Submitted sir,

Sub: RWS&S-TDWSP- Darigaongutta 700KL GLBR in Kagaznagar Mandal– Komarambheem Asifabad Segment-Adilabad District-Designs -Approval-Reg.

*****

Kindly puruse the Designs of the following 700KL GLBR at Darigaongutta(V), Kagaznagar(M), submitted by the Executive Engineer TDWSP Asifabad Division, Adilabad district for approval.

1. **700 KL GLBR.**

The Executive Engineer TDWSP Asifabad Division has submitted Structural Designs & Drawings of 700KL GLBR based on the field conditions and as per the estimate provisions , the structural designs & drawings for the above structure is verified and submitted for approval.

The following design parameters were considered:

- Capacity : 700KL
- Net SBC of Soil : 15.0 t/sqm
- Grade of concrete & Steel : M 30 & Fe 500
- Size of GLBR Inner to Inner : 15.6 x 15.6mtr
- Sidewall Height : 3.65mts
- Sidewall Thickness: 350 to 200mm
- Top Slab thickness: ~~150 mm~~ 160mm
- Raft Slab thickness: 250mm

As per the above parameters the structural design and drawings of the GLBR is verified, duly following IS codes, IS: 456-1000, SP:16, 34, IS:3370 and IS 1893-1002 (seismic codes).The sizes and steel proposed in the designs and drawings of all components are safe and sufficient.

The additional points noted after checking the designs are:

- Detailed Estimate of the Structure with these specifications has to be prepared and compared with the provision made in sanctioned estimate. Such that deviation if any is within authorized limits. If any deviations noticed, the Estimate should be submitted for obtaining approval from the Competent Authority.

Subject to approval a draft memo addressed to the EE, TDWSP Asifabad Division , for communicating approved Structure is put up for kind perusal and approval.

AEE (Designs)	DEE (Designs)	Superintending Engineer,
TDWSP,Nirmal Circle	TDWSP,Nirmal Circle	TDWSP,Nirmal Circle

GOVERNMENT OF TELANGANA
TELANGANA DRINKIMG WATER SUPPLY PROJECT
Rural Water Supply & Sanitation Department

TELANGANA WATER GRID

L&T Construction - Water, Smart World & Communication
CHENNAI

CLIENT:	CONSULTANT :
RURAL WATER SUPPLY AND SANITATION DEPARTMENT (WATER GRID), TELUNGANA.	WAPCOS LIMITED

PROJECT :	PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT
SUPPLIER / CONTRACTOR:	L&T Construction, Water, Smart World and Communication

JOB Ref. No. : LE150883

	NAME	SIGN	DATE
DSGN			
CHKD			
APPD			

TITLE :

DESIGN OF GLBR - 700KL CAPACITY DARIGAONGUTTA AT KAGHAZNAGAR MANDAL

DOC./DRG. No.	SIZE	REV.
LE150883-C-WS-RW-DC-1574	A4	A

RELEASED FOR

☐ PRELIMINARY	☐ INFORMATION	☑ APPROVAL	☐ CONSTRUCTION

DESIGN CALCULATION

PROJECT TITLE

PROVIDING DRINKING WATER TO HABITATIONS
IN KOMARAMBHEEM ASIFABAD SEGMENT
IN ADILABAD DISTRICT (30 MLD WTP)

UNIT

700 KL GLBR AT DARIGAONGUTTA VILLAGE

PRINCIPAL CLIENT

RURAL WATER SUPPLY
AND
SANITATION DEPARTMENT,
TELANGANA

CONTRACTOR

L&T CONSTRUCTION
WATER & EFFLUENT TREATMENT SBG

DESIGN OF SUMP

CAPACITY = 7 LAC

Width = 15.60 m
Length = 15.60 m
Water depth = 2.9 m

Free board = 0.45 m
Plaster thickness = 0.012 m

Column = 300 dia
Concrete grade = M 30
Clear cover to main steel = 45.0 mm

SBC: 15 T/M^2

GWT: GROUND WATER TABLE IS NOT OBSERVED

CAPACITY CHECK:

Capacity of compartment

Width = 15.60 m
Length = 15.60 m

Clear Width = 15.60–2 x plaster thickness
= 15.60 – 2 x 0.012
= 15.576 m

Dead storage = 0.3
Free board = 0.45
Water depth = 2.9 m

Volume = B x L x H
= 15.576 x 15.576 x 2.9 = 703.57 m^3

Volume of single column = pi * d x d. / 4 x H
= Pi x 0.30 x 0.30 / 4 x 2.9
= 0.205

Total nos of column = 9 nos

Less for pedestal = 9 x 1 x 1 x 0.1 = 0.9

Less volume of column = 0.205 m^3 x 9 nos = 1.845 m^3

Total deduction = 0.9 + 1.845 = 2.745

Net volume = 703.57 – 2.75 = 700.82 m^3 > 700 m^3 i.e. 7 lacs hence O.K.

Design of Sump

Design Approach

Element

- External wall
- Flat slab
- Column

EXTERNAL WALL

External wall

Wall is designed as top hinge, bottom fixed condition Subject to triangular loading

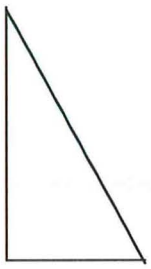
- Water pressure from inside
- Soil pressure from outside

Loading

1. Water load :
    a. Water depth = 3.20 m
    b. Free board = 0.45 m

    Total height = 3.65 m

    Water pressure is as below



2. Soil load :

    a. Depth below ground level = 1 m, Considered = 1.44 M
    b. Density of soil = 1.80 t/m
    c. Angle of repose = 30 degree

Pressure at bottom = Y * H * (1-sin th)/ (1 + sin th)
= 18 * 1.44 * (1 – sin 30)/ (1+ sin 30)
= 8.64 kN/m

Analysis is done in STADD, Input data & Output result are given

Provide, 200 to 300 mm tapered thick wall
Analysis of wall is done using software STAAD.Pro

STAAD MODEL

```
STAAD SPACE
START JOB INFORMATION
JOB NAME 7 lac sump
JOB NO P16_02
JOB PART SECTION EXTERNAL WALL
ENGINEER DATE 04-03-16
JOB CLIENT Adilabad RWSS
JOB REV R0
END JOB INFORMATION
INPUT WIDTH 79
UNIT METER KN
JOINT COORDINATES
1 0 0 0; 2 0 0.48 0; 3 0 0.96 0; 4 0 1.44 0; 5 0 1.92 0; 6 0 2.40 0;
7 0 2.8 0; 8 0 3.2 0; 9 0 3.65 0;
MEMBER INCIDENCES
4 9 8; 5 8 7; 6 7 6; 7 6 5; 8 5 4; 9 4 3; 10 3 2; 11 2 1;
DEFINE MATERIAL START
ISOTROPIC CONCRETE
E 2.73e+007
POISSON 0.17
DENSITY 25
ALPHA 1e-005
DAMP 0.05
END DEFINE MATERIAL
MEMBER PROPERTY INDIAN
4 PRIS YD 0.2 ZD 1
5 PRIS YD 0.218 ZD 1
6 PRIS YD 0.226 ZD 1
7 PRIS YD 0.241 ZD 1
8 PRIS YD 0.256 ZD 1
9 PRIS YD 0.271 ZD 1
10 PRIS YD 0.285 ZD 1
11 PRIS YD 0.3 ZD 1
SUPPORTS
1 FIXED
9 PINNED
CONSTANTS
MATERIAL CONCRETE ALL
LOAD 1 WATER
MEMBER LOAD
4 TRAP GX 0 4.5
5 TRAP GX 4.5 8.5
6 TRAP GX 8.5 12.5
7 TRAP GX 12.5 17.3
8 TRAP GX 17.3 22.1
9 TRAP GX 22.1 26.9
10 TRAP GX 26.9 31.7
11 TRAP GX 31.7 36.5
SELFWEIGHT Y -1
LOAD 2 SOIL
MEMBER LOAD
9 TRAP GX -0 -2.88
10 TRAP GX -2.88 -5.76
11 TRAP GX -5.76 -8.64
PERFORM ANALYSIS
FINISH
```

BEAM END FORCE (WATER LOAD)

Beam	L/C	Node	Axial Force kN	Shear-Y kN	Shear-Z kN	Torsion kNm	Moment-Y kNm	Moment-Z kNm
4	1	9	-10.37	-11.587	0	0	0	0
		8	8.12	10.575	0	0	0	-5.062
5	1	8	-8.12	-10.575	0	0	0	5.062
		7	5.77	7.975	0	0	0	-8.825
6	1	7	-5.77	-7.975	0	0	0	8.825
		6	3.26	3.775	0	0	0	-11.229
7	1	6	-3.26	-3.775	0	0	0	11.229
		5	0.008	-3.377	0	0	0	-11.416
8	1	5	-0.008	3.377	0	0	0	11.416
		4	-3.484	-12.833	0	0	0	-7.618
9	1	4	3.484	12.833	0	0	0	7.618
		3	-7.216	-24.593	0	0	0	1.273
10	1	3	7.216	24.593	0	0	0	-1.273
		2	-11.176	-38.657	0	0	0	16.361
11	1	2	11.176	38.657	0	0	0	-16.361
		1	-15.376	-55.025	0	0	0	38.753

Maximum moment at bottom = 38.753 kNm Say 39 KNm

Calculation for Coefficient of Uncrack condition					
RCC wall					
	notation		Unit		
DATA					Steel provided
Bending moment	Bm	**39**	kN-m		dia spc
Reinforcement	Fy	**500**	N/mm2		
Concrete grade	fck	**30**	N/mm2		**12 200**
Area of steel provised	Ast	1571	mm2		16 200
Depth provided	Dp	**350**			
Width	B	1000			
Clear Cover	Cv	**50**	mm		
maximum bar dia	dbar	**25**			
Permissible stress in Steel	Fyub	**130**	N/mm2		
Calculation					equation
Modular ratio	md	9			For Fck 30
Per.str.in direct Tension	Pst	15	kg/cm2		For Fck 30
Per.str.tension due to bending	Pstb	20	kg/cm2		For Fck 30
steel	PT	0.0045			=Ast/Dp/B
Effective depth	Def	287.5	mm		
Constants	ka	0.82			=Def/Dp
	kb	1.06			=1+2*PT*ka*(md-1)
	kc	2.07			=2+2*PT*(md-1)
Depth of neutral axis - N	n	0.5111			=kb/kc
Depth of neutral axis	nd	178.8992			=n*Dp
Check for Mu/bd2					
	kd	0.0035			=(ka-n)^2*(md-1)*PT
	ke	0.0835			=1/3-n*(1-n)
	kf	0.0869			=kd+ke
m/bd2	Unc	3.5558			=Pstb/(1-n)*kf
Depth reuired	Dr	331.2	mm		=(Bm*100/Unc)^0.5*10
Calculation od Steel	Ast				
Effective Depth	De	287.5	mm		=Dp-Cv-dbar/2
Area of steel required		1159	mm2		=Bm*1000000/(0.9*Fyub*De)
Check		OK			

BEAM END FORCE (SOIL LOAD)

Beam	L/C	Node	Axial Force kN	Shear-Y kN	Shear-Z kN	Torsion kNm	Moment-Y kNm	Moment-Z kNm
4	2	9	0	0.172	0	0	0	0
		8	0	-0.172	0	0	0	0.077
5	2	8	0	0.172	0	0	0	-0.077
		7	0	-0.172	0	0	0	0.146
6	2	7	0	0.172	0	0	0	-0.146
		6	0	-0.172	0	0	0	0.215
7	2	6	0	0.172	0	0	0	-0.215
		5	0	-0.172	0	0	0	0.297
8	2	5	0	0.172	0	0	0	-0.297
		4	0	-0.172	0	0	0	0.38
9	2	4	0	0.172	0	0	0	-0.38
		3	0	0.519	0	0	0	0.351
10	2	3	0	-0.519	0	0	0	-0.351
		2	0	2.593	0	0	0	-0.34
11	2	2	0	-2.593	0	0	0	0.34
		1	0	6.049	0	0	0	-2.359

Maximum moment at bottom = 2.359 kNm say 3 kNm

R/F at Different Place

1> Water load

GSR - TOTAL HEIGHT 3.65 m								
Water load								
concrete grade	Fck	**30**	N/mm2		fy uc	130	N/mm2	
Steel grade	Fy	**500**	N/mm2		fy uc b	130	N/mm2	
Height of wall	H	**3.65**	m		fck bc	10.0	N/mm2	
Free board	Fb	**0.3**	m		fck t	1.5	N/mm2	
cover	Cv	**45**	mm	modular ratio	m	9.3333		
Maximum Diameter of bar	Db	**12**	mm		K	0.4179		
Minimum % steel	pt	**0.35**	%		j	0.8607		

