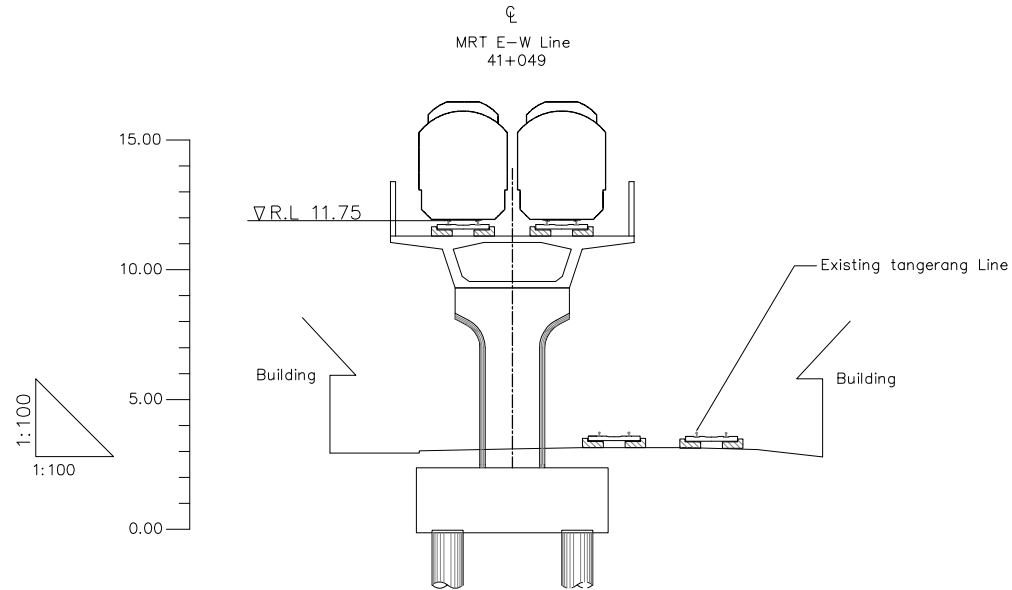


**Appendix-4**  
**Section Drawing**

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CROSS SECTION  
(41K+049m00)



REV. NO.	DATE	DESCRIPTION	BY	APPROVED

PREPARATORY SURVEY FOR JAKARTA  
MASS RAPID TRANSIT (MRT)  
EAST-WEST (E-W) LINE PROJECT

TITLE :

CROSS SECTION (41+049km)

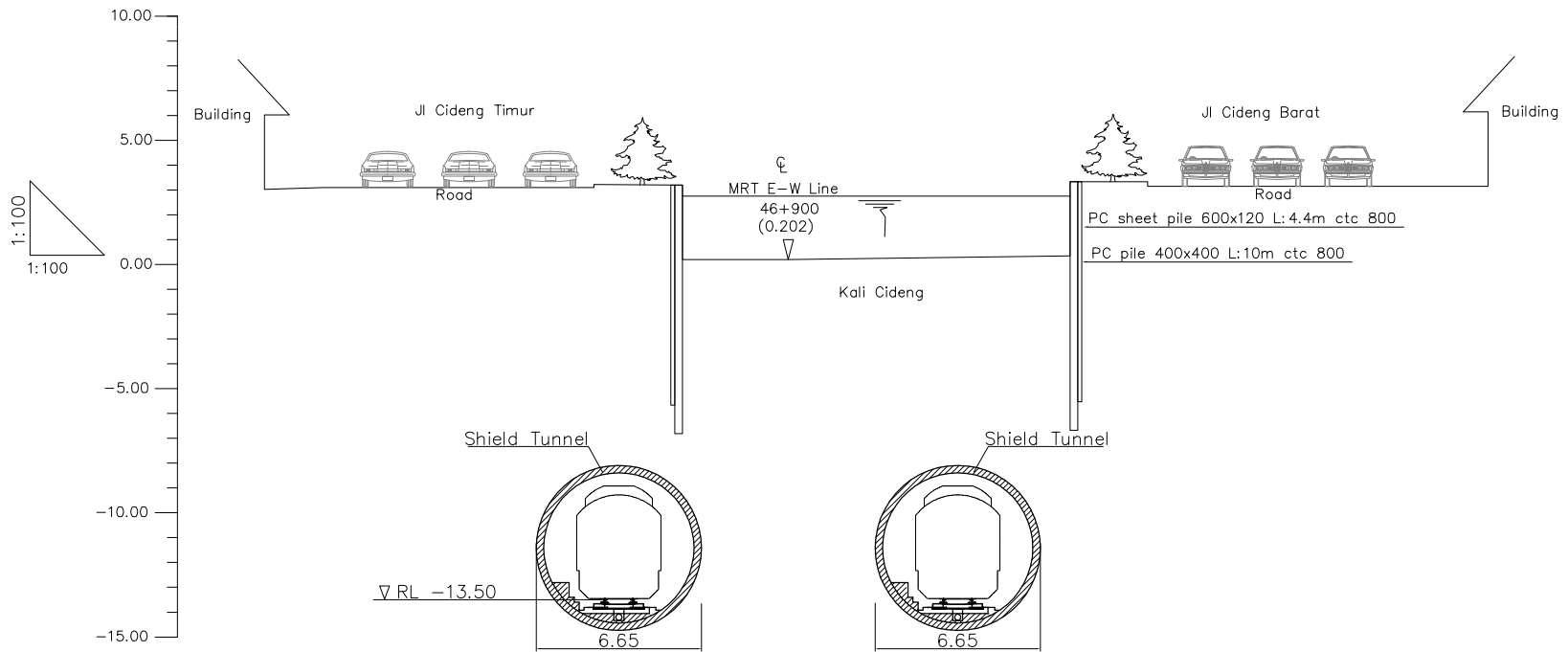
DATE :

December, 2011

DRAWING NO.:

1

CROSS SECTION  
(46K900m000)



Appendix 4-2

REV. NO.	DATE	DESCRIPTION	BY	APPROVED

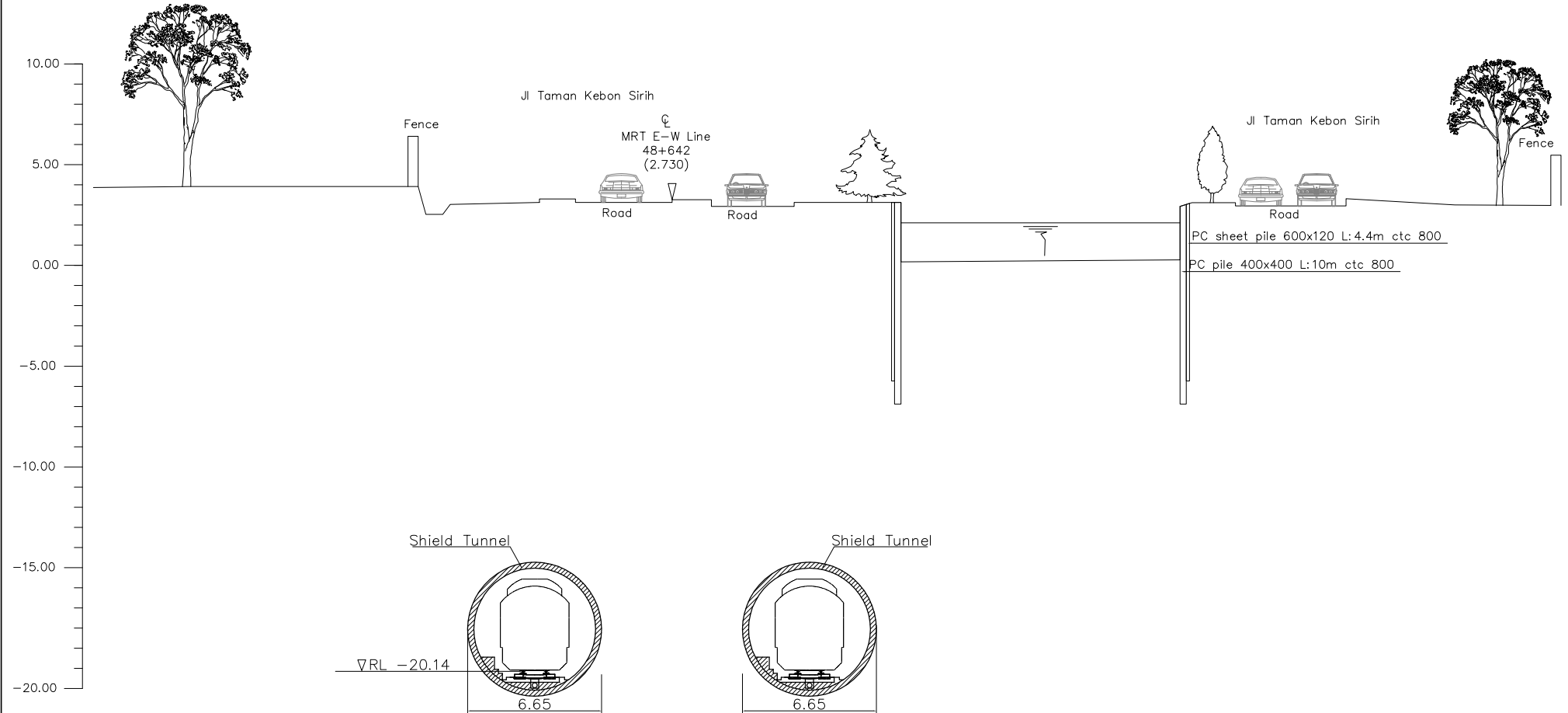
PREPARATORY SURVEY FOR JAKARTA  
MASS RAPID TRANSIT (MRT)  
EAST-WEST (E-W) LINE PROJECT

TITLE :  
CROSS SECTION (46K900m000)

DATE :  
December, 2011

DRAWING NO.:

CROSS SECTION  
(48K642m000)



