



# ASSAM ELECTRICITY GRID CORPORATION LIMITED

OFFICE OF THE MANAGING DIRECTOR

Regd. Office:(FIRST FLOOR), BIJULEE BHAWAN, PALTANBAZAR; GUWAHATI - 781001

CIN: U40101AS2003SGC007238GSTIN: 18AAFCA4973J9Z3

PHONE: 0361-2739520Web: [www.aegcl.co.in](http://www.aegcl.co.in) Email: cgm.ppd@aegcl.co.in



## Corrigendum-I

### **BID IDENTIFICATION NO: AEGCL/MD/Tech-1116/Deposit/33kV Bay/Sishugram/2023/BID**

The following clarifications may be noted for the work namely "Turnkey Construction of one no. of 33kV feeder bay along with associated works at 132kV Sishugram GSS, AEGCL" against Bid Identification No. mentioned above –

| SI No. | Item                                                                                        | Particulars                                                               | Clarification                                                                                                                                                                                                                                                    |
|--------|---------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | BOQ<br>Schedule 3 - Erection,<br>Commissioning and Testing<br>including bay extension works | 10.01. Dismantling of Single<br>Bus Conductor and storing<br>as required. | The length of single zebra bus<br>conductor which is to be dismantled is<br>90 m for single phase i.e approx<br>(3x90)= 270 m for all three phases.<br>(if required the bidders are requested<br>to visit the site; no price escalation<br>would be entertained) |
| 2      | BOQ<br>Supply, F&I and Erection,<br>Testing & Commissioning                                 | Lightning Mast                                                            | Necessary drawings/documents of<br>Lightning Mast are attached below.<br>Bidders are requested to quote the<br>price as per the drawings/documents.                                                                                                              |

*All other terms and conditions of the bidding document remain same.*

**Sd/-**

**Chief General Manager (PP&D)**

**Assam Electricity Grid Corporation Ltd**

**Bijulee Bhawan, Paltanbazar, Guwahati –01**

Memo No AEGCL/MD/Tech-1116/Deposit/33kV Bay/Sishugram/2023/17

Dtd : 11.01.2024

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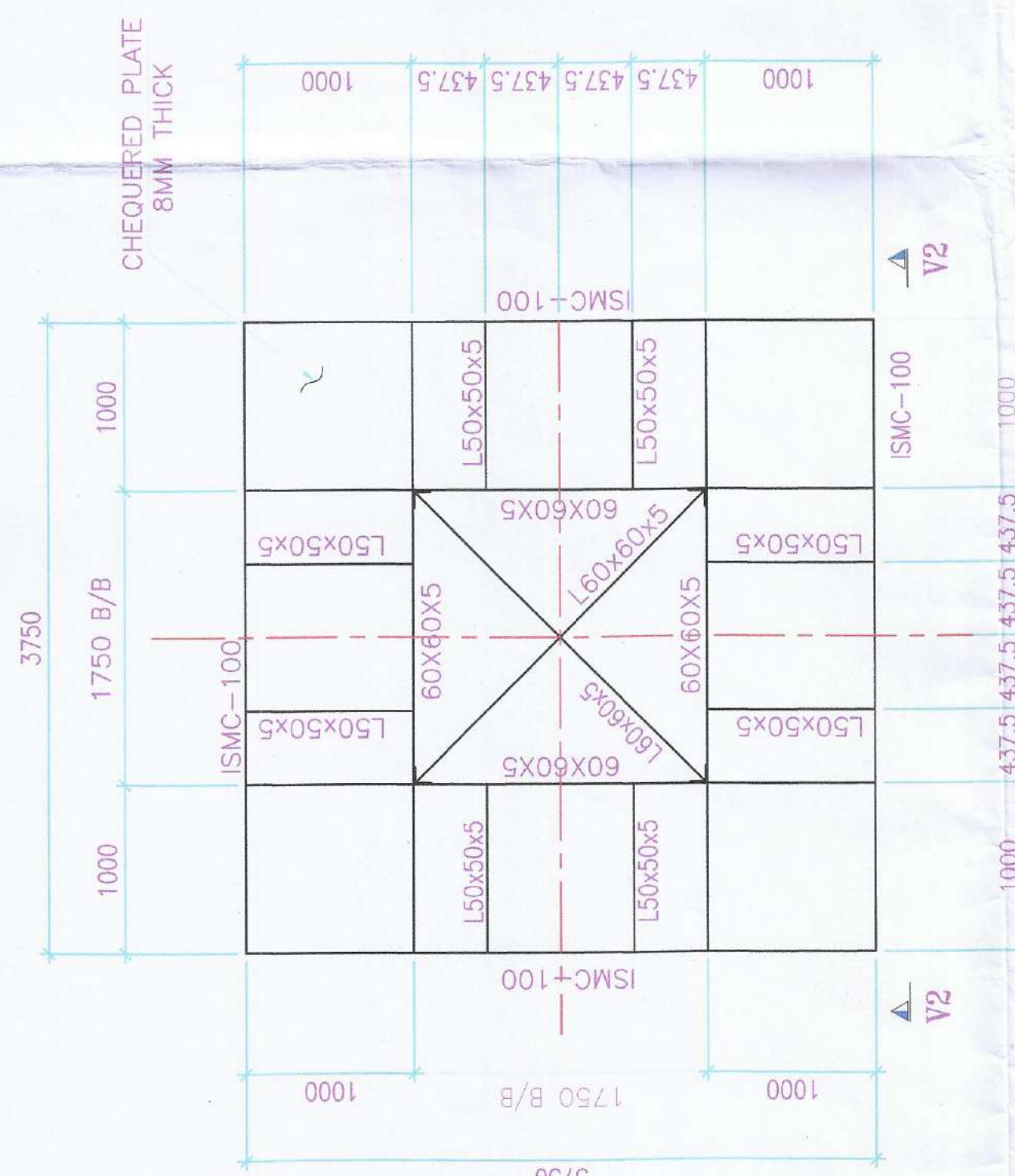
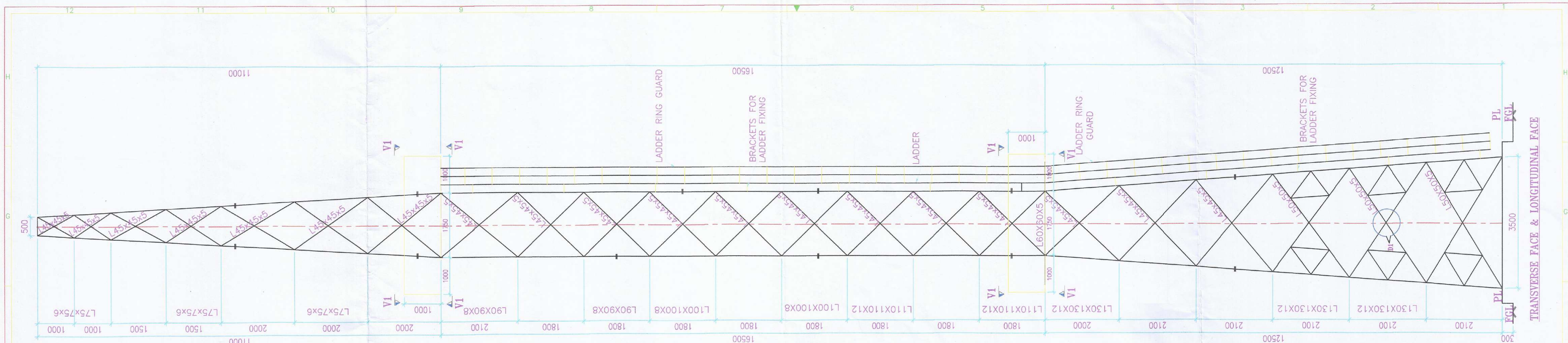
1. The AGM-IT, O/o the MD, AEGCL, for publication of the corrigendum notice in AEGCL website.

**Sd/-**

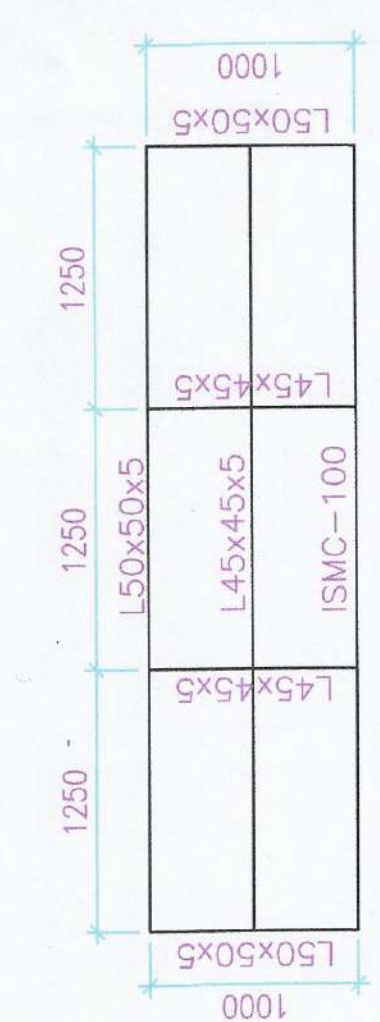
**Chief General Manager (PP&D)**

**Assam Electricity Grid Corporation Ltd**

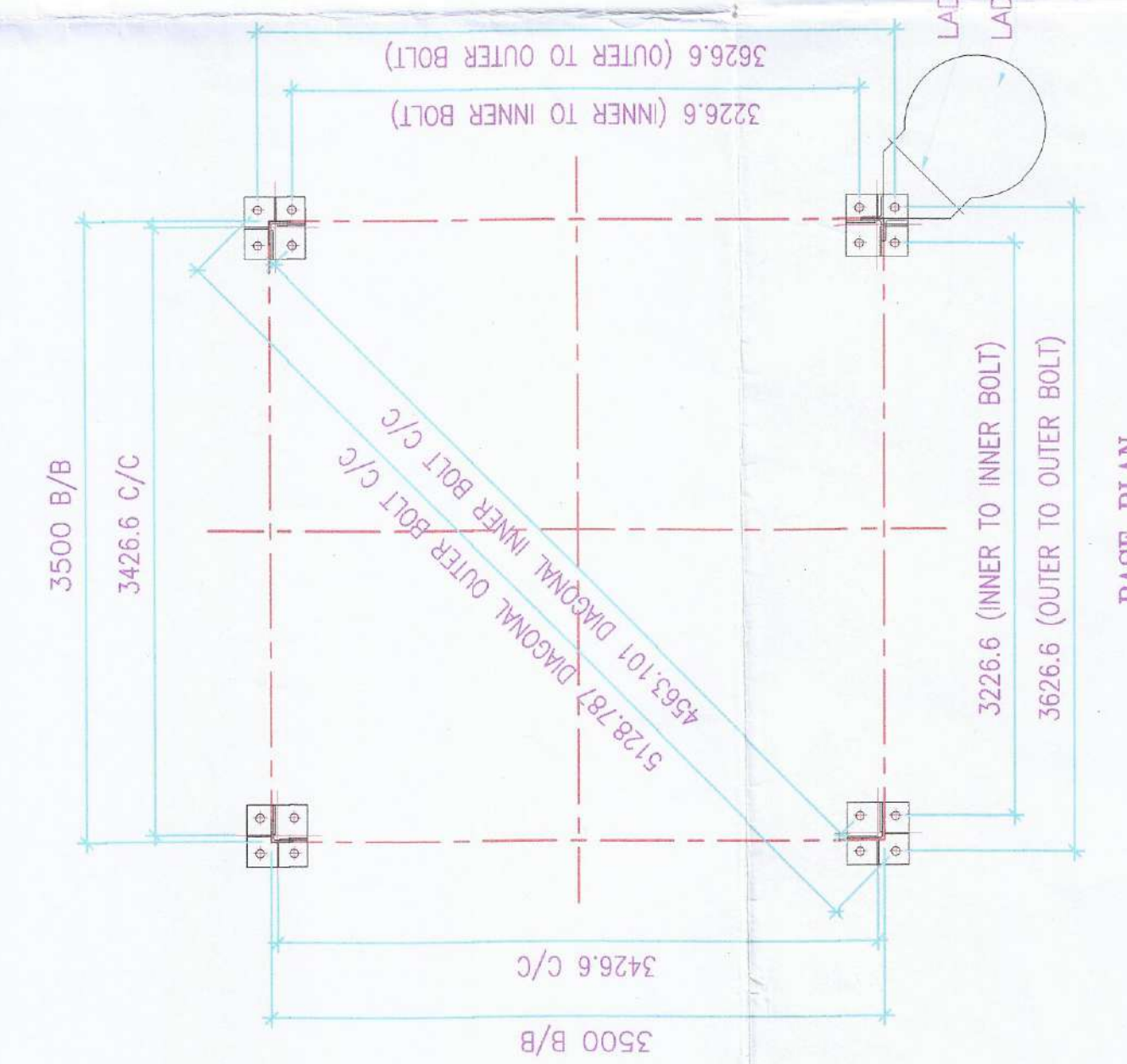
**Bijulee Bhawan, Paltanbazar, Guwahati –01**



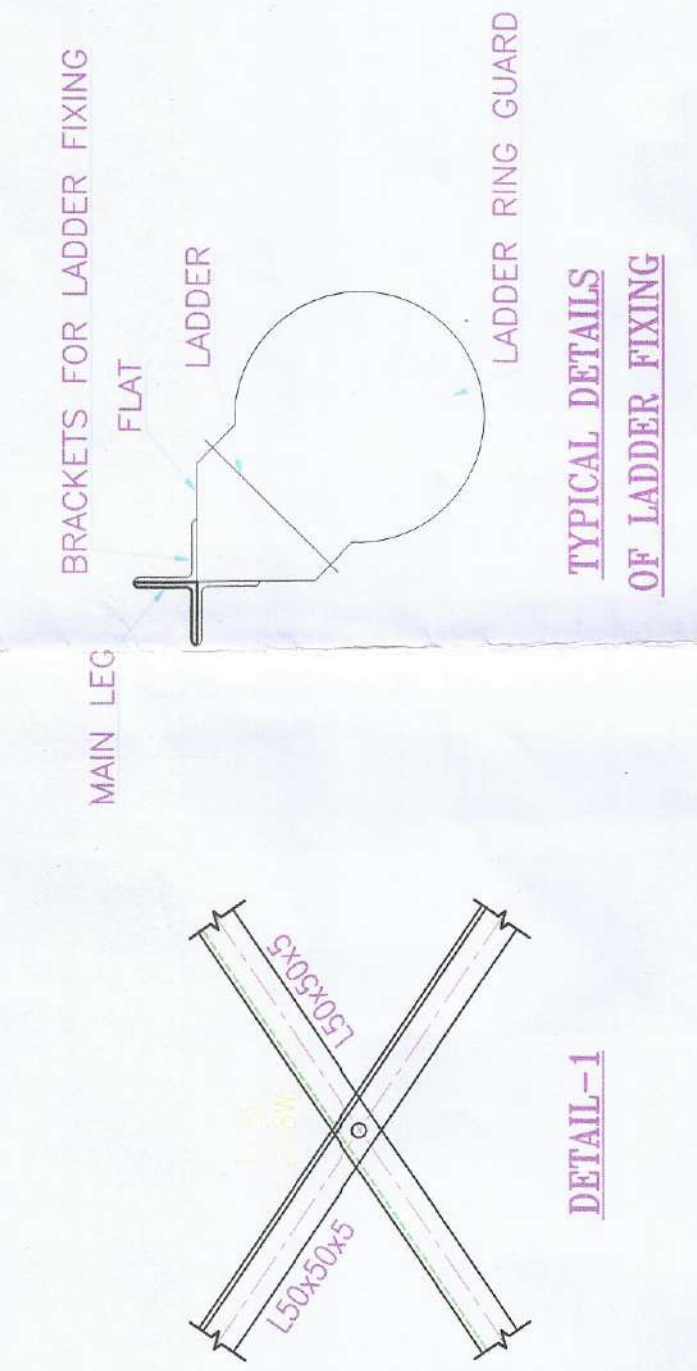
SECTION V1-V1



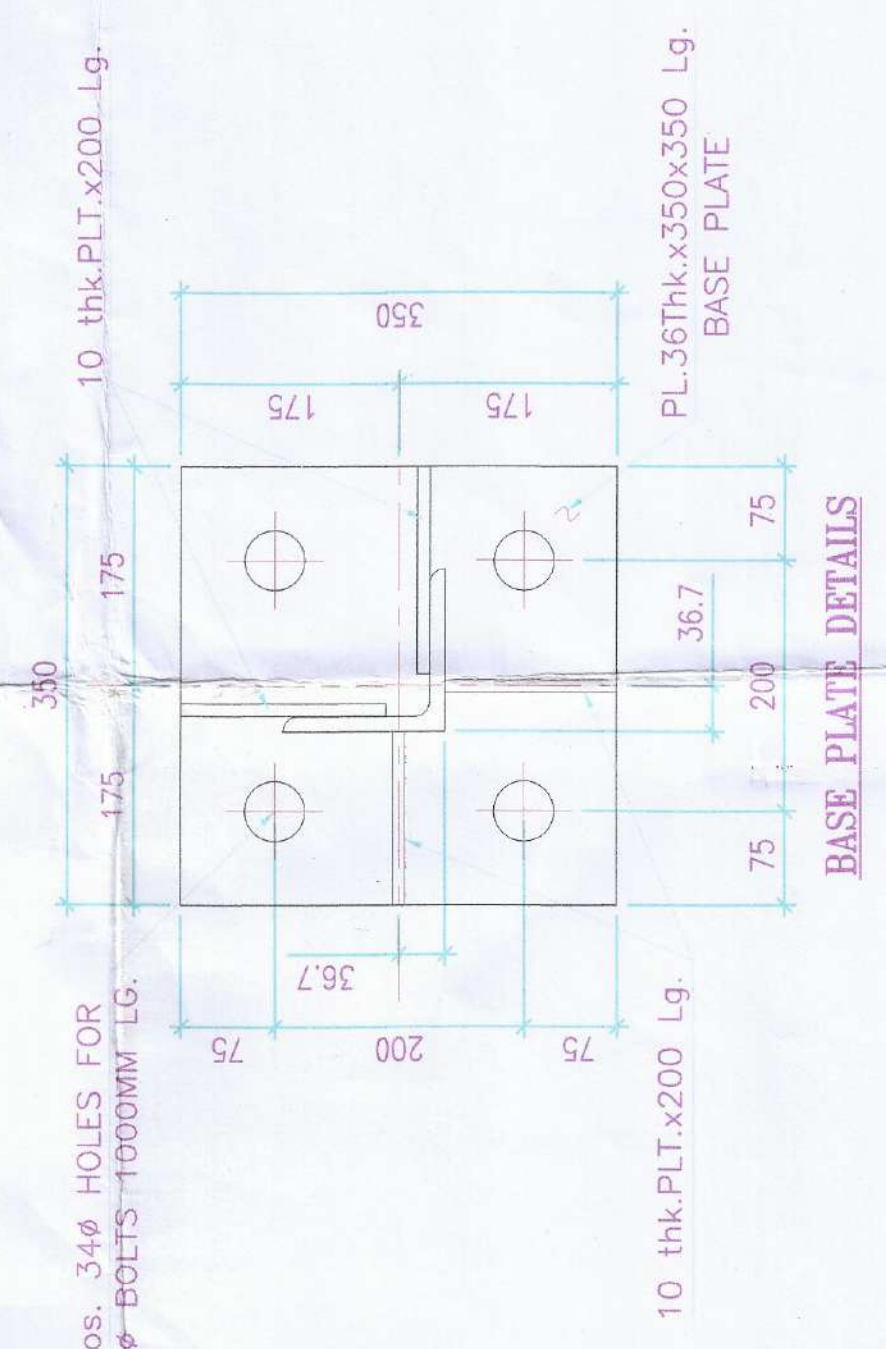
SECTION V2-V2



BASE PLAN



DETAIL-1



BASE PLATE DETAILS

APPROVED  
Deputy General Manager (C)  
AEGCL, Bijulee Bhawan,  
Paltanbazar, Guwahati-1



NOTES:  
1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SPECIFIED.

