MINISTRY OF MEGAPOLIS AND WESTERN DEVELOPMENT
DEMOCRACTIC SOCIALIST REPUBLIC OF SRI LANKA

PREPARATORY SURVEY
ON
THE PROJECT FOR ESTABLISHMENT
OF
NEW LIGHT RAIL TRANSIT SYSTEM
IN
COLOMBO

FINAL REPORT

APPENDIX I

MAY 2018

JAPAN INTERNATIONAL COOPERATION AGENCY

Oriental Consultants Global Co., Ltd.
Japan International Consultants for Transportation Co., Ltd.
Tonichi Engineering Consultants, Inc.
Environmental Resource Management
ERM Japan Ltd.

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Appendix 1

1. **MM of the First Steering Committee Meeting**
2. **MM of the First Steering Committee Meeting**
3. **MM of the Second Steering Committee Meeting**
4. **MM of O&M Working Group**

Minutes

of

the First Steering Committee Meeting

for

Preparatory Study on The Project

for

Establishment of New Light Rail Transit System

in

Colombo

(Colombo Light Rail [CLR])

Colombo, July 26th 2017

Eng. Chaminda Ariyadasa
Project Director,
Project Management Unit
Lite Rail Transit Project (JICA),
Ministry of Ministry of Megapolis
and Western Development

Yoshihisa ASADA
Team Leader
JICA Study Team

The First Steering Committee (hereinafter referred to as "S/C") meeting for "Preparatory Study on The Project for Establishment of New Light Rail Transit System in Colombo" (hereinafter referred to as "the F/S") was held on July 18th 2017. The meeting was chaired by Nihal Rupasingle, Secretary, Ministry of Megapolis and Western Development (hereinafter referred to as "MMWD"). List of attendees is attached as Annex 1.

In the welcome speech, Project Director (hereinafter referred to as "PD"), Eng. Chaminda Ariyadasa, echoed the objectives of the S/C with 33 members invited, and request constructive inputs and suggestions from S/C member to enrich the planning of the CLR which is first urban rail-based transit in Colombo. He also explained that this F/S is financially and technically supported by JICA for the preparation for further discussion on the Japanese ODA Loan under the Special Term for Economic Partnership (STEP).

Secondary, Secretary of MMWD, Eng. Nihal Rupasinghe, addressed that this CLR is the one of potentials to create and change landscapes within Colombo Metropolitan region dramatically so that member of S/C is to plays quite important roles to formulate appropriate plans for CLR. He also mentioned that other routes of Rapid Transit System (RTS) will be noticed for Request for Proposal (RFP) for other funding resources. However, he said this CLR is the most important project among RTS network supported by JICA.

Following above remarks, Director of South Asia Department JICA H.Q., Ms. Kamei, stated her expectations that this project shall be well-coordinated among stakeholders, especially by the contributions from the S/C members.

Then, PD made the presentation of outline of the F/S as well as current progress and issues in line with the presentation material which is attached as Annex-2. Also route map with A3 sizes are distributed to S/C member which is attached as Annex-3. The items presented are as follows;

- Current progress of administration, social & environmental items with showing EIA/SEIA schedule as well as planning & operation with schedule,
- Light Rail Transit (LRT) route and structure (proposed route, design principle, connectivity, recommended structure) with showing all of route/alignment by Google Earth data,
- LRT depot (example of depot in Japan, proposed location, tentative depot plan, maintenance system, impacts from depot),
- Concerns and issues (alignment options in concerned locations, especially additional requested route from MMWD),
- Summary and future discussion with items,
- Business model for operation and maintenance, preliminary construction packages, and tentative implementation plan.

PD stated that the public engagement meetings were successfully completed with almost 90% land owners is willing to provide their land to the project. Also, he explained that special treatment for land compensation, such as LARC/Super LARC was proposed to the Cabinet Meeting recently.

After PD's explanation, the Team Leader for JICA Study Team (hereinafter referred to as "JST"), Mr. ASADA, presented the contents of the Interim Report (ITR) and major topics on each chapter. He also explained deeply the Study Team's understandings and evaluation results to the additional request for route study by MMWD in the basis of comprehensive views such as i) passenger demand, ii) social aspect (catchment of colleges, employment area, zonal indications such as employment population), iii) inter-modal connectivity and iv) other aspects (technical difficulties, social &

environmental considerations and construction costs). The S/C members are requested to evaluate the route study based on the evidences described in 3.6.2 in the ITR.

After these two presentations, the short video which introduces the CLR at the public engagement meetings was projected to the S/C members.

Comments and Input to the Study Team

The main points of discussion in the 1st Steering Committee meeting are summarized as following:

CEB (Ceylon Electricity Board) clarified which transmission line is required 132 kV or 33 kV for CLR. The Study team responded that 132 kV transmission lines are required to receive the power at Receiving Sub-Station (RSS) at three locations.

NWS&DB (National Water Supply & Drainage Board) requested for further discussions for their utilities on the route. The PD explained that the nominations for dedicated officers from NWS&DB were already requested officially, so that Project Management Unit (PMU) would like to have several meetings with relevant officers.

MOT (Ministry of Transport) questioned on the reasons for disconnection between Town Hall and Kollupitiya directly. JST responded that the main reason is the concept of expanding RTS network in future, and the other reasons are summrised in 3.6.1 of ITR.

CMC (Colombo Municipality Council) asked whether or not LRT route should pass through Port City development area. The Secretary of MMWD answered that the public transport system in the Port City shall be invested by Port City itself with its own budget, and it will be connected with Fort/Pettah station. Additionally, CMC requested that locations of elevated track, column, and effected buildings should be shared as soon as possible because shifting of utility cables should be required, and there are some plans to install utilities into underground. CMC told that some of cables are under centre of road. PD stated that working group will be started to share information and have more discussion on this issue.

RDA (Road Development Agency) raised a question regarding on intersection between elevated expressway and LRT on Denzil Kobbekaduwa Mw.. The PD explained that the list provided by National Planning Department (NPD) as the candidate projects to be considered in the F/S does not include this section of elevated expressway. In addition, this expressway is almost on the Thalangama EPA (Environmental Protection Area) which is also an issue at the moment.

MOT suggested communicating with various organizations for their consultation such as CEMA as CoMTrans/SKYTRAIN did. PD stated that monthly meeting has been done to report to Adviser to Prime-minister, Mr. Paskaralingam, and presented at CCEM (Cabinet Committee on Economic Management) which are more high ranked consultation process.

Department of Agrarian Service advised for planning of depot and its land acquisition, which should be implemented together with his department.

CEB/CMC pointed out that there is lack of skill labors at this moment, especially for this project as a large-scale civil construction.

JICA requested following points to S/C members and MMWD with the consultation of ITR;

- Regarding the route study, such as Alt.-1 and Alt.-3, JICA strongly requests S/C member to provide the opinion which alternative is fine, and GoSL to decide final one with S/C's consultation as soon as possible to conduct F/S into the Stage-2.
- Deadline to submit comment on Interim Report was announced on 26th July 2017 to PMU.
- Regarding O&M scheme, it should be discussed by not only MMWD by themselves, but also by wider stakeholders for more intensive discussions. JICA proposed that MMWD shall set up the WG for O&M with participation from ERD and NPD and others.
- JICA announced that the study tour in Japan will be conducted in September 2017, so that key persons to implement this project and to operate CLR are welcomed to join this study tour.

Finally, the PD requested S/C members to submit comments on ITR in not later than 26th July 2017 because PMU would like to report the results of S/C with comments on the monthly review meeting to Mr. Paskaralingam scheduled on 28th July 2017.

[END]

1st Steering Committee Meeting
Light Rail Transit (LRT) Project – JICA
18th of July 2017, 2.30 pm at "Suhurupaya", 17th Floor, Conference Room

Attendees List

No	Institute	Original Invitee as of Chapter 1 Table 1.4 of Interim Report	1st Steering Committee Meeting			
			Name of the Attendee	Designation	Contact Number	E-mail
1	Ministry of Megapolis and Western Development	Secretary	Eng. Nihal Rupasinghe	Secretary	011-2862412	secretarymmwd@gmail.com
2	Ministry of Land	Secretary	Piumi Athugalle	Assistant Secretary	077-2003853	asbim@landmin.gov.lk dpnatty@gmail.com
3	Ministry of Transport and Civil Aviation (MOT)	Secretary	J.M. Thilakarathna Banda	Additional Secretary	071-4410568	Jmtb2007@gmail.com
4	Ministry of Highway & Higher Education	Secretary	D.D. Matharaarachchi	Senior Programme Director	077-3258483	dhammika.matara@yahoo.co.in
5	Ministry of Mahaweli Development & Environment	Secretary				
6	JICA Sri Lanka Office	Chief Representative	Ms. Haruko Kamei	Director – South Asia Department, JICA H.Q.		
			Mr. Tomohiro Kozono	Deputy Director – South Asia Department, JICA H.Q.		
			Mr. Yuki Fujita	Deputy Assistant Director, Infrastructure & Peace Building Department, JICA H.Q.		
			Mr. Toru Koayakawa	Sr. Representative		
			Ms. Namal Ralapanawe	Sr. Project Specialist	077-2674855	ralapanawenamal.sl@jica.go.jp
7	Urban Development Authority (UDA)	Chairman				
8	Sri Lanka Land Reclamation & Development Corporation (SLLRDC)	Chairman				
9	National Transport Commission	Chairman	Aloka Karunarathna	Deputy Director (Planning)	071-6562071	alokarunarathna@gmail.com
10	Sri Lanka Transport Board	Chairman				
11	Western Province Transport Authority	Chairman				
12	Road Development Authority (RDA)	Director General	H.N. Prasanga	Engineer (Planning Division)	077-2342863	hnprasanga@gmail.com
			W.M.D.I. Jayawardena	Transport System Analysis	077-3411900	jayawmdi@gmail.com
13	Sri Lanka Railway (SLR)	General Manager	E.M.D.P.K. Deegala	Deputy Chief Engineer	071-5310309	pdeegala@yahoo.com
14	Western Province Council	Chief Secretary				
15	Kaduwela Municipal Council	Commissioner				
16	Colombo Municipal Council	Commissioner	Nihal Wickramarathne	Director Engineering (TDRS)	0777-313243	dirtraffic@gmail.com
17	Sri Jayawardenapura Kotte Municipal Council	Commissioner				
18	Sri Lanka Police	DIG Traffic				
19	Central Environmental Authority (CEA)	Director General	T.S.C. Peiris	Assistant Director (EIA)	071-4440290	clifford@cea.lk / cliffordpeiris7@gmail.com
20	National Water Supply & Drainage Board (NWS&DB)	General Manager	B.S. Wijemanna	Additional General Manager (Western)	0777-583578	addlgmw@waterboard.lk
			M. Sahathevan	Engineer Planning & Design, Regional Support Centre (Western Central)	0777-678318	msananthu@yahoo.com
21	Ceylon Electricity Board (CEB)	General Manager	P.B. Mahinda Wijayasantha	DGM (WPS2)	071-4115632	mahinda.wijayasantha@gmail.com

Appendix 1-5

Annex-1

Appendix 1-6

1st Steering Committee Meeting
Light Rail Transit (LRT) Project – JICA
18th of July 2017, 2.30 pm at "Suhurupaya", 17th Floor, Conference Room

Attendees List

No	Institute	Original Invitee as of Chapter 1 Table 1.4 of Interim Report	1st Steering Committee Meeting			
			Name of the Attendee	Designation	Contact Number	E-mail
22	Sri Lanka Telecom (SLT)	Chairman	Janaka Abeysinghe	GM (Enterprise Business)	071-4222240	janaka@slt.com.lk
23	Sri Lanka Ports Authority (SLPA)	Chairman	P.L. Dahanayake	Project Engineer	077-2323750	lakmale05366@gmail.com
24	Department of Budget (Ministry of Finance)	Director General	S.A.L. Samarasekara	Assistant Director	077-6600167	anusha_samarasekara@yahoo.com
25	Department of External Resources	Director General	Wasantha Dharmasena	Director	071-4899674	wasantha@erd.gov.lk
26	Department of National Planning	Director General				
27	Department of Agrarian Service	Director General	A.Z.J. Singarayer	Sr. Engineering Assistant	071-8049364	Jzeno.singarayer@gmail.com
28	Department of Irrigation	Director General	G.K. Pathmakeerthi	Director of Irrigation	071-4880354	gkpkeerthi@yahoo.com
29	Department of Valuation	Chief Value				
30	Department of Wild Life	Director General	Eranda Gamage	Additional Director (NRM)	071-4465420	erandagm@yahoo.com
31	Department of Archaeology	Director General				
32	Survey Department	Director General	S.D.P.J. Dampegama	Additional Survey General	077-3870972	dampegama@gmail.com
33	Ministry of Megapolis & Western Development	Chief Accountant	H.P.L. Kumara	Chief Accountant		
34	District Secretariat, Colombo	District Secretary	K.G.H. Senaka P. Silva	Director Planning	071-8293709	Senaka5silva@gmail.com

PMU – MMWD (LRT - JICA)

No	Institute	Name of the Attendee	Designation	Contact Number	E-mail
1	PMU – MMWD (LRT - JICA)	Eng. Chaminda Ariyadasa	Project Director	0777-311405	priyanathariyadasa@yahoo.com
2	PMU – MMWD (LRT - JICA)	W.K.R. Pushpakumara	Deputy Project Director		wkrpushpa@gmail.com
3	PMU – MMWD (LRT - JICA)	Wanuja Abewickrema	Demand Forecasting Engineer	077-3453918	wanuja30@gmail.com
4	PMU – MMWD (LRT - JICA)	Kaushan Devasurendra	Transportation Planning Engineer		kaushanwd@gmail.com

JICA Study Team

No	Institute	Name of the Attendee	Designation	Contact Number	E-mail
1	JICA Study Team	Yoshihisa Asada	Team Leader	077-4483877	asada-ys@oriconsul.com
2	JICA Study Team	Takashi kikuiri	Engineering Group Leader	077-5518427	kikuiri@oriconsul.com
3	JICA Study Team	Akira Tsuji	Construction Plan, Cost Estimation	077-5541837	tsuji-a@chodai.co.jp
4	JICA Study Team	Yuki Kajigaya	Station Development	077-5569465	kajigaya@oriconsul.com
5	JICA Study Team	Yohei Sizuki	Environmental & Social Consideration	077-4433177	yohei.suzuki@erm.com
6	JICA Study Team	LE Thi Thuong	Project Administration	077-4421137	lethuong@oriconsul.com
7	Oriental Consultants Global Co. Ltd.,	Noboru Kitazawa	GM-OCG	077-5495917	kitazawa@oriconsul.com

Annex-2

COLOMBO LIGHT RAIL [CLR]

1st Steering Committee Meeting

18th July, 2017

Content

1. Current Progress
2. LRT Route and Structure
3. LRT Depot
4. Concerns & Issues
5. Summary & Further Discussions
6. Business Models and Operations
7. Preliminary Construction Packages
8. Tentative Implementation Plan

1 Current Progress

Current Progress – Administration

- Current status of PMU and S/C, and TAC establishment;

1 PMU of JICA-LRT F/S

- Advertised for the remaining carder positions on 15th May Daily News newspaper
- Tender awarded for the fabrication of new office space
- Recruitments of new officers are in progress

2 Steering Committee (S/C)

- 33 stakeholder organizations, 1st meeting on 18th July 2017 (today)

3 Working Group Formation

- Nominations were taken for the working groups
- First working group meeting was held with the participation of engineers from CEB

Current Progress – Social & Environmental

1 TOR for EIA

- Final ToR was made available by CEA
- Survey works of EIA process on progress

2 Initial Stakeholder Consultation Meeting (16 May)

- To share project information with relevant agencies
- Establish continuous communication and decision making mechanism

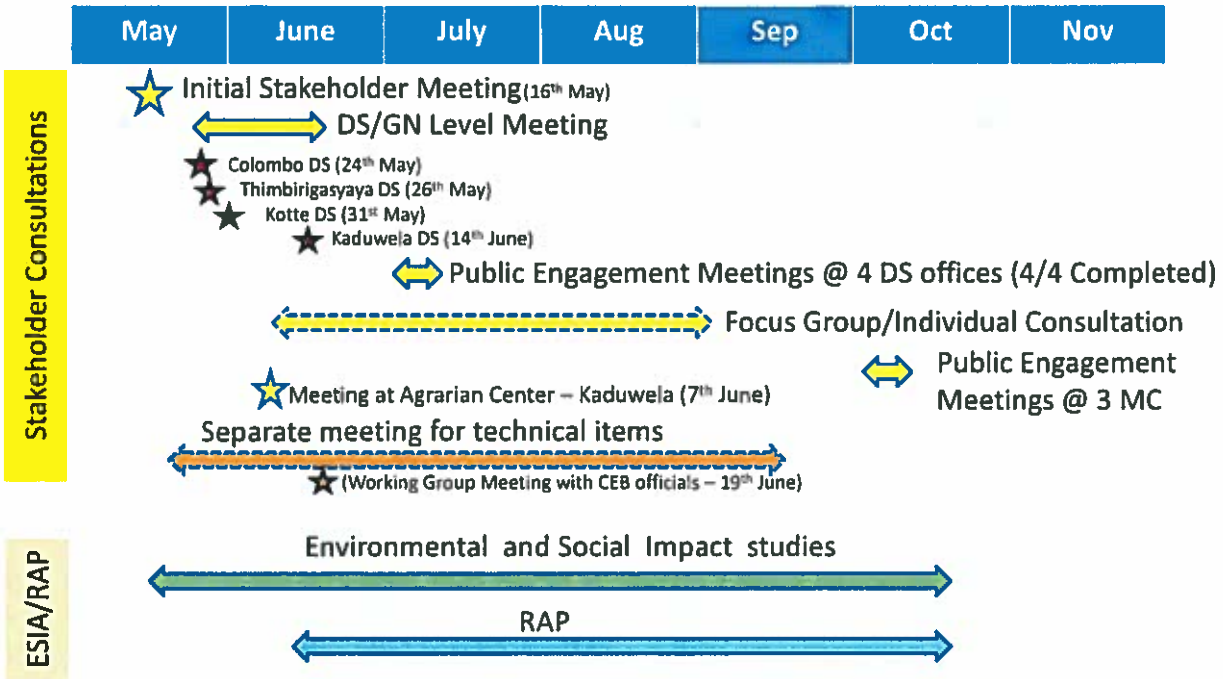
3 DS/GN…

- To get the feedback and further consultation arrangements such as public engagement meetings
- DS level meeting were held at Colombo, Thimbirigasyaya, Kotte and Kaduwela DS offices
- Meeting at the Agrarian Services Center- Kaduwela was held to discuss matters in proposed Depot area with the land owners

