General Bid Bulletin No. 3
October 23, 2017

Invitation for Bid No. 17-065-3

Expansion of the Existing Depot at Baclaran and Construction of a New Satellite Depot at Zapote for Light Rail Transit (LRT) Line 1-South (Cavite) Extension Project

Issued to revise, amend and/or clarify certain provisions in the Bidding Documents issued for this project.

A. CLARIFICATION

REFERENCE	BASES FOR CLARIFICATION/AMENDMENT/ INCLUSION
CLARIFICATIONS IN THE BIDDING DOCUMENTS FROM PROSPECTIVE BIDDERS	Please refer to the attached **ANNEX "A"** of this General Bid Bulletin for details.

All other portions of the Bidding Documents affected by these revisions, amendments and/or clarifications shall be made to conform to the same.

Revisions/amendments/clarifications made herein shall be considered an integral part of the Bidding Documents.

For the Bids and Awards Committee III

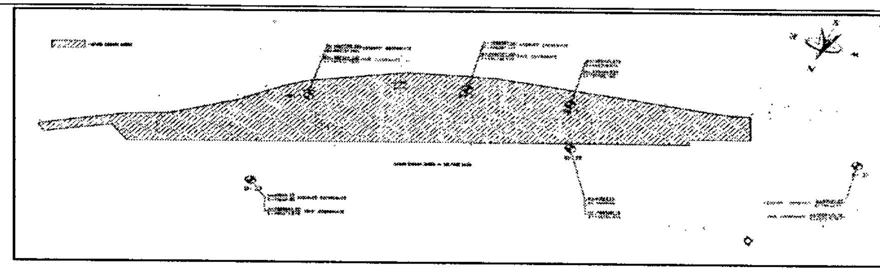
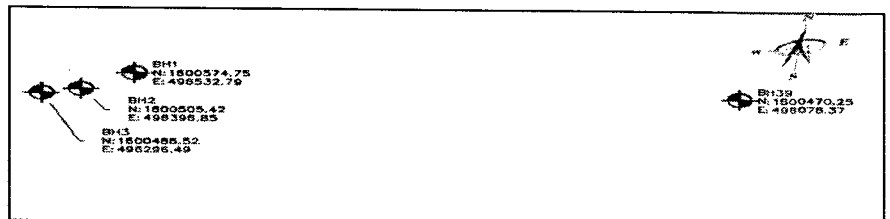
ENGR. EDWARD R. SADDI
Chairperson

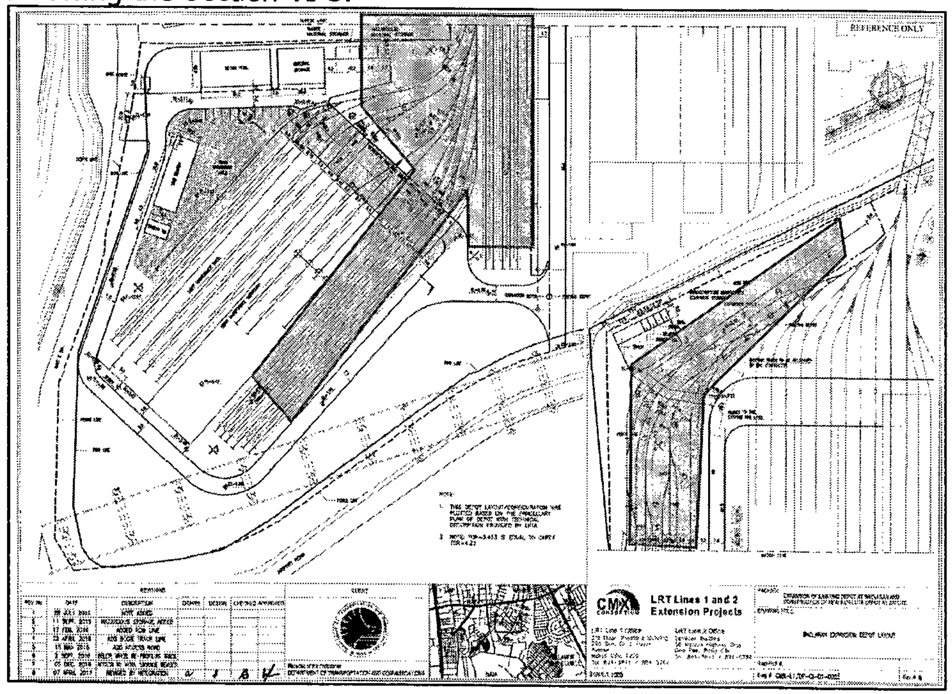
PS Complex, RR Road, Cristobal St., Paco, Manila **Tel/Fax 561-7025 & 561-6098**

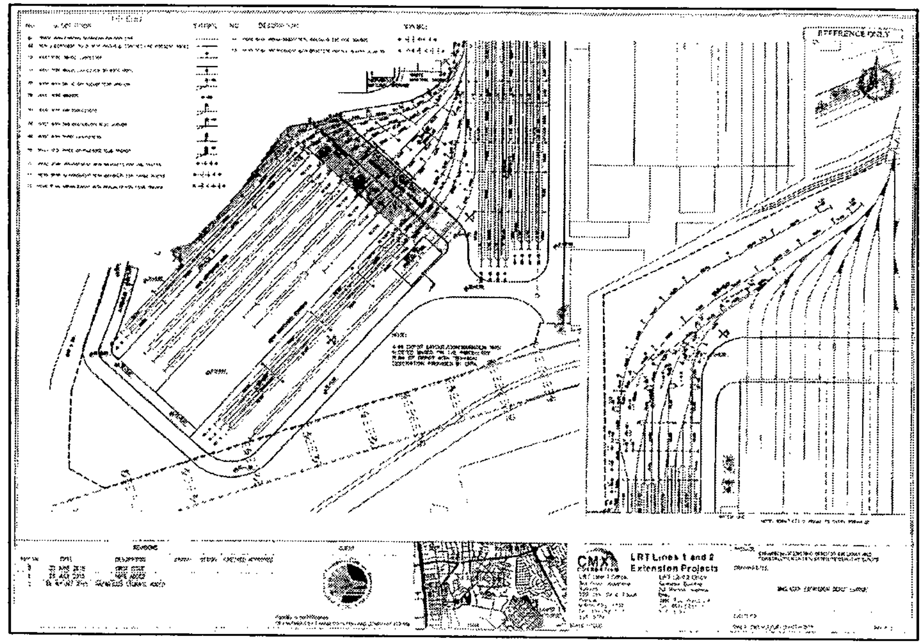
ANNEX "A"

A. CLARIFICATION

No.	Section No.	Page No.	Clause No. / Title	Clarification Request	Response
1.	GBB No.1 Site Visit Guideline Item III. Request for Authority to conduct Site Visit. Clause 3.			Updated contact details of DOTr.	Site Visit request to **DOTr End-User Unit** revised as follows: **DOTr End-User Unit** Ms. Joanna May Macaranas Telephone: (+632) 318-5762 local 8300 Facsimile: (+632) 318-5762 local 8308 Email: railoffice.dotr@gmail.com **Please see attached Site Visit Guidelines (refer to Attachment "A-1" of this GBB).**
2.				We would like to receive the extension of the deadline for the Bid submission at least until 25th January 2018, which means 120 days from the issuing date of the Invitation for Bids.	The Bidding Period is retained at this moment but request for extension is under evaluation.

					Bidders requesting for extension for the deadline of submission of Bids are required to submit a detailed Bid preparation timeline that shall be evaluated.
3.	VI-4-1		Borehole coordinates *Soil Investigation Geotechnical Investigation Report April 2017 (Job No. 2573-15-R0)* • *Borehole Location / Vicinity Map* • *Boring Log BH1, BH2 and BH3*	 Refer to above map, we found the given borehole coordinates is not clear. The only readable coordinates are those of BH39. We tried to refer to the borehole coordinates from the boring log report, which only those of BH1, BH2 and BH3 are provided. We plotted the borehole layout based on these coordinate (see below) and found that their locations are mismatch which what showed on the map (above). 	The Supplemental Information attached drawing "true coordinate" is correct. **Please refer to attached drawing "Zapote Satellite Depot Layout with Coordinates."** Based on the attached drawing all borehole locations are the same as the drawing which is attached to the Supplemental Information VI-4-1 SI-SI.

				Kindly confirm and advise us with the correct borehole coordinates. In addition, boring log data for BH37, BH38 and BH39 are missing. If they are available, kindly please provide us the data for better design and construction planning.	Data for boreholes BH36 to BH39 are shown in the Supplemental Information page SI-SI-18 to SI-SI-32.
4.	VI-3 - VI-4-4	Drawing	OCS Layout Plan *Section VI-3 Drawing* • *CMX-L1/DP-CI-01-0003* *OCS and Anchor Foundation* • *CMX-L1/DP-CI-01-0003)*	The drawing shown in *Section VI-3* and *VI-4-4* do not tally as highlighted below. Please advise which drawing to follow. In case the drawing shown in *Section VI-3* govern, please provide us the revise OCS layout plan following the *Section VI-3*.  **Section VI-3 Drawing**	Section VI-3 drawing No.CMX-L1/DP-CI-01-0003 Rev. #.8 shall govern. **Please refer to the attached updated drawing "Baclaran Exp. Depot OCS and Anchor foundation Layout."**

				 **Section VI-4-4 OCS and Anchor Foundation**	
5.	VI-4-4		Loading Consideration for OCS and Anchor Foundation	According to the summary table of OCS foundation loadings, some type of OCS is with anchor. Do the loading shown for this type includes the foundation load shown below the summary table or it is needed to be added? See table below. This applies for both Baclaran and Zapote depot	The Supplemental Information VI-4-4 SI-OCS & AF attached Baclaran and Zapote pegging plan (OCS and Anchor foundation numbers and load tables) to be superseded by the