Checked by  
Deputy Manager (C)  
Design & Project  
AEGCL, Khatipara, Ghy-18

Checked by  
Asst. General Manager (C)  
Design & Project  
AEGCL, Khatipara, Ghy-19

Team Leader  
PT Feedback Infra  
Indonesia

Civil Expert  
PT Feedback Infra  
Indonesia

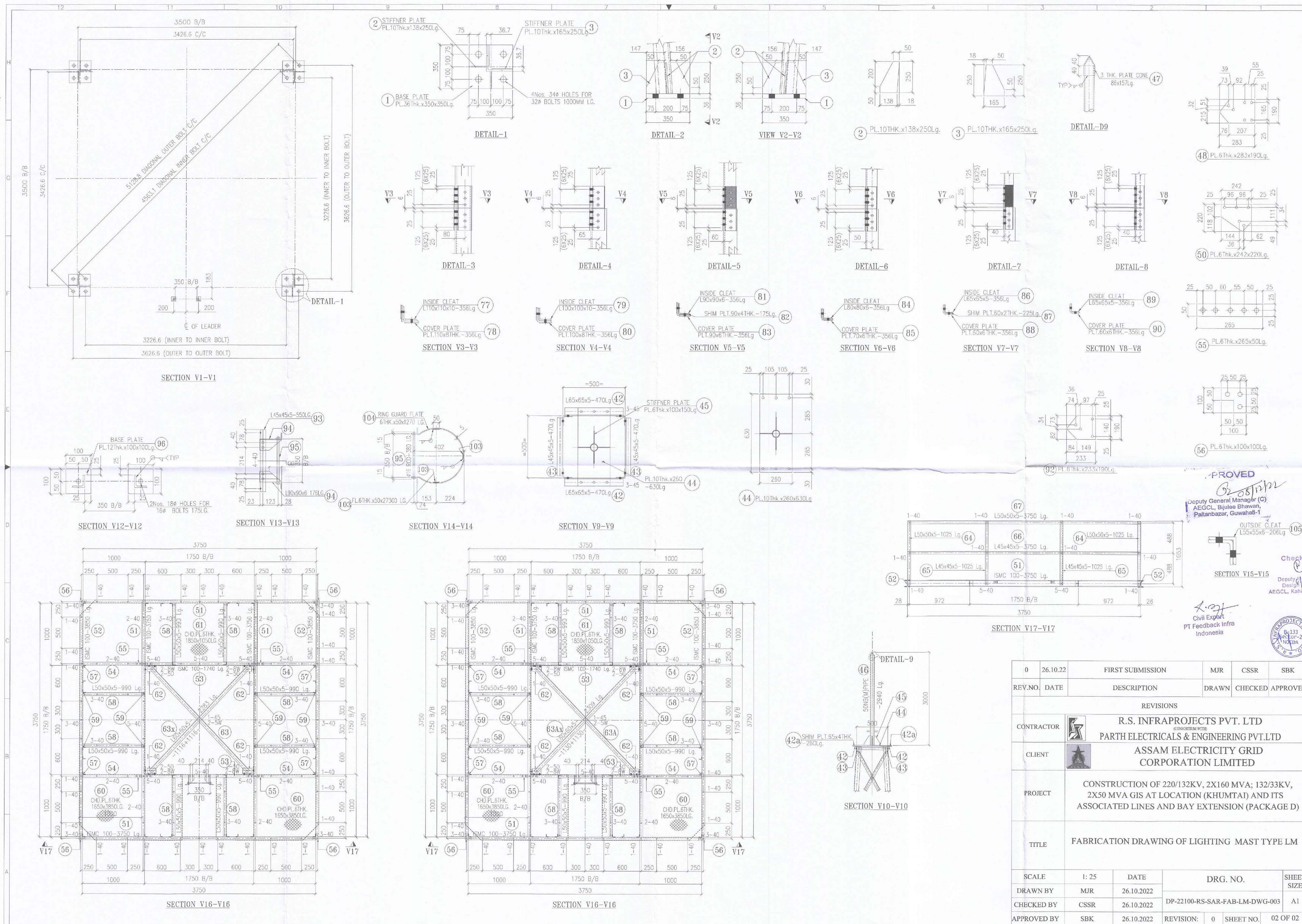
| 0           | 21.10.22                                                                                                                                                        | FIRST SUBMISSION | MJR                            | CSSR      | SBK           |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------------------|-----------|---------------|
| REV.NO.     | DATE                                                                                                                                                            | DESCRIPTION      | DRAWN                          | CHECKED   | APPROVED      |
| REVISIONS   |                                                                                                                                                                 |                  |                                |           |               |
| CONTRACTOR  | R.S. INFRAPROJECTS PVT. LTD<br>(CONSULTANT WITH)<br>PARTH ELECTRICALS & ENGINEERING PVT.LTD                                                                     |                  |                                |           |               |
| CLIENT      | ASSAM ELECTRICITY GRID<br>CORPORATION LIMITED                                                                                                                   |                  |                                |           |               |
| PROJECT     | CONSTRUCTION OF 220/132KV, 2X160 MVA; 132/33KV,<br>2X50 MVA GIS AT LOCATION (KHUMTAI) AND ITS<br>ASSOCIATED LINES AND BAY EXTENSION<br>AT SARUPATHAR(PACKAGE D) |                  |                                |           |               |
| TITLE       | SLD DRAWING OF LIGHTING MAST TYPE LM                                                                                                                            |                  |                                |           |               |
| SCALE       | 1:                                                                                                                                                              | DATE             | DRG. NO.                       |           | SHEET<br>SIZE |
| DRAWN BY    | MJR                                                                                                                                                             | 21.10.2022       | DP-22100-RS-SAR-SLD-LM-DWG-001 |           | A1            |
| CHECKED BY  | CSSR                                                                                                                                                            | 21.10.2022       | REVISION:                      |           | 01 OF 02      |
| APPROVED BY | SBK                                                                                                                                                             | 21.10.2022       | R0                             | SHEET NO. |               |

| BOQ        |             |              |                     |
|------------|-------------|--------------|---------------------|
| PRICE MARK | DESCRIPTION | ANGLE        |                     |
|            |             | LENGTH<br>mm | UNIT WEIGHT<br>kg/m |
| 4.5        | 130x130x12  | 4837         | 4                   |
| 6.7        | 130x130x12  | 4615         | 4                   |
| 6.9        | 130x130x12  | 3959         | 4                   |
| 10.11      | 110x110x12  | 5394         | 4                   |
| 12.13      | 100x100x8   | 5394         | 4                   |
| 14.15      | 90x90x8     | 5847         | 4                   |
| 16.17      | 75x75x6     | 6544         | 4                   |
| 18.19      | 75x75x6     | 5424         | 4                   |
| 20.20      | 50x50x5     | 5028         | 8                   |
| 21.21      | 50x50x5     | 3363         | 8                   |
| 22.22      | 50x50x5     | 3367         | 8                   |
| 23.23      | 45x45x5     | 3171         | 8                   |
| 24.24      | 45x45x5     | 2559         | 8                   |
| 25.25      | 45x45x5     | 2585         | 8                   |
| 26.26      | 45x45x5     | 2385         | 8                   |
| 27.27      | 45x45x5     | 2478         | 8                   |
| 28.28      | 45x45x5     | 2478         | 8                   |
| 29.29      | 45x45x5     | 2478         | 8                   |
| 30.30      | 45x45x5     | 2478         | 8                   |
| 31.31      | 45x45x5     | 2478         | 8                   |
| 32.32      | 45x45x5     | 2485         | 8                   |
| 33.33      | 45x45x5     | 2482         | 8                   |
| 34.34      | 45x45x5     | 2604         | 8                   |
| 35.35      | 45x45x5     | 2465         | 8                   |
| 36.36      | 45x45x5     | 2459         | 8                   |
| 37.37      | 45x45x5     | 2339         | 8                   |
| 38.38      | 45x45x5     | 1895         | 8                   |
| 40.40      | 45x45x5     | 1172         | 8                   |
| 41.41      | 45x45x5     | 1000         | 8                   |
| 42         | 65x65x5     | 470          | 2                   |
| 43         | 65x45x5     | 470          | 2                   |
| 46         | 60x60x5     | 972          | 4                   |
| 57         | 50x50x5     | 100          | 8                   |
| 58         | 50x50x5     | 990          | 16                  |
| 59         | 50x50x5     | 50           | 32                  |
| 62         | 90x90x10    | 140          | 8                   |
| 63.63      | 60x60x5     | 2288         | 2                   |
| 64.64      | 60x60x5     | 2989         | 2                   |
| 65         | 50x50x5     | 1025         | 8                   |
| 66         | 45x45x5     | 1025         | 16                  |
| 67         | 50x50x5     | 3790         | 8                   |
| 68.68      | 45x45x5     | 511          | 8                   |
| 69.69      | 45x45x5     | 887          | 8                   |
| 70.70      | 45x45x5     | 578          | 8                   |
| 71.71      | 45x45x5     | 590          | 8                   |
| 72.72      | 45x45x5     | 1105         | 8                   |
| 73.73      | 45x45x5     | 592          | 8                   |
| 74.74      | 45x45x5     | 689          | 8                   |
| 75.75      | 45x45x5     | 1105         | 8                   |
| 76.76      | 45x45x5     | 595          | 8                   |
| 77         | 110x110x10  | 356          | 8                   |
| 79         | 100x100x10  | 356          | 4                   |
| 81         | 30x30x6     | 356          | 4                   |
| 84         | 80x80x6     | 356          | 4                   |
| 86         | 65x65x5     | 356          | 4                   |
| 88         | 65x65x5     | 356          | 4                   |
| 91         | 50x50x5     | 3002         | 4                   |
| 93         | 30x30x6     | 176          | 30                  |
| 97.97      | 50x50x4     | 5848         | 2                   |
| 98.98      | 50x50x4     | 5394         | 2                   |
| 99.99      | 50x50x4     | 5394         | 2                   |
| 100.100    | 50x50x4     | 5394         | 2                   |
| 101.101    | 50x50x4     | 5394         | 2                   |

| PLATE      |             |              |               |     |                     |                    |
|------------|-------------|--------------|---------------|-----|---------------------|--------------------|
| PRICE MARK | DESCRIPTION | LENGTH<br>mm | BREADTH<br>mm | NOS | UNIT WEIGHT<br>kg/m | TOTAL WEIGHT<br>kg |
| 1          | 36mm THK    | 350          | 350           | 4   | 280.6               | 1344.7             |
| 2          | 10mm THK    | 250          | 138           | 8   | 79.5                | 216.7              |
| 3          | 10mm THK    | 250          | 165           | 8   | 73.5                | 25.91              |
| 4          | 4mm THK     | 250          | 265           | 2   | 35.4                | 1.06               |
| 4A         | 10mm THK    | 630          | 260           | 1   | 78.5                | 12.85              |
| 45         | 6mm THK     | 150          | 100           | 4   | 47.1                | 2.88               |
| 47         | 3 mm THK    | 157          | 86            | 1   | 23.95               | 0.32               |
| 48         | 6 mm THK    | 280          | 150           | 4   | 47.1                | 10.13              |
| 50         | 6mm THK     | 242          | 220           | 8   | 47.1                | 20.16              |
| 55         | 6 mm THK    | 268          | 50            | 16  | 47.1                | 9.99               |
| 56         | 6 mm THK    | 100          | 100           | 16  | 47.1                | 7.54               |
| 78         | 8 mm THK    | 356          | 110           | 16  | 62.8                | 39.35              |
| 80         | 8 mm THK    | 356          | 100           | 8   | 62.8                | 17.69              |
| 82         | 4 mm THK    | 175          | 90            | 8   | 31.4                | 3.36               |
| 83         | 6 mm THK    | 356          | 50            | 8   | 47.1                | 12.07              |
| 85         | 6 mm THK    | 356          | 70            | 8   | 47.1                | 9.90               |
| 87         | 2 mm THK    | 175          | 60            | 8   | 15.7                | 1.32               |
| 88         | 6 mm THK    | 356          | 60            | 8   | 47.1                | 8.05               |
| 90         | 6 mm THK    | 356          | 60            | 8   | 47.1                | 8.05               |
| 92         | 6 mm THK    | 238          | 150           | 4   | 47.1                | 8.34               |
| 95         | 12 mm THK   | 100          | 100           | 2   | 94.2                | 1.88               |
| 103        | 5 mm THK    | 27300        | 50            | 3   | 36.25               | 160.73             |
| 104        | 5 mm THK    | 1770         | 50            | 47  | 30.25               | 1371.4             |
| TOTAL      |             |              |               |     |                     | 638.28 kg          |

| PRICE MARK | DESCRIPTION | LENGTH<br>mm | NOS | UNIT WEIGHT<br>kg/m | TOTAL WEIGHT<br>kg |
|------------|-------------|--------------|-----|---------------------|--------------------|
| 51         | 5MMX100     | 3750         | 4   | 9.56                | 44.640             |
| 52         | 5MMX100     | 3850         | 2   | 9.56                | 73.61              |
| 53         | 5MMX100     | 1740         | 2   | 9.56                | 33.27              |
| 54         | 5MMX100     | 940          | 4   | 9.56                | 35.95              |
| TOTAL      |             |              |     |                     | 286.23 kg          |

| PRICE MARK | DESCRIPTION | LENGTH<br>mm | NOS | UNIT WEIGHT<br>kg/m | TOTAL WEIGHT<br>kg |
|------------|-------------|--------------|-----|---------------------|--------------------|
| 46         | 50MMXHPPE   | 2540         | 1   | 5.1                 | 14.99              |
| 95         | RCD-160     | 380          | 98  | 1.58                | 58.84              |
| TOTAL      |             |              |     |                     | 73.83 kg           |



**DESIGN OF TOWER FOUNDATION OF LIGHTING MAST TYPE LM  
132/33kV SUBSTATION SARUPATHAR**

**APPROVED**

*[Signature]*  
Deputy General Manager (C)  
AEGCL, Bijulee Bhawan,  
Paltanbazar, Guwahati-1

*[Signature]*  
Team Leader  
PT Feedback Infra  
Indonesia



*[Signature]*  
Civil Expert  
PT Feedback Infra  
Indonesia

*[Signature]*  
Deputy Manager (C)  
Design & Project  
AEGCL, Kahilipara, Ghy-19

|                 |                                |                                                     |            |                |         |            |            |            |         |
|-----------------|--------------------------------|-----------------------------------------------------|------------|----------------|---------|------------|------------|------------|---------|
| 0               | SUBMISSION<br>FOR<br>APPROVAL  | Name                                                | ART        |                |         | SBK        |            | SARK       |         |
|                 |                                | Date                                                | 05.12.2022 |                |         | 05.12.2022 |            | 05.12.2022 |         |
|                 |                                | Sign                                                |            |                |         |            |            |            |         |
| Rev No.         | Description<br>No.             | Date                                                | Prepared   | Review         | Elec.   | Civil      | Mech       | Approved   | Status  |
|                 |                                |                                                     |            |                | Checked |            |            |            |         |
| CUSTOMER        |                                | ASSAM ELECTRICITY GRID CORPORATION LIMITED          |            |                |         |            |            |            |         |
| CONTRACTOR      |                                | RS INFRA PROJECTS PVT. LTD.                         |            |                |         |            |            |            |         |
| PROJECT         |                                | 400/220/132/33KV GIS SUBSTATION AT KHUMTAI, ASSAM   |            |                |         |            |            |            |         |
| SUBSTATION NAME |                                | 132/33kV SUBSTATION SARUPATHAR                      |            |                |         |            |            |            |         |
| TITLE           |                                | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST TYPE LM |            |                |         |            |            |            |         |
| A4              | Document No:                   |                                                     |            | Document Tree: |         |            | Total Sht. | Sheet No.  | Rev No. |
|                 | DP-22100-RS-SAR-FDN-LM-DGN-002 |                                                     |            | XXX            |         |            | 23         | 1          | 0       |

