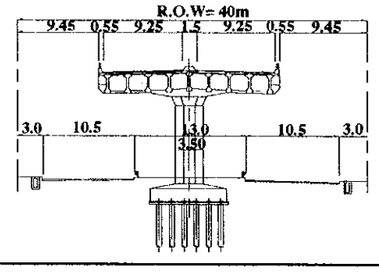


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Fig. 10.3.9 Layout of the East-West Axis (1)

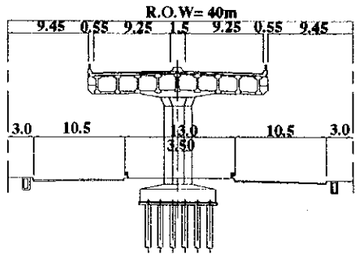
EXISTING F/O
JL. LANDASAN UTARA / SELATAN
EXISTING F/O
JL. YOS SUDARSO N - S LINK
JL. KELAPA GADING
JL. PEGANGSAN DUA
JL. RAYA BEKASI
CITY PLANNING ROAD ROUTE E - E
JL. PENGGILI NGAN
JAKARTA OUTER RING ROAD
TO BEKASI
TO EAST SUB-CENTER

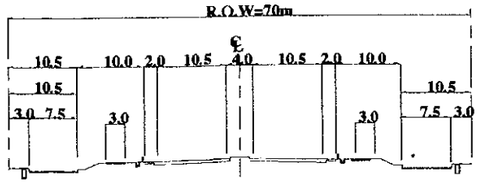
KEMEYORAN WEST I.C	KEMEYORAN EAST I.C	SUNTER I.C	KELAPA GADUNG EAST I.C	BEKASI RAYA I.C	BUARAN I.C	EAST JORR I.C
HALF DIAMOND	HALF DIAMOND	DIAMOND	DIAMOND	DIAMOND	DIAMOND	DIAMOND + FRONTAGE ROAD FLYOVER

R.O.W= 40m 10 - LANE L= 12.2km

R.O.W= 70m 10 - LANE L= 7.35km

L= 30.75km





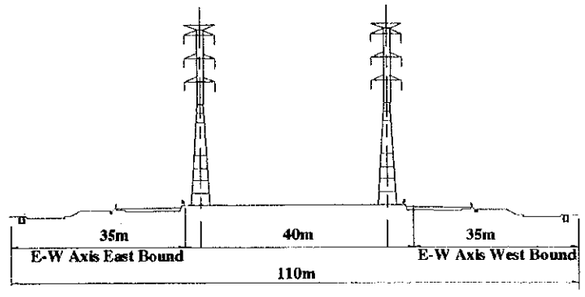


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Fig. 10.3.10 Layout of the East-West Axis (2)

10.4 Preliminary Design of Embankment

10.4.1 General

The geographical feature of the East - West Axis is generally flat, while elevation difference between the starting and ending points in the North - South is 28 m, where it is rolling in the south and flat in the north. Since the North - South Axis has viaduct in the entire stretch, no embankment section is found. The East - West Axis has embankment sections, in which little common excavation is expected and considerable volume of borrow materials will be required. The waste disposal from structural excavation will not be suitable to fill material.

10.4.2 Embankment Materials and Potential Borrow Pits

Several potential borrow pits are found in Tangerang and its surroundings. However, demand for borrow materials is so high that it would be rather difficult to get considerable volume in a short period in Jakarta in the future. Therefore, low embankment is proposed, considering small settlement, construction economy and practical construction method.

10.4.3 Embankment Height and Slope

Generally, flat slope is stable but requires larger land area. The recommended embankment slope is 1:2 for lateritic soil with the maximum embankment height of 7 m. The low embankment scheme, which is adopted in the Intra Urban Expressway and related Facilities Project, comprises extended structures, piled slab and low embankment in descending order after bridge abutment. The embankment height in this scheme is 1.7 m high at most to be free from any soft ground treatment.

10.4.4 Embankment on Soft Ground Area

The term "Soft Ground Layer" depends on the type of facilities to be constructed (i.e. highways, railways, buildings, etc.), but in the case of the developments of high standard road, soils layers which have the characteristics shown in Table 10.4.1 are generally called "Soft Ground Layer".