OCS and Anchor Foundation

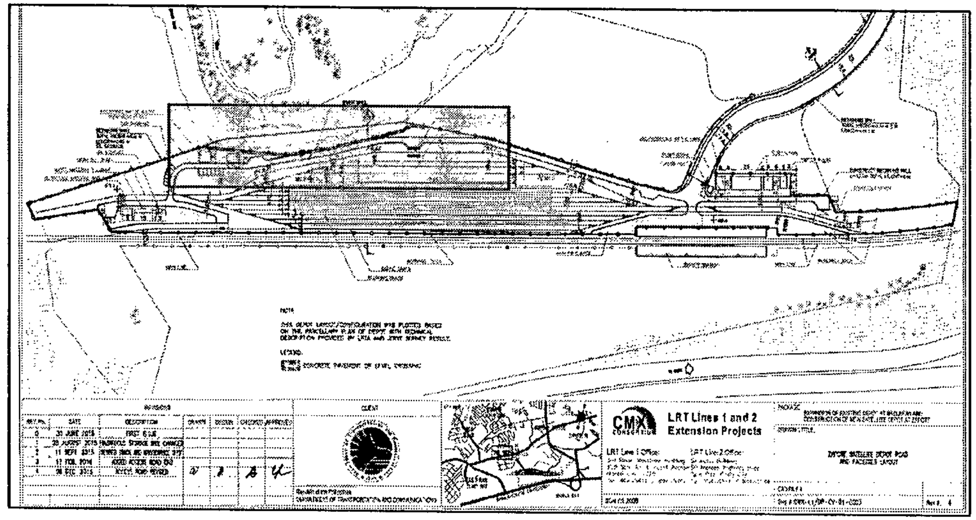
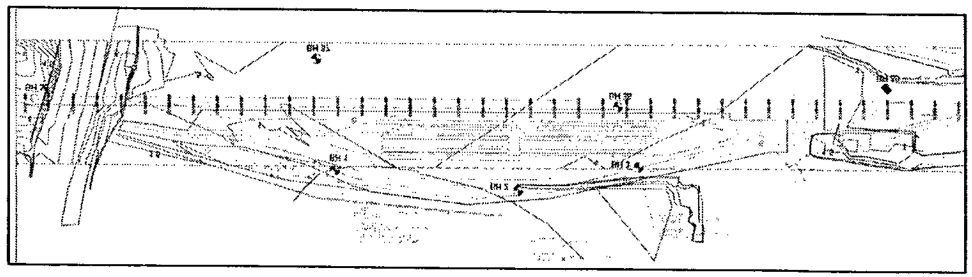
[illegible]								
S.no	Description	Symbol	Qty	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	1.1 Mast with Single cantilever		41	35198	19335	15811	7003	3754
	1.2 Mast with cantilever on both sides		0					
2	2.1 Mast with single cantilever plus anchor		1	81617	19335	36490	7008	3754
	2.2 Mast with anchor		3					
3	Mast with two cantilever		7	40241	19335	16838	8218	3754
4	Mast with two cantilevers plus anchor		5	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
5	5.1 Mast with three cantilevers		0	45288	19335	17857	5558	3754
	5.2 Mast with three cantilevers plus anchors		6					
6	Headspan across 2 tracks (For each Upright)		1	72211	19335	14910	11609	3754
7	Headspan across 3 tracks (For each Upright)		4	107484	19335	16200	16445	3754
8	Headspan across 4 tracks (For each Upright)		2	144432	19335	16773	21492	3754
9	Headspan across 5 tracks (For each Upright)		2	182014	19335	17293	26515	3754
10	Headspan across 6 tracks or higher (For each Upright)		26	219915	19335	17706	31177	3754
	Total		109					
	Anchor Foundations		[illegible]	N/A	N/A	[illegible]	[illegible]	[illegible]

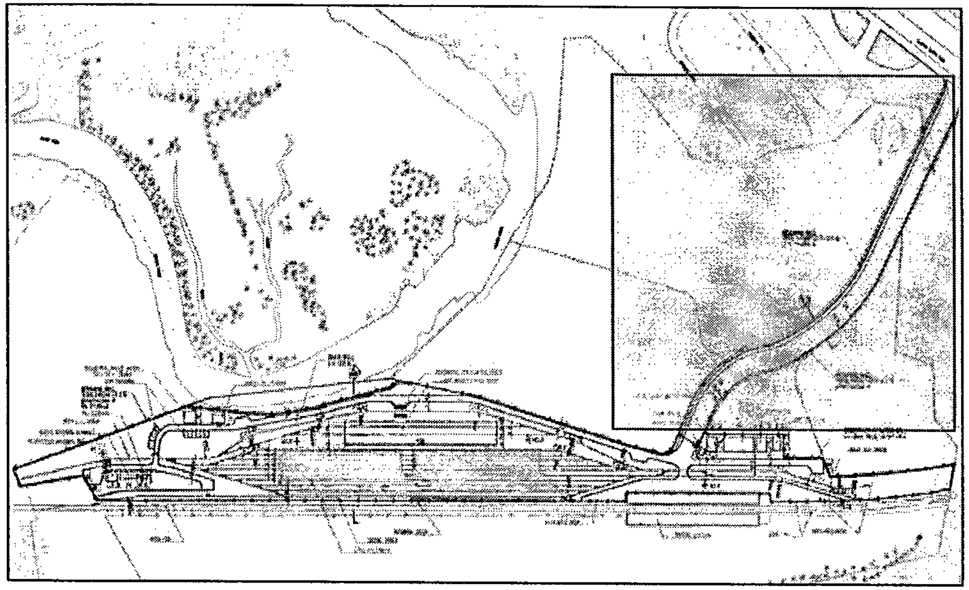
- OCS with Anchor

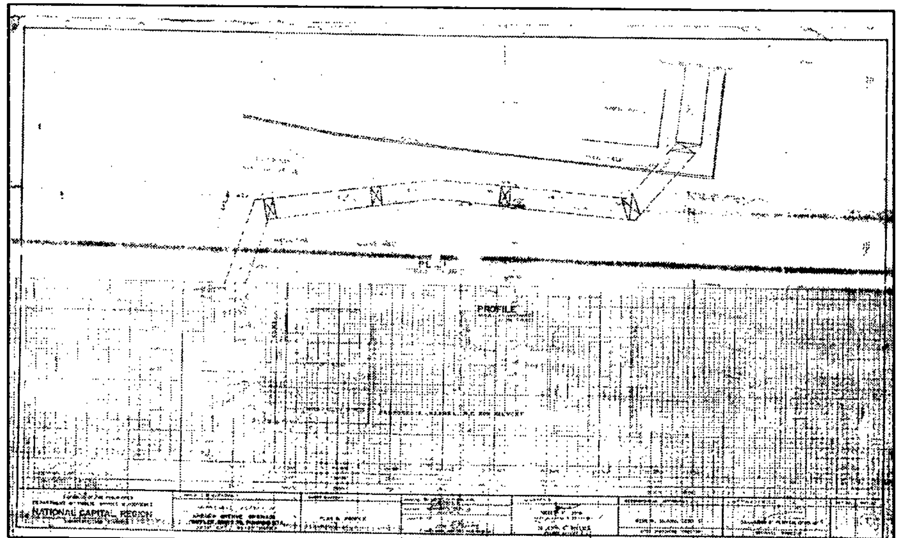
- Anchor Foundation Loading

revised data which was issued by the Concessionaire to CMX on October 11th **(Please refer to attached " Baclaran & Zapote Depot OCS and Anchor Foundation Requirement (Pegging Plan)".**

For the loading data, the Concessionaire is now confirming with the EPC contractor. Confirmation will be provided upon receipt from the Concessionaire.

6.	VI-3	Drawing	River Wall Design for Zapote Depot • *CMX-L1/DP-CV-01-0003*	According to Section VI-3 Drawing, a river wall shall design for Zapote depot. For us to design the wall we need to know the river bed level as the provided topo survey (Section VI-4-2) do not show any. Location of river wall is highlighted below.  **Section VI-3 Drawing**	River bed level to be investigated by the Bidder on site.
	VI-4-2		*Topographic Survey*	 **Section VI-4-2 Topographic Survey**	

7.	VI-3	Drawing	Access Road for Zapote Depot • *CMX-L1/DP-CV-01-0003*	An access road shall be design and constructed to connect the proposed depot to the existing drawing. But the no data is provided in Section VI-4-2 Topographic Survey for this access road area. Could you please provide to us the existing ground level along this alignment so we can design for the retaining wall and the slope of embankment.  **Section VI-3 Drawing**	Current available data is the attached data in VI-4-2 SI-TS only. Bidders are required to execute necessary investigation/ survey etc. based on the Employer's Requirements.

8.	VI-4-5		Drawing of Rain Water Drainage for Baclaran Depot *Box Culvert*	According to Section VI-4-5 Box Culvert, there are existing box culvert drain in the proposed location of Baclaran depot extension. For our design of rain water drainage we need to know the depth of this existing box culvert. For construction of the Motor Pool and Waste Material Storage Buildings, its foundation also be affected by the depth of the the Drainage that we will be designing. There are plan and profile included in the provided information but it is not clear (see below). Can we have a clearer copy of this as-built drawing? 	Clear copy is not available. Since one cross section of box culvert manhole which was surveyed during concept design is available, **we attach the drawing "Baclaran Depot Existing Box Culvert"** for your reference. Further detail information to be investigated by the Bidder on site.