| PROJECT    | 400/220/132/33KV GIS SUBSTATION AT KHUMTAI,<br>ASSAM   | CUSTOMER                       |            | ASSAM ELECTRICITY GRID CORPORATION<br>LIMITED |                  |                  |                  |
|------------|--------------------------------------------------------|--------------------------------|------------|-----------------------------------------------|------------------|------------------|------------------|
|            |                                                        | DOCUMENT NO.                   |            | REVISION                                      |                  |                  |                  |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                            | DP-22100-RS-SAR-FDN-LM-DGN-002 |            | 0                                             |                  |                  |                  |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST<br>TYPE LM | PREPARED BY                    | CHECKED BY | APPROVED BY                                   |                  | DATE             |                  |
|            |                                                        | ART                            | S&K        | SARK                                          |                  | 05.12.2022       |                  |
| Node       | LOAD COMBINATION                                       | Force-X kg                     | Force-Y kg | Force-Z kg                                    | Moment-X<br>kg-m | Moment-Y<br>kg-m | Moment-Z<br>kg-m |
| 575        | 201 (1.0 DL + 1.0 LL)                                  | -422.652                       | 6525.866   | -418.883                                      | 0                | 0                | 0                |
|            | 202 (1.0 DL + 1.0 LONG WIND(+Z))                       | -2403.281                      | 23419.39   | -1718.854                                     | 0                | 0                | 0                |
|            | 203 (1.0 DL + 1.0 TRA WIND(+X))                        | -1723.146                      | 23414.664  | -2396.895                                     | 0                | 0                | 0                |
|            | 204 (1.0 DL + 1.0 LL + 1.0 LONG WIND(+Z))              | -2615.788                      | 26813.181  | -1928.65                                      | 0                | 0                | 0                |
|            | 205 (1.0 DL + 1.0 LL + 1.0 TRA WIND(+X))               | -1935.652                      | 26808.457  | -2606.691                                     | 0                | 0                | 0                |
|            | 206 (1.0 DL + 1.0 DIAG WIND)                           | -3320.445                      | 36917.993  | -3297.045                                     | 0                | 0                | 0                |
|            | 207 (1.0 DL + 1.0 LL + 1.0 DIAG WIND)                  | -3532.951                      | 40311.783  | -3506.841                                     | 0                | 0                | 0                |
| 577        | 201 (1.0 DL + 1.0 LL)                                  | 482.979                        | 4802.2     | -346.285                                      | 0                | 0                | 0                |
|            | 202 (1.0 DL + 1.0 LONG WIND(+Z))                       | -1905.059                      | -17914.74  | 1333.445                                      | 0                | 0                | 0                |
|            | 203 (1.0 DL + 1.0 TRA WIND(+X))                        | 1845.908                       | 22481.273  | -2098.303                                     | 0                | 0                | 0                |
|            | 204 (1.0 DL + 1.0 LL + 1.0 LONG WIND(+Z))              | -1659.418                      | -15485.12  | 1164.933                                      | 0                | 0                | 0                |
|            | 205 (1.0 DL + 1.0 LL + 1.0 TRA WIND(+X))               | 2091.549                       | 24910.896  | -2266.815                                     | 0                | 0                | 0                |
|            | 206 (1.0 DL + 1.0 DIAG WIND)                           | -178.249                       | 2899.442   | -576.615                                      | 0                | 0                | 0                |
|            | 207 (1.0 DL + 1.0 LL + 1.0 DIAG WIND)                  | 67.392                         | 5329.066   | -745.126                                      | 0                | 0                | 0                |
| 576        | 201 (1.0 DL + 1.0 LL)                                  | -350.195                       | 4802.198   | 479.209                                       | 0                | 0                | 0                |
|            | 202 (1.0 DL + 1.0 LONG WIND(+Z))                       | -2094.676                      | 22486.21   | 1852.056                                      | 0                | 0                | 0                |
|            | 203 (1.0 DL + 1.0 TRA WIND(+X))                        | 1335.545                       | -17910.01  | -1900.734                                     | 0                | 0                | 0                |
|            | 204 (1.0 DL + 1.0 LL + 1.0 LONG WIND(+Z))              | -2265.978                      | 24915.831  | 2094.987                                      | 0                | 0                | 0                |
|            | 205 (1.0 DL + 1.0 LL + 1.0 TRA WIND(+X))               | 1164.243                       | -15480.39  | -1657.803                                     | 0                | 0                | 0                |
|            | 206 (1.0 DL + 1.0 DIAG WIND)                           | -481.193                       | 1549.621   | -257.497                                      | 0                | 0                | 0                |
|            | 207 (1.0 DL + 1.0 LL + 1.0 DIAG WIND)                  | -652.495                       | 3979.244   | -14.566                                       | 0                | 0                | 0                |
| 578        | 201 (1.0 DL + 1.0 LL)                                  | 289.869                        | 3232.248   | 285.959                                       | 0                | 0                | 0                |
|            | 202 (1.0 DL + 1.0 LONG WIND(+Z))                       | -1764.402                      | -18428.43  | -1466.647                                     | 0                | 0                | 0                |
|            | 203 (1.0 DL + 1.0 TRA WIND(+X))                        | -1458.307                      | -18423.49  | -1770.261                                     | 0                | 0                | 0                |
|            | 204 (1.0 DL + 1.0 LL + 1.0 LONG WIND(+Z))              | -1626.235                      | -16881.39  | -1331.271                                     | 0                | 0                | 0                |
|            | 205 (1.0 DL + 1.0 LL + 1.0 TRA WIND(+X))               | -1320.139                      | -16876.45  | -1634.885                                     | 0                | 0                | 0                |
|            | 206 (1.0 DL + 1.0 DIAG WIND)                           | -2805.101                      | -31804.62  | -2802.099                                     | 0                | 0                | 0                |
|            | 207 (1.0 DL + 1.0 LL + 1.0 DIAG WIND)                  | -2666.934                      | -30257.58  | -2666.722                                     | 0                | 0                | 0                |

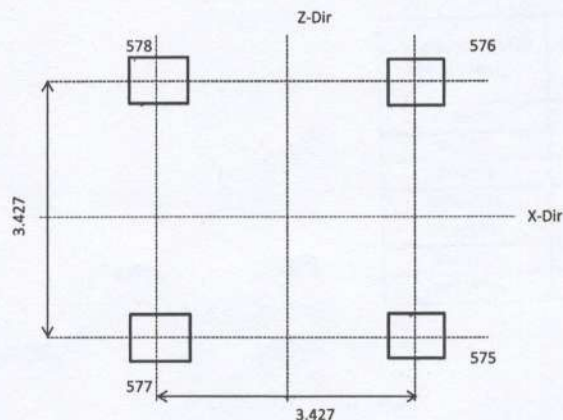


|            |                                                     |                                |            |                                            |            |
|------------|-----------------------------------------------------|--------------------------------|------------|--------------------------------------------|------------|
| PROJECT    | 400/220/132/33KV GIS SUBSTATION AT KHUMTAI, ASSAM   | CUSTOMER                       |            | ASSAM ELECTRICITY GRID CORPORATION LIMITED |            |
|            |                                                     | DOCUMENT NO.                   |            | REVISION                                   |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                         | DP-22100-R5-SAR-FDN-LM-DGN-002 |            | 0                                          |            |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST TYPE LM | PREPARED BY                    | CHECKED BY | APPROVED BY                                | DATE       |
|            |                                                     | ART                            | SBK        | SARK                                       | 05.12.2022 |

### Reaction of Forces :

Below mentioned forces have be taken from STAAD result as available from structure analysis and design of LM  
These forces have been converted into central forces at base level as per sample calculation given below.

| Node | Load case                                 | Force-X Kg | Force-Y Kg | Force-Z Kg |
|------|-------------------------------------------|------------|------------|------------|
| 575  | 201 (1.0 DL + 1.0 LL)                     | -422.65    | 6525.87    | -418.88    |
|      | 202 (1.0 DL + 1.0 LONG WIND(+Z))          | -2403.28   | 23419.39   | -1718.85   |
|      | 203 (1.0 DL + 1.0 TRA WIND(+X))           | -1723.15   | 23414.66   | -2396.90   |
|      | 204 (1.0 DL + 1.0 LL + 1.0 LONG WIND(+Z)) | -2615.79   | 26813.18   | -1928.65   |
|      | 205 (1.0 DL + 1.0 LL + 1.0 TRA WIND(+X))  | -1935.65   | 26808.46   | -2606.69   |
|      | 206 (1.0 DL + 1.0 DIAG WIND)              | -3320.45   | 36917.99   | -3297.05   |
|      | 207 (1.0 DL +1.0 LL + 1.0 DIAG WIND)      | -3532.95   | 40311.78   | -3506.84   |
| 577  | 201 (1.0 DL + 1.0 LL)                     | 482.98     | 4802.20    | -346.29    |
|      | 202 (1.0 DL + 1.0 LONG WIND(+Z))          | -1905.06   | -17914.74  | 1333.45    |
|      | 203 (1.0 DL + 1.0 TRA WIND(+X))           | 1845.91    | 22481.27   | -2098.30   |
|      | 204 (1.0 DL + 1.0 LL + 1.0 LONG WIND(+Z)) | -1659.42   | -15485.12  | 1164.93    |
|      | 205 (1.0 DL + 1.0 LL + 1.0 TRA WIND(+X))  | 2091.55    | 24910.90   | -2266.82   |
|      | 206 (1.0 DL + 1.0 DIAG WIND)              | -178.25    | 2899.44    | -576.62    |
|      | 207 (1.0 DL +1.0 LL + 1.0 DIAG WIND)      | 67.39      | 5329.07    | -745.13    |
| 576  | 201 (1.0 DL + 1.0 LL)                     | -350.20    | 4802.20    | 479.21     |
|      | 202 (1.0 DL + 1.0 LONG WIND(+Z))          | -2094.68   | 22486.21   | 1852.06    |
|      | 203 (1.0 DL + 1.0 TRA WIND(+X))           | 1335.55    | -17910.01  | -1900.73   |
|      | 204 (1.0 DL + 1.0 LL + 1.0 LONG WIND(+Z)) | -2265.98   | 24915.83   | 2094.99    |
|      | 205 (1.0 DL + 1.0 LL + 1.0 TRA WIND(+X))  | 1164.24    | -15480.39  | -1657.80   |
|      | 206 (1.0 DL + 1.0 DIAG WIND)              | -481.19    | 1549.62    | -257.50    |
|      | 207 (1.0 DL +1.0 LL + 1.0 DIAG WIND)      | -652.50    | 3979.24    | -14.57     |
| 578  | 201 (1.0 DL + 1.0 LL)                     | 289.87     | 3232.25    | 285.96     |
|      | 202 (1.0 DL + 1.0 LONG WIND(+Z))          | -1764.40   | -18428.43  | -1466.65   |
|      | 203 (1.0 DL + 1.0 TRA WIND(+X))           | -1458.31   | -18423.49  | -1770.26   |
|      | 204 (1.0 DL + 1.0 LL + 1.0 LONG WIND(+Z)) | -1626.24   | -16881.39  | -1331.27   |
|      | 205 (1.0 DL + 1.0 LL + 1.0 TRA WIND(+X))  | -1320.14   | -16876.45  | -1634.89   |
|      | 206 (1.0 DL + 1.0 DIAG WIND)              | -2805.10   | -31804.62  | -2802.10   |
|      | 207 (1.0 DL +1.0 LL + 1.0 DIAG WIND)      | -2666.93   | -30257.58  | -2666.72   |



|            |                                                     |                                |            |                                            |            |
|------------|-----------------------------------------------------|--------------------------------|------------|--------------------------------------------|------------|
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|            |                                                     | DOCUMENT NO.                   |            | REVISION                                   |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                         | DP-22100-RS-SAR-FDN-LM-DGN-002 |            | 0                                          |            |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST TYPE LM | PREPARED BY                    | CHECKED BY | APPROVED BY                                | DATE       |
|            |                                                     | ART                            | SBK        | SARK                                       | 05.12.2022 |

Back to back of leg (CG to CG dist.)

( Also centre to centre of pedestal )

In 'X' direction = 3426.60 mm

In 'Z' direction = 3426.60 mm

Sample calculation for Load case - 207

Moment in X - dir = { (+) 5329.07 (+) -30257.58 (-) 40311.78 (-)  
3979.24 } x 3.427 / 2  
= 118594.00 Kg.m

Moment in Z-dir = { (+) 3979.24 (+) -30257.58 (-) 40311.78 (-)  
5329.07 } x 3.427 / 2  
= 123220.00 Kg.m

Shear in X - dir = -3532.95 (+) 67.39 (+) -652.50 (+) -2666.93  
= 6784.99 Kg

Shear in Z - dir = -3506.84 (+) -745.13 (+) -14.57 (+) -2666.72  
= 6933.26 Kg

Vertical Load = 40311.78 (+) 5329.07 (+) 3979.24 (+) -30257.58  
= 19362.51 Kg

| Central forces at PL      |                       |                                  |                                 |                                           |                                          |
|---------------------------|-----------------------|----------------------------------|---------------------------------|-------------------------------------------|------------------------------------------|
| Desicription of forces    | 201 (1.0 DL + 1.0 LL) | 202 (1.0 DL + 1.0 LONG WIND(+Z)) | 203 (1.0 DL + 1.0 TRA WIND(+X)) | 204 (1.0 DL + 1.0 LL + 1.0 LONG WIND(+Z)) | 205 (1.0 DL + 1.0 LL + 1.0 TRA WIND(+X)) |
| Vertical load - Kg        | 19362.51              | 9562.43                          | 9562.43                         | 19362.51                                  | 19362.51                                 |
| Shear in X-dir - Kg       | 0.00                  | 8167.42                          | 0.00                            | 8167.42                                   | 0.00                                     |
| Shear in Z-dir - Kg       | 0.00                  | 0.00                             | 8166.19                         | 0.00                                      | 8166.19                                  |
| Moment in X-dir - Kg.m    | 5643.00               | 140917.00                        | 2479.00                         | 144081.00                                 | 5643.00                                  |
| Moment in Z-dir - Kg.m    | 5643.00               | 2479.00                          | 140884.00                       | 5643.00                                   | 144048.00                                |
| Compressive load per Leg  | 6525.87               | 23419.39                         | 23414.66                        | 26813.18                                  | 26808.46                                 |
| Tensile load per leg - Kg | 0.00                  | -18428.43                        | -18423.49                       | -16881.39                                 | -16876.45                                |

| Desicription of forces    | 206 (1.0 DL + 1.0 DIAG WIND) | 207 (1.0 DL + 1.0 LL + 1.0 DIAG WIND) |
|---------------------------|------------------------------|---------------------------------------|
| Vertical load - Kg        | 9562.43                      | 19362.51                              |
| Shear in X-dir - Kg       | 6784.99                      | 6784.99                               |
| Shear in Z-dir - Kg       | 6933.26                      | 6933.26                               |
| Moment in X-dir - Kg.m    | 115430.00                    | 118594.00                             |
| Moment in Z-dir - Kg.m    | 120056.00                    | 123220.00                             |
| Compressive load per Leg  | 36917.99                     | 40311.78                              |
| Tensile load per leg - Kg | -31804.62                    | -30257.58                             |



|            |                                                        |                                |            |                                               |            |
|------------|--------------------------------------------------------|--------------------------------|------------|-----------------------------------------------|------------|
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|            |                                                        | DOCUMENT NO.                   |            | REVISION                                      |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                            | DP-22100-RS-SAR-FDN-LM-DGN-002 |            | 0                                             |            |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST<br>TYPE LM | PREPARED BY                    | CHECKED BY | APPROVED BY                                   | DATE       |
|            |                                                        | ART                            | SBK        | SARK                                          | 05.12.2022 |

#### 1.0 GENERAL DATA

|                    |   |                     |
|--------------------|---|---------------------|
| Concrete mix       | = | M 20                |
| Grade of steel     | = | Fe 500              |
| Design Methodology | = | Limit State Design  |
| Reference code     | = | IS 456, SP16 & SP34 |

#### Factor of Safety for Overturning

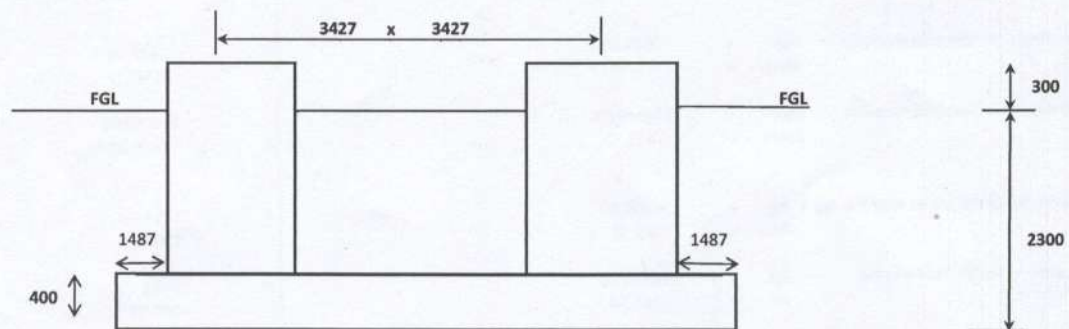
|                        |   |      |
|------------------------|---|------|
| Under Normal Condition | = | 2.20 |
| Under SCF Condition    | = | 1.65 |

#### Factor of Safety for Sliding

|                        |   |      |
|------------------------|---|------|
| Under Normal Condition | = | 2.20 |
| Under SCF Condition    | = | 1.65 |

#### Load Factor taken for strength design

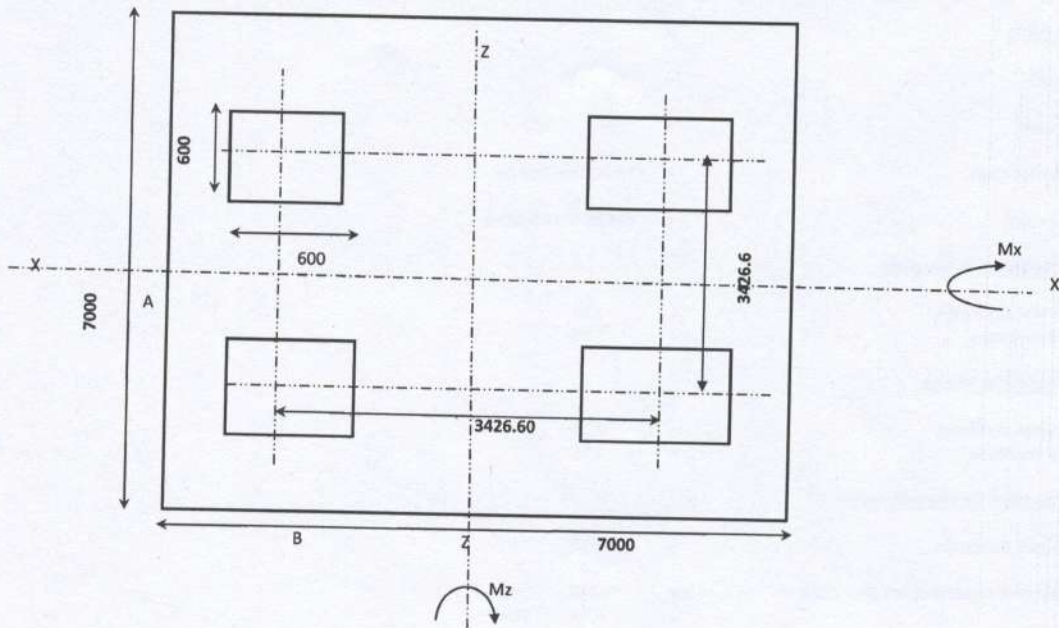
|                                           |   |                               |
|-------------------------------------------|---|-------------------------------|
| Under Normal Condition                    | = | 1.50                          |
| Net Safe bearing capacity of soil @ 2.0 m | = | 64.02 $\text{kn/m}^2$         |
|                                           | = | 6.53 $\text{T/m}^2$           |
| Depth of foundation from FGL              | = | 2.300 m                       |
| Gross Safe bearing capacity of Soil       | = | 6.53 + 2.00 x 2.0             |
|                                           | = | 10.54 $\text{T/m}^2$          |
| Density of soil                           | = | 19.66 $\text{kN./m}^3$        |
|                                           | = | 2004.76 $\text{Kg./m}^3$      |
| Angle of internal friction ( $\phi$ )     | = | 0                             |
| Co efficient of friction                  | = | 0.00 ( $\text{TAN}((\phi))$ ) |
| Density of concrete                       | = | 2500 $\text{Kg./m}^3$         |
| Height of Plinth                          | = | 300 mm                        |
| Clear cover for pad                       | = | 50 mm                         |