Table 10.4.1 Definition of Soft Ground Layer

	Natural Water Content (%)	Unconfined Compression (kg/cm2)	Number of Blows (N)
	more than	less than	less than
Organic Soils Layers	100	0.5	4
Cohesive Soils Layers	50	0.5	4
Sand or Sandy Soils Layers	30	-	10

Based on the results of geological investigations, it was judged that soft ground areas exist in the following three locations along the Design Road route.

Location	Total Layer Length	Layer Thickness	Depth
1. North-South Axis 0+500~ 3+000	4.5 km	7 m	From Surfase
2. East-West Axis 2+000~14+200	12.2 km	7 m	From Surfase
3. East-West Axis 14+200~27+000	12.8 km	7 m	From 5 m

And moreover, the Soft Ground Layer at Sta.5+500 of East-West Axis is specially soft and Layer thickness is about 22 m.
In the case of non-treated foundation, the critical embankment height is 1.7 m (referred to the Working Paper of "JAKARTA HARBOUR ROAD", October 1987 and "NORTHERN EXTENSION OF THE SOUTH WEST ARC", September 1989).
The maximum embankment height is about 7 m by the foundation treatment with diameter 40 cm sand drain piles at the center-to-center interval of 2.4 m.

10.5 Preliminary Design of Interchanges

10.5.1 Study Approach

The ability to accommodate high volumes of traffic safely and efficiently through intersections depend on what arrangement is provided for handling intersecting traffic. An interchange is a system of interconnecting roadways in conjunction with one or more grade separations that provides for the movement of traffic between two or more roadways on different levels.

An interchange may be warranted as shown in the following items:

(a) Design designation
(b) Elimination of bottlenecks spot congestion
(c) Elimination of hazards
(d) Site topography
(e) Road Users' benefits
(f) Traffic volume warrant

The study roads, East-West Axis and North-South are functionally classified into highway/arterial and tollway respectively.

Tollway, highway and arterial require regulated limitation of access to enhance their primary function of mobility. The location of interchanges, therefore, will be identified based on the road network in Jakarta by functional classification.

The type of interchange, along with its design, is influenced by many factors, such as road classification, character or composition of traffic, design speed and degree of access control. Moreover, on toll roads, the toll revenue system must be taken into consideration.

Figure 10.5.1 shows the adopted study approach for determination of interchange type and its preliminary engineering design.