9.	VI-2-2		Height Limit Gantry *Technical Specification CL. B13.3*	As specified in the technical specification, height limit gantry shall be design to control high vehicles from that will pass the area where Overhead Catenary is present. The specification also mention that location is shown in tender drawing. Upon checcking the tender drawings, the location of it is not specified. And also the height of overhead catenary is not stated or shown in any drawing. Please kindly provide these informations. **13.3 Height Limit Gantry** The Steel height limit gantry shall be constructed at the location shown on the Drawings in order to restrict entry of vehicle where overhead catenary line is running. The beam bottom elevation of Height Limit Gantry shall be a minimum of 50cm lower than the level of overhead catenary line of the area. This beam bottom elevation should be coordinated with the OCS to ensure the clearance is sufficient.	Height Limit Gantries are required before level crossings on the Depot Internal road. Minimum Requirement Required numbers are: In Baclaran Expansion Depot 3 Gantries and Zapote Satellite Depot 2 Gantries. Locations to be proposed by the Contractor during detail design. Clearance between Top of Rail to the bottom of horizontal beam is 3.8m.
10.	VI-4		Soil Investigation *Part 2 Employer's Requirements Supplemental Information VI-4-1*	Though the JSCE method is adopted for accessing liquefaction potential on Page-SI-SI-5, the procedure of NCEER 1997 is used on Page 6 of 14. In addition, we couldn't find the JSCE method in the JSCE criteria. Is it possible to give us the copy? Which criteria should we use for the assessment?	For the copy of JSCE method and criteria to be used for the assessment, it has been requested and shall be provided upon receipt through another General Bid Bulletin (GBB). Supplemental Information VI-4-1 "Evaluation Report on the Results of Geotechnical Investigation and Recommendation of Soil Improvement Methods for Zapote Depot Area" is for reference only.
11.			General	Can we change the type of the retaining wall?	Yes. As this is a Design and Build Bidding, the Bidders may propose a design that shall

					comply with the Employer's Requirements and that shall provide the same quality or better, which would be acceptable subject to the Engineer's Evaluation.
12.			General	Can you provide us a clear and detail of Topographic Survey for the Zapote Satellite Depot?	No additional data is available. The current available data is the attached data in VI-4-2 SI-TS only. Bidders are required to execute necessary investigation/ survey, etc. based on the Employer's Requirements.

For the Bids and Awards Committee III

ENGR. EDWARD R. SADDI
Chairperson

ATTACHMENT "A-1"

SITE VISIT GUIDELINES FOR THE
LRT LINE 1 – SOUTH (CAVITE) EXTENSION PROJECT
EXPANSION OF THE EXISTING DEPOT AT BACLARAN AND
CONSTRUCTION OF A NEW SATELLITE DEPOT AT ZAPOTE

I. VENUE AND COVERAGE

The venue of the first site visit on **October 13, 2017** shall be at the Light Rail Manila Consortium Engineering Office located at Existing **Baclaran Depot.** Assembly time and place is **at 7:30 A.M. outside of Gate 3**. The site visit shall include the inspection of the Existing Baclaran Depot, proposed location of Baclaran Expansion Depot and Zapote Satellite Depot such as but not limited to:

1. LRT Line 1 Existing Baclaran Depot:

    - Heavy Maintenance and Light Maintenance Shops;
    - Infrastructure and Electro-Mechanical Systems;
    - Train Wash Plant
    - Substation
    - Stabling Area
    - Depot Equipment, Machineries, Tools and Implements;
    - Material Storage Areas/Warehouse
    - LRTA Administration Building
    - Other Facilities and Premises.

2. LRT Line 1 Baclaran Expansion Depot:

3. Zapote Satellite Depot:

II. OBJECTIVES

The objective of the site visit shall be the following:

1. To allow Bidders to validate their understanding of the Bidding Documents, specifically the Technical Specifications;
2. To enable Bidders to conduct or complete their conduct of due diligence with respect to the contract under bid vis-à-vis the existing conditions of the subject systems, areas, premises and objects of the contracts; and
3. To enable Bidders to familiarize themselves with and assess the existing conditions of the subject systems, area, premises, and objects of the contract.

III. REQUEST FOR AUTHORITY TO CONDUCT SITE VISIT

1. Site visits/ocular inspections shall be allowed, **from 8:00 AM to 5:00 PM** beginning from the issuance of this guideline until seven (7) calendar days before the bid submission date.

2. Bidders who intend to conduct site visit/s shall address their requests to the Chairperson, Bids and Awards Committee III. Requests should be accompanied by a duly accomplished Confirmation Form (Form A).

   THE CHAIRPERSON
   BIDS AND AWARDS COMMITTEE III
   Procurement Division III
   Procurement Service
   PS Complex, Cristobal Street,
   RR Road, Paco, Manila 1007
   Philippines

3. Both requirements shall be submitted to the **PS BAC III through its Secretariat** and a copy furnished to the End-User Unit for this Project through fax and email **at least three (3) working days before the desired date and time for the site visit** in the following address/ contact numbers:

   BIDS AND AWARDS COMMITTEE III
   Tel.No.: (+632) 689-7750 loc 4021
   E-mail Address: pd3@ps-philgeps.gov.ph

   DOTr End-User Unit
   Ms. Joanna May Macaranas
   Tel.No.: (+632) 318-5762 local 8300
   Facsimile: (+632) 318-5762 local 8308
   Email Address: railoffice.dotr@gmail.com

4. Only formal requests duly received by the **PS BAC III** shall be given due course.

5. **The DOTr End-User Unit** shall forward the copy of request including the duly accomplished **Confirmation Form to Light Rail Manila Corporation (LRMC)** for proper coordination and to carry a Safety Induction prior to access to site, if necessary. The DOTr End-User Unit shall confirm with the bidder its request and schedule to conduct the site visit.

6. **A maximum of ten (10) representatives per Bidder** will be allowed to join the site visit. In the absence of any of the representatives indicated in Form A, alternate representatives may be allowed to join the site visit in place of the absent representatives.

IV. ATTIRE

Bidders' representatives who will be joining the site visit are required to wear proper attire as follows:

1. Bidders' are required to wear non-slip safety shoes, rubber boots, safety helmet and safety vest.;
2. Loose casual clothing should be avoided.

V. CONDUCT OF SITE VISIT/ INSPECTION

1. Duly designated PS/DOTr-LRTA/LRMC and CMX Consortium personnel will assist in the conduct of the site visit.

2. PS/DOTr-LRTA/LRMC personnel, including its contractors and service providers, who are on-site working and operating the current system, as well as the members of the BAC III, the Technical Working Group (TWG), BAC Secretariat, CMX Consortium and/or DOTr End-User Unit will not entertain and answer questions from Bidders. Bidders are therefore advised to send their queries in writing and address the same to the PS BAC III Chairperson.

3. The requested activity as well as the Bidder's representatives involved therein must not in any way impede or interfere with the normal operations, maintenance and/or business activities of the LRT Line 1 System, the activities of DOTr-LRTA /LRMC personnel and its contractors and service providers, and/or the normal movements of LRT Line 1 passengers.

4. In order to facilitate the orderly conduct of the site visit and for easy mobility, Bidder's representatives are encouraged not to bring heavy or bulky materials, equipment or gadgets. The materials, equipment or gadgets in the list submitted by the Bidder will be subject to the inspection and approval of the LRTA prior the entry in the LRT Line 1 premises.

5. In case any activity is conducted inside the train. Bidder's representatives shall not tamper, handle and/or operate any train control at any time.

6. All Bidders' representatives involved in the activity must log-in/log-out with the designated security personnel and wear proper identification tags at all times while inside the LRT Line 1 premises.

7. Taking of videos and photographs during the site visit is allowed, provided that these shall only be used by the Bidders, and only for purposes of the subject procurement process.

8. The "NO-SMOKING, NO-EATING/DRINKING AND NO-LITTERING" policy inside the LRT Line 1 premises shall be strictly observed. The Bidder's representatives shall

ensure that any activity area is clean and in order upon leaving the premises. All waste materials used by the Bidder's representatives must be completely cleaned up and brought out of the LRT Line 1 premises by the said representatives.

9. The Bidders shall be responsible for the conduct of its representatives at all times. Bidders shall not hold DOTr-LRTA/LRMC liable for any injury or loss suffered by them or their representatives while inside the LRT Line 1 premises. However, any damage or loss suffered by DOTr-LRTA /LRMC as a result of the actions of the Bidder's representatives shall be charged against the said Bidder.

10. Bidders are not allowed to request for documents, records manuals and similar documents during the site visit. All documents, record manuals and similar documents must be requested in writing and addressed to the PS BAC III, and they shall be issued through a supplemental/bid bulletin in the **Procurement Service (PS) Website**.

11. Minutes of the site visit will not be prepared. Any statement made by any official, employee, personnel and/or contractor of PS, DOTr and/or LRTA/LRMC and CMX shall not be binding nor render any effect with respect to the subject procurement process or project unless the same is addressed or contained in a duly promulgated supplement/ bid bulletin.

12. Unless otherwise amended by a subsequent issuance, the provisions in this guidelines shall continue to apply.

Form A

CONFIRMATION FORM
LRT LINE 1 – SOUTH (CAVITE) EXTENSION PROJECT
EXPANSION OF THE EXISTING DEPOT AT BACLARAN AND
CONSTRUCTION OF A NEW SATELLITE DEPOT AT ZAPOTE

Bidder's Name: ______________________________

The Bidder hereby nominates the following authorized representative/s to participate in the site visit for the above-mentioned project and undertakes to abide by the Guidelines for the Site Visit as provided by PS, DOTr and LRTA/LRMC.

List of Personnel to Enter the Facility
Maximum of ten (10) representatives per Bidder

	NAME	DESIGNATION	EMAIL ADDRESS	CONTACT NO.	SIGNATURE
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

Alternate Representatives
(In the absence of the above-mentioned representatives):

	NAME	DESIGNATION	EMAIL ADDRESS	CONTACT NO.	SIGNATURE
1					
2					

3					
4					
5					

List of Materials / Equipment / Gadget to be brought into the System / Premises by the Bidder

	DESCRIPTION	QUANTITY	UNIT
1			
2			
3			
4			
5			

____
Name and Signature of Authorized Representative
Date: ______________________________

Attachments:
Copy of one (1) company ID each of the representatives, preferably, or any Government-issued ID.