ELEVATION



|            |                                                     |                                |            |                                            |            |
|------------|-----------------------------------------------------|--------------------------------|------------|--------------------------------------------|------------|
| PROJECT    | 400/220/132/33KV GIS SUBSTATION AT KHUMTAI, ASSAM   | CUSTOMER                       |            | ASSAM ELECTRICITY GRID CORPORATION LIMITED |            |
|            |                                                     | DOCUMENT NO.                   |            | REVISION                                   |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                         | DP-22100-RS-SAR-FDN-LM-DGN-002 |            | 0                                          |            |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST TYPE LM | PREPARED BY                    | CHECKED BY | APPROVED BY                                | DATE       |
|            |                                                     | ART                            | SBK        | SARK                                       | 05.12.2022 |



**PLAN  
FOUNDATION DETAILS**

## 2.0 FOUNDATION LOADS AT PLINTH LEVEL

|                                  |      | 205 (1.0 DL + 1.0 LL + 1.0 TRA WIND(+X)) | 203 (1.0 DL + 1.0 TRA WIND(+X)) |
|----------------------------------|------|------------------------------------------|---------------------------------|
| Vertical loads (P)               | Kg   | = 19362.51                               | = 9562.43                       |
|                                  | kN   | = 189.95                                 | = 93.81                         |
| Maximum 'X' direction shear      | Kg   | = 0                                      | = 0                             |
|                                  | kN   | = 0.00                                   | = 0.00                          |
| Maximum 'Z' direction shear      | Kg   | = 8166.19                                | = 8166.19                       |
|                                  | kN   | = 80.11                                  | = 80.11                         |
| Maximum 'X' direction moment     | Kgm  | = 5643.00                                | = 2479.00                       |
|                                  | kNm  | = 55.36                                  | = 24.32                         |
| Maximum 'Z' direction moment     | Kg.m | = 144048.00                              | = 140884.00                     |
|                                  | kN.m | = 1413.11                                | = 1382.07                       |
| Maximum Compressive load per leg | Kg   | = 26808.46                               | = 23414.66                      |
|                                  | kN   | = 262.99                                 | = 229.70                        |
| Maximum Tensile load per leg     | Kg   | = -16876.45                              | = -18423.49                     |
|                                  | kN   | = -165.56                                | = -180.73                       |



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|------------|-----------------------------------------------------|--------------------------------|------------|--------------------------------------------|------------|
|            |                                                     | DOCUMENT NO.                   |            | REVISION                                   |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                         | DP-22100-RS-SAR-FDN-LM-DGN-002 |            | 0                                          |            |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST TYPE LM | PREPARED BY                    | CHECKED BY | APPROVED BY                                | DATE       |
|            |                                                     | ART                            | SBK        | SARK                                       | 05.12.2022 |

| 202 (1.0 DL + 1.0 LONG WIND(+Z)) |      |   |           | 204 (1.0 DL + 1.0 LL + 1.0 LONG WIND(+Z)) |           |  |  |
|----------------------------------|------|---|-----------|-------------------------------------------|-----------|--|--|
| Vertical loads (P)               | Kg   | = | 9562.43   | =                                         | 19362.51  |  |  |
|                                  | kN   | = | 93.81     | =                                         | 189.95    |  |  |
| Maximum 'X' direction shear      | Kg   | = | 8167.42   | =                                         | 8167.42   |  |  |
|                                  | kN   | = | 80.12     | =                                         | 80.12     |  |  |
| Maximum 'Z' direction shear      | Kg   | = | 0.00      | =                                         | 0.00      |  |  |
|                                  | kN   | = | 0.00      | =                                         | 0.00      |  |  |
| Maximum 'X' direction moment     | Kg   | = | 140917.00 | =                                         | 144081.00 |  |  |
|                                  | kN   | = | 1382.40   | =                                         | 1413.43   |  |  |
| Maximum 'Z' direction moment     | Kg.m | = | 2479.00   | =                                         | 5643.00   |  |  |
|                                  | kN.m | = | 24.32     | =                                         | 55.36     |  |  |
| Maximum Compressive load per leg | Kg   | = | 23419.39  | =                                         | 26813.18  |  |  |
|                                  | kN   | = | 229.74    | =                                         | 263.04    |  |  |
| Maximum Tensile load per leg     | Kg   | = | -18428.43 | =                                         | -16881.39 |  |  |
|                                  | kN   | = | -180.78   | =                                         | -165.61   |  |  |
| 206 (1.0 DL + 1.0 DIAG WIND)     |      |   |           | 207 (1.0 DL + 1.0 LL + 1.0 DIAG WIND)     |           |  |  |
| Vertical loads (P)               | Kg   | = | 9562.43   | =                                         | 19362.51  |  |  |
|                                  | kN   | = | 93.81     | =                                         | 189.95    |  |  |
| Maximum 'X' direction shear      | Kg   | = | 6784.99   | =                                         | 6784.99   |  |  |
|                                  | kN   | = | 66.56     | =                                         | 66.56     |  |  |
| Maximum 'Z' direction shear      | Kg   | = | 6933.26   | =                                         | 6933.26   |  |  |
|                                  | kN   | = | 68.02     | =                                         | 68.02     |  |  |
| Maximum 'X' direction moment     | Kg   | = | 115430.00 | =                                         | 118594.00 |  |  |
|                                  | kN   | = | 1132.37   | =                                         | 1163.41   |  |  |
| Maximum 'Z' direction moment     | Kg.m | = | 120056.00 | =                                         | 123220.00 |  |  |
|                                  | kN.m | = | 1177.75   | =                                         | 1208.79   |  |  |
| Maximum Compressive load per leg | Kg   | = | 36917.99  | =                                         | 40311.78  |  |  |
|                                  | kN   | = | 362.17    | =                                         | 395.46    |  |  |
| Maximum Tensile load per leg     | Kg   | = | -31804.62 | =                                         | -30257.58 |  |  |
|                                  | kN   | = | -312.00   | =                                         | -296.83   |  |  |

### 3.0 FOUNDATION DETAILS (REF. FIG)

#### GEOMETRY:

|                               |   |   |             |   |     |
|-------------------------------|---|---|-------------|---|-----|
| Pad size - A x B              | m | = | 7.00 x 7.00 |   |     |
| Pad thickness                 | m | = | 0.40        |   |     |
| Depth of foundation below FGL | m | = | 2.30        |   |     |
| Pedestal size                 | m | = | 0.60 x 0.60 | 4 | Nos |
| Plinth level from FGL         | m | = | 0.300       |   |     |

#### Back to back of leg (CG to CG dist.)

( Also centre to centre of pedestal )

|                  |   |        |    |
|------------------|---|--------|----|
| In 'X' direction | = | 3426.6 | mm |
| In 'Z' direction | = | 3426.6 | mm |



|            |                                                     |                                |            |                                            |            |
|------------|-----------------------------------------------------|--------------------------------|------------|--------------------------------------------|------------|
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|            |                                                     | DOCUMENT NO.                   |            | REVISION                                   |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                         | DP-22100-RS-SAR-FDN-LM-DGN-002 |            | 0                                          |            |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST TYPE LM | PREPARED BY                    | CHECKED BY | APPROVED BY                                | DATE       |
|            |                                                     | ART                            | SBK        | SARK                                       | 05.12.2022 |

#### 4.0 DESIGN CALCULATION

##### 4.1 STABILITY CHECK

##### 4.1.1 CHECK FOR OVERTURNING:

|                                                                 |   | 205 (1.0 DL + 1.0 LL + 1.0 TRA WIND(+X))                                                   | 203 (1.0 DL + 1.0 TRA WIND(+X))   |
|-----------------------------------------------------------------|---|--------------------------------------------------------------------------------------------|-----------------------------------|
| Net Moments acting at Pad Level in X direction                  | = | 5643.00 + 0.00 x 2.60                                                                      | = 2479.00 + 0.00 x 2.60           |
|                                                                 | = | 5643.00 Kg.m                                                                               | = 2479.00 Kg.m                    |
| Net Moments acting at Pad Level in Z direction                  | = | 144048.00 + 8166.19 x 2.60                                                                 | = 140884.00 + 8166.19 x 2.60      |
|                                                                 | = | 165280.10 Kg.m                                                                             | = 162116.10 Kg.m                  |
| Distance of horizontal portion from edge of pedestal - X - dir. | = | 1.49 m                                                                                     | = 1.49 m                          |
| Distance of horizontal portion from edge of pedestal - Z - dir. | = | 1.49 m                                                                                     | = 1.49 m                          |
| Volume of concrete                                              | = | ( 7.00 x 7.00 x 0.40 + 4.00 x 0.60 <sup>2</sup> x 1.90 + 4.00 x 0.60 <sup>2</sup> x 0.30 ) | = 22.77 m <sup>3</sup>            |
|                                                                 | = | 22.77 m <sup>3</sup>                                                                       |                                   |
| Total Volume of Earth                                           | = | ( 7.00 x 7.00 x 2.30 ) - 22.34                                                             | = 90.00 m <sup>3</sup>            |
|                                                                 | = | 90.00 m <sup>3</sup>                                                                       |                                   |
| Weight of earth                                                 | = | 90.00 x 2004.76                                                                            | = 180428.85 Kg                    |
|                                                                 | = | 180428.85 Kg                                                                               |                                   |
| Weight of concrete                                              | = | 22.77 x 2500.00                                                                            | = 56925.00 Kg                     |
|                                                                 | = | 56925.00 Kg                                                                                |                                   |
| Vertical Load P                                                 | = | 19362.51 Kg.                                                                               | = 19362.51 Kg                     |
| Total downward Load                                             | = | 180428.85 + 56925.00 + 19362.51                                                            | = 180428.85 + 56925.00 + 19362.51 |
|                                                                 | = | 256716.36 Kg.                                                                              | = 256716.36 Kg                    |
| Stabilizing moment Along 'X' Dir                                | = | 256716.36 x 7.00 / 2.00                                                                    | = 256716.36 x 7.00 / 2.00         |
|                                                                 | = | 898507.00 Kg.m                                                                             | = 898507.25 Kg.m                  |
| Stabilizing moment Along 'Z' Dir                                | = | 256716.36 x 7.00 / 2.00                                                                    | = 256716.36 x 7.00 / 2.00         |
|                                                                 | = | 898507.00 Kg.m                                                                             | = 898507.25 Kg.m                  |
| Actuating moment in X direction                                 | = | 5643.00 Kg.m                                                                               | = 2479.00 Kg.m                    |
| Factor of Safety                                                | = | 898507.00 / 5643.00                                                                        | = 898507.25 / 2479.00             |
|                                                                 | = | 159.23 > 2.20                                                                              | = 362.45 > 1.65                   |
|                                                                 | = | Hence Safe                                                                                 | = Hence Safe                      |
| Actuating moment in Z direction                                 | = | 165280.10 Kg.m                                                                             | = 162116.10 Kg.m                  |
| Factor of Safety                                                | = | 898507.00 / 165280.10                                                                      | = 898507.25 / 162116.10           |
|                                                                 | = | 5.44 > 2.20                                                                                | = 5.54 > 1.65                     |
|                                                                 | = | Hence Safe                                                                                 | = Hence Safe                      |

##### 4.1.2 CHECK FOR OVERTURNING:

|                                            |   | 202 (1.0 DL + 1.0 LONG WIND(+Z)) | 204 (1.0 DL + 1.0 LL + 1.0 LONG WIND(+Z)) |
|--------------------------------------------|---|----------------------------------|-------------------------------------------|
| Moments acting at Pad Level in X direction | = | 140917.00 + 8167.42 x 2.60       | = 144081.00 + 8167.42 x 2.60              |
|                                            | = | 162152.00 Kg.m                   | = 165316.00 Kg.m                          |
| Moments acting at Pad Level in Z direction | = | 2479.00 + 0.00 x 2.60            | = 5643.00 + 0.00 x 2.60                   |
|                                            | = | 2479.00 Kg.m                     | = 5643.00 Kg.m                            |





|            |                                                     |                                |            |                                            |            |
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|            |                                                     | DOCUMENT NO.                   |            | REVISION                                   |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                         | DP-22100-RS-SAR-FDN-LM-DGN-002 |            | 0                                          |            |
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|            |                                                     | ART                            | SBK        | SARK                                       | 05.12.2022 |

$$\begin{aligned}
 \text{Min pressure} &= - 98.71 - 2891.20 + 5239.11 \\
 &= 2249.20 \text{ Kg/m}^2 \\
 &< 10540.00 \text{ Kg/m}^2 \\
 &\text{Hence Safe}
 \end{aligned}$$

$$\begin{aligned}
 &= - 43.36 - 2835.85 \\
 &+ 5239.11 \\
 &= 2359.90 \text{ Kg/m}^2 \\
 &< 10540.00 \text{ Kg/m}^2 \\
 &\text{Hence Safe}
 \end{aligned}$$

#### 4.2.2 CHECK FOR BEARING PRESSURE:

202 (1.0 DL + 1.0 LONG WIND(+Z))

204 (1.0 DL + 1.0 LL + 1.0 LONG WIND(+Z))

$$\begin{aligned}
 \text{Maximum 'X' directional moment} &= 162152.00 \text{ Kg.m} \\
 \text{Maximum 'Z' directional moment} &= 2479.00 \text{ Kg.m} \\
 \text{Total downward Load @ Pad level} &= 256716.36 \text{ Kg} \\
 \text{Eccentricities (e}_x\text{)} &= \frac{162152.00}{256716.36} = 0.63 < \frac{7.00}{1.17} = 6.00 \\
 \text{Eccentricities (e}_z\text{)} &= \frac{2479.00}{256716.36} = 0.01 < \frac{7.00}{1.17} = 6.00
 \end{aligned}$$

$$\begin{aligned}
 &= 165316.00 \text{ Kg.m} \\
 &= 5643.00 \text{ Kg.m} \\
 &= 256716.36 \text{ Kg} \\
 &= \frac{165316.00}{256716.36} = 0.64 < \frac{7.00}{1.17} = 6.00 \\
 &= \frac{5643.00}{256716.36} = 0.02 < \frac{7.00}{1.17} = 6.00
 \end{aligned}$$

$$\begin{aligned}
 \text{a Pressure due to vertical load} &= \frac{256716.36}{7.00 \times 7.00} = 5239.11 \text{ Kg/m}^2
 \end{aligned}$$

$$\begin{aligned}
 &= \frac{256716.36}{7.00 \times 7.00} = 5239.11 \text{ Kg/m}^2
 \end{aligned}$$

$$\begin{aligned}
 \text{b Pressure due to X-dir moment } 6xM_z/AxBxB &= 2836.48 \text{ Kg/m}^2
 \end{aligned}$$

$$\begin{aligned}
 &= 2891.83 \text{ Kg/m}^2
 \end{aligned}$$

$$\begin{aligned}
 \text{c Pressure due to z-dir moment } 6xM_x/BxAxA &= 43.36 \text{ Kg/m}^2
 \end{aligned}$$

$$\begin{aligned}
 &= 98.71 \text{ Kg/m}^2
 \end{aligned}$$

$$\begin{aligned}
 \text{Max pressure} &= + 2836.48 + 43.36 + 5239.11 \\
 &= 8118.95 \text{ Kg/m}^2
 \end{aligned}$$

$$\begin{aligned}
 &= + 2891.83 + 98.71 + 5239.11 \\
 &= 8229.65 \text{ Kg/m}^2
 \end{aligned}$$

$$\begin{aligned}
 \text{Min pressure} &= - 2836.48 - 43.36 + 5239.11 \\
 &= 2359.27 \text{ Kg/m}^2
 \end{aligned}$$

$$\begin{aligned}
 &= - 2891.83 - 98.71 + 5239.11 \\
 &= 2248.57 \text{ Kg/m}^2
 \end{aligned}$$

$$\begin{aligned}
 &< 10540.00 \text{ Kg/m}^2 \\
 &\text{Hence Safe}
 \end{aligned}$$

$$\begin{aligned}
 &< 10540.00 \text{ Kg/m}^2 \\
 &\text{Hence Safe}
 \end{aligned}$$

#### 4.2.2 CHECK FOR BEARING PRESSURE:

206 (1.0 DL + 1.0 DIAG WIND)