Sr. no	Height from top	Moment (kN-m)	Depth provide(mm)	effective depth(mm)	Design Steel in mm2		Minimum steel / Dist steel in mm2		Required steel in mm2	
	m	mm	mm	mm	Water face	soil face	Water face	soil face	Water face	soil face
1	0.45	-5.06	200	149		304	350	350	350	350
2	0.85	5.06 -8.83	235	184		429	411	411	411	429
3	1.25	8.83 -11.23	251	200		502	439	439	439	502
4	1.73	11.23 -11.42	271	220		464	474	474	474	474
5	2.21	11.42 -7.62	291	240		284	509	509	509	509
6	2.69	7.62 1.27	311	260	44		544	544	544	544
7	3.17	-1.27 16.36	330	279	524		578	578	578	578
8	3.65	-16.36 38.75	350	299	1158		613	613	1158	613

REINFORCMENT BAR PROVIDED

WATER FACE due to WATER LOAD

	Dist in m	Ast required	Reinforcement						Ast Provided	
1	0.45	350	12	200				=	565	TRUE
2	0.85	411	12	200	+	16	400	=	1068	TRUE
3	1.25	439	12	200	+	16	400	=	1068	TRUE
4	1.73	474	12	200	+	16	400	=	1068	TRUE
5	2.21	509	12	200	+	16	400	=	1068	TRUE

6	2.69	544	12	200	+	16	400	=	1068	TRUE
7	3.17	578	12	200	+	16	400	=	1068	TRUE
8	3.65	1158	12	200	+	16	200	=	1571	TRUE

SOIL FACE due to WATER LOAD

	Dist in m	Ast required	Reinforcement						Ast Provided	
1	0.45	350	12	200				=	565	TRUE
2	0.85	429	12	200	+	10	200	=	958	TRUE
3	1.25	502	12	200	+	10	200	=	958	TRUE
4	1.73	474	12	200	+	10	200	=	958	TRUE
5	2.21	509	12	200	+	10	200	=	958	TRUE
6	2.69	544	12	200	+	10	200	=	958	TRUE
7	3.17	578	12	200	+	10	200	=	958	TRUE
8	3.65	613	12	200	+	10	200	=	958	TRUE

REINFORCMENT BAR PROVIDED

DISTRIBUTION STEEL

	Dist in m	Thickness	Ast required	Reinforcement				Ast Provided	
1	0.45	200	350	10	150	=	524	OK	
2	0.85	235	411	10	150	=	524	OK	
3	1.25	251	439	10	150	=	524	OK	
4	1.73	271	474	10	100	=	785	OK	
5	2.21	291	509	10	100	=	785	OK	
6	2.69	311	544	10	100	=	785	OK	
7	3.17	330	578	10	100	=	785	OK	
8	3.65	350	613	10	100	=	785	OK	

2> Soil load

GSR - TOTAL HEIGHT 3.65 m

Water load

concrete grade	Fck	**30**	N/mm2		fyuc	130	N/mm2
Steel grade	Fy	**500**	N/mm2		fycb	130	N/mm2
Height of wall	H	**3.65**	m		fckbc	10.0	N/mm2
Free board	Fb	**0.3**	m		fckt	1.5	N/mm2
cover	Cv	**45**	mm	modular ratio	m	9.3333	
Maximum Diameter of bar	Db	**12**	mm		K	0.4179	
Minimum % steel	pt	**0.35**	%		j	0.8607	

Sr. no	Height from top	Moment (kN-m)	Depth provide(mm)	effective depth(mm)	Design Steel in mm2		Minimum steel / Dist steel in mm2		Required steel in mm2	
	m	mm	mm	mm	Water face	soil face	Water face	soil face	Water face	soil face
1	0.45	0.08	200	149	5		350	350	350	350
2	0.85	-0.08 0.15	235	184	7		411	411	411	411
3	1.25	-0.15 0.22	251	200	10		439	439	439	439
4	1.73	-0.22 0.30	271	220	12		474	474	474	474
5	2.21	-0.30 0.38	291	240	14		509	509	509	509
6	2.69	-0.38 0.35	311	260	12		544	544	544	544
7	3.17	-0.35 -0.34	330	279		11	578	578	578	578
8	3.65	0.34 -2.36	350	299		71	613	613	613	613

REINFORCMENT BAR PROVIDED

WATER FACE due to SOIL LOAD

	Dist in m	Ast required	Reinforcement					Ast Provided	
1	0.45	350	12	200				= 565	TRUE
2	0.85	411	12	200	+	16	400	= 1068	TRUE
3	1.25	439	12	200	+	16	400	= 1068	TRUE
4	1.73	474	12	200	+	16	400	= 1068	TRUE
5									

6	2.21	509	12	200	+	16	400	=	1068	TRUE
7	2.69	544	12	200	+	16	400	=	1068	TRUE
8	3.17	578	12	200	+	16	200	=	1571	TRUE
	3.65	613	12	200	+	16	200	=	1571	TRUE

SOIL FACE due to SOIL LOAD

	Dist in m	Ast required	Reinforcement					Ast Provided	
1	0.45	350	12	200				= 565	TRUE
2	0.85	411	12	200	+	10	200	= 958	TRUE
3	1.25	439	12	200	+	10	200	= 958	TRUE
4	1.73	474	12	200	+	10	200	= 958	TRUE
5	2.21	509	12	200	+	10	200	= 958	TRUE
6	2.69	544	12	200	+	10	200	= 958	TRUE
7	3.17	578	12	200	+	10	200	= 958	TRUE
8	3.65	613	12	200	+	10	200	= 958	TRUE

REINFORCMENT BAR PROVIDED

DISTRIBUTION STEEL

	Dist in m	Thickness	Ast required	Reinforcement			Ast Provided	
1	0.45	200	350	10	150	=	524	OK
2	0.85	235	411	10	150	=	524	OK
3	1.25	251	439	10	150	=	524	OK
4	1.73	271	474	10	100	=	785	OK
5	2.21	291	509	10	100	=	785	OK
6	2.69	311	544	10	100	=	785	OK
7	3.17	330	578	10	100	=	785	OK
8	3.65	350	613	10	100	=	785	OK

WALL FOOTING

WALL FOOTING DESIGN							
PROJECT : P16_02_Adilabad W.S.S					JOB : P16_02		
UNIT : Rectangular Sump							
WALL TYPE 1				W1			
BASIC DATA							
Density of water	denwt	**10**	kN/m3		fyuc	130	N/mm2
Density of soil	denso	**18**	kN/m3		fyucb	130	N/mm2
Density of concrete	decon	**25**	kN/m3		fckbc	10.0	N/mm2
Angle of Repose	Phi	**30**	degree		fckt	1.5	N/mm2
Safe bearing capacity of soil	Sbc	**150.0**	kN/m2	modular ratio	m	9.33	
Concrete grade	Fck	**30**	N/mm2		K	0.418	
Steel grade	Fy	**500**	N/mm2		j	0.861	
Depth below GI	Dbg	**0.85**	m				
Water depth	wtd	**3.20**	m				
free board	fb	**0.45**	m				
Wall above Ground		**2.80**	m				
Clear cover	Cv	**50**	mm				
Maximum size of bar dia	Db	**12**	mm				
Water depth with free board	Wd	**3.65**	m				
minimum % steel	pt	**0.35**	%				
Moment							
Due to Water	Mtw	**39.00**	kN-m	(From Analysis Result)			
Due to soil if any	Mts	**3.00**	kN-m				
Wt from top dome/slab/column/wall	Slabwt	**27.00**	kN-m				
Wall geometry (Figure 1)							
Straight portion	lb	**0.000**	m				
Tapered portion	lc	**3.650**	m				
	tb	**0.200**	m				
	td	**0.350**	m				
Footing geometry							
Toe projection	ht	**0.450**	m				
Heel straight projection	hh1	**1.400**	m				
Heel tapered projection	hh2	**0.000**	m				
Heel portion for soil stability	hh3	**0.500**	m				
Thickness at toe (free end)	tta	**0.250**	m				
Thickness at toe (fwall face)	ttb	**0.250**	m				
Thickness at heel (wall end)	tha	**0.250**	m				
Thickness at heel (freel face)	thb	**0.250**	m				
Total Height of Wall	Tlw	3.650	m				
Total length of wall footing	wf	2.200	m				
CASE 1 : TANK FULL CONDITION WITH NO SOIL OUTSIDE							
Total load & Moment calculation							
Taking moment @ toe							
Component	Wt	Lever	Momen				

		kN	Arm m	t kN-m
		W	Dist	W * dist
Wall Straight portion	W1	18.25	0.70	12.78
Wall Tapered portion	W2	6.84	0.55	3.76
Walkway/slab	P	27.00	0.70	18.90
Footing				
Footing : toe	W3	2.81	0.23	0.63
Footing center	W4	2.19	0.63	1.37
Footing : heel (straight)	W5	8.75	1.50	13.13
Footing : heel (tapered)	W6	0.00	2.20	0.00
Water	W7	51.10	1.50	76.65
Total downward load		116.94		127.21

Total restoring moment @ toe	TRM	127.2	kN-m
Total over turning moment		39.0	kN-m
F.S.against over turning		3.3	
Check for over turning	Hense o.k		
Total moment due to vertical load	Tmv	127.2	kN-m
Total moment due to horizontal load	Tmh	39.0	kN-m
Total vertical load	TPv	116.9	kn
Net Moment	Tmn	88.2	kN-m
M/p	E	0.75	m
Ecc	Ecc	0.346	m
b/6	Aec	0.37	m
Net moment From ECC	Mdg	40.424	

Property of footing

Width of footing		1.00	m
Depth of footing		2.20	m
Footing Area	Fare	2.20	m2
Modulus of section	Fz	0.81	m3

Pressure distribution			
Pressure due to direct load =P/A	prea	53.16	kN/m 2
Pressure due to moment =M/Z	Preb	50.11	kN/m 2
Pressure			
Maximum pressure - P/A + M/Z	Pma x	103.27	kN/m 2
Minimum pressure - P/A + M/Z	Pmin	3.04	kN/m

		2	
Check for SBC			
Maximum pressure < SBC	OK		
Minimum presure > 0	OK		
		100.2	
Pressure difference		2	
		45.55	
Pressure difference / m		7	
			kN/m
Pressure at outer Wall face - A	preow	82.77	2
Pressure at inner Wall face B	preiw	66.82	kN/m 2
Pressure at point C	preiw1	3.04	kN/m 2

Design of Toe - At Point A

Moment at face of outer wall			
Due to rectangle diagram	Mreco	8.38	kN-m
	Mtrio	1.38	kN-m
Total moment due to upward pressure		9.76	kN-m
Net moment at A from Toe side	Toem	9.76	kN-m
Thickness at toe		250	mm
Effective depth	Deftoe	194	mm
Ast required =		450	mm2
Check for minimum steel			
top		437.5	mm2
bottom		0	mm2
Design Steel			
Main steel - Top		438	mm2
Main steel - bottom		450	mm2
Distribution steel - top		438	mm2
Distribution steel - bottom		0	mm2

Design of heel : At point B & C

Design at point B			
Due to rectangle diagram (upward)	Mreci	3.0	kN-m
	Mtrii	20.8	kN-m
Total Upward moment		23.8	kN-m
Due to water (down ward)		35.8	kN-m
Net downward moment at B from heel side	heelm	12.0	kN-m
Thickness Provided		250	mm
	defheel	194	mm
Ast required =		551	mm2
Check for minimum steel - straight portion			
top		437.5	mm2
bottom		0	mm2
Design Steel			
Main steel - Top		551	mm2
Main steel - bottom		0	mm2
Distribution steel - top		438	mm2
Distribution steel -bottom		0	mm2

Design at point C			
Due to rectangle diagram (upward)	Mreci	0.00	kN-m
	Mtrii	0.00	kN-m
Total Upward moment		0.00	kN-m
Due to water (down ward)		0.00	kN-m
Net downward moment at B from heel side	heelm	0.00	kN-m
Thickness Provided		250	mm
	defhe el	194	mm
Ast required =		0	mm2
Check for minimum steel - tapered portion			
Avrage thickness	thav	0.25	m
top		437.5	mm2
bottom		0	mm2
Design Steel			
Main steel - Top		438	mm2
Main steel - bottom		0	mm2
Distribution steel - top		438	mm2
Distribution steel -bottom		0	mm2