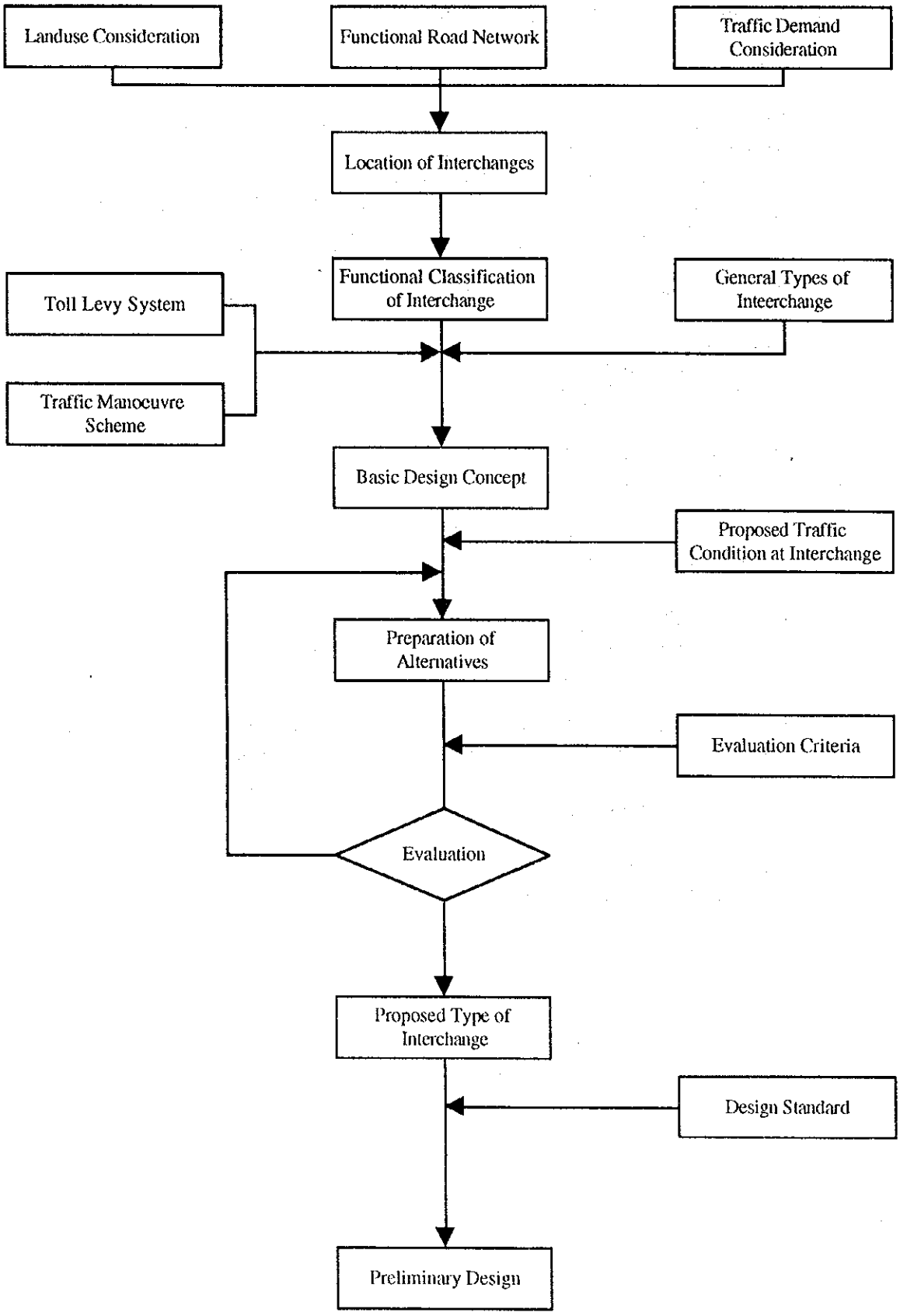


Fig. 10.5.1 Study Methodology of Selection of Interchange Type and Design

10.5.2 Basic Design Concept

1) General Types of Interchange

Typical three-leg interchanges are trumpet type and three-leg directional interchanges. Typical four-leg interchanges are diamond type, cloverleaf and directional interchanges.

Diamond type interchanges have numerous other configurations incorporating frontage roads and continuous collector or distributor roads. Diamond type interchanges with multiple levels may also be considered in urban area where space is limited.

A partial or half cloverleaf configuration containing cloverleaf type loops and diagonal ramps configuration can be readily modified to follow the predominant traffic flow direction. A full cloverleaf has an independent ramp for each interchanging movement. Weaving maneuvers are generated on the stretch between loops. Therefore, contemporary full cloverleaf designs usually incorporate collector or distributor roads.

Directional interchanges are generally required at the intersections of high volume expressway in order to ensure high speed and capacity without weaving and at-grade intersections.

Directional interchange design is the assembly of one or more of the basic types or ramps.

Generally, ramp and connection are classified into the following four types as shown in Figure 10.5.2.

(1) Outer Connection

It diverges from the left lane of throughway and merges to another throughway from the left. This type is always adopted for the left-turning ramp.

(2) Semi-direct Ramp

It diverges from the left lane of throughway and turns to the right. This type has the advantage in observing the left diverging rule.

(3) Direct Ramp

It diverges from the right lane of throughway and turns to the right. This type is usually used to manage heavy and high speed traffic.

(4) Loop

It diverges from the left lane of throughway and turns to the right by a 270 degree left turn. This type is generally used for minor and low speed traffic.

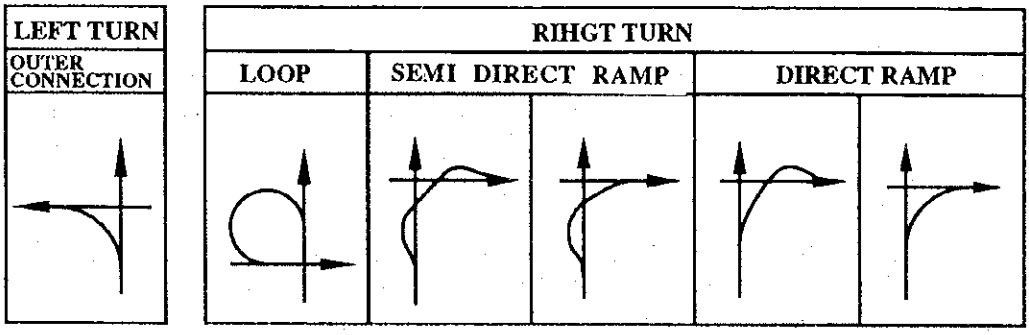


Figure 10.5.2 Types of Ramp and Connection

The layout for any specific ramp and type of traffic movement will reflect site conditions of topography and culture, cost and the degree of flexibility in traffic operation desired.

Junction (tollway to tollway interchange) must provide high mobility for traffic using expressways. Design speed of rampway structured system interchange, is at least half of that of throughway design speed. Design speed of an expressway network is planned to be 80 km/h. So the design speed of rampway must ensure movement at 50 km/h. In the case of having a loop ramp system interchange it will require a 40 m minimum curve radius and excessive land area.

Figure 10.5.5 shows several interchange types for 3-leg designs. From single structure type, a trumpet type interchange is common and practical. The trumpet type interchange has two alternatives, A-type and B-type.

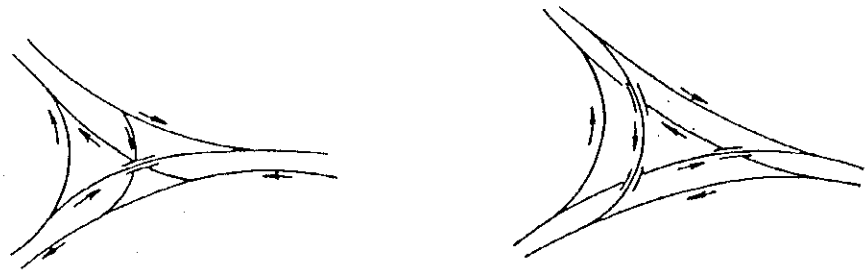
Type-A trumpet interchange utilizes a loop for right-turning traffic from crossroad, while type-B uses a loop for right-turning traffic from throughway. A criteria for selection of either type is the relative volumes of the right-turning movements, the more direct alingment favoring the heavier volume and the loop the lesser volume.

The small radii loop ramps are not considered to be an adequate method of terminating a tollway type roadway. Y-type interchange with more than one structure or with one three-level structure provides for all of the movements without loops. There are two types of Y-type interchange, namely direct Y-type and semi-direct Y-type as shown in Fig. 10.5.3. This type is more costly than trumpet type and is justified only where all movements are rather large.

Among the many types of interchange configurations, ten (10) basic types considered to be practical for application to the study roads are shown in Table 10.5.1. A general comparison of their salient features and land area requirement is also summarized in Table 10.5.1.

Single Structure Trumpet

3-leg Directional



3-leg Semi-directional

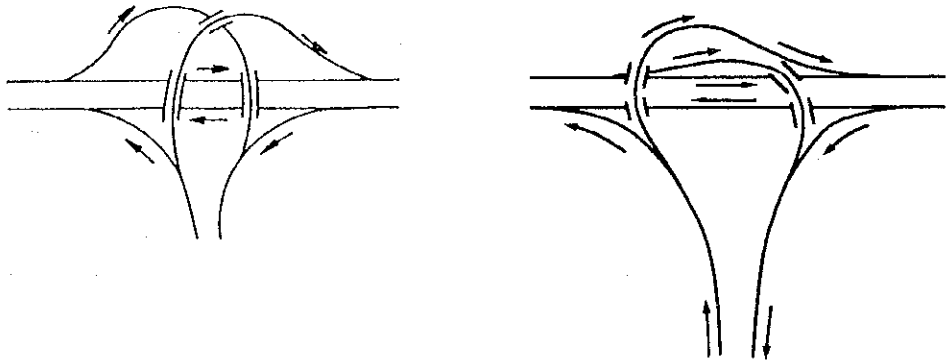


Figure 10.5.3 Interchange Types for 3-leg Designs

2) Traffic Maneuver Scheme and Uniformity of Interchange Pattern

Two other major factors in the determination of interchange types are traffic maneuver scheme at the interchange and the uniformity of interchange pattern.

At times, the complexity of traffic maneuver scheme in a group of successive interchanges warrant the adoption of a specific interchange type at a certain location or explains why the capacity of certain intersections can be suppressed. This is most applicable when the location of two interchanges are too close to each other such that the functions may be shared or delegated among them. There are eight locations on North-South Axis where traffic maneuver scheme at the interchange becomes the deciding factor in determining interchange type. These will be discussed further in Sub-Section 10.5.5.

When a series of interchanges is being designed, attention must be given to the group as well as to each individually. Considering the need for high capacity, appropriate level of service and maximum safety in conjunction with expressway or highway operations, it is desirable to provide uniformity in exit and entrance patterns.

In this study all traffic movements will enter or leave from left only using a semi-directional ramp. If there is no physical constraint, an 'A'-type interchange, that is, traffic entering from near side of structure exit ramp will be adopted; if a 'B'-type interchange (that is, traffic entering from the far side) has to be adopted from viewpoint of major turn volume, then considerations for good sighting distance and visibility become important.

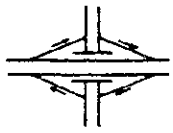
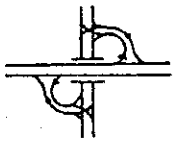
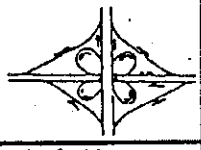
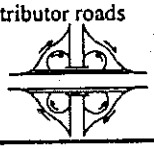
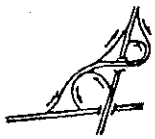
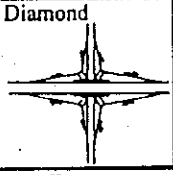
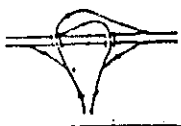
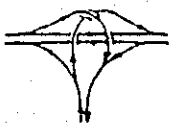
A third consideration on uniformity is to design for all turning movements to get off from a single point as a principle.

In addition to the extent practicable all interchanges along an expressway should be reasonably uniform in geometric layout and general appearance.

10.5.3 Forecasted Interchange Traffic Volume for the North-South Axis and Interchanges' Service Coverage Area

The forecasted traffic volume at interchanges in year 2010 are shown in Appendix 7A. The service coverage area of each interchange are shown in Figs. 10.5.4 and 10.5.5.

Table 10.5.1 Typical Configuration of Some Practical Type of Interchange and their Characteristics

	Layout Configuration	Salient Features	Land Area (ha)
Interchange	1. Diamond 	Turning movements on minor road may be controlled by signals. Traffic detour distance is shortest.	4.0
	2. Half Cloverleaf 	Its two loop ramps configuration is readily adaptable to allow free movement in predominant direction. Turning movements on minor road may be controlled by signals	5.1
	3. Full Cloverleaf 	Its four loop ramps configuration alows free movement in all directions. There are two entrances and two exists on through-way. Weaving occurs between loop ramps.	6.8
	4. Full Cloverleaf with Collector-distributor roads 	Free movement in all directions through four loop ramps. There is only one entrance and one exit on throughway. No weaving	9.0
	5. Trumpet 	Loop ramp occurs at one point. Turning movement on minor road may be controlled by signals. Favourable configuration if there is great difference between traffic volume by direction. Toll gates can be located at a single point.	7.5
	6. Double Trumpet 	Loop ramps occur at two points. All turning movements pass through one point. there is weaving traffic but toll gates can be located at a single point. No signalisation is necessary.	10.5
	7. Three-level Diamond 	Allows free movement for through traffic of crossing roads. Can increase interchange capacity efficiently in an area with limited space.	4.0
Junction	8. Single Structure Trumpet 	A simple structure commonly used for 3-leg intersection. Requires a large area which is influenced by the minimum curve radius due to design speed.	15.4
	9. Two Structures Trumpet 	Separate roadways are provided for each right turning movement with two 2-level structrues separating the ramps from through traffic.	14.8
	10. Three Structures Trumpet 	Two double jug-handle configuration usually applies where the crossing road is of considerable importance too. Requires the use of three structures thereby reducing land area.	10.6