Response to RFI-ALS-CEM-0001-A

As requested we have reviewed and revised our previous calculations of OCS foundation requirements from the calculation performed two years ago based on the following changes introduced following a more detailed review of the parameters of the existing system :

- The wind speed and design wind pressure: (It was considered 150kgf/m2 earlier now 240 kgf/m2 as per preliminary calculations)
- Aerial earth wire: taken previously and not considered for calculation now
- Tramway OHE regulated or not: previously assumed regulated, OHE considered unregulated now
- Height of contact wire: Now we have considered it 4.7 m in Single structure calculation but it might rise upto 5.5 m)
- Radial loads due to tension varied: this has reduced now, knowing that the tramway is not regulated anymore (as tramway is not regulated , and initial tension is increased to 1200 kg; and span is considered as 10 to 35 m. Worst loading condition is at minimum temperature with increase in tension due to unregulated OHE. So calculation is performed on tension of 1911 kg)
- Range of temperature variation: two years ago, we took as -2.5 to 50 deg C (Range of Temperature is considered as per new environmental conditions 15 to 40 deg C)
- Type of cantilever as its weight is a factor.(now considered 50 kg)
- Construction weight included as 100 kg as per EN 50119.
- Type of Mast (Changed to HEB Series Mast)
- Mast Height (Changed as per new calculations)
- Span Length (Changed as per new preliminary calculation)

Attached are the revised calculation results and a draft document explaining the basis for the calculation.The design and optimization is ongoing and is the subject of some iterative discussion between various parties, as such there may be some variation between these calculations and those formally submitted as part of preliminary design of the OCS later this month. Nevertheless, these Calculations are a more accurate representation of the eventual loads than those provided previously.

Project:	**MANILA LRT1 CAVITE EXTENSION (L1CEP)**
Asset Owner / Grantor:	**Department of Transportation (DOTr.) & Light Rail Transit Authority (LRTA)**
Concessionaire:	**Light Rail Manila Corporation (LRMC)**
EPC Contractor:	**Bouygues Travaux Publics Philippines Inc. & Alstom SA. & Alstom Transport Construction Philippines Inc.**
Other:	

	PREPARED BY	REVIEWED BY	CHECKED BY	APPROVED BY
NAME	H.Jain	Naveen Mann	Peter Edwards	Simon Cordier
POSITION	Design Engineer - POS	OCS Design & Interface Coordinator	System Technical Manager	Deputy Project Director
SIGNATURE				
DATE				

Status

Title – Document type

Title – Area / Location

ZAPOTE & BACLARAN DEPOT

Title – Discipline

OCS

Title – Document

Baclaran & Zapote Depot - Calculations Note / Design Brief

Document Number

Project and Number Code	*Originator*	*Location*	*Sys.\ Sub-Sys.\ Discipline*	*Document Type*	*Number*	*Revision*

Document number							
-	-	-	-	-	-	-	0 0
Project Code	NTP Code	Organization	Location Code	Discipline	DocT	Unique Number	Revisinn

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Content

1. Introduction

ALSTOM is part of the consortium awarded with the contract for Cavite extension in manila light rail transit.

2. Purpose and Scope

2.1. Purpose

The purpose of this document is to finalize the design methodology for load and Bending Moment calculations for OHE masts and head spans for various loadings conditions inside a depot structure..
The main purpose of this document is to

- This document describes the calculation method for Independent OCS masts,Headspans, wall mounted headspans according to the different loads, the load calculation allows the load and Bending moment at the top of the foundation .With these load values multiplied with the safety factors as per the prevalent standards foundations will be designed.
- The selection of OHE HEA Series (H column masts) masts in function of stress, deflection at the top of mast and at the contact wire level and torsion (twin cantilever), the length of mast is imposed by the assembly to be made, and must be determined beforehand.
- The selection of adequate mast foundation and anchor foundation.
- Establish the torsional effect of an intermediate and axis mast in an uninsulated or insulated overlap.

Determine the correct torsion on the cantilever in order to calculate the appropriate rotation angle and avoid twisting of mast wherever applicable.

2.2. Scope

This document is applicable for the present project of Cavite extension in manila light rail transit. The scope of the present document is to formulate the methodology for load and Bending moment calculations at the top of the foundations in depot area for different loading conditions.

3. References and Standards Applicable

3.1. References

#	Title	Reference
[1]	Project Glossary	L1CEPG-G-M100-0-PMG-000xx
[2]	Project Quality Manual	L1CEP1-G-M500-0-PMG-000xx
[3]	Project Management Plan	L1CEPG-G-M100-0-PMG-000xx
[4]	Records Management Procedure	L1CEPG-G-M500-0-PMG-000xx
[5]	Exhibit #14 of EPC Contract	
[6]	Exhibit #2 od EPC Contract	
[7]	System General Specifications	L1CEPG-1-D200-0-ATSA-00001

3.2. Standards Applicable

Reference	Title
EN 50119	Railway Applications - Fixed installations - Electric traction overhead contact lines
NSCP-2015	The National structural Code of the Philippines Vol 1, 7th edition 2015
EN 50149	Railway applications. Fixed installations. Electric traction. Copper and copper alloy grooved contact wires
DN 48201-1	Copper stranded conductors

4. Mast types, Loading Conditions, General and OHE parameters

4.1. General

Overhead equipment masts of steel have been successfully developed on trial and are cleared for erection on main line and depot for supporting overhead equipment. The overhead equipment is unregulated and tension at ambient temperature is considered as 1250 kgf for design of structure. Environmental conditions are considered as per the technical specifications of Project.

4.2. Type of Masts

The H beam masts are considered for supporting Overhead equipment's. HEA,HEB Series structures (H Beam Steel) of Length as per the design required is considered for erection on main line and yard lines for supporting overhead equipment.

Type of Loadings

There are mainly six (6) types of loading where the above fabricated steel masts will be in use.

These are

- Load Condition 1: Masts with Single cantilever (Push or Pull off)
- Load Condition 2: Masts with Single cantilever and anti-creep anchor wire (Push or Pull off)
- Load Condition 3: Masts with Double cantilever (Push or Pull off)
- Load Condition 4: Masts with Double cantilever and anti-creep wire (Push and Pull off)
- Load Condition 5: Masts with Triple cantilever (Push and Pull off)
- Load Condition 6: Masts with Triple cantilever and anti-creep wire (Push and Pull off)

4.3. Ambient Conditions

PARAMETER	TYPE	VALUE	REFERENCE
TEPMERATURE	MAXIMUM	+40 °C	Technical Specifications
	MINIMUM	15°C	
	AVERAGE	+ 27.5°C	
Wind Pressure	Above 10m from MGL	200 kgf/m²	Design Consideration

4.4. OHE Parameters

	CONTACT WIRE	ANTICREEP WIRE (WHERE EXIST)
QTY	1	1
MATERIAL	CU-AG	GALV. STEEL
SECTION (MM²)	150	93.3
DIAMETER (MM)	14.5	12.5
LINEAR MASS (KG/M)	1.334	0.7915
MAXIMUM TENSION IN WIRE (Kg)	1250	1250

5. Mast Orientation and Load Sign Convention

- The H section mast (HEA Series): The masts are oriented such as that Maximum inertia considered in the direction of the greatest loads.
- The mast is assumed to be perfectly fixed to the foundation.

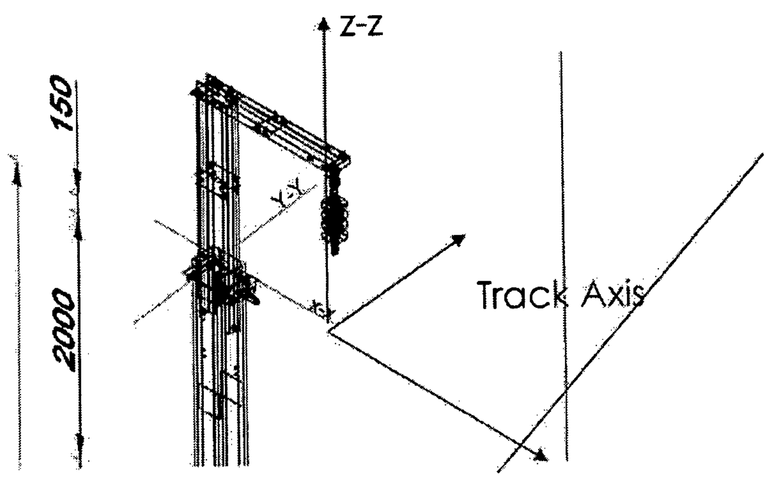


Figure 1 : Orientation of Mast for Illustrative propose only, Actual representation will be different at site.

Note: M_x = Moments Perpendicular to the track (XX Axis is perpendicular to track)
M_y = Moments Parallel to the track (YY Axis is parallel to track)

The above sketch is just for the purpose of information for understanding the principal of calculation and they do not correspond to the real assembly drawing or distances.

6. Loads

All the catenary structure calculation is based on the resistance of material theory and concept. These calculations also follow the International standards, customer requisitions and local construction legislations.

6.1. Permanent Loads

6.1.1. Vertical Loads

Vertical loads include

- Self-weight of each component. (Includes contact, Cantilevers and other components attached to the mast etc.).
- Anchoring Stay.(includes the self-weight of anchor wire e.g. OHE anchor, anticreep anchor as the case may be including the attachments)

6.1.2. Horizontal Loads

a) Horizontal and Perpendicular to track

- Loads due to cables and wires deviated where they are attached to the mast
- Transversal anchoring

b) Horizontal and parallel to track

- Longitudinal anchoring without stays (if any)

6.2. Non-Permanent Loads

6.2.1. Vertical Loads

- Assembly loads – eventual worker on the cable (1715N). Half of this load is applied at the point of attachment of messenger wire at the cantilever and half on the mast.

6.2.2. Horizontal Loads

a) Horizontal and Perpendicular to track

- Wind load on the cable when it blows perpendicularly to track.
- Wind load on the mast when it blows perpendicularly to track

Note: Earth quake load is not considered as wind load is governing.

b) Horizontal and parallel to track

- Wind load on the mast when it blows parallel to the track.

7. Elementary Calculation

7.1. Load Calculations

7.1.1. Vertical Load Calculations

- **Cable Weight**

  The cable weight is normally specified in weight per unit length and generally expressed in Kg/m. With this information the cable weight is calculated by the following expression.

  W = p * L in kg

  Where:

  p : per unit length

  L = Total length of the cable (In case of catenary calculation correspond to the span)

  W = Weight of the cable in Kg

- **Mast Weight**

  The mast weight is calculated similarly to the cable weight calculation. The mast weight is generally expressed in weight per unit length (Kg/m). Therefore, the mast weight is calculated by:

  W = p * L in kg

  Where:

  p = weight per unit length;

  L = Total length of the mast

  W = Weight of the mast (Kg)

- **Other accessories attached to the mast**

  The weight of all the accessories attached to the mast will depend to the materials, compositions and volumes.