4 Public Engagement …

- To introduce LRT project to public & explain environmental and social safeguard of the project and to get feedback
- Website Development in progress
- Finalization of the dedicated video for LRT

EIA/SEIA Schedule



Current Progress – Planning & Operations

1 Topographic & Geological Survey

- Mobile Mapping survey Completed
- Borehole investigations at 20 different locations along the trace was completed

2 Discussions on Operation Plans

- Different operational plans are under study

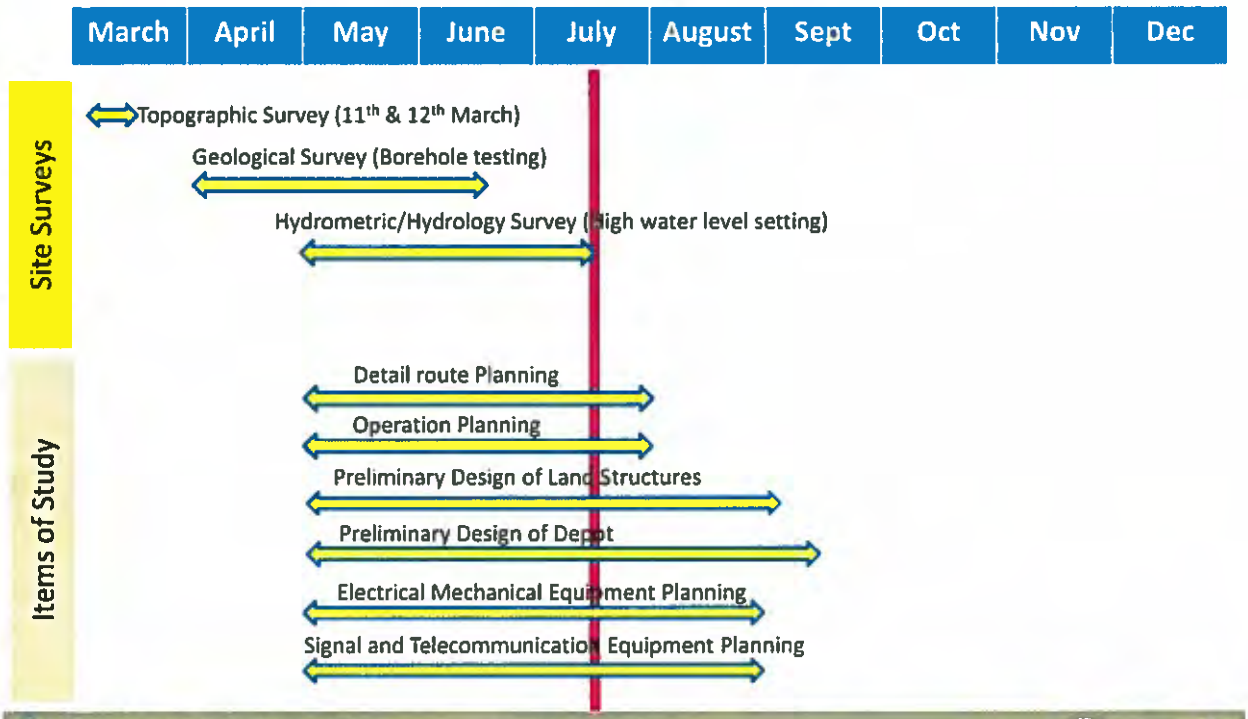
3 Signal And Telecommunication

- Specialists from study team works in progress
- Site visits to Rathmalana, Dematagoda Existing depots and workshops

4 Depot

- Finalization of the depot layout and its functionalities
- Discussions on waste generations and maintenance of the depot

Planning Schedule



2 LRT Route and Structure

Design Principle

- **Develop a "User-Friendly LRT System"**

Comfortable
Space in LRT, Smooth ride

Safe
Train operation, Security

Reliable
Shortening travel time, punctuality


Conceptual image of LRT system in Colombo

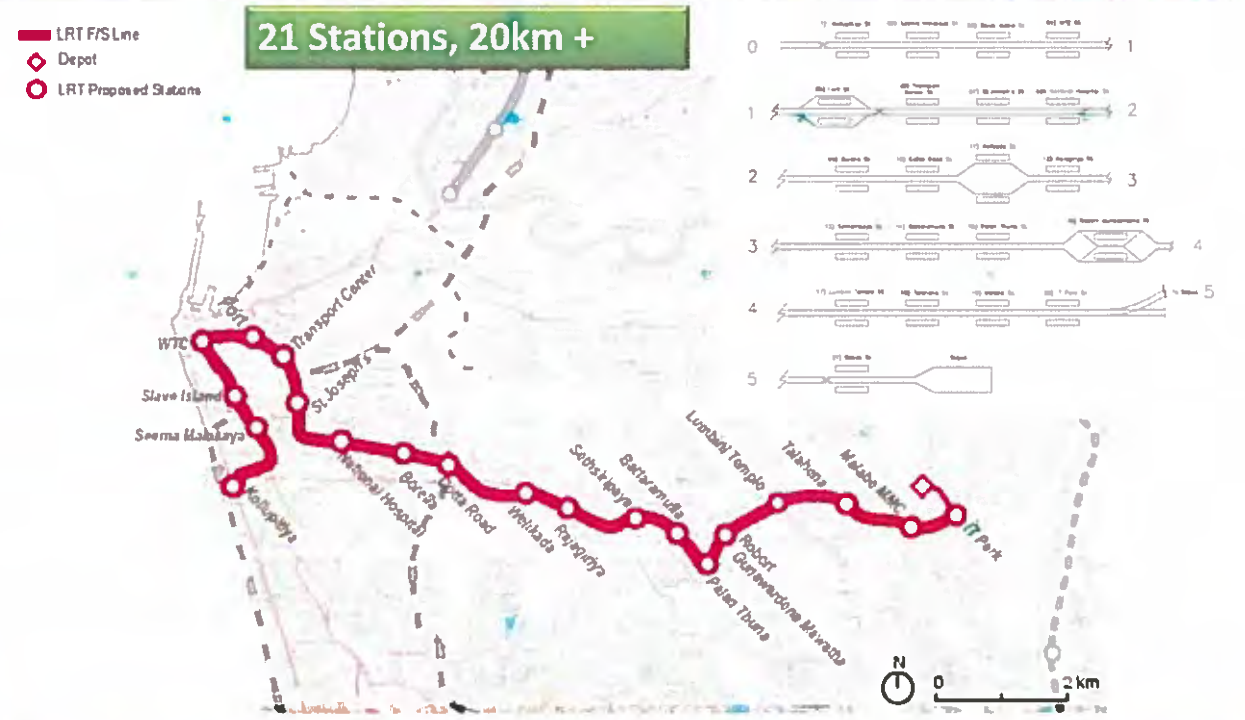
minimizing and avoiding negative impacts for both environmental and social aspects;

Environmental Aspects
Due to construction, vibration, noise, ...

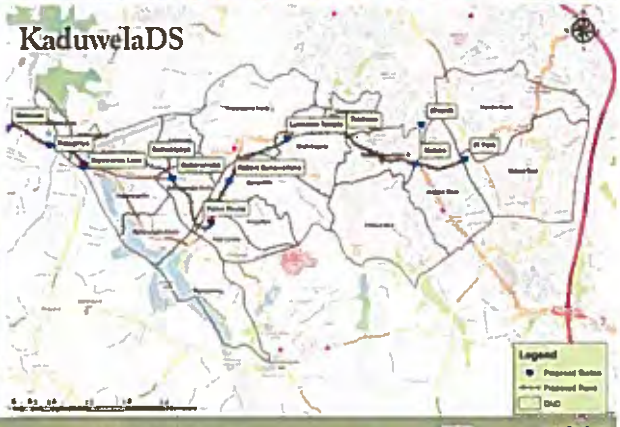
Social Aspects
Land acquisition, livelihood impacts, ...

Conceptual image of train station (platform)

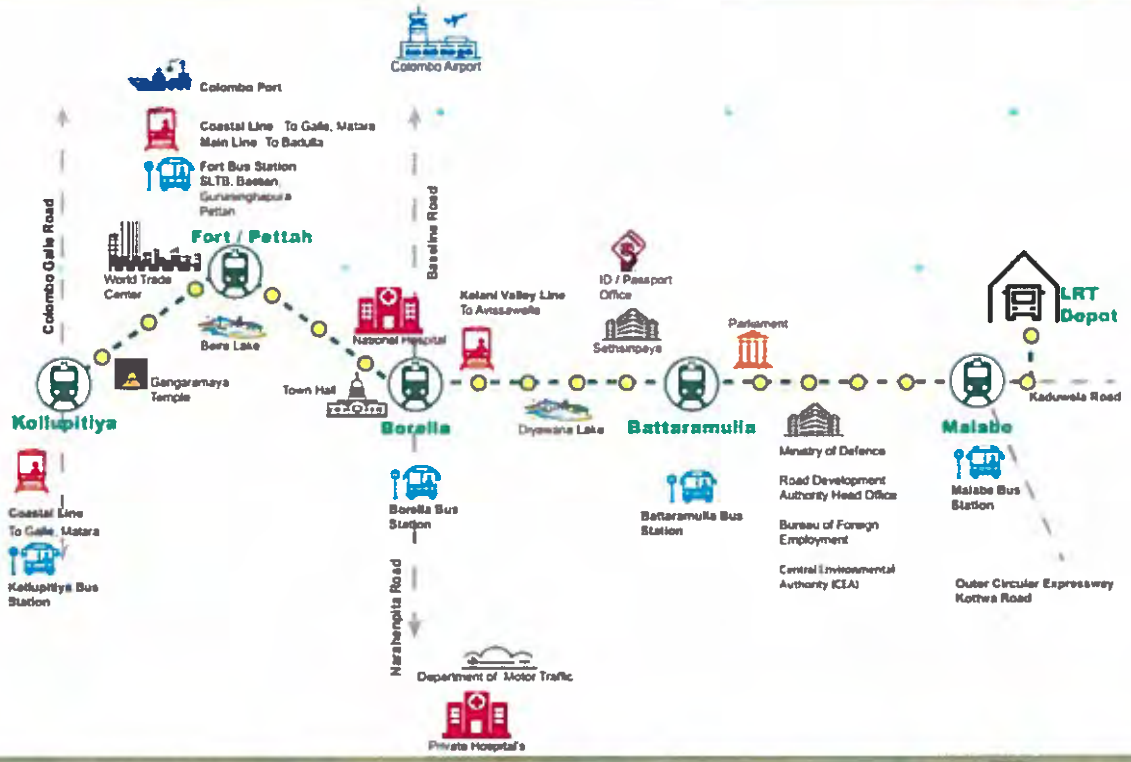
Proposed LRT Route



Note : this route is the basis for further examination of alignment through the stakeholder consultation



Connectivity



Recommended Structure of LRT

- **To secure enough space for trains/ evacuation,**
  All specifications can decided by the Operator

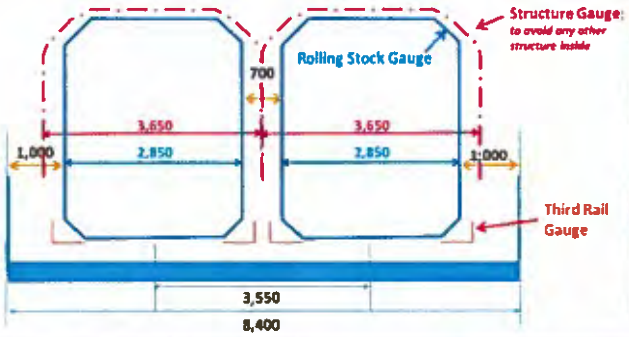
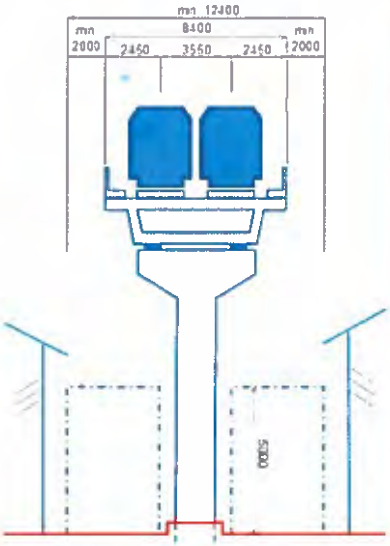


Image of LRT Structures

- **At least 12.4 m width is required at straight section.**

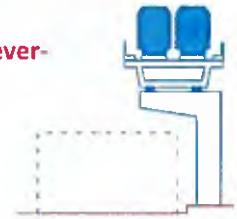
Straight Section

Min. 12.4 m



Another Types

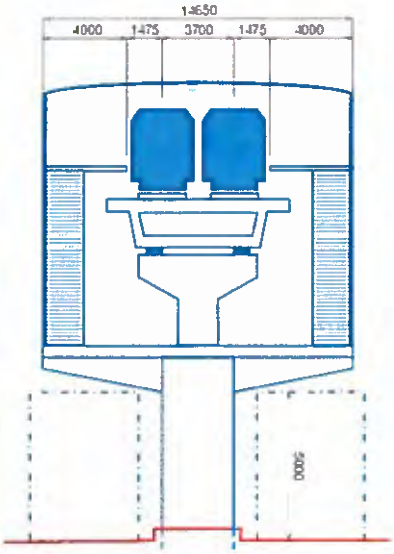
Cantilever-type



Portal -type

Station (Image)

14.6m (structure only)