SUMMARY

Pressure Check

1>	P/A + M/Z	103.3	<	150	OK
2>	P/A - M/Z	3.044	>	0	OK

Reinforcement

	AstR			+		Astp	
Toe		dia	spc		dia	spc	
Top - main	438	12	200		12	200	1131 OK
Bottom main	450	12	200		0	0	565 OK
Top - Dist	438	12	200		0	0	565 OK
Bottom - Dist	0	12	200		0	0	565 OK
Heel Straight portion							
Top - main	551	12	200		12	200	1131 OK
Bottom main	0	12	200		0	0	565 OK
Top - Dist	438	12	200		0	0	565 OK
Bottom - Dist	0	12	200		0	0	565 OK
Heel tapered portion							
Top - main	438	12	200		0	0	565 OK
Bottom main	0	0	0		0	0	
Top - Dist	438	12	200		0	0	565 OK
Bottom - Dist	0	0	0		0	0	

CASE 2 : TANK EMPTY CONDITION WITH SOIL OUTSIDE

Total load & Moment calculation
Taking moment @ toe

Component		Wt kN W	Lever Arm m Dist	Moment kN-m W * dist
Wall Straight portion	W1	18.25	0.60	10.95
Wall Tapered portion	W2	6.84	0.75	5.13
Walkway/slab	P	27.00	0.60	16.20
Footing				
Footing : toe	W3	2.81	1.08	3.02
Footing center	W4	2.19	0.68	1.48
Footing : heel	W5	3.13	0.25	0.78
Soil on toe	W6	6.89	1.08	7.40
Total downward load		**67.10**		**44.97**

Total restoring moment @ heel	TRMs	45.0	kN-m
Total over turning moment due to soil		3.0	kN-m
F.S.against over turning		15.0	
Check for over turning	Hense o.k		
Total moment due to vertical load	Tmv1	45.0	kN-m
Total moment due to horizontal load	Tmh1	3.0	kN-m
Total vertical load	TPv1	67.1	kn
Net Moment	Tmn1	42.0	kN-m
M/p	E1	0.63	m
Ecc	Ecc1	0.025	m
b/6	Aec1	0.22	m
Net moment From ECC	Mdg1	1.652	
Property of footing			
Width of footing		1.00	m
Depth of footing		1.30	m
Footing Area	Fare1	1.30	m2
Modulus of section	Fz1	0.28	m3
Pressure distribution			
Pressure due to direct load =P/A	prea1	51.62	kN/m2
Pressure due to moment =M/Z	Preb1	5.9	kN/m2
Pressure			
Maximum pressure - P/A + M/Z	Pmax1	57.48	kN/m2
Minimum pressure - P/A + M/Z	Pmin1	45.75	kN/m2
Check for SBC			
Maximum pressure < SBC		OK	
Minimum presure > 0		OK	
Pressure difference		11.73	kN/m2
Pressure difference / m		9.02	kN/m2
Pressure at outer Wall face - A	preow1	49.81	kN/m2
Pressure at inner Wall face B	preiw1	52.97	kN/m2

Design of Toe - At Point A

Moment at face of outer wall			
Due to rectangle diagram	Mreco1	4.63	kn-m
Due to triabgular diagram	Mtrio1	0.14	kn-m
Total moment due to upward pressure		4.77	kn-m
Total downward moment due to soil		1.55	kn-m
Net moment at A from Toe side	Toem1	-3.22	kn-m
Thickness at toe		250	mm
Effective depth	Deftoe1	194	mm
Ast required =		-148.36	mm2

Check for minimum steel			
top		438	mm2
bottom		0	mm2
Design Steel			
Main steel - Top		438	mm2
Main steel - bottom		0	mm2
Distribution steel - top		438	mm2
Distribution steel - bottom		0	mm2

Design of heel : At point B			
Design at point B			
Due to rectangle diagram (upward)	Mreci1	6.62	kn-m
	Mtrii1	0.38	kn-m
Total Upward moment	heelm1	7.00	kn-m
Net downward moment at B from heel side		250	mm
Thickness Provided	defheel1	194	mm
Steel required at bottom		322	mm2
Ast required =			
Check for minimum steel - straight portion			
top		437.5	mm2
bottom		0	mm2
Design Steel			
Main steel - Top		438	mm2
Main steel - bottom		322	mm2
Distribution steel - top		438	mm2
Distribution steel -bottom		0	mm2

SUMMARY

Pressure Check

1>	P/A + M/Z	57.48	<	150.0	OK	
2>	P/A - M/Z	45.75	>	0	OK	

Reinforcement

	AstR						Astp	
Toe		dia	spc	+	dia	spc		
Top - main	438	12	200		12	200	1131	OK
Bottom main	0	12	200		0	0	565	OK
Top - Dist	438	12	200		0	0	565	OK
Bottom - Dist	0	10	200		0	0	393	OK
Heel Straight portion								
Top - main	438	12	200		12	200	1131	OK
Bottom main	322	12	200		0	0	565	OK
Top - Dist	438	12	200		0	0	565	OK
Bottom - Dist	0	12	200		0	0	565	OK

DESIGN OF FLAT SLAB

Top slab

Loading:

Assume top slab = 160 th

(1) Dead load = 0.160 x 2.5 = 4 t/m2
(2) Live load = 0.150 t/m2
(3) Finishing load = 0.125 t/m2

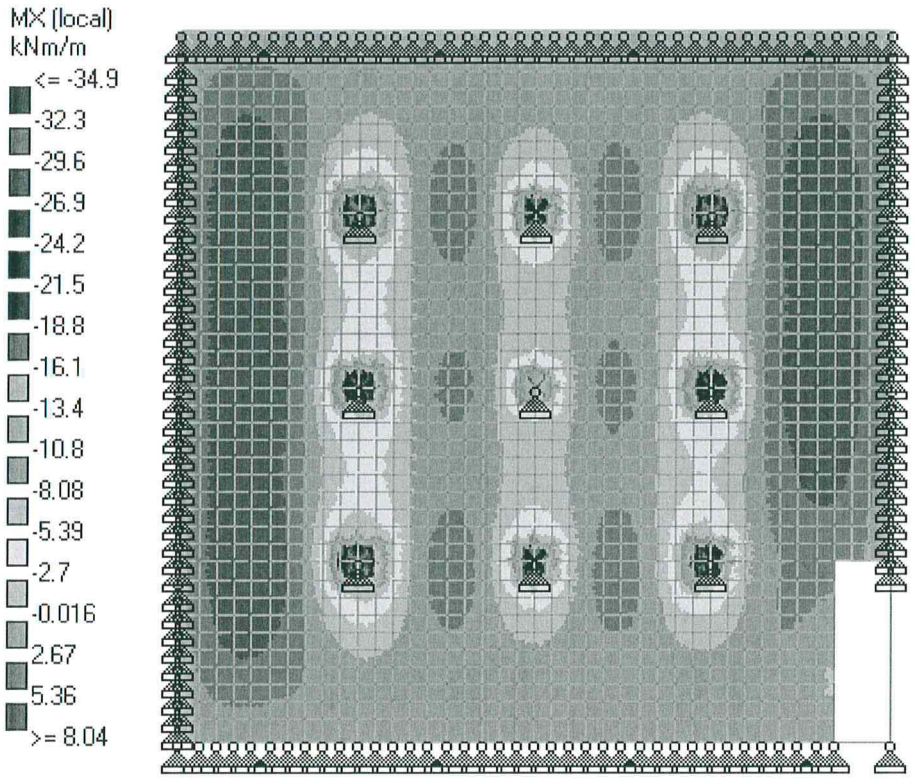
Total load = 0.675 t/m2

Analysis of Slab is done on STAAD.Pro with Slab is Plate.