Appendix 4-3

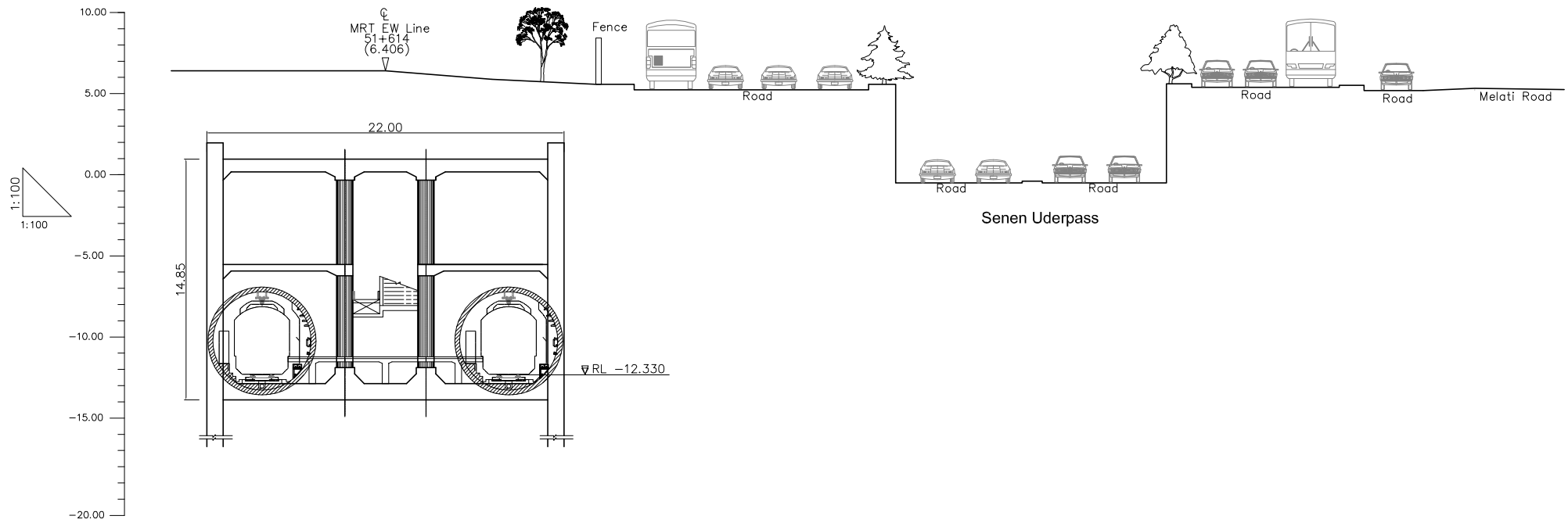
REV. NO.	DATE	DESCRIPTION	BY	APPROVED

PREPARATORY SURVEY FOR JAKARTA  
MASS RAPID TRANSIT (MRT)  
EAST-WEST (E-W) LINE PROJECT

TITLE :  
CROSS SECTION (48K642m000)

DATE :  
December, 2011  
DRAWING NO.:

CROSS SECTION  
(51K614m000)



Appendix 4-4

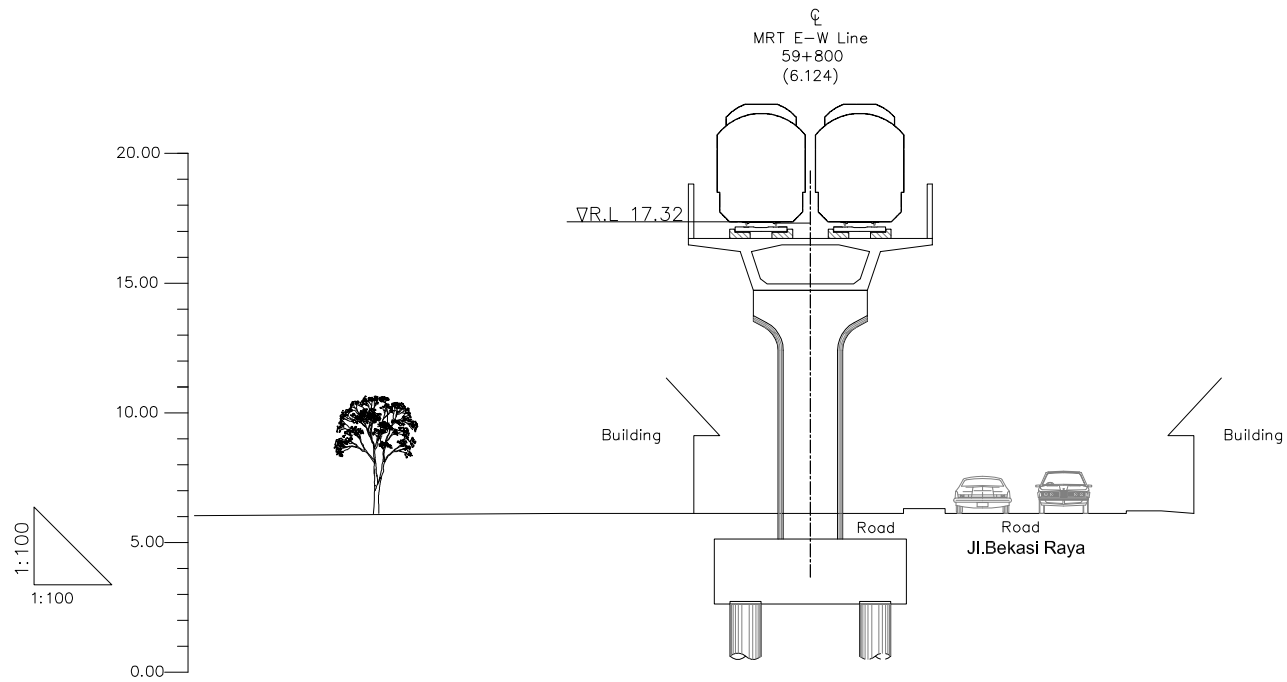
REV. NO.	DATE	DESCRIPTION	BY	APPROVED

PREPARATORY SURVEY FOR JAKARTA  
MASS RAPID TRANSIT (MRT)  
EAST-WEST (E-W) LINE PROJECT

TITLE :	CROSS SECTION (51K614m000)
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DATE :	December, 2011
DRAWING NO.:	4

CROSS SECTION  
(59K800m000)



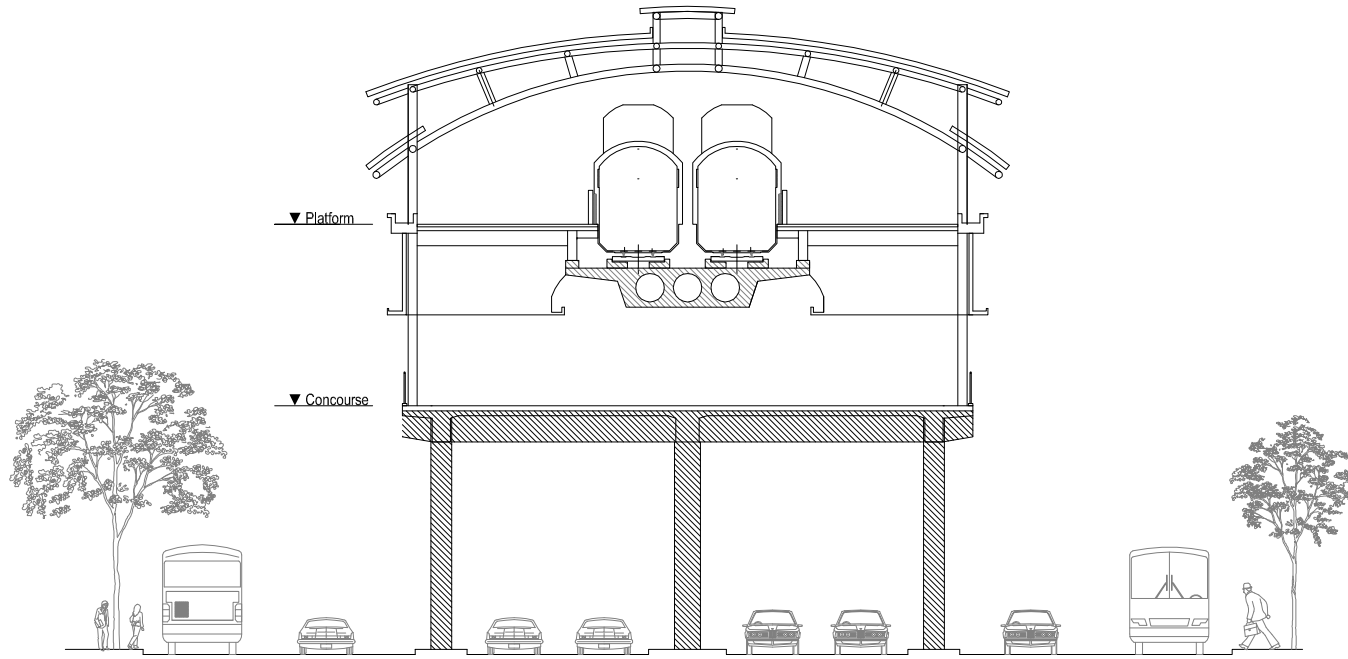
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PREPARATORY SURVEY FOR JAKARTA  
MASS RAPID TRANSIT (MRT)  
EAST-WEST (E-W) LINE PROJECT

TITLE :  
CROSS SECTION (59K800m000)

DATE :	December, 2011
DRAWING NO.:	5

TYPICAL CROSS SECTION OF ELEVATED STATION



CROSS SECTION

REV. NO.	DATE	DESCRIPTION	BY	APPROVED

PREPARATORY SURVEY FOR JAKARTA  
 MASS RAPID TRANSIT (MRT)  
 EAST-WEST (E-W) LINE PROJECT

TITLE :

TYPICAL CROSS SECTION OF  
 ELEVATED STATION

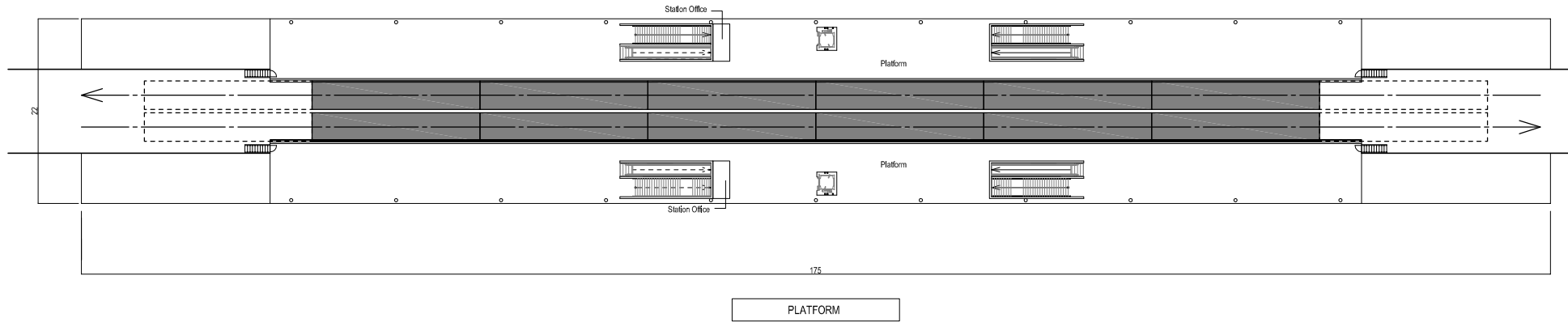
DATE :

December, 2011

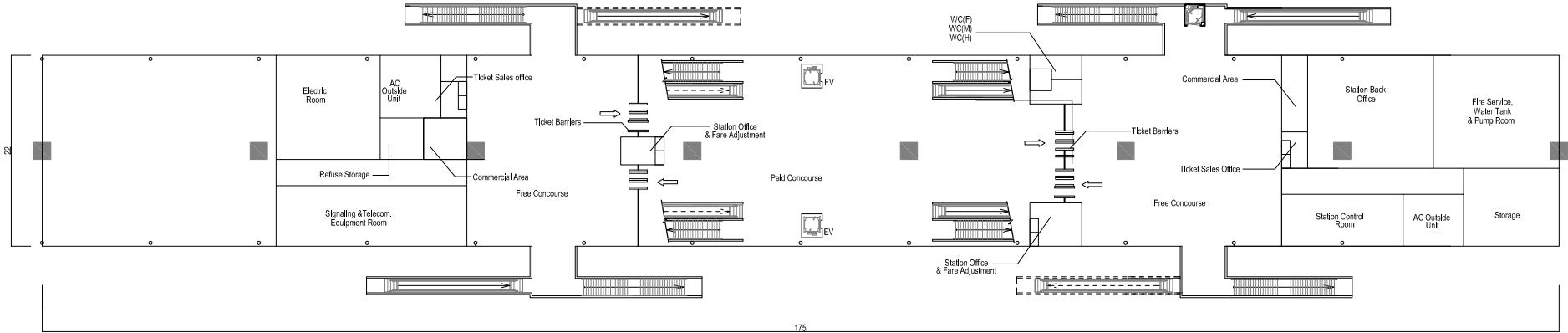
DRAWING NO.:

6

TYPICAL PLAN OF ELEVATED STATION



PLATFORM



CONCOURSE

Appendix 4-7

PREPARATORY SURVEY FOR JAKARTA  
 MASS RAPID TRANSIT (MRT)  
 EAST-WEST (E-W) LINE PROJECT

TITLE :  
 TYPICAL PLAN OF ELEVATED STATION

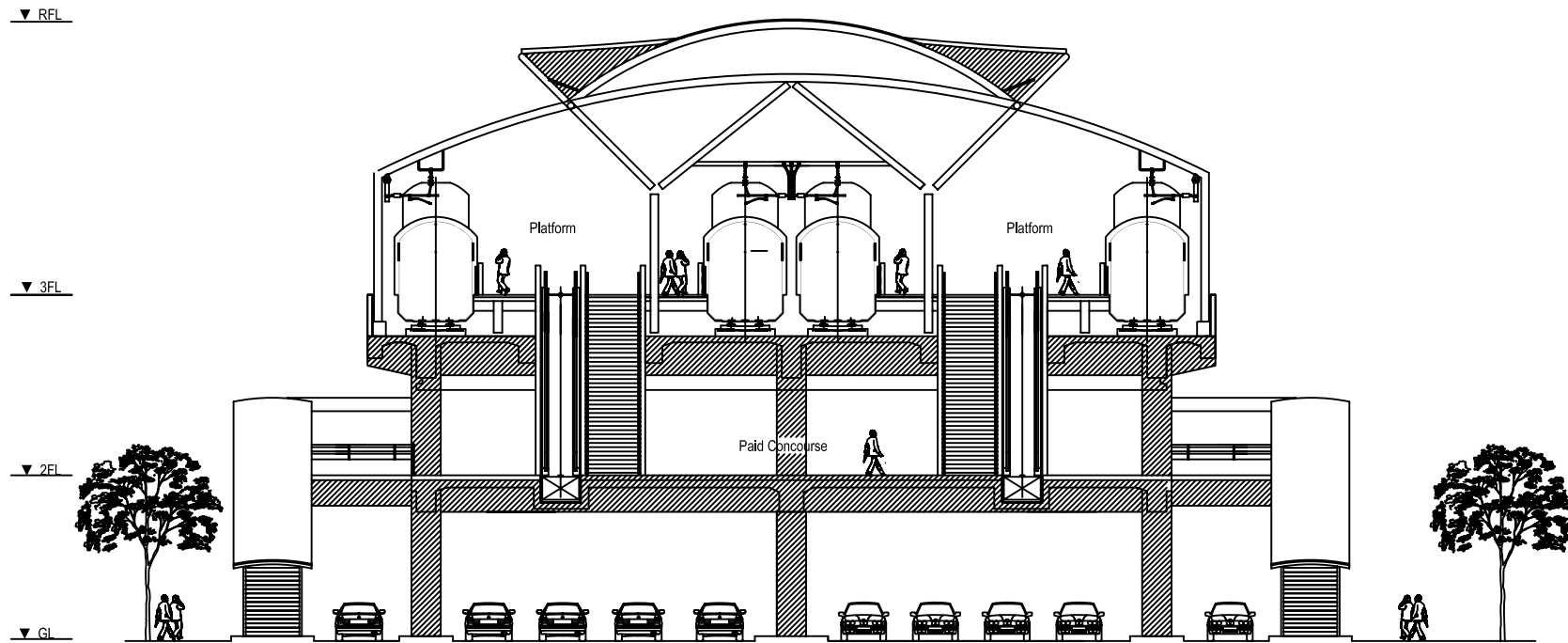
DATE :  
 December , 2011

DRAWING NO. :  
 7

REV. NO.	DATE	DESCRIPTION	BY	APPROVED



TYPICAL CROSS SECTION  
ELEVATED STATION



SECTION X-X S = 1:500

Appendix 4-8

REV. NO.	DATE	DESCRIPTION	BY	APPROVED

PREPARATORY SURVEY FOR JAKARTA  
MASS RAPID TRANSIT (MRT)  
EAST-WEST (E-W) LINE PROJECT

TITLE

TYPICAL CROSS SECTION  
ELEVATED STATION

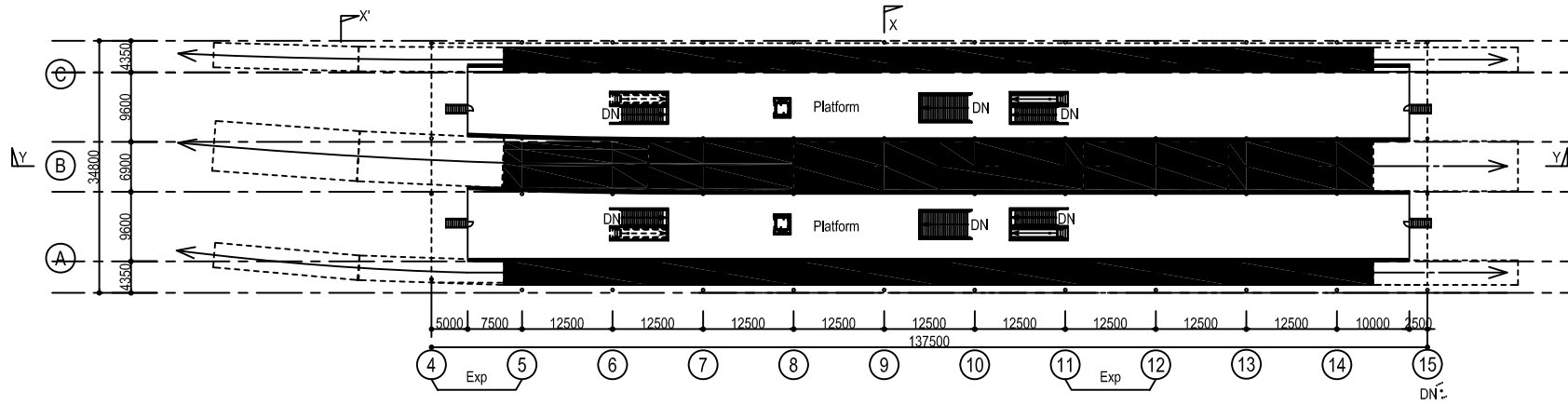
DATE :

December , 2011

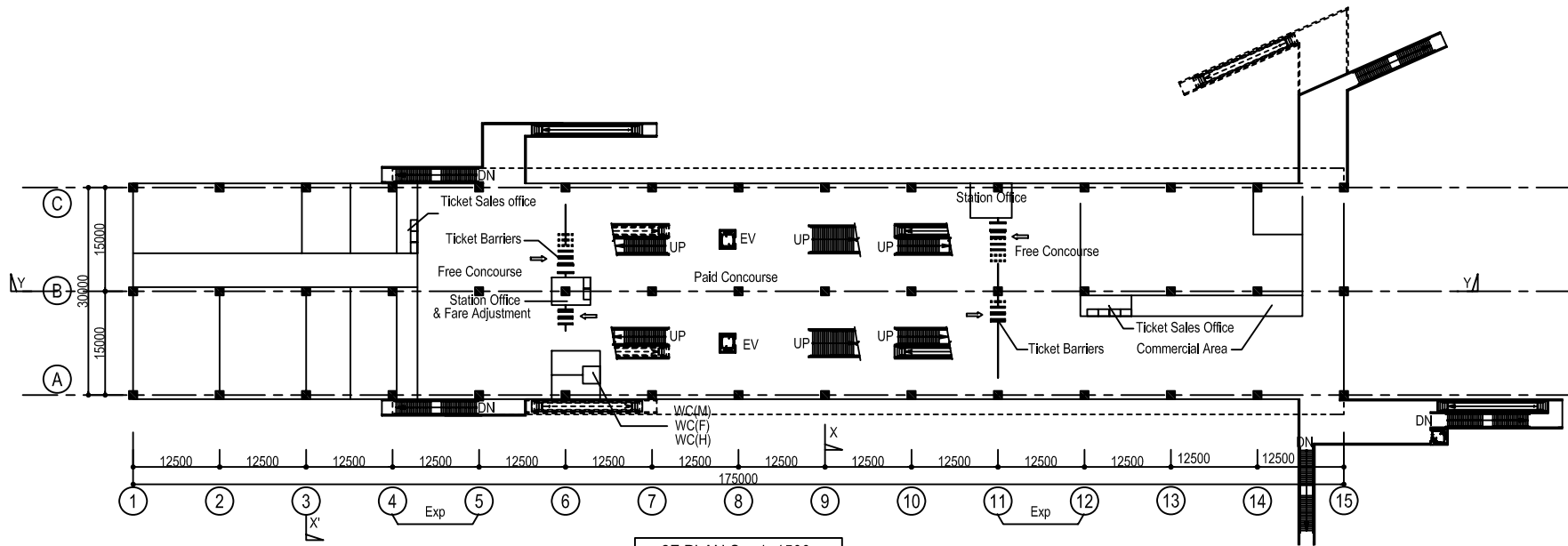
DRAWING NO.