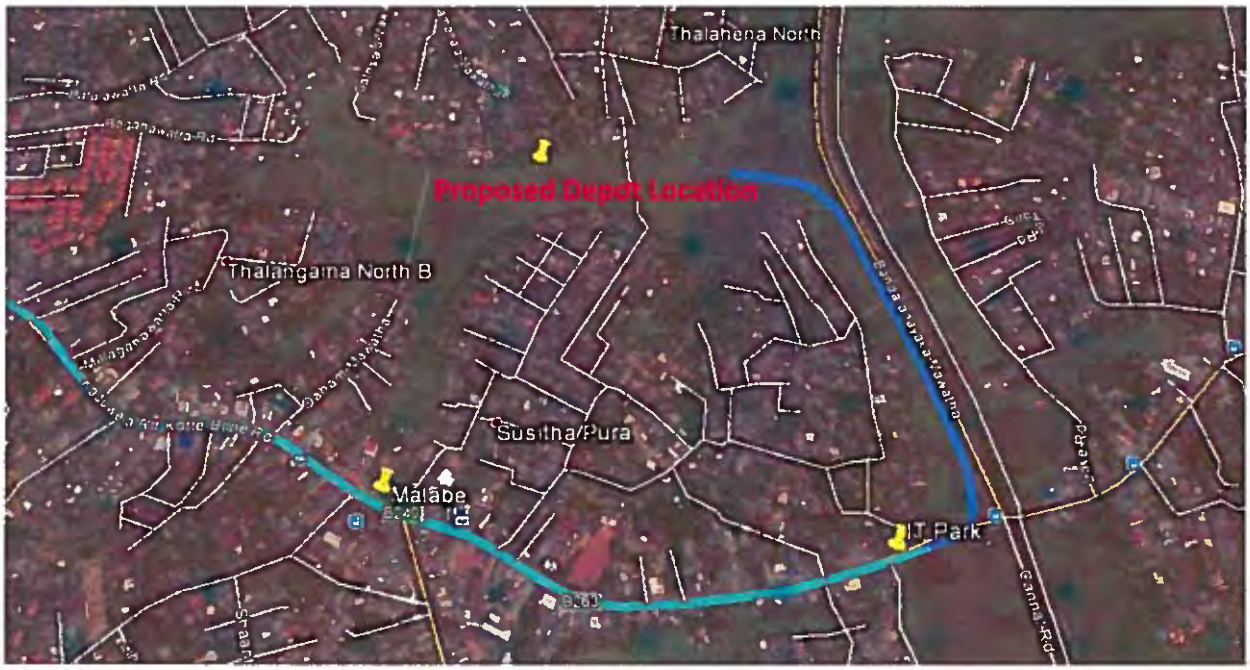


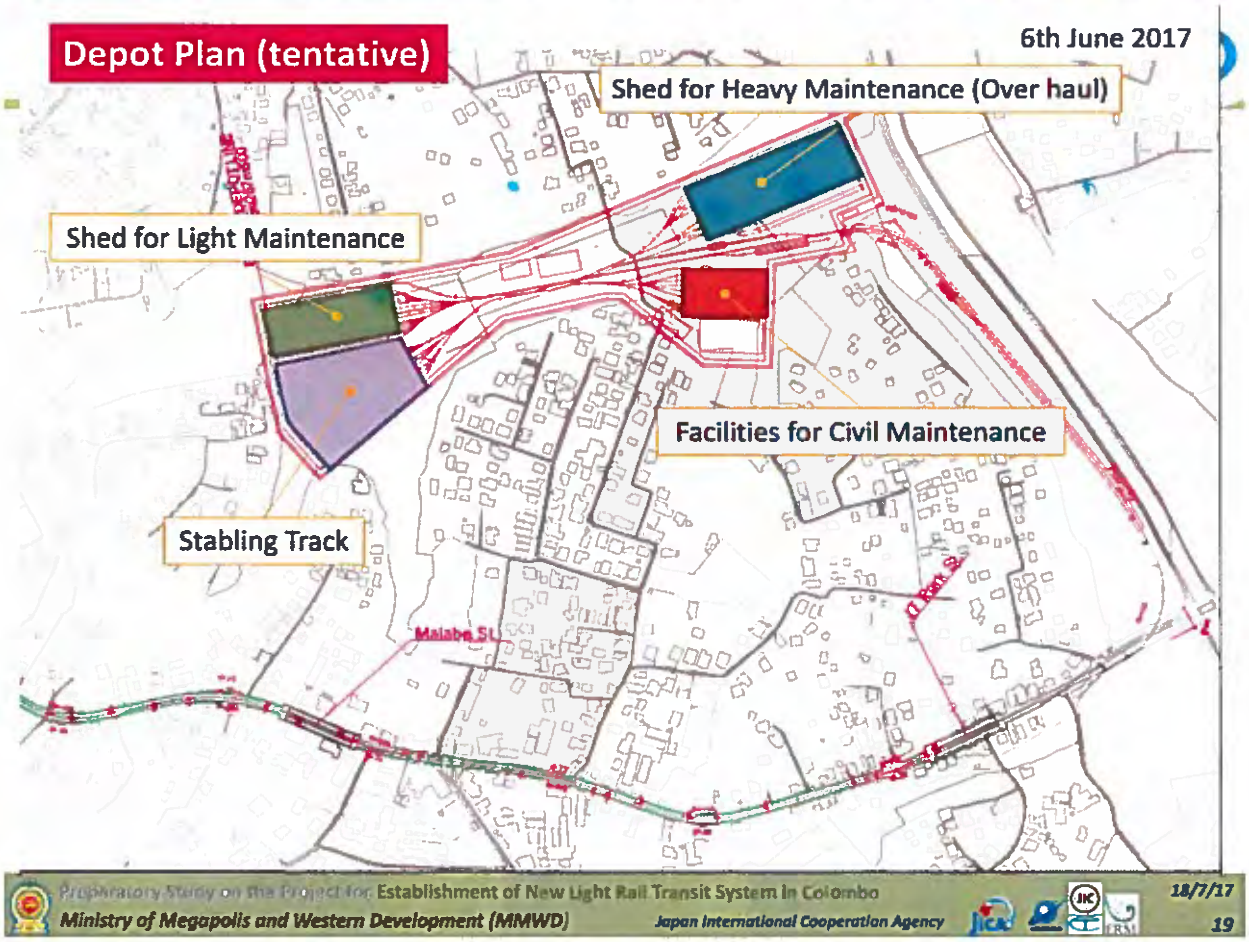
3 LRT Depot

Nakano Depot - Japan

Nakano Depot - Japan

Proposed Depot Location





Train Cleaning

Washing Parts

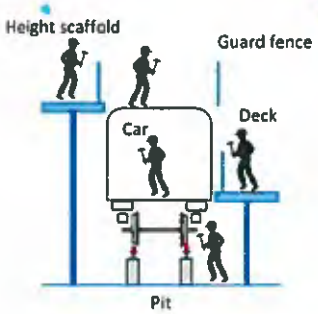
Washing booth

Washing Car Body

Automatic car body washer

Light Maintenance

Facilities for Light Maintenance



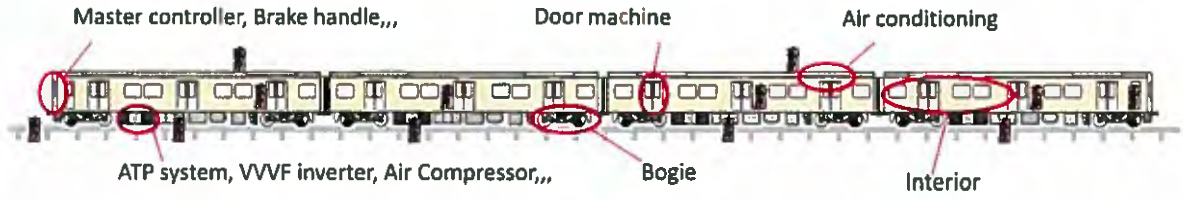
Occupational Safety and Health–Receive an electric shock

Facilities for Overhaul

Maintenance System (Preventive maintenance)

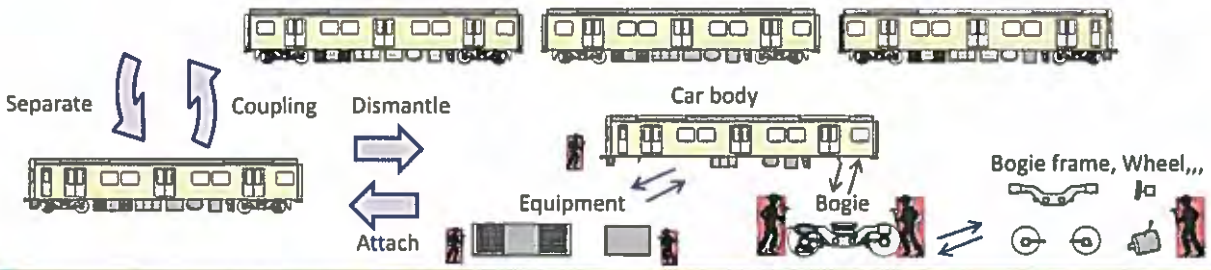
Light Maintenance

Check or Inspect the condition and function of a train-set (Operating condition).



Heavy Maintenance

Overhaul equipment on a train car.



Impacts from Depot

- Typical Industrial Waste at Depot & Workshop

- -Sludge
- from Waste Water Treatment Equipment
- (Train Cleaning, and Parts Cleaning)

- -Lubricant Oil
- used for Air Compressor, and Gear Box

- -Brake Shoe (Brake Pad)
- used for Brake equipment

- -Iron Scrap
- from Wheel Re-Profiling Lathe etc.
- (Wheel Re-profiling, and exchanging Parts)

- -Rubber tube
- used for Brake System
- (need to exchange every 8 years depends on its spec.)

4 Concerns & Issues

Sethsiripaya stage III/Battaramulla MMC

Thanlangama EPA

- **Alignment Options**

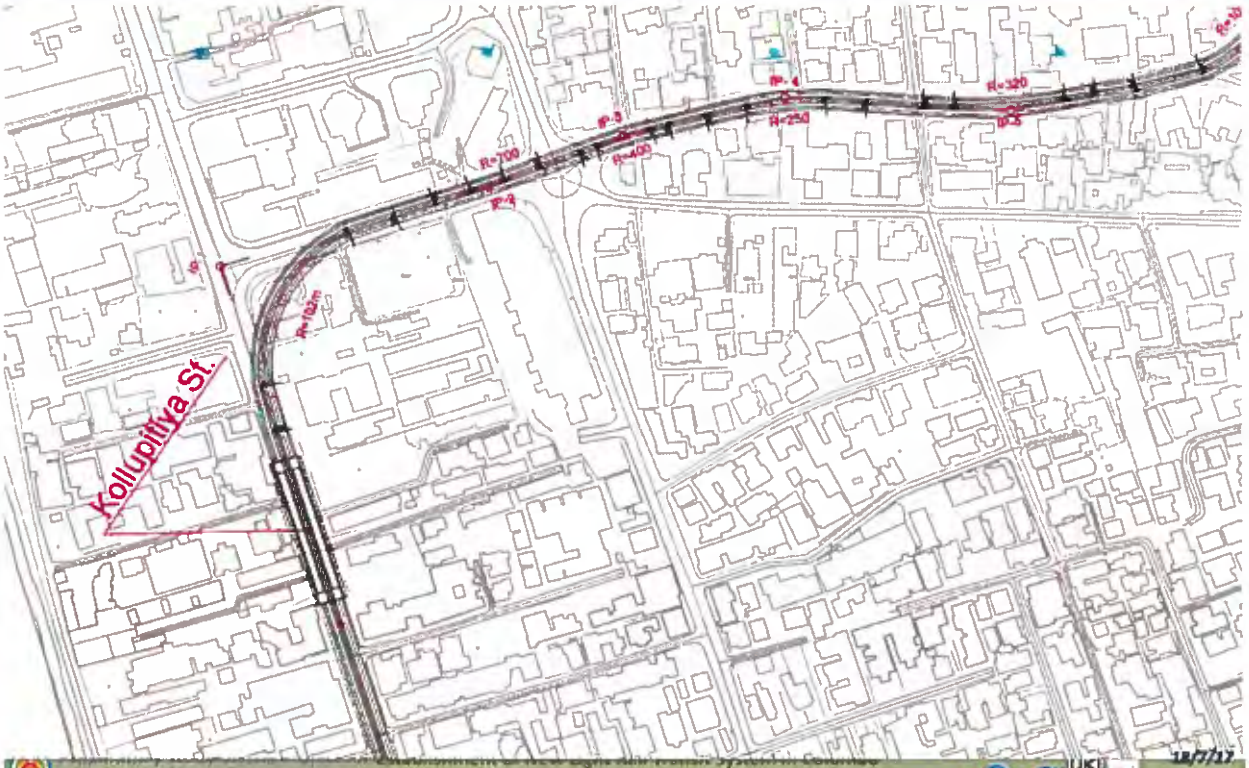
Original Alignment

Diverted to outside edge of EPA

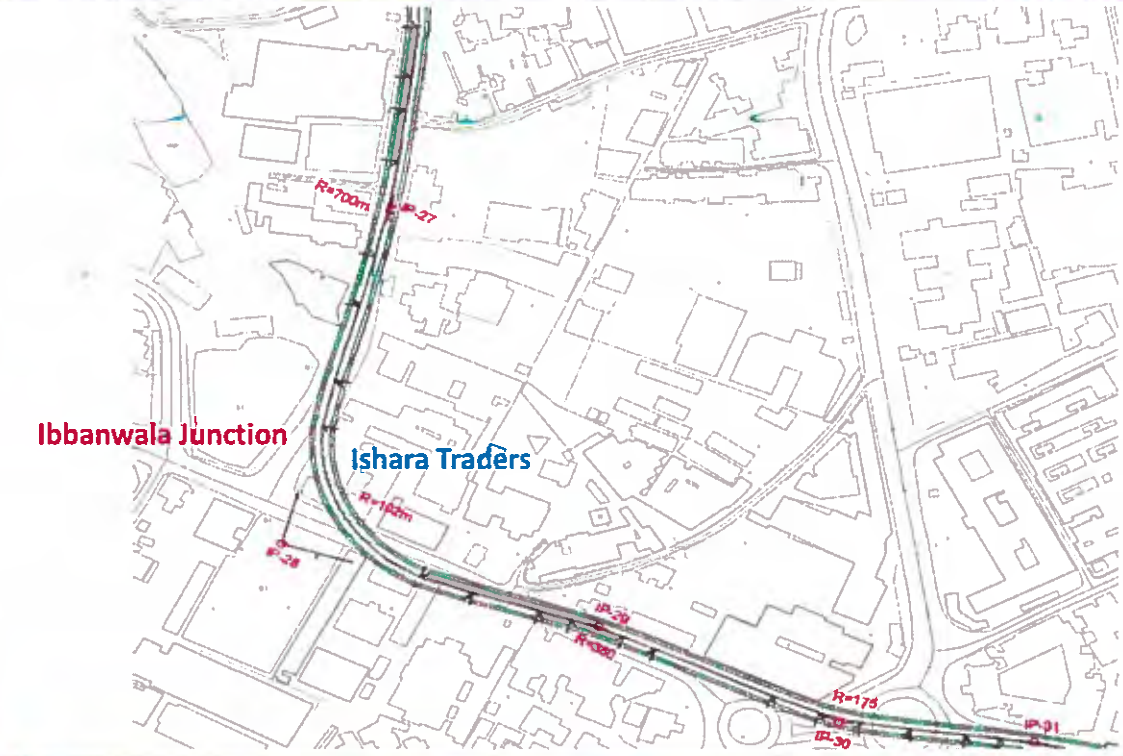
Diverted to on road

Gangaramaya

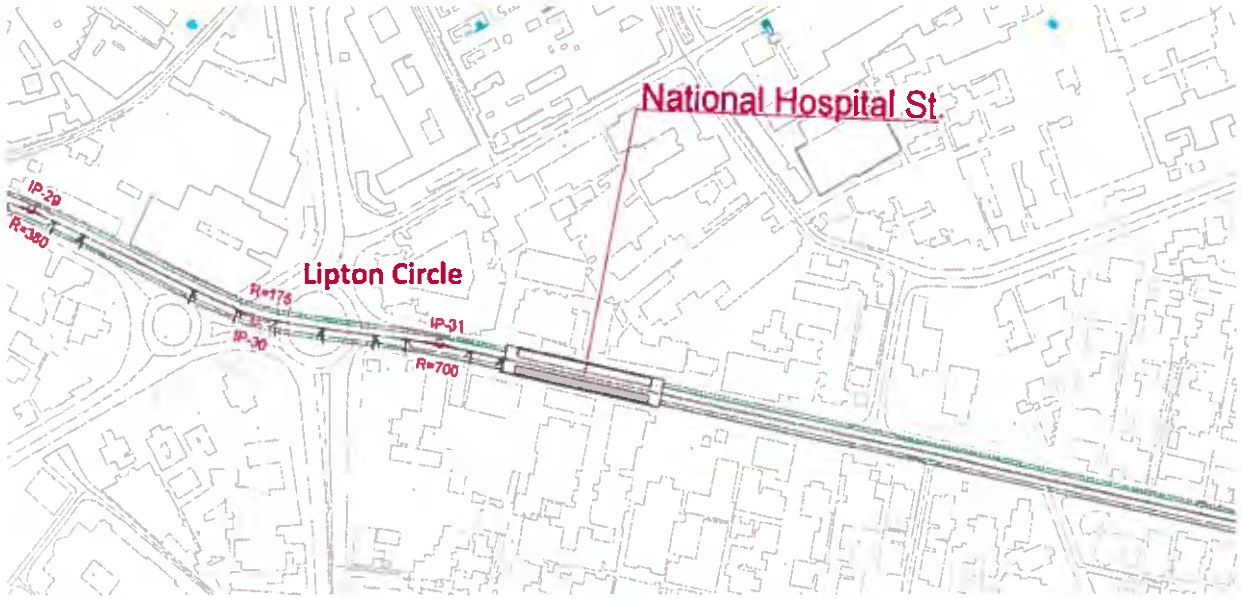
Kollupitiya



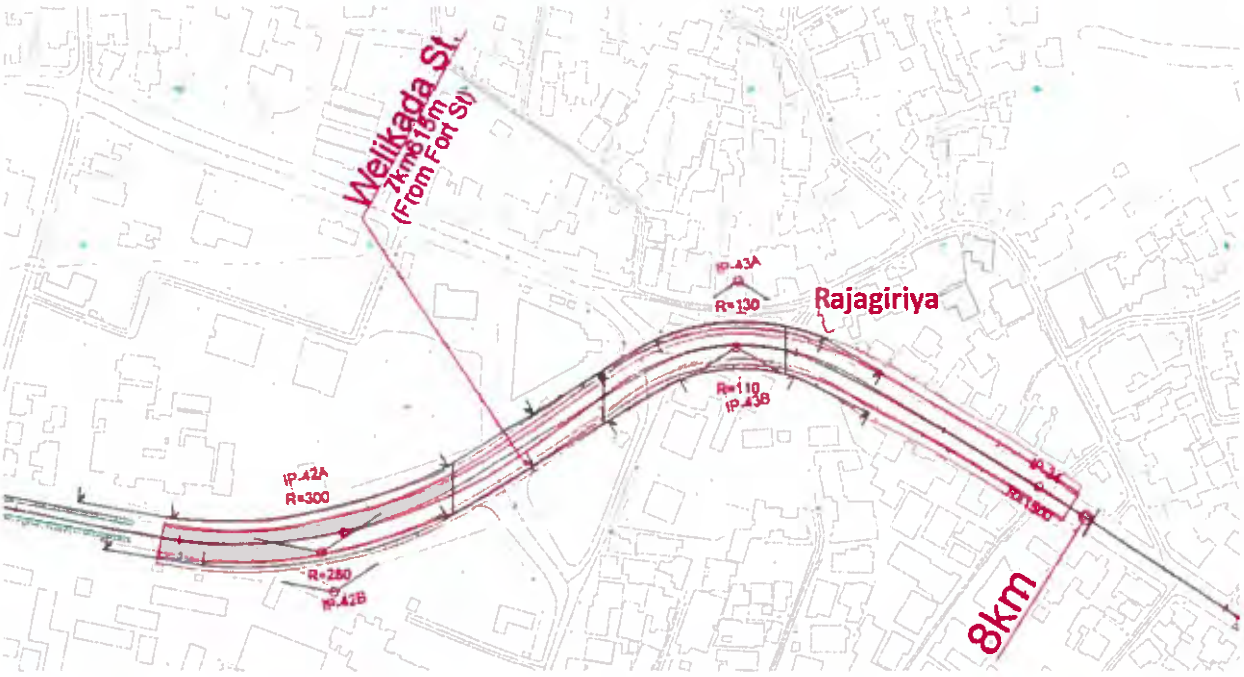
Ibbanwala Junction



Lipton Circle



Rajagiriya



Catchment Area of LRT Stations

- Circles of radius 800 meter, and colored in orange for LRT Alternative Routes and in purple for the other proposed RTS lines.
- Alt-1 cover a broader catchment area than Alt-3
- Alt-3 locates around the Museaus College and City Hall is not covered

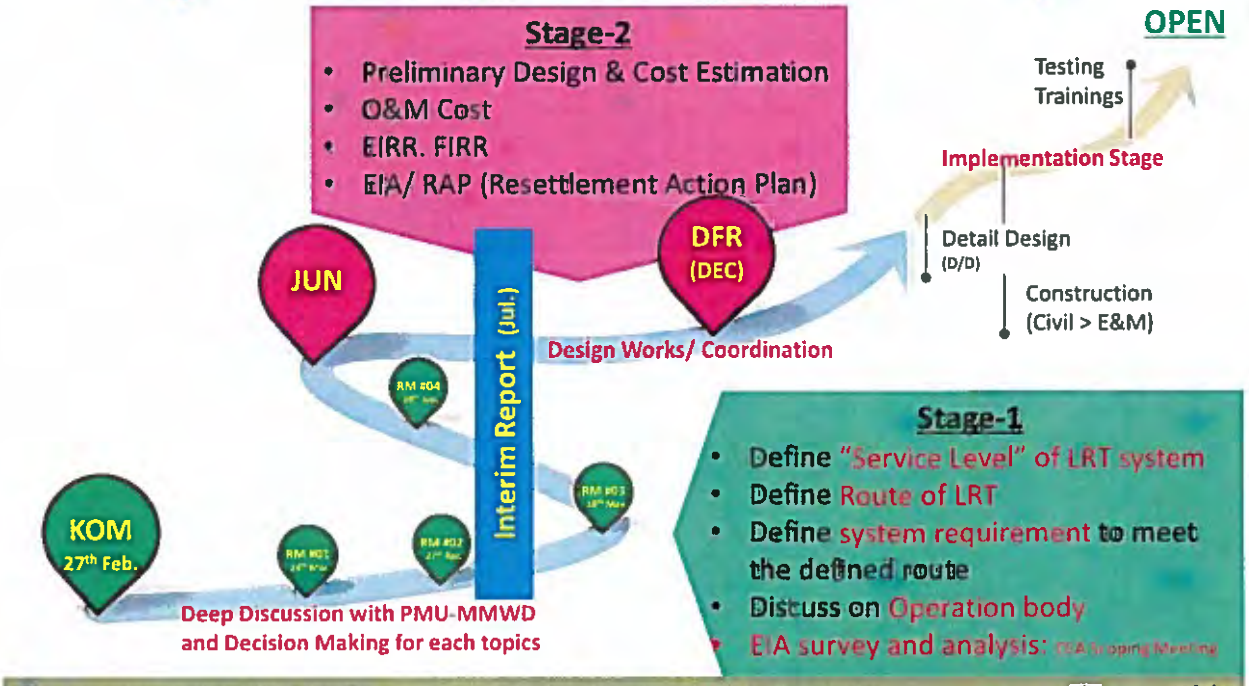
Route Alternative-1

Route Alternative-3

5 Summary & Further Discussions

Roadmap toward Opening of LRT System

- Since 27th Feb., F/S conducted and prepared ITR.