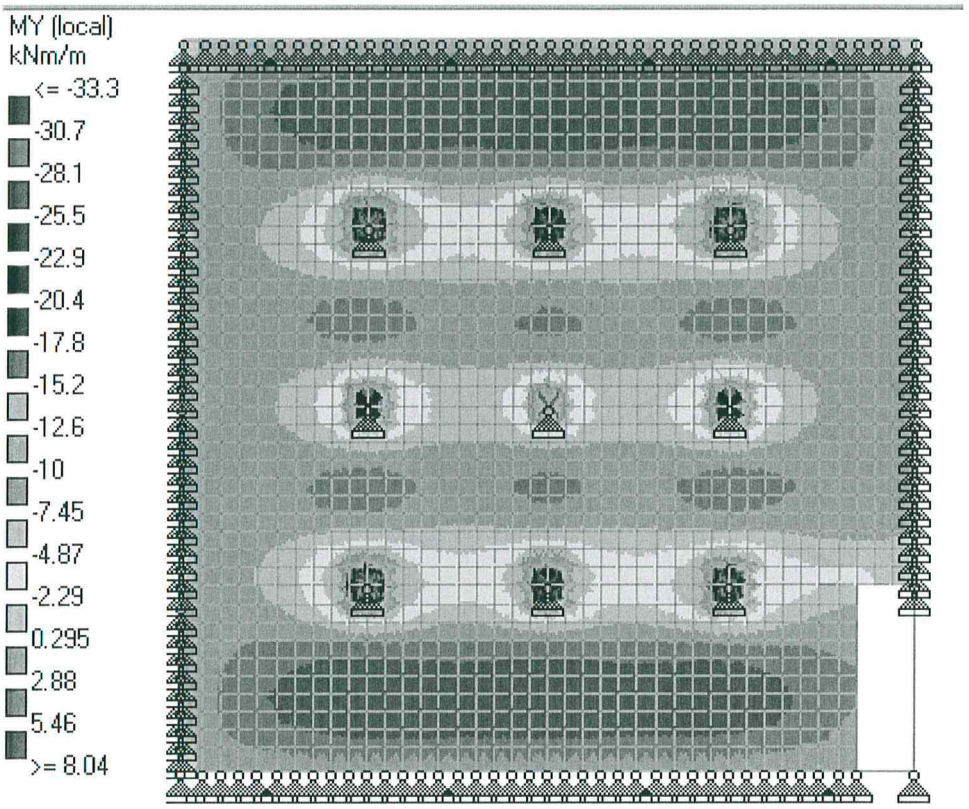
STAAD INPUT DATA

```
STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 01-Mar-16
END JOB INFORMATION
INPUT WIDTH 79
UNIT METER KN
JOINT COORDINATES
1 -0.1 0 -0.1; 2 3.9 0 -0.1; 3 -0.1 0 3.9; 4 3.9 0 3.9; 5 0.39 0 -0.1;6 0.39 0 0.39; 7 -
0.1 0 0.39; 8 0.78 0 -0.1; 9 0.78 0 0.39; 10 1.17 0 -0.1;11 1.17 0 0.39; 12 1.56 0 -0.1;
13 1.56 0 0.39; 14 1.95 0 -0.1; 15 1.95 0 0.39;16 2.34 0 -0.1; 17 2.34 0 0.39; 18 2.73 0
-0.1; 19 2.73 0 0.39; 20 3.12 0 -0.1;21 3.12 0 0.39; 22 3.51 0 -0.1; 23 3.51 0 0.39; 24
3.9 0 0.39; 25 0.39 0 0.78;26 -0.1 0 0.78; 27 0.78 0 0.78; 28 1.17 0 0.78; 29 1.56 0
0.78; 30 1.95 0 0.78;31 2.34 0 0.78; 32 2.73 0 0.78; 33 3.12 0 0.78; 34 3.51 0 0.78; 35
3.9 0 0.78;36 0.39 0 1.17; 37 -0.1 0 1.17; 38 0.78 0 1.17; 39 1.17 0 1.17; 40 1.56 0
1.17;41 1.95 0 1.17; 42 2.34 0 1.17; 43 2.73 0 1.17; 44 3.12 0 1.17; 45 3.51 0 1.17;
46 3.9 0 1.17; 47 0.39 0 1.56; 48 -0.1 0 1.56; 49 0.78 0 1.56; 50 1.17 0 1.56;51 1.56 0
1.56; 52 1.95 0 1.56; 53 2.34 0 1.56; 54 2.73 0 1.56; 55 3.12 0 1.56;56 3.51 0 1.56; 57
3.9 0 1.56; 58 0.39 0 1.95; 59 -0.1 0 1.95; 60 0.78 0 1.95;61 1.17 0 1.95; 62 1.56 0
1.95; 63 1.95 0 1.95; 64 2.34 0 1.95; 65 2.73 0 1.95;66 3.12 0 1.95; 67 3.51 0 1.95; 68
MEMBER INCIDENCES
2001 1171 1262; 2002 1262 1263; 2003 1263 1264; 2004 1264 1265; 2005 1265 1266;
2006 1266 1267; 2007 1267 1268; 2008 1268 1269; 2009 1269 1270; 2010 1270 1271;
2011 1678 1681; 2012 1268 1588; 2013 1588 1598; 2014 1598 1608; 2015 1608 1618;
2016 1618 1628; 2017 1628 1638; 2018 1638 1648; 2019 1648 1658; 2020 1658 1668;
2021 1668 1678; 2022 1271 1681;
ELEMENT INCIDENCES SHELL
7 1 5 6 7; 9 5 8 9 6; 11 8 10 11 9; 13 10 12 13 11; 15 12 14 15 13;
17 14 16 17 15; 19 16 18 19 17; 21 18 20 21 19; 23 20 22 23 21; 25 22 2 24 23;
27 7 6 25 26; 28 6 9 27 25; 29 9 11 28 27; 30 11 13 29 28; 31 13 15 30 29;
32 15 17 31 30; 33 17 19 32 31; 34 19 21 33 32; 35 21 23 34 33; 37 23 24 35 34;
39 26 25 36 37; 40 25 27 38 36; 41 27 28 39 38; 42 28 29 40 39; 43 29 30 41 40;
44 30 31 42 41; 45 31 32 43 42; 46 32 33 44 43; 47 33 34 45 44; 49 34 35 46 45;
51 37 36 47 48; 52 36 38 49 47; 53 38 39 50 49; 54 39 40 51 50; 55 40 41 52 51;
56 41 42 53 52; 57 42 43 54 53; 58 43 44 55 54; 59 44 45 56 55; 61 45 46 57 56;
63 48 47 58 59; 64 47 49 60 58; 65 49 50 61 60; 66 50 51 62 61; 67 51 52 63 62;
68 52 53 64 63; 69 53 54 65 64; 70 54 55 66 65; 71 55 56 67 66; 73 56 57 68 67;
75 59 58 69 70; 76 58 60 71 69; 77 60 61 72 71; 78 61 62 73 72; 79 62 63 74 73;
80 63 64 75 74; 81 64 65 76 75; 82 65 66 77 76; 83 66 67 78 77; 85 67 68 79 78;
87 70 69 80 81; 88 69 71 82 80; 89 71 72 83 82; 90 72 73 84 83; 91 73 74 85 84;
ELEMENT PROPERTY
140 231 240 331 340 431 450 540 541 550 631 640 641 650 731 740 741 831 850 -
940 941 950 1031 1040 1041 1050 1131 1140 1141 1231 1250 1341 1350 1441 1450 -
1541 THICKNESS 0.31
7 9 11 13 15 17 19 21 23 25 27 TO 35 37 39 TO 47 49 51 TO 59 61 63 TO 71 73 -
75 TO 83 85 87 TO 95 97 99 TO 107 109 111 TO 119 121 123 125 127 129 131 -
133 135 137 139 141 TO 230 232 TO 239 241 TO 330 332 TO 339 341 TO 430 432 -
433 TO 449 451 TO 539 542 TO 549 551 TO 630 632 TO 639 642 TO 649 651 TO 730 -
732 TO 739 742 TO 830 832 TO 849 851 TO 939 942 TO 949 951 TO 1030 -
1032 TO 1039 1042 TO 1049 1051 TO 1130 1132 TO 1139 1142 TO 1230 -
1232 TO 1249 1251 TO 1340 1342 TO 1349 1351 TO 1440 1442 TO 1449 -
1451 TO 1540 1542 TO 1547 1551 TO 1557 1561 TO 1567 1571 TO 1577 -
1581 TO 1587 1591 TO 1597 1601 TO 1607 1611 TO 1617 1621 TO 1627 -
1631 TO 1637 THICKNESS 0.16
DEFINE MATERIAL START
ISOTROPIC CONCRETE
E 2.7386e+007
POISSON 0.17
```

```
DENSITY 25
ALPHA 1e-005
DAMP 0.05
TYPE CONCRETE
STRENGTH FCU 27579
END DEFINE MATERIAL
MEMBER PROPERTY INDIAN
2001 TO 2010 2012 TO 2021 PRIS YD 0.45 ZD 0.23
2011 2022 PRIS YD 0.1 ZD 0.1
CONSTANTS
MATERIAL CONCRETE ALL
SUPPORTS
1 TO 5 7 8 10 12 14 16 18 20 22 26 37 48 59 70 81 92 103 122 124 126 128 130 -
132 134 136 138 140 231 232 234 236 238 240 242 244 246 248 250 341 342 344 -
346 348 350 352 354 356 358 360 361 371 381 391 401 411 421 431 441 451 453 -
464 475 486 497 508 519 530 541 552 561 661 761 771 781 791 801 811 821 831 -
841 851 861 863 874 885 896 907 918 929 940 951 962 971 1071 1171 1181 1191 -
1201 1211 1221 1231 1241 1251 1261 1271 1273 1284 1295 1306 1317 1328 1339 -
1350 1361 1371 TO 1381 1472 TO 1481 1572 TO 1581 1672 TO 1678 1681 PINNED
LOAD 1 LOADTYPE Dead  TITLE DL
SELFWEIGHT Y -1
ELEMENT LOAD
7 9 11 13 15 17 19 21 23 25 27 TO 35 37 39 TO 47 49 51 TO 59 61 63 TO 71 73 -
75 TO 83 85 87 TO 95 97 99 TO 107 109 111 TO 119 121 123 125 127 129 131 -
133 135 137 139 TO 1547 1551 TO 1557 1561 TO 1567 1571 TO 1577 1581 TO 1587 -
1591 TO 1597 1601 TO 1607 1611 TO 1617 1621 TO 1627 1631 TO 1636 -
1637 PR GY -1.25
LOAD 2 LOADTYPE Live REDUCIBLE TITLE LL
ELEMENT LOAD
7 9 11 13 15 17 19 21 23 25 27 TO 35 37 39 TO 47 49 51 TO 59 61 63 TO 71 73 -
75 TO 83 85 87 TO 95 97 99 TO 107 109 111 TO 119 121 123 125 127 129 131 -
133 135 137 139 TO 1547 1551 TO 1557 1561 TO 1567 1571 TO 1577 1581 TO 1587 -
1591 TO 1597 1601 TO 1607 1611 TO 1617 1621 TO 1627 1631 TO 1636 -
1637 PR GY -1.5
LOAD COMB 3 COMBINATION LOAD
1 1.0 2 1.0
PERFORM ANALYSIS
LOAD LIST 3
FINISH
```



STRESS DIAGRAM – MX



STRESS DIAGRAM – MY

Design of bottom Reinforcement

Provide depth of 160 mm

Program for Finding Wall steel subject to moment & Axial tension

Basic Data

Concrete mix	fck	30	N/mm2
Modular ratio	m	9.3	
Permissible stress in concrete : Direct tension	Psd	3	N/mm2
Permissible stress in concrete : bending	Pst	15	N/mm2
Permissible stress in steel	Pstb	20	N/mm2
Cover	Pstt	13 00	kg/cm2
wall thickness	Cv	45	mm
	wth	0.1 6	m

Type A : Horivontal wall : Horizontal steel at corner

Depth provide 160 mm

At Corner	Load case	Moment kn-m	Tension /comp kn/m2	Design moment kn-m	Design tension kn	Calculation for constant	Depth required mm	Depth provided mm	Effective depth mm	Ecc due to moment mm	Ea mm	Moment kn-m	Steel for moment cm2	Steel for tension cm2	Total steel cm2	Minimum steel cm2
bottom	3	9.0	0.0	9.0	10.4	0.1 27 0.3	159	160	115	868	833	8.6	6.64	0.80	7.44	3.62
bottom	3	9.0	0.0	9.0	10.4	0.1 27 0.3	159	160	115	868	833	8.6	6.64	0.80	7.44	3.62

Check for Shear:

Slab is to be checked at a distance d/2 from column head

Total depth D = 160

Effective depth = 160-45-5 =110 mm

Length at critical section for shear = 1060, Similar area = 0.94 x0.94

Total panel load = 3.9 x 3.9 x 0.675 = 10.27 T

Net load at critical section

= 10.27 – 0.94x0.94 x 0.625

= 9.72 T

Net load at critical section = 9.72 T

Actual shear stress = $9.72 \times 10^4 / (940 \times 4 \times 110)$

$= 0.235 \text{ N/mm}^2$

Permissible stress = Ks x Tc

$Tc = 0.16 * fck^{0.5}$

$= 0.16 * 30^{0.5}$

=0.87

Ks = (0.5 + beta) or Ks < 1

Beta = 1

Hence Ks = 1.0

$Tc = 0.87 * 1 = 0.87 \text{ N/mm}^2 >> 0.235$ O.K.

COLUMN REACTION

Node	L/C	Force-X kN	Force-Y kN	Force-Z kN	Moment-X kNm	Moment-Y kNm	Moment-Z kNm
4	3	0	139.945	0	0	0	0
231	3	0	115.133	0	0	0	0
341	3	0	140.078	0	0	0	0
561	3	0	115.035	0	0	0	0
661	3	0	85.93	0	0	0	0
761	3	0	114.561	0	0	0	0
971	3	0	139.931	0	0	0	0
1071	3	0	115.346	0	0	0	0
1171	3	0	143.715	0	0	0	0

Maximum load on column = 14.5 T (Refer computer output)
Add self wt = 1.0 T

Total = 15.5 t

Capacity of column = σ_{cc}*Ac + σ_{sc} *Ast

= 8*70686 + 275*2512

= 125.63 T > > 15.5 T O.K

Design of Stair Case

STAIR DESIGN							
Project : Adilabad W.S.S					**Proj. No P16_02**		
Unit : Adilabad W.S.S							
DATA							
Concrete grade	Fck	**30**	N/mm2				
Steel	Fy	**500**	N/mm2		fyucb	275	N/mm2
Clear cover	Cv	**25**	mm		fckbc	10.0	N/mm2
Stair effective span	L	**5.60**	m		fckt	1.5	N/mm2
				modular			
Width	B	**1000**	mm	ratio	m	9.333	
Depth of Waist slab	D	**200**	mm		K	0.253	
Riser	R	**194**	mm		j	0.916	
Tread	T	**250**	mm				
Density of concrete	Wd	25	kN/m3				
Moment coefficient	Me	**0.125**					
Maximum Dia of Bar	Db	**10**	mm				
Minimum % Steel	ptmin	**0.12**	%				
Basic Span to depth ratio	rat	**26**					
Loading							
Live load	LI	3.00	kN/m2				
Finishing load	FI	1.50	kN/m2				
Calculation							
Calculation of loading							
Self wt (Dead load)	DI	6.33	kN/m2				
Weight of step	WS	3.08	kN/m2				
Total Load	TI	13.91	kN/m2				
Effective depth	De	170	mm				
Design							
Moment	M	54.54	kN-m				
Required area of steel	Ast(req)	806	mm^2				
Provide area of steel	Ast(pro)	1131	mm^2	**12**	**100**		O.K
Distribution steel	Ast(min)	240	mm^2				
Provide Distribution steel	DAst(pro)	335	mm^2	**8**	**150**		O.K
Shear Check							
Maximum shear	V	39.0	kN				
Facotred Shear	Vu	58.4	kN				
Actual Shear stress	Tv	0.344	N/mm2				
% Ast	pt	0.67	%				
beta	beta	5.24					
Value of K for Solid slab							
Overall Depth		200.00	mm				
	K	1.20					
permissible shear for pt	Tc	0.691	N/mm2		OK		
CHECK FOR DEFLECTION							
basic span /deph ratio	bsd	26					
fs	fs	207	N/mm2				

% steel provided	ptt	0.67	%	
Moification factor	mf	1.29		
permissible span/ depth ratio	psd	33.44		
actual span /depth ratio	sdr	28.00		OK

Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad

"Designs Vetted"

M/s. ASSOCIATES Hyd-08.

APPROVED
30/4/16
SE, NIRMAL

LARSEN & TOUBRO LTD. Komaram Bheem - Asifabad Segment Construction-TDWSP -ADILABAD

वाप्कोस लिमिटेड Hyderabad WAPCOS LIMITED

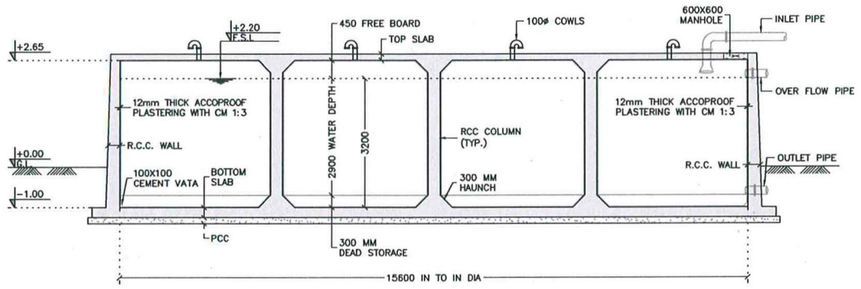
SCHEDULE OF OPENING			
SYMBOLE	SIZE	LINTEL	REMARK
D	750 X 2500	2500	DOOR

SCHEDULE OF PIPE	
INLET PIPE SIZE	–
OUTLET PIPE SIZE	–
OVER FLOW PIPE SIZE	–

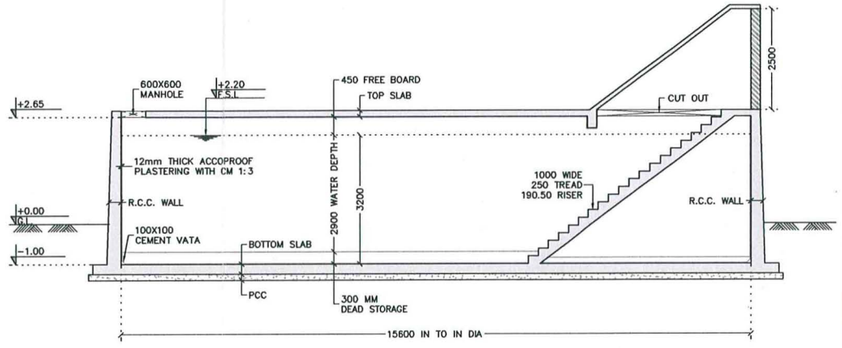
NOTES :

<1> ALL DIMENSION ARE IN MM AND LEVELS ARE IN METER.

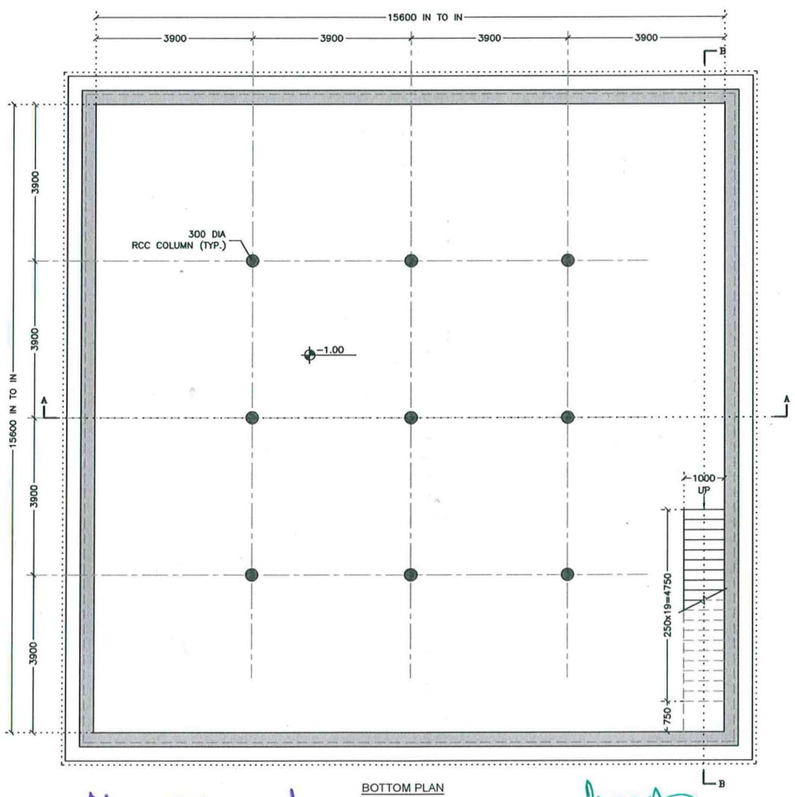
<2> LOCATION & LEVELS OF INLET,OUTLET & OVERFLOW PIPE SHALL BE VARIFIED WITH ENGINEER INCHARGE BEFORE EXECUTION



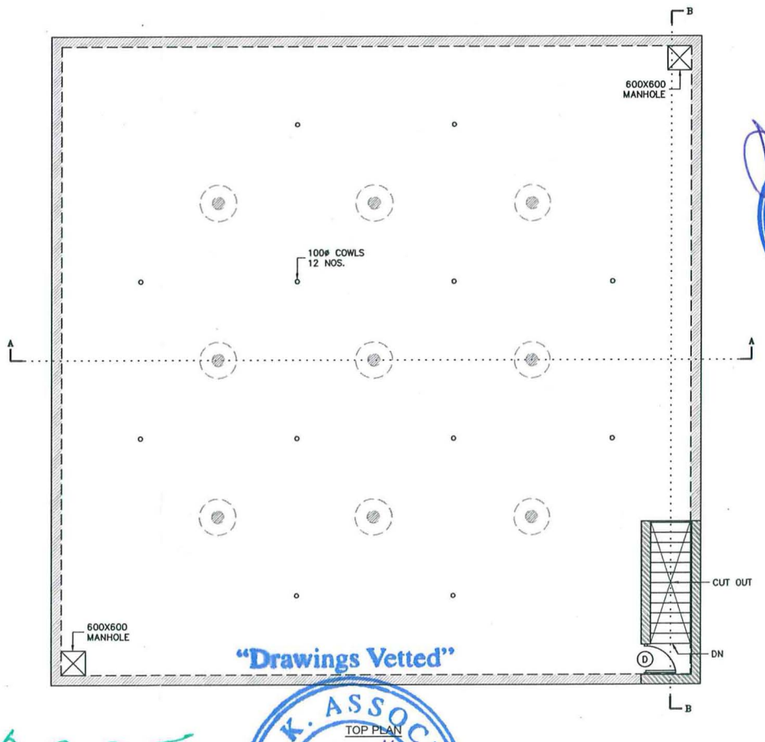
SECTION : A - A



SECTION : B - B



BOTTOM PLAN



TOP PLAN

"Drawings Vetted"

M/s. S.K. ASSOCIATES G. Gowtham Hyd-08.

Asst. Executive Engineer TDWSP Asifabad

Dy. Executive Engineer TDWSP Asifabad

Executive Engineer TDWSP Asifabad

APPROVED 30/4/16

SE, NIRMAL

LARSEN & TOUBRO LTD. Komaram Bheem - Asifabad Segment Construction-TDWSP -ADILABAD

WAPCOS LIMITED Hyderabad

REV. No	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED
A	FOR APPROVAL	04-04-16	HMP	PMD	RMM	–

REVISIONS

L&T Construction
Water, Smart World & Communication.

CLIENT : RURAL WATER SUPPLY AND SANITATION DEPARTMENT, TELANGANA.

CONSULTANT : -

PROJECT : PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT

SUPPLIER / CONTRACTOR : L&T Construction Water & Effluent Treatment SBG

JOB No. : LE150883

	NAME	SIGN	DATE
DSGN	HMP		04-04-16
DRWN	PMD		04-04-16
CHKD	RMM		04-04-16
APPD	–		04-04-16

TITLE : 700KL CAPACITY GLBR AT DARIGAONGUTTA VILLAGE (GENERAL ARRANGEMENT DRAWING)

SCALE 1:100

PROJECTION

DRAWING No. LE150883-C-WS-RW-GA-1571

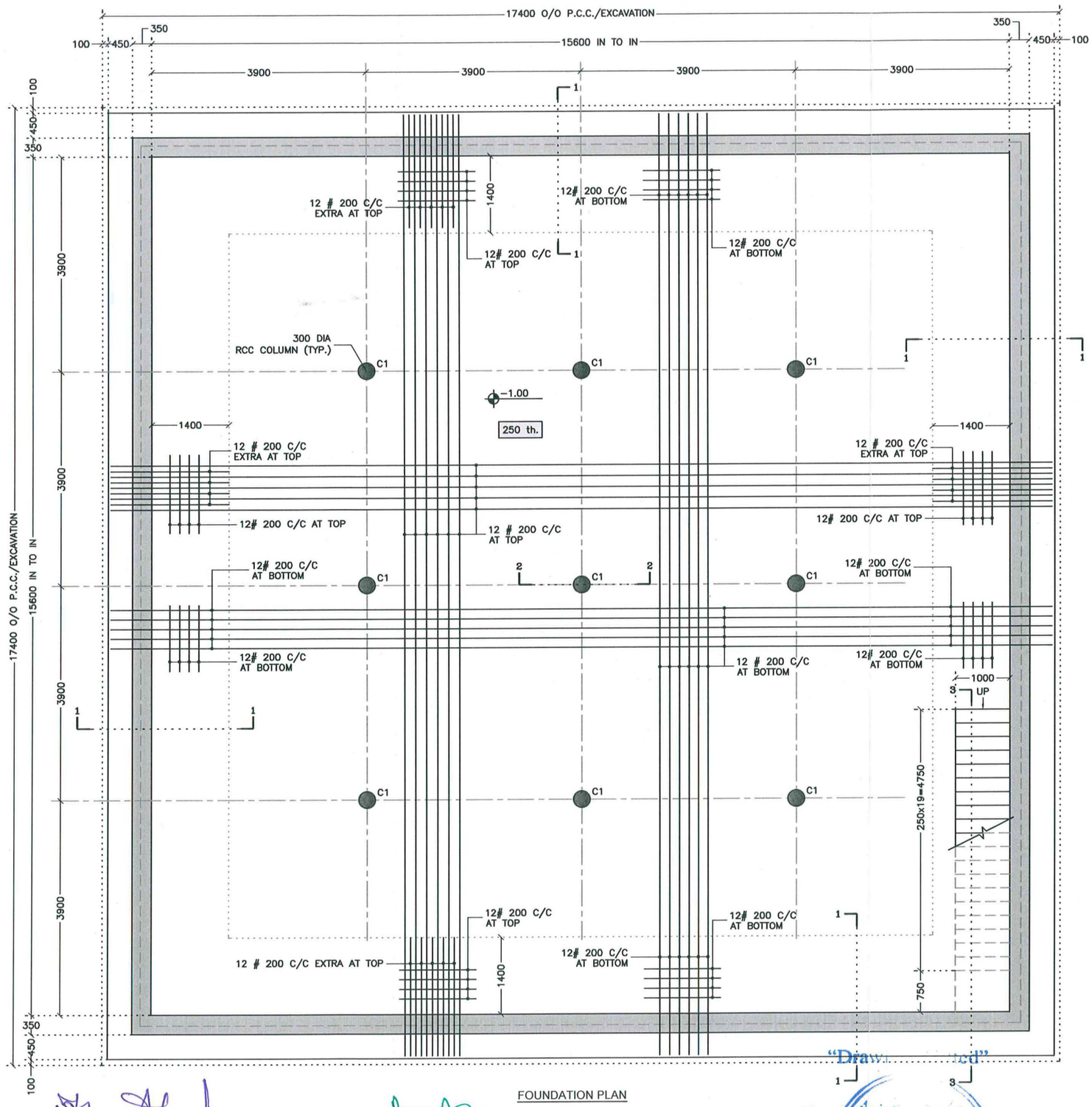
COMP. DATA : P16-02_100-01-01

SHEET 1 OF 1

SIZE A2

REV. A

RELEASED FOR ☐ PRELIMINARY ☐ TENDER ☐ INFORMATION ☑ APPROVAL ☐ CONSTRUCTION



FOUNDATION PLAN

IMPORTANT NOTES

1 NO GROUND WATER TABLE WAS FOUND UP TO DEPTH OF INVESTIGATION. IF WATER TABLE IS FOUND DURING THE EXECUTION, WORK SHALL BE STOP AND SAME SHALL BE INFORMED TO CONCERNED AUTHORITY AND DESIGNER. PROPER STORM WATER DRAINAGE SYSTEM FOR SURROUNDING AREA SHALL ALSO BE PROVIDED TO AVOID LOCALIZED TEMPORARY WATER TABLE EFFECTS.

2 FOUNDATION SHALL REST ON GOOD SOIL. IT SHOULD NOT REST ON BLACK COTTON SOIL OR SOIL HAVING EXPANSIVE PROPERTY.

NOTES -

1 ALL DIMENSION ARE IN MM AND LEVELS ARE IN METER
2 ALL CONCRETE MIX M:30 WITH MAXIMUM FREE WATER CEMENT RATIO OF 0.45 AND MAXIMUM CEMENT CONTENT OF 400kg/m3 FOR WATER RETAINING STRUCTURE
3 ALL CONCRETE SHALL BE MACHINE MIXED AND MACHINE VIBRATED
4 # – INDICATE TMT BAR FE–500 GRADE 1 CONFIRMING TO I.S 1786–LATEST REVISION
5 CLEAR COVER TO MAIN STEEL 50mm IN BOTTOM SLAB & 45mm TOP SLAB & WALL
6 FOUNDATION SHALL REST ON IN–SITU SOIL AND IT SHALL NOT BE ON FILLING MATERIAL i.e. MADE UP SOIL OR HIGHLY COMPRESSIBLE SOIL
7 BACK FILLING SHALL BE DONE IN WELL COMPACTED AND WELL WATER LAYER NOT EXCEEDING 150mm IN DEPTH
8 SBC CONSIDERED 15.0 t/m2 IN DESIGN.
9 INLET & OVERFLOW PIPE SHALL BE DECIDED AS PER SITE CONDITION
10 LOCATION & LEVELS OF INLET,OUTLET & OVERFLOW PIPE SHALL BE VERIFY WITH ENGINEER INCHARGE BEFORE EXECUTION
11 SEISMIC ZONE CONSIDERED IN DESIGN IS ZONE II
12 READ THIS DRAWING ALONG WITH SHEET NO. 2 OF 4 TO 4 OF 4.
13 STEEL CHAIRS SHALL BE PROVIDE TO KEPT TOP REINFORCEMENT OF SLAB IN PROPER POSITION

APPROVED
SE, NIRMAL

REV. No	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED
A	FOR APPROVAL	04/04/16	HMP	NSP	RMM	–

REVISIONS

L&T Construction
Water, Smart World & Communication.

CLIENT : RURAL WATER SUPPLY AND SANITATION DEPARTMENT, TELANGANA.
CONSULTANT : -

PROJECT : PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT

SUPPLIER / CONTRACTOR : L&T Construction Water & Effluent Treatment SBG

JOB No. : LE150883

	NAME	SIGN	DATE
DSGN	HMP		04–04–16
DRWN	NSP		04–04–16
CHKD	RMM		04–04–16
APPD	–		04–04–16

TITLE : 700KL CAPACITY GLBR AT DARIGAONGUTTA VILLAGE (FOUNDATION PLAN)

SCALE 1: 75
PROJECTION

DRAWING No. LE150883–C–WS–RW–RC–1574
COMP. DATA : P16–02_100–02–01
SHEET 1 OF 4
SIZE A3
REV. A

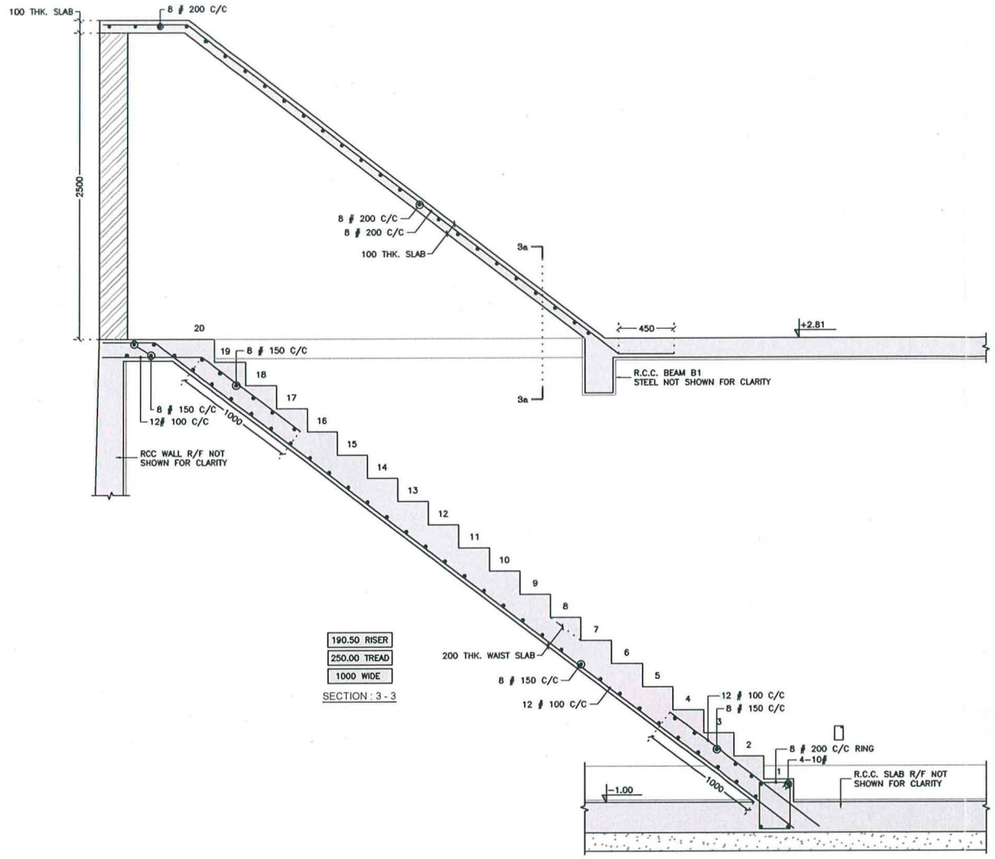
RELEASED FOR ☐ PRELIMINARY ☐ TENDER ☐ INFORMATION ☑ APPROVAL ☐ CONSTRUCTION

"Drawing Approved"

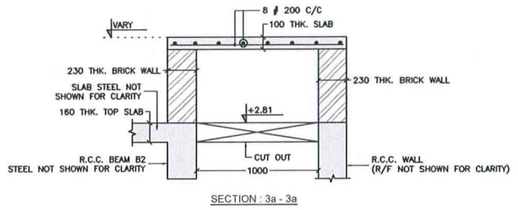
Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

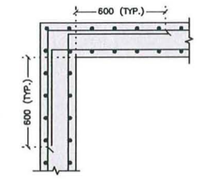
Executive Engineer
TDWSP Asifabad



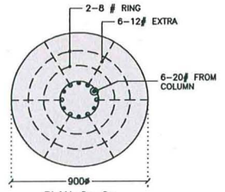
SECTION : 3 - 3



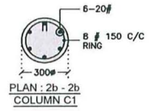
SECTION : 3a - 3a



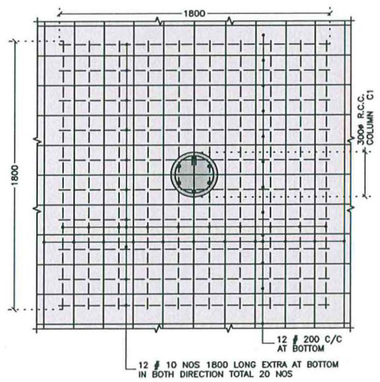
TYPICAL ENLARGE DETAIL FOR RCC WALL (AT CORNER)



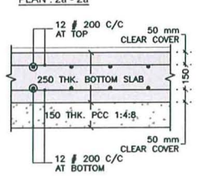
PLAN : 2c - 2c



PLAN : 2b - 2b
COLUMN C1



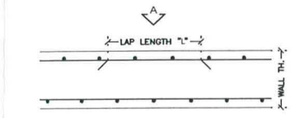
PLAN : 2a - 2a



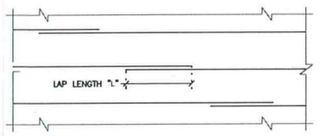
ENLARGE DETAIL "X"

NOTES :
<1> ALL DIMENSION ARE IN MM AND LEVELS ARE IN METER.
<2> FOR ALL OTHER NOTES REFER SHEET NO 1 OF 4.
<3> READ THIS DRAWING ALONG WITH DRG.NO. 1 OF 4 TO 4 OF 4.

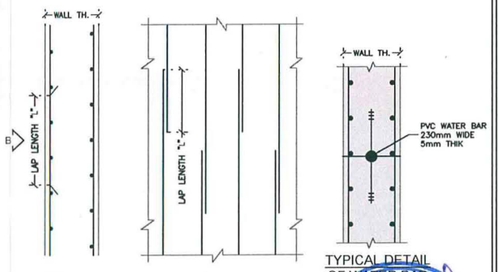
LAP LENGTH SECHDULE	
DIA OF BAR	LAP LENGTH "L" IN mm
8	320
10	400
12	480
16	640
20	800
25	1000



WALL PLAN
(LAP DETAILS FOR HORIZONTAL STEEL)
(LAP SHALL BE STAGGERED AS PER ELEVATION – A)



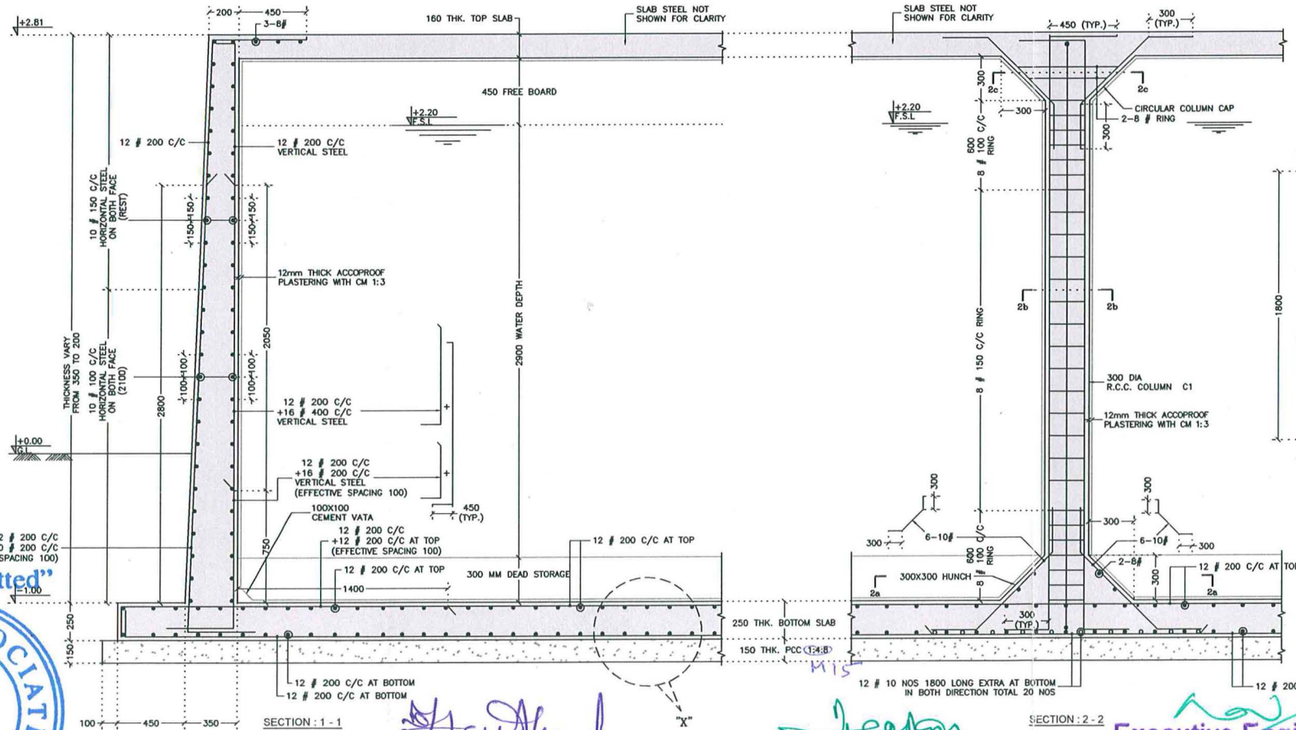
ELEVATION : A



WALL SECTION
LAP DETAILS FOR VERTICAL STEEL
(LAP SHALL BE STAGGERED AS PER ELEVATION – B)

ELEVATION : B

TYPICAL DETAIL OF WATER BAR



SECTION : 1 - 1

SECTION : 2 - 2

"Drawings Vetted"
M/s. S.K. ASSOCIATES
Hyd-08.

Asst. Executive Engineer,
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad

WAPCOS LIMITED
Hyderabad

APPROVED
30/4/16
SE, NIRMAL

REV. No	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED
A	FOR APPROVAL	04/04/16	HMP	NSP	RMM	–

REVISIONS

L&T Construction
Water, Smart World & Communication.

CLIENT : RURAL WATER SUPPLY AND SANITATION DEPARTMENT, TELANGANA.
CONSULTANT : -

PROJECT : PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT

SUPPLIER / CONTRACTOR : L&T Construction
Water & Effluent Treatment SBG

JOB No. : LE150883

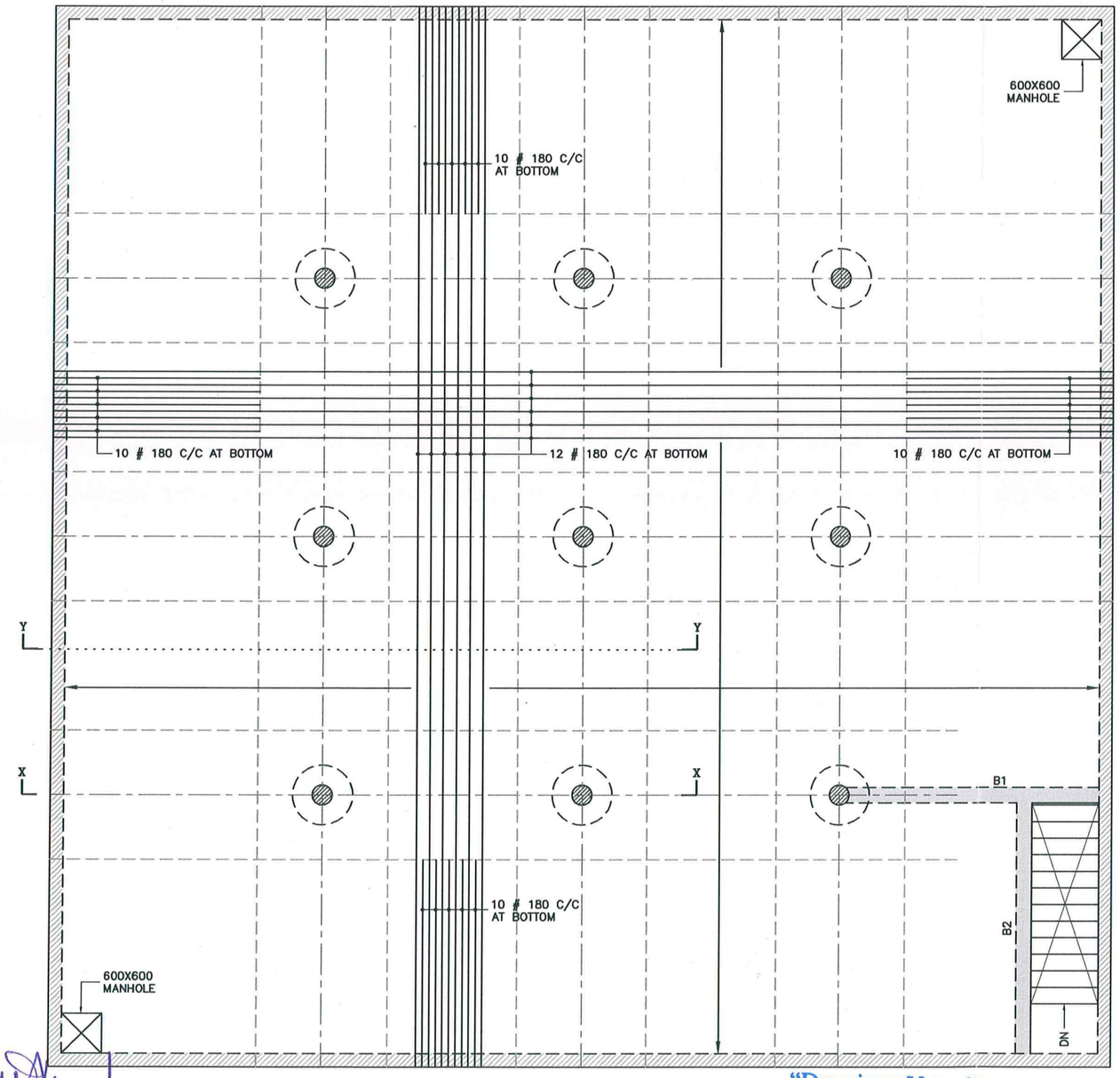
	NAME	SIGN	DATE
DSGN	HMP		04-04-16
DRWN	NSP		04-04-16
CHKD	RMM		04-04-16
APPD	–		04-04-16

TITLE : 700KL CAPACITY GLBR AT DARIGAONGUTTA VILLAGE (ENLARGE SECTION DETAIL)

SCALE 1:30,25
PROJECTION

DRAWING No. LE150883-C-WS-RW-RC-1574
COMP. DATA : P16-02_100-02-02
SIZE A2 REV. A
SHEET 2 OF 4

RELEASED FOR ☐ PRELIMINARY ☐ TENDER ☐ INFORMATION ☑ APPROVAL ☐ CONSTRUCTION



PLAN FOR TOP SLAB BOTTOM REINFORCEMENT
ALL SLAB ARE 160 THK. (CONCRETE MIX M:30)

Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad

"Drawings Vetted"
M/s. S.K. ASSOCIATES
Hyd-08.

NOTES :
<1> ALL DIMENSION ARE IN MM AND LEVELS ARE IN METER.
<2> FOR ALL OTHER NOTES REFER SHEET NO 1 OF 4.
<3> READ THIS DRAWING ALONG WITH DRG.NO. 1 OF 4 TO 4 OF 4.

WAPCOS LIMITED Hyderabad

LARSEN & TOUBRO LTD Komaram Bheem - Asifabad Segment Construction-TDWSP -ADILABAD

APPROVED
SE, NIRMAL

REV. No	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED
A	FOR APPROVAL	04/04/16	HMP	NSP	RMM	–

REVISIONS

L&T Construction
Water, Smart World & Communication.

CLIENT : RURAL WATER SUPPLY AND SANITATION DEPARTMENT, TELANGANA.
CONSULTANT : -

PROJECT : PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT

SUPPLIER / CONTRACTOR : L&T Construction
Water & Effluent Treatment SBG

JOB No. : LE150883

	NAME	SIGN	DATE
DSGN	HMP		04-04-16
DRWN	NSP		04-04-16
CHKD	RMM		04-04-16
APPD	–		04-04-16

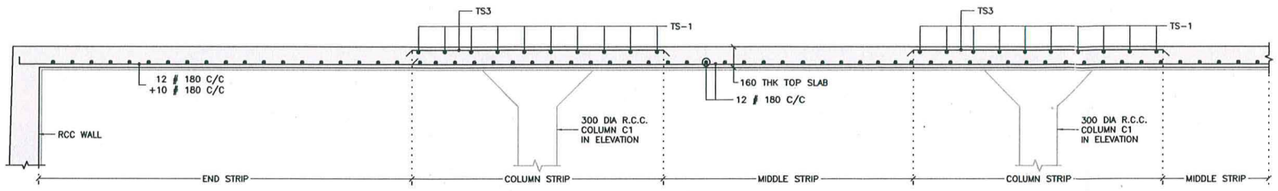
TITLE : 700KL CAPACITY GLBR AT DARIGAONGUTTA VILLAGE (STRUCTURAL LAYOUT AT BOTTOM REINFORCEMENT OF TOP SLAB)

SCALE 1:75

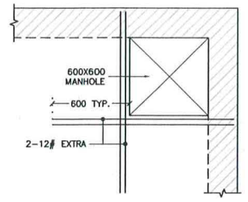
PROJECTION

DRAWING No. LE150883-C-WS-RW-RC-1574 | SIZE A3 | REV. A
COMP. DATA : P16-02_100-02-03 | SHEET 3 OF 4

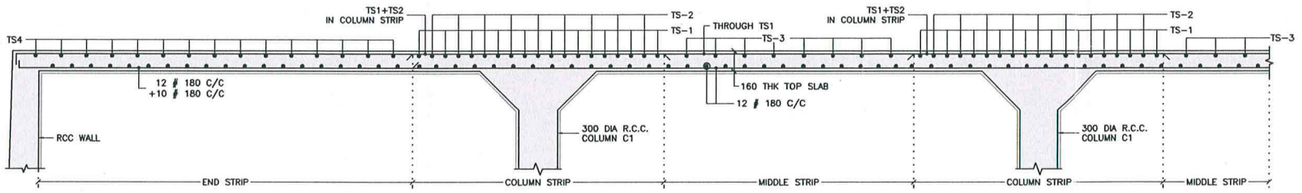
RELEASED FOR ☐ PRELIMINARY ☐ TENDER ☐ INFORMATION ☑ APPROVAL ☐ CONSTRUCTION



SECTION :Y - Y

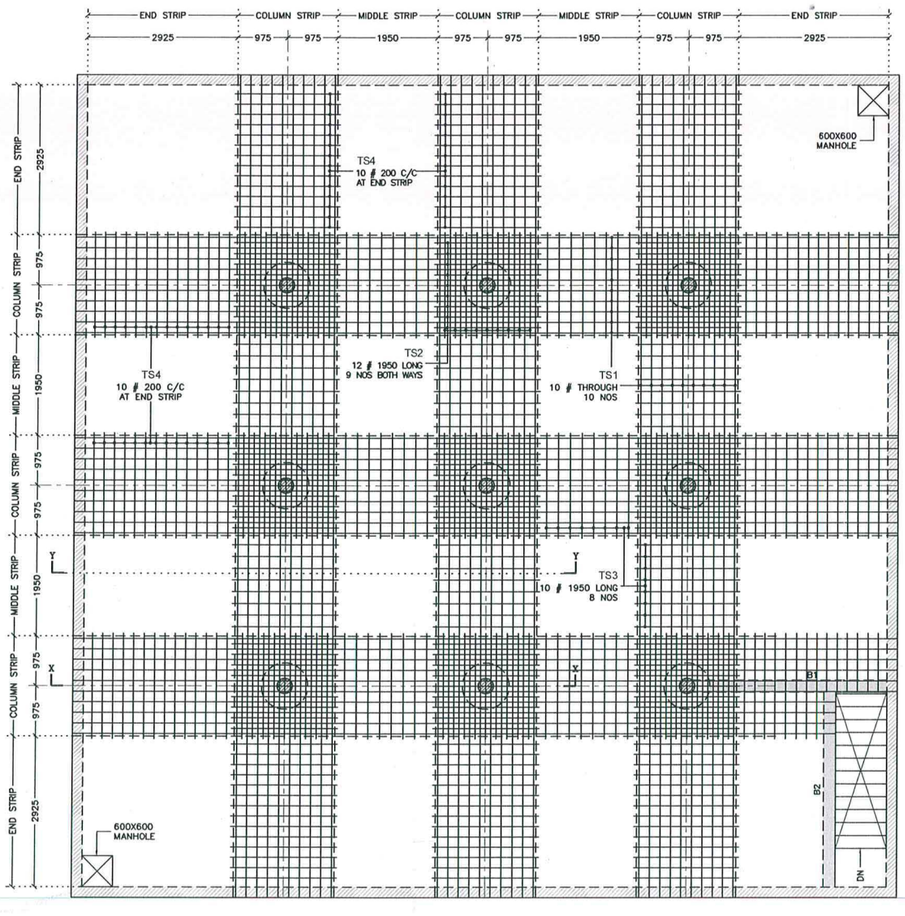


TYPICAL DETAIL FOR MANHOLE

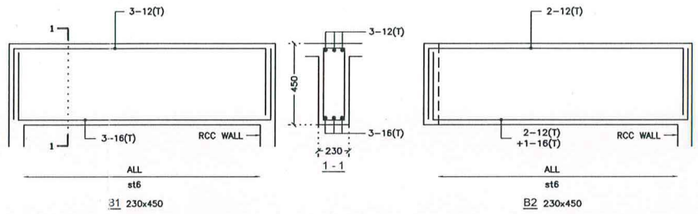


SECTION : X - X

STEEL CHAIRS SHALL BE PROVIDE TO KEPT TOP REINFORCEMENT OF SLAB IN PROPER POSITION

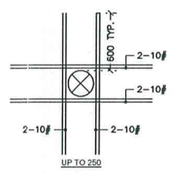


PLAN FOR TOP SLAB TOP REINFORCEMENT
ALL SLAB ARE 160 THK. (CONCRETE MIX M:30)

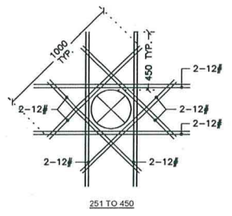


31 230x450

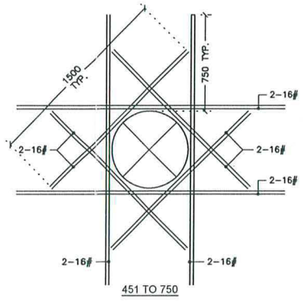
B2 230x450



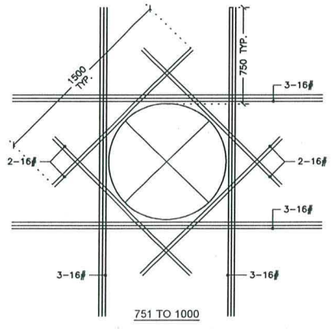
UP TO 250



251 TO 450



451 TO 750



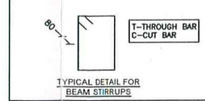
751 TO 1000

TYPICAL DETAIL FOR EXTRA STEEL BAR AT CUT-OUT

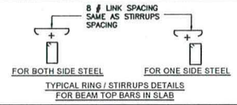
NOTES :
<1> ALL DIMENSION ARE IN MM AND LEVELS ARE IN METER.
<2> FOR ALL OTHER NOTES REFER SHEET NO 1 OF 4.
<3> READ THIS DRAWING ALONG WITH DRG.NO. 1 OF 4 TO 4 OF 4.

SLAB SCHEDULE

TYPE	DESCRIPTION
TS - 1	10 ∮ THROUGH 10 NOS
TS - 2	12 ∮ 1950 LONG 9 NOS BOTH WAYS (TOTAL 18 NOS)
TS - 3	10 ∮ 1950 LONG 8 NOS
TS - 4	10 ∮ 200 C/C AT END STRIP



TYPICAL DETAIL FOR BEAM STIRRUPS



TYPICAL RING / STIRRUPS DETAILS FOR BEAM TOP BARS IN SLAB

STIRRUPS SCHEDULE
(2 Legged STIRRUPS UNLESS OTHERWISE SPECIFIED)

TYPE	DESCRIPTION	TYPE	DESCRIPTION	TYPE	DESCRIPTION
st1	8 ∮ 225 C/C	st2	8 ∮ 200 C/C	st3	8 ∮ 175 C/C
st4	8 ∮ 150 C/C	st5	8 ∮ 125 C/C	st6	8 ∮ 100 C/C
st7	10 ∮ 150 C/C	st8	10 ∮ 125 C/C	st9	10 ∮ 100 C/C
st10	12 ∮ 125 C/C	st11	12 ∮ 100 C/C	st12	12 ∮ 75 C/C

APPROVED
SE, NIRMAL
30/4/16

REV. No	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED
A	FOR APPROVAL	04/04/16	HMP	NSP	RMM	–

REVISIONS

L&T Construction
Water, Smart World & Communication.

CLIENT : RURAL WATER SUPPLY AND SANITATION DEPARTMENT, TELANGANA.
CONSULTANT : -
PROJECT : PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT
SUPPLIER / CONTRACTOR : L&T Construction Water & Effluent Treatment SBG
JOB No. : LE150883
TITLE : 700KL CAPACITY GLBR AT DARIGAONGUTTA VILLAGE (STRUCTURAL LAYOUT & DETAILS AT TOP REINFORCEMENT OF TOP SLAB)
SCALE 1: 75,30
PROJECTION

	NAME	SIGN	DATE
DSGN	HMP		04-04-16
DRWN	NSP		04-04-16
CHKD	RMM		04-04-16
APPD	-		04-04-16

DRAWING No. LE150883-C-WS-RW-RC-1574 | SIZE A2 | REV. A
COMP. DATA : P16-02_100-02-04 | SHEET 4 OF 4

RELEASED FOR ☐ PRELIMINARY ☐ TENDER ☐ INFORMATION ☑ APPROVAL ☐ CONSTRUCTION

"Drawn Vetted"

Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad

W/S.S.K

वाप्कोस लिमिटेड हैदराबाद Hyderabad WAPCOS LIMITED

L&T Construction Komaram Bheem Asifabad Segment Construction-TDWSP-ADILABAD

GEOTECHNICAL INVESTIGATION REPORT

TELANGANA DRINKING WATER SUPPLY PROJECT

KOMARAM BHEEM - ASIFABAD- SEGMENT 22

ASIFABAD , ADILABAD DISTRICT

700 KL GLBR AT DARIGAONGUTTA, KAGHAZNAGAR

CONTRACTOR :

M/s. LARSEN& TOUBRO LIMITED,L&T CONSTRUCTION,

WATER & EFFLUENT TREATMENT SBG, CHENNAI

Drilling By:

M/s. ANJI DRILLING & GROUTING WORKS

Report Prepared by

DR. D. BABU RAO,

M.E.(IIT,Roorkee), Ph.D.(USA), MIGS

MCH Panellist No. 2490 /TP/2000-2

GEOTECHNOLOGIES

CONSULTING GEO TECHNICAL ENGINEER

FORMER PROFESSOR &HEAD OF CIVIL ENGINEERING

OSMANIA UNIVERSITY

Phone: 6663 8830, Mobile : 98490 – 39337

Email :dbaburao2000@yahoo.com

TELANGANA DRINKING WATER SUPPLY PROJECT

700 KL GLBR AT DARIGAONGUTTA, KAGHAZNAGAR(M)

1. INTRODUCTION

M/s. L &T Construction, Water & Effluent Treatment is proposing to construct 700 kL BPT at Sirpur-u. The work is taken up under Segment 22 , Komaram Bheem Project , TDWSP, in Adilabad Dt.

The present Report presents the results of (1) Bore hole.

M/S Anji Drilling & Grouting works; Anantapur has carried out the drilling of bore holes, collection of soil and rock samples and conduct of Standard Penetration Tests at different levels in the respective bore holes at the proposed site.

Analysis of borehole data , Laboratory tests and geotechnical investigation report have been made by Prof. D Babu Rao, ME (IIT,R) , Ph.D. (USA), MIGS, Empanelled Consulting Geo technical Engineer &,Director, Geo technologies, Former Professor of Civil Engineering, Osmania University.

2. SCOPE OF WORK

The following is the scope of work of M/s. Anji Drilling and Grouting Works:

- Drilling Borehole at (1) location for 700 kL GLBR at Sirpur (M).
- Conducting SPT at regular intervals, where feasible
- Collection of undisturbed / disturbed samples from the Bore holes
- Preparation of Technical Report recommending suitable foundations and safe bearing capacity

Dr. D. BABU RAO
M.E., Ph.D.(USA)
Consulting Geotechnical Engineer

GEO TECHNOLOGIES

Following is the scope of work of Prof. D Babu Rao ,

Testing of soil samples in the Laboratory

Preparation of Technical Report

3. SUB SOIL INVESTIGATION

The sub soil investigation was carried out to determine:

Nature of sub stratum and engineering properties of sub strata which may affect the mode of construction of the proposed work.

FIELD INVESTIGATION PROCEDURE:

The following technique is adopted for sub soil investigations.

a) BORINGS:

Rotary Drilling was done using TC / Diamond bits. The size of the casing used was 125 to 75 mm, yielding samples of NX size.

TC bits were employed for the overburden, and Impregnated Diamond Core bits were used for rock formation.

Drilling was performed on 13 Jan ,2016.

The following relevant data was recorded during Rotary drilling operations.

- Nature of strata
- Details of samples
- Core Recovery (CR)
- Rock Quality Designation (RQD)

Dr. D. BABU RAO
M.E., Ph.D.(USA)
Consulting Geotechnical Engineer

b) STANDARD PENETRATION TEST (SPT):

SPT split spoon sampler of standard dimensions was driven into the soil from the borehole bottom using 63.5 kg hammer with a fall of 75 cm height. The SPT weight was lifted to the specified height and allowed to fall freely on the anvil with the use of cat-head winch with one to one and half turn of the drum. Blow counts for the penetration of every 15 cm were recorded and the 'N' value is reported as the blow counts for 30 cm penetration of the sampler excluding the first 15 cm penetration as seating drive.

When the number of blows exceeded 50 to penetrate the first or second 15 cm length of the sampler, the SPT 'N' is regarded as more than 100 as described in IS 2131 - 1981. The test is terminated in such case and a record of the penetration of the sampler under 50 blows is made. SPT refusal is recorded when there is no penetration of the sampler at any stage and also when a rebound of the sounding system is recorded. These tests were conducted at close intervals of 1.0m so that a continuous SPT 'N' profile is available.

Disturbed soil collected in the SPT sampler was preserved in polythene covers and transported to the laboratory. Additional polythene cover was used to prevent the loss of moisture during the transit period.

c) DEPTH OF BORING: The depth of the Bore hole was as follows:

BH No	Drilled depth
1	3 m

GEO TECHNOLOGIES

Dr. D. BABU RAO
M.E., Ph.D.(USA)
Consulting Geotechnical Engineer

d) LOG OF BORE HOLE:

All the results obtained from the field operations are presented in Log of Bore hole in Fig. 1 .

4. LABORATORY TESTING:

The laboratory tests are conducted in the laboratory of Geotechnolgies, Hyderabad, an ISO- 9000 approved Laboratory.

- No cores were obtained in weathered rock strata. The following Tests were conducted on rock cores.

  Unconfined compressive strength (as per IS: 9143)

Table 1 gives the rock properties of Cores.

5. SUB SOIL PROFILE

Based on Field and Laboratory tests, the following idealized sub soil profile is evolved.

Depth	Strata	N value
0 – 3 m	HARD ROCK	>100

. In Hard rock, no SPT can be conducted. However, in SDR strata, SPT can be conducted with N values tending to be 'refusal'. This is the criterion for distinguishing between Soft rock /Weathered rock and Hard rock.

6.0 SHALLOW FOUNDATIONS

In general, the following pertains to foundations resting in soils.

. A properly designed foundation has to satisfy the following two limit states.

GEO TECHNOLOGIES

Dr. D. BABU Ra
M.E., Ph.D.(USA
Consulting Geotechnical Engi

1) Limit state of collapse (i.e. Shear strength)

2) Limit state of serviceability (i.e. Settlement)

SHEAR CRITERIA:

The first criterion is depends on shear strength. The calculations are based on "TERZAGHI" bearing capacity equation as recommended by IS: 6403 (with factor of Safety) which takes care of L/B ratio (shape), foundation depth etc., along with other parameters.

SETTLEMENT CRITERIA:

The intensity of loading that will cause a permissible settlement or specified settlement of the structure is termed as allowable bearing pressure. The settlement in this type of layer will be elastic settlement.

These foundation settlements are evaluated using elastic theory. The pressure distribution below the footing is assumed as 2 V: 1 H for estimating the settlement. Since rock formation is available at shallow depth. The settlement will be within the permissible limit. Hence open foundation is suitable.

ALLOWABLE BEARING CAPACITY:

Allowable Bearing capacity (ABC) is the net intensity of the loading which the foundation will carry without undergoing settlement in excess of the permissible value for the structure under consideration but not exceeding the net safe bearing capacity (SBC).

7.0 DISCUSSION ON FOUNDATION OPTIONS: From sub soil profile and laboratory test data, it can be seen that rock / soft disintegrated rock exists from 0m to 3m depth. Hence shallow foundation is feasible and same is recommended.

GEO TECHNO LOGIES

Dr. D. BABU RAO
M.E., Ph.D.(USA)
Consulting Geotechnical Engineer

8.0 RECOMMENDATIONS

Based on Field Investigations and laboratory testing, the following Recommendations are made for construction of 700 kL GLBR

a) Open foundations resting at 2 m below GL ,are recommended. The structure is likely to result in saturation and inundation of the sub soil during long – time operation,

b) SBC is recommended as follows :

Location		BH 1
S. No.	Depth (m)	Recommended SBC t/ sq m
1	2.0	25
2	3.0	30

c) The actual size of foundations will be based on loads from the superstructure.

For ANJI DRILLING AND GROUTING WORKS

(DR. D. BABU RAO)

M. E(IIT,R), Ph. D. (USA), MIGS

Former Professor of Civil Engineering

Consulting Geotechnical Engineer

MCH Panelist No. 2490/TP/2000-2

GEO TECHNOLOGIES

Dr. D. BABU RAO
M.E., Ph.D.(USA)
Consulting Geotechnical Engineer

APPENDIX

CALCULATION OF SBC

700 KL GLBR AT DARIGAONGUTTA, KAGHAZNAGAR(M)

FOUNDATIONS RESTING IN SDR (*Based on N Value)*

a) ***Shear Criterion :***

Assumed value of N = 50

Assumed width of foundation =4 m

Assumed depth of foundation = 1,5 m inside SDR

Correction factors Rq = Rr = 0.5

With a F.S. of 2.5 ,

Allowable q = 1 / 15 [2 N^2 B Rr + 6 (100 + N^2) D Rq] = 21700 kN / sq m

b) ***Settlement Criterion :***

For permissible settlement of 40 mm,

Allowable Bearing Pressure = 12.25 N (B + 0.3) / B

= 658 kN / sq m

Adopt 250 kN / sq m .

c) ***As per IS : 8009 (Fig. 2) Code of Practice for calculation of settlements of foundations:***

For N = 50, B = 4,

Settlement = 0.0045 m per unit pressure of 1 kg / sq cm

GEO TECHNOLO

Dr. B. BABU RAO
M.E., Ph.D.(USA)
Consulting Geotechnical Engineer

For a pressure of 30 t/ sq m,

Settlement = 0.0025 x 4.5 x1000 = 11.25 mm OK

d) *As per IS : 12070 (Code of Practice for Design & Construction of Shallow Foundations on Rocks) :*

Weathered and disintegrated rock is treated under Classification No. V of Table 3 of the Code

For this *very poor* rock , net allowable bearing pressure is recommended as 45 t / sq m , for settlement less than 12 mm.

Keeping the above considerations in view, Recommended Safe Bearing Capacity is 25 t per sq m

GEO TECHNOLOGIST

Dr. D. BABU RAO
M.E., Ph.D.(USA)
Consulting Geotechnical Engineer

Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad