



प्रसार भारती
Prasar Bharati
भारत का लोक सेवा प्रसारक
India's Public Service Broadcaster
कार्यालय: अपर महानिदेशक (अभि.) (उत्तरी क्षेत्र)
Office of the Additional Director General (E) (NZ)
आकाशवाणी एवं दूरदर्शन
Akashvani & Doordarshan
आठवां तल, सूचना भवन, सी.जी.ओ. कॉम्प्लेक्स, नई दिल्ली 110003
8th floor, Soochna Bhawan, CGO Complex, New Delhi-110003



सत्यम् शिवम् सुन्दरम्

Pithoragarh/2V/3/2025-26/Instt./(Structural health analysis)

Dated: 24.09.2025

Subject: Structural health analysis of 45Meter SS TV Tower at Akashvani Pithoragarh (Uttarakhand).

1. The budgetary quotation of the upcoming bid is enclosed herewith to offer comments, if any by prospective bidders/firms.
2. Bidders/firms are requested to provide information about content in respect of scope along with budgetary quote.
3. Bidders/firms may please submit the above detail on or before due date by e-mail to rksrivastav@prasarbharati.gov.in or at following address.

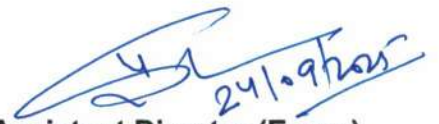
R.K Srivastav
Assistant Director (Engg.)
Room No. 899-C,
O/o ADG (E)(NZ)
Akashvani & Doordarshan,
8th floor, CGO Complex,
Soochna Bhawan, New Delhi-110003
Mobile No.: 9873364977
e-mail id: rksrivastav@prasarbharati.gov.in

Budgetary Quotation for: Structural health analysis of 45Meter SS TV Tower at Akashvani Pithoragarh (Uttarakhand).

Due Date to offer Comments: 08.10.2025

Enclosed:

1. Budgetary Quotation form & related drawings of the upcoming bid is enclosed herewith to offer comments, if any by prospective bidders/firms.


Assistant Director (Engg.)
For Add. Director General (NZ)
रविन्द्र कुमार श्रिवास्तव
सहायक निदेशक (अभि.)
Ravindra Kumar Srivastava
Asst. Director (Engg.)



Pithoragarh/2V/3/2025-26/Instt./(Structural health analysis)

Dated: 24.09.2025

Budgetary Quotation Form

Please read carefully the terms and conditions given the enquiry quotation form.

Project: Installation of 01KW FM Transmitters at Akashvani Pithoragarh (Uttarakhand).

Subject: Structural health analysis of 45Meter SS TV Tower at Akashvani Pithoragarh (Uttarakhand).

Last date of receipt of budgetary quotation in this office: 08.10.2025 up to 12:00Hrs

S.No.	Description	Qty.	Rate	Amount
1.	Structural analysis of 45M TV Tower at Akashvani Pithoragarh (Uttarakhand) in view of hauling of 4-Bay Pole type FM Antenna. <u>Scope of work for structural analysis are as per below:</u> The following scope points may also be taken into consideration with respect to the structural analysis of the existing 45M TV Tower at Akashvani Pithoragarh (Uttarakhand). a) Analysis for hoisting and fixing of 4-Bay Pole type FM Antenna on aperture of tower for FM radio transmission. 4-Bay Pole type FM Antenna weight: ≤160 Kg - Antenna Wind Load: ≤240 Kg - Maximum Wind Speed: 180 km/hr - Approx Antenna aperture height: 12000 mm b) 2way FM antenna is already hoisted on upper most apertures meant for FM is being utilized. c) Preliminary site visit is mandatory for the structural analysis. The site visit certificate issued from station may be submitted along with the submission of tender/bid. d) Detailed measurement of existing structural members with bolts, panel dimensions, Base dimension etc. (physical inspection) e) Preparation of drawing as per site condition. f) Effect on foundation by trees nearby. g) Analysis of foundation. h) Analysis modeling in STAAD pro with load calculation etc. i) Strength assessment and recommendations with drawings. j) 45Meter SS TV Tower stability certificate from IIT/NIT. <u>Note:</u> - Drawing of the 45Meter SS Tower has been enclosed for reference, however if this drawing does not match with the tower available at the site, fresh drawing of the tower shall be prepared by tenderer & the rates may be quoted separately.	01 Job		
	Total			
	GST @			
	Grand Total			

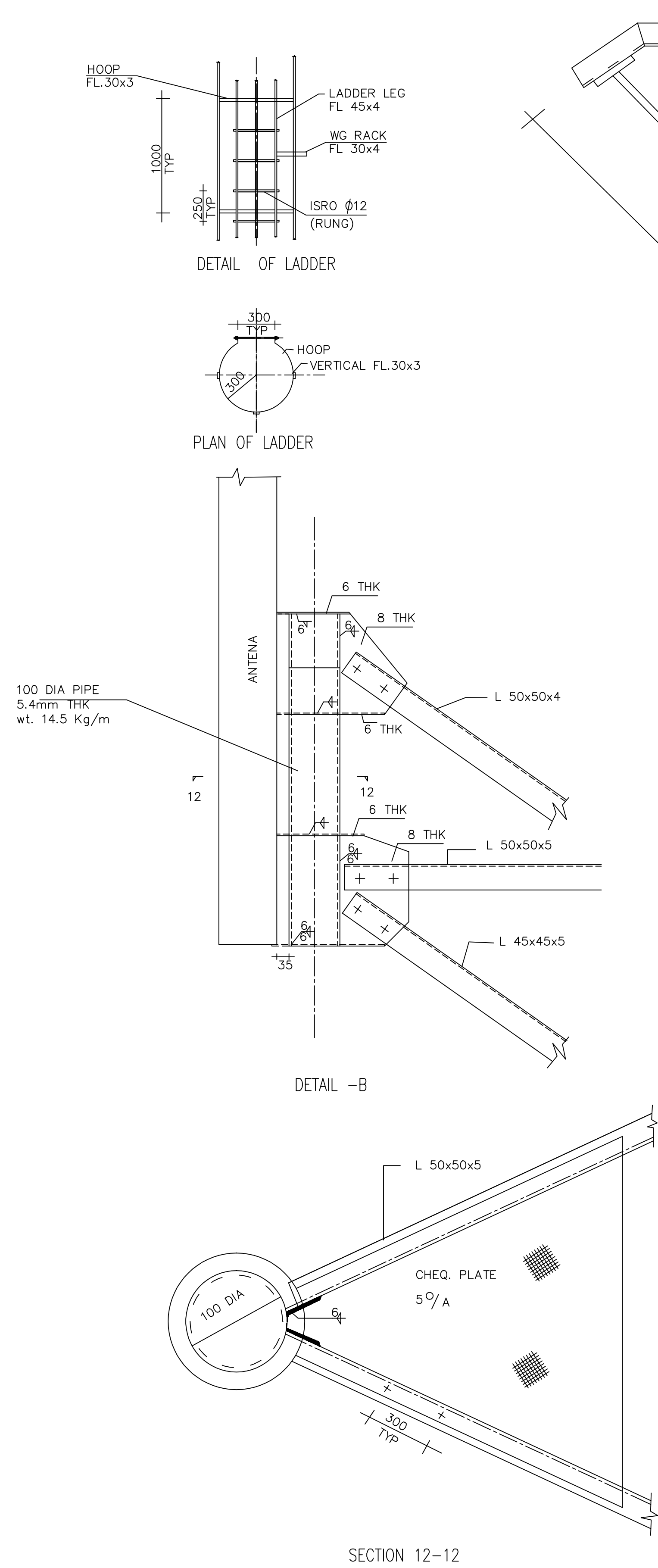
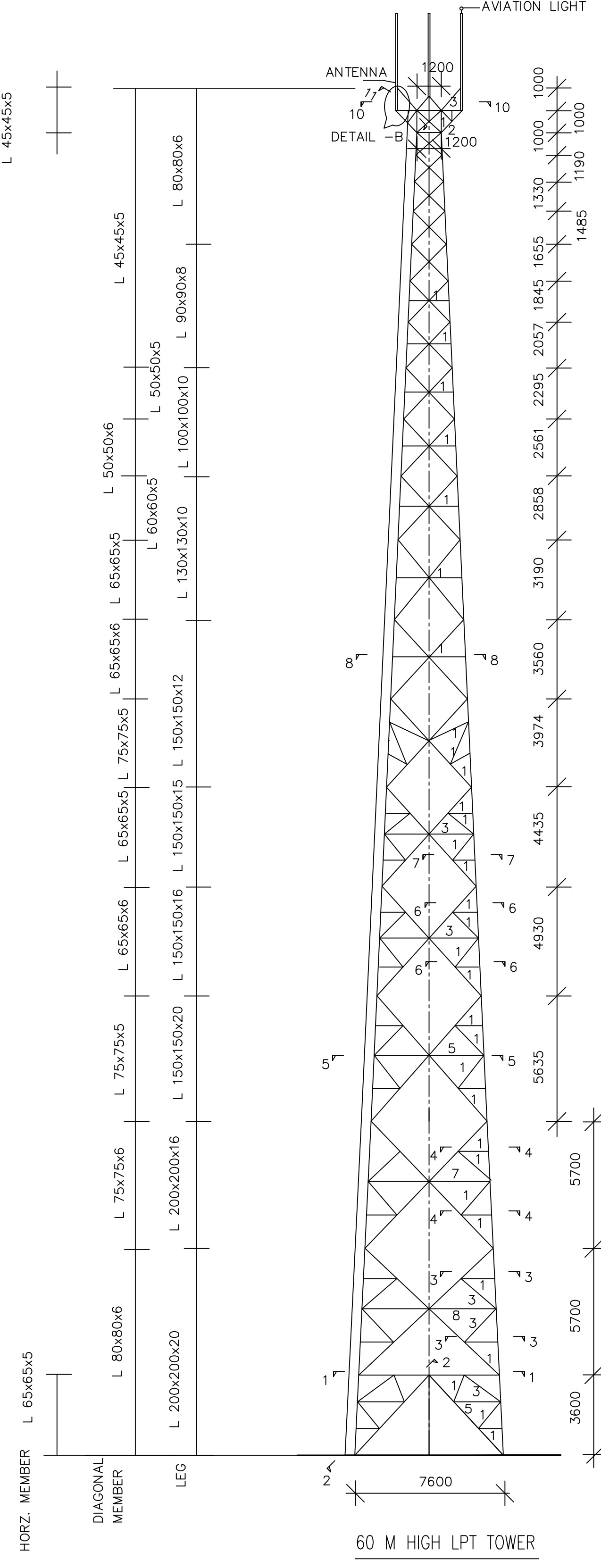
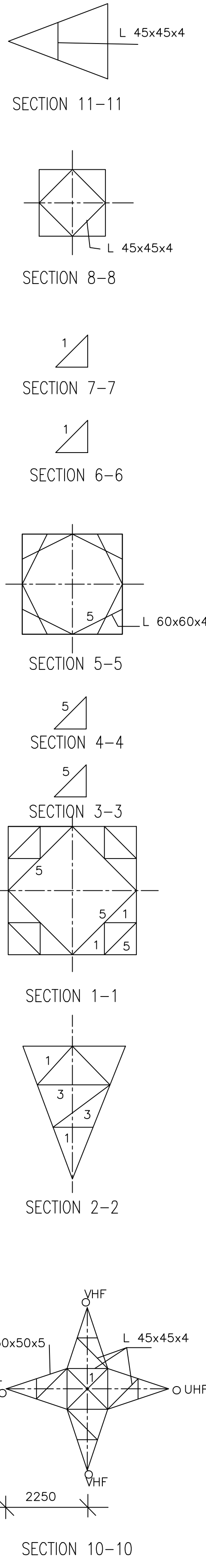
Note:

- Scope of the order shall be as defined in the order, specifications, drawings and Appendices there to.
- Completeness of the equipment shall be the responsibility of the supplier/contractor. Any equipment, fittings and accessories, which may not be specifically mentioned in the specification or drawing(s) but which are usual or necessary for the satisfactory functioning of the equipment (successful operation and functioning of the equipment being supplier's/contractor's responsibility) shall be provided by the supplier/contractor without any extra cost.
- The supplier/contractor shall follow the best modern practice in the manufacture of high grade equipment notwithstanding any omission in that, the supplier/contractor shall in all respect design, engineer, manufacture, and supply the same within delivery period to the entire satisfaction of the organization.
- The scope of current bid/tender is structural health analysis of 45Meter SS TV Tower at Akashvani Pithoragarh (Uttarakhand).
- Time of execution as per permission of engineer in-charge at Akashvani Pithoragarh (Uttarakhand).
- The bidder must be experienced in same kind of scope & shall submit documentary evidence with offer. The completion certificate is also to be attached issued by any Central and State Government agency, PSUs, Private organizations. (In case of SITC/SETC and specialized scope, the contractor should also have sufficient experience and shall submit the experience certificate of satisfactory completion of at least three similar works, each of value not less than 40% of the estimated cost put to tender or two similar works, each of value not less than 60% of the estimated cost or one similar work of value not less than 80% of the estimated cost, all amounts rounded off to a convenient full figure, in the last 7 years ending on the last day of the month previous to the one in which the tenders are invited").
- Execution of scope has to be completed without break in service at Akashvani Pithoragarh (Uttarakhand).
- Before submitting the offer tenderer must visit site and with prior permission of the site in-charge and submit confirmation of site visit. Technical details will be provided by In-charge of Site/I.O.
- The firm has to produce a list all such labour along with the address proof which are to be employed office on signing contract. The firm shall issue the identity cards to all such persons to facilitate the entry in at Akashvani Pithoragarh (Uttarakhand).
- Any damage or misplace in equipment will have to be provided by the firm during execution.

Note:

- 1. Quantity of scope may increase or decrease as per actual requirement/constraints at site.
- 2. Please read carefully the terms and conditions given in this quotation form.
 - a) GSTIN No: b) PAN No.....
- 3. **Delivery at:** Installation of 01KW FM Transmitters sites at Akashvani Pithoragarh (Uttarakhand).
- 4. **Consignee:** Installation officer, Akashvani Pithoragarh (Uttarakhand).
- 5. **Completion Period:** Execution/Completion of scope in good condition within 60days from the date of order.
- 6. **Validity:** 120days
- 7. **Payment terms:**
 - 100% payment will be paid on completion/execution of scope & submission of report in good condition.
- 8. **Declaration:** We declare that all the conditions as given in the quotation form have been read by us.

Name (in capital) _____
(Seal & Signature of the Bidder)



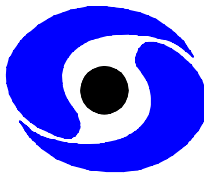
SCHEDULE OF SECTIONS

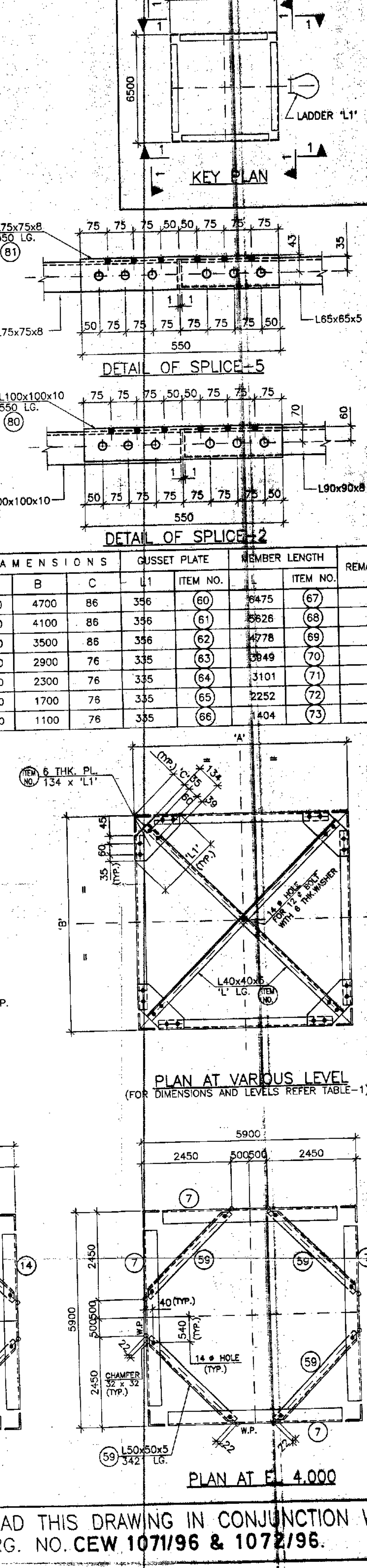
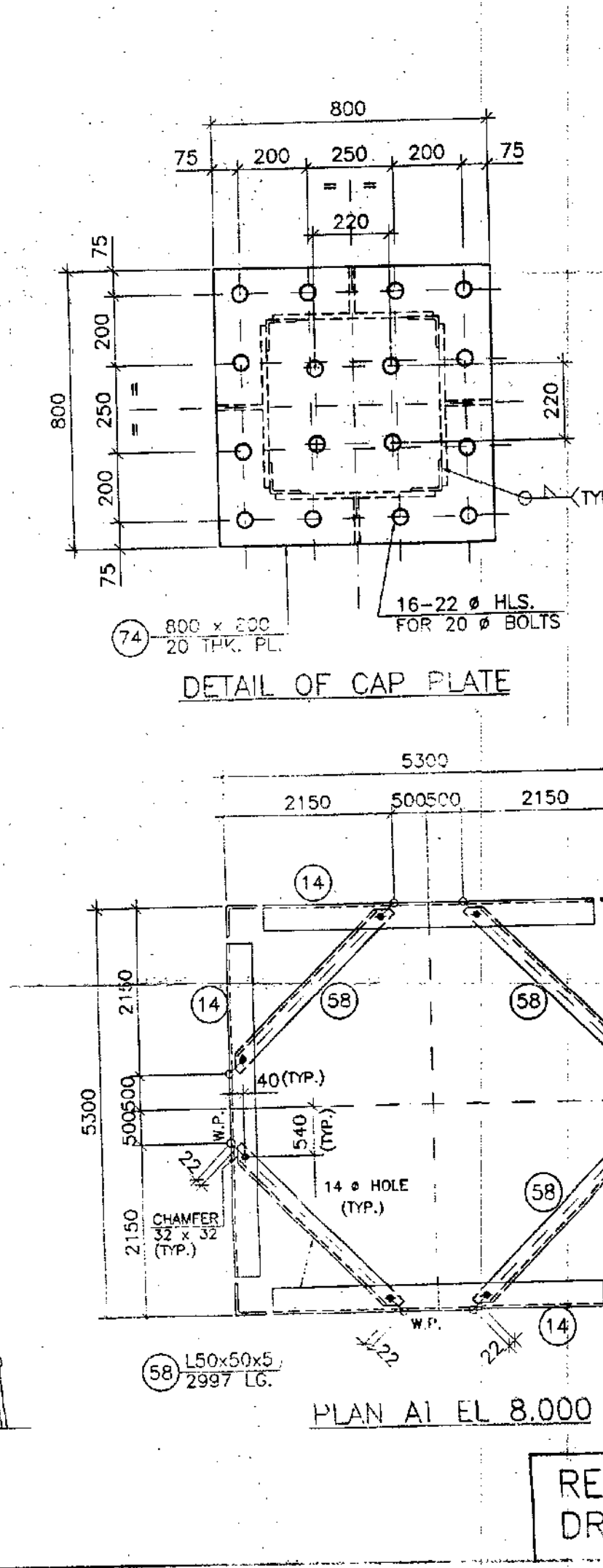
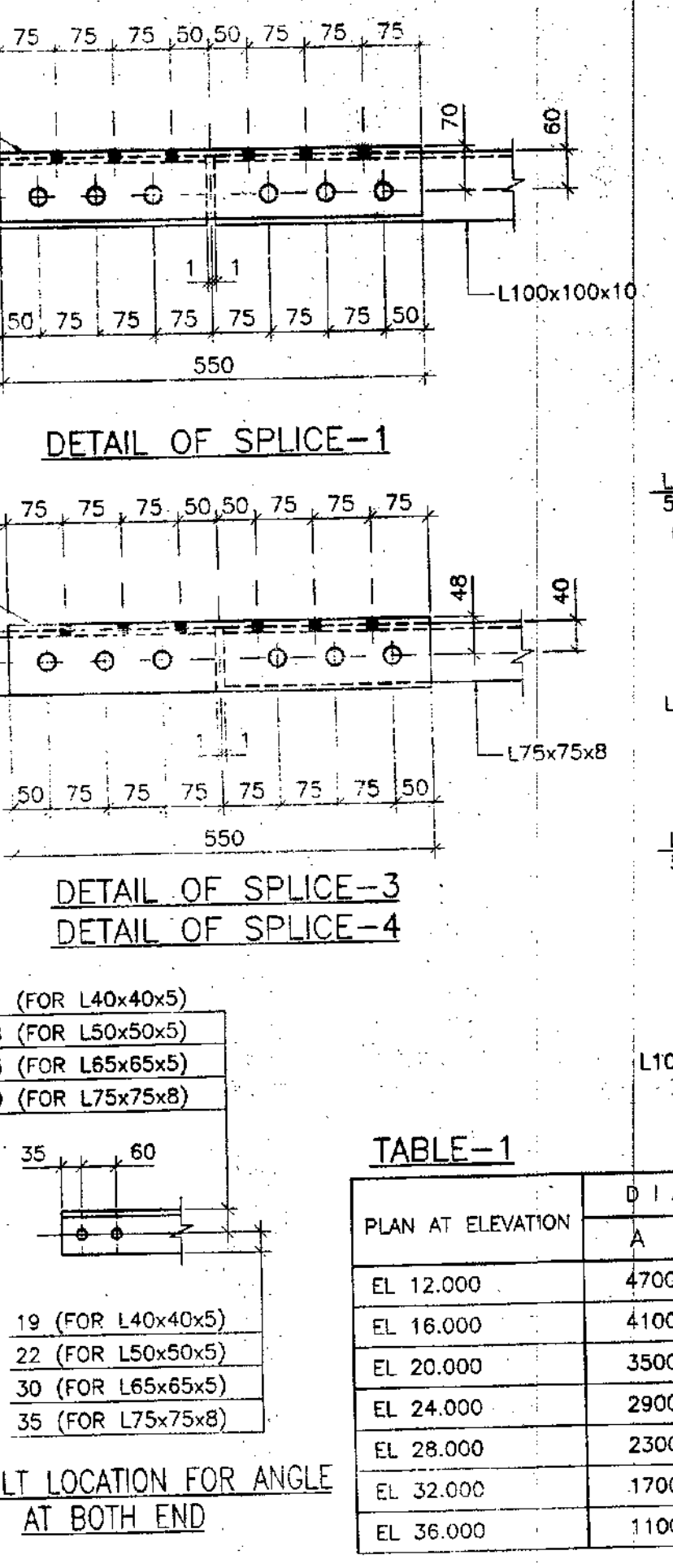
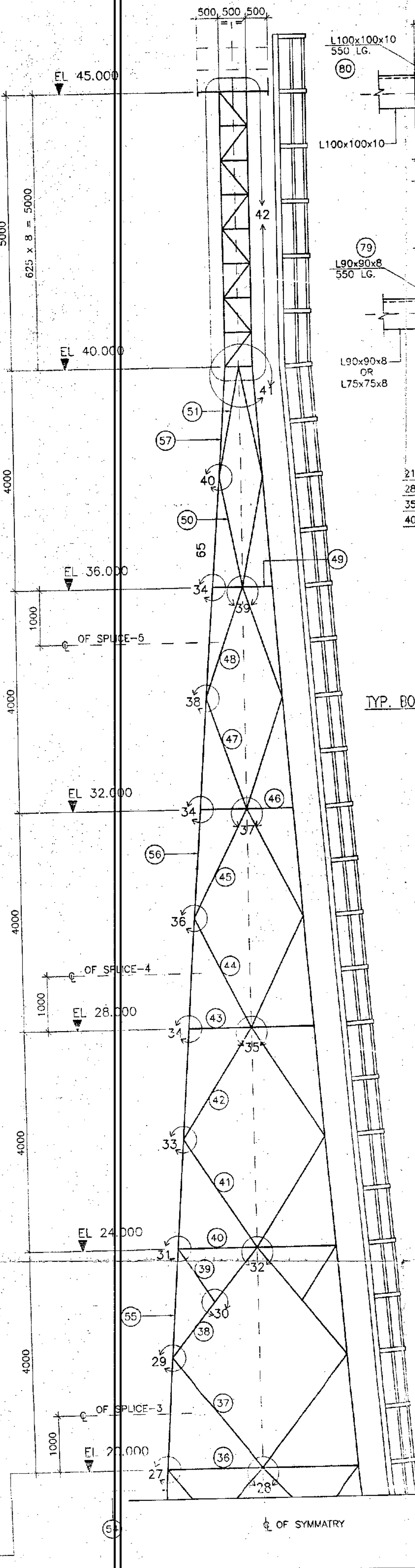
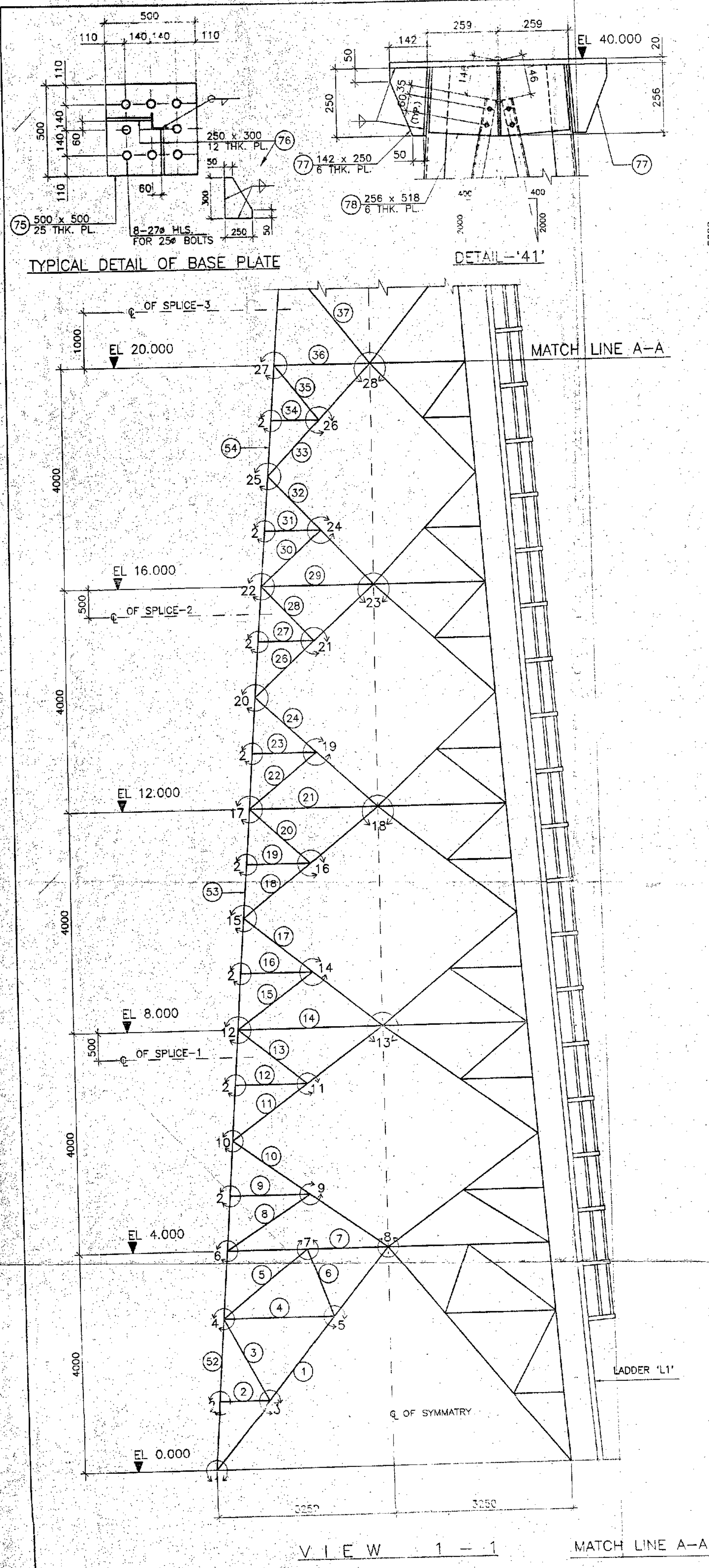
MEMBER NO.	SECTION
1	45 x 45 x 4
2	45 x 45 x 5
3	50 x 50 x 4
4	50 x 50 x 5
5	60 x 60 x 4
6	60 x 60 x 5
7	65 x 65 x 5
8	JL 45 x 45 x 4