207 (1.0 DL + 1.0 LL + 1.0 DIAG WIND)

$$\begin{aligned}
 \text{Maximum 'X' directional moment} &= 133071.00 \text{ Kg.m} \\
 \text{Maximum 'Z' directional moment} &= 138082.00 \text{ Kg.m} \\
 \text{Total downward Load @ Pad level} &= 256716.36 \text{ Kg} \\
 \text{Eccentricities (e}_x\text{)} &= \frac{133071.00}{256716.36} = 0.52 < \frac{7.00}{1.17} = 6.00 \\
 \text{Eccentricities (e}_z\text{)} &= \frac{138082.00}{256716.36} = 0.54 < \frac{7.00}{1.17} = 6.00
 \end{aligned}$$

$$\begin{aligned}
 &= 136235.00 \text{ Kg.m} \\
 &= 141246.00 \text{ Kg.m} \\
 &= 256716.36 \text{ Kg} \\
 &= \frac{136235.00}{256716.36} = 0.53 < \frac{7.00}{1.17} = 6.00 \\
 &= \frac{141246.00}{256716.36} = 0.55 < \frac{7.00}{1.17} = 6.00
 \end{aligned}$$

$$\begin{aligned}
 \text{a Pressure due to vertical load} &= \frac{256716.36}{7.00 \times 7.00} = 5239.11 \text{ Kg/m}^2
 \end{aligned}$$

$$\begin{aligned}
 &= \frac{256716.36}{7.00 \times 7.00} = 5239.11 \text{ Kg/m}^2
 \end{aligned}$$

$$\begin{aligned}
 \text{b Pressure due to X-dir moment } 6xM_z/AxBxB &= 2327.77 \text{ Kg/m}^2
 \end{aligned}$$

$$\begin{aligned}
 &= 2383.12 \text{ Kg/m}^2
 \end{aligned}$$



| PROJECT                                           | 400/220/132/33KV GIS SUBSTATION AT KHUMTAI,<br>ASSAM   | CUSTOMER                                           |                                                        | ASSAM ELECTRICITY GRID<br>CORPORATION LIMITED |            |
|---------------------------------------------------|--------------------------------------------------------|----------------------------------------------------|--------------------------------------------------------|-----------------------------------------------|------------|
|                                                   |                                                        | DOCUMENT NO.                                       |                                                        | REVISION                                      |            |
| CONTRACTOR                                        | RS INFRA PROJECTS PVT. LTD.                            | DP-22100-RS-SAR-FDN-LM-DGN-002                     |                                                        | 0                                             |            |
| TITLE                                             | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST<br>TYPE LM | PREPARED BY                                        | CHECKED BY                                             | APPROVED BY                                   | DATE       |
|                                                   |                                                        | ART                                                | SBK                                                    | SARK                                          | 05.12.2022 |
| c Pressure due to z-dir moment<br>6xMx/BxAxA      |                                                        | = 2415.43 Kg/m²                                    | = 2470.78 Kg/m²                                        |                                               |            |
| Max pressure                                      |                                                        | = + 2327.77 + 2415.43 + 5239.11<br>= 9982.31 Kg/m² | = + 2383.12 + 2470.78<br>+ 5239.11<br>= 10093.01 Kg/m² |                                               |            |
| Min pressure                                      |                                                        | = - 2327.77 - 2415.43 + 5239.11<br>= 495.91 Kg/m²  | = - 2383.12 - 2470.78<br>+ 5239.11<br>= 385.21 Kg/m²   |                                               |            |
|                                                   |                                                        | < 10540.00 Kg/m²<br>Hence Safe                     | < 10540.00 Kg/m²<br>Hence Safe                         |                                               |            |
| 4.3 CHECK FOR SLIDING                             |                                                        | 205 (1.0 DL + 1.0 LL + 1.0 TRA WIND(+X))           |                                                        | 203 (1.0 DL + 1.0 TRA WIND(+X))               |            |
| Max. Shear Load At Plinth level<br>In X direction |                                                        | = 0 Kg                                             | = 0.00 Kg                                              |                                               |            |
| Resistance against Sliding                        |                                                        | = 0.00 x 256716.36 = 0.00 Kg                       | = 0.00 x 256716.36 = 0.00 Kg                           |                                               |            |
| Factor of Safety                                  |                                                        | = 0.00 / 0.00<br>= - > 2.20<br>Hence Safe          | = 0.00 / 0.00<br>= - > 1.65<br>Hence Safe              |                                               |            |
| Max. Shear Load At Plinth level<br>In Z direction |                                                        | = 8166.19 Kg                                       | = 8166.19 Kg                                           |                                               |            |
| Resistance against Sliding                        |                                                        | = 0.00 x 256716.36 = 0.00 Kg                       | = 0.00 x 256716.36 = 0.00 Kg                           |                                               |            |
| Factor of Safety                                  |                                                        | = 0.00 / 8166.19<br>= - > 2.20<br>Hence Safe       | = 0.00 / 8166.19<br>= - > 1.65<br>Hence Safe           |                                               |            |
| 4.3.1 CHECK FOR SLIDING                           |                                                        | 202 (1.0 DL + 1.0 LONG WIND(+Z))                   |                                                        | 204 (1.0 DL + 1.0 LL + 1.0 LONG<br>WIND(+Z))  |            |
| Max. Shear Load At Plinth level<br>In X direction |                                                        | = 8167.42 Kg                                       | = 8167.42 Kg                                           |                                               |            |
| Resistance against Sliding                        |                                                        | = 0.00 x 256716.36 = 0.00 Kg                       | = 0.00 x 256716.36 = 0.00 Kg                           |                                               |            |
| Factor of Safety                                  |                                                        | = 0.00 / 8167.42<br>= - > 2.20<br>Hence Safe       | = 0.00 / 8167.42<br>= - > 1.65<br>Hence Safe           |                                               |            |
| Max. Shear Load At Plinth level<br>In Z direction |                                                        | = 0.00 Kg                                          | = 0.00 Kg                                              |                                               |            |
| Resistance against Sliding                        |                                                        | = 0.00 x 256716.36 = 0.00 Kg                       | = 0.00 x 256716.36 = 0.00 Kg                           |                                               |            |
| Factor of Safety                                  |                                                        | = 0.00 / 0.00<br>= - > 2.20<br>Hence Safe          | = 0.00 / 0.00<br>= - > 1.65<br>Hence Safe              |                                               |            |
| 4.3.1 CHECK FOR SLIDING                           |                                                        | 206 (1.0 DL + 1.0 DIAG WIND)                       |                                                        | 207 (1.0 DL + 1.0 LL + 1.0 DIAG WIND)         |            |
| Max. Shear Load At Plinth level<br>In X direction |                                                        | = 6784.99 Kg                                       | = 6784.99 Kg                                           |                                               |            |
| Resistance against Sliding                        |                                                        | = 0.00 x 256716.36 = 0.00 Kg                       | = 0.00 x 256716.36 = 0.00 Kg                           |                                               |            |
| Factor of Safety                                  |                                                        | = 0.00 / 6784.99<br>= - > 2.20<br>Hence Safe       | = 0.00 / 6784.99<br>= - > 1.65<br>Hence Safe           |                                               |            |
| Max. Shear Load At Plinth level<br>In Z direction |                                                        | = 6933.26 Kg                                       | = 6933.26 Kg                                           |                                               |            |
| Resistance against Sliding                        |                                                        | = 0.00 x 256716.36 = 0.00 Kg                       | = 0.00 x 256716.36 = 0.00 Kg                           |                                               |            |
| Factor of Safety                                  |                                                        | = 0.00 / 6933.26<br>= - > 2.20<br>Hence Safe       | = 0.00 / 6933.26<br>= - > 1.65<br>Hence Safe           |                                               |            |



|            |                                                     |                                |                                            |             |            |
|------------|-----------------------------------------------------|--------------------------------|--------------------------------------------|-------------|------------|
| PROJECT    | 400/220/132/33KV GIS SUBSTATION AT KHUMTAI, ASSAM   | CUSTOMER                       | ASSAM ELECTRICITY GRID CORPORATION LIMITED |             |            |
|            |                                                     | DOCUMENT NO.                   | REVISION                                   |             |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                         | DP-22100-RS-SAR-FDN-LM-DGN-002 | 0                                          |             |            |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST TYPE LM | PREPARED BY                    | CHECKED BY                                 | APPROVED BY | DATE       |
|            |                                                     | ART                            | SBK                                        | SARK        | 05.12.2022 |

## 5.0 STRENGTH CHECK

### DESIGN OF PAD:

#### 5.1 NET PRESSURE

Pressure due to over burden soil & pad

$$= \left( \frac{0.40 + 0.40}{1.90 + 1.90} \right) \times 2,500.00 + \left( \frac{1.90 + 1.90}{1.90 + 1.90} \right) \times 2,004.76$$

$$= 4,809.05 \text{ Kg./m}^2$$

Net. Pressure at the edge of the pad

$$= 10,093.0 - 4,809.05$$

$$= 5,283.96 \text{ Kg/m}^2$$

$$= 51.84 \text{ kN/m}^2$$

Maximum for Pressure for Design

$$= 51.84 \text{ kN/m}^2$$

#### TRANSVERSE WIND

$$= 4,809.05 \text{ Kg./m}^2$$

$$= 10,093.01 - 4,809.05$$

$$= 5,283.96 \text{ Kg/m}^2$$

$$= 51.84 \text{ kN/m}^2$$

$$= 51.84 \text{ kN/m}^2$$

#### 5.2 BOTTOM REINFORCEMENT

##### 5.2.1 Z - Direction

Maximum overhang of pad Longer side

$$= \left( \frac{7000 - 3426.60 - 600}{1487} \right) \times 2$$

$$= 1487 \text{ mm}$$

Moment at the face of the pedestal

$$= \frac{51.84 \times 1.487^2}{57.29 \text{ kN.m}} \times \frac{1}{2}$$

Effective depth provided

$$= \frac{400 - 50 - 12}{344 \text{ mm}} \times \frac{1}{2}$$

$M_u/bd^2$

$$= \left( \frac{57.29 \times 1.50 \times 10^6}{1000 \times 344^2} \right) \times \frac{1}{0.73 \text{ N/mm}^2}$$

Percentage of reinforcement required ( $P_t$ ) (As per Table 2 of SP16)

$$= 0.176$$

$A_{st}$  required

$$= \frac{0.176}{604} \times 100 \times 1000 \times 344$$

Minimum  $A_{st}$  required

$$= \frac{0.120}{480} \times 100 \times 1000 \times 400$$

Provide 12 f @ 150 c/c bothways at bottom ( $A_{st}$  provided =

$$754 \text{ mm}^2)$$

Hence safe

##### 5.2.2 X - Direction

Maximum overhang of pad Shoter side

$$= \left( \frac{7000 - 3426.60 - 600}{1486.7} \right) \times 2$$

$$= 1486.7 \text{ mm}$$

Moment at the face of the pedestal

$$= \frac{51.84 \times 1.487^2}{57.29 \text{ kN.m}} \times \frac{1}{2}$$

Effective Depth, d

$$= \frac{344 - 12}{332 \text{ mm}}$$

$M_u/bd^2$

$$= \left( \frac{57.29 \times 1.50 \times 10^6}{1000 \times 332^2} \right) \times \frac{1}{0.78 \text{ N/mm}^2}$$

Percentage of reinforcement required ( $P_t$ ) (As per Table 2 of SP16)

$$= 0.188$$

$A_{st}$  required

$$= \frac{0.188}{625} \times 100 \times 1000 \times 332$$

Minimum  $A_{st}$  required

$$= \frac{0.120}{480} \times 100 \times 1000 \times 400$$

Provide 12 f @ 150 c/c bothways at bottom ( $A_{st}$  provided =

$$754 \text{ mm}^2)$$

Hence safe



| PROJECT    | 400/220/132/33KV GIS SUBSTATION AT KHUMTAI, ASSAM   | CUSTOMER                       |            | ASSAM ELECTRICITY GRID CORPORATION LIMITED |            |
|------------|-----------------------------------------------------|--------------------------------|------------|--------------------------------------------|------------|
|            |                                                     | DOCUMENT NO.                   |            | REVISION                                   |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                         | DP-22100-RS-SAR-FDN-LM-DGN-002 |            | 0                                          |            |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST TYPE LM | PREPARED BY                    | CHECKED BY | APPROVED BY                                | DATE       |
|            |                                                     | ART                            | SBK        | SARK                                       | 05.12.2022 |

### 5.3 TOP REINFORCEMENT:

#### 5.3.1 Z-Direction

$$\begin{aligned}
 \text{Maximum moment at centre } w l^2 / 8 - w(L-l)^2 / 8 &= 51.84 \times \frac{3.4266^2}{8} - 51.84 \times \frac{7.00^2 - 3.4266^2}{8} \\
 &= -6.66 \text{ KN.m} \\
 M_u / b d^2 &= \left( \frac{0 \times 1.50 \times 10^6}{1000 \times 344^2} \right) / 0.000 \\
 &= 0.000 \\
 \text{Percentage of reinforcement } A_{st} \text{ required at centre} &= \left( \frac{0}{0} / 100 \right) \times 1000 \times 344 \\
 &= 0 \text{ mm}^2 \\
 \text{Minimum } A_{st} \text{ required} &= \left( \frac{0.120}{480} / 100 \right) \times 1000 \times 400 \\
 &= 480 \text{ mm}^2 \\
 \text{Provide } 12 \text{ f @ } 200 \text{ c/c bothways at Top (} A_{st} \text{ provided = } 565 \text{ mm}^2 \text{) Hence safe}
 \end{aligned}$$

#### 5.3.2 X-Direction

$$\begin{aligned}
 \text{Maximum moment at centre } w l^2 / 8 - w(L-l)^2 / 8 &= 51.84 \times \frac{3.4266^2}{8} - 51.84 \times \frac{7.00^2 - 3.4266^2}{8} \\
 &= -6.66 \text{ KN.m} \\
 M_u / b d^2 &= \left( \frac{0 \times 1.50 \times 10^6}{1000 \times 344^2} \right) / -0.08 \\
 &= -0.02 \\
 \text{Percentage of reinforcement} &= 0.0000 \\
 A_{st} \text{ required at centre} &= \left( \frac{0}{0} / 100 \right) \times 1000 \times 344 \\
 &= 0 \text{ mm}^2 \\
 \text{Minimum } A_{st} \text{ required} &= \left( \frac{0.120}{480} / 100 \right) \times 1000 \times 400 \\
 &= 480 \text{ mm}^2 \\
 \text{Provide } 12 \text{ f @ } 200 \text{ c/c bothways at Top (} A_{st} \text{ provided = } 565 \text{ mm}^2 \text{) Hence safe}
 \end{aligned}$$

### 6.0 CHECK FOR PUNCHING SHEAR:

$$\begin{aligned}
 \text{Maximum axial load on pedestal} &= 395.46 \text{ KN.} \\
 \text{Self weight of Pedestal} &= 1 \times 0.60 \times 0.60 \times 2.200 \\
 &= 1980.00 \text{ Kg} \\
 &= 19.4238 \text{ kN} \\
 \text{Max Soil Resistance} &= \frac{4 \times 414.88 \times (944 \times 944)}{7000 \times 7000} \\
 &= 30.18 \text{ KN} \\
 \text{Net Punching Shear} &= 414.88 - 30.181 \\
 &= 384.70 \text{ KN} \\
 \text{Effective depth at critical section} &= 0.40 + \left( \frac{0.2691 \times -0.1717}{0.006} \right) - 0.05 \\
 &= 0.298 \text{ m} \\
 \text{Area resisted by shear stress} &= \left( \left( 4 \times (600 + 344) \right) \times 298 \right) \\
 &= 1125248 \text{ mm}^2 \\
 \text{Actual punching shear} &= \frac{384.70 \times 10^3 \times 1.50}{1125248} \\
 &= 0.51 \text{ N/mm}^2 \\
 &< 1.118 \text{ N/mm}^2 \text{ Hence Safe} \\
 &\text{(as per cl 31.6.3.1 of IS: 456 - 2000)}
 \end{aligned}$$



|            |                                                     |                                |            |                                            |            |
|------------|-----------------------------------------------------|--------------------------------|------------|--------------------------------------------|------------|
| PROJECT    | 400/220/132/33KV GIS SUBSTATION AT KHUMTAI, ASSAM   | CUSTOMER                       |            | ASSAM ELECTRICITY GRID CORPORATION LIMITED |            |
|            |                                                     | DOCUMENT NO.                   |            | REVISION                                   |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                         | DP-22100-RS-SAR-FDN-LM-DGN-002 |            | 0                                          |            |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST TYPE LM | PREPARED BY                    | CHECKED BY | APPROVED BY                                | DATE       |
|            |                                                     | ART                            | SBK        | SARK                                       | 05.12.2022 |

#### 6.1 CHECK FOR ONE WAY SHEAR:

|                                                                                |   |                                                          |   |                                                          |                   |
|--------------------------------------------------------------------------------|---|----------------------------------------------------------|---|----------------------------------------------------------|-------------------|
| Distance of face of pedestal from edge of pad - d2                             | = | $\frac{7.00 - 3.4266 - 0.60}{2}$                         | = | 1.487                                                    | m                 |
| Critical section for shear is at a distance 'd3' from the face of the pedestal | = | 1.487 - 0.34                                             | = | 1.143                                                    | m                 |
| Shear force/m width                                                            | = | $\frac{51.84}{59.254} \times 1.143 \times 1.00$          | = | $\frac{51.84}{59.253} \times 1.143 \times 1.00$          | KN                |
| Effective depth at critical section                                            | = | $0.40 + (0.27 \times \frac{1.143}{1.00}) - 0.05$         | = | 0.653                                                    | m                 |
| Actual shear Stress                                                            | = | $\frac{59.25}{653} \times \frac{10^3}{1000} \times 1.50$ | = | $\frac{59.25}{653} \times \frac{10^3}{1000} \times 1.50$ | N/mm <sup>2</sup> |
| Allowable shear stress (Refer Table 19 of IS: 456 - 2000)                      | = | 0.136 N/mm <sup>2</sup>                                  | = | 0.1361 N/mm <sup>2</sup>                                 |                   |
|                                                                                | > | 0.136 N/mm <sup>2</sup>                                  | > | 0.136 N/mm <sup>2</sup>                                  | Hence Safe        |

#### 7.0 DESIGN OF PEDESTAL:

205 (1.0 DL + 1.0 LL + 1.0 TRA WIND(+X))

203 (1.0 DL + 1.0 TRA WIND(+X))

#### 8.0 COMPRESSION WITH BENDING

|                                                                     |   |                       |      |       |                     |   |                       |      |       |                     |
|---------------------------------------------------------------------|---|-----------------------|------|-------|---------------------|---|-----------------------|------|-------|---------------------|
| Size of pedestal                                                    | = | 600                   | x    | 600   | mm                  | = | 600                   | x    | 600   | mm                  |
| Height of pedestal above pad                                        | = | 2200                  | mm   |       |                     | = | 2200                  | mm   |       |                     |
| <b>Check for Slenderness Ratio</b>                                  |   |                       |      |       |                     |   |                       |      |       |                     |
| lex / D                                                             | = | (                     | 2200 | x     | 2 / 600 )           | = | (                     | 2200 | x     | 2 / 600 )           |
|                                                                     | = | 7.4                   | <    | 12.0  |                     | = | 7.4                   | <    | 12.0  |                     |
| Hence, Short Column subject to Bi-axial bending                     |   |                       |      |       |                     |   |                       |      |       |                     |
| Considering the reinforcement is distributed equally on four sides, |   |                       |      |       |                     |   |                       |      |       |                     |
| Max. downward load on pedestal                                      | = | 262.99                | kN   |       |                     | = | 229.70                | kN   |       |                     |
| Factor Load                                                         | = | 262.99                | x    | 1.5   |                     | = | 229.70                | x    | 1.50  |                     |
|                                                                     | = | 394.49                | KN   |       |                     | = | 344.55                | KN   |       |                     |
| Maximum 'X' direction shear Per Pedestal                            | = | 0.00                  | kN   |       |                     | = | 0.00                  | kN   |       |                     |
|                                                                     | = |                       |      |       |                     | = |                       |      |       |                     |
| Net Maximum 'X' directional moment at Top of Pad                    | = | 0.00                  | x    | 2.200 |                     | = | 0.00                  | x    | 2.200 |                     |
|                                                                     | = | 0.00                  | kN.m |       |                     | = | 0.00                  | kN.m |       |                     |
| Maximum Z directional shear Per Pedestal                            | = | 80.11                 | kN   |       |                     | = | 80.11                 | kN   |       |                     |
|                                                                     | = |                       |      |       |                     | = |                       |      |       |                     |
| Maximum 'Z' directional moment at Top of Pad                        | = | 80.11                 | x    | 2.200 |                     | = | 80.11                 | x    | 2.200 |                     |
|                                                                     | = | 176.24                | kN.m |       |                     | = | 176.24                | kN.m |       |                     |
| Moment due to Slenderness                                           |   |                       |      |       |                     |   |                       |      |       |                     |
| X - Dir & Z - Dir                                                   |   |                       |      |       |                     |   |                       |      |       |                     |
| $\frac{Pu \times D \times (lex / D)^2}{2000}$                       | = | $\frac{262.99}{2000}$ | x    | 0.60  | x( 0 ) <sup>2</sup> | = | $\frac{229.70}{2000}$ | x    | 0.60  | x( 0 ) <sup>2</sup> |
|                                                                     | = | 0.000                 | KN.m |       |                     | = | 0.000                 | KN.m |       |                     |
| Total Moment in X dir                                               | = | 0.00                  | KN.m | (     | 0.00 + 0.00 )       | = | 0.00                  | KN.m |       |                     |
| Total Moment in Z dir                                               | = | 176.2                 | KN.m | (     | 176.24 + 0.00 )     | = | 176.2                 | KN.m |       |                     |