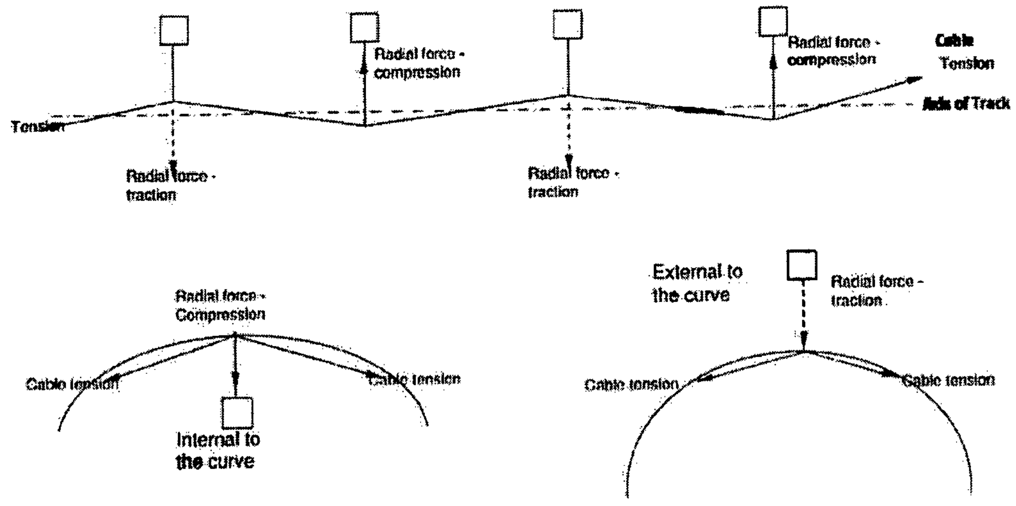
  Normally, the weight of the accessories are information given by the respective supplier and for the same accessory, the weight can change according to different supplier.

  As estimated weight, of 50 Kg is considered for the cantilever.

7.1.2. Perpendicular Horizontal Load Calculations

7.1.2.1 Cable radial forces – due to deviations

The radial force is the force due to the cable mechanical tension and stagger or curve. This force's direction is perpendicular to the track and in the radial sense of the cable.



The force is calculated by the following expression.

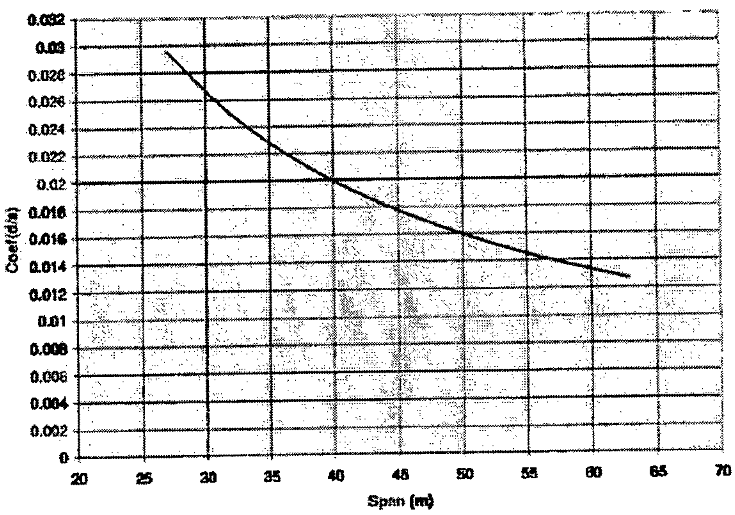
$F_r = \mathbf{Coef}_{d/a} * T$

Where;

F_r = Radial force of the cable (Sense of the load)

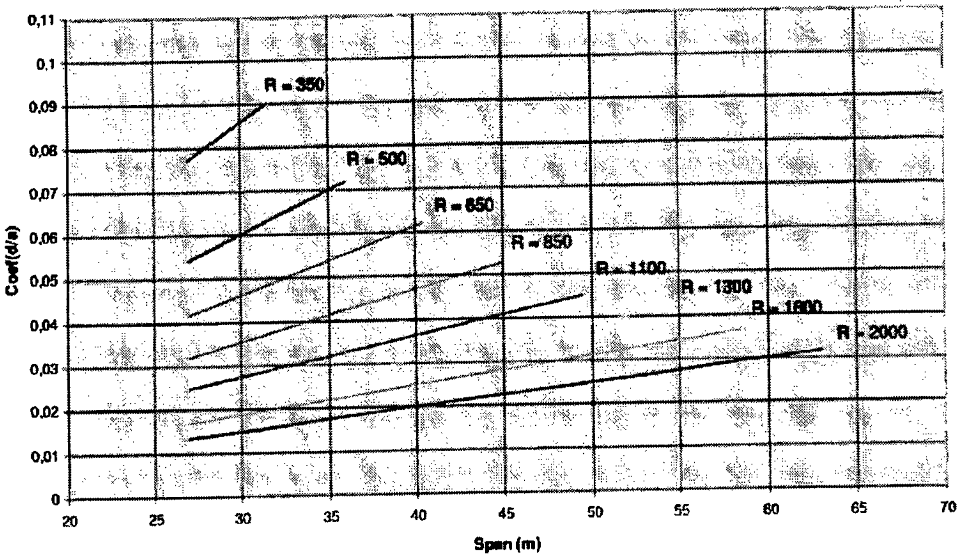
$\mathbf{Coef}_{d/a}$ = Coefficient of deviation (In function of stagger, span and radius)

T = Cable Mechanical tension



Graphic 1 - Coef (d/a) - Straight line – Stagger of 0,2 m

Coef(d/a) x Span - Curve



Graphic 2 - coef(d/a) – Curve

7.1.2.2 Wind Effect

The perpendicular winds effect, also cause a considered, influence on the mast load. The main effect of the wind is,

- Load on the cable
- Load on the mast

The parallel wind also implicates loads on the mast but its effect on the cables can be disconsidered. To calculate the loads, the wind makes an effort of 240 kgf/mon the surface of the structure, having this information in mind, the load calculation for the wind effect can be made on the following expression.

- Cable and tubes
  F = 240 * 0.75 * S1, where; S1 is the section area perpendicular to the direction of the wind, 0.75 is the structure response factor as per EN 50119.
- Flat surface (Wind Perpendicular to track)
  F = 240 * 1.4 * s1, where S1 is section area perpendicular to the direction of wind and 1.4 is the wind coefficient perpendicular to the track.
- Flat surface (Wind Parallel to track)
  F = 240 * 1.4 * s1, where S1 is section area perpendicular to the direction of wind and 1.4 is the wind coefficient perpendicular to the track.

7.1.3. Perpendicular Horizontal Load Calculations

In these direction two considerable loads:

- Wind load, which is calculated with the same method as mentioned in Para 8.1.2.2
  Flat surface (Wind Parallel to track)

F = 240 * 1.4 * s1, where S1 is section area perpendicular to the direction of wind and 1.4 is the wind coefficient perpendicular to the track.

8. MAST DIMENSIONING

8.1. Critical Load

To choose a proper mast, the criteria of dimensioning is to divide the maximum yield stress of the steel structure by the actual stress on the structure due to the loads is taken into consideration for mast dimensioning.

It is worthwhile to understand, the loads calculated in the chapter 7.1 are the real one that acts on structure. After have calculated those values, the stresses on the steel structure due to these various load values shall be calculated.

- The allowable design stress of the steel structure a shall be compared with actual applied stresses on the steel structure and then taken into account for the mast dimensioning.
- The mast deflection shall be calculated at the top anchor cantilever tube height as against the allowable deflection limit and based on the same a pre-sag is determined for the mast before loading.

8.2. Load Combination

The loads on the structure should not be taken individually to make the dimensioning of the structure but should be combined according to the following expression.

Case 1: (Permanent loads only)

Case 2: (Permanent loads) + (Non-permanent loads)

Case 3: (Permanent loads) – (Non-permanent loads)

8.3. Dimensioning

8.4.1.Stress Requirement
After having the stress calculated by the formula expressed above, the following step is find the worst point on the critical surface which these stresses are acting on.
The stress admissible for this dimensioning process is the elastic limit of the material. For the material grade E 250, the yield strength of the steel is $\sigma_{yield} = 250\ N/mm^2$.
The biggest stress on the critical section is calculated by:

$\sigma_d = \sigma_{MXX} + \sigma_N + \sigma_{sec} < \sigma_{max}$

8.4.2 Deflection of Mast
Mast deformation shall be limited to avoid assembly and adjustement problems.
The deformation is calculated under the following situations:

- Permanent loads
- With normal wind for the calculation of the contact wire displacement due to wind perpendicular to the track

Type of Deflection	Limit	In function of
At top tube cantilever height	8 cm	Permanent loads
At top tube cantilever height	5 cm	Non-permanent loads (wind)

At top tube cantilever height	8 cm	(Permanent loads) + (Non- permanent loads)
At top tube cantilever height	8 cm	(Permanent loads) - (Non- permanent loads)

The calculation method is mentioned in chapter 9.7.3.

8.4.3. Deflection of Mast

Symbols for the calculation of Mast deflection

Symbols	**Unit**	**Denomination**
F	[Kg]	Concentrated load
M	[Kg.m]	Flexion Moment
Q	[Kg/m]	Distributed load
H	[m]	Height of the mast
H	[m]	Height of the application of F
E	[Kg/mm^2]	Elasticity module
I	[Cm^4]	Inertia moment
F_h	[Cm]	Sag at the load application point
F_H	[Cm]	Sag at the top of the mast

1) Sag at height h due to applied load F at point h'

$f_h = [F * h'^2 * \{2h' + 3(h-h')\}] / (6 * E * I)$

Where; h' is the height of the force acting and h is the height where the sag is being calculated.