NOTES:-

- ALL DIMENSIONS ARE IN MM
- ALL CONNECTIONS SHOULD BE DEVELOPED WITH 50% OF THE CAPACITY OF THE MEMBER, EXCEPT SPLICES WHICH WILL BE 100% CAPACITY.
- ALL BOLTS SHALL BE 16 DIA THAT IS 5.6/5.0 CONFORMING TO DIMENSION AS PER IS:6639.
- ALL WEILDS SHOULD BE 6mm UNTILL NOTED OTHER WISE AND ALL CONTACT SURFACE SHOULD BE WELDED.
- ALL BOLTS SHOULD HAVE ONE SPRING WASHER. SPRING WASHER CONT.TO IS:3063 R OR IS:4072 GA.
- ALL TOWER MEMBER SHALL BE OF STRUCTURAL STEEL CONFORMING TO IS:2062 Gr A STEEL 5th AND ABOVE SHALL BE PROCURED EXCLUSIVELY FROM MAIN PRODUCER i.e. STAIL ,TISCO, RINL (VSP) PRIOR PERMISSION SHOULD BE OBTAINED FROM DOORDARSHAN FOR USE OF STEEL FROM OTHER SOURCES THAN SPECIFIED.
- ALL STEEL MEMBERS SHALL BE HOT- DIP GALVANIZED CONFORMING TO IS:2629-1985 FASTNERS AS PER IS:1367 PORT XIII. AND WASHERS AS PER IS:1573-1986.
- ALL MEMBERS SHALL BE PAINTED AFTER ERECTION AS PER PAINT SCHEDULES GIVEN BELOW:-
 - ONE COAT OF ETCH PRIMER CONT. TO IS:5666-1970
 - ONE COAT OF ZINC CROMATE PRIMER :-IS:104
 - TWO COATS OF SYNTHATIC ENAMEL PAINTS, INTERNATIONAL ORANGE & WHITE COLORS:IS:2932
- THE TOWER SHALL BE PAINTED TO HAVE ALTERNATE BAND OF INTERNATIONAL ORANGE AND WHITE COLOURS WITH TOP & BOTTOM HAND PAINTED IN ORANGE AS PER CIVIL AVIATION REGULATIONS.
- FOR FOUNDATION DETAIL REF. FOUNDATION DESIGN DRAWING.

11 THIS DRAWING SHALL BE USED FOR THE LPT TOWER SITES HAVING MAX BASIC WIND SPEED OF 55 m/SEC (198 km/h) i.e. EAST GUJRAT COAST, NORTH EAST , LADAKH REGION OF J & K AND ALSO SNOW BOUND AREAS WITH MAX WIND SPEED OF 39M/SEC (140.4 KM/h OF HIMACHAL PRADESH, J&K & UTRANCHAL.

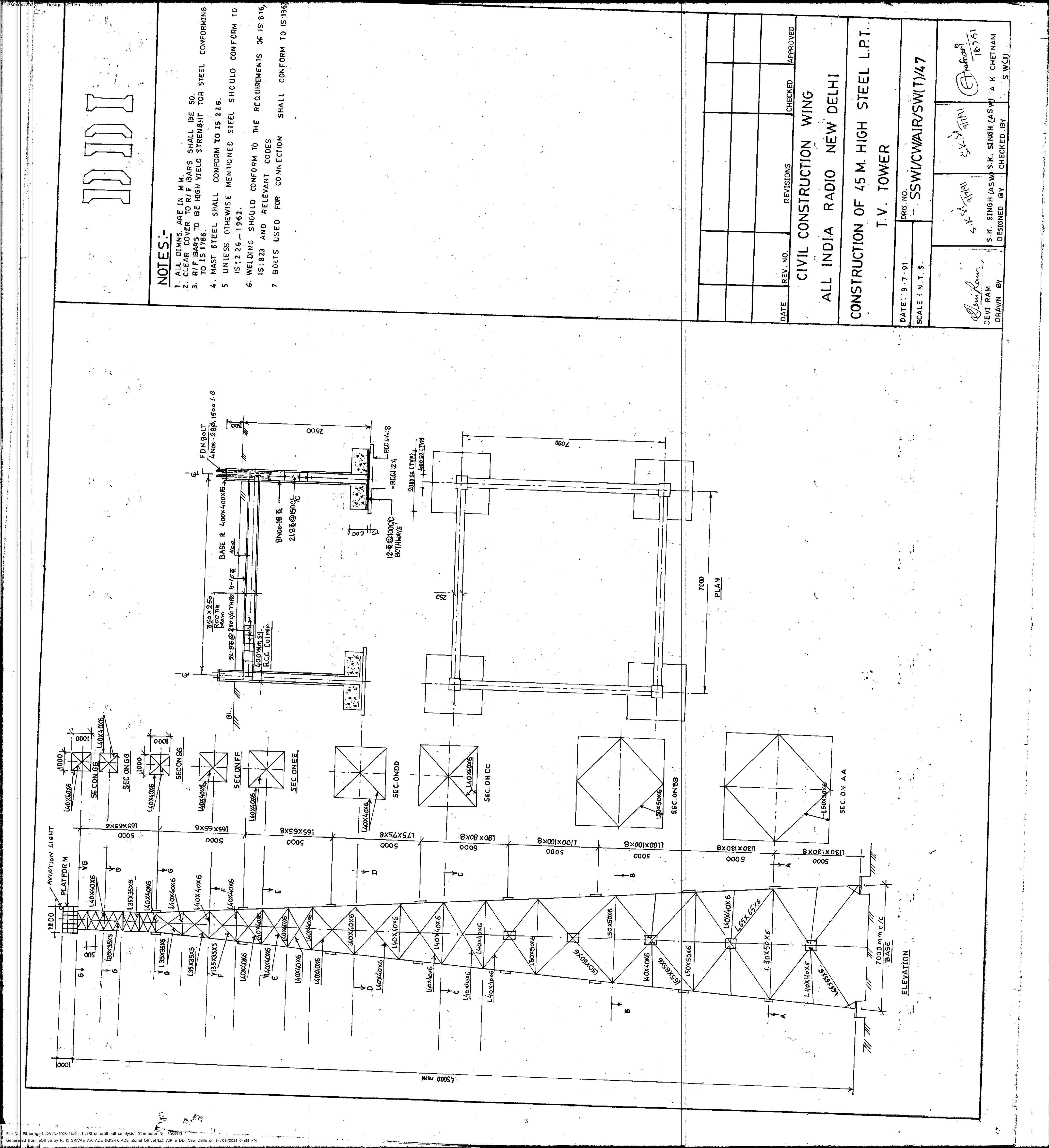
PROJECT		DRG:NO.		MOD.	
LPT STEEL TOWER GENERAL		TVT-7235			
60M. HIGH LPT STEEL TV TOWER FOR 55m/sec WIND SPEED & SNOW BOUND WITH 39M/SEC WIND SPEED AREAS					
SCALE		NTS		DATE	
				APR- 2003	
 DIRECTORATE GENERAL DOORDARSHAN NEW DELHI					
DRAWN		DESIGN/ CHECKED		APPROVED	
M S SAHI		DR. A.K.M.TRIPATHI (CONSULTANT)		DR. A.K.M.TRIPATHI (CONSULTANT)	



BILL OF MATERIAL									
ITEM NO.	DESCRIPTION	LENGTH IN mm.	QTY.	WEIGHT IN KGS.	REMARK	UNIT	WT.	TOTAL WT.	
1	L75x75x8	4801	8	8.9				71.2	
2	40x40x5	727	8	3.0				24.0	
3	40x40x5	1391	8	3.0				24.0	
4	40x40x5	1823	8	3.0				24.0	
5	40x40x5	1771	8	3.0				24.0	
6	40x40x5	1135	8	3.0				24.0	
7	L75x75x8	5506	4	8.9				35.6	
8	40x40x5	1818	8	3.0				24.0	
9	40x40x5	1240	8	3.0				24.0	
10	L75x75x8	3129	8	8.9				71.2	
11	L75x75x8	3138	8	8.9				71.2	
12	40x40x5	1093	8	3.0				24.0	
13	40x40x5	1387	8	3.0				24.0	
14	L75x75x8	5078	4	8.9				35.6	
15	40x40x5	1445	8	3.0				24.0	
16	40x40x5	1109	8	3.0				24.0	
17	65x65x5	2742	8	4.9				39.2	
18	65x65x5	2726	8	4.9				39.2	
19	40x40x5	961	8	3.0				24.0	
20	40x40x5	1274	8	3.0				24.0	
21	L50x50x6	4476	4	4.5				18.0	
22	40x40x5	772	8	3.0				24.0	
23	40x40x5	968	8	3.0				24.0	
24	65x65x5	2696	8	4.9				39.2	
25	NOT USED	-	-	-				-	
26	65x65x5	2675	8	4.9				39.2	
27	40x40x5	820	8	3.0				24.0	
28	40x40x5	1158	8	3.0				24.0	
29	L50x50x6	3876	4	4.5				18.0	
30	40x40x5	1257	8	3.0				24.0	
31	40x40x5	837	8	3.0				24.0	
32	50x50x5	2492	8	3.8				30.4	
33	50x50x5	2469	8	3.8				30.4	
34	40x40x5	684	8	3.0				24.0	
35	40x40x5	1048	8	3.0				24.0	
36	L50x50x6	3276	4	4.5				18.0	
37	50x50x5	2307	8	3.8				30.4	
38	50x50x5	2276	8	3.8				30.4	
39	40x40x5	973	8	3.0				24.0	
40	L50x50x6	2708	4	4.5				18.0	
41	40x40x5	2122	8	3.0				24.0	
42	40x40x5	2086	8	3.0				24.0	
43	L50x50x6	2106	4	4.5				18.0	
44	40x40x5	1980	8	3.0				24.0	
45	40x40x5	1938	8	3.0				24.0	
46	L50x50x6	1528	8	4.5				36.0	
47	40x40x5	1748	8	3.0				24.0	
48	40x40x5	1576	8	3.0				24.0	
49	L50x50x6	906	4	4.5				18.0	
50	40x40x5	1465	8	3.0				24.0	
51	40x40x5	1448	8	3.0				24.0	
52	L100x100x10	7520	4	13.9				55.6	
53	L100x100x10	8020	4	14.9				59.6	
54	L90x90x8	5813	4	10.8				43.2	
55	L75x75x8	8020	4	8.9				35.6	
56	L75x75x8	8015	4	8.9				35.6	
57	L65x65x5	4993	4	4.9				19.6	
58	50x50x5	2987	4	3.8				15.2	
59	50x50x5	3421	4	3.8				15.2	
60	134 x 6 THK. PL	356	4	47.1				188.4	
61	134 x 6 THK. PL	356	4	47.1				188.4	
62	134 x 6 THK. PL	356	4	47.1				188.4	
63	134 x 6 THK. PL	335	4	47.1				176.4	
64	134 x 6 THK. PL	335	4	47.1				176.4	
65	134 x 6 THK. PL	335	4	47.1				176.4	
66	134 x 6 THK. PL	335	4	47.1				176.4	
67	50x50x5	6475	2	3.8				7.6	
68	50x50x5	5626	2	3.8				7.6	
69	50x50x5	4778	2	3.8				7.6	
70	50x50x5	3849	2	3.8				7.6	
71	50x50x5	3101	2	3.8				7.6	
72	50x50x5	2252	2	3.8				7.6	
73	50x50x5	1404	2	3.8				7.6	
74	800 x 20 THK. PL	800	1	157.0				157.0	
75	500 x 25 THK. PL	500	4	196.35				785.4	
76	250 x 12 THK. PL	300	8	94.2				753.6	
77	142 x 6 THK. PL	250	4	47.1				188.4	
78	256 x 6 THK. PL	518	4	47.1				188.4	
79	L90x90x8	550	8	10.8				86.4	
80	L100x100x10	550	8	14.9				119.2	
81	L75x75x8	550	4	8.9				35.6	
TOTAL W.T. IN KGS.								5851.8	

REV.	DESCRIPTION	BY	CHKD.	DATE
0	ISSUED FOR FABRICATION	P.N.P.	N.B.P.	14.6.96
T.V. PROJECT				
O/O THE CHIEF ENGINEER (WZ), AIR & DOORDARSHAN, MUMBAI-20				
TITLE: 45M. SELF SUPPORT T.V. TOWER G.A AND DETAIL OF TOWER				
SCALE	DATE	DRAWING NO.	REV.	
1:50/N.T.S	14.6.96	CEW-1070/96	0	

READ THIS DRAWING IN CONJUNCTION WITH DRG. NO. CEW 1071/96 & 1072/96.



NOTES:-

1. ALL DIMNS. ARE IN MM.
2. CLEAR COVER TO R/F BARS SHALL BE 50.
3. R/F BARS TO BE HIGH YIELD STRENGTH FOR STEEL CONFORMING TO IS 1786.
4. MAST STEEL SHALL CONFORM TO IS 226.
5. UNLESS OTHERWISE MENTIONED STEEL SHOULD CONFORM TO IS 226-1962.
6. WELDING SHOULD CONFORM TO THE REQUIREMENTS OF IS 816, IS 823 AND RELEVANT CODES
7. BOLTS USED FOR CONNECTION SHALL CONFORM TO IS 1365

DATE	REV. NO.	REVISIONS	CHECKED	APPROVED

CIVIL CONSTRUCTION WING
ALL INDIA RADIO NEW DELHI

CONSTRUCTION OF 45 M. HIGH STEEL L.P.T.
T.V. TOWER

DATE: 9.7.91
SCALE: N.T.S.

DRG. NO. SSW/CW/AIR/SW(T)/47
DESIGNED BY S.K. SINGH (ASW) S.K. SINGH (ASW) A.K. CHETANI
DRAWN BY DEVI RAM
CHECKED BY S.W.(I)

SN0309
PRASAR BHARATI
 (Broadcasting Corporation of India)
 Office of the Chief Engineer(NZ)
 Akashvani & Doordarshan

Jamnagar House, Shahjahan Road
 New Delhi-110 011

Dated: 18.9.2004

No.1/T/3/03/Adm.

The Director General,
 (By name: Shri V.K. Agrawal, DE),
 Doordarshan,
 Doordarshan Bhavan,
 Copernicus Marg,
 New Delhi-110 001.

Sub:- Proposal for Design detail Fabrication Drawing of 45 meter Self Supporting Tower.

Ref:- 1. This office letter of even number dated 3.6.04 and 18.8.04.
 2. Dte. letter No.1(1)/5/LPT/2004-EV dtd. 3.9.04

Sir,

As per above IIT Roorkee was approached for design and drawing of 45 meter self supporting steel tower as per new wind and seismic code. They have agreed to take up the work on payment basis. The letter received from them is enclosed for your kind perusal.

We intend to allot the work to M/s IIT Roorkee on payment basis. It is requested that approval in principle to pay Rs.1,65,300 (Rupees one lakh sixtyfive thousand three hundred) only as advance payment may kindly be accorded. The expenditure will be met from the overall savings of the scheme of replacement of transmitter with 1+1 Automode transmitter.

An early action is requested.

Yours faithfully,

(N.K. GUPTA)
 Director Engineering
 For Chief Engineer(NZ)

On file 1(1)/LPT Tower/2004/ED

LS
 22/9/04

AS (ACT)
 on file for

LS
 22/9/04

LS
 22/9/04

1392/E-2
 22/9



भारतीय प्रौद्योगिकी संस्थान रुड़की

जानपद अभियांत्रिकी विभाग

रुड़की-247 667, उत्तरांचल, भारत

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

DEPARTMENT OF CIVIL ENGINEERING

ROORKEE - 247 667, UTTARANCHAL, INDIA

FAX : (91) 01332-275568, 273560

Ph. : 01332-285426 (O) ; -285486 (R) , -2872774 (R)

e-mail : civil@iitr.ernet.in



Krishen Kumar
Professor

No: CED/KK/0918

Dt: Sept 18, 2004

To
The Chief Engineer (NZ)
Prasar Bharti
Jamnagar House
Shahjahan Road
NEW DELHI- 110 011

Sub: Design & Drawing of 45m Self Supporting Steel Tower
Ref: Your letter No.1/T/3/03/Adm. dated 16-09-2004

1. Your above referred letter, addressed to the Civil Engineering Department has been directed to the undersigned for necessary action.
2. In this connection I may inform that we have the expertise in design of tall steel latticed towers and we shall be able to take up the design of the 45m tall tower mentioned in your above letter along with the design of its foundation for various soil conditions categorized by bearing capacity values of 5, 10, 20 and 30 t/m². The design of the steel tower, however, would be carried out for the most critical loading condition applicable to all the eight States of the Country mentioned in your letter so that the same tower would remain safe irrespective of the location, that is for basic wind speed of 47 m/s and horizontal seismic coefficient as 0.09.
3. We will also provide the necessary design, fabrication and erection specifications as per the relevant Indian Standard Codes.
4. The Institute (I.I.T. Roorkee) consultancy fees for the design work, including detailed design drawings, will be Rs.1,50,000/- (Rs. One lac fifty thousand only) plus 10.2% Service Tax, that is, Rs.15,300/-; total gross amount Rs.1,65,300/- (Rs. One lac sixty five thousand three hundred only) payable in advance as per Institute Rules.
5. The design and drawings of the said tower would be submitted to you within 12 to 14 weeks time after the receipt of the consultancy fee.
6. A Proforma Invoice for the Institute design charges is enclosed in duplicate. The Demand Draft should be drawn in favour of the "Indian Institute of Technology Roorkee, Roorkee". The D.D. shall be sent to the undersigned so that it is posted in the appropriate account head. It may also be noted that no Income Tax at source is to be deducted as IIT Roorkee is exempted from Income Tax, which is paid by the working team members in their individual capacity.

With best wishes and regards.

Encl: As above

Yours truly,

Krishen Kumar
18/9/04

(Krishen Kumar)

Dr. Krishen Kumar

Professor of Civil Engg.

I.I.T. Roorkee, Roorkee



भारतीय प्रौद्योगिकी संस्थान रुड़की

जानपद अभियांत्रिकी विभाग

रुड़की-247 667, उत्तरांचल, भारत

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

DEPARTMENT OF CIVIL ENGINEERING

ROORKEE - 247 667, UTTARANCHAL, INDIA

FAX : (91) 01332-275568, 273560

Ph. : 01332-

e-mail : civil@iitr.ernet.in



First/ Second Copy

PROFORMA INVOICE

Krishen Kumar
Professor

No: CED/KK/0919

Dt: Sep 18, 2004

To

The Chief Engineer (NZ)
Prasar Bharti
Jamnagar House
Shahjahan Road
NEW DELHI- 110 011

Sub: Design & Drawing of 45m Self Supporting Steel Tower- Proforma Invoice for the same.

Ref: Your letter No.1/T/3/03/Adm. dated 16-09-2004

S.No.	Description of Work	Amount
1.	Structural design of a 45m tall latticed steel tower for the most critical loading condition applicable to all the eight States of the Country mentioned in your above referred letter.	
2.	Design of the tower foundation for various soil conditions categorized by bearing capacity values of 5, 10, 20 and 30 t/m ² .	
3.	Design Report of the tower and its foundations.	
4.	Design drawings of the steel tower and its foundations.	
Institute (IIT Roorkee) Charges for above work (S.No. 1 to 4)		Rs.1.500 lac
Plus Service Tax @ 10.2%		Rs.0.153 lac
Total including Service Tax		Rs.1.653 lac*

(Rs. One lac sixty five thousand three hundred only)

* Payable by Demand Draft drawn in favour of "Indian Institute of Technology Roorkee, Roorkee".
The D.D. shall be sent to the undersigned so that it is posted in the appropriate account head. It may also be noted that no Income Tax at source is to be deducted as IIT Roorkee is exempted from Income Tax, which is paid by the working team members in their individual capacity.