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|            |                                                        | DOCUMENT NO.                   |            | REVISION                                      |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                            | DP-22100-RS-SAR-FDN-LM-DGN-002 |            | 0                                             |            |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST<br>TYPE LM | PREPARED BY                    | CHECKED BY | APPROVED BY                                   | DATE       |
|            |                                                        | ART                            | SBK        | SARK                                          | 05.12.2022 |

|                                                         |   |                                                                                                           |   |                                                       |             |
|---------------------------------------------------------|---|-----------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------|-------------|
| Minimum Ast Req<br>(as per cl 26.5.3.1 IS 456-2000)     | = | 0.80 %                                                                                                    | x | Gross sectional area                                  |             |
|                                                         | = | $\frac{0.80}{100.00}$                                                                                     | x | 600 x 600                                             |             |
| Minimum Ast Req                                         | = | 2880.00                                                                                                   |   | mm <sup>2</sup>                                       |             |
| Provide 8 Nos. 20 dia rods. (A <sub>st</sub> provided = |   | 2513                                                                                                      |   | mm <sup>2</sup> )                                     |             |
| Provide 8 Nos. 20 dia rods. (A <sub>st</sub> provided = |   | 2513                                                                                                      |   | mm <sup>2</sup> )                                     |             |
| p/f <sub>ck</sub>                                       | = | 1.40                                                                                                      | / | 20                                                    | = 1.40 / 20 |
| (\ Provided 1.40 % reinforcement)                       | = | 0.07                                                                                                      |   |                                                       | = 0.07      |
| d'/D                                                    | = | 50                                                                                                        | / | 600                                                   | = 50 / 600  |
|                                                         | = | 0.08                                                                                                      |   |                                                       | = 0.08      |
| P <sub>u</sub> /f <sub>ck</sub> bd                      | = | ( 262.99 x 1000 x 1.50 ) /                                                                                |   | ( 229.70 x 1000 x 1.50 ) /                            |             |
|                                                         | = | ( 20 x 600 x 600 )                                                                                        |   | ( 20 x 600 x 600 )                                    |             |
|                                                         | = | 0.06                                                                                                      |   | 0.05                                                  |             |
| <u>From Chart 48 - SP16</u>                             |   |                                                                                                           |   |                                                       |             |
| M <sub>ux1</sub> /f <sub>ck</sub> bD <sup>2</sup>       | = | 0.13                                                                                                      |   |                                                       | = 0.13      |
| M <sub>ux1</sub>                                        | = | ( 0.13 x 20 ) x                                                                                           |   | ( 0.13 x 20 ) x                                       |             |
|                                                         | = | (( 600 x 600 <sup>2</sup> ) / 10 <sup>6</sup> )                                                           |   | (( 600 x 600 <sup>2</sup> ) / 10 <sup>6</sup> )       |             |
|                                                         | = | 561.60 kN.m                                                                                               |   | 561.6 kN.m                                            |             |
| M <sub>uz1</sub> /f <sub>ck</sub> bD <sup>2</sup>       | = | 0.13                                                                                                      |   |                                                       | = 0.13      |
| M <sub>uz1</sub>                                        | = | 0.13 x 20 x                                                                                               |   | 0.13 x 20 x                                           |             |
|                                                         | = | (( 600 x 600 <sup>2</sup> ) / 10 <sup>6</sup> )                                                           |   | (( 600 x 600 <sup>2</sup> ) / 10 <sup>6</sup> )       |             |
|                                                         | = | 561.60 kN.m                                                                                               |   | 561.6 kN.m                                            |             |
| P <sub>uz</sub><br>(Refer IS:456-2000 cl: 39.6)         | = | ( 0.45 x 20 x 600 <sup>2</sup> +                                                                          |   |                                                       |             |
|                                                         | = | 0.75 x 500 x 5026 ) / 1000                                                                                |   |                                                       |             |
|                                                         | = | 5124.75 kN                                                                                                |   | 5124.75 kN                                            |             |
| M <sub>ux</sub> /M <sub>ux1</sub>                       | = | ( 0.00 x 1.50 ) /                                                                                         |   | ( 0.000 x 1.50 ) /                                    |             |
|                                                         | = | 0.00                                                                                                      |   | 0.00                                                  |             |
| M <sub>uz</sub> /M <sub>uz1</sub>                       | = | ( 176.2 x 1.50 ) /                                                                                        |   | ( 176.2 x 1.50 ) /                                    |             |
|                                                         | = | 0.470                                                                                                     |   | 0.47                                                  |             |
| P <sub>u</sub> /P <sub>uz</sub>                         | = | ( 262.990963 x 1000 x 1.50 ) /                                                                            |   | ( 230 x 1000 x 1.50 ) /                               |             |
|                                                         | = | ( 5124.75 x 1000 )                                                                                        |   | ( 5124.75 x 1000 )                                    |             |
|                                                         | = | 0.08                                                                                                      |   | 0.067                                                 |             |
| For P <sub>u</sub> /p <sub>uz</sub>                     | = | 0.08                                                                                                      |   | 0.067                                                 |             |
| a <sub>n</sub>                                          | = | 1.00                                                                                                      |   | 1.00                                                  |             |
| Check for Interaction                                   | = | ( M <sub>ux</sub> /M <sub>ux1</sub> ) <sup>an</sup> + ( M <sub>uz</sub> /M <sub>uz1</sub> ) <sup>an</sup> |   | ( M <sub>ux</sub> /M <sub>ux1</sub> ) <sup>an</sup> + |             |
|                                                         | = | 0.00 + 0.47                                                                                               |   | ( M <sub>uz</sub> /M <sub>uz1</sub> ) <sup>an</sup>   |             |
|                                                         | = | 0.47 < 1.0                                                                                                |   | 0.00 + 0.47                                           |             |
|                                                         |   | Hence Safe                                                                                                |   | 0.47 < 1.0                                            |             |
|                                                         |   |                                                                                                           |   | Hence Safe                                            |             |



|            |                                                        |                                |            |                                               |            |
|------------|--------------------------------------------------------|--------------------------------|------------|-----------------------------------------------|------------|
| PROJECT    | 400/220/132/33KV GIS SUBSTATION AT KHUMTAI,<br>ASSAM   | CUSTOMER                       |            | ASSAM ELECTRICITY GRID<br>CORPORATION LIMITED |            |
|            |                                                        | DOCUMENT NO.                   |            | REVISION                                      |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                            | DP-22100-RS-SAR-FDN-LM-DGN-002 |            | 0                                             |            |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST<br>TYPE LM | PREPARED BY                    | CHECKED BY | APPROVED BY                                   | DATE       |
|            |                                                        | ART                            | SBK        | SARK                                          | 05.12.2022 |

### 8.1 TENSION WITH BENDING

205 (1.0 DL + 1.0 LL + 1.0 TRA WIND(+X))

203 (1.0 DL + 1.0 TRA WIND(+X))

Considering the reinforcement is desributed equally on four sides,

$$\begin{aligned} \text{Maximum Tensile load} &= -165.6 \text{ kN} \\ \text{Factor Load} &= -165.56 \times 1.5 \\ &= -248.34 \text{ KN} \end{aligned}$$

$$\begin{aligned} \text{Maximum 'X' directional shear} &= 0.00 \text{ kN} \\ \text{Per Pedestal} & \end{aligned}$$

$$\begin{aligned} \text{Net Maximum 'X' directional moment} &= 0.00 \times 2.20 \\ \text{at top of pad} &= 0.00 \text{ kN.m} \end{aligned}$$

$$\begin{aligned} \text{Maximum 'Z' directional shear} &= 80.11 \text{ kN} \\ \text{Per Pedestal} & \end{aligned}$$

$$\begin{aligned} \text{Net Maximum 'Z' directional moment} &= 80.11 \times 2.2 \\ \text{at top of pad} &= 176.24 \text{ kN.m} \end{aligned}$$

Moment due to Slenderness  
X - Dir & Z - Dir

$$\begin{aligned} \frac{P_u \times D \times (l_{ex} / D)^2}{2000} &= \frac{-165.56 \times 0.60 \times (0)^2}{2000} \\ &= 0.000 \text{ KN.m} \end{aligned}$$

$$\begin{aligned} \text{Total Moment in X dir} &= 0.00 \text{ KN.m} \quad (0.00 + 0.000) \end{aligned}$$

$$\begin{aligned} \text{Total Moment in Z dir} &= 176.2 \text{ KN.m} \quad (176.24 + 0.00) \end{aligned}$$

Minimum Ast Req  
(as per cl 26.5.3.1 IS 456-2000)

$$\begin{aligned} &= 0.80 \% \times \text{Gross sectional area} \\ &= \frac{0.80}{100.00} \times 600 \times 600 \end{aligned}$$

$$\begin{aligned} \text{Minimum Ast Req} &= 2880.00 \text{ mm}^2 \end{aligned}$$

Provide 8 Nos. 20 dia rods. ( $A_{st}$  provided = 2513 mm<sup>2</sup>)

Provide 8 Nos. 20 dia rods. ( $A_{st}$  provided = 2513 mm<sup>2</sup>)

$$p/f_{ck} = 1.40 / 20$$

(\ Assuming 1.40 % reinforcement)

$$\begin{aligned} d'/D &= 50 / 600 \\ &= 0.08 \end{aligned}$$

$$\begin{aligned} P_u/f_{ck}bd &= \left( \frac{-165.6 \times 1000 \times 1.50}{20 \times 600 \times 600} \right) / \\ &= -0.03 \end{aligned}$$

From Chart 83 - SP16

$$M_{ux1}/f_{ck}bD^2 = 0.12$$

$$\begin{aligned} M_{ux1} &= \frac{0.12 \times 20 \times ((600 \times 600)^2)}{10^6} \\ &= 518.40 \text{ kN.m} \end{aligned}$$

$$M_{uz1}/f_{ck}bD^2 = 0.12$$

$$\begin{aligned} M_{uz1} &= \frac{0.12 \times 20 \times ((600 \times 600)^2)}{10^6} \\ &= 518.40 \text{ kN.m} \end{aligned}$$

$$P_{uz} = 5124.75 \text{ kN}$$

$$\begin{aligned} M_{ux}/M_{ux1} &= \left( \frac{0.00 \times 1.50}{0.00} \right) / 518.40 \\ &= 0.00 \end{aligned}$$

$$\begin{aligned} &= -180.7 \text{ kN} \\ &= -180.73 \times 1.5 \\ &= -271.11 \text{ KN} \end{aligned}$$

$$\begin{aligned} \text{Maximum 'X' directional shear} &= 0.00 \text{ kN} \end{aligned}$$

$$\begin{aligned} \text{Net Maximum 'X' directional moment} &= 0.00 \times 2.2 \\ &= 0.00 \text{ kN.m} \end{aligned}$$

$$\begin{aligned} \text{Maximum 'Z' directional shear} &= 80.11 \text{ kN} \end{aligned}$$

$$\begin{aligned} \text{Net Maximum 'Z' directional moment} &= 80.11 \times 2.2 \\ &= 176.24 \text{ kN.m} \end{aligned}$$

$$\begin{aligned} \frac{P_u \times D \times (l_{ex} / D)^2}{2000} &= \frac{-180.73 \times 0.60 \times (0)^2}{2000} \\ &= 0.000 \text{ KN.m} \end{aligned}$$

$$\begin{aligned} \text{Total Moment in X dir} &= 0.00 \text{ KN.m} \end{aligned}$$

$$\begin{aligned} \text{Total Moment in Z dir} &= 176.2 \text{ KN.m} \end{aligned}$$

$$\begin{aligned} p/f_{ck} &= 1.40 / 20 \\ &= 0.07 \end{aligned}$$

$$\begin{aligned} d'/D &= 50 / 600 \\ &= 0.08 \end{aligned}$$

$$\begin{aligned} P_u/f_{ck}bd &= \left( \frac{-180.7 \times 1000 \times 1.50}{20 \times 600 \times 600} \right) / \\ &= -0.038 \end{aligned}$$

$$M_{ux1}/f_{ck}bD^2 = 0.12$$

$$\begin{aligned} M_{ux1} &= \frac{0.12 \times 20 \times ((600 \times 600)^2)}{10^6} \\ &= 518.40 \text{ kN.m} \end{aligned}$$

$$M_{uz1}/f_{ck}bD^2 = 0.12$$

$$\begin{aligned} M_{uz1} &= \frac{0.12 \times 20 \times ((600 \times 600)^2)}{10^6} \\ &= 518.40 \text{ kN.m} \end{aligned}$$

$$P_{uz} = 5124.75 \text{ kN}$$

$$\begin{aligned} M_{ux}/M_{ux1} &= \left( \frac{0.00 \times 1.50}{0} \right) / 518.40 \\ &= 0 \end{aligned}$$



| PROJECT    | 400/220/132/33KV GIS SUBSTATION AT KHUMTAI, ASSAM   | CUSTOMER                       |            | ASSAM ELECTRICITY GRID CORPORATION LIMITED |            |
|------------|-----------------------------------------------------|--------------------------------|------------|--------------------------------------------|------------|
|            |                                                     | DOCUMENT NO.                   |            | REVISION                                   |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                         | DP-22100-RS-SAR-FDN-LM-DGN-002 |            | 0                                          |            |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST TYPE LM | PREPARED BY                    | CHECKED BY | APPROVED BY                                | DATE       |
|            |                                                     | ART                            | SBK        | SARK                                       | 05.12.2022 |

|                                   |                                                                   |                                                                  |
|-----------------------------------|-------------------------------------------------------------------|------------------------------------------------------------------|
| $M_{uz}/M_{uz1}$                  | $= ( 176.24 \times 1.50 ) / 518.40$                               | $= ( 176.2 \times 1.50 ) / 518.40$                               |
|                                   | $= 0.51$                                                          | $= 0.51$                                                         |
| $P_u/P_{uz}$                      | $= ( -165.56 \times 1000 \times 1.50 ) / ( 5124.75 \times 1000 )$ | $= ( -180.7 \times 1000 \times 1.50 ) / ( 5124.75 \times 1000 )$ |
|                                   | $= -0.05$                                                         | $= -0.05$                                                        |
| For $P_u/P_{uz}$                  | $= -0.05$                                                         | $= -0.05$                                                        |
| $a_n$                             | $= 1.00$                                                          | $= 1.00$                                                         |
| Check for Interaction             | $= ( M_{ux}/M_{ux1} )^{an} + ( M_{uz}/M_{uz1} )^{an}$             | $= ( M_{ux}/M_{ux1} )^{an} + ( M_{uz}/M_{uz1} )^{an}$            |
|                                   | $= 0.00 + 0.51$                                                   | $= 0.00 + 0.51$                                                  |
|                                   | $= 0.51 < 1.0$                                                    | $= 0.51 < 1.0$                                                   |
|                                   | Hence Safe                                                        | Hence Safe                                                       |
| <u>Spacing of tie is least of</u> |                                                                   |                                                                  |
| i) $16 \times 20$                 | $= 320$ mm                                                        |                                                                  |
| ii) $48 \times 8$                 | $= 384$ mm                                                        |                                                                  |
| iii) Least dimension of pedestal  | $= 600$ mm                                                        |                                                                  |
| Provide 8 f ties @ 250 c/c        |                                                                   |                                                                  |

9.0 DESIGN OF PEDESTAL:

| 10.0 COMPRESSION WITH BENDING                                       | 202 (1.0 DL + 1.0 LONG WIND(+Z))                   | 204 (1.0 DL + 1.0 LL + 1.0 LONG WIND(+Z))          |
|---------------------------------------------------------------------|----------------------------------------------------|----------------------------------------------------|
| Size of pedestal                                                    | $= 600 \times 600$ mm                              | $= 600 \times 600$ mm                              |
| Height of pedestal above pad                                        | $= 2200$ mm                                        | $= 2200$ mm                                        |
| <u>Check for Slenderness Ratio</u>                                  |                                                    |                                                    |
| $l_{ex}/D$                                                          | $= ( 2200 \times 2 / 600 )$                        | $= ( 2200 \times 2 / 600 )$                        |
|                                                                     | $= 7.4 < 12.0$                                     | $= 7.40 < 12.0$                                    |
| Hence, Short Column subject to Bi-axial bending                     |                                                    |                                                    |
| Considering the reinforcement is distributed equally on four sides, |                                                    |                                                    |
| Max. downward load on pedestal                                      | $= 229.74$ kN                                      | $= 263.04$ kN                                      |
| Factor Load                                                         | $= 229.74 \times 1.5$                              | $= 263.04 \times 1.5$                              |
|                                                                     | $= 344.62$ KN                                      | $= 394.56$ KN                                      |
| Maximum 'X' direction shear Per Pedestal                            | $= 80.12$ kN                                       | $= 80.12$ kN                                       |
| Net Maximum 'X' directional moment at Top of Pad                    | $= 80.12 \times 2.200$                             | $= 80.12 \times 2.200$                             |
|                                                                     | $= 176.27$ kN.m                                    | $= 176.27$ kN.m                                    |
| Maximum Z directional shear Per Pedestal                            | $= 0.00$ kN                                        | $= 0.00$ kN                                        |
| Maximum 'Z' directional moment at Top of Pad                        | $= 0.00 \times 2.200$                              | $= 0.00 \times 2.200$                              |
|                                                                     | $= 0.00$ kN.m                                      | $= 0.00$ kN.m                                      |
| Moment due to Slenderness                                           |                                                    |                                                    |
| X - Dir & Z - Dir                                                   |                                                    |                                                    |
| $P_u \times D \times (l_{ex}/D)^2$                                  | $= \frac{229.74 \times 0.60 \times ( 0 )^2}{2000}$ | $= \frac{263.04 \times 0.60 \times ( 0 )^2}{2000}$ |
|                                                                     | $= 0.000$ KN.m                                     | $= 0.000$ KN.m                                     |
| Total Moment in X dir                                               | $= 176.27$ KN.m ( $176.27 + 0.000$ )               | $= 176.27$ KN.m                                    |
| Total Moment in Z dir                                               | $= 0.0$ KN.m ( $0.00 + 0.000$ )                    | $= 0.0$ KN.m                                       |
| Minimum Ast Req (as per cl 26.5.3.1 IS 456-2000)                    | $= 0.80 \% \times \text{Gross sectional area}$     |                                                    |
|                                                                     | $= \frac{0.80}{100.00} \times 600 \times 600$      |                                                    |



| PROJECT    | 400/220/132/33KV GIS SUBSTATION AT KHUMTAI, ASSAM   | CUSTOMER                       |            | ASSAM ELECTRICITY GRID CORPORATION LIMITED |            |
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|            |                                                     | DOCUMENT NO.                   |            | REVISION                                   |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                         | DP-22100-RS-SAR-FDN-LM-DGN-002 |            | 0                                          |            |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST TYPE LM | PREPARED BY                    | CHECKED BY | APPROVED BY                                | DATE       |
|            |                                                     | ART                            | SBK        | SARK                                       | 05.12.2022 |