8

TYPICAL PLAN ELEVATED STATION



3F PLAN S = 1:1500



2F PLAN S = 1:1500

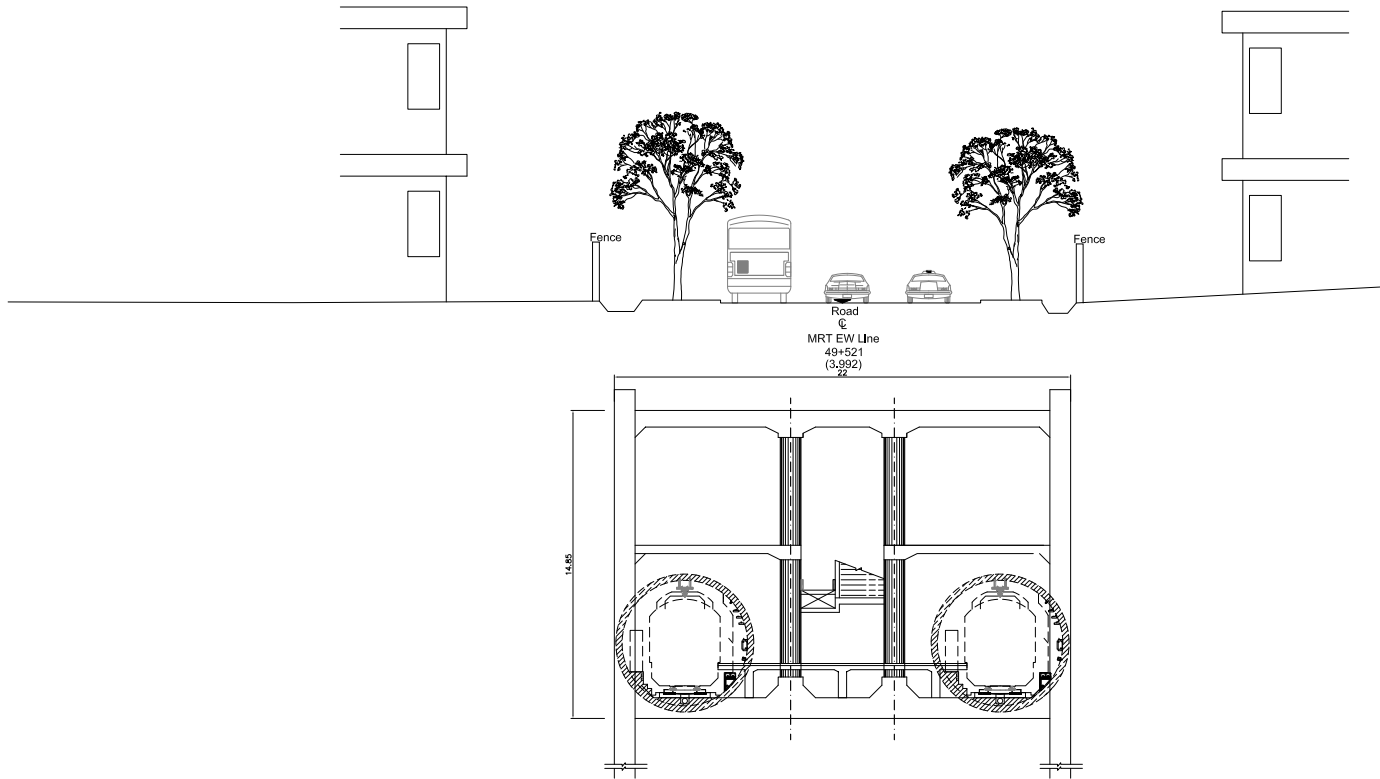
Appendix 4-9

REV. NO.	DATE	DESCRIPTION	BY	APPROVED

PREPARATORY SURVEY FOR JAKARTA  
 MASS RAPID TRANSIT (MRT)  
 EAST-WEST (E-W) LINE PROJECT

TITLE	TYPICAL PLAN ELEVATED STATION
DATE	December, 2011
DRAWING NO.	9

TYPICAL CROSS SECTION OF UNDERGROUND STATION



Appendix 4-10

REV. NO.	DATE	DESCRIPTION	BY	APPROVED

PREPARATORY SURVEY FOR JAKARTA  
 MASS RAPID TRANSIT (MRT)  
 EAST-WEST (E-W) LINE PROJECT

TITLE :

TYPICAL CROSS SECTION OF  
 UNDERGROUND STATION

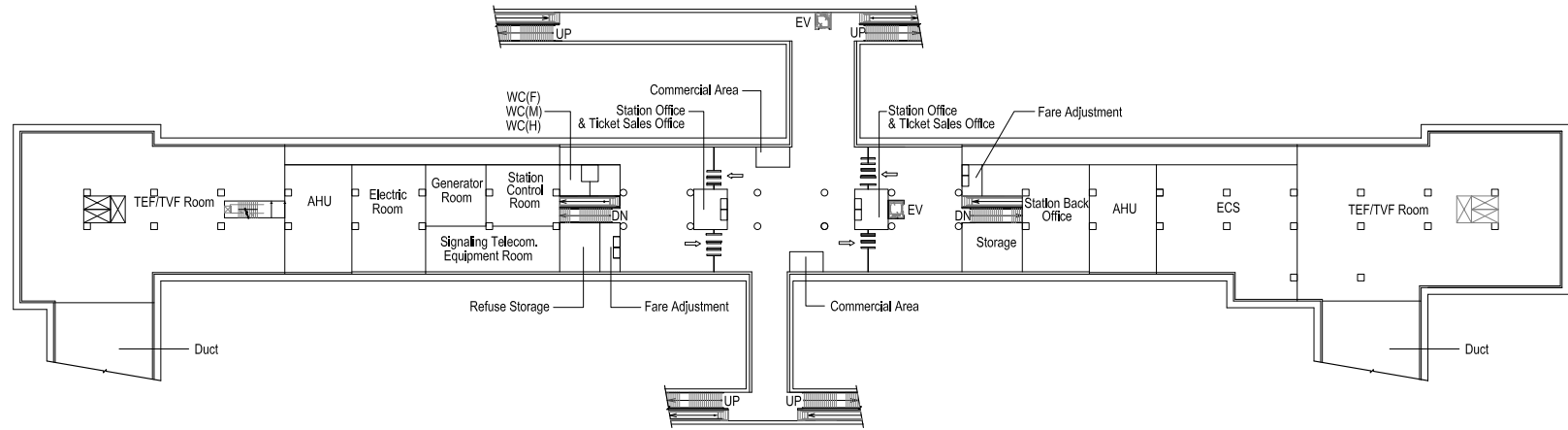
DATE :

December , 2011

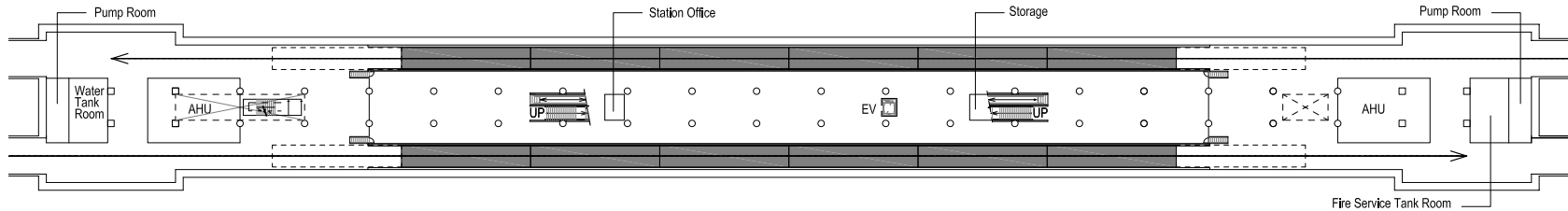
DRAWING NO.

10

TYPICAL PLAN OF UNDERGROUND STATION



CONCOURSE



PLATFORM

Appendix 4-11

PREPARATORY SURVEY FOR JAKARTA  
MASS RAPID TRANSIT (MRT)  
EAST-WEST (E-W) LINE PROJECT

TITLE :  
TYPICAL PLAN OF UNDERGROUND STATION

DATE :  
December , 2011

DRAWING NO.

11

REV. NO.	DATE	DESCRIPTION	BY	APPROVED

## **Appendix-5**

### **Voltage Drop Calculation**

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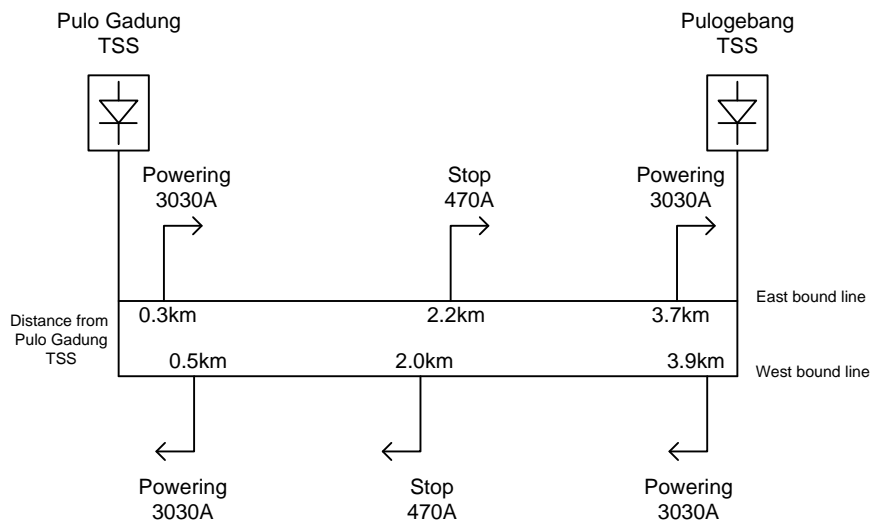
## Appendix-5: Voltage Drop Calculation

### [Voltage drop calculation on contact line]

The interval of adjacent two TSSs has to satisfy a condition that the contact line voltage exceeds the permissive minimum voltage. For the determination of TSS locations, the above-mentioned condition is to be confirmed by the voltage drop calculation on the contact line and between the most distant adjacent two TSSs under the severest conditions of train operation headway.