Krishen Kumar
18.9.04
(Krishen Kumar)



भारतीय प्रौद्योगिकी संस्थान रुड़की

जानपद अभियांत्रिकी विभाग

रुड़की-247 667, उत्तरांचल, भारत

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

DEPARTMENT OF CIVIL ENGINEERING

ROORKEE - 247 667, UTTARANCHAL, INDIA

FAX : (91) 01332-275568, 273560

Ph. : 01332-285426 (0) ; - 285486 (1) ; - 272774 (2)

e-mail : civil@iitr.ernet.in



First/ Second Copy

PROFORMA INVOICE

Krishen Kumar
Professor

No: CED/KK/0919
Dt: Sep 18, 2004

To

The Chief Engineer (NZ)
Prasar Bharti
Jamnagar House
Shahjahan Road
NEW DELHI- 110 011

Sub: Design & Drawing of 45m Self Supporting Steel Tower- Proforma Invoice for the same.

Ref: Your letter No.1/T/3/03/Adm. dated 16-09-2004

S.No.	Description of Work	Amount
1.	Structural design of a 45m tall latticed steel tower for the most critical loading condition applicable to all the eight States of the Country mentioned in your above referred letter.	
2.	Design of the tower foundation for various soil conditions categorized by bearing capacity values of 5, 10, 20 and 30 t/m ² .	
3.	Design Report of the tower and its foundations	
4.	Design drawings of the steel tower and its foundations.	

Institute (IIT Roorkee) Charges for above work (S.No. 1 to 4)

Rs.1.500 lac

Plus Service Tax @ 10.2%

Rs.0.153 lac

Total including Service Tax

Rs.1.653 lac*

(Rs. One lac sixty five thousand three hundred only)

* Payable by Demand Draft drawn in favour of "Indian Institute of Technology Roorkee, Roorkee".

The D.D. shall be sent to the undersigned so that it is posted in the appropriate account head. It may also be noted that no Income Tax at source is to be deducted as IIT Roorkee is exempted from Income Tax, which is paid by the working team members in their individual capacity.

Krishen Kumar
18.9.04
(Krishen Kumar)
Dr. Krishen Kumar
Professor of Civil Engg.
I.I.T. Roorkee, Roorkee

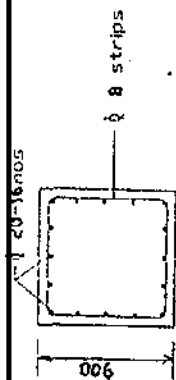
15

14. COMPLIANCE STATEMENTS

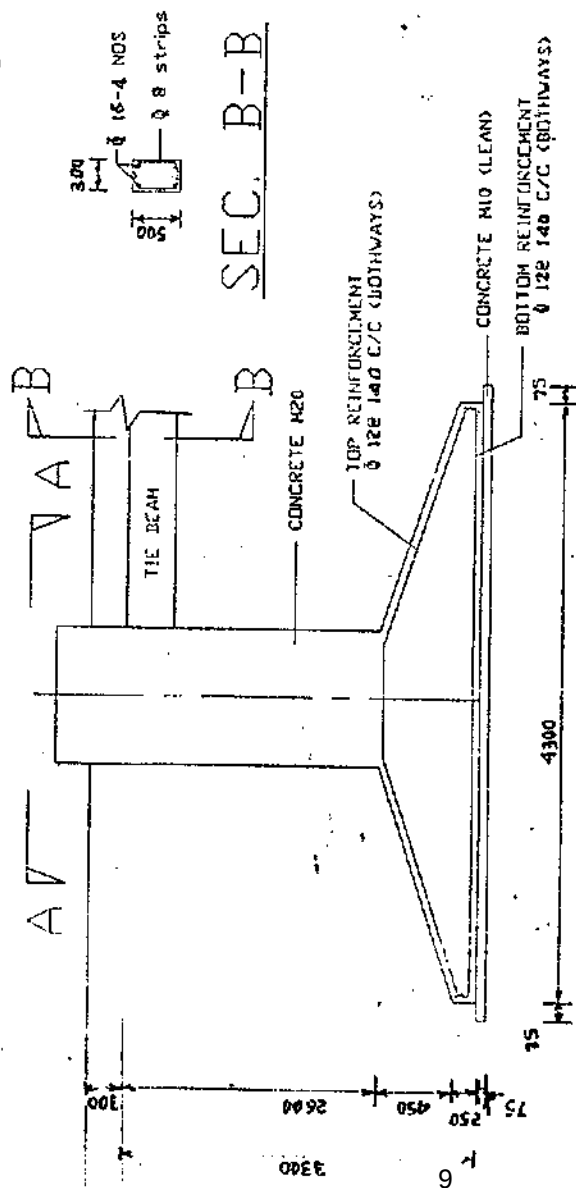
A para by para compliance statement in tubular form giving Doordarshan specification clause by clause, contractor's compliance and deviation if any under remarks shall be attached with the offer. This is a mandatory requirement without which tender is liable to be rejected.

15. List of Drawings for 45M LPT Tower

- (1) General Arrangement Drawing No.: TVT/45M/IITR/GAD.
- (2) Detail of Tower Elevation from 0.000 to 5.638M
- (3) Detail of Tower Elevation from 5.638 to 18.970M
- (4) Detail of Tower Elevation from 18.970 to 25.724M
- (5) Detail of Tower Elevation from 25.724 to 33.428M
- (6) Detail of Tower Elevation from 33.428 to 45.000M
- (7) Detail of Platform at 45M & Antenna Fixture.
- (8) Detail of Ladder & Cable Rack from 0.00 to 45.00M
- (9) Detail of Foundation.



SEC. A-A



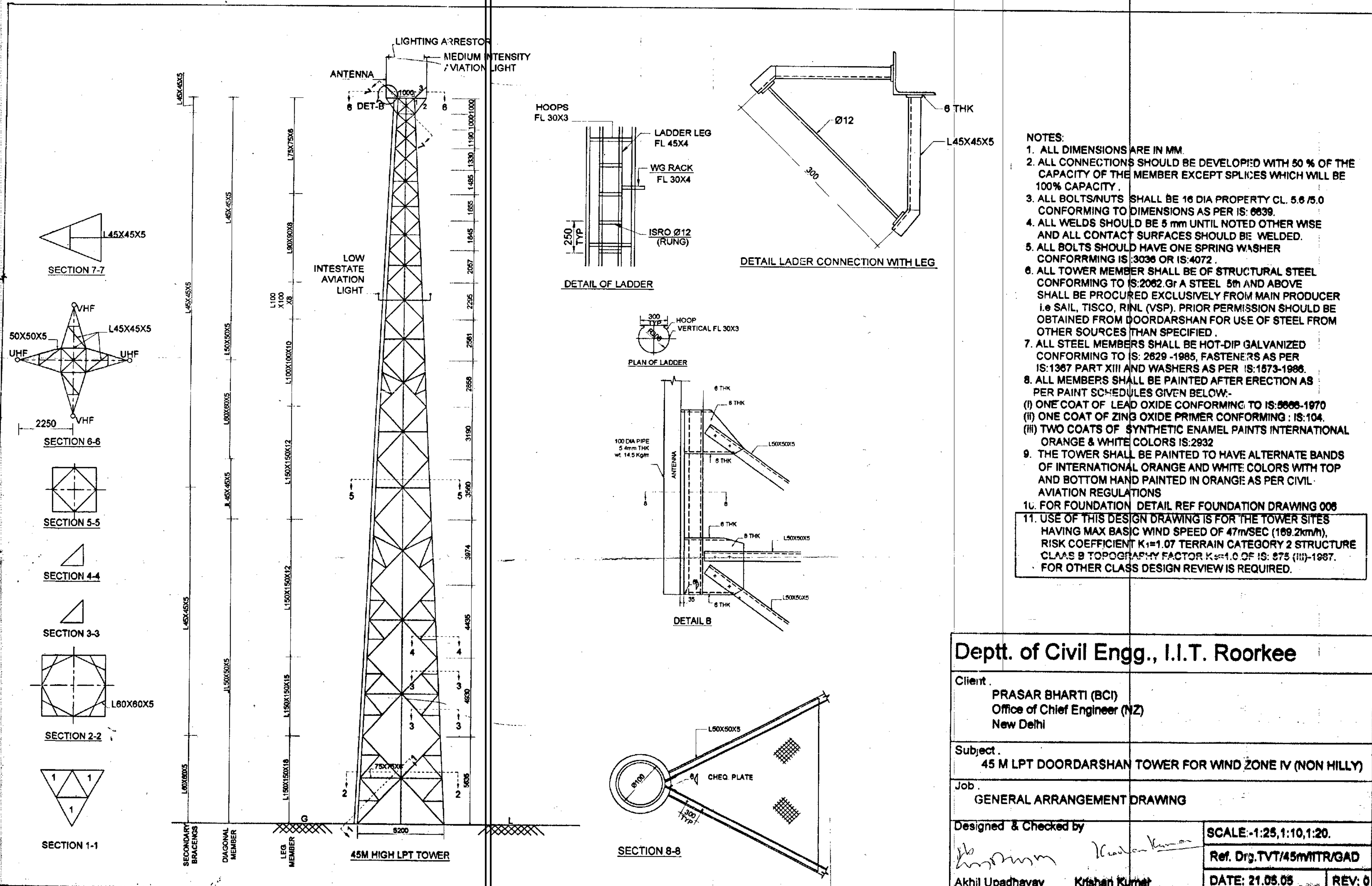
NOTE

1. IN PEDESTAL FOUNDATION SLAB & TIE BEAM CONCRETE M 20 SHALL BE USED.
2. FOUNDATION AS PER DRAWING CAN BE USED IF BEARING CAPACITY IS MORE THAN 8.2 T/M², AND FOR OTHER CASES REQUIRES CHECKING AND SPECIAL FOUNDATIONS.

DETAIL OF FOUNDATION FOR 45M LPT TOWER

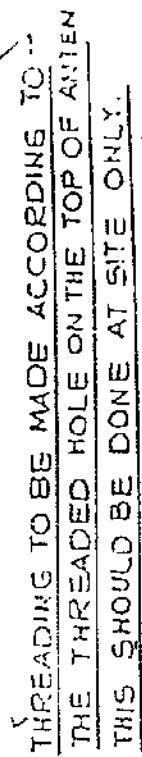
SK-1

106



- NOTES:
1. ALL DIMENSIONS ARE IN MM.
 2. ALL CONNECTIONS SHOULD BE DEVELOPED WITH 50 % OF THE CAPACITY OF THE MEMBER EXCEPT SPLICES WHICH WILL BE 100% CAPACITY.
 3. ALL BOLTS/NUTS SHALL BE 16 DIA PROPERTY CL. 5.6 /5.0 CONFORMING TO DIMENSIONS AS PER IS: 6839.
 4. ALL WELDS SHOULD BE 5 mm UNTIL NOTED OTHER WISE AND ALL CONTACT SURFACES SHOULD BE WELDED.
 5. ALL BOLTS SHOULD HAVE ONE SPRING WASHER CONFORMING IS:3036 OR IS:4072.
 6. ALL TOWER MEMBER SHALL BE OF STRUCTURAL STEEL CONFORMING TO IS:2062 Gr A STEEL 5th AND ABOVE SHALL BE PROCURED EXCLUSIVELY FROM MAIN PRODUCER i.e SAIL, TISCO, RINL (VSP). PRIOR PERMISSION SHOULD BE OBTAINED FROM DOORDARSHAN FOR USE OF STEEL FROM OTHER SOURCES THAN SPECIFIED.
 7. ALL STEEL MEMBERS SHALL BE HOT-DIP GALVANIZED CONFORMING TO IS: 2629 -1985, FASTENERS AS PER IS:1367 PART XIII AND WASHERS AS PER IS:1573-1986.
 8. ALL MEMBERS SHALL BE PAINTED AFTER ERECTION AS PER PAINT SCHEDULES GIVEN BELOW:-
(i) ONE COAT OF LEAD OXIDE CONFORMING TO IS:5566-1970
(ii) ONE COAT OF ZINC OXIDE PRIMER CONFORMING : IS:104.
(iii) TWO COATS OF SYNTHETIC ENAMEL PAINTS INTERNATIONAL ORANGE & WHITE COLORS IS:2932
 9. THE TOWER SHALL BE PAINTED TO HAVE ALTERNATE BANDS OF INTERNATIONAL ORANGE AND WHITE COLORS WITH TOP AND BOTTOM HAND PAINTED IN ORANGE AS PER CIVIL AVIATION REGULATIONS
 10. FOR FOUNDATION DETAIL REF FOUNDATION DRAWING 006
 11. USE OF THIS DESIGN DRAWING IS FOR THE TOWER SITES HAVING MAX BASIC WIND SPEED OF 47m/SEC (169.2km/h), RISK COEFFICIENT $K_1=1.07$ TERRAIN CATEGORY 2 STRUCTURE CLASS B TOPOGRAPHY FACTOR $K_2=1.0$ OF IS: 875 (III)-1987. FOR OTHER CLASS DESIGN REVIEW IS REQUIRED.

Deptt. of Civil Engg., I.I.T. Roorkee			
Client.		PRASAR BHARTI (BCI) Office of Chief Engineer (NZ) New Delhi	
Subject.		45 M LPT DOORDARSHAN TOWER FOR WIND ZONE IV (NON HILLY)	
Job.		GENERAL ARRANGEMENT DRAWING	
Designed & Checked by		SCALE:-1:25,1:10,1:20.	
Akhil Upadhyay		Ref. Drg.TVT/45MTR/GAD	
Krishan Kumar		DATE: 21.05.05	
		REV: 0	

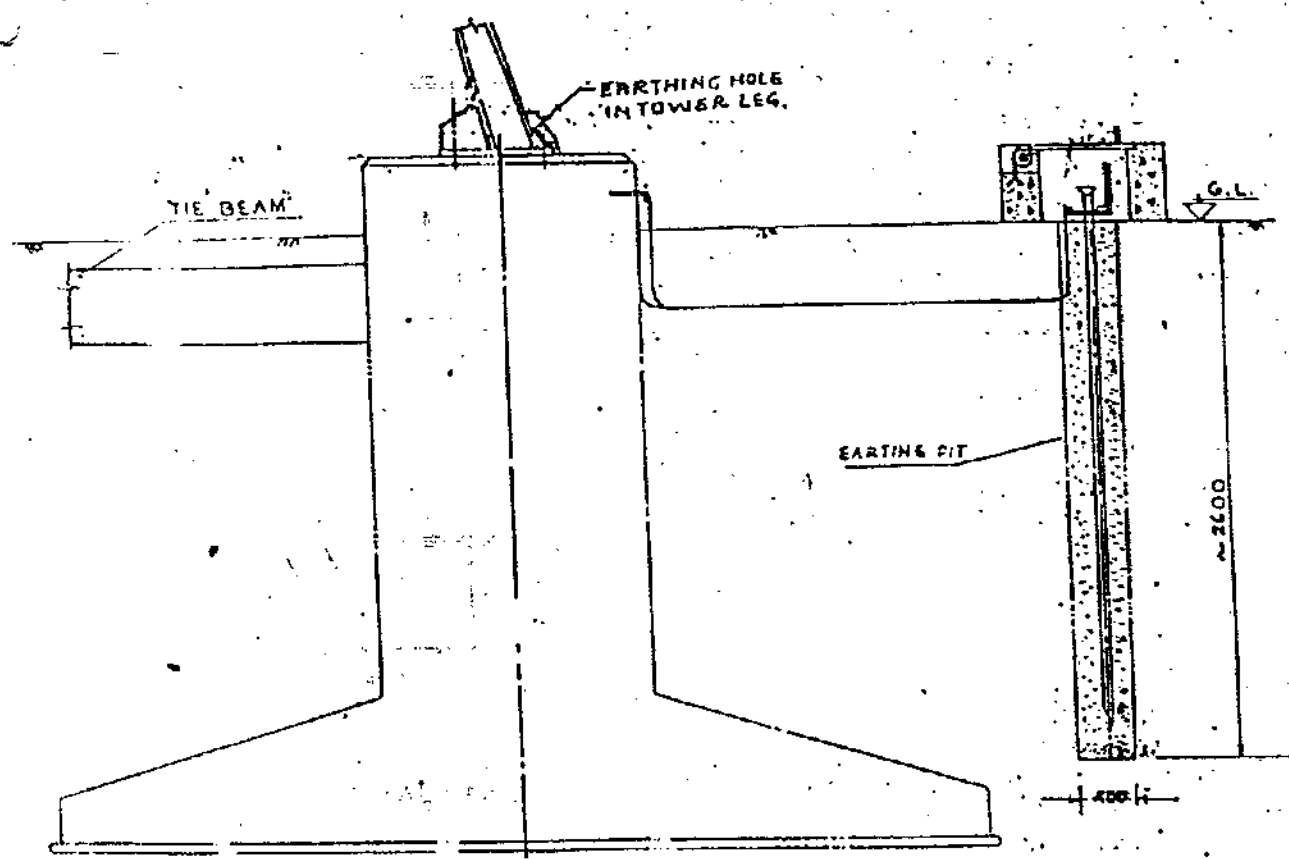


LIGHTNING ARRESTOR
FOR
45MLPT TOWER

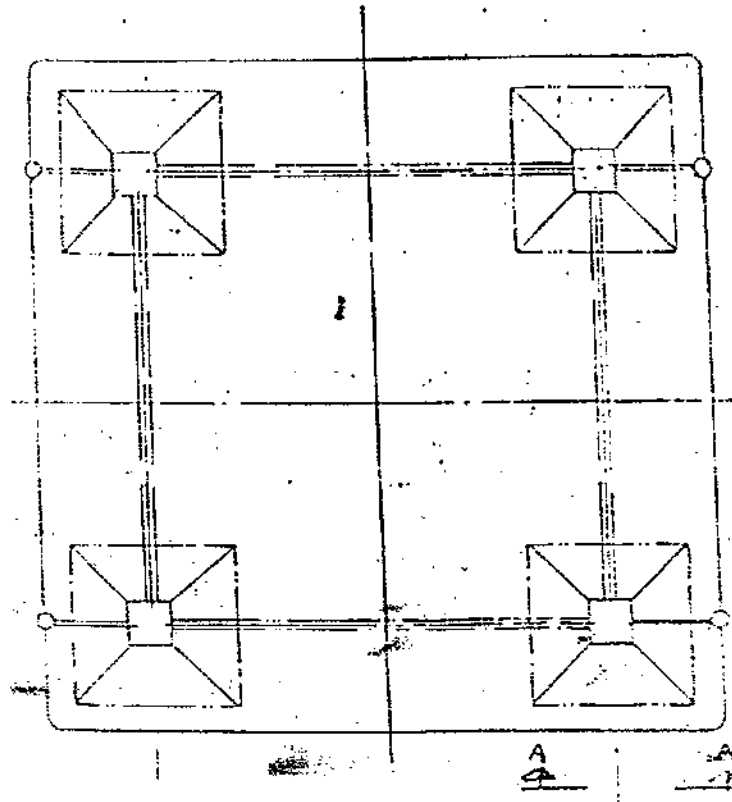
$$\frac{2-x}{5}$$

104

103



VIEW A-A



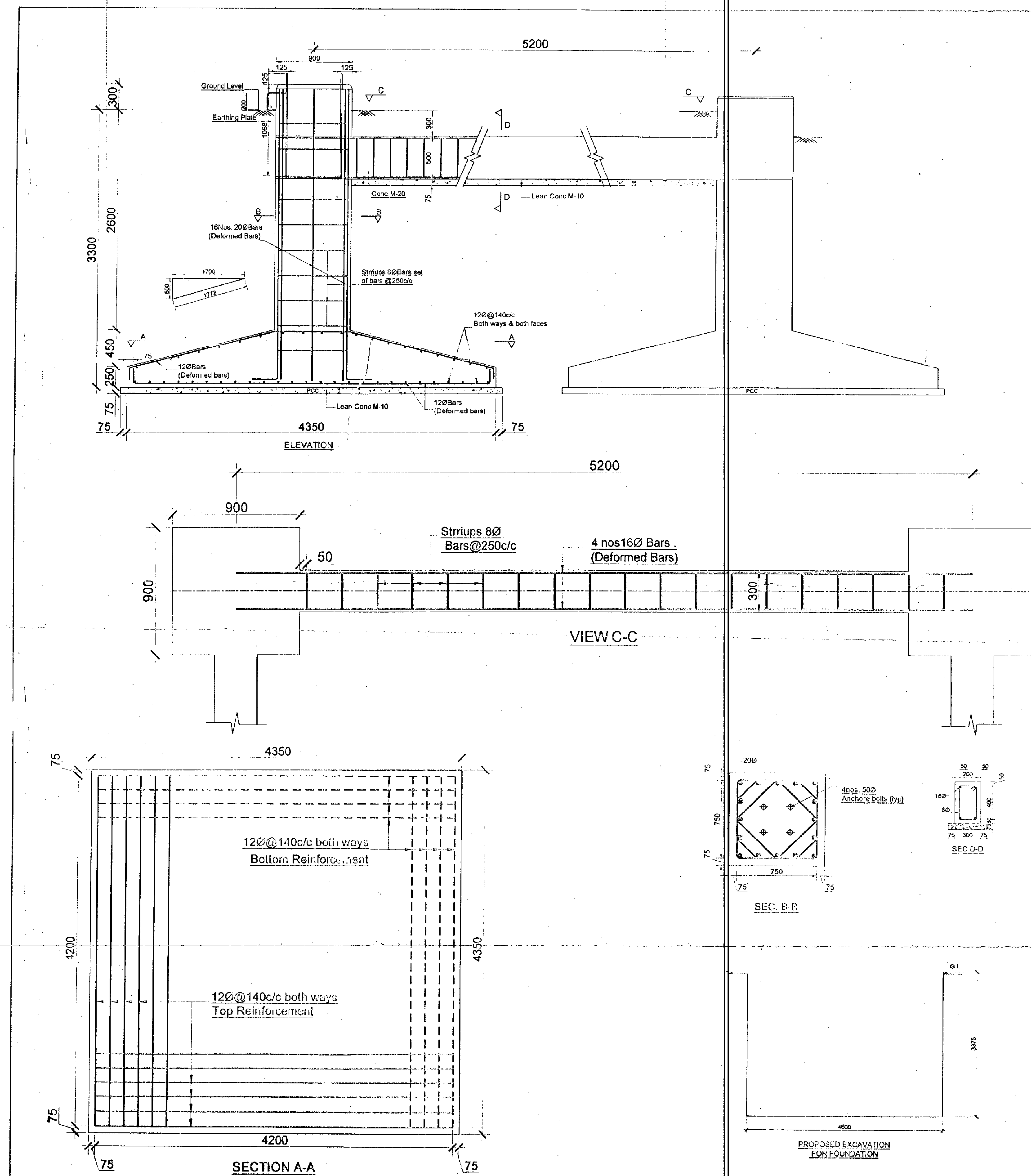
GENERAL - ARRANGEMENT

NOTE : LIGHTENING PROTECTION
AND EARTHING SHALL BE
AS PER IS: 2309 & 3043 REF.

EARTHING :

SYSTEMATIC DIAGRAM
OF EARTHING
FOR
45 MLPT TOWER

SK-3



Deptt. of Civil Engg., I.I.T. Roorkee

Client

PRASAR BHARTI (BCI)
Office of Chief Engineer (NZ)
New Delhi

Subject

45 M LPT DOORDARSHAN TOWER FOR WIND ZONE IV (NON HILLY)

Job

FOUNDATION DETAILS

Designed & Checked by

SCALE: 1:25, 1:30, 1:50, 1:20.

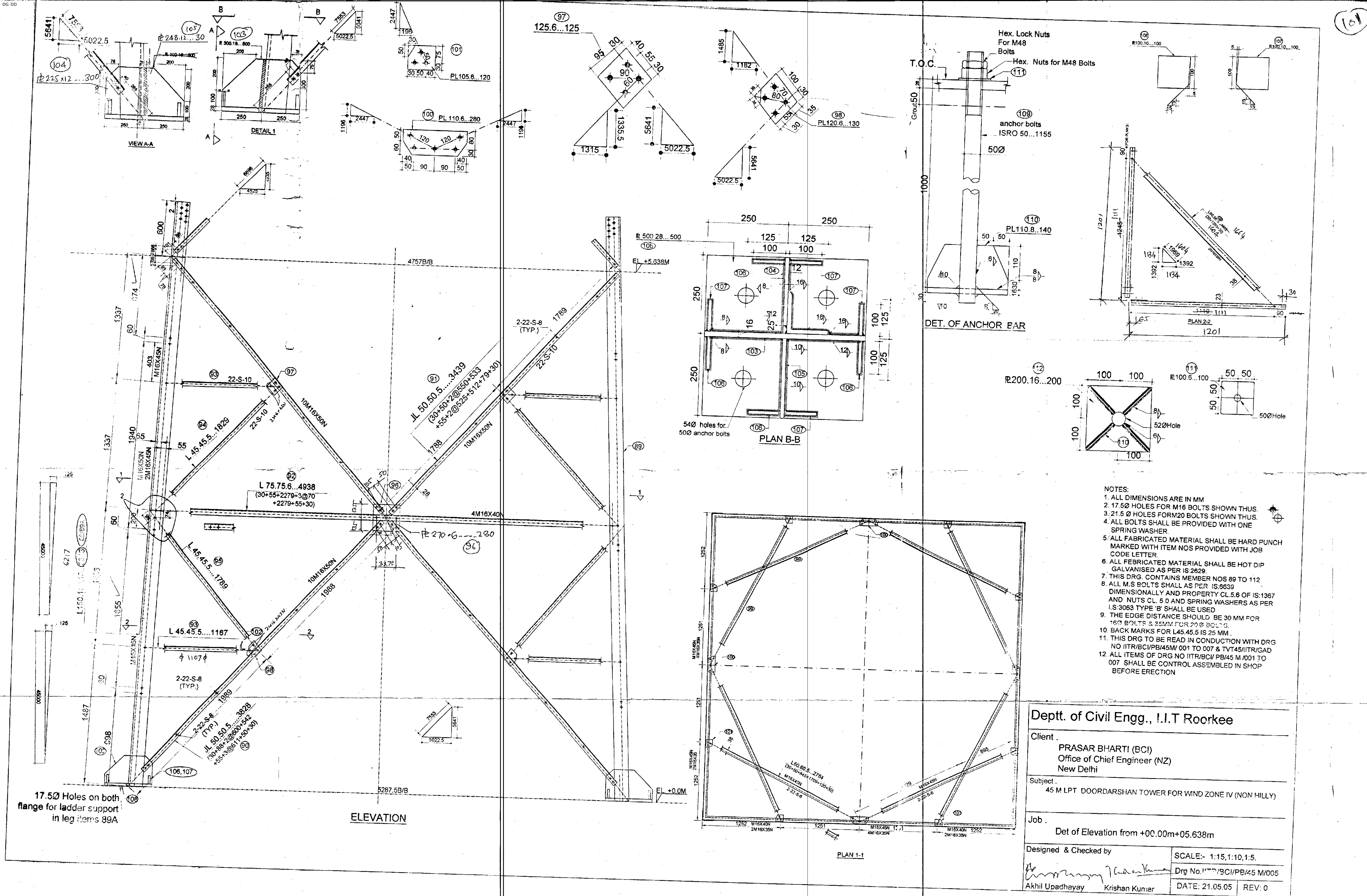
Akhil Upadhyay

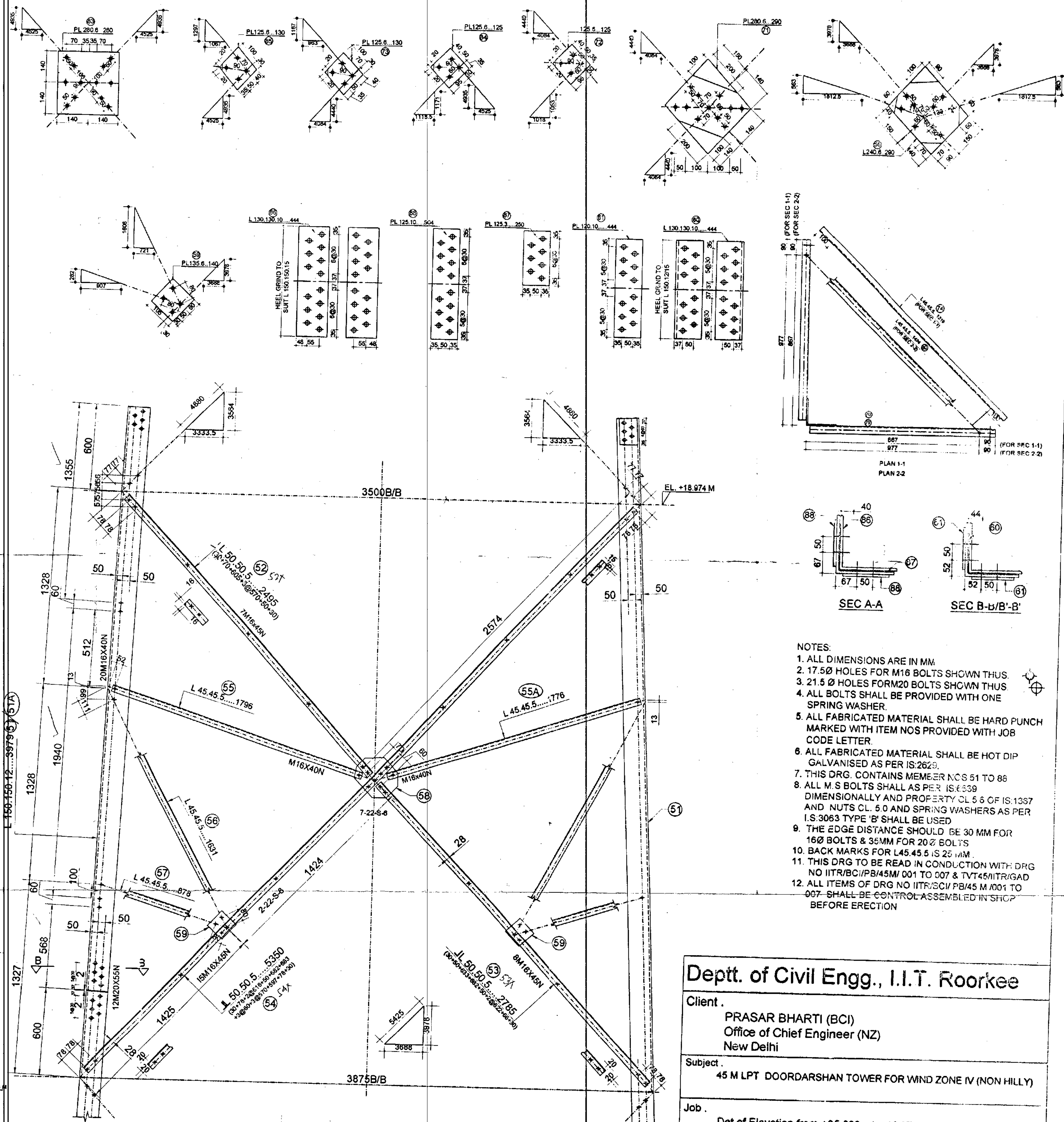
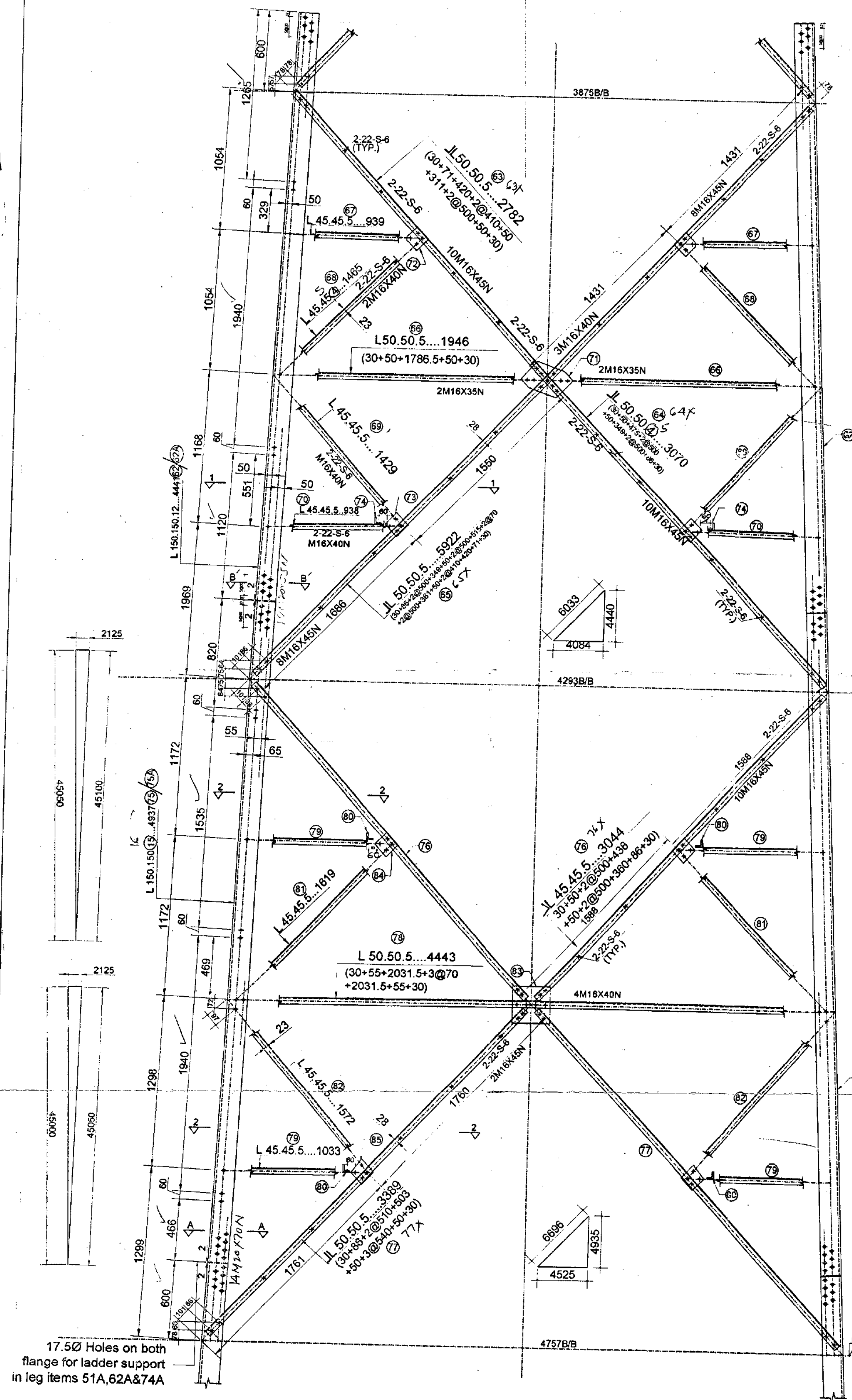
Krishan Kumar

Drg No. IITR/BCI/PB/45 M/006

DATE: 21.05.05

REV: 0





- NOTES:
1. ALL DIMENSIONS ARE IN MM.
 2. 17.50 HOLES FOR M16 BOLTS SHOWN THUS
 3. 21.5 HOLES FORM20 BOLTS SHOWN THUS
 4. ALL BOLTS SHALL BE PROVIDED WITH ONE SPRING WASHER.
 5. ALL FABRICATED MATERIAL SHALL BE HARD PUNCH MARKED WITH ITEM NOS PROVIDED WITH JOB CODE LETTER.
 6. ALL FABRICATED MATERIAL SHALL BE HOT DIP GALVANISED AS PER IS:2623.
 7. THIS DRG. CONTAINS MEMBER NOS 51 TO 86
 8. ALL M.S BOLTS SHALL AS PER IS:4329 DIMENSIONALLY AND PROPERTY CL 5.8 OF IS:1337 AND NUTS CL 5.0 AND SPRING WASHERS AS PER IS:3063 TYPE 'B' SHALL BE USED
 9. THE EDGE DISTANCE SHOULD BE 30 MM FOR 16Ø BOLTS & 35MM FOR 20 Ø BOLTS
 10. BACK MARKS FOR L45.45.5 IS 25 MM
 11. THIS DRG TO BE READ IN CONDUCTION WITH DRG NO IITR/BCI/PB/45M/001 TO 007 & VIT45M/ITR/GAD
 12. ALL ITEMS OF DRG NO IITR/BCI/PB/45 M/001 TO 007 SHALL BE CONTROL ASSEMBLED IN SHOP BEFORE ERECTION

Deptt. of Civil Engg., I.I.T. Roorkee

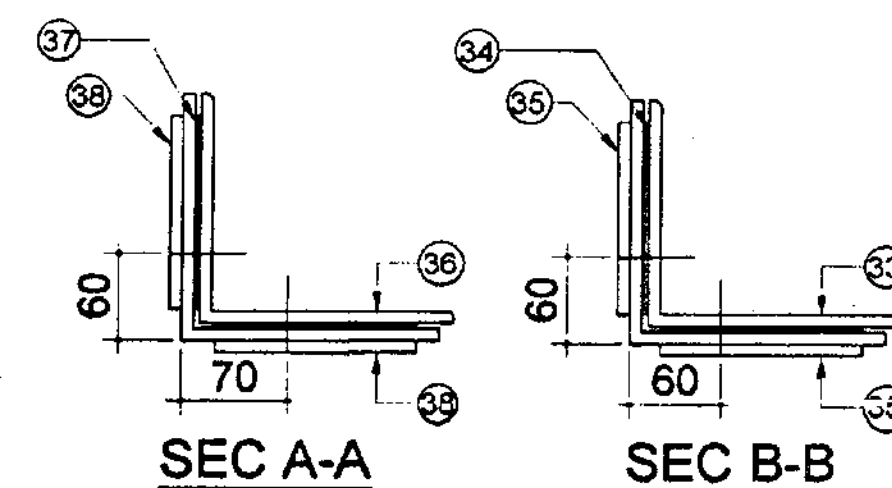
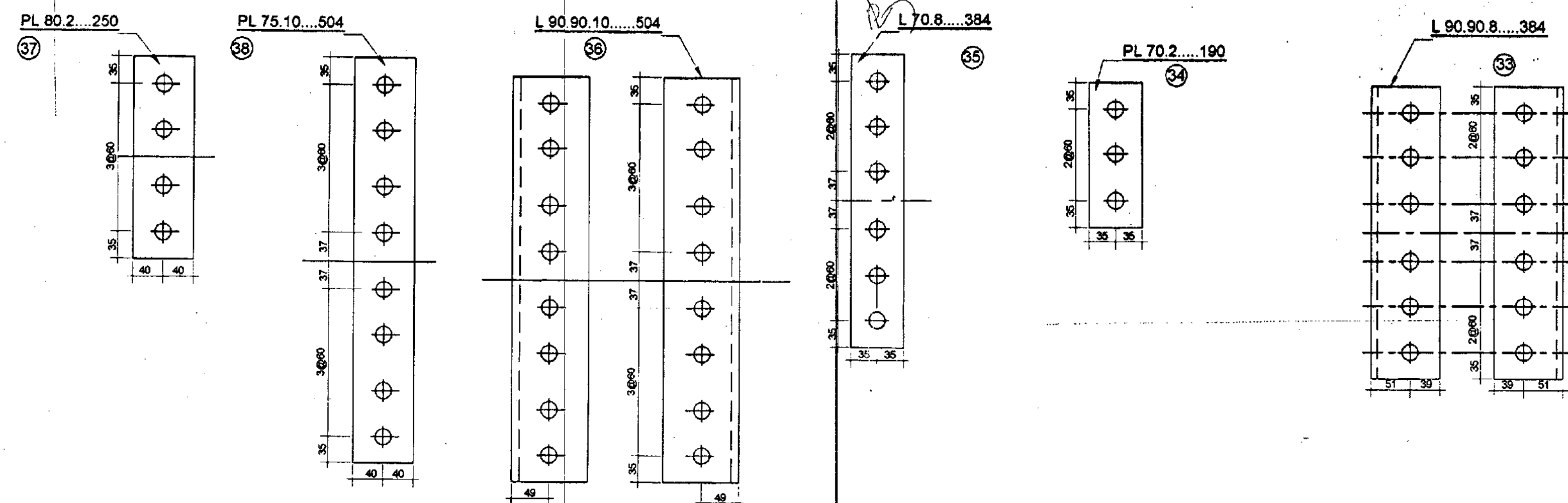
Client .
PRASAR BHARTI (BCI)
Office of Chief Engineer (NZ)
New Delhi

Subject .
45 M LPT DOORDARSHAN TOWER FOR WIND ZONE IV (NON HILLY)

Job .
Det of Elevation from +05.638m to+18.974m

Designed & Checked by
Akhil Upadhayay Krishan Kumar
SCALE:- 1:15,1:10,1:5
Drp No.IITR/BCI/PB/45M/004
DATE: 21.05.05 REV: 0

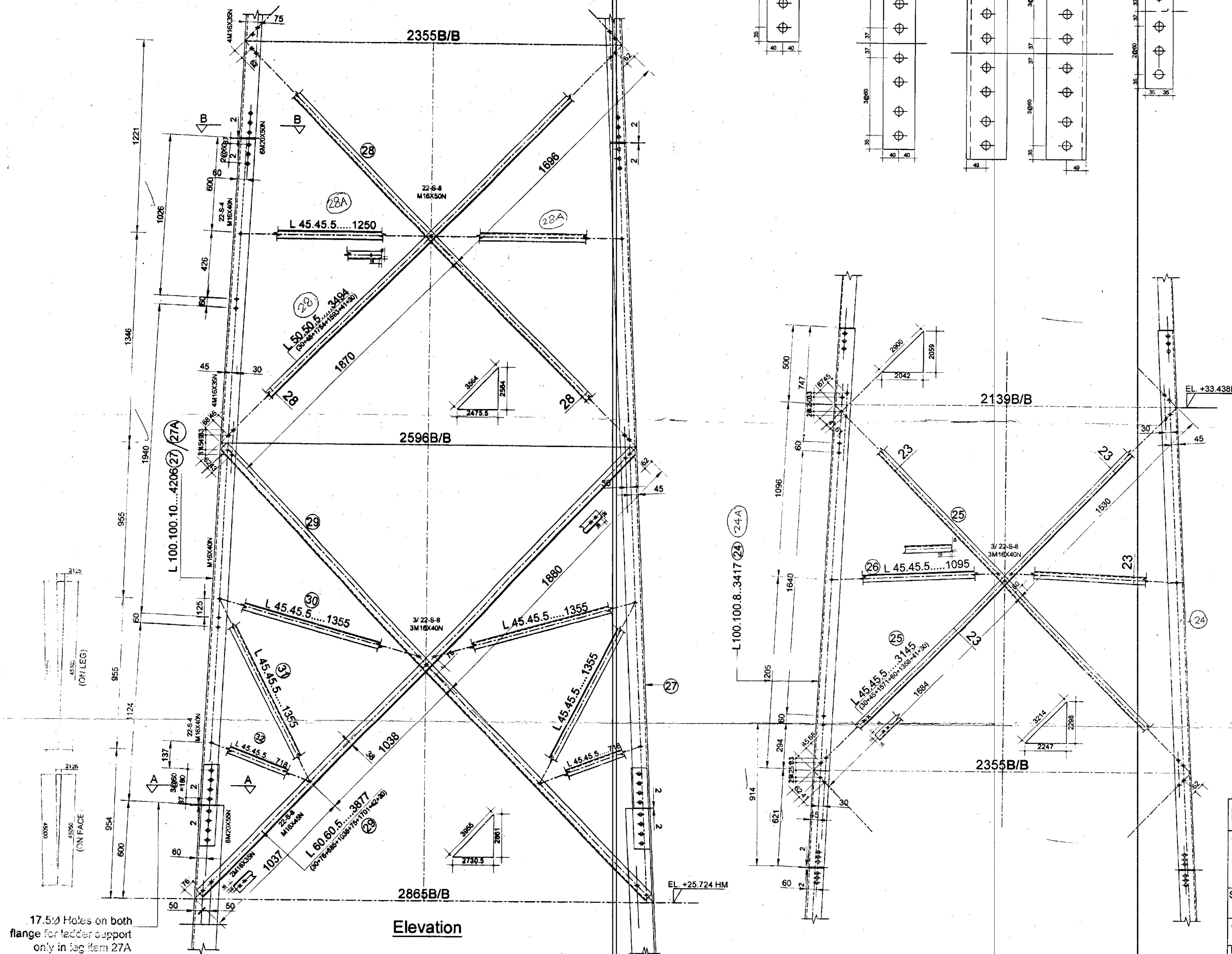
ELEVATION



- NOTES:
1. ALL DIMENSIONS ARE IN MM
 2. 17.5Ø HOLES FOR M16 BOLTS SHOWN THUS.
 3. 21.5 Ø HOLES FOR M 20 BOLTS SHOWN THUS.
 4. ALL BOLTS SHALL BE PROVIDED WITH ONE SPRING WASHER.
 5. ALL FABRICATED MATERIAL SHALL BE HARD PUNCH MARKED WITH ITEM NO PREFIXED WITH JOB CODE LETTER.
 6. ALL FABRICATED MATERIAL SHALL BE HOT DIP GALVANIZED AS PER IS:2629.
 7. THIS DR. CONTAINS ITEM NO 24 TO 38.
 8. ALL MS. BOLTS SHALL BE AS PER IS:6639 DIMENSIONALLY AND PROPERTY CL.5.6 OF IS: 1367 AND NUTS CL. 5.0 AND SPRING WASHERS AS PER IS:3063 TYPE 'B' SHALL BE USED
 9. THE EDGE DISTANCE SHOULD BE 30 MM FOR 16Ø BOLTS & 35MM FOR 20Ø BOLTS.
 10. BACK MARKS FOR L50.50.5 AND L45.45.5 SHALL BE 28MM AND 23MM
 11. THIS DRG TO BE READ IN CONJUNCTION WITH DRG NO IITR/BCI/PB/45/M/001 TO 007 & TVT/45/IITR/GAD
 12. ALL ITEMS OF DRAG NO IITR/BCI/PB/45 M/001 TO 007 SHALL BE CONTROL ASSEMBLED IN SHOP BEFORE ERECTION