Further Discussions

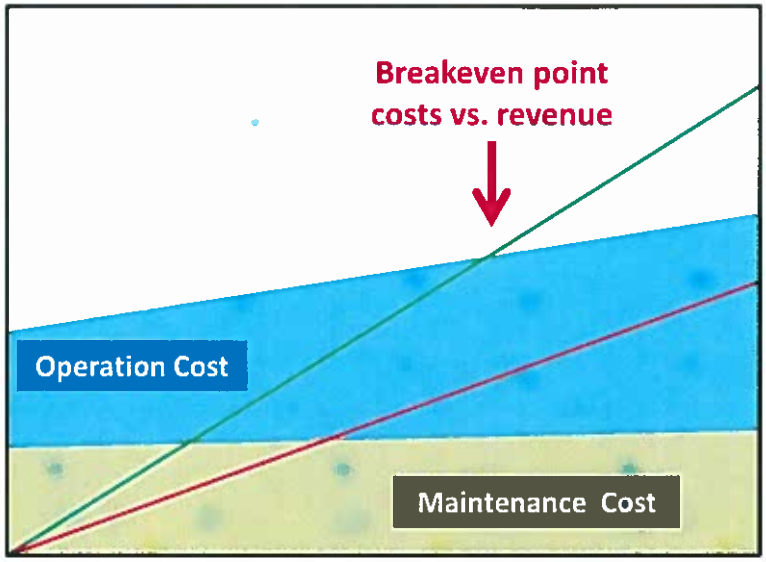
Further Discussions regarding following matters needs to be arranged

Subject (Tentative)	Note
Those who lose their land/building/livelihood	Socio-Economic Survey Resettlement Action Plan
Acquisition of Depot Land at Chandrika Kumarathunga Mawatha infront of CINEC Campus	Cultivated/ Abundant lands Consultation with Agrarian services and land owners
Culturally important site (e.g. Borella Bo Tree, Gangaramaya temples)	Consultation with key stakeholders (e.g. chief Monk and daayaka Sabha)
Thalangama EPA	Consultation with key stakeholders (e.g. CEA, Dpt. Of Agrarian) based on 3 options.
Other Developments (e.g. Rajagiriya flyover)	Consultation with key stakeholders (e.g. UDA, RDA)
Utility issues	Consultation with key stakeholders (e.g. CEB, NWSDB, SLT, etc)

6 Business Models and Operations

Business model of LRT system

- **Fixed O&M costs exist to ensure sustainable operation.**

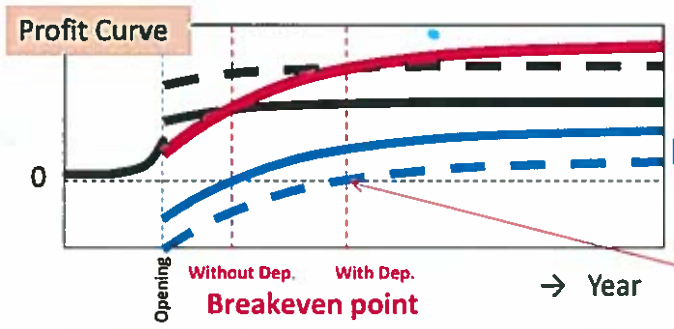


Revenue:
Fare Level High

Revenue:
Fare Level Law

Business model of LRT system

- License requirement of operator in Japan is set as 15 years/40 years.

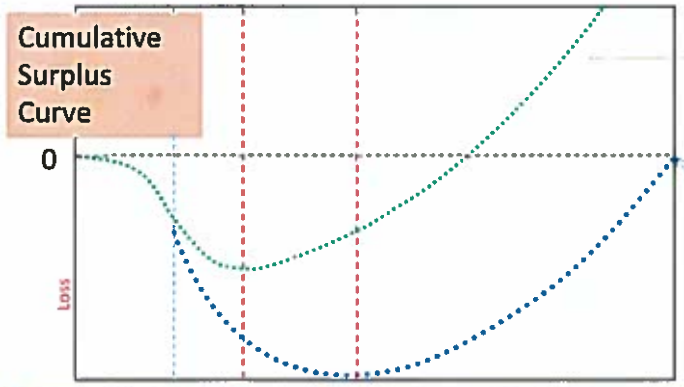


Revenue according to Demand

Cost
- O&M Cost with Depreciation
- Only O&M Cost

Profit
- Without Depreciation
- With Depreciation

e.g. Japanese operator < 15 years



Cumulative Surplus without Depreciation for Infrastructure

e.g. Japanese operator < 40 years

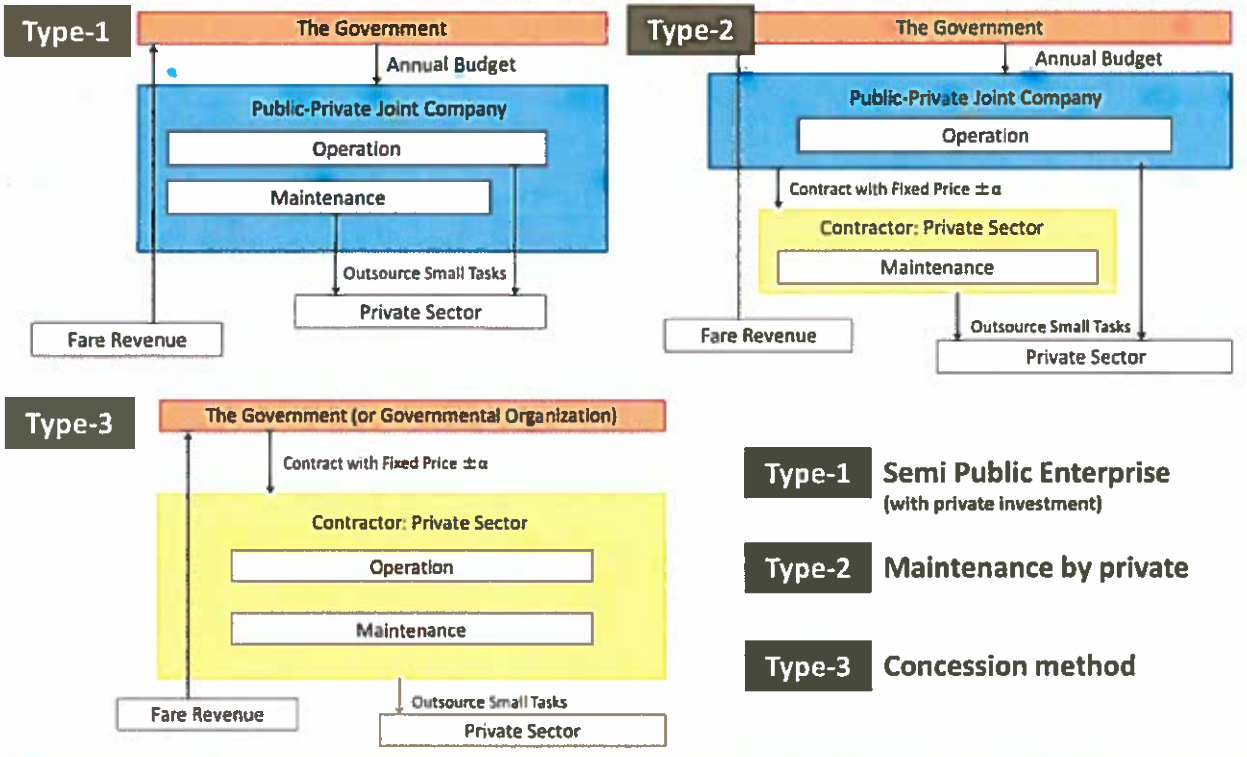
Cumulative Surplus with Depreciation for Infrastructure

Lessons learnt from Unban Railway Busines

- LRT Business is low profitable, but gains stable profits in long term after breakeven point.
- Uncertain pax. demands due to several factors.
- Fixed O&M costs exists, and Revenue is directly affected by pax. demand.

If the "financial gap" between costs against revenue is not supported by the government, Operator (private and even public enterprises) feels the risk to operate and maintain.

Scheme of Operation (Type 1-3)



7 Preliminary Construction Packages

3. Preliminary Construction Packages

Option-1: Combined with System and Rolling Stock

Contract Package	Package 1	Package 2	Package 3
Name of Tender	Civil Works (Construction) Kallupitaya St.(including station)-National Hospital St. (excluding station)	Civil Works (Construction) National Hospital St.(including station)-Battaramulla St. bin(including station)	Civil Works (Construction) Battaramulla St.(excluding station)-Depot(excluding Depot)
Scope of Works	Construction of Viaduct and stations (7 stations)	Construction of Viaduct and stations (7 stations)	Construction of Viaduct and stations (7 stations)
Section Length	Approx. 7km	Approx. 7km	Approx. 7km
Construction Cost	TBA	TBA	TBA
Qualification	Joint Prequalification with Bidding		
Method of Bidding	2 Envelops		
Application of FIDIC Book Type	MDB Harmonized, Edition June 2010 (Pink Book) as part of the JICA SBD (WORKS)		

3. Preliminary Construction Packages

Option-1: Combined with System and Rolling Stock

Contract Package	Package 4	Package 5
Name of Tender	Rolling Stock, System Works and Track Works (Design, Procurement, Supply, Test and Commissioning).	Depot (Construction) and Worksop Equipment (Design, Procurement, Supply and Test).
Scope of Works	LRT (2.8m wide and 18m long) 5 cars x 30 set=150 cars Track System, Signaling and Telecommunication System, Power Supply System, AFC system, and Train Operation Management System	Construction of Depot and Workshop (8 ha)
Section Length	Approx. 21km-	-
Construction Cost	TBA	TBA
Qualification	Joint Prequalification with Bidding	
Method of Bidding	2 Envelops	
Application of FIDIC Book Type	Plant and Design Build, Edition 1999 (Yellow Book) as part of the JICA SBD for the Procurement of Electric and Mechanical Plant, and for Building and Engineering Works, Designed by The Contractor (Trial Version) published by JICA in July, 2015	MDB Harmonized, Edition June 2010 (Pink Book) as part of the JICA SBD (WORKS) with Additional Clause for Design, Procurement, Supply, installation and Test of Depot Equipment

3. Preliminary Construction Packages

Option-2: Separated with System and Rolling Stock

Contract Package	Package 1	Package 2	Package 3
Name of Tender	Civil Works (Construction) Kallupitaya St.(including station)-National Hospital St. (excluding station)	Civil Works (Construction) National Hospital St.(including station)-Battaramulla St. bin(including station)	Civil Works (Construction) Battaramulla St.(excluding station)-Depot(excluding Depot)
Scope of Works	Construction of Viaduct and stations (7 stations)	Construction of Viaduct and stations (7 stations)	Construction of Viaduct and stations (7 stations)
Section Length	Approx. 7km	Approx. 7km	Approx. 7km
Construction Cost	TBA	TBA	TBA
Qualification	Joint Prequalification with Bidding		
Method of Bidding	2 Envelops		
Application of FIDIC Book Type	MDB Harmonized, Edition June 2010 (Pink Book) as part of the JICA SBD (WORKS)		

3. Preliminary Construction Packages

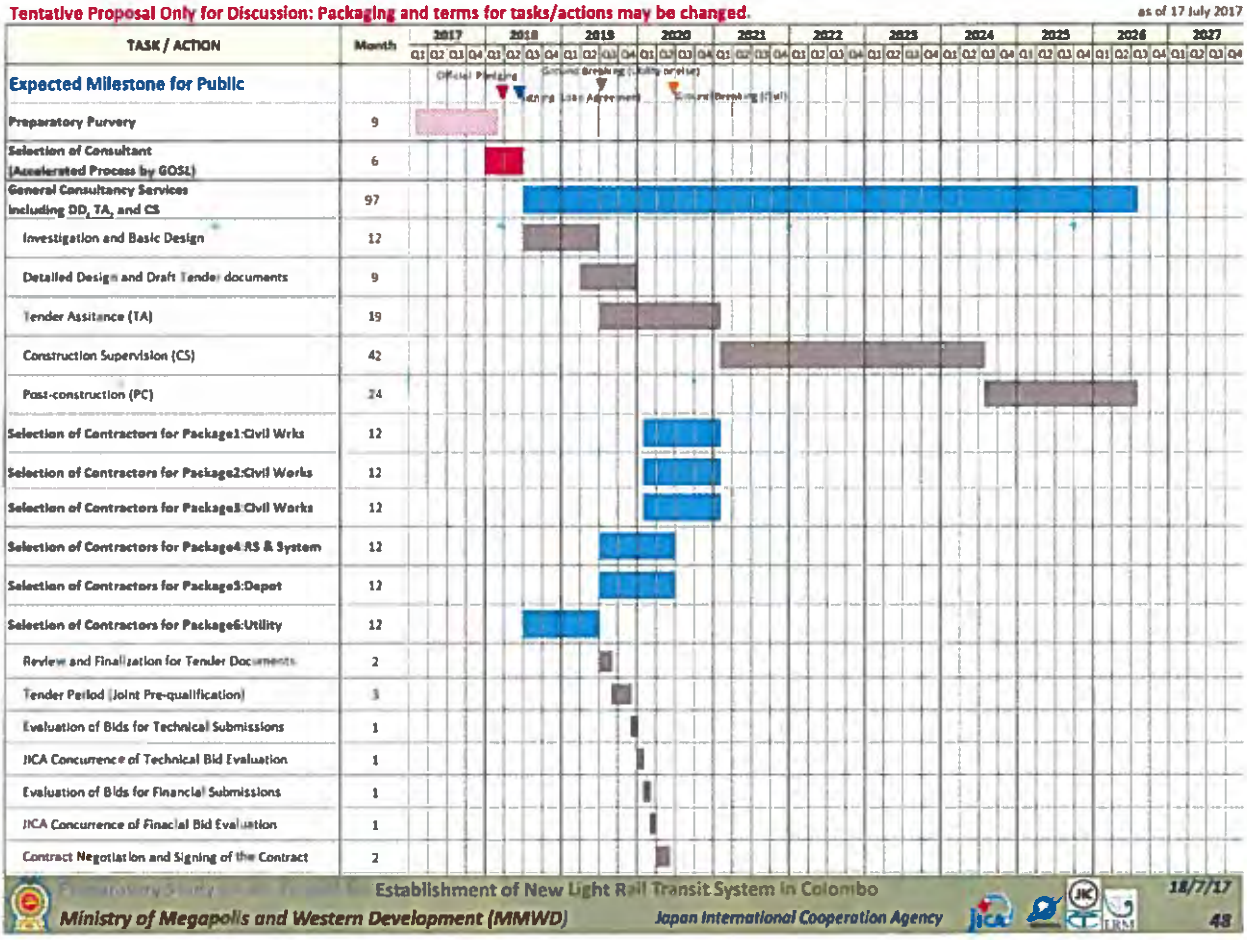
Option-2: Separated with System and Rolling Stock

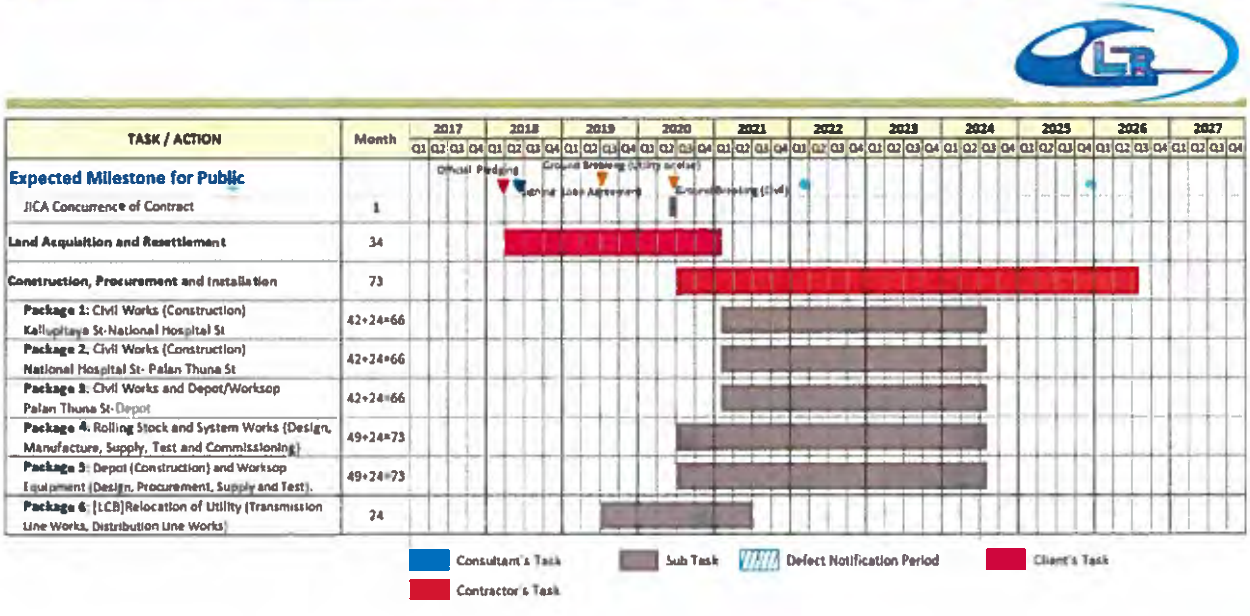
Contract Package	Package 4	Package 5	Package 6
Name of Tender	Rolling Stock (Design, Manufacture, Supply, Test and Commissioning)	System Works and Track Works (Design, Procurement, Supply, Test and Commissioning).	Depot (Construction) and Worksop Equipment (Design, Procurement, Supply and Test).
Scope of Works	LRT (2.8m wide and 18m long) 5 cars x 30 set=150 cars	Track System, Signaling and Telecommunication System, Power Supply System, AFC system, and Train Operation Management System	Construction of Depot and Workshop (8 ha)
Section Length	-	Approx. 21km-	-
Construction Cost	TBA	TBA	TBA
Qualification	Joint Prequalification with Bidding		
Method of Bidding	2 Envelops		
Application of FIDIC Book Type	Plant and Design Build, Edition 1999 (Yellow Book) as part of the JICA SBD for the Procurement of Electric and Mechanical Plant, and for Building and Engineering Works, Designed by The Contractor (Trial Version) published by JICA in July, 2015		MDB Harmonized, Edition June 2010 (Pink Book) as part of the JICA SBD (WORKS) with Additional Clause for Design, Procurement, Supply, Installation and Test of Depot Equipment

8 Tentative Implementation Plan

Tentative Proposal Only for Discussion: Packaging and terms for tasks/actions may be changed.

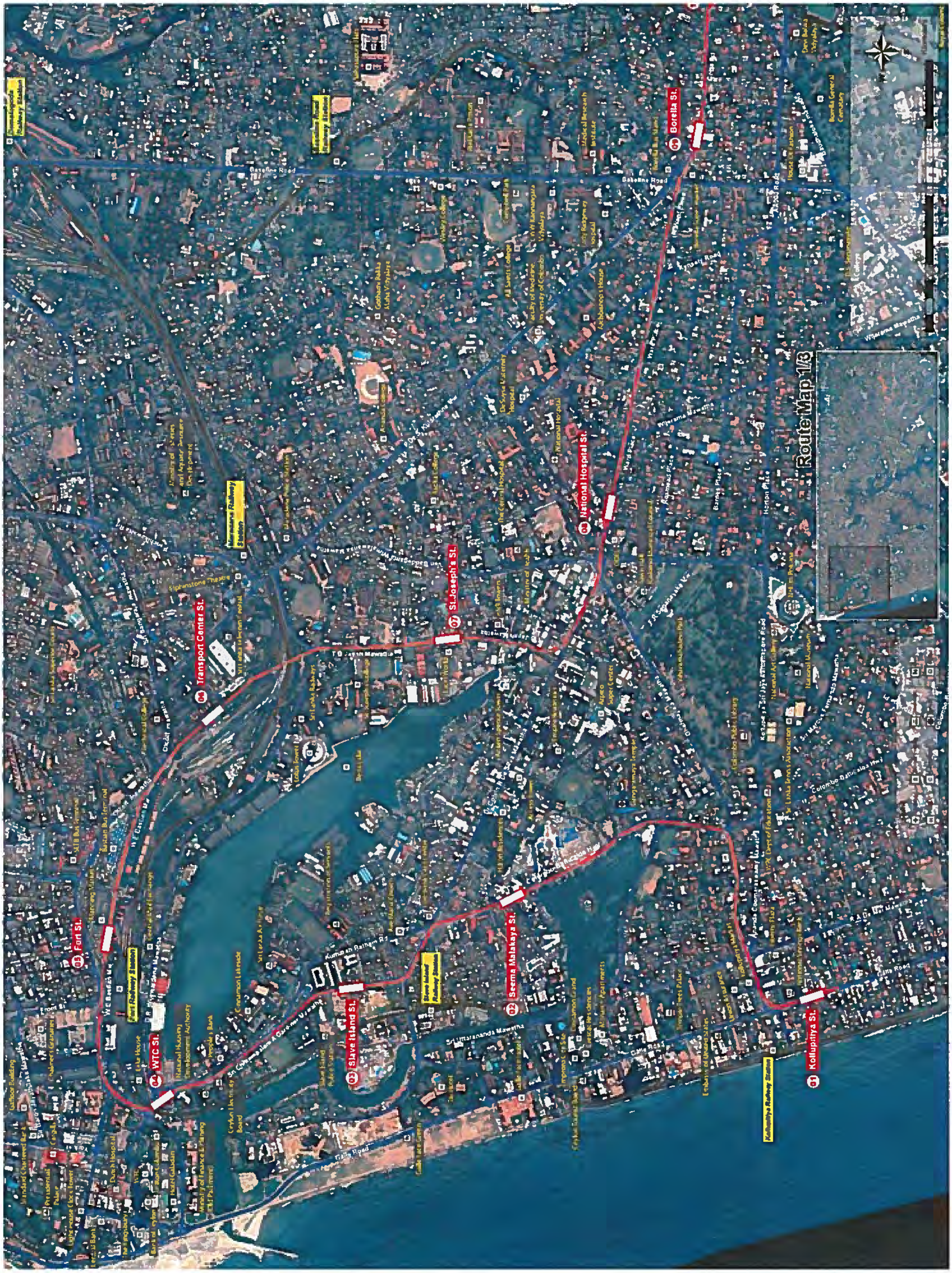
as of 17 July 2017





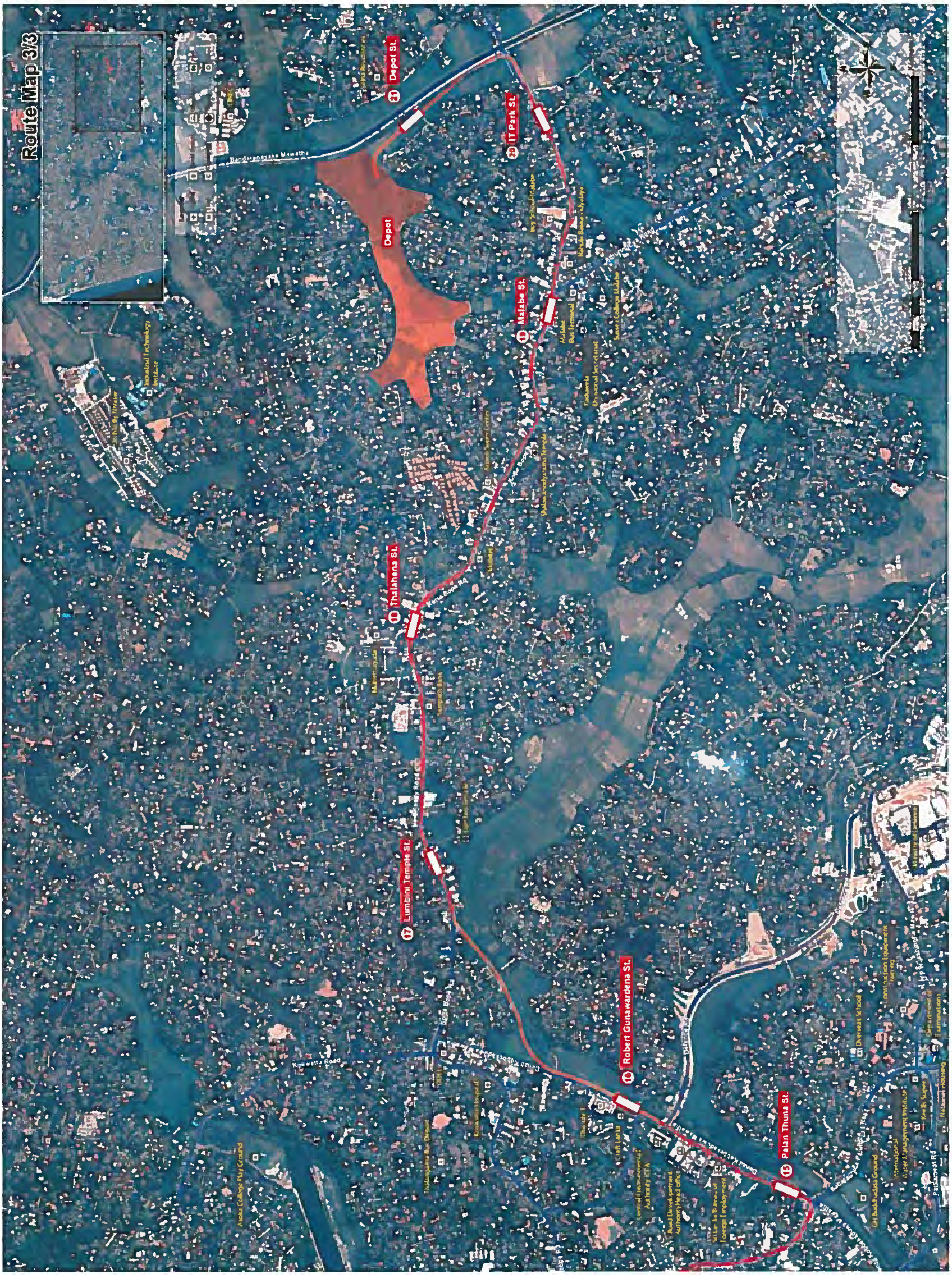

Thank you!
Preparatory Study on the Project for Establishment of New Light Rail Transit System in Colombo
Ministry of Megapolis and Western Development (MMWD)
Japan International Cooperation Agency
18/7/17
50

Annex - 3



Route Map 1/3
Borella St.
National Hospital St.
St.Joseph's St.
Transport Center St.
Fort St.
WTC St.
Slave Island St.
Seema Malakaya St.
Kollupitiya St.


Route Map 2/3
10 Cotta Road St.
11 Welikada St.
12 Rajagiriya St.
13 Sethsiripaya St.
14 Battaramulla St.
15


Route Map 3/3
21 Depot St.
20 IT Park St.
Depot
19 Malabe St.
18 Thalahena St.
17 Lumbini Temple St.
16 Robert Gunawardena St.
15 Pelan Thuna St.
Bandaranayake Mawatha

Appendix 2 Japanese Specifications for Rolling Stocks

Appendix 2 Japanese Specifications for Rolling Stocks

Technical Parameters		Specification		
Maximum Speed		75km/h		
Gauge		1,435mm (Standard gauge)		
Traction Power Supply		Third Rail System		
Train Formation Tc: Trailer Car with driver's cab, M: Motor car, T: Trailer Car.		3M3T (Tc+M+T+M+M+Tc)		
Standard Passenger Capacity		**Seated**	**Standing** (3.3 persons/m^2)	**Total**
	Lead Car	42	82	**124**
	Intermediate Car	52	84	**136**
Capacity of a Train (6 car-sets)		**Per Car**	**Nos. of cars**	**Total**
	Lead Car	124	2	**248**
	Intermediate Car	136	4	**544**
	Total Passengers (3.3 persons/m^2) Including Seated passenger			**792 (seated : 292)**
	Total Passengers in different AW (Added Weight due to standing passenger)			
	AW-4: stand (4persons/m^2) + seat	-		
	AW-6: stand (6persons/m^2) + seat	-		
Major Dimension				
	Leading Car Length	18,000mm		
	Intermediate Car Length	18,000mm		
	Body Width	2,790mm		
	Body Height	3,495mm		
Weight per Train (tare)		160.9t		
Car weight (tare)		Tc : 26.3t, M : 28.4t, T : 23.1t		
Body Materials		Aluminum		
Saloon Design				
	Door Ways	3 doorways each side of car		
	Door Type	Double slide doors 1,300 mm width		
	Seat type	Longitudinal seat type		
Special Facilities				
	Wheel Chair Space	Equipped		
	Baggage Space	Not Equipped		
	Toilet	Not Equipped		
Traffic performance				
	Acceleration	3.2 km/h/s (0~30km/h)		
	Deceleration	Service 4.0 km/h/s		
		Emergency 5.0 km/h/s		
Propulsion System				
	Power Collection System	DC 600 V, Collector shoe, (2set / 1 Bogie)		
	Control System	VVVF inverter with IGBT, (1 unit/ M car)		

	Brake Control System	All electric command electro-pneumatic brake
Bogies		Bolster-less type (air suspension)
Air Conditioning Equipment		Roof top type
Auxiliary Power Supply Equipment		SIV: 3-phase inverter with IGBT
Inter communication system		Communication system between front and rear cabin
Passenger Information System		Public address system via loudspeaker Visual information system via LCD screens
Security camera		Preparation
Signal System		ATC Track Circuit System
Maker		Kawasaki, Nippon sharyo, Kinki sharyo, Tokyu sharyo

Source: Study Team

Source: Study Team

Tokyo metro series 02 EMU

Specifications of Osaka Subway series 30000 EMU

Technical Parameters		Specification		
Maximum Speed		70km/h		
Gauge		1,435mm (Standard gauge)		
Traction Power Supply		Third Rail System		
Train Formation Tc: Trailer Car with driver's cab, M: Motor car, T: Trailer Car.		5M5T (Tc+M+M+T+M+T+T+M+M+Tc)		
Standard Passenger Capacity		**Seated**	**Standing (3.3 persons/m^2)**	**Total**
	Lead Car	42	88	**130**
	Intermediate Car	48	92	**140**
Capacity of a Train (10 car-sets)		**Per Car**	**Nos. of cars**	**Total**
	Lead Car	130	2	**260**
	Intermediate Car	140	8	**1120**
	Total Passengers (3.3 persons/m^2) Including Seated passenger			**1380 (seated : 468)**
	Total Passengers in different AW (Added Weight due to standing passenger)			

	AW-4: stand (4persons/m^2) + seat	-
	AW-6: stand (6persons/m^2) + seat	-
Major Dimension		
	Leading Car Length	18,200mm
	Intermediate Car Length	18,000mm
	Body Width	2,800mm
	Body Height	3,745mm(Leading Car), 3720mm(Intermediate Car)
Weight per Train (tare)		324.0t
Car weight (tare)		Tc : 33.0t, M : 36.0t, T : 25.5t, 27.0t
Body Materials		Light weight stainless steel
Saloon Design		
	Door Ways	4 doorways each side of car
	Door Type	Double slide doors 1,300 mm width
	Seat type	Longitudinal seat type
Special Facilities		
	Wheel Chair Space	Equipped
	Baggage Space	Not Equipped
	Toilet	Not Equipped
Traffic performance		
	Acceleration	3.0 km/h/s
	Deceleration	Service 3.5 km/h/s
		Emergency 4.0 km/h/s
Propulsion System		
	Power Collection System	DC 750 V, Third Rail System
	Control System	VVVF inverter with, (1 unit/ M and M' car)
	Brake Control System	All electric command electro-pneumatic brake
Bogies		Bolster type (air suspension)
Air Conditioning Equipment		Roof top type
Auxiliary Power Supply Equipment		Static Inverter
Inter communication system		Communication system between front and rear cabin
Passenger Information System		Public address system via loudspeaker Visual information system via LCD screens
Security camera		—
Signal System		ATC Track Circuit System
Maker		Kawasaki

Source: Study Team

Source
https://ja.wikipedia.org/wiki/%E5%A4%A7%E9%98%AA%E5%B8%82%E5%96%B6%E5%9C%B0%E4%B8%8B%E9%89%84 Wikipedia 大阪市営地下鉄

Osaka Subway series 30000 EMU

Specifications of Osaka Subway series 20 EMU

Technical Parameters		Specification		
Maximum Speed		70km/h		
Gauge		1,435mm (Standard gauge)		
Traction Power Supply		Third Rail System		
Train Formation Tc: Trailer Car with driver's cab, M: Motor car, T: Trailer Car.		3M3T (Tc+M+T+M+M+Tc)		
Standard Passenger Capacity		**Seated**	**Standing (3.3 persons/m^2)**	**Total**
	Lead Car	42	88	**130**
	Intermediate Car	48	92	**140**
Capacity of a Train (6 car-sets)		**Per Car**	**Nos. of cars**	**Total**
	Lead Car	130	2	**260**
	Intermediate Car	140	4	**560**
	Total Passengers (3.3 persons/m^2) Including Seated passenger			**820 (seated : 276)**
	Total Passengers in different AW (Added Weight due to standing passenger)			
	AW-4: stand (4persons/m^2) + seat	-		
	AW-6: stand (6persons/m^2) + seat	-		
Major Dimension				
	Leading Car Length	18,200mm		
	Intermediate Car Length	18,000mm		
	Body Width	2,800mm		
	Body Height	3,745mm		
Weight per Train (tare)		190.5t		
Car weight (tare)		Tc : 31.0t, M : 35.0t, T : 23.5t		

Body Materials		Light weight stainless steel
Saloon Design		
	Door Ways	4 doorways each side of car
	Door Type	Double slide doors 1,300 mm width
	Seat type	Longitudinal seat type
Special Facilities		
	Wheel Chair Space	Equipped
	Baggage Space	Not Equipped
	Toilet	Not Equipped
Traffic performance		
	Acceleration	3.68 km/h/s
	Deceleration	Service 5.0 km/h/s
		Emergency 5.0 km/h/s
Propulsion System		
	Power Collection System	DC 750 V, Pantograph
	Control System	VVVF inverter with, (1 unit/ M and M' car)
	Brake Control System	All electric command electro-pneumatic brake
Bogies		Bolster type (air suspension)
Air Conditioning Equipment		Roof top type
Auxiliary Power Supply Equipment		3-phase Generator
Inter communication system		Communication system between front and rear cabin
Passenger Information System		Public address system via loudspeaker Visual information system via LCD screens
Security camera		—
Signal System		ATC Track Circuit System
Maker		Hitach, Kawasaki

Source: Study Team

Source: Study Team

Osaka Subway series 20 EMU

Specifications of Hanshin Electric Railway series 5700 EMU

Technical Parameters		Specification		
Maximum Speed		110km/h		
Gauge		1,435mm (Standard gauge)		
Traction Power Supply		Catenary System		
Train Formation Tc: Trailer Car with driver's cab, M: Motor car, T: Trailer Car.		2M2m (mc+M+M+mc) "m" mean One is T bogie + another is M bogie.		
Standard Passenger Capacity		**Seated**	**Standing** **(3.3 persons/m^2)**	**Total**
	Lead Car	41	83	**124**
	Intermediate Car	45,46	92	**133**
Capacity of a Train (4 car-sets)		**Per Car**	**Nos. of cars**	**Total**
	Lead Car	124	2	**248**
	Intermediate Car	133	2	**266**
	Total Passengers (3.3 persons/m^2) Including Seated passenger			**514 (seated : 173)**
	Total Passengers in different AW (Added Weight due to standing passenger)			
	AW-4: stand (4persons/m^2) + seat	-		
	AW-6: stand (6persons/m^2) + seat	-		
Major Dimension				
	Leading Car Length	18,380mm		
	Intermediate Car Length	18,180mm		
	Body Width	2,750mm		
	Body Height	3,670mm		
Weight per Train (tare)		142.0t		
Car weight (tare)		mc : 34.0t, M : 37.0t		
Body Materials		Light weight stainless steel		
Saloon Design				
	Door Ways	3 doorways each side of car		
	Door Type	Double slide doors 1,300 mm width		
	Seat type	Longitudinal seat type		
Special Facilities				
	Wheel Chair Space	Equipped		
	Baggage Space	Not Equipped		
	Toilet	Not Equipped		
Traffic performance				
	Acceleration	4 km/h/s		
	Deceleration	Service 4.5 km/h/s		
		Emergency 4.5 km/h/s		
Propulsion System				
	Power Collection System	DC 1500 V, Pantograph		
	Control System	VVVF inverter with, (1 unit/ M car)		
	Brake Control System	All electric command electro-pneumatic brake		
Bogies		Bolster type (air suspension)		
Air Conditioning Equipment		Roof top type		

Auxiliary Power Supply Equipment	Static Inverter
Inter communication system	Communication system between front and rear cabin
Passenger Information System	Public address system via loudspeaker Visual information system via LCD screens
Security camera	—
Signal System	ATC Track Circuit System
Maker	Kinki sharyo

Source: Study Team

Source
https://ja.wikipedia.org/wiki/%E9%98%AA%E7%A5%9E5700%E7%B3%BB%E9%9B%BB%E8%BB%8A#/media/File:Hanshin_5700_amagasaki.jpg Wikipedia 阪神 5700 系電車

Hanshin Electric Railway series 5700 EMU

Specifications of JR East series 233 EMU

Technical Parameters	Specification		
Maximum Speed	120km/h		
Gauge	1,067mm		
Traction Power Supply	Catenary System		
Train Formation Tc: Trailer Car with driver's cab, M,M': Motor car, T: Trailer Car.	6M4T (Tc+M+M'+M+M'+T+T+M+M'+Tc)		
Standard Passenger Capacity	**Seated**	**Standing (3.3 persons/m²)**	**Total**
Lead Car	39	103	**142**
Intermediate Car	54	106	**160**
Capacity of a Train (10 car-sets)	**Per Car**	**Nos. of cars**	**Total**
Lead Car	142	2	**284**
Intermediate Car	160	8	**1280**

	Total Passengers (3.3 persons/m^2) Including Seated passenger	**1564 (seated : 510)**
	Total Passengers in different AW (Added Weight due to standing passenger)	
	AW-4: stand (4persons/m^2) + seat	-
	AW-6: stand (6persons/m^2) + seat	-
Major Dimension		
	Leading Car Length	19,570mm
	Intermediate Car Length	19,500mm
	Body Width	2,950mm
	Body Height	3,620mm
Weight per Train (tare)		313t
Car weight (tare)		Tc : 31.6t, M : 32.2t~32.8t, M' : 29.5t, 32.5, T : 28.9t
Body Materials		Aluminum
Saloon Design		
	Door Ways	3 doorways each side of car
	Door Type	Double slide doors 1,300 mm width
	Seat type	Longitudinal seat type
Special Facilities		
	Wheel Chair Space	Equipped
	Baggage Space	Not Equipped
	Toilet	Not Equipped
Traffic performance		
	Acceleration	3.2 km/h/s (0~30km/h)
	Deceleration	Service 4.0 km/h/s
		Emergency 5.0 km/h/s
Propulsion System		
	Power Collection System	DC 1500 V, Catenary System
	Control System	VVVF inverter with IGBT, (1 unit/ M car)
	Brake Control System	All electric command electro-pneumatic brake
Bogies		Bolster-less type (air suspension)
Air Conditioning Equipment		Roof top type
Auxiliary Power Supply Equipment		SIV: 3-phase inverter with IGBT
Inter communication system		Communication system between front and rear cabin
Passenger Information System		Public address system via loudspeaker Visual information system via LCD screens
Security camera		Preparation
Signal System		ATS, Track Circuit System
Maker		JTREC, Kawasaki

Source: Study Team

Source: Study Team

JR East series 233 EMU

Specifications of Tokyo metro series 16000 EMU

Technical Parameters		Specification		
Maximum Speed		110km/h		
Gauge		1,067mm		
Traction Power Supply		Catenary System		
Train Formation Tc: Trailer Car with driver's cab, M: Motor car, T: Trailer Car.		4M6T (Tc+M'+T+M+T+T+M+T+M'+Tc)		
Standard Passenger Capacity		**Seated**	**Standing (3.3 persons/m^2)**	**Total**
	Lead Car	48	95	**143**
	Intermediate Car	54	100	**154**
	Intermediate Car with wheel chair space	51	103	**154**
Capacity of a Train (10 car-sets)		**Per Car**	**Nos. of cars**	**Total**
	Lead Car	143	2	**286**
	Intermediate Car	154	8	**1232**
	Total Passengers (3.3 persons/m^2) Including Seated passenger			**1518 (seated : 522)**
	Total Passengers in different AW (Added Weight due to standing passenger)			
	AW-4: stand (4persons/m^2) + seat	-		
	AW-6: stand (6persons/m^2) + seat	-		
Major Dimension				
	Leading Car Length	19,968mm		
	Intermediate Car Length	19,500mm		
	Body Width	2,800mm		
	Body Height	3,635mm		
Weight per Train (tare)		299.8t		

Car weight (tare)		Tc : 27.8t,27.9t, M : 33.6t, M' : 33.5t T : 26.5t,26.7t
Body Materials		Aluminum
Saloon Design		
	Door Ways	4 doorways each side of car
	Door Type	Double slide doors 1,300 mm width
	Seat type	Longitudinal seat type
Special Facilities		
	Wheel Chair Space	Equipped
	Baggage Space	Not Equipped
	Toilet	Not Equipped
Traffic performance		
	Acceleration	3.3 km/h/s
	Deceleration	Service 3.7 km/h/s
		Emergency 4.7 km/h/s
Propulsion System		
	Power Collection System	DC 1,500V Catenary System
	Control System	VVVF inverter with IGBT, (1 unit/ M car)
	Brake Control System	All electric command electro-pneumatic brake
Bogies		Bolster type (air suspension)
Air Conditioning Equipment		Roof top type
Auxiliary Power Supply Equipment		SIV: 3-phase inverter with IGBT
Inter communication system		Communication system between front and rear cabin
Passenger Information System		Public address system via loudspeaker Visual information system via LCD screens
Security camera		Preparation
Signal System		ATC Track Circuit System
Maker		Hitachi, Kawasaki

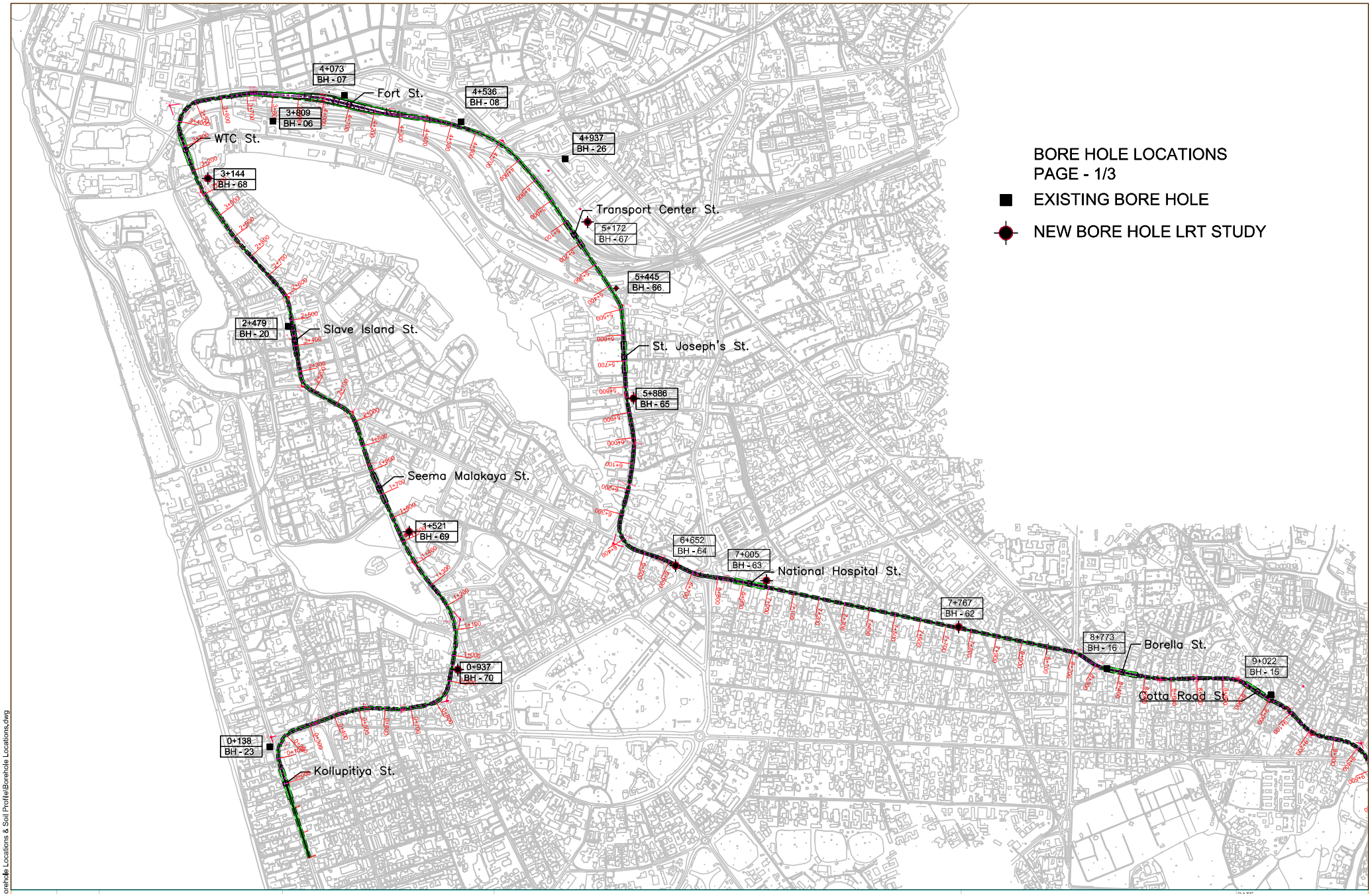
Source: Study Team

Source: Study Team

Tokyo metro series 16000 EMU

Appendix 3 Location of Boreholes and Soil Profile

- **Boring Survey on the JICA-LRT Route: Appendix 3-1 to Appendix 3-6**
- **Boring Survey at the JICA-LRT Depot Area: Appendix 3-7 to Appendix 3-10**



VERSIONS	DATE	DESCRIPTION

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

CONSULTANT

ORIENTAL CONSULTANTS GLOBAL CO.,LTD
JAPAN INTERNATIONAL CONSULTANTS FOR TRANSPORTATION CO.,LTD
TONICHI ENGINEERING CONSULTANTS INC
ENVIRONMENTAL RESOURCE MANAGEMENT ERM JAPAN LTD.

TITLE	NAME	SIGNATURE
DESIGNER		
CHECK		
TEAM LEADER		
PR. MANAGER		

ESTABILISHMENT OF NEW LIGHT RAIL TRANSIT SYSTEM IN COLOMBO

FEASIBILITY STUDY

BOREHOLE LOCATION (1/3)

DATE 12/15/2017
SCALE
SHEET No.
DRG No.
DRG S.
REV X1

Last modified by Cad1 12/15/2017 11:46:30 AM
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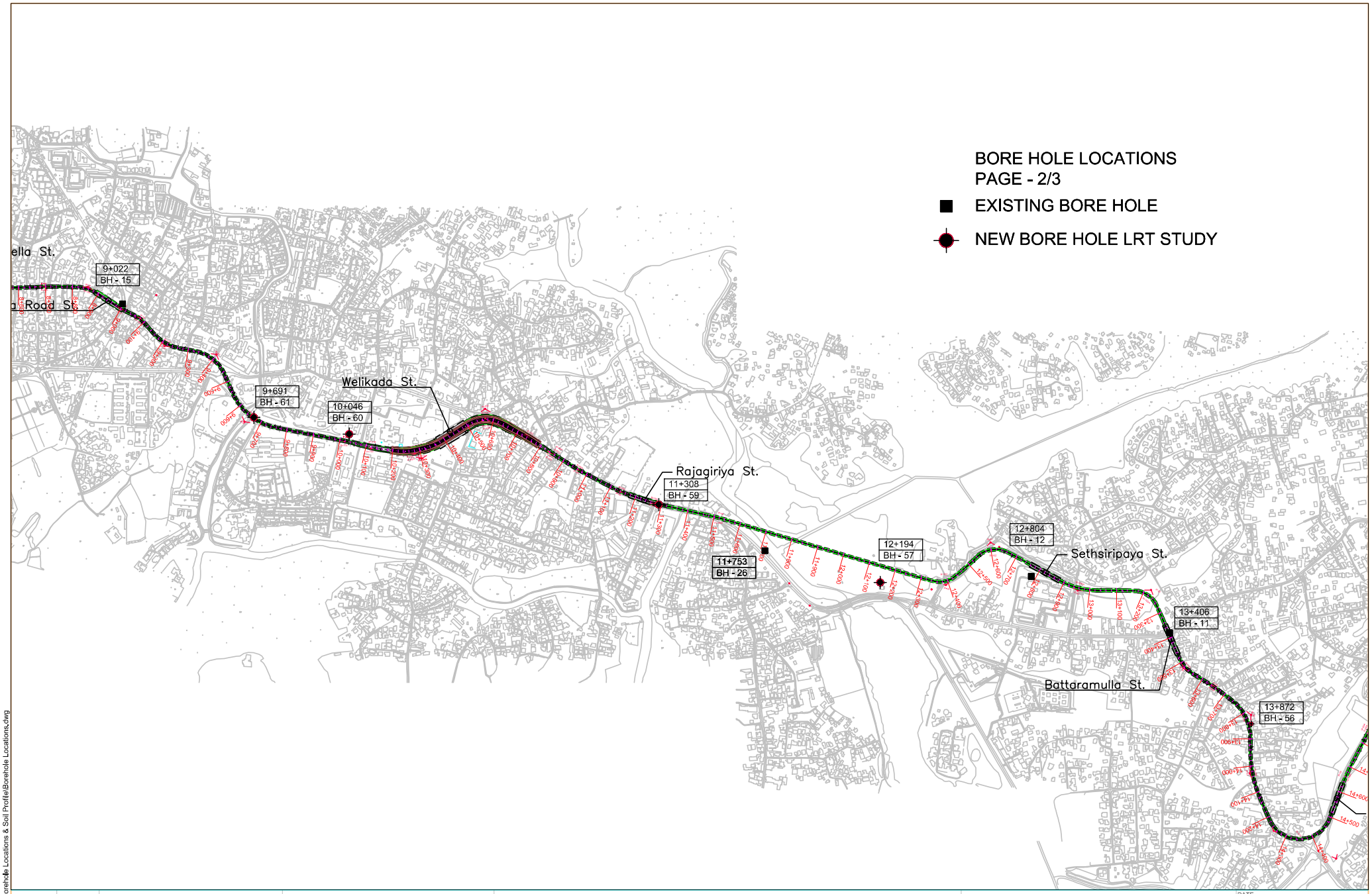
Appendix 3-2



VERSIONS	DATE	DESCRIPTION

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

CONSULTANT

ORIENTAL CONSULTANTS GLOBAL CO.,LTD
JAPAN INTERNATIONAL CONSULTANTS FOR TRANSPORTATION CO.,LTD
TONICHI ENGINEERING CONSULTANTS INC
ENVIRONMENTAL RESOURCE MANAGEMENT ERM JAPAN LTD.

	TITLE	NAME	SIGNATURE
	DESIGNER		
	CHECK		
	TEAM LEADER		
	PR. MANAGER		

ESTABILISHMENT OF NEW LIGHT RAIL TRANSIT SYSTEM IN COLOMBO

FEASIBILITY STUDY

BOREHOLE LOCATION (2/3)

DATE 12/15/2017
SCALE
SHEET No.
DRG No.
DRG S.
REV X1

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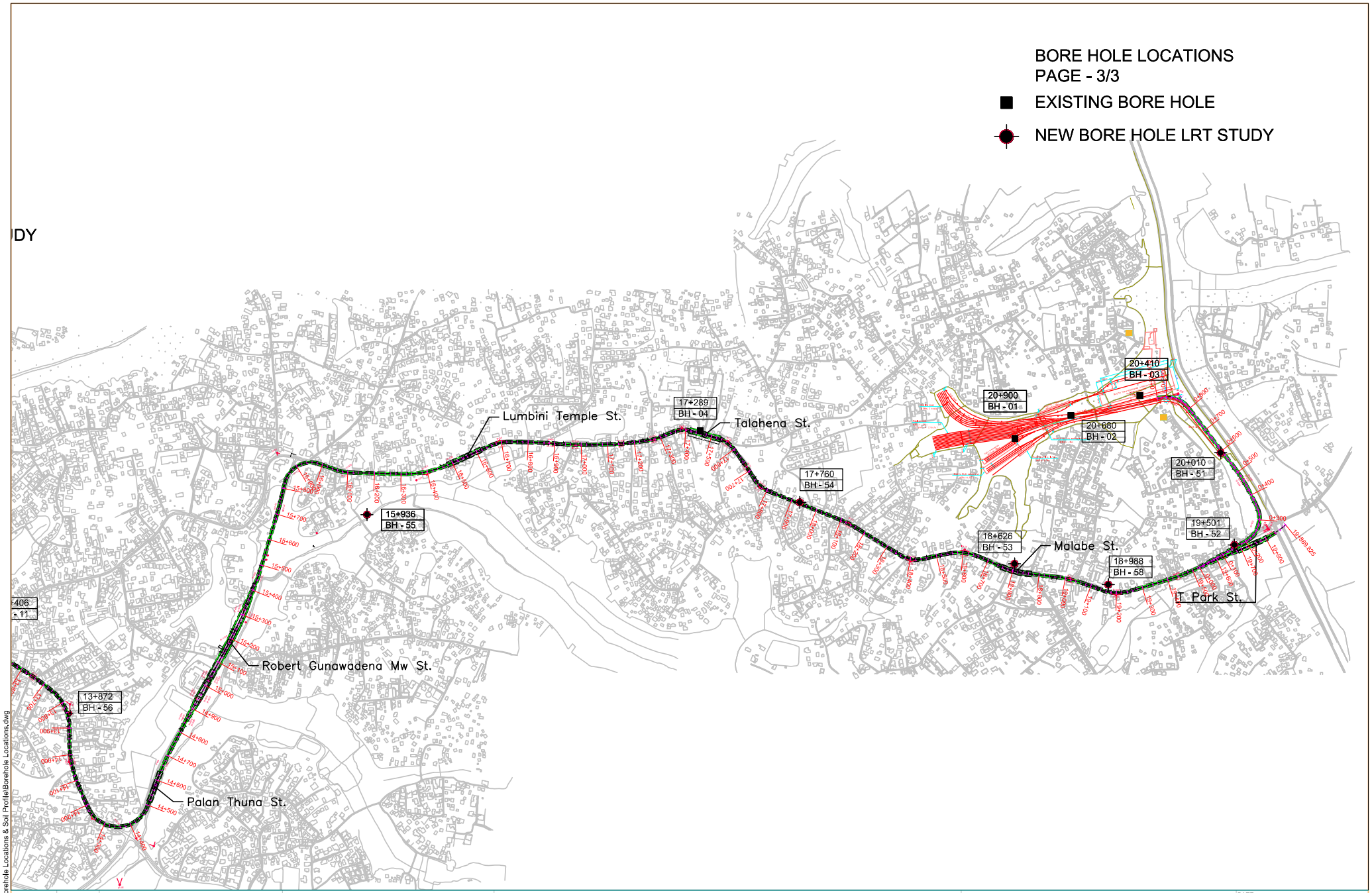

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VERSIONS	DATE	DESCRIPTION

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ENVIRONMENTAL RESOURCE MANAGEMENT ERM JAPAN LTD.

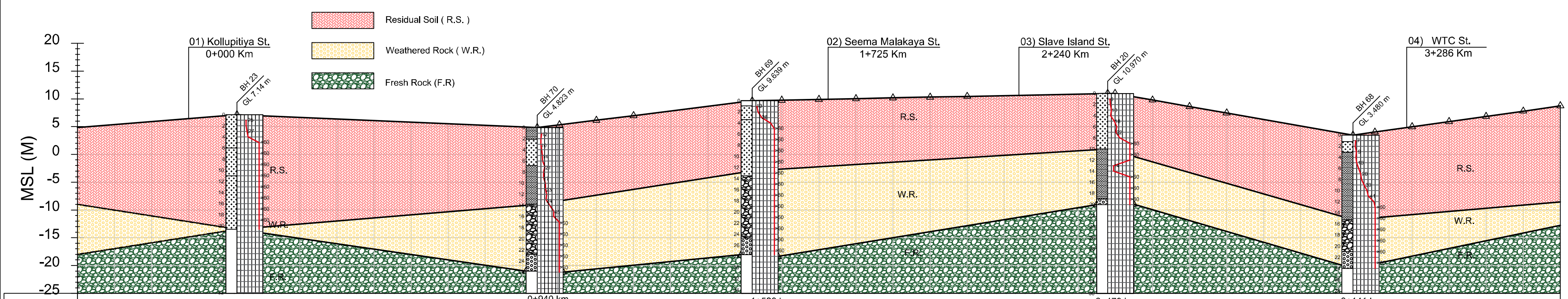
TITLE	NAME	SIGNATURE
DESIGNER		
CHECK		
TEAM LEADER		
PR. MANAGER		

ESTABLISHMENT OF NEW LIGHT RAIL TRANSIT SYSTEM IN COLOMBO

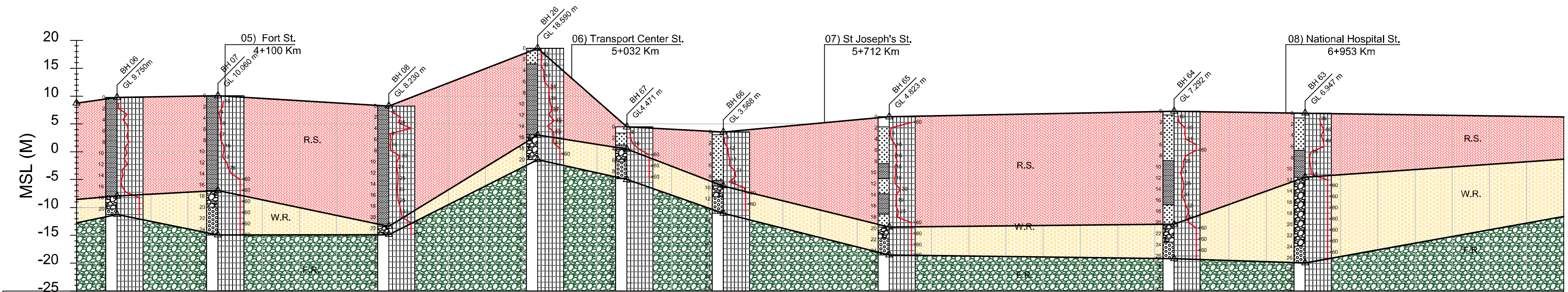
FEASIBILITY STUDY

BOREHOLE LOCATION (3/3)

DATE	12/15/2017
SCALE	
SHEET No.	
DRG No.	
DRG S.	REV X1



STATION (km)	EXISTING GR. LEVEL MSL(M)	WEATHERED ROCK MSL(M)	FRESH ROCK MSL(M)
-0+300	4.823	-8.977	-18.000
-0+200	5.363	-10.023	-16.947
-0+100	5.902	-11.068	-15.894
0+000	6.442	-12.114	-14.842
0+100	6.981	-13.159	-13.789
0+200	6.942	-13.085	-14.147
0+300	6.656	-12.529	-15.109
0+400	6.370	-11.974	-16.071
0+500	6.083	-11.419	-17.033
0+600	5.797	-10.864	-17.995
0+700	5.510	-10.309	-18.957
0+800	5.224	-9.754	-19.919
0+900	4.938	-9.199	-20.881
1+000	5.321	-8.355	-21.148
1+100	6.152	-7.317	-20.593
1+200	6.982	-6.280	-19.944
1+300	7.812	-5.243	-19.294
1+400	8.643	-4.206	-18.645
1+500	9.473	-3.168	-18.091
1+600	9.750	-2.633	-18.252
1+700	9.889	-2.223	-17.167
1+800	10.028	-1.813	-16.081
1+900	10.166	-1.403	-14.996
2+000	10.305	-0.993	-13.910
2+100	10.444	-0.584	-12.825
2+200	10.583	-0.174	-11.739
2+300	10.722	0.236	-10.654
2+400	10.860	0.646	-9.568
2+500	10.958	0.566	-8.978
2+600	9.792	-1.356	-9.926
2+700	8.625	-3.278	-11.885
2+800	7.458	-5.199	-13.843
2+900	6.292	-7.121	-15.801
3+000	5.125	-9.043	-17.759
3+100	3.958	-10.965	-19.717
3+200	4.034	-11.417	-19.701
3+300	4.972	-10.848	-18.314
3+400	5.911	-10.279	-16.926
3+500	6.850	-9.709	-15.538
3+600	7.788	-9.140	-14.150
3+700	8.727	-8.571	-12.763



STATION (km)	EXISTING GR. LEVEL MSL(M)	WEATHERED ROCK MSL(M)	FRESH ROCK MSL(M)
3+700	8.727	-8.571	-12.763
3+800	9.666	-8.001	-11.375
3+900	9.854	-7.611	-12.489
4+000	9.968	-7.238	-13.851
4+100	9.980	-7.220	-14.937
4+200	9.583	-8.617	-14.922
4+300	9.185	-10.015	-14.907
4+400	8.787	-11.413	-14.891
4+500	8.389	-12.811	-14.876
4+600	9.784	-10.916	-12.851
4+700	12.374	-6.826	-9.486
4+800	14.964	-2.736	-6.121
4+900	17.554	1.354	-2.756
5+000	15.060	2.360	-2.308
5+100	9.177	1.311	-3.803
5+200	4.402	-0.037	-5.464
5+300	4.054	-2.577	-7.784
5+400	3.707	-5.116	-10.104
5+500	3.933	-7.126	-12.039
5+600	4.542	-8.782	-13.718
5+700	5.150	-10.438	-15.396
5+800	5.759	-12.094	-17.075
5+900	6.300	-13.509	-18.531
6+000	6.432	-13.442	-18.621
6+100	6.564	-13.376	-18.711
6+200	6.696	-13.309	-18.801
6+300	6.828	-13.242	-18.891
6+400	6.960	-13.176	-18.981
6+500	7.092	-13.109	-19.071
6+600	7.223	-13.043	-19.161
6+700	7.245	-11.858	-19.309
6+800	7.147	-9.463	-19.520
6+900	7.050	-7.068	-19.731
7+000	6.952	-4.673	-19.942
7+100	6.852	-4.112	-18.813
7+200	6.753	-3.647	-17.614
7+300	6.653	-3.183	-16.415
7+400	6.553	-2.718	-15.215
7+500	6.453	-2.253	-14.016
7+600	6.354	-1.789	-12.816
7+700	6.254	-1.324	-11.617

VERSIONS | DATE | DESCRIPTION

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TONICHI ENGINEERING CONSULTANTS INC

ENVIRONMENTAL RESOURCE MANAGEMENT ERM JAPAN LTD.

TITLE	NAME	SIGNATURE
DESIGNER		
CHECK		
TEAM LEADER		
PR. MANAGER		

ESTABILISHMENT OF NEW LIGHT RAIL TRANSIT SYSTEM IN COLOMBO

FEASIBILITY STUDY

VERTICAL PROFILE ACROSS BOREHOLE

0-300~7+700 Km

DATE 12/14/2017
SCALE
SHEET No. 1
DRG No.
DRG S.
REV

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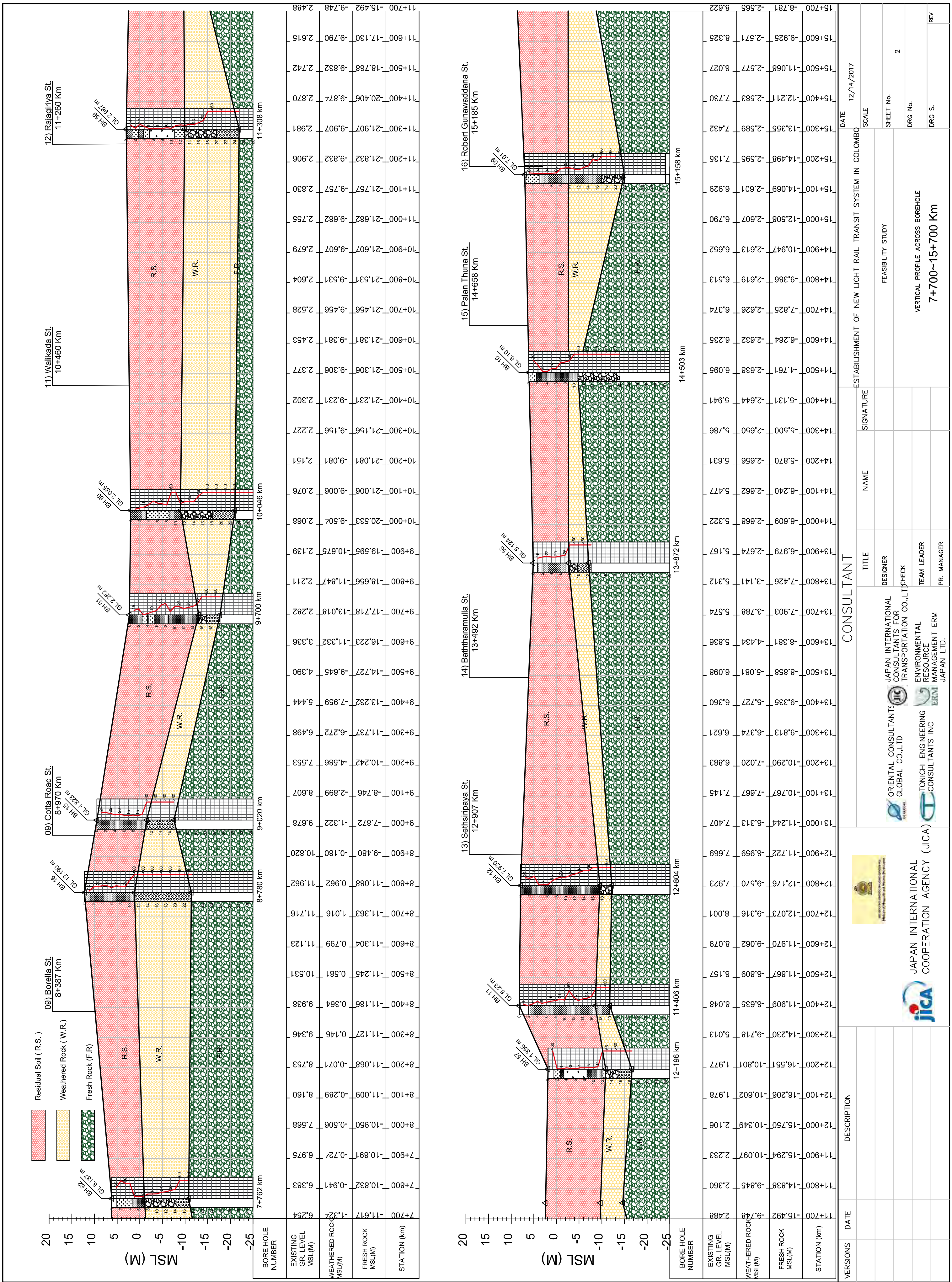
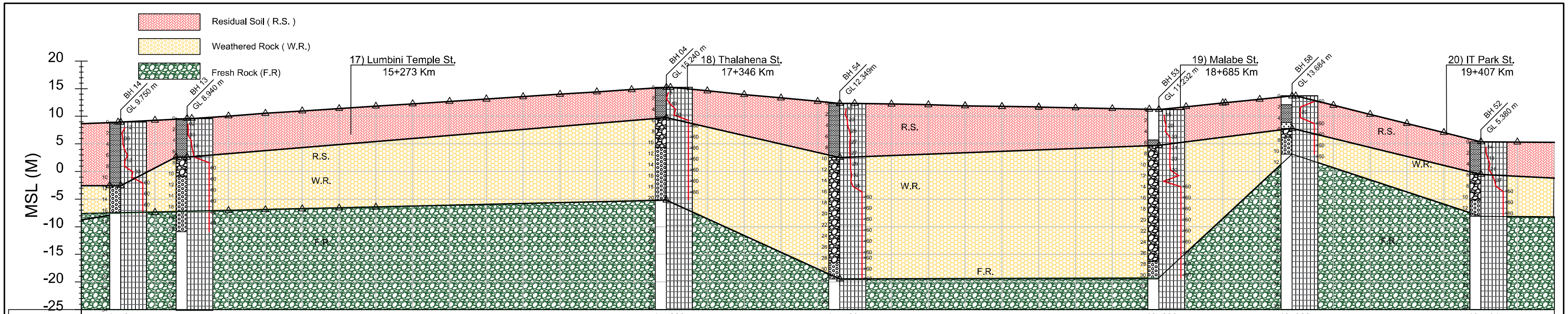
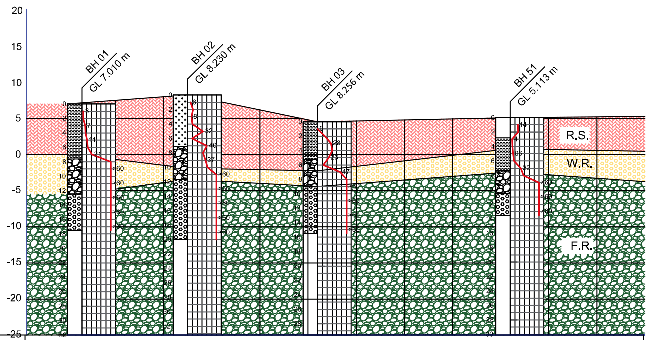