The calculation was done on the interval between Pulo Gadung TSS and Pulogebang TSS (4.2km) under the headway of 2:30 after 2027.

The train locations and current consumption of trains were assumed for the calculation as shown in Figure-1. The train locations and driving conditions (powering, coasting, breaking, and stop) of trains were derived from the run curve.



Source: JICA Study Team

**Figure-1 Assumptions for train location and current consumption between Pulo Gadung TSS and Pulogebang TSS**

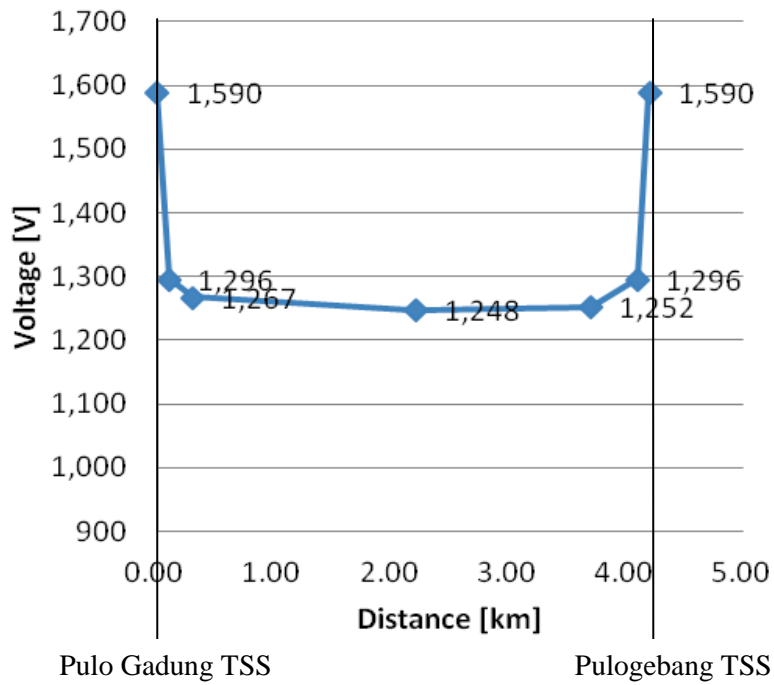
The other assumptions are as shown in Table-1. The permissive minimum voltage in the calculation, 1,100V was determined considering a margin though the permissive minimum voltage is 1,000V in IEC standard 60850.

**Table-1 Other assumptions in the voltage drop calculation**

Voltage regulation [%]	6.0
Rated voltage [V]	1,500
Rated capacity of rectifier[kW]	3,000
Permissive min. voltage [V]	1,100
No load voltage of TSS [V]	1,590
Combined resistance of contact wire and rail [Ohm/km]	00. 283

Source: JICA Study Team

The results of the voltage drop calculation between Pulo Gadung and Pulogebang TSS are as shown in Figure-2. It was confirmed that the TSS interval is acceptable because the minimum contact line voltage 1,246V is higher than the permissive minimum voltage.



Source: JICA Study Team

**Figure-2 Result of the voltage drop calculation between Pulo Gadung TSS and Pudogebang TSS**

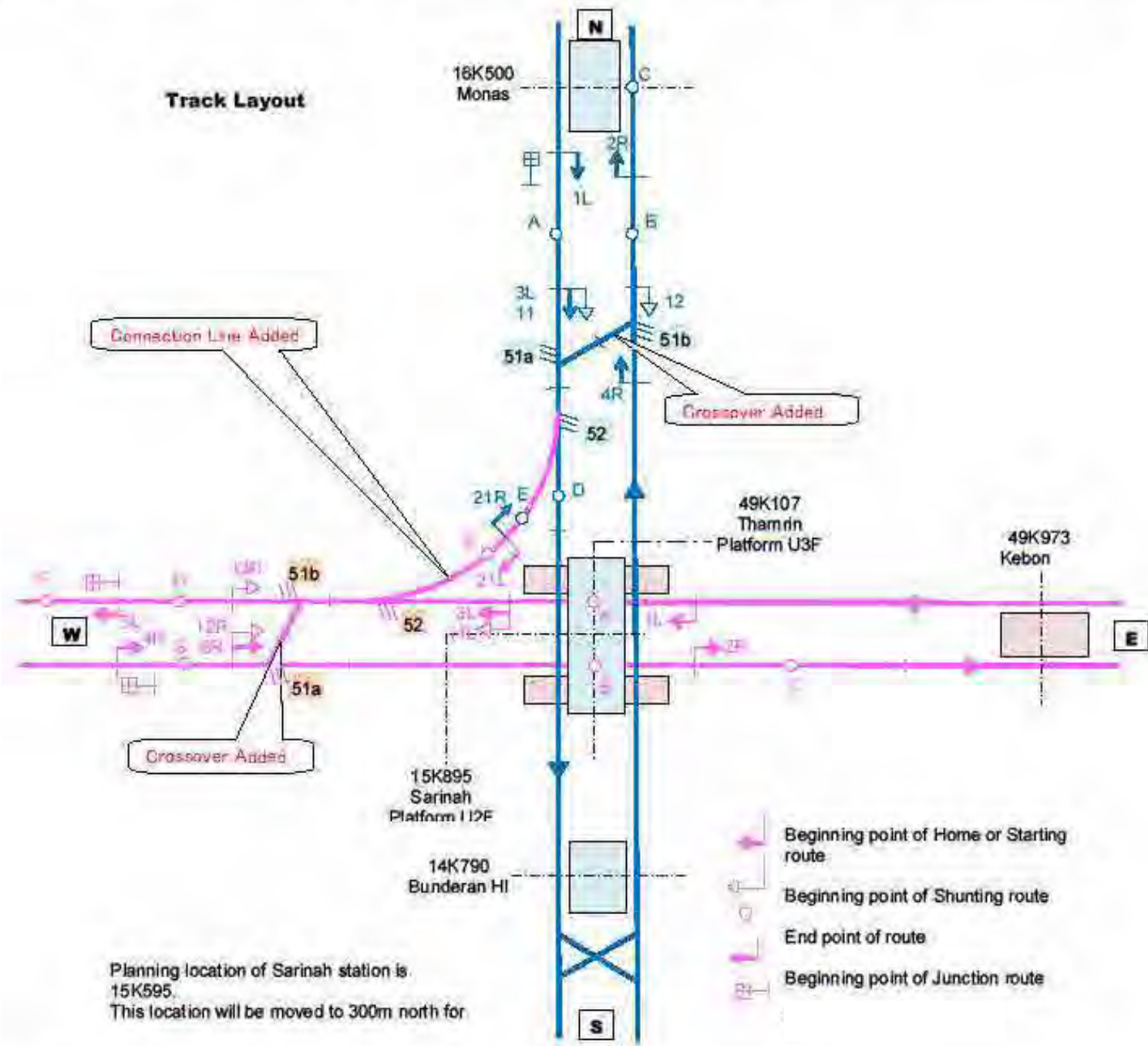
## **Appendix-6**

### **Connection Layout**

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**Track Layout and Route table of Two Level Crossing Section for East/West Line and North/South Line**



**Route Table**

Route Table for Thamrin Station (East-West Line)			Route Table for Cross Station of North-South Line		
Route		Comment	Route		Comment
Home Route	1LA		Home Route	1LA	
Starting Route	2RC		Starting Route	2RC	
	3LD	For transfer from N-S Line to E direction		3LD	
Home Route 1	4RG		Home Route	4RB	
Starting Route	5LF	For transfer from N-S Line to West direction	Shunting Route	11LE	For transfer to E-W Line 11LE and 12LE lock 21LD to Reverse.
	6RB			12LE	
Shunting Route	11LD	For transfer to N-S Line			
	12RE	For transfer to N-S Line. 12RE and			
	13RE	13RE lock 21RA and 21RB to Reverse			
Junction Route	21LD	21LD and 21LG are locked to reverse when 11LE and 12LE belonging to S/N are set.	Junction Route	21RA	21RA and 21RB are locked to reverse when Thamrin 13RE setting.
	21LG			21RB	

## **Appendix-7**

# **Environmental Checklist**

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## Appendix-7: Environmental Checklist

Category	Environmental Item	Main Check Items	Yes: Y No: N	Confirmation of Environmental Considerations (Reasons, Mitigation Measures)
1 Permits and Explanations	(1) EIA and Environmental Permits	<p>(a) Have EIA reports been already prepared in official process?</p> <p>(b) Have EIA reports been approved by authorities of the host country's government?</p> <p>(c) Have EIA reports been unconditionally approved? If conditions are imposed on the approval of EIA reports, are the conditions satisfied?</p> <p>(d) In addition to the above approvals, have other required environmental permits been obtained from the appropriate regulatory authorities of the host country's government?</p>	<p>(a)N</p> <p>(b)N</p> <p>(c)-</p> <p>(d)-</p>	<p>(a)The EIA Reports (ANDAL,RKL,RPL) are under preparation in accordance with the AMDAL procedures.</p> <p>(b)The EIA Reports (ANDAL,RKL,RPL) have been not approved by BPLHD, the Department of Environment in DKI Jakarta, due to no submission of the official letter from DGR.</p> <p>(c)It is not applicable</p> <p>(d)There is no additional environmental permission.</p>
	(2) Explanations to the Local stakeholders	<p>(a) Have contents of the project and the potential impacts been adequately explained to the Local stakeholders based on appropriate procedures, including information disclosure? Is understanding obtained from the Local stakeholders?</p> <p>(b) Have the comment from the stakeholders (such as local residents) been reflected to the project design?</p>	<p>(a)Y</p> <p>(b)Y</p>	<p>(a) The project was disclosed through newspaper, e.g. The public consultations of TOR-EIA were held during the EIA study. The participants including central governments, local authorities, community leaders and associations (bus operators, taxi companies, taxi drivers) were invited. And in the local level public consultation, local people who live in social boundary were noticed through publication of RT/RW. .</p> <p>(b) No strong negative comments were expressed on the project but the project description and methodology of TOR-EIA will be revised based on the comments. The participants' comments can generally be satisfied. Their comments were reflected in the EIA process.</p>