Minimum Ast Req = 2880.00 mm<sup>2</sup>

Provide 8 Nos. 20 dia rods. (A<sub>st</sub> provided = 2513 mm<sup>2</sup>)

Provide 8 Nos. 20 dia rods. (A<sub>st</sub> provided = 2513 mm<sup>2</sup>)

$$p/f_{ck} = 1.40 / 20$$

$$(\backslash \text{ Provided } 1.40 \% \text{ reinforcement}) = 0.07$$

$$d'/D = 50 / 600$$

$$P_u/f_{ck}bd = (229.74 \times 1000 \times 1.50) / (20 \times 600 \times 600) = 0.05$$

From Chart 48 - SP16

$$M_{ux1}/f_{ck}bD^2 = 0.12$$

$$M_{ux1} = (0.12 \times 20) \times ((600 \times 600^2) / 10^6) = 518.40 \text{ kN.m}$$

$$M_{ux1}/f_{ck}bD^2 = 0.12$$

$$M_{ux1} = (0.12 \times 20) \times ((600 \times 600^2) / 10^6) = 518.40 \text{ kN.m}$$

$$P_{uz} = (0.45 \times 20 \times 600^2 + 0.75 \times 500 \times 5026) / 1000 = 5124.75 \text{ kN}$$

$$M_{ux}/M_{ux1} = (176.27 \times 1.50) / 518.40 = 0.51$$

$$M_{uz}/M_{uz1} = (0.0 \times 1.50) / 518.40 = 0.000$$

$$P_u/P_{uz} = (229.744216 \times 1000 \times 1.50) / (5124.75 \times 1000) = 0.07$$

$$\text{For } P_u/p_{uz} = 0.07$$

$$a_n = 1.00$$

$$\text{Check for Interaction} = (M_{ux}/M_{ux1})^{an} + (M_{uz}/M_{uz1})^{an} = 0.51 + 0.00 = 0.51 < 1.0$$

Hence Safe

$$= 1.40 / 20 = 0.07$$

$$= 50 / 600 = 0.08$$

$$= (263.04 \times 1000 \times 1.50) / (20 \times 600 \times 600) = 0.06$$

$$= 0.12$$

$$= (0.12 \times 20) \times ((600 \times 600^2) / 10^6) = 518.40 \text{ kN.m}$$

$$= 0.12$$

$$= (0.12 \times 20) \times ((600 \times 600^2) / 10^6) = 518.40 \text{ kN.m}$$

$$= 5124.75 \text{ kN}$$

$$= (176.269 \times 1.50) / 518.40 = 0.51$$

$$= (0.0 \times 1.50) / 518.40 = 0.00$$

$$= (263 \times 1000 \times 1.50) / (5124.75 \times 1000) = 0.077$$

$$= 0.077$$

$$= 1.00$$

$$= (M_{ux}/M_{ux1})^{an} + (M_{uz}/M_{uz1})^{an} = 0.51 + 0.00 = 0.51 < 1.0$$

Hence Safe

#### 10.1 TENSION WITH BENDING

202 (1.0 DL + 1.0 LONG WIND(+Z))

Considering the reinforcement is desitributed equally on four sides,

$$\text{Maximum Tensile load} = -180.8 \text{ kN}$$

$$\text{Factor Load} = -180.78 \times 1.5 = -271.18 \text{ KN}$$

$$\text{Maximum 'X' directional shear Per Pedestal} = 80.12 \text{ kN}$$

$$\text{Net Maximum 'X' directional moment at top of pad} = 80.12 \times 2.20 = 176.27 \text{ kN.m}$$

$$\text{Maximum 'Z' directional shear Per Pedestal} = 0.00 \text{ kN}$$

$$\text{Net Maximum 'Z' directional moment at top of pad} = 0.00 \times 2.2 = 0.00 \text{ kN.m}$$

204 (1.0 DL + 1.0 LL + 1.0 LONG WIND(+Z))

$$= -165.6 \text{ kN}$$

$$= -165.61 \times 1.5 = -248.41 \text{ KN}$$

$$= -248.41 \text{ KN}$$

$$= 80.12 \text{ kN}$$

$$= 80.12 \times 2.2 = 176.27 \text{ kN.m}$$

$$= 0.00 \text{ kN}$$

$$= 0.00 \times 2.2 = 0.00 \text{ kN.m}$$



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|------------|-----------------------------------------------------|--------------------------------|------------|--------------------------------------------|------------|
|            |                                                     | DOCUMENT NO.                   |            | REVISION                                   |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                         | DP-22100-RS-SAR-FDN-LM-DGN-002 |            | 0                                          |            |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST TYPE LM | PREPARED BY                    | CHECKED BY | APPROVED BY                                | DATE       |
|            |                                                     | ART                            | SBK        | SARK                                       | 05.12.2022 |

|                                                                                                   |                                                                                                    |                                                                                                    |
|---------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Moment due to Slenderness<br>X - Dir & Z - Dir<br>$\frac{P_u \times D \times (l_{ex}/D)^2}{2000}$ | $= \frac{-180.78 \times 0.60 \times (0)^2}{2000}$                                                  | $= \frac{-165.61 \times 0.60 \times (0)^2}{2000}$                                                  |
|                                                                                                   | $= 0.000 \text{ KN.m}$                                                                             | $= 0.000 \text{ KN.m}$                                                                             |
| Total Moment in X dir                                                                             | $= 176.27 \text{ KN.m}$                                                                            | $= 176.27 \text{ KN.m}$                                                                            |
| Total Moment in Z dir                                                                             | $= 0.0 \text{ KN.m}$                                                                               | $= 0.0 \text{ KN.m}$                                                                               |
| Minimum Ast Req<br>(as per cl 26.5.3.1 IS 456-2000)                                               | $= 0.80 \% \times \text{Gross sectional area}$                                                     |                                                                                                    |
|                                                                                                   | $= \frac{0.80}{100.00} \times 600 \times 600$                                                      |                                                                                                    |
| Minimum Ast Req                                                                                   | $= 2880.00 \text{ mm}^2$                                                                           |                                                                                                    |
| Provide 8 Nos. 20 dia rods. ( $A_{st}$ provided =                                                 | 2513 mm <sup>2</sup> )                                                                             |                                                                                                    |
| Provide 8 Nos. 20 dia rods. ( $A_{st}$ provided =                                                 | 2513 mm <sup>2</sup> )                                                                             |                                                                                                    |
| $p/f_{ck}$                                                                                        | $= 1.40 / 20$                                                                                      | $= 1.40 / 20$                                                                                      |
| (\ Assuming 1.40 % reinforcement)                                                                 | $= 0.07$                                                                                           | $= 0.07$                                                                                           |
| $d'/D$                                                                                            | $= 50 / 600$                                                                                       | $= 50 / 600$                                                                                       |
|                                                                                                   | $= 0.08$                                                                                           | $= 0.08$                                                                                           |
| $P_u/f_{ck}bd$                                                                                    | $= \left( \frac{-180.8 \times 1000 \times 1.50}{20 \times 600 \times 600} \right) /$               | $= \left( \frac{-165.6 \times 1000 \times 1.50}{20 \times 600 \times 600} \right) /$               |
|                                                                                                   | $= -0.04$                                                                                          | $= -0.04$                                                                                          |
| <u>From Chart 83 - SP16</u>                                                                       |                                                                                                    |                                                                                                    |
| $M_{ux1}/f_{ck}bD^2$                                                                              | $= 0.10$                                                                                           | $= 0.10$                                                                                           |
| $M_{ux1}$                                                                                         | $= \frac{0.1 \times 20 \times ((600 \times 600)^2)}{10^6}$                                         | $= \frac{0.1 \times 20 \times ((600 \times 600)^2)}{10^6}$                                         |
|                                                                                                   | $= 432.00 \text{ kN.m}$                                                                            | $= 432.00 \text{ kN.m}$                                                                            |
| $M_{uz1}/f_{ck}bD^2$                                                                              | $= 0.1$                                                                                            | $= 0.1$                                                                                            |
| $M_{uz1}$                                                                                         | $= \frac{0.1 \times 20 \times ((600 \times 600)^2)}{10^6}$                                         | $= \frac{0.1 \times 20 \times ((600 \times 600)^2)}{10^6}$                                         |
|                                                                                                   | $= 432.00 \text{ kN.m}$                                                                            | $= 432.00 \text{ kN.m}$                                                                            |
| $P_{uz}$                                                                                          | $= 5124.75 \text{ kN}$                                                                             | $= 5124.75 \text{ kN}$                                                                             |
| $M_{ux}/M_{ux1}$                                                                                  | $= \left( \frac{176.27 \times 1.50}{432.00} \right)$                                               | $= \left( \frac{176.27 \times 1.50}{432.00} \right)$                                               |
|                                                                                                   | $= 0.61$                                                                                           | $= 0.61$                                                                                           |
| $M_{uz}/M_{uz1}$                                                                                  | $= \left( \frac{0.00 \times 1.50}{432.00} \right)$                                                 | $= \left( \frac{0.0 \times 1.50}{432.00} \right)$                                                  |
|                                                                                                   | $= 0$                                                                                              | $= 0$                                                                                              |
| $P_u/P_{uz}$                                                                                      | $= \left( \frac{-180.78 \times 1000 \times 1.50}{5124.75 \times 1000} \right) /$                   | $= \left( \frac{-165.6 \times 1000 \times 1.50}{5124.75 \times 1000} \right) /$                    |
|                                                                                                   | $= -0.05$                                                                                          | $= -0.05$                                                                                          |
| For $P_u/P_{uz}$                                                                                  | $= -0.05$                                                                                          | $= -0.05$                                                                                          |
| $a_n$                                                                                             | $= 1.00$                                                                                           | $= 1.00$                                                                                           |
| Check for Interaction                                                                             | $= \left( \frac{M_{ux}/M_{ux1}}{0.61} \right)^{an} + \left( \frac{M_{uz}/M_{uz1}}{0} \right)^{an}$ | $= \left( \frac{M_{ux}/M_{ux1}}{0.61} \right)^{an} + \left( \frac{M_{uz}/M_{uz1}}{0} \right)^{an}$ |
|                                                                                                   | $= 0.61 + 0.00$                                                                                    | $= 0.61 + 0.00$                                                                                    |
|                                                                                                   | $= 0.61 < 1.0$                                                                                     | $= 0.61 < 1.0$                                                                                     |
|                                                                                                   | Hence Safe                                                                                         | Hence Safe                                                                                         |



|            |                                                     |                                |            |                                            |            |
|------------|-----------------------------------------------------|--------------------------------|------------|--------------------------------------------|------------|
| PROJECT    | 400/220/132/33KV GIS SUBSTATION AT KHUMTAI, ASSAM   | CUSTOMER                       |            | ASSAM ELECTRICITY GRID CORPORATION LIMITED |            |
|            |                                                     | DOCUMENT NO.                   |            | REVISION                                   |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                         | DP-22100-RS-SAR-FDN-LM-DGN-002 |            | 0                                          |            |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST TYPE LM | PREPARED BY                    | CHECKED BY | APPROVED BY                                | DATE       |
|            |                                                     | ART                            | SBK        | SARK                                       | 05.12.2022 |

Spacing of tie is least of

- i) 16 x 20 = 320 mm  
 ii) 48 x 8 = 384 mm  
 iii) Least dimension of pedestal = 600 mm

Provide 8 fties @ 250 c/c

**9.0 DESIGN OF PEDESTAL:-**

**10.0 COMPRESSION WITH BENDING**

206 (1.0 DL + 1.0 DIAG WIND)

207 (1.0 DL + 1.0 LL + 1.0 DIAG WIND)

Size of pedestal = 600 x 600 mm

Height of pedestal above pad = 1900 mm

Check for Slenderness Ratio

$l_{ex} / D = ( \frac{1900}{6.4} \times \frac{2}{12.0} )$   
 $= 6.4 < 12.0$

Hence, Short Column subject to Bi-axial bending

Considering the reinforcement is distributed equally on four sides,

Max. downward load on pedestal = 362.17 kN

Factor Load =  $362.17 \times 1.5$   
 $= 543.25$  KN

Maximum 'X' direction shear Per Pedestal = 66.56 kN

Net Maximum 'X' directional moment at Top of Pad =  $66.56 \times 1.900$   
 $= 126.47$  kN.m

Maximum Z directional shear Per Pedestal = 68.02 kN

Maximum 'Z' directional moment at Top of Pad =  $68.02 \times 1.900$   
 $= 129.23$  kN.m

Moment due to Slenderness

X - Dir & Z - Dir

$\frac{P_u \times D \times (l_{ex} / D)^2}{2000} = \frac{362.17 \times 0.60 \times (0)^2}{2000}$   
 $= 0.000$  KN.m

Total Moment in X dir = 126.47 KN.m ( 126.47 + 0.000 )

Total Moment in Z dir = 129.2 KN.m ( 129.23 + 0.000 )

Minimum Ast Req (as per cl 26.5.3.1 IS 456-2000) = 0.80 % x Gross sectional area

$= \frac{0.80}{100.00} \times 700 \times 700$

Minimum Ast Req = 3920.00 mm<sup>2</sup>

Provide 8 Nos. 20 dia rods. ( $A_{st}$  provided = 2513 mm<sup>2</sup>)  
 Provide 8 Nos. 20 dia rods. ( $A_{st}$  provided = 2513 mm<sup>2</sup>)

$p / f_{ck}$  (Provided 1.40 % reinforcement) =  $\frac{1}{0.06}$  / 25

$d' / D$  =  $\frac{50}{600}$   
 $= 0.08$

$P_u / f_{ck} b d$  =  $( \frac{362.17 \times 1000 \times 1.50}{25 \times 600 \times 600} )$  /  
 $= 0.06$

= 600 x 600 mm

1900 mm

$= ( \frac{1900}{6.40} \times \frac{2}{12.0} )$   
 $= 6.40 < 12.0$

= 395.46 kN

=  $395.46 \times 1.5$   
 $= 593.19$  KN

= 66.56 kN

=  $66.56 \times 1.900$   
 $= 126.47$  kN.m

= 68.02 kN

=  $68.02 \times 1.900$   
 $= 129.23$  kN.m

$= \frac{395.46 \times 0.60 \times (0)^2}{2000}$   
 $= 0.000$  KN.m

= 126.47 KN.m

= 129.2 KN.m

= 0.80 % x Gross sectional area

$= \frac{0.80}{100.00} \times 700 \times 700$

Minimum Ast Req = 3920.00 mm<sup>2</sup>

Provide 8 Nos. 20 dia rods. ( $A_{st}$  provided = 2513 mm<sup>2</sup>)  
 Provide 8 Nos. 20 dia rods. ( $A_{st}$  provided = 2513 mm<sup>2</sup>)

$p / f_{ck}$  (Provided 1.40 % reinforcement) =  $\frac{1}{0.06}$  / 25

$d' / D$  =  $\frac{50}{600}$   
 $= 0.08$

$P_u / f_{ck} b d$  =  $( \frac{395.46 \times 1000 \times 1.50}{25 \times 600 \times 600} )$  /  
 $= 0.07$



| PROJECT    | 400/220/132/33KV GIS SUBSTATION AT KHUMTAI,<br>ASSAM   | CUSTOMER                       |            | ASSAM ELECTRICITY GRID<br>CORPORATION LIMITED |            |
|------------|--------------------------------------------------------|--------------------------------|------------|-----------------------------------------------|------------|
|            |                                                        | DOCUMENT NO.                   |            | REVISION                                      |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                            | DP-22100-R5-SAR-FDN-LM-DGN-002 |            | 0                                             |            |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST<br>TYPE LM | PREPARED BY                    | CHECKED BY | APPROVED BY                                   | DATE       |
|            |                                                        | ART                            | SBK        | SARK                                          | 05.12.2022 |

#### From Chart 48 - SP16

$$\begin{aligned}
 M_{ux1}/f_{ck}bD^2 &= 0.11 & = 0.11 \\
 M_{ux1} &= \left( \frac{0.11 \times 25}{600 \times 600^2} \right) \times 10^6 & = \left( \frac{0.11 \times 25}{600 \times 600^2} \right) \times 10^6 \\
 &= 594.00 \text{ kN.m} & = 594 \text{ kN.m} \\
 M_{uz1}/f_{ck}bD^2 &= 0.11 & = 0.11 \\
 M_{uz1} &= \left( \frac{0.11 \times 25}{600 \times 600^2} \right) \times 10^6 & = \left( \frac{0.11 \times 25}{600 \times 600^2} \right) \times 10^6 \\
 &= 594.00 \text{ kN.m} & = 594 \text{ kN.m} \\
 P_{uz} &= \left( \frac{0.45 \times 25 \times 600^2 + 0.75 \times 500 \times 5026}{5934.75} \right) / 1000 & = 5934.75 \text{ kN} \\
 (Refer IS:456-2000 cl: 39.6) & & \\
 M_{ux}/M_{ux1} &= \left( \frac{126.47 \times 1.50}{594.00} \right) & = \left( \frac{126.465 \times 1.50}{594} \right) \\
 &= 0.32 & = 0.32 \\
 M_{uz}/M_{uz1} &= \left( \frac{129.2 \times 1.50}{594.00} \right) & = \left( \frac{129.2 \times 1.50}{594} \right) \\
 &= 0.330 & = 0.33 \\
 P_u/P_{uz} &= \left( \frac{362.165511 \times 1000 \times 1.50}{5934.75 \times 1000} \right) & = \left( \frac{395 \times 1000 \times 1.50}{5934.75 \times 1000} \right) \\
 &= 0.09 & = 0.100 \\
 \text{For } P_u/P_{uz} &= 0.09 & = 0.100 \\
 a_n &= 1.00 & = 1.00 \\
 \text{Check for Interaction} &= \left( \frac{M_{ux}}{M_{ux1}} \right)^{an} + \left( \frac{M_{uz}}{M_{uz1}} \right)^{an} & = \left( \frac{M_{ux}}{M_{ux1}} \right)^{an} + \left( \frac{M_{uz}}{M_{uz1}} \right)^{an} \\
 &= 0.32 + 0.33 & = 0.32 + 0.33 \\
 &= 0.65 < 1.0 & = 0.65 < 1.0 \\
 &\text{Hence Safe} & \text{Hence Safe}
 \end{aligned}$$