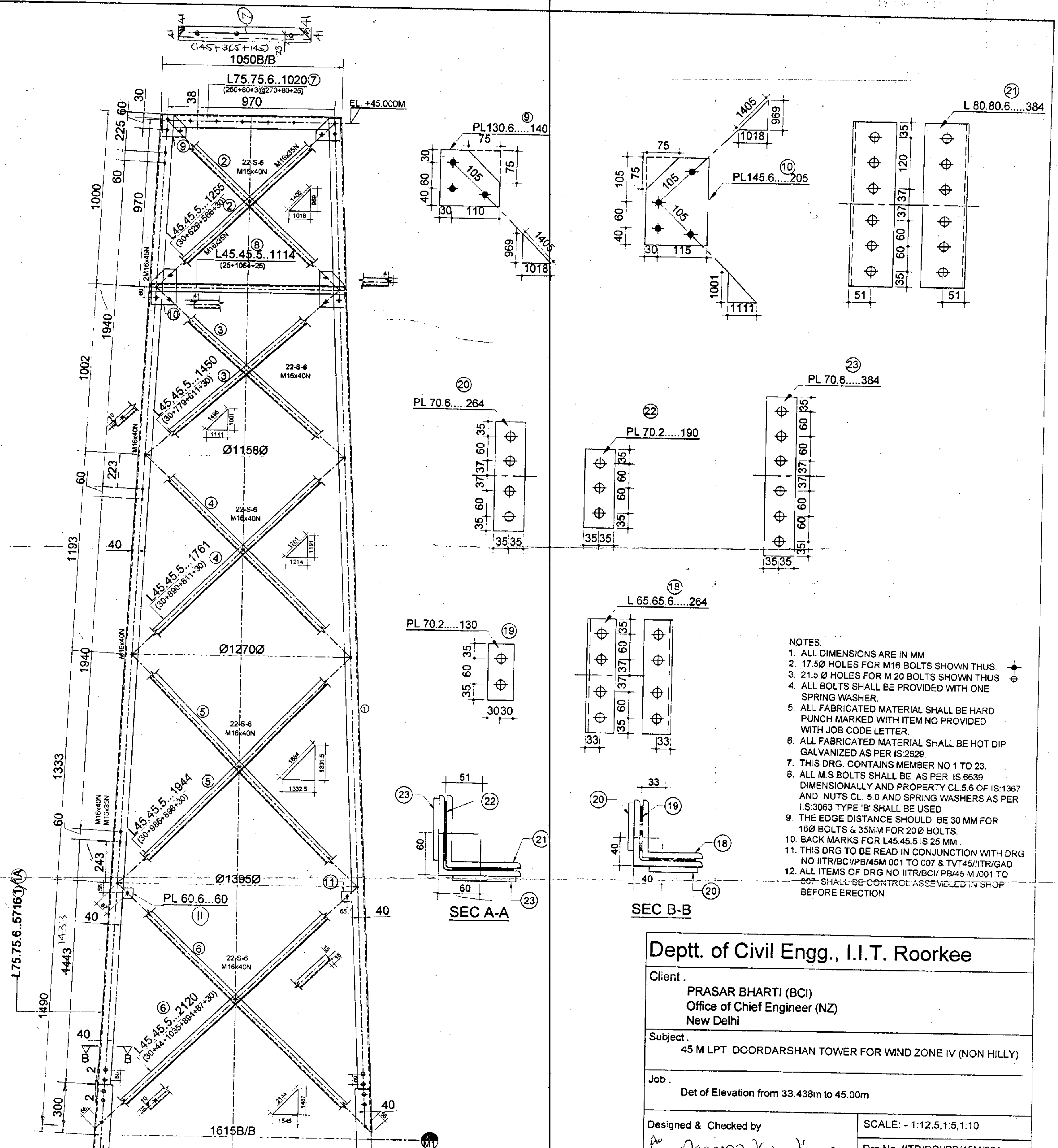
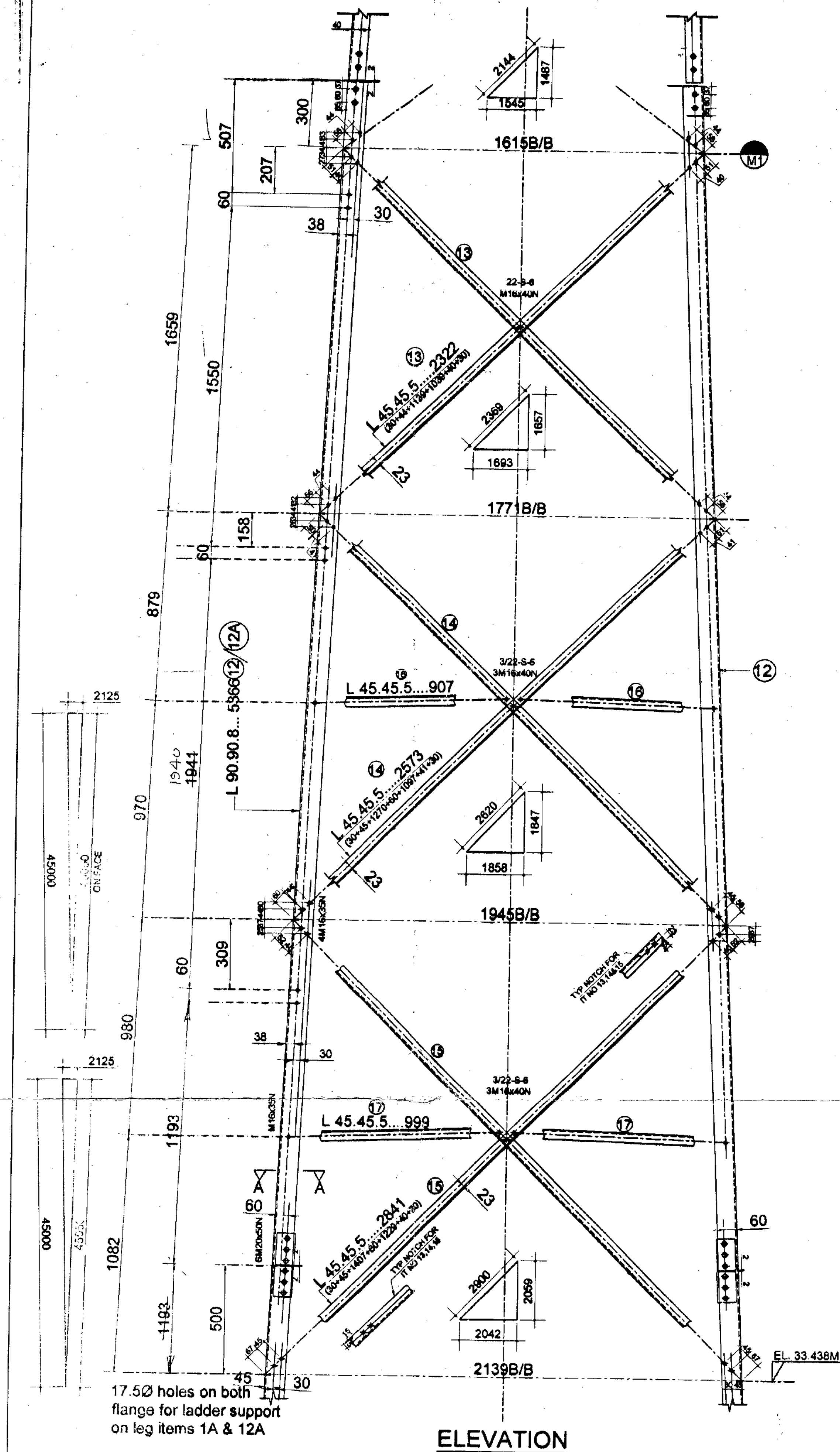
Deptt. of Civil Engg., I.I.T. Roorkee

Client. PRASAR BHARTI (BCI) Office of Chief Engineer (NZ) New Delhi	
Subject. 45 M LPT DOORDAF SHAN TOWER FOR WIND ZONE IV (NON HILLY)	
Job. Det of Elevation from 25.724m to 33.438m	
Designed & Checked by Akhil Upadhayay	SCALE:- 1:12.5, 1:10
Checked by Krishan Kumar	Drg No. IITR/BCI/PB/45 M/002
DATE: 21.05.05	REV: 0



17.5Ø Holes on both flange for ladder support only in leg item 27A

Elevation



By Hand.

**PRASAR BHARATI
(BROADCASTING CORPORATION OF INDIA)
OFFICE OF THE CHIEF ENGINEER (NZ)
ALL INDIA RADIO & DOORDARSHAN**

**JAMNAGAR HOUSE
SHAHJAHAN ROAD
NEW DELHI-110 011**

No. 45M S/S Mast/LPT/1/T/3/2006-CTV

Dated: 08/06/2007

The Director General, Doordarshan
(By Name Sh. Md. Kasim, DDE),
Doordarshan Bhawan, Copernicus Marg,
New Delhi

Subject: - Foundation Design for 45 Mtr. Self supporting Mast at places having soil bearing capacity of 5 Ton/Sq.mtr.

Sir,

This is with reference to DG: DD letter no. 1(1) Towers/LPT/2004/EV
Dated 16/03/2007

A copy of the foundation design and details for 45 Mtr. high self supporting Tower suitable for places having soil bearing capacity of 5 Ton/SqM duly vetted by IIT Delhi is being enclosed for kind perusal. This foundation design will be used at LPT Basti, Bahraich, and Akbarpur.

This is for kind information.

Yours faithfully

Encl:- A/A (6 Pages)

(S. A. TRIPATHI)
Deputy Director (Eng.)
for Chief Eng. (NZ)

AD(5)

Pl. keep in records

14/6

To 1(1) Power/LPT/2004/EV
filed
20/6/07
SP. A. H.

INDIAN INSTITUTE OF TECHNOLOGY, DELHI

Department of Civil Engineering



Dr. T.K. Datta FNAE
Dugesi Chair Emeritus Professor

Add : Hauz Khas, New Delhi - 110 016
Fax : 91 - 11 - 2658 1117
Phone: 2659 1184 (O), 2659 1820 (R)
Email : tkdatta@civil.iitd.ernet.in

Date: April 19, 2007

TO WHOM SOEVER IT MAY CONCERN

This is to certify that the design of Foundation for 45M High Self Supported Steel Tower has been checked and approved w.r.t. Structural Safety & Stability with adequate Factor of Safety as per IS: 456-2000 & IS: 11233-1985.

The above structure is safe & stable to carry the forces of 45M High Self Supported Tower (Max. Comp. - 707.34, Max. Tension -673.00 KN & Side Thrust -78.23 KN) on the ground suitable for Soil Bearing Capacity of 5 Ton/SqM.

With the existing loadings based on IS:875:1987 for wind analysis and IS:1893:2002 for earthquake analysis, our analysis results indicate that the existing structure in present position is safe under design loading in accordance with strength requirements of IS:875:1987 & IS:1893:2002.

The above certificate has been issued for the exclusive use for the project of PRASAR BHARATI (Broadcasting Corporation of India).

This vetting/approval are meant for the restricted use of the Client M/s PRASAR BHARATI (Broadcasting Corporation of India) and not for submission to any third party for any further authentication etc.


(Dr. T.K. DATTA)

Professor
Department of Civil Engineering
Indian Institute of Technology, Delhi
Hauz Khas, New Delhi - 110 016

DESIGN AND ANALYSIS OF FOUNDATION
FOR
45M HIGH LPT DOORDARSHAN TOWER

SPECIFICATIONS AND DESIGN VALUES

IS: 11233-1985 FOUNDATION DESIGN FOR MICROWAVE TOWER
 IS: 875 (PART-I)-1987
 IS: 875 (PART-II)-1987
 IS: 875 (PART-III)-1987
 IS: 456-2000

<u>HEIGHT OF TOWER</u>	45.00 M
Maximum Downward Force =	673.00 KN
Maximum Uplift Force =	707.34
Side Thrust	78.23 KN
Grade of Concrete	M20
Grade of Steel	FE415
Density of Concrete	25.00 KN/CUM
C/C distance of Tower Legs	5.20 M

SOIL PARAMETERS FROM SOIL INVESTIGATION REPORT

Safe Bearing Capacity of Soil	5.00 T/SQM
OR	49.05 KN SQM
Water Table : Not Encountered upto 10M from NGL	
Angle of repose	20 Degree
Dry Density of Soil	16 KN/CUM
Assumed Data	
Side of Base Slab	8.50 M
Depth of Base Slab	0.45 M
Height of Foundation above Ground Level	0.30 M
Height of Foundation below Ground Level	3.00 M
Side of Column	0.90 M
Width of Lower Beam	0.45 M
Depth of Lower Beam	0.75 M
No. of Legs of Tower	4 NOS.

CALCULATION FOR WEIGHT OF SOIL

Height of Frustum	2.25 M
Side of Soil Frustum at Top	10.14 M
Area of Base Slab, A1	72.25 SQM
Area of Soil Frustum, A2	102.78 SQM
Volume of Dry Soil	200.44 CUM
Weight of Soil	3,207.01 KN

CALCULATION FOR WEIGHT OF CONCRETE

Volume of Column	1.82 CUM
Volume of Slab	32.51 CUM
Volume of Beam	2.97 CUM
Volume of Concrete in Soil (Except Slab)	43.13 KN
Weight of Concrete in Soil	335.75 KN
Total weight of Soil and Concrete	3542.75 KN

CHECK FOR SLIDING

Pressure Due to Dry Soil

$$p = wxhx(1 + \sin \phi) / (1 - \sin \phi)$$

At 2.55M Level, p_1

83.22 KN/SQM

At 3.0M Level, p_2

97.90 KN/SQM

F1

190.98 KN

F2

187.24 KN

Total Resisting Force

1263.90 KN

F.O.S. Against Sliding

4.04 > 2

HENCE SAFE**CHECK FOR OVERTURNING**

Volume of Concrete in Dry Soil (Except Slab)

43.13 KN

Total Weight of Soil & Concrete

3,542.75 KN

Resisting Moment Due to Soil Pressure

$$M = F \times \text{Lever Arm, } M1 =$$

315.12 KNM

$$M2 =$$

653.15 KNM

Moment Due to Soil & Concrete

15,056.69 KNM

Total Resisting Moment

16,024.97 KNM

Overturning Moment

516.32 KNM

6,012.39 KNM

F.O.S. against Overturning

2.45 > 2

HENCE SAFE**CHECK FOR BEARING PRESSURE**

Maximum Downward Force =

673.00 KN

Maximum Uplift Force =

707.34 KN

Self Weight of Column

45.56 KN

Self Weight of Beam

74.25 KN

Selfweight of Beam & Columns /M Length

14.10 KN/M

Equivalent Load at Center of Slab

792.81 KN

Equivalent Moment at Center of Slab

3,568.94 KNM

Direct Stress

21.95 KN/SQM

Bending Stress

$$Mx/z =$$

34.87 KN/SQM

$$My/z =$$

34.87 KN/SQM

Maximum Net Pressure on Soil

91.68 KN/SQM

Minimum Net Pressure on Soil

(47.79) KN/SQM

Pressure on Soil due to Raft Slab

9.29 KN/SQM

Gross Allowable Bearing Capacity of Soil at 3M D

97.05 KN/SQM

Safe Bearing Capacity of Soil with wind effect

121.31 KN/SQM

HENCE SAFE**DESIGN OF SLAB**

Cantilever Distance

1.20

Maximum Factored Bending Moment at

Cantilever portion

99.02 KNM

 M_u/bdd

0.70

 p_t

0.20

 A_{st}

761.25 SQMM

PROVIDE 12MM DIA TOR @ 150 MM C/C BOTHWAYS AT TOP AND BOTTOM**DESIGN OF FOUNDATION BEAM (SIZE 450X750)**

Maximum Design Pressure

158.35

Factored MAX. B.M.	479.51 KNM
Mu/bdd	2.25 N/SQMM
pt	0.74
Ast	1,917.34 SQMM
PROVIDE 20MM DIA TOR 7 NOS. AT TOP	
Ast	2,198.00 SQMM
PROVIDE 20 MM DIA TOR 5 NOS. AT BOTTOM	
Ast	1,570.00 SQMM

CHECK FOR SHEAR FORCE

MAX. SHEAR FORCE	280.85 KN
Tv=Vu/bd	0.91 N/SQMM
pt	0.71
Tc	0.56 N/SQMM
	As per Table 61 of SP-16
Vc	173,250.00 N
Factored Shear Force, Vu	107.60 KN
Tv=Vu/bd	0.35 N/SQMM
	< Tcmax.(2.8 N/Sqmm)
Shear to be carried by Stirrups	
Vus=Vu-Tcbd	107.60 KN
Vus/d	1.565 KN/CM
Use 8MM Dia 4 Legged Stirrups @ 100MM C/C upto 1100MM from each support + Rest @ 150MM C/C	

DESIGN OF COLUMN/CHIMNEY

Side of Pedestal	0.90 M
Factored downward Load, Pu	1,009.50 KN
Area of Pedestal	810,000.00 SQMM
Dia. of Bars	20 MM
No. of Bars	16 NO.
Effective of Cover	50 MM
Effective of Depth	850 MM
Area of Steel Provided	5,024.00 SQMM
% of Steel	0.66 %
Pu/fck*b*D	0.06
d'/d	0.06
p/fck	0.03
Referring chart 44 of SP:16	
Mu/fckbD ²	0.07
HENCE Mux1 = Muy1	
Mux1	1,020.60 KNM
Mux	222.96
Mux/Mux1	0.22
Referring Chart 63 of SP:16	
Puz/Ag	11.50
Puz	9,315.00 KN
Pu/Puz	0.11
Referring Chart 64 of SP:16	
Muy/Muy1	0.75 > 0.218
	HENCE OK
Assume dia of Ties	8 MM

Spacing of Ties

Least of the following

Least dimension of Column

16 Times dia of Main Bars

48 Times dia of Ties

900 MM

320 MM

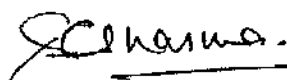
384 Say 150 MM C/C

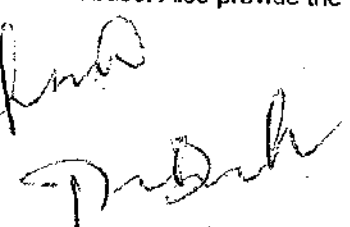
CHECK FOR TENSION AND BENDING

Tu	1,061,010.00 N
Mxu = My	176,017,500 N-MM
Tu/fckbD	0.08935
Mxu/fckbD ²	0.01353
p/fck	0.02 As per chart 79, SP-16
p	0.4 < 0.657 %

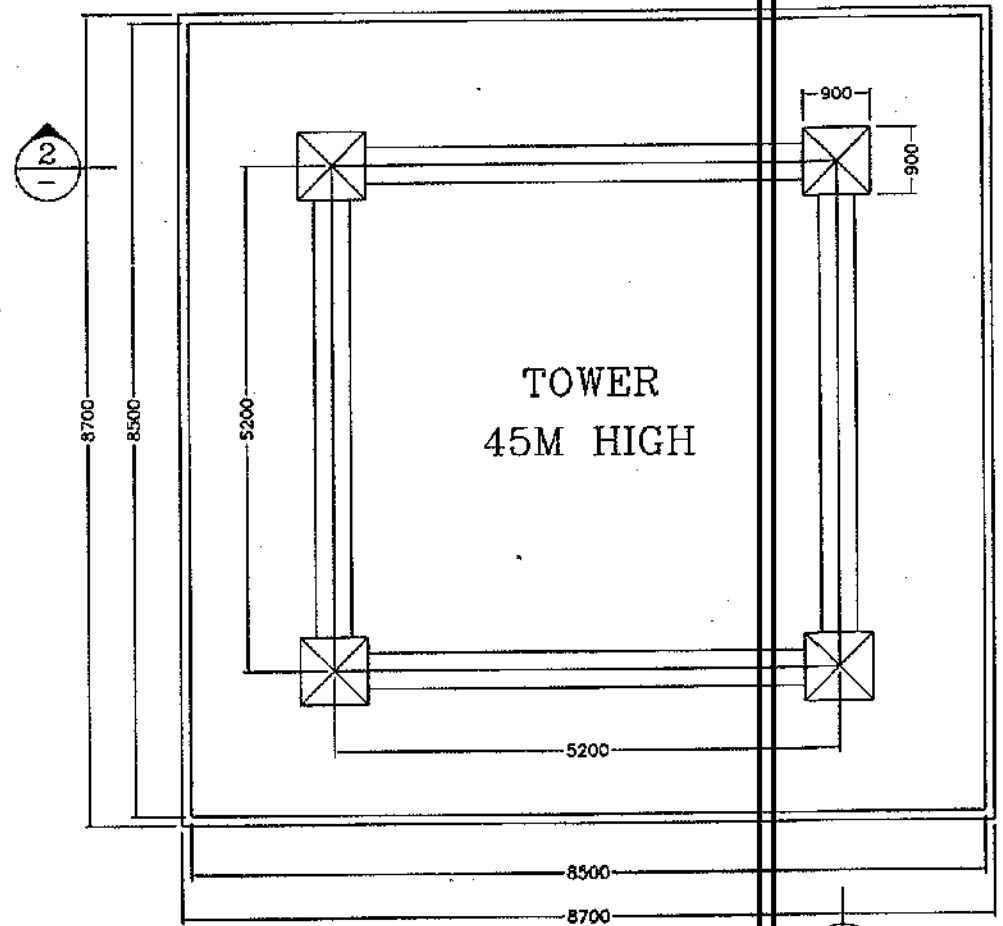
Hence safe.

So, Provide Longitudinal reinforcement as of 16 Nos. 20 mm dia at base. Also provide the Lateral reinforcement (ties) as 8 dia @ 150 mm C/C

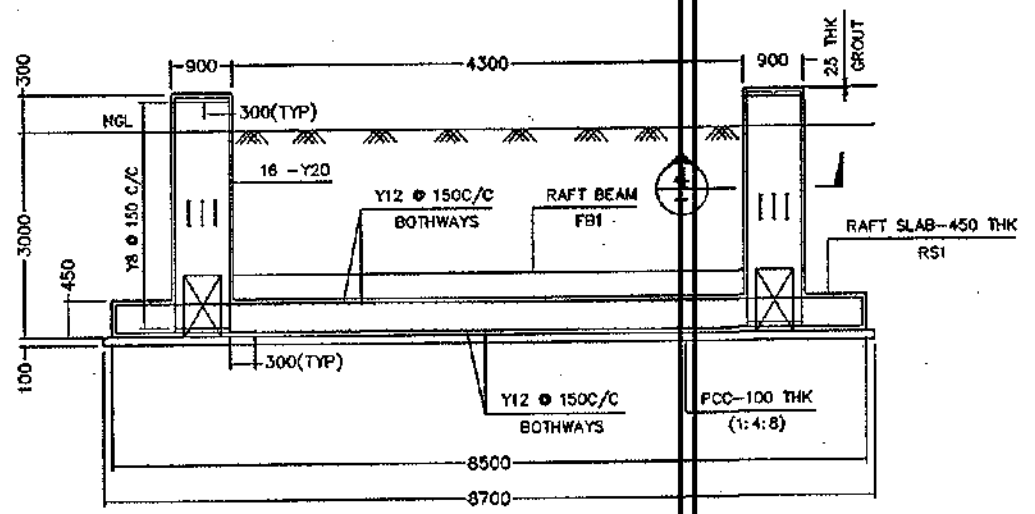

 Setendra Kumar Sharma
 Consulting Engineer-AFM-35
 SMS Engineering Consultants
 21F, SFS Flats, Sector-8
 Jasola Vihar, New Delhi-110 025
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 Professor
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 Hauz Khas, New Delhi-110 016

SMS/PB_BCI/07-08/CW-001

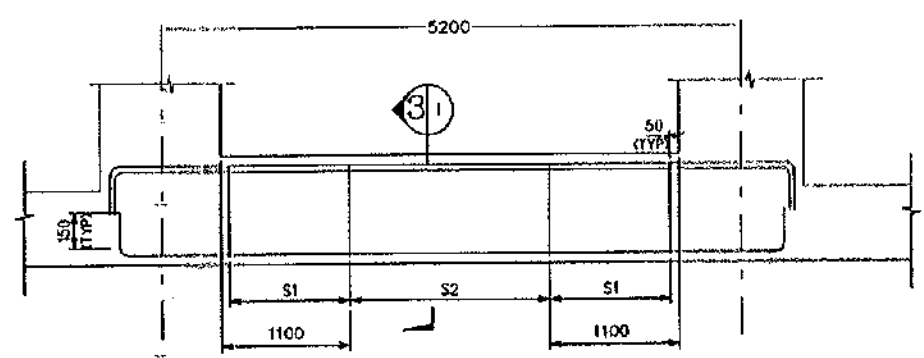


FOUNDATION PLAN



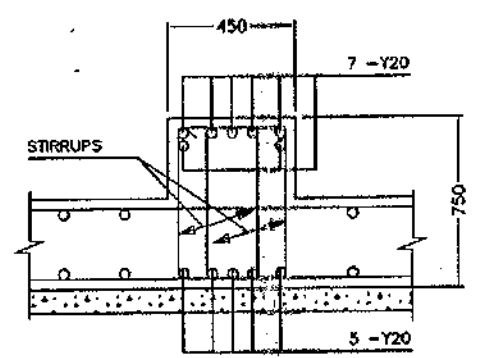
SECTION 2

(BEAM REINFORCEMENT NOT SHOWN FOR CLARITY)



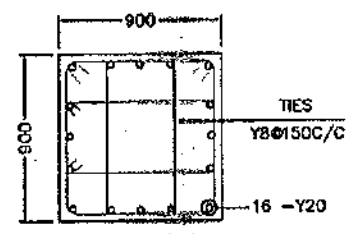
SECTION 1

(SLAB REINFORCEMENT NOT SHOWN FOR CLARITY)



SECTION 3

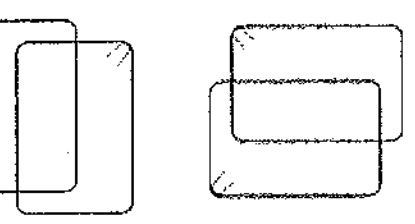
STIRRUP DETAILS
S1: -4 LEGGED Ø 100 C/C
S2: -4 LEGGED Ø 150 C/C



SECTION 4

COLUMN 900X900

Satendra Kumar Sharma
Satendra Kumar Sharma
Consulting Engineer-AFM-35
SMS Engineering Consultants
21F, SFS Plaza, Sector-8
Jasola Vihar, New Delhi-110 025
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Professor
Department of Civil Engineering
Indian Institute of Technology, Delhi
New Delhi, New Delhi-110 016

NOTES

1. ALL DIMENSIONS ARE IN MM UNLESS NOTED OTHERWISE.
2. USE M20 GRADE CONCRETE AND Fe 415 GRADE FOR STEEL.
3. CLEAR COVER TO MAIN REINFORCEMENT:-
(a) 15MM FOR SLAB (b) 25MM FOR BEAMS
(c) 40MM FOR COLUMNS (d) 50MM AT ENDS
4. PRIOR TO AND DURING CONCRETING ALL BOLTS SHALL BE SECURELY HELD IN POSITION BY USE OF TEMPLATE.
5. GROUT -USE NON SHRINK GROUT OF FOSROC CONCREXTRA GP1 OR EQUIVALENT UNDER THE MAIN LEG MEMBERS OF TOWER.
6. CONCRETE SHALL BE MECHANICALLY MIXED & VIBRATED.
7. SPLICING OF BARS SHALL NOT BE MORE THAN 50% AT ANY LOCATION.
8. PROPER CURING OF CONCRETE SHALL BE DONE.
9. BENDING OF BARS SHALL BE AS PER IS: 2502.
10. ANY DISCREPANCY SHOULD BE BROUGHT TO THE CONSULTANT'S ATTENTION.

GENERAL DETAILS

S.No	DESCRIPTION	DETAILS
1	SOIL BEARING CAPACITY	5.0 T/SQM

BILL OF MATERIALS

S.NO.	ITEM	UNIT	TOTAL
1.	EXCAVATION	CUM	234.64
2.	PCC-(1:4:8)	CUM	7.57
3.	RCC-M20	CUM	44.07
4.	STEEL-Fe415	KG	3557.27

BAR BENDING SCHEDULE

ITEM	POSITION	TYPE	A (MM)	B (MM)	C (MM)	LENGTH (MM)	NOS	DIA. (MM)	U.WT (KG)	WEIGHT (KG)
RS1	TOP	A	8400	150	150	8700	114	12	0.89	882.70
	BOTTOM	B	8400	150	150	8700	114	12	0.89	882.70
FB1	TOP	A	6000	150	150	6300	28	20	2.47	435.71
	BOTTOM	B	6000	150	150	6300	20	20	2.47	311.22
COL	STPS	C	270	700		2100	304	8	0.89	248.98
	MAIN	F	3175	300	300	3776	64	20	2.47	596.91
COL	TIES	D	550	820		2900	176	8	0.39	199.06
TOTAL WT.										3557.27

REVISION NOTES

REV. NO.	DESCRIPTION	DATE	SIGN.
DRAWN	CHECKED	APPROVED	DATE
SAHJEEV SHARMA	S. K. SHARMA	<i>S. K. Sharma</i>	16/04/07

SMS ENGINEERING CONSULTANTS
21F, SFS PLAZA, SECTOR-8, JASOLA VIHAR, NEW DELHI-110025
Tel: +91-11-26971807, Fax: +91-11-26971807
Email: sms@smsengg.com, www.smsengg.com

CLIENT: PRASAR BHARATI
(BROADCASTING CORPORATION OF INDIA)
OFFICE OF THE CHIEF ENGINEER (R&E), ALL INDIA RADIO & DOOR-TO-DOOR
JANAKI HOUSE, SHALIMAR ROAD, NEW DELHI-110011

DRAWING TITLE: FOUNDATION DETAILS
FOR 45M HIGH SELF SUPPORTED TOWER

SMS	DRAWING No.	SH. NO.	REV.
	SMS/PB_BCI/07-08/CW-001	01	00

PRASAR BHARATI
(Broadcasting Corporation of India)
Office of the Chief Engineer(NZ)
Akashvani & Doordarshan

Jamnagar House, Shahjahan Road
New Delhi - 110 011

131-132

S.No 22(R) / P-131-132/Coop.

No.45M S/S Mast/LPT/1/T/3/2006-CTV

Dated: 2.3.2007

✓ The Director General,
(By name: Shri S.K. Sharma, DE),
All India Radio,
Akashvani Bhavan,
Parliament Street,
New Delhi-110 001.

Subject: SITC of 45 Mtr. Mast at LPT Basti, Bahraich, Akbarpur & Pathankot.

Sir,

You are kindly aware that 1+1 Auto Mode LPTs are being installed at above locations. As per the sanction 45Mtr. S/S Tower are to be provided at these sites for installing new antennas. The status of soil bearing capacity at these LPTs is given below:-

1. LPT Pathankot:- As per the test report "filled up soil is observed upto 10 Mtr. depth so foundation is not recommended". In view of this it is proposed to install 45 Mtr. Guyed Mast at LPT Pathankot to install the antenna. The proposal may please be approved.
2. The result of soil ^{bearing} capacity at following LPT is tabulated below.

	Name	Depth in Mtrs.	Soil Bearing Capacity In T/M2
A	LPT Basti	3X3	5
B	LPT Bahraich	3X3	6
C	LPT Akbarpur	3X3	5.25

The foundation design approved by the Directorate is for soil bearing capacity of 8.2T/M². Hence this design is not suitable for above locations as per the test report of the soil bearing capacity. In order to install 45 Mtr. S/S Tower, foundation is to be designed as per the soil bearing capacity of 5T/M². This foundation will be raft foundation & isolated footing foundation is not recommended for above soil bearing capacity.

It is proposed that approval for designing the foundation suitable for 5 T/M² soil bearing capacity may be accorded. The design will be duly vetted by IIT. It is requested that the proposals may kindly be approved for taking further action in the matter, the photocopy of the reports of all the 4 LPTs is enclosed for your kind perusal. The raft foundation is likely to be costlier than the isolated footing foundation.

Yours faithfully,

(N.K. GUPTA)

Director Engineering
For Chief Engineer(NZ)

13/10/07

13/3/07 pl. examine

SSB
613

DD(MK)

AD(S)

on file for

h
12/3

20 Aug 10
1(1) LPT/Towers

13/10/07

S.K. A.K



131-132
Report

**REPORT ON
SOIL INVESTIGATION
FOR THE FOUNDATIONS OF PROPOSED
SELF SUPPORTING TOWER
AT
DOORDARSHAN MAINTAINANCE CENTRE,
PATHANKOT
IN PUNJAB.**

**SUBMITTED TO
M/s GENERAL MERCANTILE INDUSTRIES
6/6, SHANTI NIKETAN
NEW DELHI**

**STRUCTURAL CONSULTANT
M/s SMS ENGINEERING CONSULTANTS
NEW DELHI**

**SOIL CONSULTANT
SANGUINE CONSULTANTS
RZ-456/13, 3rd FLOOR, TUGHLAKABAD EXTENSION,
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9.	SIEVE ANALYSIS CURVE (FIG.- 01)	09



1.0 INTRODUCTION

PRASAR BHARTI is planning to install a LPT Self supporting tower at Doordarshan Maintainance Centre, Pathankot in Punjab. For a detailed design & engineering of proposed tower, the work of sub-soil investigation has been awarded to M/s Sanguine Consultants, New Delhi, The Structural consultant of entire project is M/s SMS Engineering Consultants, New Delhi.

The report presents the compiled data of test results of geotechnical investigation. The observed data of field investigations and laboratory tests are presented and uses to access the nature of subsoil strata and to evaluate the soil parameters required for the detailed design and engineering of proposed micro-wave tower.

SITE

The site is located at Doordarshan Maintainance Centre, Pathankot in Punjab & is developed, levelled and drained. The informations & recommendations are given with respect to existing ground level at particular points rather than the reference level.



2.0 SCOPE OF WORK

In order to establish the sub-soil characteristics at the area marked for installation of self supporting tower, the entire investigation program had been divided into field and laboratory tests leading to preparation of comprehensive report on the recommendations of foundation.

As mentioned within the framework of this job contract, the field investigations comprised of the following :-

- a) Boring of one borehole of 150mm dia. upto the depth of 10m or refusal whichever encountered earlier.
- b) Collection of representative disturbed and undisturbed soil samples, 100mm in diameter, from the exploratory bore holes for detailed laboratory analysis.
- c) Carrying out standard penetration tests as per IS:2131 - 1981 in each bore hole and subsequently preparation of penetration charts depth-wise for each bore hole.

The laboratory tests part of this job contract comprised of the following:-

- i) Grain size analysis
- ii) Liquid limit & plastic limit.
- iii) Specific gravity
- iv) Natural moisture content
- ix) Bulk density & dry density
- x) Direct shear test
- vi) Triaxial shear tests in unconsolidated undrained condition



3.0 FIELD INVESTIGATION METHODOLOGY

3.1 DRILLING OF BOREHOLE

Borehole of 150mm diameter was drilled by using auger method upto the depth of 10.0m as per IS:1892 at proposed site location. The details of the soil type, type of sample collected and SPT 'N'-value are shown in Table-01.

3.2 COLLECTION OF UNDISTURBED SOIL SAMPLES

Undisturbed soil samples have been collected from each boreholes at interval of 3.0m in thin wall sampling tubes of 45cm long with area ratio less than of 10%. All undisturbed soil samples were collected by open drive tube sampler as per IS:2132 and the tube so recovered with samples, after removal of loose disturbed soil, were sealed by wax from both end to protect against the loss of moisture. After sealing, the sampling tubes were marked for testing of sample for various parameters.

3.3 STANDARD PENETRAION TEST

Standard Penetration tests have been conducted as per IS:2131 in the borehole at interval of 1.50m or at the change of strata, whichever encountered earlier. The penetration resistance (SPT) is expressed as number of blows required for 30 cm. On a rigid steel head and standard "A" rod attachment. Also seating number of blows of 150mm were recorded before recording actual SPT 'N' for 30 cm penetration. On removal of sampler, the soil entrapped in the sampler is taken out and the representative disturbed soil sample is preserved in polythene bags to avoid any loss of fines and marked for identification.



4.0 LABORATORY TESTING

1. The laboratory test was carried out after the completion of field work & sufficient number of samples have reached the laboratory.
2. All samples brought from field, whether disturbed or undisturbed was extracted/prepared and examined by competent technical personnel, and the test was carried out as per the procedures laid out in the latest edition of the relevant I.S. Codes.

The following laboratory test has been carried out

- i) Grain size analysis
- ii) Liquid limit & plastic limit.
- iii) Specific gravity
- iv) Natural moisture content
- vii) Bulk density & dry density
- viii) Drained direct shear test

All the above tests were conducted as per the provisions laid down in the relevant IS Code of practice. The test results for all the samples tested have been tabulated in proper format as shown in Table No.01.



5.0 LITHOLOGY

One borehole, drilled down to a depth of 10.0m reveals that the entire stratum consists of two Lithounits (layesr), namely Lithounit-X and Lithounit-Y.

LITHOUNIT-X

Lithounit-X is filled up soil (sandy silt with brick pieces) starting from GL to 6.0m depth of boring.

LITHOUNIT-Y

Lithounit-Y is light brown filled up soil (silty sand with brick pieces) starting from 6.0m to the depth of boring.

6.0 FOUNDATION ANALYSIS AND DISCUSSIONS

One borehole drilled down to a depth of 10.0m and disturbed/ undisturbed soil samples have been collected for laboratory testing. Standard Penetration Tests have been carried out as per I.S. standard. On the field investigation data, it is found that soil is loose to medium dense in nature..

6.1 GENERAL

A suitable foundation for any structure should satisfy two basic criteria. Firstly, the soils should have adequate shear strength to support the superimposed loads so that there is an adequate safety factors against the bearing capacity. Secondly, the settlement of the soils should be within the tolerable limits for the structure. The net allowable bearing pressure on the foundations should be taken as the lower of the two values obtained from these two criteria.



6.2 FOUNDATIONS TYPE

In general, light to medium loaded structure may bear an open shallow footings. Heavily loaded structure may bear on raft foundation.

6.3 ALTERNATIVE FOUNDATION SCHEMES

Considering the filled up strata up to depth of boring, no foundation is recommended.



7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on field and laboratory investigations, following recommendations can be made :

1. As per field data & lab. results, the entire stratum consists of two Lithounits (layers). Detail is shown in article 5.0.
2. Based upon SPT value & density, the soil strata is found loose to medium dense in nature.
3. Since filled up soil is observed up to 10m depth, so foundation can not be recommended.
4. Furthe soil investigation of deeper borehole is recommended for any foundation scheme.
5. Water level was not encountered during the field investigation.

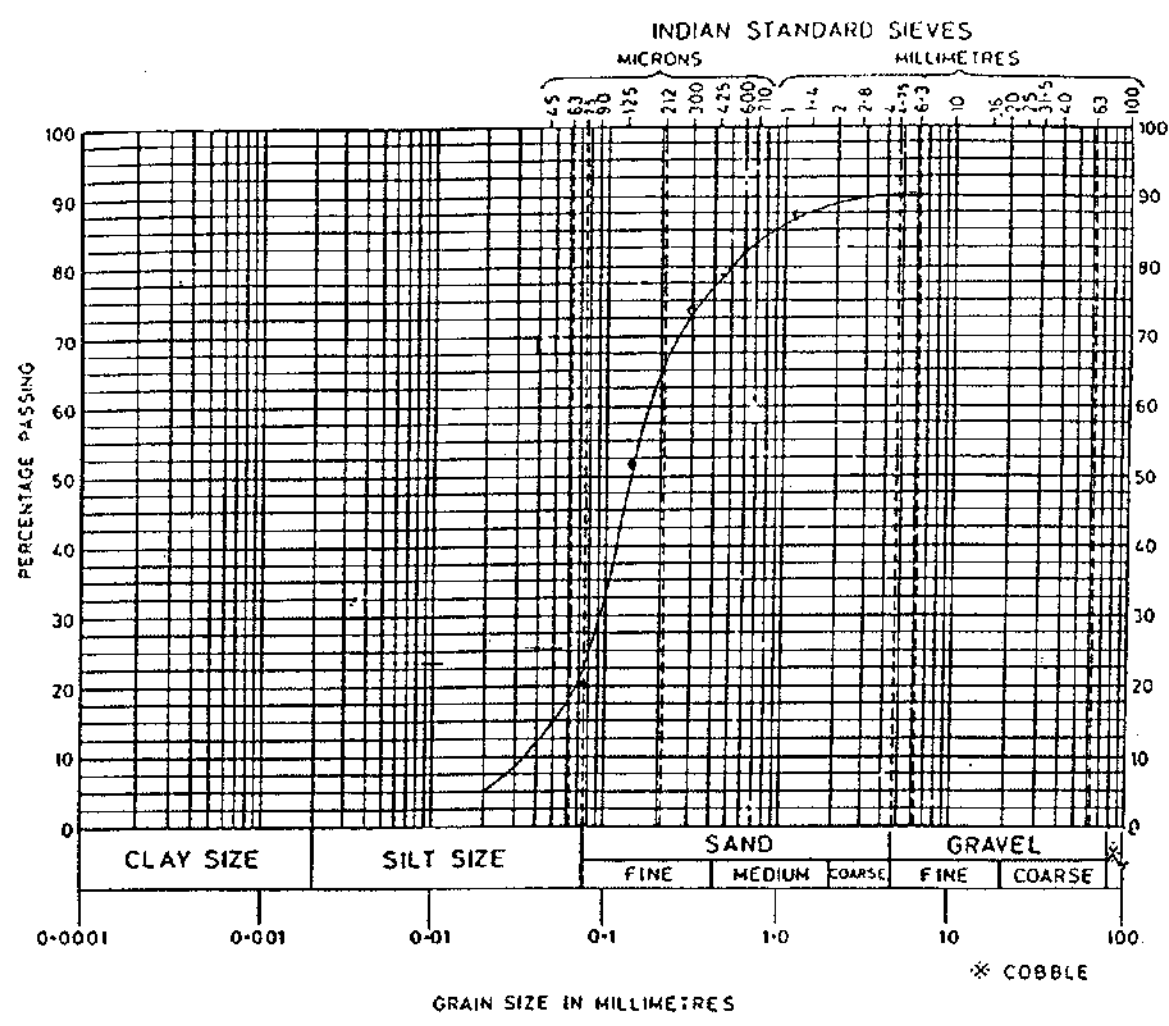
For SANGUINE CONSULTANTS

M.K.SINGH.

M.E.(Geotech)



IS : 2720 (Part 4) - 1985



LOCATION	DEPTH mm	SYMBOL	CLASSIFICATION	GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	C_u	C_c
PATHAN ROT	8.5	●—●	SM	10	70	20	0		
		X—X							
		▲—▲							

FIG. NO: 01

GRAIN SIZE ANALYSIS

-09 38-



**REPORT ON
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IN U.P.**

**SUBMITTED TO
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6/6, SHANTI NIKETAN
NEW DELHI**

**STRUCTURAL CONSULTANT
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9.	SIEVE ANALYSIS CURVE (FIG.- 01)	10
10.	SHEAR CURVE (FIG.- 02)	11



1.0 INTRODUCTION

PRASAR BHARTI is planning to install a LPT Self supporting tower at Doordarshan Maintenance Centre, Basti in U.P. For a detailed design & engineering of proposed tower, the work of sub-soil investigation has been awarded to M/s Sanguine Consultants, New Delhi; The Structural consultant of entire project is M/s SMS Engineering Consultants, New Delhi.

The report presents the compiled data of test results of geotechnical investigation. The observed data of field investigations and laboratory tests are presented and uses to access the nature of subsoil strata and to evaluate the soil parameters required for the detailed design and engineering of proposed micro-wave tower.

SITE

The site is located at Doordarshan Maintenance Centre, Basti in U.P. & is developed, levelled and drained. The informations & recommendations are given with respect to existing ground level at particular points rather than the reference level.



2.0 SCOPE OF WORK

In order to establish the sub-soil characteristics at the area marked for installation of self supporting tower, the entire investigation program had been divided into field and laboratory tests leading to preparation of comprehensive report on the recommendations of foundation.

As mentioned within the framework of this job contract, the field investigations comprised of the following :-

- a) Boring of one borehole of 150mm dia. upto the depth of 10m or refusal whichever encountered earlier.
- b) Collection of representative disturbed and undisturbed soil samples, 100mm in diameter, from the exploratory bore holes for detailed laboratory analysis.
- c) Carrying out standard penetration tests as per IS:2131 - 1981 in each bore hole and subsequently preparation of penetration charts depth-wise for each bore hole.

The laboratory tests part of this job contract comprised of the following:-

- i) Grain size analysis
- ii) Liquid limit & plastic limit.
- iii) Specific gravity
- iv) Natural moisture content
- v) Bulk density & dry density
- vi) Direct shear test
- vii) Triaxial shear tests in unconsolidated undrained condition



3.0 FIELD INVESTIGATION METHODOLOGY

3.1 DRILLING OF BOREHOLE

Borehole of 150mm diameter was drilled by using shell and auger method upto the depth of 10.0m as per IS:1892 at proposed site location. The details of the soil type, type of sample collected and SPT 'N'-value are shown in Table-01.

3.2 COLLECTION OF UNDISTURBED SOIL SAMPLES

Undisturbed soil samples have been collected from each boreholes at interval of 3.0m in thin wall sampling tubes of 45cm long with area ratio less than of 10%. All undisturbed soil samples were collected by open drive tube sampler as per IS:2132 and the tube so recovered with samples, after removal of loose disturbed soil, were sealed by wax from both end to protect against the loss of moisture. After sealing, the sampling tubes were marked for testing of sample for various parameters.

3.3 STANDARD PENETRAION TEST

Standard Penetration tests have been conducted as per IS:2131 in the borehole at interval of 1.50m or at the change of strata, whichever encountered earlier. The penetration resistance (SPT) is expressed as number of blows required for 30 cm. On a rigid steel head and standard "A" rod attachment. Also seating number of blows of 150mm were recorded before recording actual SPT 'N' for 30 cm penetration. On removal of sampler, the soil entrapped in the sampler is taken out and the representative disturbed soil sample is preserved in polythene bags to avoid any loss of fines and marked for identification.



4.0 LABORATORY TESTING

1. The laboratory test was carried out after the completion of field work & sufficient number of samples have reached the laboratory.
2. All samples brought from field, whether disturbed or undisturbed was extracted/prepared and examined by competent technical personnel, and the test was carried out as per the procedures laid out in the latest edition of the relevant I.S. Codes.

The following laboratory test has been carried out

- i) Grain size analysis
- ii) Liquid limit & plastic limit.
- iii) Specific gravity
- iv) Natural moisture content
- v) Bulk density & dry density
- vi) Triaxial shear tests in unconsolidated undrained condition
- vii) Consolidation test

All the above tests were conducted as per the provisions laid down in the relevant IS Code of practice. The test results for all the samples tested have been tabulated in proper format as shown in Table No.01.



5.0 LITHOLOGY

One borehole, drilled down to a depth of 10.0m reveals that the entire stratum consists of two Lithounits (layesr), namely Lithounit-X and Lithounit-Y.

LITHOUNIT-X

Lithounit-X is light brown clayey silt with/without gravels starting from GL to 2.80m and from 5.0m to 10m depth of boring. Atterbergs' limit shows that this lithounit is MI indicating medium-plastic in nature. Standard penetration test conducted in the boreholes indicate that the strata is stiff to very stiff in nature. Specific gravity of soil particles is found to be 2.68 to 2.69.

LITHOUNIT-Y

Lithounit-Y is light brown silty sand starting from 2.80m to 5.0m depth of boring. Soil classification shows that this lithounit is SM indicating non-plastic in nature. Standard penetration test conducted in the boreholes indicate that the strata is medium dense in nature.

6.0 FOUNDATION ANALYSIS AND DISCUSSIONS

One borehole drilled down to a depth of 10.0m and disturbed/undisturbed soil samples have been collected for laboratory testing. Standard Penetration Tests have been carried out as per I.S. standard. On the field investigation data, it is found that soil is stiff to medium dense to very stiff in nature. Shallow foundation is suggested.



6.1 GENERAL

A suitable foundation for any structure should satisfy two basic criteria. Firstly, the soils should have adequate shear strength to support the superimposed loads so that there is an adequate safety factors against the bearing capacity. Secondly, the settlement of the soils should be within the tolerable limits for the structure. The net allowable bearing pressure on the foundations should be taken as the lower of the two values obtained from these two criteria.

6.2 FOUNDATIONS TYPE

In general, light to medium loaded structure may bear an open shallow footings. Heavily loaded structure may bear on raft foundation.

6.3 ALTERNATIVE FOUNDATION SCHEMES

Considering the above nature of soils, site conditions & load coming through microwave tower, we suggest the Isolated/Raft foundation at 3.0m depth.

Detailed recommendation of this scheme is given in the following sections. The designer may select the appropriate foundation scheme based on the loading condition, economic consideration & ease of construction.

6.4 ISOLATED SQUARE FOOTING

Square footings are feasible foundation schemes. Bearing capacity analysis for the shallow square footings is in accordance with IS 6403-1981. Since water table is encountered at 4.25m depth during boring, so the effects of water table has been taken into account. A safety factor of three has been considered in the analysis as per IS 1904.



6.4.1 SHEAR CONSIDERATION

As per IS:6403 - 1981, the net ultimate bearing capacity can be calculated as:

$$q_u = \frac{2}{3} C N_c^1 \text{Scd}_a i_c + q (N_q^1 - 1) S_q d_q i_q + 0.5 B_r N_r^1 S_r d_r i_r W^1$$

At 3.0 m. Depth

$$C = 5.0 \text{ T/M}^2, \phi = 5^\circ, \phi^1 = 3.35^\circ, N_c^1 = 6.04, N_q^1 = 1.382, N_r^1 = 0.3015,$$

$$r = 1.71 \text{ T/M}^2, S_c = 1.3, S_q = 1.2, S_r = 0.8, w = 0.5, \text{FOS} = 3.$$

$$Q_u = \frac{2}{3} \times 5 \times 6.04 \times 1.3 + 1.71 \times 3 \times 0.382 \times 1.2 + 0.5 B \times 1.71 \times 0.3015 \times 0.8 \times 0.5$$

$$= 28.52 + 0.103 B$$

for 3mx3m - $q_a = 9.60 \text{ T/M}^2$

4mx4m - $q_a = 9.64 \text{ T/M}^2$

5mx5m - $q_a = 9.67 \text{ T/M}^2$

6mx6m - $q_a = 9.71 \text{ T/M}^2$

8mx8m - $q_a = 9.78 \text{ T/M}^2$

6.4.2 SETTLEMENT CONSIDERATION

Net safe bearing capacity on settlement criteria is calculated as per IS: 8009(PART-1) -1976. For computation of foundation settlement in average lower bound corrected N value has been used. A tolerable total settlement of 25mm has been considered as per IS:1904. The following table present recommended value for different sizes at 3.0m depth of footing.

ISOLATED FOOTING

NET SAFE BEARING CAPACITY IN T/M2

DEPTH	3MX3M	4MX4M	5MX5M
3.00m	5.0	5.0	5.0

RAFT FOUNDATION

NET SAFE BEARING CAPACITY IN T/M2

DEPTH	6MX6M	8MX8M
3.00m	5.50	5.50



7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on field and laboratory investigations, following recommendations can be made :

1. As per field data & lab. results, the entire stratum consists of two Lithounits (layers). Detail is shown in article 5.0.
2. Based upon SPT value & density, the soil strata is found stiff to medium dense to very stiff in nature.
3. The net safe bearing capacity at 3.0m depth of foundation may be taken as given:

ISOLATED FOOTING

NET SAFE BEARING CAPACITY IN T/M²

DEPTH	3MX3M	4MX4M	5MX5M
3.0m	5.0	5.0	5.0

RAFT FOUNDATION

NET SAFE BEARING CAPACITY IN T/M²

DEPTH	6MX6M	7MX7M
3.0m	5.50	5.50

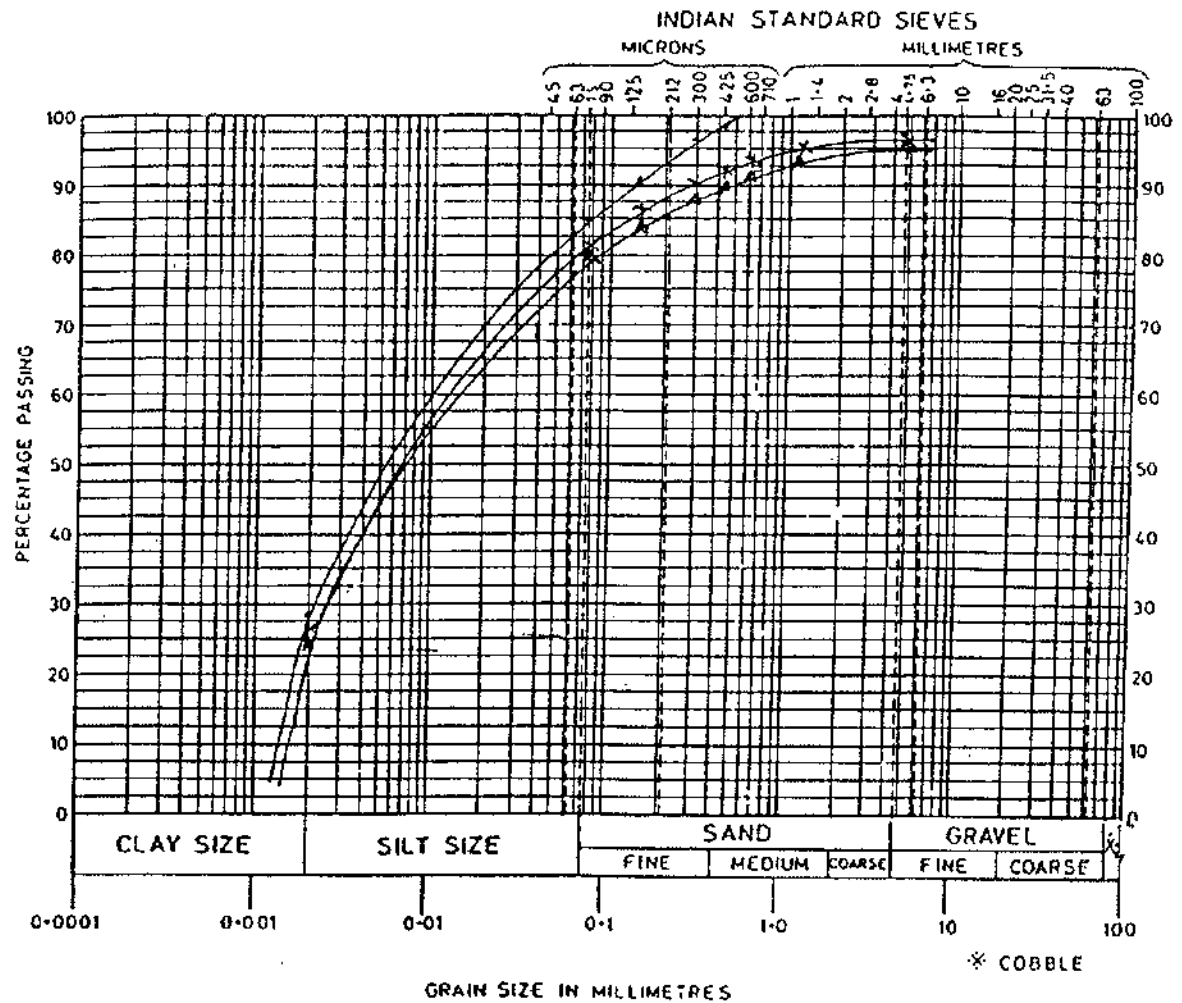
4. The angle of repose & Bulk density should be taken as 20 degree & 1.71 gm/cc respectively for design purposes.
5. Water level was encountered at 4.25m depth during the field investigation which may rise/fall with climatic condition.
6. The stability/capacity of the foundation against uplift action must be checked & the size/type of foundations shall accordingly be modified.

For SANGUINE CONSULTANTS

M.K.SINGH.
M.E.(Geotech)



IS : 2720 (Part 4) - 1985



LOCATION	DEPTH (m)	SYMBOL	CLASSIFICATION	GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	w_L	w_p
Basti	2.50	●—●	MI	0	15	57	28		
	5.50	X—X	MI	4	14	55	27		
	8.50	▲—▲	MI	5	15	55	25		

FIG. NO: 01

GRAIN SIZE ANALYSIS

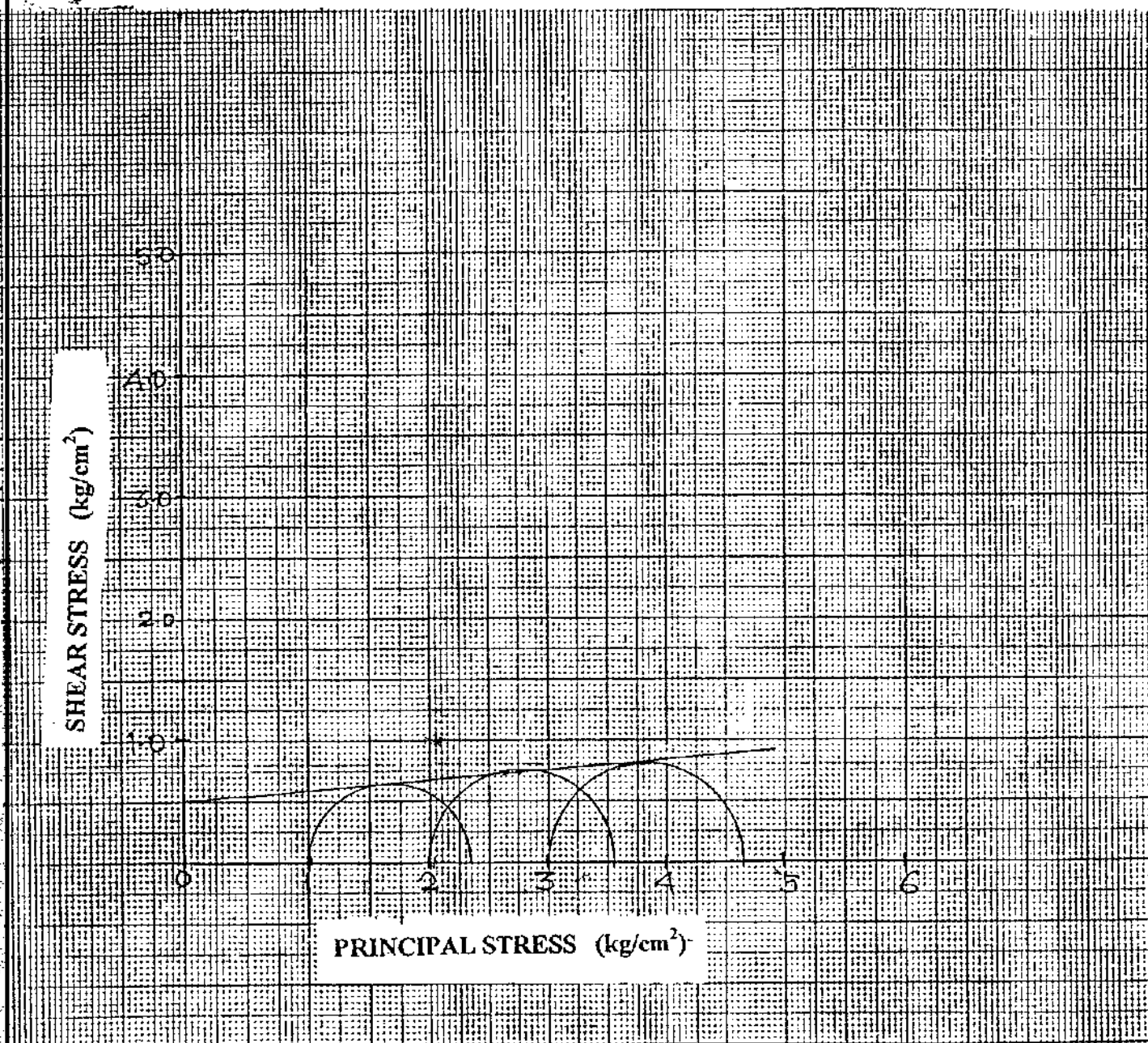
B.H.No.: 01

 $C: 0.5 \text{ kg/cm}^2$

SAMPLE: VDS-01

 $\phi: 50 \text{ Degree.}$

TYPE OF TEST : UUT.

FIG. NO: 02

SANGUINE CONSULTANTS



**REPORT ON
SOIL INVESTIGATION
FOR THE FOUNDATIONS OF PROPOSED
SELF SUPPORTING TOWER
AT
DOORDARSHAN MAINTAINANCE CENTRE,
BEHRAICH
IN U.P.**

**SUBMITTED TO
M/s GENERAL MERCANTILE INDUSTRIES
6/6, SHANTI NIKETAN
NEW DELHI**

**STRUCTURAL CONSULTANT
M/s SMS ENGINEERING CONSULTANTS
NEW DELHI**

**SOIL CONSULTANT
SANGUINE CONSULTANTS
RZ-456/13, 3rd FLOOR, TUGHLAKABAD EXTENSION,
NEW DELHI-110019.
PH:011- 26052881.**



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8.	LAB.TEST RESULTS (TABLE-01)	09
9.	SIEVE ANALYSIS CURVE (FIG.- 01)	10
10.	SHEAR CURVE (FIG.- 02)	11



1.0 INTRODUCTION

PRASAR BHARTI is planning to install a LPT Self supporting tower at Doordarshan Maintainance Centre, Behraich in U.P. For a detailed design & engineering of proposed tower, the work of sub-soil investigation has been awarded to M/s Sanguine Consultants, New Delhi, The Structural consultant of entire project is M/s SMS Engineering Consultants, New Delhi.

The report presents the compiled data of test results of geotechnical investigation. The observed data of field investigations and laboratory tests are presented and uses to access the nature of subsoil strata and to evaluate the soil parameters required for the detailed design and engineering of proposed micro-wave tower.

SITE

The site is located at Doordarshan Maintainance Centre, Behraich in U.P. & is developed, levelled and drained. The informations & recommendations are given with respect to existing ground level at particular points rather than the reference level.



2.0 SCOPE OF WORK

In order to establish the sub-soil characteristics at the area marked for installation of self supporting tower, the entire investigation program had been divided into field and laboratory tests leading to preparation of comprehensive report on the recommendations of foundation.

As mentioned within the framework of this job contract, the field investigations comprised of the following :-

- a) Boring of one borehole of 150mm dia. upto the depth of 10m or refusal whichever encountered earlier.
- b) Collection of representative disturbed and undisturbed soil samples, 100mm in diameter, from the exploratory bore holes for detailed laboratory analysis.
- c) Carrying out standard penetration tests as per IS:2131 – 1981 in each bore hole and subsequently preparation of penetration charts depth-wise for each bore hole.

The laboratory tests part of this job contract comprised of the following:-

- i) Grain size analysis
- ii) Liquid limit & plastic limit.
- iii) Specific gravity
- iv) Natural moisture content
- v) Bulk density & dry density
- vi) Direct shear test
- vii) Triaxial shear tests in unconsolidated undrained condition



3.0 FIELD INVESTIGATION METHODOLOGY

3.1 DRILLING OF BOREHOLE

Borehole of 150mm diameter was drilled by using auger method upto the depth of 10.0m as per IS:1892 at proposed site location. The details of the soil type, type of sample collected and SPT 'N'-value are shown in Table-01.

3.2 COLLECTION OF UNDISTURBED SOIL SAMPLES

Undisturbed soil samples have been collected from each boreholes at interval of 3.0m in thin wall sampling tubes of 45cm long with area ratio less than of 10%. All undisturbed soil samples were collected by open drive tube sampler as per IS:2132 and the tube so recovered with samples, after removal of loose disturbed soil, were sealed by wax from both end to protect against the loss of moisture. After sealing, the sampling tubes were marked for testing of sample for various parameters.

3.3 STANDARD PENETRAION TEST

Standard Penetration tests have been conducted as per IS:2131 in the borehole at interval of 1.50m or at the change of strata, whichever encountered earlier. The penetration resistance (SPT) is expressed as number of blows required for 30 cm. On a rigid steel head and standard "A" rod attachment. Also seating number of blows of 150mm were recorded before recording actual SPT 'N' for 30 cm penetration. On removal of sampler, the soil entrapped in the sampler is taken out and the representative disturbed soil sample is preserved in polythene bags to avoid any loss of fines and marked for identification.



4.0 LABORATORY TESTING

1. The laboratory test was carried out after the completion of field work & sufficient number of samples have reached the laboratory.
2. All samples brought from field, whether disturbed or undisturbed was extracted/prepared and examined by competent technical personnel, and the test was carried out as per the procedures laid out in the latest edition of the relevant I.S. Codes.

The following laboratory test has been carried out

- i) Grain size analysis
- ii) Liquid limit & plastic limit.
- iii) Specific gravity
- iv) Natural moisture content
- v) Bulk density & dry density
- vi) Drained direct shear test

All the above tests were conducted as per the provisions laid down in the relevant IS Code of practice. The test results for all the samples tested have been tabulated in proper format as shown in Table No.01.



5.0 LITHOLOGY

One borehole, drilled down to a depth of 10.0m reveals that the entire stratum consists of three Lithounits (layers), namely Lithounit-X, Lithounit-Y and Lithounit-Z.

LITHOUNIT-X

Lithounit-X is filled up soil starting from GL to 2.50m depth of boring.

LITHOUNIT-Y

Lithounit-Y is light brown silty sand starting from 2.50m to 3.25m depth of boring. This lithounit is SM indicating non-plastic in nature. Standard penetration test conducted in the boreholes indicate that the strata is medium in nature. Specific gravity of soil particles is found to be 2.62.

LITHOUNIT-Z

Lithounit-Z is light brown sand starting from 3.25m to 10.0m depth of boring. Soil classification shows that this lithounit is SP-SM/SP indicating non-plastic in nature. Standard penetration test conducted in the boreholes indicate that the strata is medium dense in nature. Specific gravity of soil particles is found to be 2.63.

6.0 FOUNDATION ANALYSIS AND DISCUSSIONS

One borehole drilled down to a depth of 10.0m and disturbed/undisturbed soil samples have been collected for laboratory testing. Standard Penetration Tests have been carried out as per I.S. standard. On the field investigation data, it is found that soil is medium dense in nature. Shallow foundation is suggested.



6.1 GENERAL

A suitable foundation for any structure should satisfy two basic criteria. Firstly, the soils should have adequate shear strength to support the superimposed loads so that there is an adequate safety factors against the bearing capacity. Secondly, the settlement of the soils should be within the tolerable limits for the structure. The net allowable bearing pressure on the foundations should be taken as the lower of the two values obtained from these two criteria.

6.2 FOUNDATIONS TYPE

In general, light to medium loaded structure may bear an open shallow footings. Heavily loaded structure may bear on raft foundation.

6.3 ALTERNATIVE FOUNDATION SCHEMES

Considering the above nature of soils, site conditions & load coming through microwave tower, we suggest the Isolated/Raft foundation at 3.0m depth.

Detailed recommendation of this scheme is given in the following sections. The designer may select the appropriate foundation scheme based on the loading condition, economic consideration & ease of construction.

6.4 ISOLATED SQUARE FOOTING

Square footings are feasible foundation schemes. Bearing capacity analysis for the shallow square footings is in accordance with IS 6403-1981. Since water table is not encountered during boring, so the effects of water table has not been taken into account. A safety factor of three has been considered in the analysis as per IS 1904.



6.4.1 SHEAR CONSIDERATION

As per IS:6403 -1981, the net ultimate bearing capacity can be calculated as:

$$q_u = \frac{2}{3} C N_c^1 \text{Scd}_c i_c + q (N_q^1 - 1) S_q d_q i_q + 0.5 B_r N_r^1 S_r d_r i_r W^1$$

At. 3.0 m. Depth

$$C = 0.0 \text{ T/M}^2, \phi = 30^\circ, \phi^1 = 21^\circ, N_q^1 = 7.252, N_r^1 = 6.50,$$

$$r = 1.68 \text{ T/M}^3, \text{Sc}=1.3, S_q=1.2, S_r=0.8, \text{F.O.S}=3$$

$$Q_u = 1.68 \times 0.5 \times 6.252 \times 1.2 + 0.5 B \times 1.68 \times 6.50 \times 0.8 \times 1$$

$$= 6.30 + 4.37 B$$

for	3mx3m	- qa = 6.47 T/M ²
	4mx4m	- qa = 7.92 T/M ²
	5mx5m	- qa = 9.38 T/M ²
	6mx6m	- qa = 10.84 T/M ²
	8mx8m	- qa = 13.75 T/M ²

6.4.2 SETTLEMENT CONSIDERATION

Net safe bearing capacity on settlement criteria is calculated as per IS: 8009(PART-1) -1976. For computation of foundation settlement in average lower bound corrected N value has been used. A tolerable total settlement of 25mm has been considered as per IS:1904. The following table present recommended value for different sizes at 3.0m depth of footing.

ISOLATED FOOTING

NET SAFE BEARING CAPACITY IN T/M²

DEPTH	3MX3M	4MX4M	5MX5M
3.00m	6.00	6.00	6.00

RAFT FOUNDATION

NET SAFE BEARING CAPACITY IN T/M²

DEPTH	6MX6M	8MX8M
3.00m	9.00	9.00



7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on field and laboratory investigations, following recommendations can be made :

1. As per field data & lab. results, the entire stratum consists of two Lithounits (layers). Detail is shown in article 5.0.
2. Based upon SPT value & density, the soil strata is found medium dense in nature.
3. The net safe bearing capacity at 3.0m depth of foundation, may be taken as given:

ISOLATED FOOTING

NET SAFE BEARING CAPACITY IN T/M²

DEPTH	3MX3M	4MX4M	5MX5M
3.00m	6.00	6.00	6.00

RAFT FOUNDATION

NET SAFE BEARING CAPACITY IN T/M²

DEPTH	6MX6M	7MX7M
3.00m	9.00	9.00

4. The angle of repose & Bulk density should be taken as 15 degree & 1.68 gm/cc respectively for design purposes.
5. Water level was not encountered during the field investigation.
6. The stability/capacity of the foundation against uplift action must be checked & the size/type of foundations shall accordingly be modified.

For SANGUINE CONSULTANTS

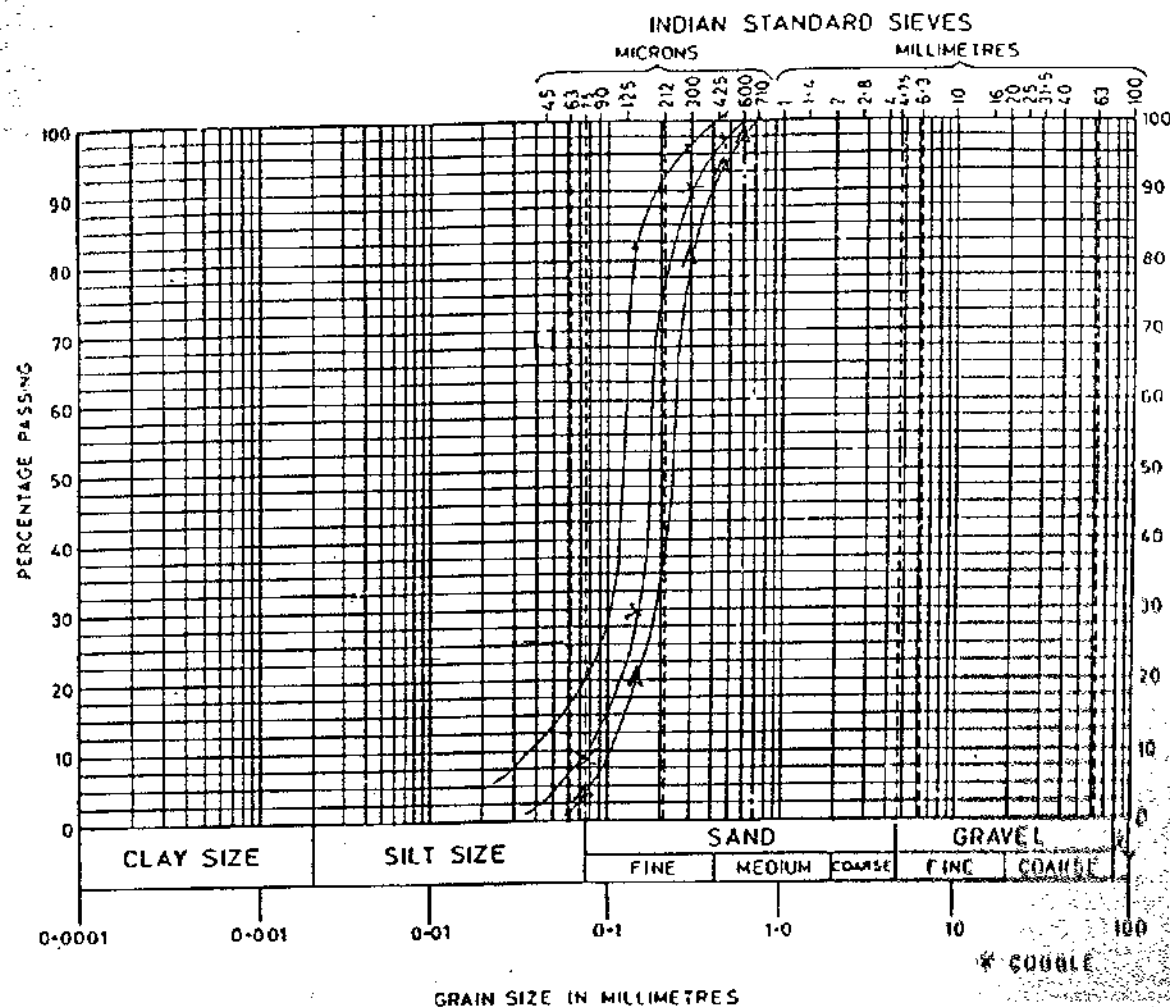

M.K.SINGH.

M.E.(Geotech)

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LOCATION	DEPTH (m)	SYMBOL	CLASSIFICATION	GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	e_c	e_{cs}
Behrakh	2.50	●—●	SM	0	78	22	0		
	5.50	x—x	SP-SM	0	91	9	0		
	8.50	▲—▲	SP	0	96	4	0		

FIG. NO:-01

GRAIN SIZE ANALYSIS



B.H.No.: 01

 $C: 0 \text{ kg/cm}^2$

SAMPLE: VDS-01

 $\phi: 30 \text{ Degree.}$

TYPE OF TEST : DS.

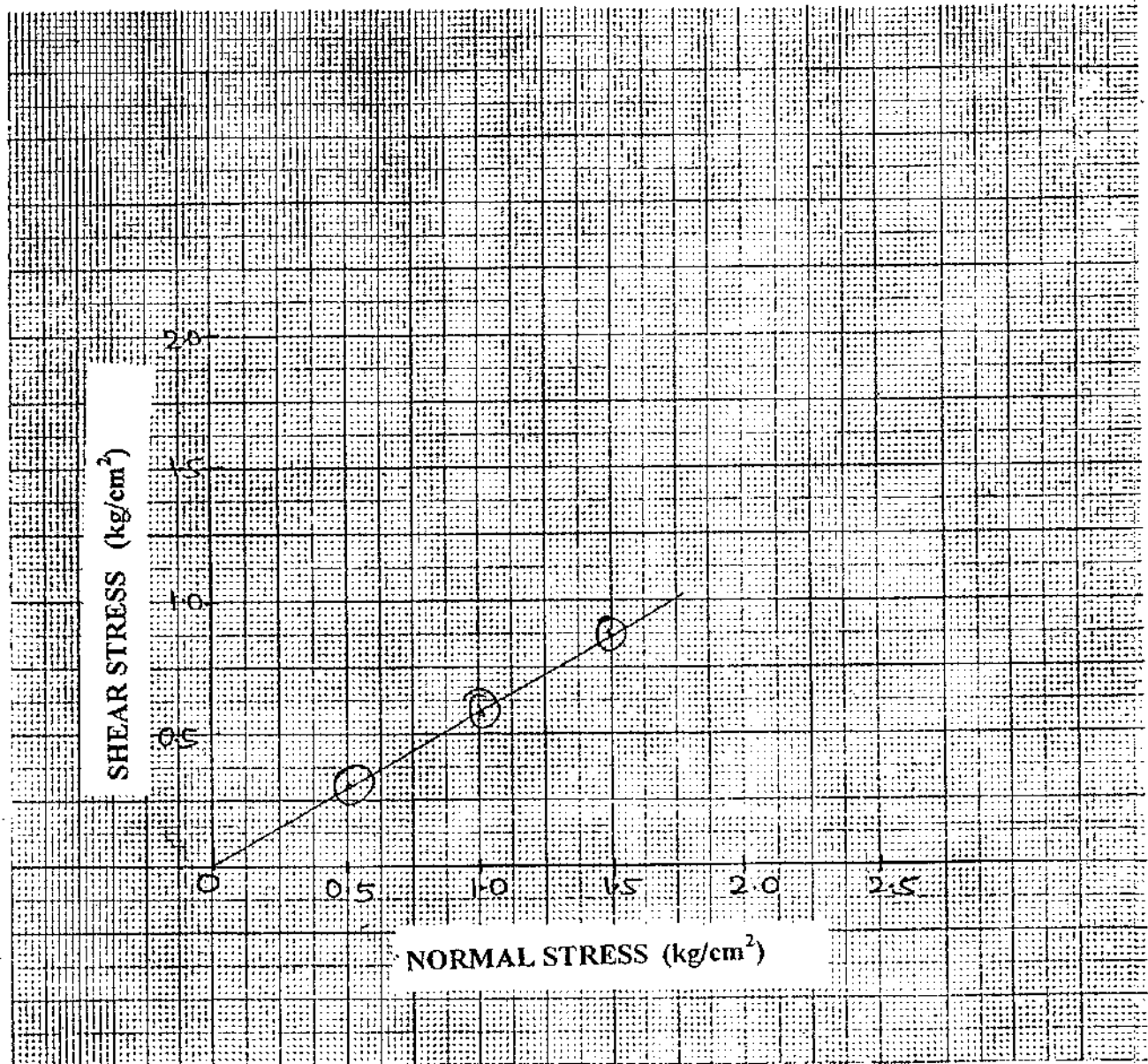


FIG NO.: 02

SANGUINE CONSULTANTS



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**SUBMITTED TO
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9.	SIEVE ANALYSIS CURVE (FIG.- 01)	10
10.	SHEAR CURVE (FIG.- 02)	11



1.0 INTRODUCTION

PRASAR BHARTI is planning to install a LPT Self supporting tower at Akbarpur in U.P. For a detailed design & engineering of proposed tower, the work of sub-soil investigation has been awarded to M/s Sanguine Consultants, New Delhi, The Structural consultant of entire project is M/s SMS Engineering Consultants, New Delhi.

The report presents the compiled data of test results of geotechnical investigation. The observed data of field investigations and laboratory tests are presented and uses to access the nature of subsoil strata and to evaluate the soil parameters required for the detailed design and engineering of proposed micro-wave tower.

SITE

The site is located at Akbarpur in U.P. & is developed, levelled and drained. The informations & recommendations are given with respect to existing ground level at particular points rather than the reference level.



2.0 SCOPE OF WORK

In order to establish the sub-soil characteristics at the area marked for installation of self supporting tower, the entire investigation program had been divided into field and laboratory tests leading to preparation of comprehensive report on the recommendations of foundation.

As mentioned within the framework of this job contract, the field investigations comprised of the following :-

- a) Boring of one borehole of 150mm dia. upto the depth of 10m or refusal whichever encountered earlier.
- b) Collection of representative disturbed and undisturbed soil samples, 100mm in diameter, from the exploratory bore holes for detailed laboratory analysis.
- c) Carrying out standard penetration tests as per IS:2131 - 1981 in each bore hole and subsequently preparation of penetration charts depth-wise for each bore hole.

The laboratory tests part of this job contract comprised of the following:-

- i) Grain size analysis
- ii) Liquid limit & plastic limit.
- iii) Specific gravity
- iv) Natural moisture content
- v) Bulk density & dry density
- vi) Direct shear test
- vii) Triaxial shear tests in unconsolidated undrained condition



3.0 FIELD INVESTIGATION METHODOLOGY

3.1 DRILLING OF BOREHOLE

Borehole of 150mm diameter was drilled by using shell and auger method upto the depth of 10.0m as per IS:1892 at proposed site location. The details of the soil type, type of sample collected and SPT 'N'-value are shown in Table-01.

3.2 COLLECTION OF UNDISTURBED SOIL SAMPLES

Undisturbed soil samples have been collected from each boreholes at interval of 3.0m in thin wall sampling tubes of 45cm long with area ratio less than of 10%. All undisturbed soil samples were collected by open drive tube sampler as per IS:2132 and the tube so recovered with samples, after removal of loose disturbed soil, were sealed by wax from both end to protect against the loss of moisture. After sealing, the sampling tubes were marked for testing of sample for various parameters.

3.3 STANDARD PENETRAION TEST

Standard Penetration tests have been conducted as per IS:2131 in the borehole at interval of 1.50m or at the change of strata, whichever encountered earlier. The penetration resistance (SPT) is expressed as number of blows required for 30 cm. On a rigid steel head and standard "A" rod attachment. Also seating number of blows of 150mm were recorded before recording actual SPT 'N' for 30 cm penetration. On removal of sampler, the soil entrapped in the sampler is taken out and the representative disturbed soil sample is preserved in polythene bags to avoid any loss of fines and marked for identification.



4.0 LABORATORY TESTING

1. The laboratory test was carried out after the completion of field work & sufficient number of samples have reached the laboratory.
2. All samples brought from field, whether disturbed or undisturbed was extracted/prepared and examined by competent technical personnel, and the test was carried out as per the procedures laid out in the latest edition of the relevant I.S. Codes.

The following laboratory test has been carried out

- i) Grain size analysis
- ii) Liquid limit & plastic limit.
- iii) Specific gravity
- iv) Natural moisture content
- v) Bulk density & dry density
- vi) Drained direct shear tests
- vii) Triaxial shear tests in unconsolidated undrained condition

All the above tests were conducted as per the provisions laid down in the relevant IS Code of practice. The test results for all the samples tested have been tabulated in proper format as shown in Table No.01.



5.0 LITHOLOGY

One borehole, drilled down to a depth of 10.0m reveals that the entire stratum consists of two Lithounits (layers), namely Lithounit-X and Lithounit-Y.

LITHOUNIT-X

Lithounit-X is light brown clayey silt with gravels starting from GL to 4.0m depth of boring. Atterbergs' limit shows that this lithounit is MI indicating medium-plastic in nature. Standard penetration test conducted in the boreholes indicate that the strata is very stiff in nature. Specific gravity of soil particles is found to be 2.69.

LITHOUNIT-Y

Lithounit-Y is light brown silty sand starting from 4.0m to the depth of boring. Soil classification shows that this lithounit is SM indicating non-plastic in nature. Standard penetration test conducted in the boreholes indicate that the strata is medium dense in nature. Specific gravity of soil particles is found to be 2.64.

6.0 FOUNDATION ANALYSIS AND DISCUSSIONS

One borehole drilled down to a depth of 10.0m and disturbed/undisturbed soil samples have been collected for laboratory testing. Standard Penetration Tests have been carried out as per I.S. standard. On the field investigation data, it is found that soil is very stiff to medium dense in nature. Shallow foundation is suggested.



6.1 GENERAL

A suitable foundation for any structure should satisfy two basic criteria. Firstly, the soils should have adequate shear strength to support the superimposed loads so that there is an adequate safety factors against the bearing capacity. Secondly, the settlement of the soils should be within the tolerable limits for the structure. The net allowable bearing pressure on the foundations should be taken as the lower of the two values obtained from these two criteria.

6.2 FOUNDATIONS TYPE

In general, light to medium loaded structure may bear an open shallow footings. Heavily loaded structure may bear on raft foundation.

6.3 ALTERNATIVE FOUNDATION SCHEMES

Considering the above nature of soils, site conditions & load coming through microwave tower, we suggest the Isolated/Raft foundation at 3.0m depth.

Detailed recommendation of this scheme is given in the following sections. The designer may select the appropriate foundation scheme based on the loading condition, economic consideration & ease of construction.

6.4 ISOLATED SQUARE FOOTING

Square footings are feasible foundation schemes. Bearing capacity analysis for the shallow square footings is in accordance with IS 6403-1981. Since water table is encountered at 4.0m during boring, so the effects of water table has been taken into account. A safety factor of three has been considered in the analysis as per IS 1904.



6.4.1 SHEAR CONSIDERATION

As per IS:6403 -1981, the net ultimate bearing capacity can be calculated as:

$$q_u = \frac{2}{3} C N_c^I \text{Sc} \phi_c i_c + q (N_q^I - 1) S_q d_q i_q + 0.5 B r N_r^I S_r d_r i_r W^I$$

At. 3.0 m. Depth

$$C = 5.0 \text{ T/M}^2, \phi = 6^\circ, \phi^I = 4^\circ, N_c^I = 6.22, N_q^I = 1.456, N_r^I = 0.36,$$

$$r = 1.73 \text{ T/M}^3, \text{Sc}=1.3, S_q=1.2, S_r=0.8, \text{FOS} = 3.$$

$$Q_u = \frac{2}{3} \times 5.0 \times 6.04 \times 1.3 + 1.73 \times 3.0 \times 0.456 \times 1.2 + 0.5 B \times 1.73 \times 0.36 \times 0.8 \times 0.5$$

$$= 29.01 + 0.125 B$$

for $3\text{m} \times 3\text{m} - q_a = 9.79 \text{ T/M}^2$

$4\text{m} \times 4\text{m} - q_a = 9.84 \text{ T/M}^2$

$5\text{m} \times 5\text{m} - q_a = 9.87 \text{ T/M}^2$

$6\text{m} \times 6\text{m} - q_a = 9.92 \text{ T/M}^2$

$8\text{m} \times 8\text{m} - q_a = 10.00 \text{ T/M}^2$

6.4.2 SETTLEMENT CONSIDERATION

Net safe bearing capacity on settlement criteria is calculated as per IS: 8009(PART-1) -1976. For computation of foundation settlement in average lower bound corrected N value has been used. A tolerable total settlement of 25mm has been considered as per IS:1904. The following table present recommended value for different sizes at 3.0m depth of footing.

ISOLATED FOOTING

NET SAFE BEARING CAPACITY IN T/M2

DEPTH	3MX3M	4MX4M	5MX5M
3.00m	5.25	5.25	5.25

RAFT FOUNDATION

NET SAFE BEARING CAPACITY IN T/M2

DEPTH	6MX6M	8MX8M
3.00m	6.50	6.50



7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on field and laboratory investigations, following recommendations can be made :

1. As per field data & lab. results, the entire stratum consists of two Lithounits (layers). Detail is shown in article 5.0.
2. Based upon SPT value & density, the soil strata is found very stiff to medium dense in nature.
3. The net safe bearing capacity at 3.0m depth of foundation may be taken as given :

ISOLATED FOOTING

NET SAFE BEARING CAPACITY IN T/M2

DEPTH	3MX3M	4MX4M	5MX5M
3.00m	5.25	5.25	5.25

RAFT FOUNDATION

NET SAFE BEARING CAPACITY IN T/M2

DEPTH	6MX6M	8MX8M
3.00m	6.50	6.50

4. The angle of repose & Bulk density should be taken as 22 degree & 1.73 gm/cc respectively for design purposes.
5. Water level was encountered at 4.0m depth during the field investigation work which may rise/fall with climatic condition.
6. The stability/capacity of the foundation against uplift action must be checked & the size/type of foundations shall accordingly be modified.

For SANGUINE CONSULTANTS

M.K.SINGH.

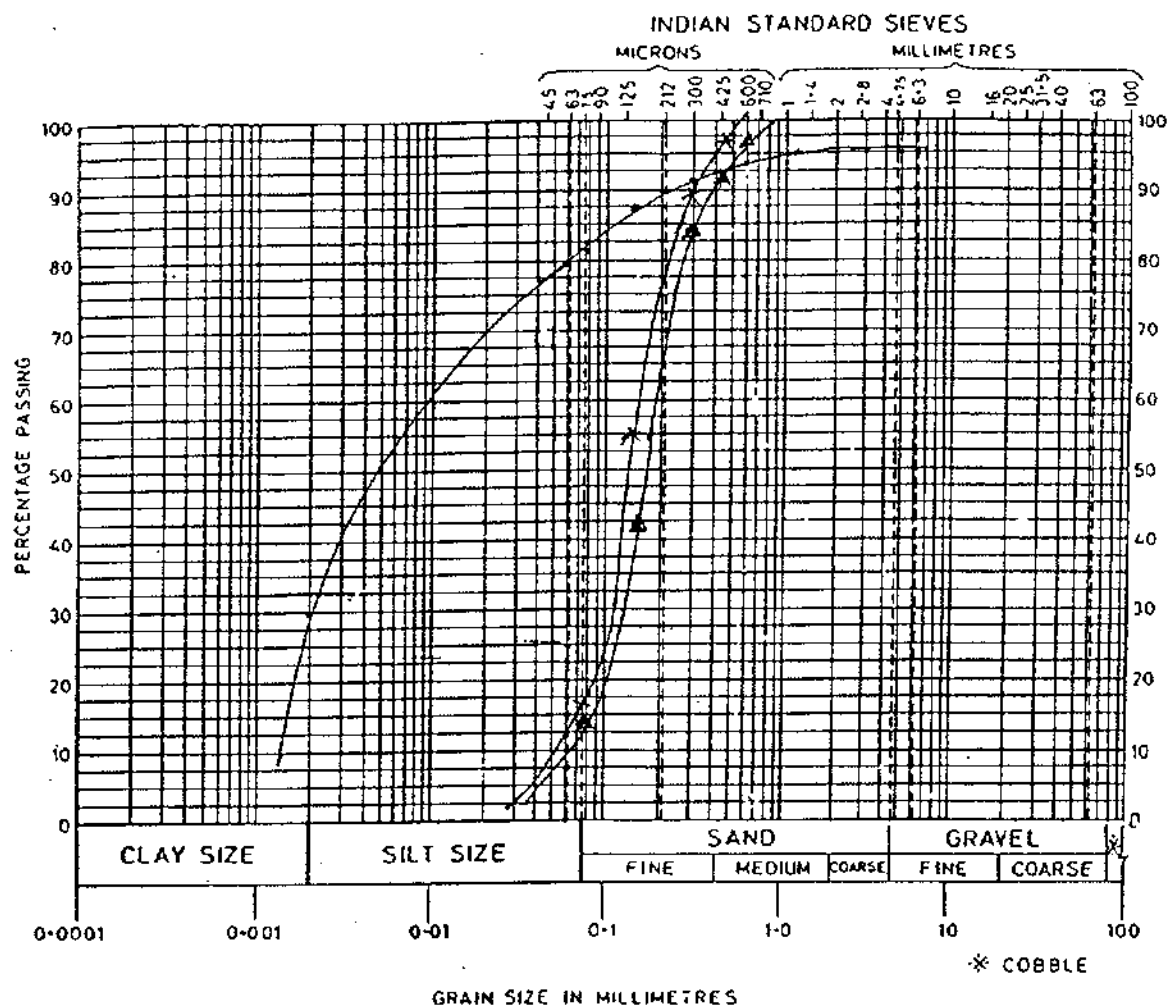
M.E.(Geotech)

SOIL PROFILE										PROJECT:AKBARPUR, U.P.				B.H.NO.:01				TERMINATION		TABLE :01									
										SITE NAME: AKBARPUR.				Water Table:4.0m.				Depth:10.0m.											
										SPT-PLOT				Sieve Analysis				Limits				N. Density, gm/cc		Moisture content, %		Type of test		Cohesion Kg/cms ²	
N-VALUE	Depth(M)	Sample	SOIL DESCRIPTION				Sp. Gr.	Gravels, %	Sand, %	Silt, %	Clay, %	LL, %	PL, %																
17	0	DS-01	Light brown clayey silt																										
17	1.5	SPT-1	with gravels				2.69	5	13	52	30	40.2	28	1.73	12.9	UUT	0.5	6								0.102	0.755		
16	2.5	UDS-1	-do-																										
16	3	SPT-2	- 4.0m-																										
11	4.5	SPT-3	Light brown silty sand																										
	5.5	UDS-2	-do-					0	83	17	0	N	P			DST	0	31											
12	6	SPT-4																											
13	7.5	SPT-5	-do-																										
	8.5	UDS-3					2.64	0	86	14	0	N	P			DST	0	33											
18	9	SPT-6																											
21	10	SPT-7	-do-																										
										UUT UNCONSOLIDATED UNDRAINED TRIAXIAL TEST																			
										DST DRAINED DIRECT SHEAR TEST																			
										NP NON-PLASTIC																			

-0678-



IS : 2720 (Part 4) - 1985



LOCATION	DEPTH (m)	SYMBOL	CLASSIFICATION	GRAVEL (%)	SAND (%)	SILT (%)	CLAY (%)	w_L	w_p
AKBAR PUR	2.50	●—●	MI	5	13	52	30		
		×—×	SM	0	83	17	0		
		▲—▲	SM	0	86	14	0		

FIG. NO: 01

GRAIN SIZE ANALYSIS

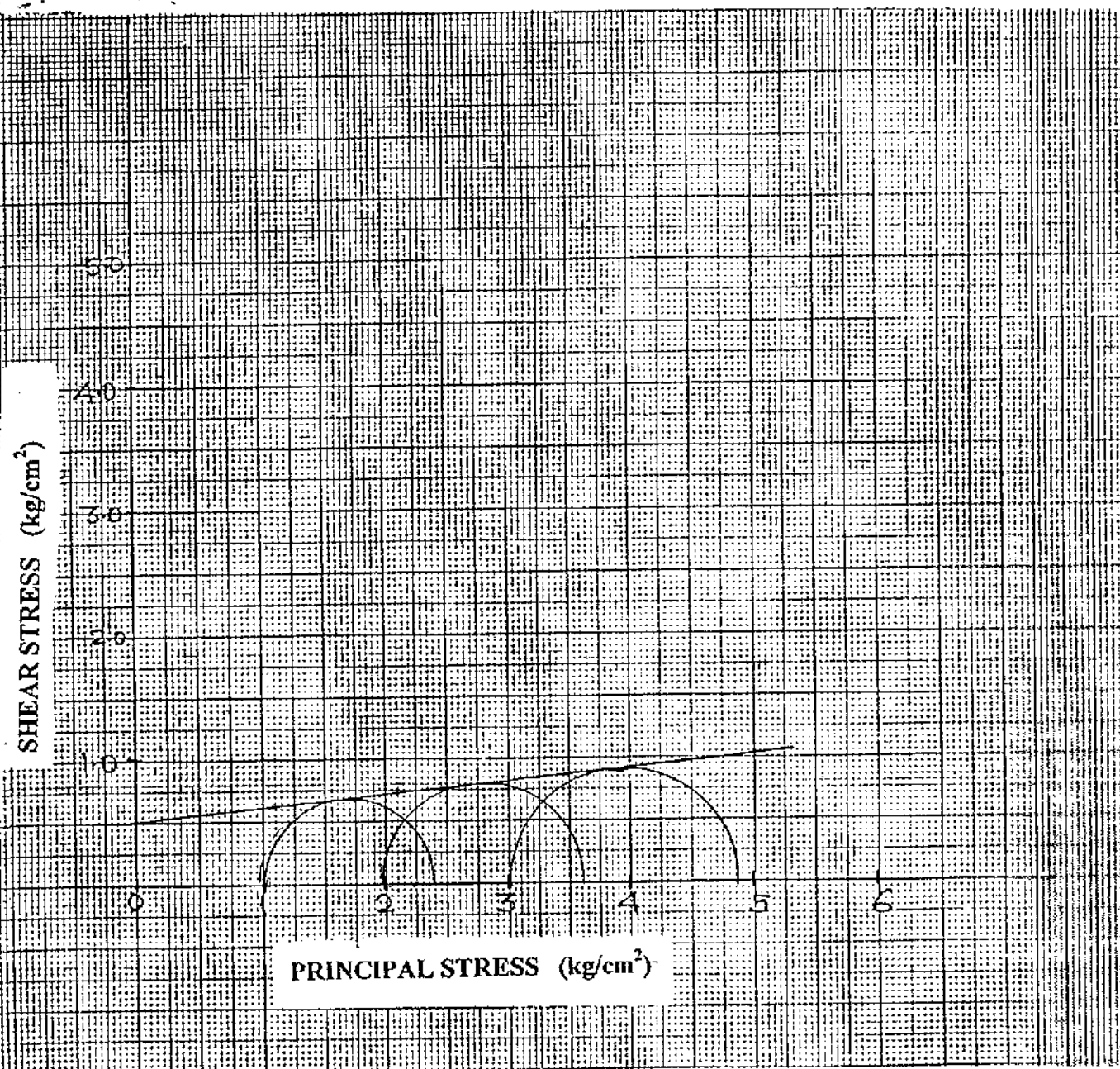
B.H.No.: 01

C: 0.5 kg/cm²

SAMPLE: UDS-01

 ϕ : 6.0 Degee.

TYPE OF TEST : UUT.

FIG. NO: 02

SANGUINE CONSULTANTS