2) Sag at height h due to distributed load q

$f_h = [q/H] * h^3 * / (8 * E * I)$

3) Sag at height h due to moment M applied at point h'

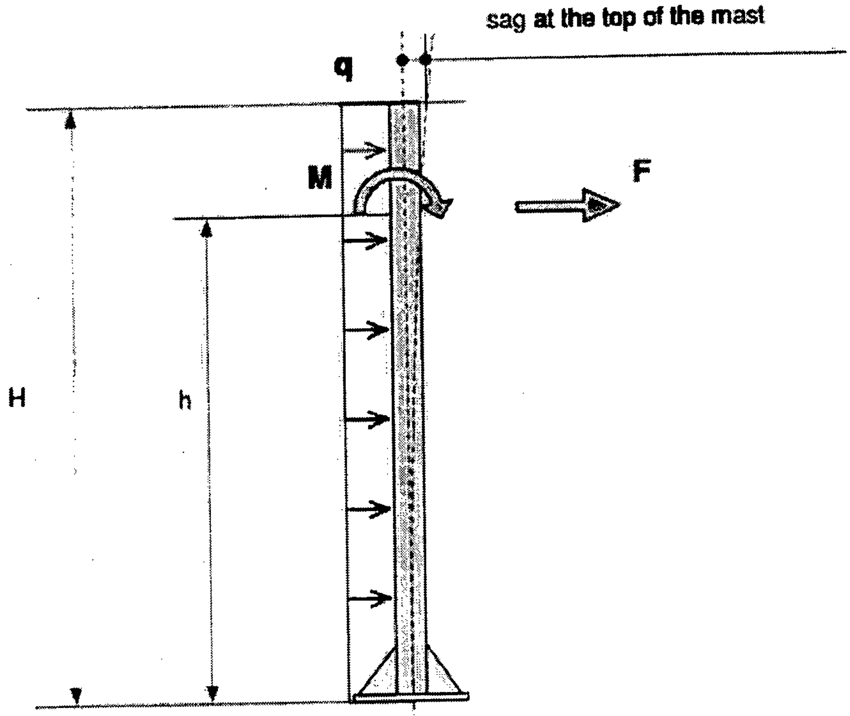
$[M * h' * \{2h - h'\}] / (2 * E * I)$

8.4.4. Presag due to permanent load actions perpendicular to track

For the assembly, a presag (reverse deflection) is imposed to the mast according to the sag calculated

Sag at top tube cantilever height (cm)	Pre-sag of the mast (cm)
$0 \le f_H \le 1.5$	0
$1.5 \le f_H \le 4.5$	3
$4.5 \le f_H \le 8.0$	6

The pre sag (reverse deflection) will be negative when it is track side and positive when it is field side.



8.5. Torsional effect for twin cantilever locations

8.5.1 Methodology

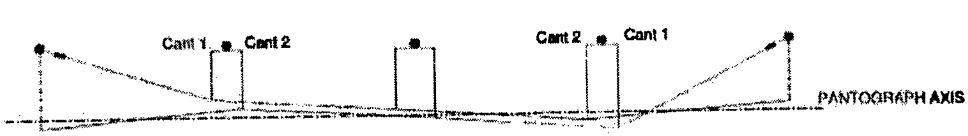
Torsional effect can be calculated according to the following steps.

- Calculations of reactions R_a and R_b
- Calculation of the twist angle at Points A and B
- Calculation of the cross piece twist angle
- For definite installation

8.5.2 Calculation basis

8.5.2.1 Calculation of Reactions R_a and R_b

Consider the overlap shown in figure-1 below, which can be either insulated or uninsulated.



- Cant 1 is the cantilever that supports the catenary to be anchored.
- Cant 2 is the cantilever that supports the main catenary to the following mast

Figure 2 illustrates the forces acting on the two cantilevers of the intermediate mast in the case of pull off arrangement.

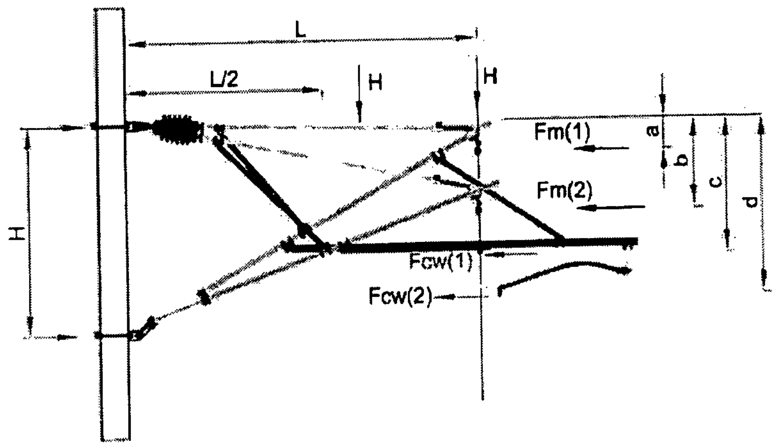


Figure 2: Cantilever arrangement at Overlap

Cantilever 1: RED (Supports catenary to be anchored)

Cantilever 2: BLACK (Supports main catenary)

Fm (1): Radial force of messenger wire on cantilever 1

Fm (2): Radial force of messenger wire on cantilever 2

Fcw (1): Radial force of Contact wire on cantilever 1

Fcw (2): Radial force of Contact wire on cantilever 2

L = Distance between cantilever attachment on the transverse and cable

H = Distance between the attachments on the mast

Wc = Weight of the cantilever

Wt = Total weight of catenary

Ra = Reaction on the cantilever attachment at point A

Rb = Reaction on the cantilever attachment at point B

Since all the parameters have been established, the calculation proceeds as follows.

For Cant 1:

$$\Sigma Fx = 0$$
$$\Rightarrow R_{a_1} + R_{b_1} + F_{m_1} + F_{cw_1} = 0$$
$$\Rightarrow R_{a_1} = -(R_{b_1} + F_{m_1} + F_{cw_1}) - Equation\ (1)$$

Taking moments about point A we have:

$$\Sigma M_A = 0$$
$$\Rightarrow R_{b_1} \cdot H + Wc \cdot \frac{L}{2} + Wt \cdot L - F_{m_1} \cdot a - F_{cw_1} \cdot c = 0$$

By solving the above equation, the value of R_{b1} can be found out.

Substituting of Value of Rb1 in the equation 1, Value of R_{a1} can be found out.

For Cant 2:

$$\Sigma Fx = 0$$
$$\Rightarrow R_{a_2} = -(R_{b_2} + F_{m_2} + F_{cw_2}) - Equation\ (4)$$

Taking moments about point A we have:

$$\Sigma M_A = 0++$$
$$\Rightarrow R_{b_2} \cdot H + Wc \cdot \frac{L}{2} + Wt \cdot L - F_{m_2} \cdot b - F_{cw_2} \cdot d = 0$$

Same way by solving R_{b2} and then R_{a2} value can be found out from the above equations for cant 2.

Note:

- In case of push-off arrangement the same method is followed but the values of radial forces F_{m1}, F_{m2}, F_{cw1} and F_{cw2} have negative sign.
- The value of W_c, Wt, L & H are depending upon the type of cantilever to be used.
- Finally, for the calculation of reactions in the case of axis mast the same method is followed.

8.5.2.2 Calculation of the twist angles at point A and B

The twist angle is calculated by the following expression.

$$\omega = \left(\frac{M_T \cdot h}{G \cdot J_0}\right) - Equation\ (7)$$

Where:

M_T : Torsional moment (daN.m)
h : Height of the mast at the point of application (m)
G : Torsional module (daN/mm^2)
J_0 : Polar inertia moment (cm^4)
ω : Twist angle (rad)

The Torsional moment at the point A and B can be calculated as follows:

MA1 = Ra1 * r

MA2 = Ra2 * r

MB1 = (Rb1 +Ra1) * r

MB2 = (Rb2 + Ra2) * r

Where; r is the distance between mast axis and cantilever supports as shown in figure 3.

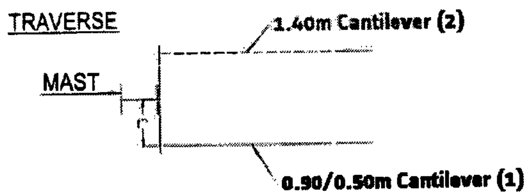


Figure 3: Cantilever arrangement on Traverse

If:

- **ω_{A1} is the twist angle at point A for cantilever 1**
- **ω_{A2} is the twist angle at point A for cantilever 2**
- **ω_{B1} is the twist angle at point B for cantilever 1**
- **ω_{B2} is the twist angle at point B for cantilever 2**

Then

$$\omega_{B_1} = \frac{M_{B_1} \cdot h_1}{J_0 \cdot G} \Rightarrow \omega_{B_1} = \frac{(R_{a_1} + R_{b_1}) \cdot r \cdot h_1}{J_0 \cdot G}$$

$$\omega_{A_1} = \frac{M_{A_1} \cdot (h_2 - h_1)}{J_0 \cdot G} + \omega_{B_1} \Rightarrow \omega_{A_1} = \frac{(R_{a_1} \cdot h_2 + R_{b_1} \cdot h_1) \cdot r}{J_0 \cdot G}$$

and

$$\omega_{B_2} = \frac{M_{B_2} \cdot h_1}{J_0 \cdot G} \Rightarrow \omega_{B_2} = \frac{(R_{a_2} + R_{b_2}) \cdot r \cdot h_1}{J_0 \cdot G}$$

$$\omega_{A_2} = \frac{M_{A_2} \cdot (h_2 - h_1)}{J_0 \cdot G} + \omega_{B_2} \Rightarrow \omega_{A_2} = \frac{(R_{a_2} \cdot h_2 + R_{b_2} \cdot h_1) \cdot r}{J_0 \cdot G}$$

Where; h1 and h2 are the point of application.