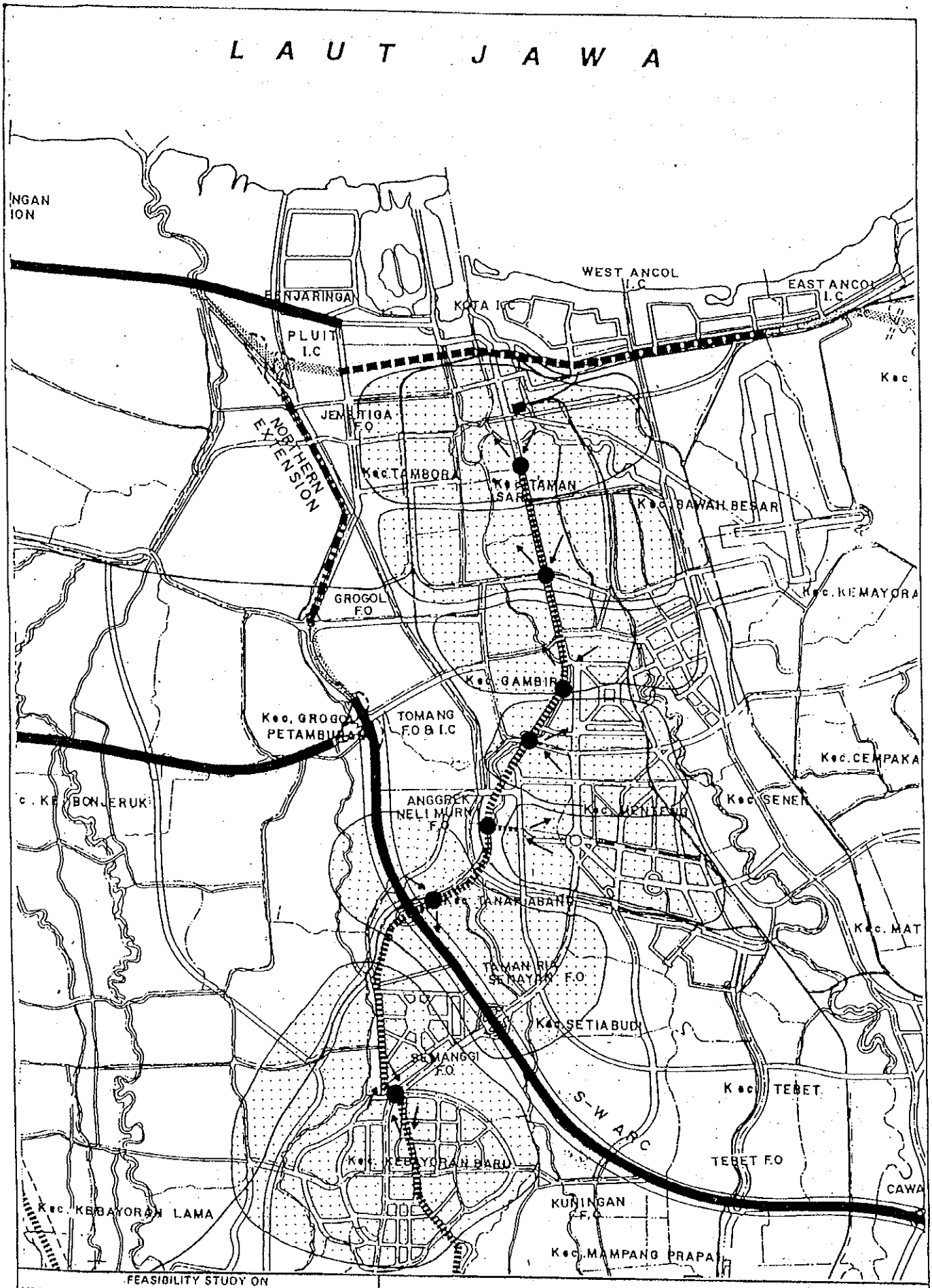


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Fig. 10.5.4 Services Coverage Area at Northern ICs