#### 10.1 TENSION WITH BENDING

206 (1.0 DL + 1.0 DIAG WIND)

207 (1.0 DL + 1.0 LL + 1.0 DIAG WIND)

Considering the reinforcement is desitributed equally on four sides,

$$\begin{aligned}
 \text{Maximum Tensile load} &= -312.0 \text{ kN} & = -296.8 \text{ kN} \\
 \text{Factor Load} &= -312.00 \times 1.5 & = -296.83 \times 1.5 \\
 &= -468.01 \text{ KN} & = -445.25 \text{ KN} \\
 \text{Maximum 'X' directional shear Per Pedestal} &= 66.56 \text{ kN} & = 66.56 \text{ kN} \\
 \text{Net Maximum 'X' directional moment at top of pad} &= 66.56 \times 1.90 & = 66.56 \times 1.9 \\
 &= 126.47 \text{ kN.m} & = 126.47 \text{ kN.m} \\
 \text{Maximum 'Z' directional shear Per Pedestal} &= 68.02 \text{ kN} & = 68.02 \text{ kN} \\
 \text{Net Maximum 'Z' directional moment at top of pad} &= 68.02 \times 1.9 & = 68.02 \times 1.9 \\
 &= 129.23 \text{ kN.m} & = 129.23 \text{ kN.m} \\
 \text{Moment due to Slenderness X - Dir \& Z - Dir} & & \\
 \frac{P_u \times D \times (l_{ex}/D)^2}{2000} &= \frac{-312.00 \times 0.60 \times (0)^2}{2000} & = \frac{-296.83 \times 0.60 \times (0)^2}{2000} \\
 &= 0.000 \text{ KN.m} & = 0.000 \text{ KN.m} \\
 \text{Total Moment in X dir} &= 126.47 \text{ KN.m} & = 126.47 \text{ KN.m} \\
 \text{Total Moment in Z dir} &= 129.2 \text{ KN.m} & = 129.2 \text{ KN.m}
 \end{aligned}$$



|            |                                                     |                                |                                            |             |
|------------|-----------------------------------------------------|--------------------------------|--------------------------------------------|-------------|
| PROJECT    | 400/220/132/33KV GIS SUBSTATION AT KHUMTAI, ASSAM   | CUSTOMER                       | ASSAM ELECTRICITY GRID CORPORATION LIMITED |             |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                         | DOCUMENT NO.                   | REVISION                                   |             |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST TYPE LM | DP-22100-RS-SAR-FDN-LM-DGN-002 | 0                                          |             |
|            |                                                     | PREPARED BY                    | CHECKED BY                                 | APPROVED BY |
|            |                                                     | ART                            | SBK                                        | SARK        |
|            |                                                     |                                |                                            | DATE        |
|            |                                                     |                                |                                            | 05.12.2022  |

Minimum Ast Req (as per cl 26.5.3.1 IS 456-2000) = 0.80 % x Gross sectional area

$$= \frac{0.80}{100.00} \times 700 \times 700$$

Minimum Ast Req = 3920.00 mm<sup>2</sup>

Provide 8 Nos. 20 dia rods. (A<sub>st</sub> provided = 2513 mm<sup>2</sup>)  
Provide 8 Nos. 20 dia rods. (A<sub>st</sub> provided = 2513 mm<sup>2</sup>)

$$p/f_{ck} \quad (\text{Assuming } 1.40 \% \text{ reinforcement}) = \frac{1.40}{0.06} \quad / \quad 25$$

$$d'/D = \frac{50}{0.08} \quad / \quad 600$$

$$P_u/f_{ck}bd = \frac{(-312.0 \times 1000 \times 1.50)}{(25 \times 600 \times 600)} \quad /$$

From Chart 83 - SP16

$$M_{ux1}/f_{ck}bD^2 = 0.09$$

$$M_{ux1} = \frac{0.09 \times 25 \times ((600 \times 600)^2)}{10^6} = 486.00 \text{ kN.m}$$

$$M_{uz1}/f_{ck}bD^2 = 0.09$$

$$M_{uz1} = \frac{0.09 \times 25 \times ((600 \times 600)^2)}{10^6} = 486.00 \text{ kN.m}$$

$$P_{uz} = 5934.75 \text{ kN}$$

$$M_{ux}/M_{ux1} = \frac{(126.47 \times 1.50)}{0.39} \quad / \quad 486.00$$

$$M_{uz}/M_{uz1} = \frac{(129.23 \times 1.50)}{0.4} \quad / \quad 486.00$$

$$P_u/P_{uz} = \frac{(-312.00 \times 1000 \times 1.50)}{(5934.75 \times 1000)} \quad /$$

$$\text{For } P_u/p_{uz} \quad a_n = \frac{-0.08}{1.00}$$

$$\text{Check for Interaction} = (M_{ux}/M_{ux1})^{an} + (M_{uz}/M_{uz1})^{an} = 0.39 + 0.40 = 0.79 < 1.0$$

Hence Safe

Spacing of tie is least of

- i) 16 x 20 = 320 mm
- ii) 48 x 8 = 384 mm
- iii) Least dimension of pedestal = 600 mm

Provide 8 fties @ 250 c/c

$$= \frac{1.396111111}{0.06} \quad / \quad 25$$

$$= \frac{50}{0.08} \quad / \quad 600$$

$$= \frac{(-296.8 \times 1000 \times 1.50)}{(25 \times 600 \times 600)} \quad /$$

$$= 0.09$$

$$= \frac{0.09 \times 25 \times ((600 \times 600)^2)}{10^6} = 486.00 \text{ kN.m}$$

$$= 0.09$$

$$= \frac{0.09 \times 25 \times ((600 \times 600)^2)}{10^6} = 486.00 \text{ kN.m}$$

$$= 5934.75 \text{ kN}$$

$$= \frac{(126.47 \times 1.50)}{0.39} \quad / \quad 486.00$$

$$= \frac{(129.2 \times 1.50)}{0.4} \quad / \quad 486.00$$

$$= \frac{(-296.8 \times 1000 \times 1.50)}{(5934.75 \times 1000)} \quad /$$

$$= \frac{-0.08}{1.00}$$

$$= (M_{ux}/M_{ux1})^{an} + (M_{uz}/M_{uz1})^{an} = 0.39 + 0.40 = 0.79 < 1.0$$

Hence Safe

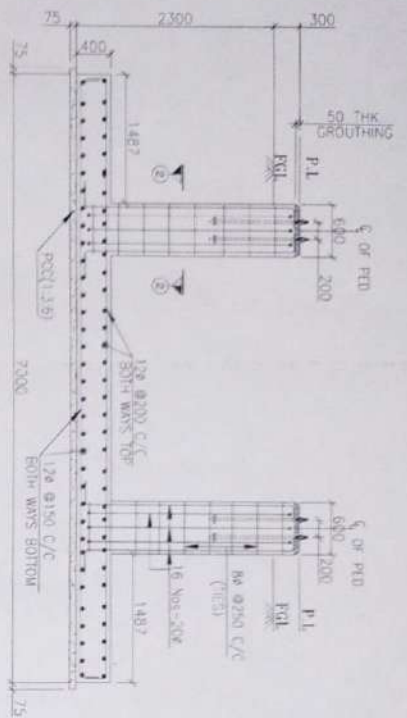


|            |                                                        |                                |            |                                               |            |
|------------|--------------------------------------------------------|--------------------------------|------------|-----------------------------------------------|------------|
| PROJECT    | 400/220/132/33KV GIS SUBSTATION AT KHUMTAI,<br>ASSAM   | CUSTOMER                       |            | ASSAM ELECTRICITY GRID<br>CORPORATION LIMITED |            |
|            |                                                        | DOCUMENT NO.                   |            | REVISION                                      |            |
| CONTRACTOR | RS INFRA PROJECTS PVT. LTD.                            | DP-22100-RS-SAR-FDN-LM-DGN-002 |            | 0                                             |            |
| TITLE      | DESIGN OF TOWER FOUNDATION OF LIGHTING MAST<br>TYPE LM | PREPARED BY                    | CHECKED BY | APPROVED BY                                   | DATE       |
|            |                                                        | ART                            | SBK        | SARK                                          | 05.12.2022 |

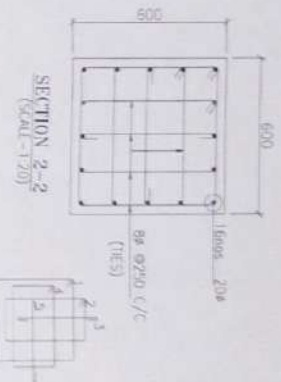
# 11 RESULT

|                                 |   |      |               |         |             |
|---------------------------------|---|------|---------------|---------|-------------|
| 1. Depth of foundation from FGL | = | 2.3  | m             |         |             |
| 2. Plinth level above FGL       | = | 0.30 | m             |         |             |
| 3. Bottom pad Details           |   |      |               |         |             |
| Size of bottom pad in 'm'       | = | 7.00 | x             | 7.00    |             |
| Thickness of bottom pad         | = | 0.40 | m             |         |             |
| Clear cover                     | = | 50   | mm            |         |             |
| Bottom reinforcement            |   |      |               |         |             |
| In Z-direction                  | = | 12   | mm Dia @      | 150     | mm C/C      |
| Bottom reinforcement            | = | 12   | mm Dia @      | 150     | mm C/C      |
| In X-direction                  |   |      |               |         |             |
| Top reinforcement               |   |      |               |         |             |
| In Z-direction                  | = | 12   | mm Dia @      | 200     | mm C/C      |
| Top reinforcement               | = | 12   | mm Dia @      | 200     | mm C/C      |
| In X-direction                  |   |      |               |         |             |
| 4. Pedestal Details             |   |      |               |         |             |
| Pedestal Size in 'm'            | = | 0.60 | x             | 0.60    |             |
| No. of pedestal                 | = | 4    | Nos           |         |             |
| Clear cover                     | = | 40   | mm            |         |             |
| Main (vertical) reinforcement   | = | 8    | Nos. of       | 20      | mm Dia bars |
|                                 |   | 8    | Nos. of       | 20      | mm Dia bars |
| Lateral ties (four legged)      | = | 8    | mm Dia bars @ | 250     | mm C/C      |
| 5. Foundation Bolt details      | = | 4    | Nos. of M: 32 | per leg |             |

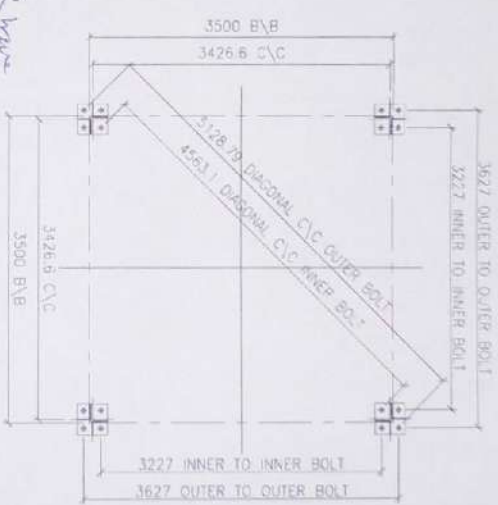




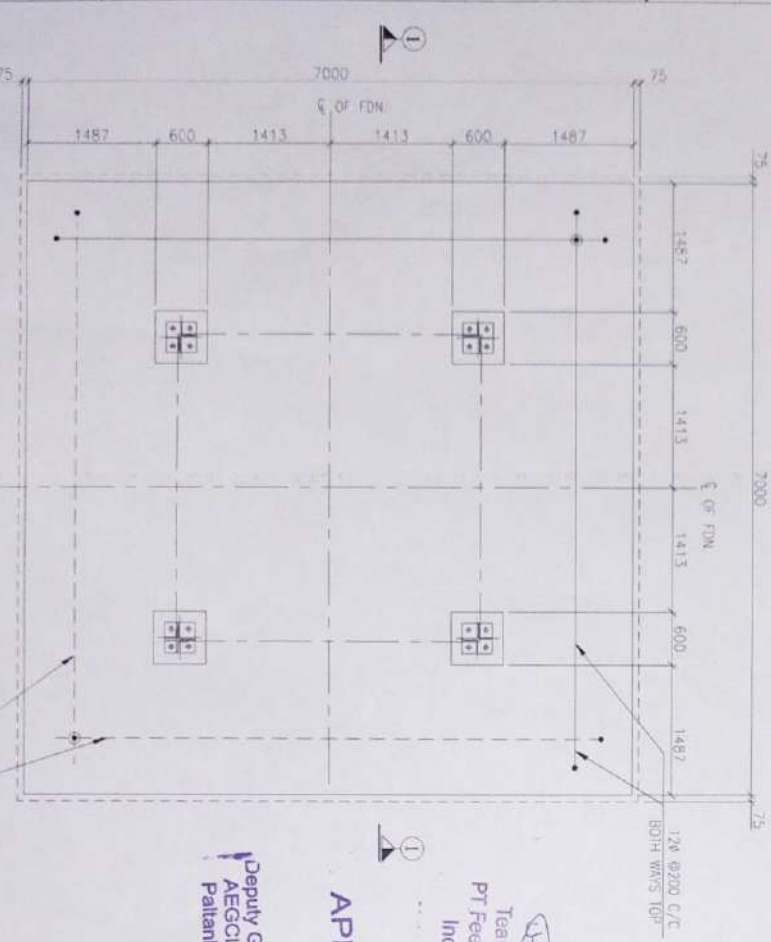
SECTION 1-1



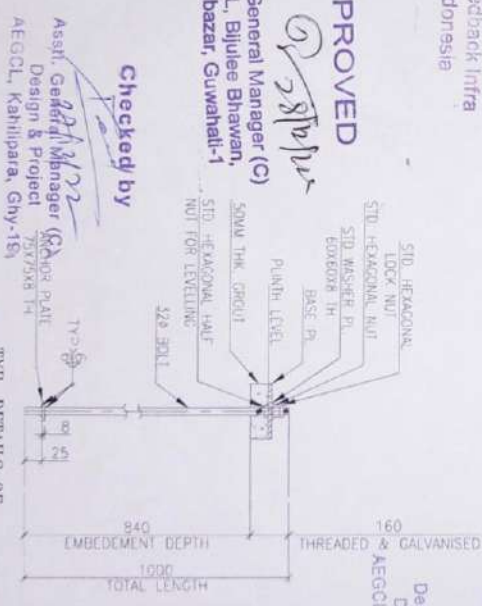
SECTION 2-2  
(SCALE: 1/20)



BASE PLAN



FOUNDATION PLAN



TYP. DETAILS OF  
1.6 GRADE FOUNDATION BOLT

- LEGEND**
1. FGL = FINISHED GROUND LEVEL
  2. PL = PLINTH LEVEL
  3. BOT = BOTTOM OF FOUNDATION
  4. FIN = FOUNDATION
  5. PED = PILE
  6. C/C = CENTER TO CENTER
  7. B/B = BACK TO BACK
- NOTES:-**
1. ALL DIMENSIONS ARE IN MILLIMETERS AND LEVELS ARE IN METERS.
  2. GRADE OF CONCRETE SHALL BE M20 FOR RCC, M-10 FOR P.C.C.
  3. ALL REINFORCEMENT BARS SHALL BE HYSD BARS OF GRAD Fe 500 CONFORMING TO IS: 1786.
  4. CLEAR COVER TO MAIN REINFORCEMENT SHALL BE AS FOLLOWS: a) FOUNDATION - 50 MM b) PILES - 40 MM.
  5. ALL BOND LENGTH & LAP LENGTH SHALL BE 50X DIA AND DEVELOPMENT LENGTH SHALL BE 10X DIA OF BAR.
  6. FOUNDATION BOLTS SHALL BE WITH STIRRUPS. STIRRUPS MAY BE ADJUSTED SUITABLY AT SITE.
  7. FOUNDATION BOLTS SHALL BE PLACED (AS PER APPROVED DMC) IN POSITION BEFORE CONCRETING.
  8. UNDER ADJUSTMENT MAY BE DONE AS SITE IN CONSULTATION WITH ENGINEER IN-CHARGE.
  9. FOR LOCATION OF FOUNDATION REFER TO OVER ALL FOUNDATION LAYOUT DRAWING.
  10. THIS DRAWING SHALL BE VERIFIED WITH RELEVANT STRUCTURE CA DRAWING BEFORE CONCRETING.

Team Leader  
PT Feedback Infra  
Indonesia

APPROVED

Deputy General Manager (C)  
AEGCL, Biljee Bhawan,  
Pattanbazar, Guwahati-1

Checked by

Asstt. General Manager  
Design & Project  
AEGCL, Kahilpara, Ghy-16

Checked by  
Deputy Manager (C)  
Design & Project  
AEGCL, Kahilpara, Ghy-16  
Indonesia



| NO. | DATE     | DESCRIPTION      | DATE | REVISION |
|-----|----------|------------------|------|----------|
| 01  | 06/12/22 | FIRST SUBMISSION |      |          |
| 02  | 06/12/22 | REVISION         |      |          |
| 03  | 06/12/22 | REVISION         |      |          |
| 04  | 06/12/22 | REVISION         |      |          |
| 05  | 06/12/22 | REVISION         |      |          |
| 06  | 06/12/22 | REVISION         |      |          |
| 07  | 06/12/22 | REVISION         |      |          |
| 08  | 06/12/22 | REVISION         |      |          |
| 09  | 06/12/22 | REVISION         |      |          |
| 10  | 06/12/22 | REVISION         |      |          |
| 11  | 06/12/22 | REVISION         |      |          |
| 12  | 06/12/22 | REVISION         |      |          |
| 13  | 06/12/22 | REVISION         |      |          |
| 14  | 06/12/22 | REVISION         |      |          |
| 15  | 06/12/22 | REVISION         |      |          |
| 16  | 06/12/22 | REVISION         |      |          |
| 17  | 06/12/22 | REVISION         |      |          |
| 18  | 06/12/22 | REVISION         |      |          |
| 19  | 06/12/22 | REVISION         |      |          |
| 20  | 06/12/22 | REVISION         |      |          |