8.5.2.3 Calculation of the transverse twist angle

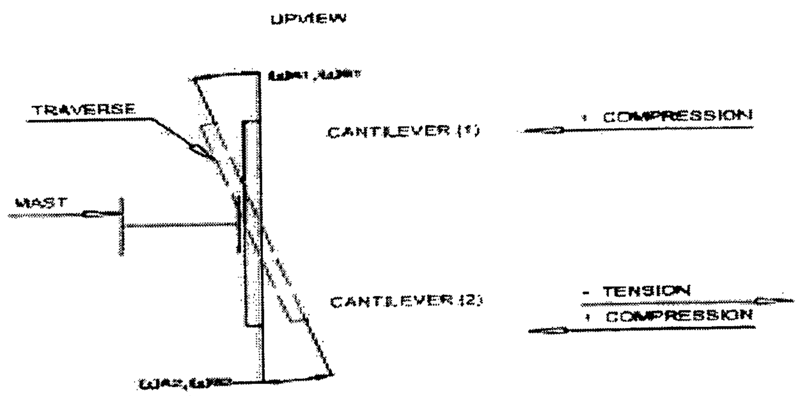


Figure 4: Twisting angle for transverse for multiple cantilever

The twist angle on the transverse can be calculated from the algebraic sum of the angles W_{A1}, W_{A2}, W_{A3} and W_{A4}

Figure 4 shows possible twist of the transverse when the latter is under torsion. Depending on the staggering of the catenary on cantilever 2 there may be tension or compression applied. In case of compression applies, angle WA2 and WB2 will have a positive sign whilst in case of tension, they will have a negative sign giving a higher tension on the transverse. Assuming that cantilever 1 is always in compression due to the anchoring of the catenary, the total twist angle on the transverse can be calculated with the following expression.

Tension on Cantilever 2

$WA = WA1 - (-WA2) = WA1 + WA2$

$WB = WB1 - (-WB2) = WB1 + WB2$

Compression on Cantilever 2

$WA = WA1 - (WA2) = WA1 - WA2$

$WB = WB1 - (WB2) = WB1 - WB2$

The maximum admissible twisting angle is 0.1 Radian

Thus the twist angle always be

$WA, WB < 0.1$ radian

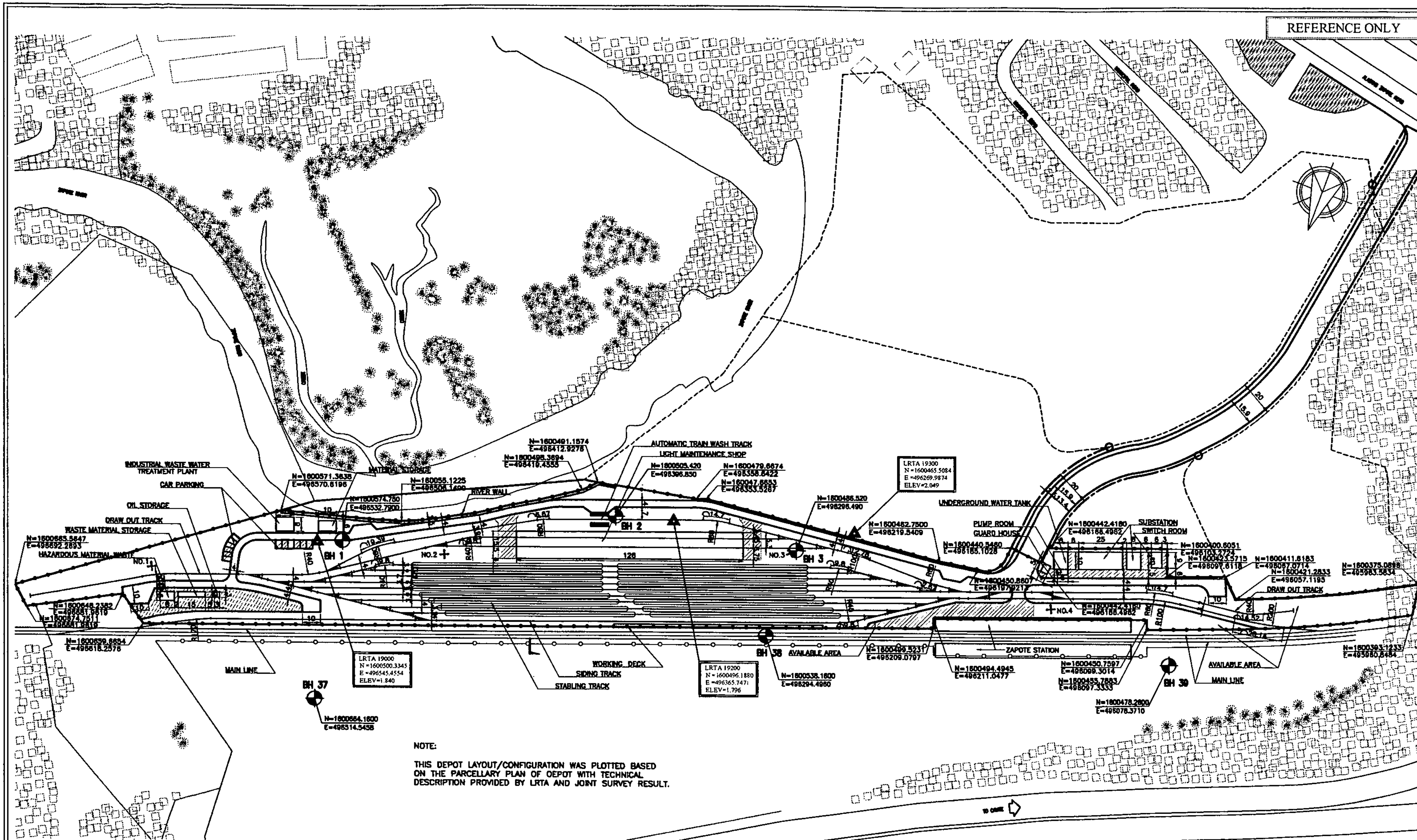
Baclaran Yard Pre - pegging plan								
S.no.	Description	Symbol	Qty [illegible]	Bending Moment XX (Nm)	Bending Moment ZZ (Nm)	Total Vertical Force (N)	Horizontal Force XX(N)	Horizontal Force ZZ (N)
1	1.1 Mast with Single cantilever		26	49730	26287	8570	10612	6682
	1.2 Mast with cantilever on both sides		0					
2	2.1 Mast with single cantilever plus anchor		3	60952	26287	21070	12289	6682
	Mast with single cantilever plus back to back anchor		1					
	2.2 Mast with anchor		20					
3	Mast with two cantilever		6	61780	27994	9671	12505	7182
4	Mast with two cantilevers plus anchor		6	74011	27994	22170	13895	7182
5	5.1 Mast with three cantilevers		4	70066	29627	107709	13713	7682
	5.2 Mast with three cantilevers plus anchors		0	84105	29627	23271	15467	7682
6	Headspan across 2 tracks (For each Upright)		2	102490	90870	21720	14460	13280
7	Headspan across 3 tracks (For each Upright)		7	133410	11050	23130	19310	16300
8	Headspan across 4 tracks (For each Upright)		9	133410	11050	23130	19310	16300
9	Headspan across 5 tracks (For each Upright)		7	184870	151000	30950	25270	20430
10	Headspan across 6 tracks or higher (For each Upright)		29	184870	151000	30950	25270	20430
	Total		119					
	Anchor Foundations		41	N/A	N/A	-19110	19110	N/A

Note:
1. Diagram showing the forces direction is enclosed as attachment 1.
2. For these preliminary calculations, load combinations have been taken from EN50119, unfactored considering a single Load case considering (Permanent + Radial + Wind loads)
3. The loads indocated are maximum loads calculated (without factor of safety applied) with assumptions regarding wind loads, environmental conditions, permanent loads and conductor tensions, but they are not concomitant, and further actual detailed load schedule will be given at Detailed Design Stage.
4. seismic loads not considered as per requirements of EN 50119 et para 6.2.10.
5. ZZ corresponds to the across the track direction. XX coresponds to along the track direction.
6. -ve sign on vertical load corresponds to uplift load.

Zapote Yard Pre - pegging plan

S.no.	Description	Symbol	Qty with a margin of 10% per location	Bending Moment XX (Nm)	Bending Moment ZZ (Nm)	Total Vertical Force (N)	Horizontal Force XX(N)	Horizontal Force ZZ(N)
1	1.1 Mast with Single cantilever		45	49730	26287	8570	10612	6682
	1.2 Mast with cantilever on both sides		0					
2	2.1 Mast with single cantilever plus anchor		9	60952	26287	21070	12289	6682
	2.2 Mast with anchor		3					
3	Mast with two cantilever		8	61780	27994	9671	12505	7182
4	Mast with two cantilevers plus anchor		10	74011	27994	22170	13895	7182
5	5.1 Mast with three cantilevers		0	70066	29627	107709	13713	7682
	5.2 Mast with three cantilevers plus anchors		7	84105	29627	23271	15467	7682
6	Headspan across 2 tracks (For each Upright)		1	102490	90870	21720	14460	13280
7	Headspan across 3 tracks (For each Upright)		4	133410	11050	23130	19310	16300
8	Headspan across 4 tracks (For each Upright)		2	133410	11050	23130	19310	16300
9	Headspan across 5 tracks (For each Upright)		2	184870	151000	30950	25270	20430
10	Headspan across 6 tracks or higher (For each Upright)		29	184870	151000	30950	25270	20430
	Total		120					
	Anchor Foundations		35	N/A	N/A	-19110	-19110	N/A

REFERENCE ONLY



REVISIONS

REV. No.	DATE	DESCRIPTION	DRAWN	DESIGN	CHECKED	APPROVED

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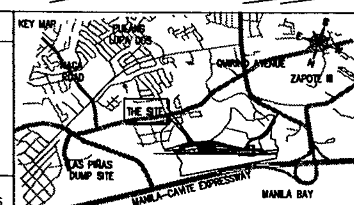
KEY MAP