Residual Soil (R.S.)
Weathered Rock (W.R.)
Fresh Rock (F.R)
MSL (M)
09) Borella St. 8+387 Km
09) Cotta Road St. 8+970 Km
11) Wallikada St. 10+460 Km
12) Rajagiriya St. 11+260 Km
13) Sethsiripaya St. 12+907 Km
14) Baththaramulla St. 13+492 Km
15) Palan Thuna St. 14+658 Km
16) Robert Gunawaddana St. 15+185 Km
BORE HOLE NUMBER
EXISTING GR. LEVEL MSL(M)
WEATHERED ROCK MSL(M)
FRESH ROCK MSL(M)
STATION (km)
CONSULTANT
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
ORIENTAL CONSULTANTS GLOBAL CO.,LTD
JAPAN INTERNATIONAL CONSULTANTS FOR TRANSPORTATION CO.,LTD
TONICHI ENGINEERING CONSULTANTS INC
ENVIRONMENTAL RESOURCE MANAGEMENT ERM JAPAN LTD.
TITLE
DESIGNER
CHECK
TEAM LEADER
PR. MANAGER
NAME
SIGNATURE
ESTABLISHMENT OF NEW LIGHT RAIL TRANSIT SYSTEM IN COLOMBO
FEASIBILITY STUDY
VERTICAL PROFILE ACROSS BOREHOLE
7+700~15+700 Km
DATE 12/14/2017
SCALE
SHEET No. 2
DRG No.
DRG S.
REV
VERSIONS
DATE
DESCRIPTION



BORE HOLE NUMBER	15+877 km	15+957 km	17+289 km	17+760 km	18+626 km	18+988 km	19+501 km

STATION (km)	EXISTING GR. LEVEL MSL(M)	WEATHERED ROCK MSL(M)	FRESH ROCK MSL(M)
15+700	8.622	-2.565	-8.781
15+800	8.920	-2.560	-7.638
15+900	9.287	0.649	-7.409
16+000	9.611	2.682	-7.247
16+100	10.048	3.230	-7.085
16+200	10.532	3.777	-6.923
16+300	10.964	4.325	-6.761
16+400	11.397	4.872	-6.599
16+500	11.829	5.420	-6.438
16+600	12.261	5.968	-6.276
16+700	12.694	6.515	-6.114
16+800	13.126	7.063	-5.952
16+900	13.558	7.610	-5.790
17+000	13.991	8.158	-5.628
17+100	14.423	8.705	-5.466
17+200	14.855	9.253	-5.304
17+300	15.240	9.572	-5.494
17+400	14.612	8.045	-8.528
17+500	13.945	6.519	-11.562
17+600	13.331	4.992	-14.596
17+700	12.717	3.465	-17.630
17+800	12.349	2.650	-19.443
17+900	12.214	2.902	-19.421
18+000	12.079	3.154	-19.400
18+100	11.910	3.406	-19.379
18+200	11.781	3.658	-19.358
18+300	11.652	3.910	-19.337
18+400	11.524	4.162	-19.316
18+500	11.395	4.414	-19.295
18+600	11.266	4.666	-19.273
18+700	11.733	5.356	-14.678
18+800	12.411	6.199	-8.476
18+900	13.088	7.042	-2.274
19+000	13.651	7.590	2.920
19+100	12.000	5.971	0.723
19+200	10.349	4.352	-1.475
19+300	8.698	2.734	-3.673
19+400	7.047	1.115	-5.870
19+500	5.397	-0.504	-8.068
19+600	5.325	-0.865	-8.151
19+700	5.269	-1.213	-8.213



BORE HOLE NUMBER	20+873 km	20+650 km	20+380 km	19+980 km

STATION (KM)	EXISTING GR. LEVEL MSL (M)	WETHERED ROCK MSL (M)	FRESH ROCK MSL (M)
20+900			
20+800	7.409	-0.679	-4.795
20+700	7.956	-1.473	-3.912
20+600	7.552	-1.937	-3.648
20+500	6.197	-2.070	-4.003
20+400	4.841	-2.203	-4.359
20+300	4.679	-1.621	-4.021
20+200	4.814	-0.861	-3.551
20+100	4.950	-0.100	-3.000
20+000	5.086	0.661	-2.489
19+900	5.158	0.707	-2.777
19+800	5.213	0.575	-3.264
19+700	5.269	-4.443	-3.751

VERSIONS	DATE	DESCRIPTION

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ENVIRONMENTAL RESOURCE MANAGEMENT ERM JAPAN LTD.

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CHECK		
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PR. MANAGER		

ESTABILISHMENT OF NEW LIGHT RAIL TRANSIT SYSTEM IN COLOMBO

FEASIBILITY STUDY

VERTICAL PROFILE ACROSS BOREHOLE

15+700~20+900 km

DATE 12/14/2017
SCALE
SHEET No. 3
DRG No.
DRG S.
REV

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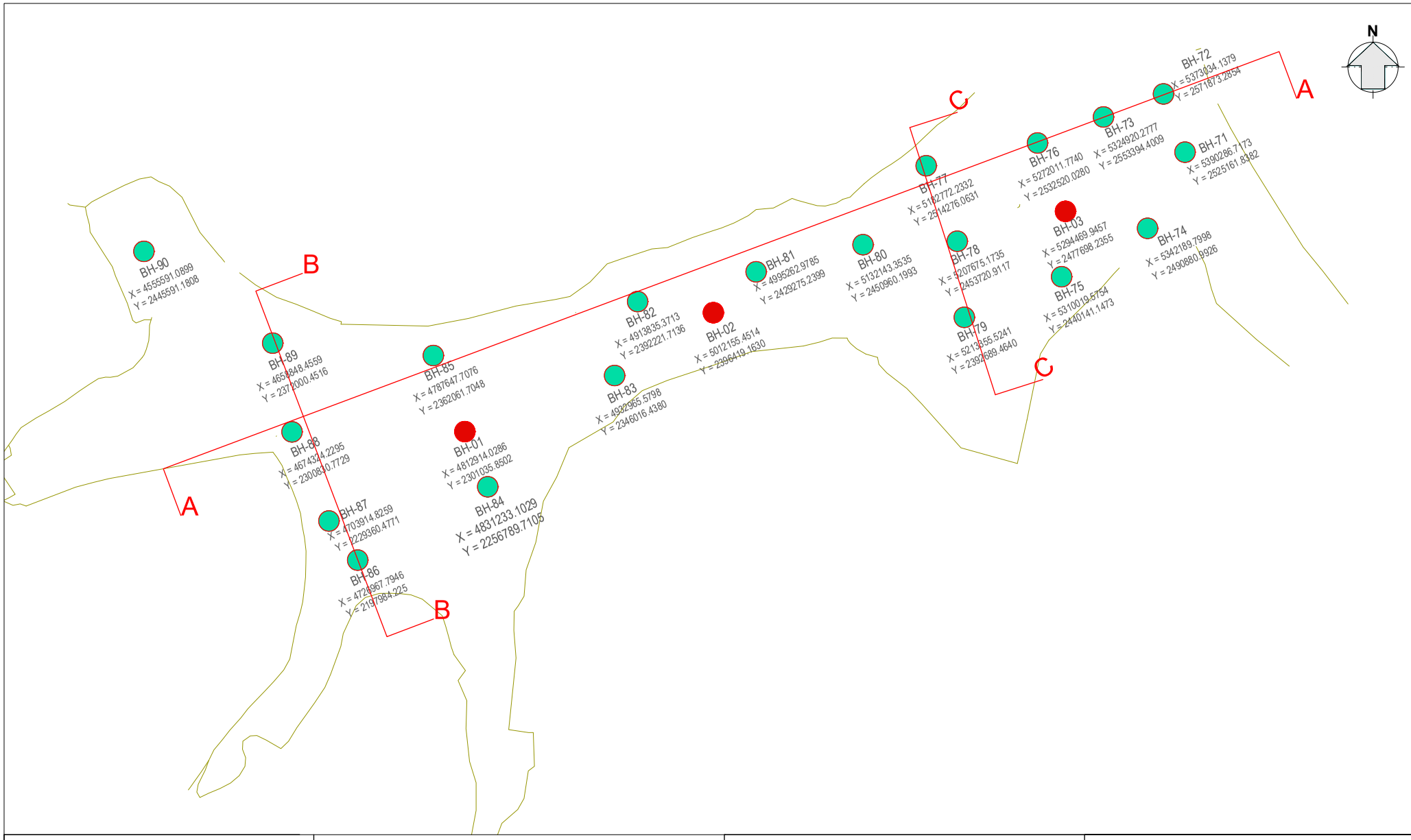
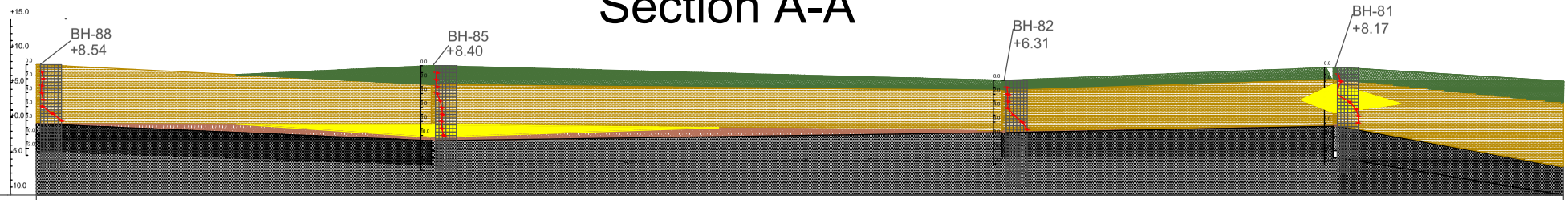
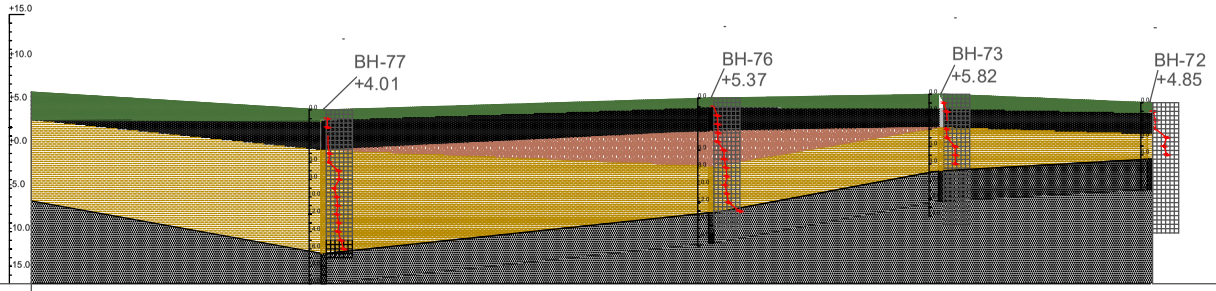


CLIENT	PROJECT	CONTRACTOR	DRAWING
Oriental Consultants Global Co. Ltd	Preparatory Study on the Project for Establishment of New Light Rail Transit System in Colombo,Sri Lanka	Soiltech Pvt Ltd 352, Rajagiriya Road Rajagriya, Sri Lanka	Location map Of Boreholes

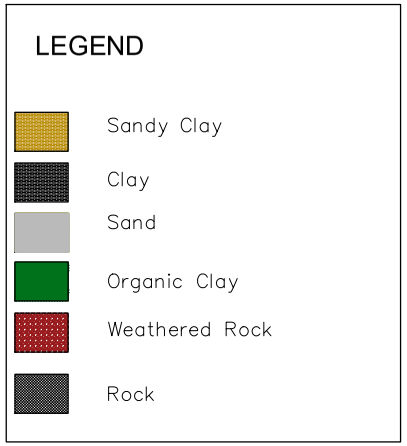
Section A-A



Bore Hole No	BH- 88	BH - 85	BH - 82	BH - 81
Existing Ground Level (MSL)	+8.54	+8.40	+6.31	+8.17
Weathered rock Level (MSL)	+0.09	-1.85	-0.94	-0.18
Fresh Rock Level (MSL)	+0.04	-1.90	-1.19	-0.33

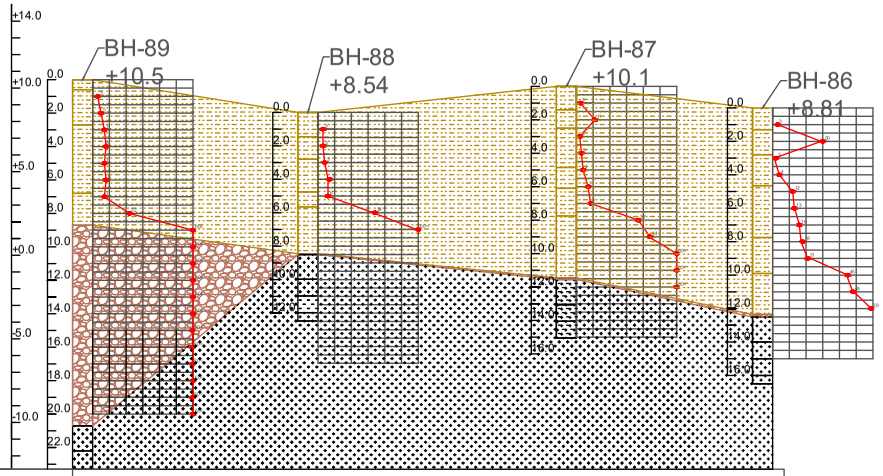


Bore Hole No	BH - 77	BH - 76	BH-73	BH-72
Existing Ground Level (MSL)	+4.01	+5.37	+5.82	+4.85
Weathered rock Level (MSL)	Not Exist	-1.57	Not Exist	Not Exist
Fresh Rock Level (MSL)	-11.49	-7.83	-2.99	-1.65



CLIENT	PROJECT	CONTRACTOR	DRAWING
Oriental Consultants Global Co. Ltd	Preparatory Study on the Project for Establishment of New Light Rail Transit System in Colombo,Sri Lanka	Soiltech Pvt Ltd 352, Rajagiriya Road Rajagriya, Sri Lanka	Soil Strata -Section A-A

Section B-B



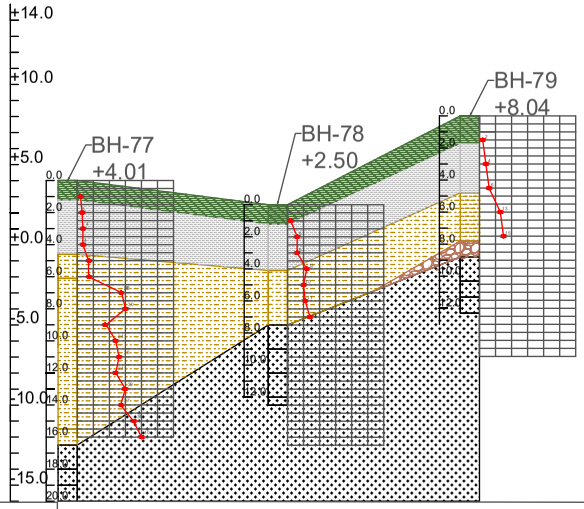
Bore Hole No	BH-89	BH-88	BH-87	BH-86
Existing Ground Level (MSL)	+10.5	+8.54	+10.1	+8.81
Weathered rock Level (MSL)	+1.80	+0.09	-1.34	-3.54
Fresh Rock Level (MSL)	-10.2	+0.04	-1.44	+3.69

LEGEND

- Sandy Clay
- Clay
- Sand
- Organic Clay
- Weathered Rock
- Rock

CLIENT	PROJECT	CONTRACTOR	DRAWING
Oriental Consultants Global Co. Ltd	Preparatory Study on the Project for Establishment of New Light Rail Transit System in Colombo,Sri Lanka	Soiltech Pvt Ltd 352, Rajagiriya Road Rajagriya, Sri Lanka	Soil Strata -Section B-B

Section C-C



Bore Hole No	BH-77	BH-78	BH-79
Existing Ground Level (MSL)	+4.01	+2.50	+8.04
Weathered rock Level (MSL)	Not Exist	Not Exist	+0.24
Fresh Rock Level (MSL)	-12.49	-5.00	-0.76

LEGEND

- Sandy Clay
- Clay
- Sand
- Organic Clay
- Weathered Rock
- Rock

CLIENT	PROJECT	CONTRACTOR	DRAWING
Oriental Consultants Global Co. Ltd	Preparatory Study on the Project for Establishment of New Light Rail Transit System in Colombo,Sri Lanka	Soiltech Pvt Ltd 352, Rajagiriya Road Rajagriya, Sri Lanka	Soil Strata -Section C-C