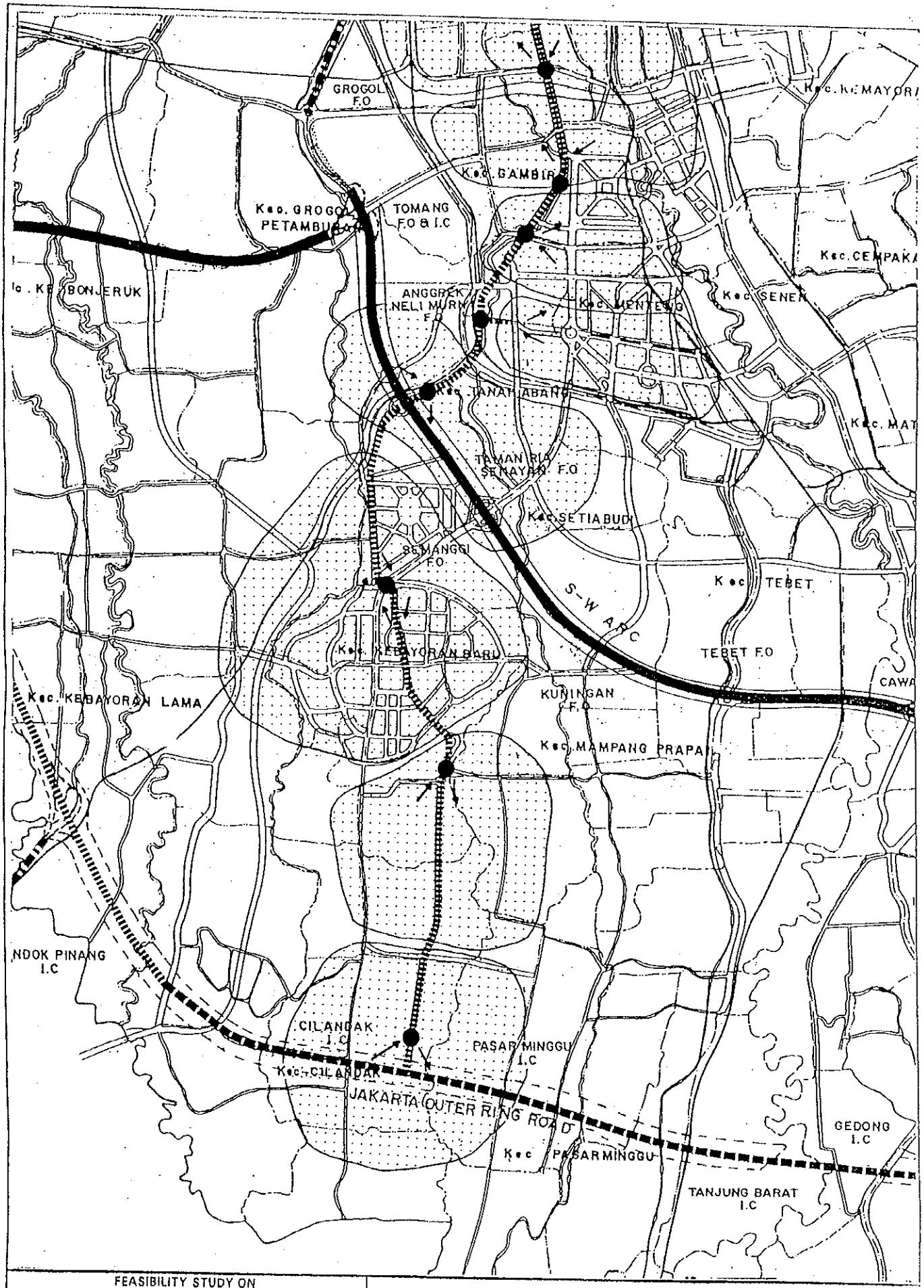

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Fig. 10.5.5 Services Coverage Area at Southern ICs