	(3) Examination of Alternatives	(a) Have alternative plans of the project been examined with social and environmental considerations?	(a)Y	(a)Yes, there are three alternative which has been considered in aspect of social environment to reduce the number of project affected persons.
2 Pollution Control	(1) Water Quality	(a) Is there a possibility that soil runoff from the bare lands resulting from earthmoving activities, such as cutting and filling will cause water quality degradation in downstream water areas?  (b) Do effluents from the project facilities, such as stations, comply with the country's effluent standards and ambient water quality standards? Is there a possibility that the effluents will cause areas not to comply with the country's ambient water quality standards?	(a)Y  (b)Y	(a) Yes, the soil excavation and earth moving for the construction work has possibility to cause water quality deterioration made by soil runoff. However, in the implementation plan on soil excavation, sheet pile work will be applied to avoid the possibility of landslide or disturbance of soil stability. Construction plan will be designed to prevent soil runoff during the Engineering Stage.  (b) Effluent from the project facilities will comply with the effluent standards by appropriate treatment methods such as wastewater treatment in the depots and on-site treatment system like other near buildings.
	(2) Wastes	(a) Are wastes generated from the project facilities, such as stations and depot, properly treated and disposed of in accordance with the country's regulations?	(a)Y	(a)Yes, there are wastes generated from the project facilities such as stations and depot but it will be properly treated and disposed by the support of cleansing department in accordance with the country's regulations.  During construction stage, the wastes of excavated soil will be produced in the construction work for the underground subway which will be monitored.
	(3) Noise and Vibration	(a) Do noise and vibrations from the vehicle and train traffic comply with the country's standards?	(a)No	(a)When considering impacts of noise and vibration from the Project, it is necessary to also consider the current road traffic and bus terminal operation along the Project route.  The current noise level (baseline) in sampling points is exceeding the allowed

				<p>noise standard grade (55dB for residence area, 65dB for office area, and 70dB for commercial area). And the noise level prediction of MRT and existing traffic is also beyond the noise level regulation.</p> <p>Mitigation measures to reduce impact noise and vibration during operation may include</p> <p>i) track with suitable noise mitigation procedure, ii) noise absorber on side wall, iii) long rail.</p>
	(4) Subsidence	(a) In the case of extraction of a large volume of groundwater, is there a possibility that the extraction of groundwater will cause subsidence (especially in case of Undergrounds/Subways)?	(a)Y	(a)Currently, the ground subsidence occur in DKI Jakarta. The extraction of large groundwater will also cause subsidence. During construction and operation stage, the monitoring of groundwater level as well as salinity and level of ground subsidence will be implemented by the contractor. If there are something, the countermeasure will be applied for the mitigation.
3 Natural Environment	(1) Protected Areas	(a) Is the project site located in protected areas designated by the country's laws or international treaties and conventions? Is there a possibility that the project will affect the protected areas?	(a)N	(a) There are no protected areas designated by the country's laws or international treaties and conventions around the project site.
	(2) Ecosystem	(a) Does the project site encompass primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats)? (b) Does the project site encompass the protected habitats of endangered species designated by the country's laws or international treaties and conventions? (c) If significant ecological impacts are anticipated, are adequate protection measures taken to reduce the impacts on the ecosystem?	(a)N (b)N (c)- (d)- (e)N (f)N	(a) There are no primeval forests, tropical rain forests, ecologically valuable habitats (e.g., coral reefs, mangroves, or tidal flats). (b) There are no protected habitats of endangered species designated by the country's laws or international treaties and conventions. (c) Above reasons, the project is not expected to cause ecological impacts. (d) Above reasons, it will be not necessary to take adequate protection measures to prevent impacts, such as disruption of migration routes, habitat fragmentation, and

	<p>(d) Are adequate protection measures taken to prevent impacts, such as disruption of migration routes, habitat fragmentation, and traffic accident of wildlife and livestock?</p> <p>(e) Is there a possibility that installation of rail roads will have impacts, such as destruction of forest, poaching, desertification, reduction in wetland areas, and disturbance of ecosystems due to introduction of exotic (non-native invasive) species and pests? Are adequate measures for preventing such impacts considered?</p> <p>(f) In cases the project site is located at undeveloped areas, is there a possibility that the new development will result in extensive loss of natural environments?</p>		<p>traffic accident of wildlife and livestock.</p> <p>(e) There are no possibility of destruction of forest, poaching, desertification, reduction in wetland areas, disturbance of ecosystems, e.g. because the project site is located in the urban area.</p> <p>(f) The project is located in the urban area so that there is no possibility of extensive loss of natural environments.</p>
(3) Hydrology	(a) Is there a possibility that alteration of topographic features and installation of structures, such as tunnels will adversely affect surface water and groundwater flows?	(a)N	(a)There is less possibility of alteration of topographic features because the train structures are constructed above and/or under ground. Tunnels are constructed by Shield Method so that disturbance of groundwater flows can be minimized.
(4) Topography and Geology	<p>(a) Is there a soft ground on the route that may cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides, where needed?</p> <p>(b) Is there a possibility that civil works, such as cutting and filling will cause slope failures or landslides? Are adequate measures considered to prevent slope failures or landslides?</p> <p>(c) Is there a possibility that soil runoff will result from cut and fill areas, waste</p>	<p>(a)Y</p> <p>(b)</p> <p>(c)</p>	<p>(a)The elevated structures will cross only some rivers and canals such as Banjir Canal or Ciliwung Riverl. Construction plan will be designed to prevent landslides during the Engineering Stage.</p> <p>(b)Civil works, such as cutting and filling will be planned in consideration to prevent slope failures of landslides.</p> <p>(c)It is planned to prevent soil runoff at cut and fill areas, waste soil disposal sites, and borrow sites during the Engineering Stage.</p>

		soil disposal sites, and borrow sites? Are adequate measures taken to prevent soil runoff?		
4 Social Environment	(1) Resettlement	<p>(a) Is involuntary resettlement caused by project implementation? If involuntary resettlement is caused, are efforts made to minimize the impacts caused by the resettlement?</p> <p>(b) Is adequate explanation on compensation and resettlement assistance given to affected people prior to resettlement?</p> <p>(c) Is the resettlement plan, including compensation with full replacement costs, restoration of livelihoods and living standards developed based on socioeconomic studies on resettlement?</p> <p>(d) Are the compensations going to be paid prior to the resettlement?</p> <p>(e) Are the compensation policies prepared in document?</p> <p>(f) Does the resettlement plan pay particular attention to vulnerable groups or people, including women, children, the elderly, people below the poverty line, ethnic minorities, and indigenous peoples?</p> <p>(g) Are agreements with the affected people obtained prior to resettlement?</p> <p>(h) Is the organizational framework established to properly implement resettlement? Are the capacity and budget secured to implement the plan?</p>	<p>(a)Y</p> <p>(b)Y</p> <p>(c)Y</p> <p>(d)Y</p> <p>(e)Y</p> <p>(f)Y</p> <p>(g)Y</p> <p>(h)Y</p> <p>(i)Y</p> <p>(j)Y</p>	<p>(a)A few hundreds of households are expected for involuntary resettlement. It is considered to reduce the number of resettlement at a minimum by selecting such route and design the locations of railway station and transition part of the underground or elevated railways during the planning stage. During operation, some houses and facilities affected during construction shall be rebuilt as a form of compensation.</p> <p>(b) Public consultation meetings will be conducted for the PAPs of land acquisition or resettlement.</p> <p>(c)The draft LARAP will be prepared with entitlement matrix. Proper compensation based on replacement cost and resettlement alternative are considered and proposed based on socioeconomic studies on resettlement in draft LARAP.</p> <p>(d)They are proposed in LARAP.</p> <p>(e)They are prepared in LARAP.</p> <p>(f) It pays particular attention to vulnerable groups or people.</p> <p>(g)The agreement with the PAP will be obtained prior to resettlement.</p> <p>(h)The organization framework will be proposed in LARAP, namely, i) implementing institution for land</p>

	<p>(i) Are any plans developed to monitor the impacts of resettlement?</p> <p>(j) Is the grievance redress mechanism established?</p>		<p>procurement , ii) responsibility institution for financing, and iii) working team for resettlement and assistance.</p> <p>(i)The monitoring mechanism are proposed in LARAP.</p> <p>(j)The grivance redress mechanism are proposed in LARAP.</p>
(2) Living and Livelihood	<p>(a) Where railways are newly installed, is there a possibility that the project will affect the existing means of transportation and the associated workers? Is there a possibility that the project will cause significant impacts, such as extensive alteration of existing land uses, changes in sources of livelihood, or unemployment? Are adequate measures considered for preventing these impacts?</p> <p>(b) Is there any possibility that the project will adversely affect the living conditions of inhabitants other than the affected inhabitants? Are adequate measures considered to reduce the impacts, if necessary?</p> <p>(c) Is there any possibility that diseases, including infectious diseases, such as HIV will be brought due to immigration of workers associated with the project? Are adequate considerations given to</p>	<p>(a)N</p> <p>(b)N</p> <p>(c)Y</p> <p>(d)Y</p> <p>(e)N</p> <p>(f)N</p>	<p>(a)Basically, existing transportation system, such as buses, taxis, private vehicles, are continued to be operated. Therefore impact to transportation can be minimized. Meanwhile it will be necessary to study the necessity and possibility of busway operation. There is less possibility of significant impacts, such as extensive alteration of existing land uses, changes in sources of livelihood, or unemployment because of small scale of landuse on the private land. Adequate measures will be planned in the LARAP Study if necessary.</p> <p>(b)There is less possibility that the project will adversely affect the living conditions of inhabitants other than the affected inhabitants.</p> <p>(c)There could be risks due to infectious disease but this will be temporary during construction, and can be managed by educating the workers.</p> <p>(d)Regarding impact on public transportation, especially the</p>



		<p>public health, if necessary?</p> <p>(d) Is there any possibility that the project will adversely affect road traffic in the surrounding areas (e.g., by causing increases in traffic congestion and traffic accidents)?</p> <p>(e) Is there any possibility that railways will impede the movement of inhabitants?</p> <p>(f) Is there any possibility that structures associated with railways (such as bridges) will cause a sun shading and radio interference?</p>		<p>dedicated lane for buses, it is planned to continue existing service by temporarily transferring the lane during MRT construction.</p> <p>During the operation, the access to public transportation will be improved as MRT starts its operations.</p> <p>(e) Most of the railway lines are constructed as either elevated or underground, and thus, community division is not expected.</p> <p>(f) The elevated structures may cause a sun shading, however, this impact is not seriously perceived because elevated structures are not comparatively tall so that affected area is not so wide. There is no possibility of radio interference because DC power source will be used for MRT driving.</p>
4 Social Environment	(3) Heritage	(a) Is there a possibility that the project will damage the local archeological, historical, cultural, and religious heritage? Are adequate measures considered to protect these sites in accordance with the country's laws?	(a)Y	(a) The information of historical buildings around the project area is not clear though there is no cultural heritage in ROW.
	(4) Landscape	(a) Is there a possibility that the project will adversely affect the local landscape? Are necessary measures taken?	(a)Y	(a) It is expected not to adversely affect the local landscape, considering to design elevated structures to harmonize with the landscape. It will be necessary to take replantation in accordance with city reforestation and beautification programs.
	(5) Ethnic Minorities and Indigenous Peoples	<p>(a) Are considerations given to reduce impacts on the culture and lifestyle of ethnic minorities and indigenous peoples?</p> <p>(b) Are all of the rights of ethnic minorities and indigenous peoples in relation to land and resources</p>	<p>(a)N</p> <p>(b)N</p>	<p>(a) There are no ethnic minorities and indigenous peoples living around the project site.</p> <p>(b) ditto</p>

		respected?		
	(6) Working Condition s	<p>(a) Is the project proponent not violating any laws and ordinances associated with the working conditions of the country which the project proponent should observe in the project?</p> <p>(b) Are tangible safety considerations in place for individuals involved in the project, such as the installation of safety equipment which prevents industrial accidents, and management of hazardous materials?</p> <p>(c) Are intangible measures being planned and implemented for individuals involved in the project, such as the establishment of a safety and health program, and safety training (including traffic safety and public health) for workers etc.?</p> <p>(d) Are appropriate measures taken to ensure that security guards involved in the project not to violate safety of other individuals involved, or local residents?</p>	<p>(a)N</p> <p>(b)Y</p> <p>(c)Y</p> <p>(d)Y</p>	<p>(a)The project proponent is not violating any laws and ordinances associated with them.</p> <p>(b) They will be planned.</p> <p>(c) They will be planned and implemented.</p> <p>(d) They will be planned and taken.</p>
5 Others	(1) Impacts during Construct ion	<p>(a) Are adequate measures considered to reduce impacts during construction (e.g., noise, vibrations, turbid water, dust, exhaust gases, and wastes)?</p> <p>(b) If construction activities adversely affect the natural environment (ecosystem), are adequate measures considered to reduce impacts?</p> <p>(c) If construction activities adversely affect the social environment, are</p>	<p>(a)Y</p> <p>(b)Y</p> <p>(c)Y</p> <p>(d)Y</p>	<p>(a) Adequate mitigation measures will be considered for noise and vibration such as the selection appropriate construction method and equipment for the lower noise and vibration level and installation of sound barrier and for air quality of the cover of the roof rack of the truck and spray water on ground in the construction site and proper handling of generated waste.</p> <p>(b) There is no significant adverse impact for natural environment but the tree</p>

	<p>adequate measures considered to reduce impacts?</p> <p>(d) If the construction activities might cause traffic congestion, are adequate measures considered to reduce such impacts?</p>		<p>re-planting will be considered to mitigate the tree-cut during the construction period</p> <p>(c) The social impact by involuntary resettlement due to land acquisition will be compensated by appropriate compensation procedure as well as the mitigation of health and safety issues such as public health or accident during construction stage .</p> <p>(d) Traffic management plan including road diversion or the control of mobilization hours</p>
(2) Monitoring	<p>(a) Does the proponent develop and implement monitoring program for the environmental items that are considered to have potential impacts?</p> <p>(b) What are the items, methods and frequencies of the monitoring program?</p> <p>(c) Does the proponent establish an adequate monitoring framework (organization, personnel, equipment, and adequate budget to sustain the monitoring framework)?</p> <p>(d) Are any regulatory requirements pertaining to the monitoring report system identified, such as the format and frequency of reports from the proponent to the regulatory authorities?</p>	<p>(a)Y</p> <p>(b)Y</p> <p>(c)Y</p> <p>(d)Y</p>	<p>(a) The proposed monitoring in the EIA Reports are 1) Noise and Vibration (measurement of noise and vibration), 2) Air Quality (NO<sub>2</sub>, SO<sub>2</sub>,CO,TSP,Pb), 3) Water Quality (BOD, COD, heavy metal, etc), Waste (observation of construction site conditions, soil contamination test of excavated material. etc)</p> <p>(b) Monitoring items, method and frequency will be determined by a detailed monitoring program to be prepared by a consultant during the Engineering Stage.</p> <p>(c) DGR and DKI Jakarta Government confirmed that they will develop a system, including a responsible agency, for environmental management/monitoring.</p> <p>(d) A consultant shall be hired under the JICA Loan to prepare a detailed monitoring program, based on the RPL. The program should be prepared in such formats commonly as applicable to reporting to JICA and the local relevant governmental agencies.</p>

6 Note	Reference to Checklist of Other Sectors	(a) Where necessary, pertinent items described in the Forestry Projects checklist should also be checked (e.g., projects including large areas of deforestation).  (b) Where necessary, pertinent items described in the Power Transmission and Distribution Lines checklist should also be checked (e.g., projects including installation of power transmission lines and/or electric distribution facilities).	(a)N (b)N	(a) The project does not generate huge deforestation.  (b) Not applicable to the Project.
	Note on Using Environmental Checklist	(a) If necessary, the impacts to transboundary or global issues should be confirmed, if necessary (e.g., the project includes factors that may cause problems, such as transboundary waste treatment, acid rain, destruction of the ozone layer, or global warming).	(a)Y	(a)The project can contribute to mitigate global warming because of reduction of traffic volume and CO2 emission. There is no other transboundary issues in this project.

1) Regarding the term "Country's Standards" mentioned in the above table, in the event that environmental standards in the country where the project is located diverge significantly from international standards, appropriate environmental considerations are required to be made.

In cases where local environmental regulations are yet to be established in some areas, considerations should be made based on comparisons with appropriate standards of other countries (including Japan's experience).

2) Environmental checklist provides general environmental items to be checked. It may be necessary to add or delete an item taking into account the characteristics of the project and the particular circumstances of the country and locality in which it is located.

## **Appendix-8**

### **Procedure of Estimation of GHG Reduction Amount**

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## Appendix-8: Procedure of Estimation of GHG Reduction Amount

### [Steps for Estimation of GHG Reduction Amount]

For the estimation, the following existing methodologies were referred.

- CDM methodologies ACM0016: Baseline Methodology for Mass Rapid Transit Projects
- JICA Climate Finance Impact Tool/ for Mitigation and Adaptation Draft Ver. 1.0

“CDM methodologies ACM0016: Baseline Methodology for Mass Rapid Transit Projects” is a methodologies for estimating effectiveness on GHG emission reduction by modal shift from existing transportation mode to MRT, which was approved by UNFCCC in October 2009.

The methodology can be referred by the following URL.

<http://cdm.unfccc.int/methodologies/DB/8PBZENI1PK0QIJW8RJ5LEDXV6WX600>

“JICA Climate Finance Impact Tool/ for Mitigation and Adaptation Draft Ver. 1.0” was prepared for evaluation of projects effectiveness on GHG emission reduction when JICA plans and implements a project for adaptation or mitigation of impacts by climate change in April 2011.

The tool can be referred by the following URL.

[http://www.jica.go.jp/english/operations/climate\\_change/mitigation.html](http://www.jica.go.jp/english/operations/climate_change/mitigation.html)

GHG reduction amount was estimated for operation of MRT East-West line in Phase I section in 2020. Number of daily passengers used for estimation was 386,200 which is a base case in 2020.

GHG emissions reduction by operation of MRT East-West line is calculated as the difference of GHG emissions amount between a case named “Baseline Emission” that the MRT East-West line will not be constructed and operated and existing transportation mode, such as private passenger car, motor cycle and bus, will be utilized continuously and another case named “Project Emission” that expected modal shift will be realized by the Project. The basic equation for estimation of GHG emission reduction is shown below.

$$ER_y = BE_y - PE_y \quad (\text{t-CO}_2/\text{y})$$

**$ER_y$**  : GHG emissions reduction by operation of MRT East-West Line in year  $y$  (t-CO<sub>2</sub>/y)

**$BE_y$**  : GHG emissions without construction and operation of MRT East-West line in year  $y$  (t-CO<sub>2</sub>/y) (Baseline emissions)

**$PE_y$**  : GHG emissions after realization of expected modal shift by construction and operation of MRT East-West line in year  $y$  (t-CO<sub>2</sub>/y) (Project emissions)

The following sections explains the procedure for calculation of GHG reduction amount adopted in the Survey.

### [Estimation of Baseline Emission]

The baseline emission, in case that existing transport mode would cover a number of expected passengers transported by MRT East-West line, was estimated by the following equation with prospected ratio of passengers using each transportation mode driven in the case mentioned above, and respective CO<sub>2</sub> emission factors per passenger:

$$BE_y = \sum_i (EF_{P,i,y} \times P_{PJ,i,j})$$

Items	Description
$BE_y$	Baseline emissions: without construction and operation of MRT East-West line in year $y$ (gr-CO <sub>2</sub> /y)
$EF_{P,i,y}$	CO <sub>2</sub> emission factor per passenger for vehicle category $i$ in year $y$ (gr-CO <sub>2</sub> /passenger)
$P_{PJ,i,y}$	Annual number of passengers transported by vehicle category $i$ if MRT East-West line is not operated.

### CO<sub>2</sub> Emission Factor per Passenger by Each Vehicle Category in 2020

CO<sub>2</sub> emission factors per passenger by each vehicle type was calculated by the following equation, with average trip distance and average occupational rate by each vehicle type, and CO<sub>2</sub> emission factors per km driven by each vehicle category:

$$EF_{P,i,y} = \frac{EF_{KM,i} \times TD_i}{OC_i}$$

$EF_{KM,i}$  : CO<sub>2</sub> emission factor per km driven by vehicle category  $i$  by each person (gr-CO<sub>2</sub>/km)

$TD_i$  : Average trip distance by vehicle category  $i$  (km/vehicle)

$OC_i$  : Average occupancy rate by vehicle category  $i$  (person/vehicle)

### CO<sub>2</sub> Emission Factor per km by Each Vehicle Category by Each Person

$EF_{KM,i}$  was calculated by the following formula:

$$EF_{KM,i} = \sum_x \left[ \frac{1}{SEC_{x,i}} \times EF_{CO_2,x} \times \left( \frac{N_{x,i}}{N_i} \right) \right]$$

$EF_{KM,i}$  : CO<sub>2</sub> emission factor per km driven by vehicle category  $i$  by each person (gr-CO<sub>2</sub>/km)

$SEC_{x,i}$  : Specific fuel consumption per vehicle category  $i$  (km/L)

$EF_{CO_2,x}$  : CO<sub>2</sub> emission factor of fuel category  $x$  (gr-CO<sub>2</sub>/L)

$N_{x,i}$  : Number of vehicle category  $i$  using fuel category  $x$  (vehicle)

$N_i$  : Number of vehicle category  $i$  (vehicle)

Specific fuel consumption rates for each existing vehicle category were estimated considering average trip-speed based on SITRAMP and information collected by Jakarta Mass Rapid Transit South-North Line Project, as shown in Table-1.

**Table-1 Specific Fuel Consumption Rate for Each Vehicle Category**

Unit: L/km

Vehicle Category	Specific Fuel Consumption
Passenger car	0.118
Motorcycle	0.033
Large Bus	0.575
Medium Bus	0.283
Small Bus	0.167
BRT	0.575

Note: BRT diverts its fuel from compressed natural gas to diesel oil from the end of 2012. Therefore, specific fuel consumption of BRT is set as same value with large bus.

Source: The Preparatory Survey for Jakarta Mass Transit System North-South Line Extension Project

Regarding CO<sub>2</sub> emission factor by fuel category, CO<sub>2</sub> emission factors described in the CDM methodology AM 0031, Baseline Methodology for Bus Rapid Transit Projects, and JICA Climate Finance Impact Tool/ for Mitigation and Adaptation Draft Ver. 1.0 were adopted for estimation of GHG emission reduction in the Study,. The figures of emission factors are shown in Table-2.

**Table-2 CO<sub>2</sub> Emission Factor by Type of Fuel**

Unit: gr-CO<sub>2</sub>/L

Type of Fuel	2021	2024	2027	2041
Gasoline	2,313	2,222	2,156	2,092
Diesel Oil	2,661	2,556	2,480	2,407

Source: CDM Methodology AM0031, JICA Climate Finance Impact Tool/ for Mitigation and Adaptation Draft Ver. 1.0

The ratio of a certain fuel using by each vehicle category was set as shown in Table-3.

**Table-3 Ratio of Fuel Used for Each Vehicle Category**

Type of Fuel	Passenger Car	Motorcycle	Bus
Gasoline	1.0	1.0	-
Diesel Oil	-	-	1.0

Source: JICA Study Team

The calculated CO<sub>2</sub> emission factors per passenger per km by each vehicle category are shown in Table-4.

**Table-4 Ratio of Fuel Used for Each Vehicle Category**

Unit: gr-CO<sub>2</sub>/km

Vehicle Category	2021	2024	2027	2041
Passenger car	273	262	254	247
Motorcycle	76	73	71	69
Bus	909	873	847	822

Note: CO<sub>2</sub> emission factor per passenger per km of bus was set as average of large bus, medium bus and small bus.

Source: JICA Study Team



### Average Trip Distance by Each Vehicle Category

Average trip distance by each vehicle category by each person was calculated based on the demand forecast result of a case without Project in 2020. Vehicle category was divided into four (4) groups, such as passenger car, motorcycle, bus and BRT. The following equation was used for calculation.

$$AD_i = TD_i / NT_i$$

$AD_i$ : Average trip distance by vehicle category  $i$  (km)

$TD_i$ : Total distance driven by vehicle category  $i$  (km)

$NT_i$ : Number of trip by vehicle category  $i$

The calculated average distances driven by each vehicle category are shown in Table-5.

**Table-5 Average Trip Distance by Each Vehicle Category**

				Unit: km
Vehicle Category	2021	2024	2027	2041
Passenger car	14.7	14.9	15.0	15.2
Motorcycle	16.6	16.6	16.7	16.7
Bus	8.3	8.3	8.3	8.3

Source: JICA Study Team

### Average Occupancy Rate by Each Vehicle Category

Average occupancy rate by each vehicle category was set as Table-6, based on the information in “The Preparatory Survey for Jakarta Mass Transit System North-South Line Extension Project”.

**Table-6 Average Occupancy Rate by Each Vehicle Category**

Vehicle Category	Average Distance Driven
Passenger car	1.2
Motorcycle	1.2
Bus	27.1
BRT	22.3

Note: Average occupation rate of bus was set as average of large bus, medium bus and small bus.

Source: The Preparatory Survey for Jakarta Mass Transit System North-South Line Extension Project

### Annual Number of Passengers Transported by Each Vehicle Category If MRT East-West Line Is Not Operated

Annual number of passengers transported by each vehicle category after operating of MRT East-West line was calculated based on the interview survey results on willing-to-pay survey for MRT East-West line. Table-7 shows the results of willing-to-pay survey.

**Table-7 Results of Willing-to-Pay Survey**

Existing Transportation Mode	Total Number of Interviewee	Number of Interviewee Answered		
		When MRT East-West line is operated, I will use it usually	When MRT East-West line is operated, I will use sometimes	Even though MRT East-West line is operated, I will not use
Passenger car	279	108	164	7
Motorcycle	195	83	110	2
Bus	71	42	29	0
BRT	384	244	140	0
Train	213	170	42	1

Source: JICA Study Team

Based on the survey results, by each transportation mode, ratio of transportation mode shifting to MRT East-West line with total number of expected passengers was estimated. The estimated result is shown in Table-8.

**Table-8 Ratio of Transportation Mode Shifting from Existing Mode to MRT East-West Line**

Unit: %

Existing Transportation Mode	Ratio
Passenger car	17.5
Motorcycle	18.2
Bus	20.4
BRT	21.0
Train	23.0
Total	100.0

Note: Number of daily passenger is 386,200.

Source: JICA Study Team

### [Estimation of Project Emission]

Project emissions are calculated by multiplying the total annual electricity consumption by MRT East-West line with the CO<sub>2</sub> emission factor of electricity. The equation is shown as follows:

$$PE_y = TC_y \times EF_{CO_2,x}$$

Type	Item	Description
Output	$PE_y$	Project emissions : GHG emissions after realization of expected model shift by construction and operation of MRT East-West line in year y (t-CO <sub>2</sub> /y)
Input	$TC_y$	Total annual electricity consumption of MRT East-West line (kWh/y)
	$EF_{CO_2,x}$	CO <sub>2</sub> emission factor of electricity (gr-CO <sub>2</sub> /kWh)

### Total Annual Electricity Consumption of MRT East-West Line

The total electricity consumption of MRT East-West line was estimated by the following equation with electricity consumption rate and total annual trip distance of MRT East-West line:

$$TC_{et,y} = DD_y \cdot SEC_{et,y}$$

$SEC_{et,y}$  : Electricity consumption rate (kWh/km)

$DD_y$  : Total annual trip distance (train km/y)

Based on the design of MRT East-West line, electricity consumption rate and total annual trip distance were set as shown in Table-9.

**Table-9 Electricity Consumption Rate and Total Annual Trip Distance of MRT West-West Line**

Operation	Year	Electricity Consumption Rate per One Train Set (kWh/km)	Total Annual Trip Distance (km/year)
Operation in Phase I Section	2021	12.26	1,935,062
	2024	12.26	3,056,124
Operation in Phase I and Phase II Section	2027	12.26	15,520,394
	2041	12.26	15,520,394

Source: JICA Study Team

### CO<sub>2</sub> emission factor of electricity

Indonesian government publicize CO<sub>2</sub> emission factors of grid electricity by several areas in Indonesia. For estimation of GHG reduction amount in the Study, an emission factor on combined margin of JAMARI grid electricity was adopted. The emission factor is shown in Table-10.

**Table-10 Adopted Emission Factor of Grid Electricity**

Grid	Emission Factor (tCO <sub>2</sub> /MWh)
JAMALIGrid	0.713

Note: Ex-post emission factor was adopted.

Source: <http://pasarkarbon.dnpi.go.id/web/index.php/dnacdm/read/20/emission-factors-for-jawa-madura-bali-electricity-grid-jamali-2010-.html>

### [Estimation Result of GHG Reduction by the Project]

As a result of calculation based on the estimation procedure shown in the above section, expected reduction amount of GHG emission was estimated as approximately ~~11000,0900~~ 11000,0900 ton-CO<sub>2</sub>/year by operation of MRT East-West line in the Phase I section in 2020 as shown in Table-11.

**Table-11 Adopted Emission Factor of Grid Electricity**

Unit: ton-CO<sub>2</sub>/year

Operation	Year	Daily passenger	GHG Emission Reduction Amountt by the Project (a) – (b)	Baseline Emissions (a)	Proeject Emissions (b)
Operation in Phase I Section	2021	252,629	110,000	127,000	17,000
	2024	405,524	180,000	207,000	27,000
Operation in Phase I and Phase II Section	2027	1,181,329	515,000	651,000	136,000
	2041	1,227,624	546,000	682,000	136,000

Note: In case that MRT East-West line is operated only in the Phase I section, same train operation plan is adopted in 2020 and 2027. Therefore, estimated project emissions were same figure in 2020 and 2027.

Source: JICA Study Team