CMX CONSORTIUM

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Tel: 894-5811 / 894-5764

SCALE: 1:2000

PACKAGE: EXPANSION OF EXISTING DEPOT AT BACLARAN AND CONSTRUCTION OF NEW SATELLITE DEPOT AT ZAPOTE

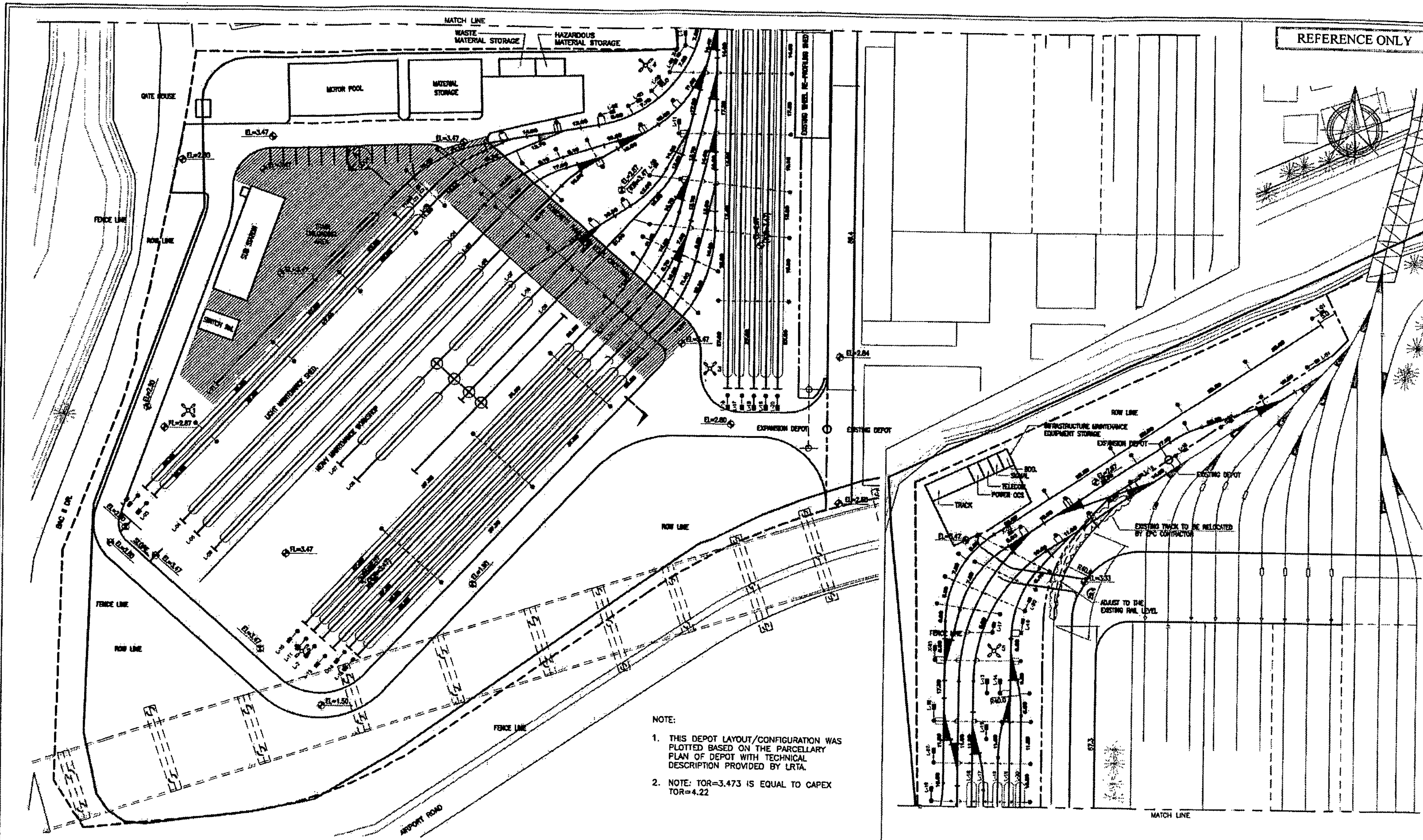
DRAWING TITLE:

ZAPOTE SATELLITE DEPOT LAYOUT WITH COORDINATES

CAD FILE #:

Dwg. #:

Rev. #:



NOTE:

1. THIS DEPOT LAYOUT/CONFIGURATION WAS PLOTTED BASED ON THE PARCELLARY PLAN OF DEPOT WITH TECHNICAL DESCRIPTION PROVIDED BY LRTA.
2. NOTE: TOR=3.473 IS EQUAL TO CAPEX TOR=4.22

REVISIONS

REV. No.	DATE	DESCRIPTION	DRAWN	DESIGN	CHECKED	APPROVED
1	28 JULY 2015	NOTE ADDED				
2	11 SEPT. 2015	HAZARDOUS STORAGE ADDED				
3	17 FEB. 2016	ADDED ROW LINE				
4	22 APRIL 2016	ADD BOGIE TRACK LINE				
5	16 MAY 2016	ADD ACCESS ROAD				
6	2 SEPT. 2016	DELETE WHEEL RE-PROFILING TRACK				
7	06 DEC. 2016	ACCESS TO INFRA. STORAGE REVISED				
8	07 APRIL 2017	REVISED BY INTEGRATION				

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KEY MAP

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SCALE: 1:1000

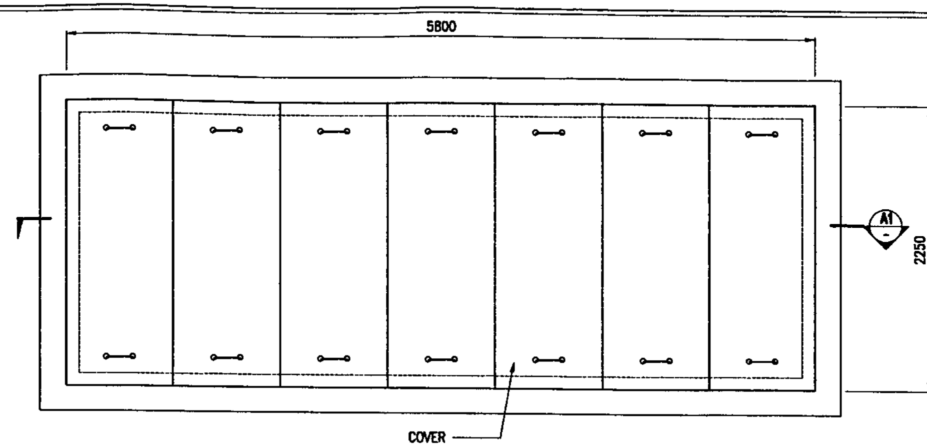
PACKAGE: EXPANSION OF EXISTING DEPOT AT BACLARAN AND CONSTRUCTION OF NEW SATELLITE DEPOT AT ZAPOTE

DRAWING TITLE: BACLARAN EXPANSION DEPOT LAYOUT

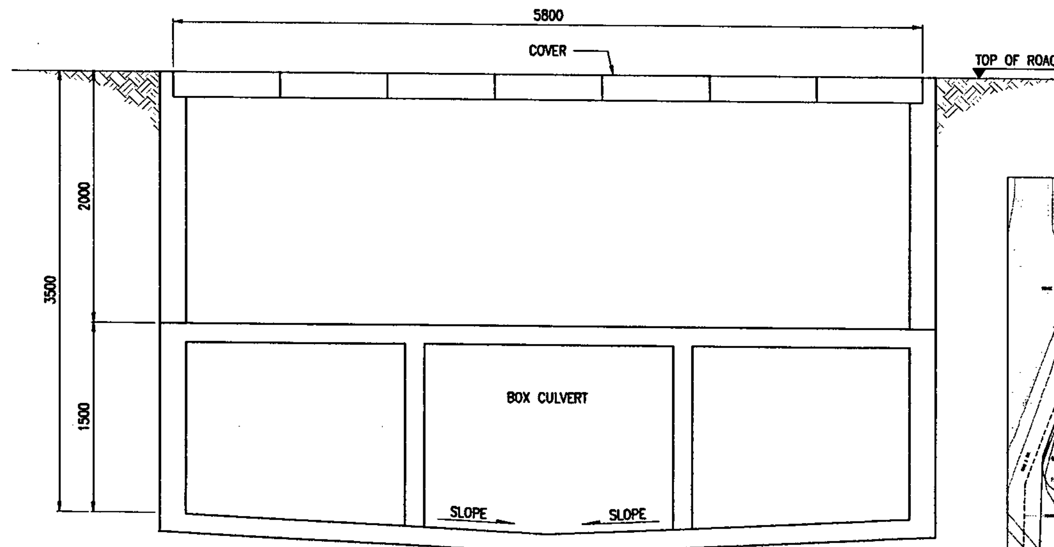
CAD FILE #:

Dwg. #: CMX-L1/DP-CI-01-0003

Rev. #: 8

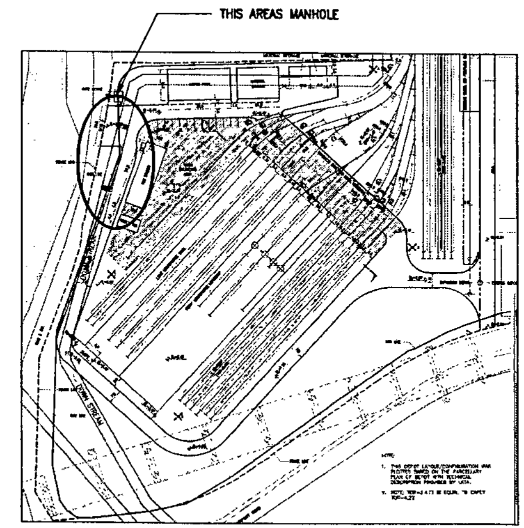


A PLAN
SCALE 1:20



A1 ELEVATION
SCALE 1:20

1 EXISTING BOXCULVERT
SCALE 1:20



BACLARAN DEPOT PLAN

REVISIONS

REV. No.	DATE	DESCRIPTION	DRAWN	DESIGN	CHECKED	APPROVED

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DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

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SCALE: 1:20

PACKAGE: EXPANSION OF EXISTING DEPOT AT BACLARAN AND CONSTRUCTION OF NEW SATELLITE DEPOT AT ZAPOTE

DRAWING TITLE:

BACLARAN DEPOT
EXISTING BOX CULVERT

CAD FILE #:

Dwg. #:

Rev. #: