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 SUMP - 700KL CAPACITY SIRPUR U AT SIRPUR-U MANDAL

DOC./DRG. No.

LE150883-C-WS-RW-DC-1152

SIZE: A4

REV.: A

RELEASED FOR

- ☐ PRELIMINARY
- ☐ INFORMATION
- ☑ APPROVAL
- ☐ CONSTRUCTION

Submitted sir,

Sub: RWS&S-TDWSP- Sirpur U 700KL clear water sump in Tandur Mandal– Komarambheem Asifabad Segment-Adilabad District-Designs -Approval-Reg.

*****

Kindly peruse the Designs of the following 700KL Clear Water sump at Sirpur U (V) ,Sirpur U (M), submitted by the Executive Engineer TDWSP Asifabad Division , Adilabad district for approval.

1. **700 KL Clear Water Sump.**

The Executive Engineer TDWSP Asifabad Division has submitted Structural Designs & Drawings of 700KL Clear Water sump based on the field conditions vetted by consultant(third party) as well as WAPCOS and as per the estimate provisions , the structural designs & drawings for the above structure is verified with RWS&S standard Type Designs 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 sump Inner to Inner: 15.6m X 15.6m
- Sidewall Height :3.35mts
- Sidewall Thickness:300mm
- Top Slab thickness: 160mm
- RaftSlab thickness: 200mm to 250mm

As per the above parameters the structural design and drawings of the clear water sump is verified, duly following IS codes, IS: 456-2000, SP:16, 34, IS:3370 and IS 1893-2002 (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)	6/4/16 Superintending Engineer,
TDWSP,Nirmal Circle	TDWSP,Nirmal Circle	TDWSP,Nirmal Circle

DESIGN CALCULATION

PROJECT TITLE

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

UNIT

700 KL SUMP

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 = 3.35 m

Free board = 0.30 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 = 0.15
Free board = 0.3
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 = 8 nos

Less for pedestal = 8 x 1 x 1 x 0.1 = 0.8

Less volume of column = 0.205 m^3 x 8 nos = 1.64 m^3

Total deduction = 0.8 + 1.64 = 2.44

Net volume = 703.57 – 2.44 = 701.13 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

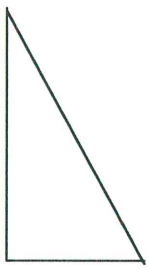
- Water pressure from inside
- Soil pressure from outside

Loading

1. Water load :
   a. Water depth = 3.050 m
   b. Free board = 0.30 m

      Total height = 3.350 m

   Water pressure is as below



2. Soil load :

   a. Depth below ground level = 1.7 m, Considered = 1.96 m
   b. Density of soil = 1.80 t/m3
   c. Angle of repose = 30 degree

Pressure at bottom = Y * H * (1-sin th)/ (1 + sin th)
= 18 * 1.96 * (1 – sin 30)/ (1+ sin 30)
= 11.76 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 0.49 0; 3 0 0.98 0; 4 0 1.47 0; 5 0 1.96 0; 6 0 2.45 0;
7 0 2.75 0; 8 0 3.05 0; 9 0 3.35 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 0.2 ZD 1
6 PRIS YD 0.2 ZD 1
7 PRIS YD 0.2 ZD 1
8 PRIS YD 0.225 ZD 1
9 PRIS YD 0.25 ZD 1
10 PRIS YD 0.275 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 3
5 TRAP GX 3 6
6 TRAP GX 6 9
7 TRAP GX 9 13.9
8 TRAP GX 13.9 18.8
9 TRAP GX 18.8 23.7
10 TRAP GX 23.7 28.5
11 TRAP GX 28.5 33.5
SELFWEIGHT Y -1
LOAD 2 SOIL
MEMBER LOAD
8 TRAP GX 0 -2.94
9 TRAP GX -2.94 -5.88
10 TRAP GX -5.88 -8.82
11 TRAP GX -8.82 -11.76
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	-8.235	-9.312	0	0	0	0
		8	6.735	8.862	0	0	0	-2.749
5	1	8	-6.735	-8.862	0	0	0	2.749
		7	5.235	7.512	0	0	0	-5.227
6	1	7	-5.235	-7.512	0	0	0	5.227
		6	3.735	5.262	0	0	0	-7.166
7	1	6	-3.735	-5.262	0	0	0	7.166
		5	1.285	-0.348	0	0	0	-8.468
8	1	5	-1.285	0.348	0	0	0	8.468
		4	-1.472	-8.36	0	0	0	-6.433
9	1	4	1.472	8.36	0	0	0	6.433
		3	-4.534	-18.772	0	0	0	0.117
10	1	3	4.534	18.772	0	0	0	-0.117
		2	-7.903	-31.561	0	0	0	12.352
11	1	2	7.903	31.561	0	0	0	-12.352
		1	-11.578	-46.751	0	0	0	31.439

Maximum moment at bottom = 31.439 kNm Say 31.5 KNm

Calculation for Coefficient of Uncrack condition						
RCC wall						
	notation		Unit			
DATA					Steel provided	
Bending moment	Bm	**31.5**	kN-m		dia	spc
Reinforcement	Fy	**500**	N/mm2			
Concrete grade	fck	**30**	N/mm2		**10**	**200**
Area of steel provised	Ast	1398	mm2		16	200
Depth provided	Dp	**300**				
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	0.0047			=Ast/Dp/B	
Effective depth	Def	237.5	mm			
Constants	ka	0.79			=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	0.5105			=kb/kc	
Depth of neutral axis	nd	153.1448			=n*Dp	
Check for Mu/bd2						
	kd	0.0029			=(ka-n)^2*(md-1)*PT	
	ke	0.0834			=1/3-n*(1-n)	
	kf	0.0864			=kd+ke	
m/bd2	Unc	3.5296			=Pstb/(1-n)*kf	
Depth reuired	Dr	298.7	mm		=(Bm*100/Unc)^0.5*10	
Calculation od Steel	Ast					
Effective Depth	De	237.5	mm		=Dp-Cv-dbar/2	
Area of steel required		1134	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	0.636	0	0	0	0
		8	0	-0.636	0	0	0	0.191
5	2	8	0	0.636	0	0	0	-0.191
		7	0	-0.636	0	0	0	0.382
6	2	7	0	0.636	0	0	0	-0.382
		6	0	-0.636	0	0	0	0.573
7	2	6	0	0.636	0	0	0	-0.573
		5	0	-0.636	0	0	0	0.884
8	2	5	0	0.636	0	0	0	-0.884
		4	0	0.084	0	0	0	1.079
9	2	4	0	-0.084	0	0	0	-1.079
		3	0	2.245	0	0	0	0.567
10	2	3	0	-2.245	0	0	0	-0.567
		2	0	5.846	0	0	0	-1.357
11	2	2	0	-5.846	0	0	0	1.357
		1	0	10.889	0	0	0	-5.398

Maximum moment at bottom = 5.398 kNm say 6 kNm

R/F at Different Place

1> Water load

GSR - TOTAL HEIGHT 3.35 m							
		Water load					
concrete grade	Fck	**30**	N/mm2		fyuc	130	N/mm2
Steel grade	Fy	**500**	N/mm2		fyuc b	130	N/mm2
Height of wall	H	**3.35**	m		fckb c	10.0	N/mm2
Free board	Fb	**0.3**	m		fckt	1.5	N/mm2
cover	Cv	**45**	mm	modular ratio	m	9.333	
Maximum Diameter of bar	Db	**12**	mm		K	0.418	
Minimum % steel	pt	**0.35**	%		j	0.861	

Sr. no	Height from top	Moment (kN-m)	Depth provide(mm)	effective depth(m m)	Design Steel in mm2		Minimum steel / Dist steel in mm2		Required steel in mm2	
					Water face	soil face	Water face	soil face	Water face	soil face
	m	mm	mm	mm						
1	0.30	-2.75	200	149		165	350	350	350	350
2	0.60	2.75 -5.23	200	149		314	350	350	350	350
3	0.90	5.23 -7.17	200	149		430	350	350	350	430
4	1.39	7.17 -8.47	200	149		508	350	350	350	508
5	1.88	8.47 -6.43	225	174		330	394	394	394	394
6	2.37	6.43 0.12	250	199	5		438	438	438	438
7	2.86	-0.12 12.35	275	224	493		481	481	493	481
8	3.35	-12.35 31.44	300	249	1128		525	525	1128	525

REINFORCMENT BAR PROVIDED

WATER FACE due to WATER LOAD

	Dist in m	Ast required	Reinforcement						Ast Provided	
1	0.30	350	10	200				=	393	TRUE
2	0.60	350	10	200				=	393	TRUE
3	0.90	350	10	200				=	393	TRUE
4	1.39	350	10	200				=	393	TRUE
5	1.88	394	10	200	+	16	400	=	895	TRUE
6	2.37	438	10	200	+	16	400	=	895	TRUE
7										

8	2.86	493	10	200	+	16	200		=	1398	TRUE
	3.35	1128	10	200	+	16	200		=	1398	TRUE

SOIL FACE due to WATER LOAD

	Dist in m	Ast required	Reinforcement						Ast Provided	
1	0.30	350	10	200				=	393	TRUE
2	0.60	350	10	200				=	393	TRUE
3	0.90	430	10	200	+	8	200	=	644	TRUE
4	1.39	508	10	200	+	8	200	=	644	TRUE
5	1.88	394	10	200	+	8	200	=	644	TRUE
6	2.37	438	10	200	+	8	200	=	644	TRUE
7	2.86	481	10	200	+	8	200	=	644	TRUE
8	3.35	525	10	200	+	8	200	=	644	TRUE

REINFORCMENT BAR PROVIDED

~~DISTRIBUTION~~ STEEL

	Dist in m	Thickness	Ast required	Reinforcement			Ast Provided	
1	0.30	200	350	10	200	=	393	OK
2	0.60	200	350	10	200	=	393	OK
3	0.90	200	350	10	200	=	393	OK
4	1.39	200	350	10	~~200~~ 150	=	393	OK
5	1.88	225	394	10	~~170~~ 150	=	462	OK
6	2.37	250	438	10	~~170~~ 150	=	462	OK
7	2.86	275	481	10	~~140~~ 120	=	561	OK
8	3.35	300	525	10	140 120	=	561	OK

2> Soil load

GSR - TOTAL HEIGHT 3.5 m

Water load

concrete grade	Fck	**30**	N/mm2		fyuc	130	N/mm2
Steel grade	Fy	**500**	N/mm2		fyucb	130	N/mm2
		3.3			fckbc	10.0	N/mm2
Height of wall	H	**5**	m		fckt	1.5	N/mm2
Free board	Fb	**0.3**	m	modular ratio	m	9.333	
cover	Cv	**45**	mm		K	0.418	
Maximum Diameter of bar	Db	**12**	mm				
		0.3					
Minimum % steel	pt	**5**	%		j	0.861	

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	
					Water face	soil face	Water face	soil face	Water face	soil face
	m	mm	mm	mm						
1	0.30	0.19	200	149	11		350	350	350	350
2	0.60	-0.19 0.38	200	149	23		350	350	350	350
3	0.90	-0.38 0.57	200	149	34		350	350	350	350
4	1.39	-0.57 0.88	200	149	53		350	350	350	350
5	1.88	-0.88 1.08	225	174	55		394	394	394	394
6	2.37	-1.08 0.57	250	199	25		438	438	438	438
7	2.86	-0.57 -1.36	275	224		54	481	481	481	481
8	3.35	1.36 -5.40	300	249		194	525	525	525	525

REINFORCMENT BAR PROVIDED

WATER FACE due to SOIL LOAD

	Dist in m	Ast required	Reinforcement			Ast Provided	
1	0.30	350	10	200	=	393	TRUE
2	0.60	350	10	200	=	393	TRUE
3	0.90	350	10	200	=	393	TRUE
4	1.39	350	10	200	=	393	TRUE

5	1.88	394	10	200	+	16	400	=	895	TRUE
6	2.37	438	10	200	+	16	400	=	895	TRUE
7	2.86	481	10	200	+	16	200	=	1398	TRUE
8	3.35	525	10	200	+	16	200	=	1398	TRUE

SOIL FACE due to SOIL LOAD

	Dist in m	Ast required	Reinforcement					Ast Provided	
1	0.30	350	10	200				= 393	TRUE
2	0.60	350	10	200				= 393	TRUE
3	0.90	350	10	200				= 393	TRUE
4	1.39	350	10	200				= 393	TRUE
5	1.88	394	10	200	+	8	200	= 644	TRUE
6	2.37	438	10	200	+	8	200	= 644	TRUE
7	2.86	481	10	200	+	8	200	= 644	TRUE
8	3.35	525	10	200	+	8	200	= 644	TRUE

REINFORCMENT BAR PROVIDED

DISTRIBUTION STEEL

	Dist in m	Thickness	Ast required	Reinforcement			Ast Provided	
1	0.30	200	350	10	200		= 393	OK
2	0.60	200	350	10	200		= 393	OK
3	0.90	200	350	10	200		= 393	OK
4	1.39	200	350	10	~~200~~	15	= 393	OK
5	1.88	225	394	10	~~170~~	15	= 462	OK
6	2.37	250	438	10	~~170~~	15	= 462	OK
7	2.86	275	481	10	~~140~~	190	= 561	OK
8	3.35	300	525	10	~~140~~	190	= 561	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	0.42	
Steel grade	Fy	**500**	N/mm2		j	0.86	
Depth below GI	Dbg	**1.70**	m				
Water depth	wtd	**3.05**	m				
free board	fb	**0.30**	m				
Wall above Ground		**1.35**	m				
Clear cover	Cv	**50**	mm				
Maximum size of bar dia	Db	**12**	mm				
Water depth with free board	Wd	**3.35**	m				
minimum % steel	pt	**0.35**	%				
Moment							
Due to Water	Mtw	**31.50**	kN-m	(From Analysis Result)			
Due to soil if any	Mts	**5.40**	kN-m				
Wt from top dome/slab/column/wall	Slabwt	**25.00**	kN-m				
Wall geometry (Figure 1)							
Straight portion	lb	**1.390**	m				
Tapered portion	lc	**1.960**	m				
	tb	**0.200**	m				
	td	**0.300**	m				
Footing geometry							
Toe projection	ht	**0.450**	m				
Heel straight projection	hh1	**1.000**	m				
Heel tapered projection	hh2	**0.300**	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	**0.200**	m				
Total Height of Wall	Tlw	3.350	m				
Total length of wall footing	wf	2.050	m				
CASE 1 : TANK FULL CONDITION WITH NO 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	W 1	16.75	0.65	10.89
Wall Tapered portion	W 2	2.45	0.52	1.27
Walkway/slab	P	25.00	0.65	16.25
Footing				
Footing : toe	W 3	2.81	0.23	0.63
Footing center	W 4	1.88	0.60	1.13
Footing : heel (straight)	W 5	6.25	1.25	7.81
Footing : heel (tapered)	W 6	1.69	1.85	3.12
Water	W 7	43.55	1.40	60.97
Total downward load		100.38		102.07

Total restoring moment @ toe	TRM	102.1	kN-m
Total over turning moment		31.5	kN-m
F.S.against over turning		3.2	
Check for over turning	Hense o.k		
Total moment due to vertical load	Tmv	102.1	kN-m
Total moment due to horizontal load	Tmh	31.5	kN-m
Total vertical load	TPv	100.4	kn
Net Moment	Tmn	70.6	kN-m
M/p	E	0.70	m
Ecc	Ecc	0.322	m
b/6	Aec	0.34	m
Net moment From ECC	Mdg	32.32	

Property of footing

Width of footing		1.00	m
Depth of footing		2.05	m
Footing Area	Fare	2.05	m2
Modulus of section	Fz	0.70	m3

Pressure distribution			
Pressure due to direct load =P/A	prea	48.96	kN/m2
Pressure due to moment =M/Z	Preb	46.14	kN/m2
Pressure			
Maximum pressure - P/A + M/Z	Pmax	95.11	kN/m2
Minimum pressure - P/A + M/Z	Pmin	2.82	kN/m2
Check for SBC			
Maximum pressure < SBC		OK	

Minimum presure > 0	OK		
Pressure difference	92.28		
Pressure difference / m	45.02		
Pressure at outer Wall face - A	preow	74.85	kN/m2
Pressure at inner Wall face B	preiw	61.34	kN/m2
Pressure at point C	preiw1	16.33	kN/m2

Design of Toe - At Point A

Moment at face of outer wall			
Due to rectangle diagram	Mreco	7.58	kN-m
	Mtrio	1.37	kN-m
Total moment due to upward pressure		8.95	kN-m
Net moment at A from Toe side	Toem	8.95	kN-m
Thickness at toe		250	mm
Effective depth	Deftoe	194	mm
Ast required =		412	mm2
Check for minimum steel			
top		437.5	mm2
bottom		0	mm2
Design Steel			
Main steel - Top		438	mm2
Main steel - bottom		412	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	2.4	kN-m
	Mtrii	16.5	kN-m
Total Upward moment		18.9	kN-m
Due to water (down ward)		28.3	kN-m
Net downward moment at B from heel side	heelm	9.4	kN-m
Thickness Provided		250	mm
	defheel	194	mm
Ast required =		435	mm2
Check for minimum steel - straight portion			
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
Design at point C			
Due to rectangle diagram (upward)	Mreci	0.13	kN-m
	Mtrii	0.20	kN-m
Total Upward moment		0.33	kN-m
Due to water (down ward)		1.51	kN-m
Net downward moment at B from heel side	heelm	1.18	kN-m

Thickness Provided		250	mm
	defhee l	194	mm
Ast required =		54	mm2
Check for minimum steel - tapered portion			
Avrage thickness	thav	0.23	m
top		393.8	mm2
bottom		0	mm2
Design Steel			
Main steel - Top		394	mm2
Main steel - bottom		0	mm2
Distribution steel - top		394	mm2
Distribution steel -bottom		0	mm2

SUMMARY

Pressure Check

1>	P/A + M/Z	95.1	<	150	OK
2>	P/A - M/Z	2.82	>	0	OK

Reinforcement

	AstR	dia	spc	+ dia	spc	Astp	
Toe							
Top - main	438	12	200	0	0	565	OK
Bottom main	412	10	175	0	0	449	OK
Top - Dist	438	10	175	0	0	449	OK
Bottom - Dist	0	10	175	0	0	449	OK
Heel Straight portion							
Top - main	438	12	200	10	200	958	OK
Bottom main	0	10	175	0	0	449	OK
Top - Dist	438	10	175	0	0	449	OK
Bottom - Dist	0	10	175	0	0	449	OK
Heel tapered portion							
Top - main	394	12	200	0	0	565	OK
Bottom main	0	0	0	0	0		
Top - Dist	394	10	175	0	0	449	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	16.75	0.60	10.05
Wall Tapered portion	W2	2.45	0.73	1.80
Walkway/slab	P	25.00	0.60	15.00
Footing				
Footing : toe	W3	2.81	1.03	2.88
Footing center	W4	1.88	0.65	1.22
Footing : heel	W5	3.13	0.25	0.78
Soil on toe	W6	13.77	1.03	14.11
Total downward load		**65.78**		**45.84**

Total restoring moment @ heel	TRMs	45.8	kN-m
Total over turning moment due to soil		5.4	kN-m
F.S.against over turning		8.5	
Check for over turning	Hense o.k		
Total moment due to vertical load	Tmv1	45.8	kN-m
Total moment due to horizontal load	Tmh1	5.4	kN-m
Total vertical load	TPv1	65.8	kn
Net Moment	Tmn1	40.4	kN-m
M/p	E1	0.61	m
Ecc	Ecc1	0.010	m
b/6	Aec1	0.21	m
Net moment From ECC	Mdg1	0.6703	

Property of footing

Width of footing		1.00	m
Depth of footing		1.25	m
Footing Area	Fare1	1.25	m2
Modulus of section	Fz1	0.26	m3

Pressure distribution			
Pressure due to direct load =P/A	prea1	52.63	kN/m2
Pressure due to moment =M/Z	Preb1	2.6	kN/m2
Pressure			
Maximum pressure - P/A + M/Z	Pmax1	55.20	kN/m2
Minimum pressure - P/A + M/Z	Pmin1	50.05	kN/m2
Check for SBC			
Maximum pressure < SBC		OK	
Minimum presure > 0		OK	
Pressure difference		5.15	kN/m2
Pressure difference / m		4.12	kN/m2
Pressure at outer Wall face - A	preow1	51.91	kN/m2
Pressure at inner Wall face B	preiw1	53.14	kN/m2

Design of Toe - At Point A

Moment at face of outer wall				
Due to rectangle diagram	Mreco1	5.07	kn-m	
Due to triabgular diagram	Mtrio1	0.06	kn-m	
Total moment due to upward pressure		5.13	kn-m	
Total downward moment due to soil		3.10	kn-m	
Net moment at A from Toe side	Toem1	-2.03	kn-m	
Thickness at toe		250	mm	
Effective depth	Deftoe1	194	mm	
Ast required =		-93.61	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	6.64	kn-m
	Mtrii1	0.17	kn-m
Total Upward moment	heelm1	6.81	kn-m
Net downward moment at B from heel side		250	mm
Thickness Provided	defheel1	194	mm
Steel required at bottom		314	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		314	mm2
Distribution steel - top		438	mm2
Distribution steel -bottom		0	mm2

SUMMARY

Pressure Check

1>	P/A + M/Z	55.2	<	150.0	OK
2>	P/A - M/Z	50.1	>	0	OK

Reinforcement

	AstR						Astp	
Toe		dia	spc	+	dia	spc		
Top - main	438	10	175				449	OK
Bottom main	0	10	175		0	0	449	OK
Top - Dist	438	10	175		0	0	449	OK
Bottom - Dist	0	10	175		0	0	449	OK
Heel Straight portion								
Top - main	438	10	175		0	0	449	OK
Bottom main	314	10	175		0	0	449	OK
Top - Dist	438	10	175		0	0	449	OK
Bottom - Dist	0	10	175		0	0	449	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.

"Designs Vetted"

M/s. S.K. Associates
HYD-8

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;
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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 0.32
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
```

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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 -
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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 -
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LOAD COMB 3 COMBINATION LOAD
1 1.0 2 1.0
PERFORM ANALYSIS
LOAD LIST 3
FINISH
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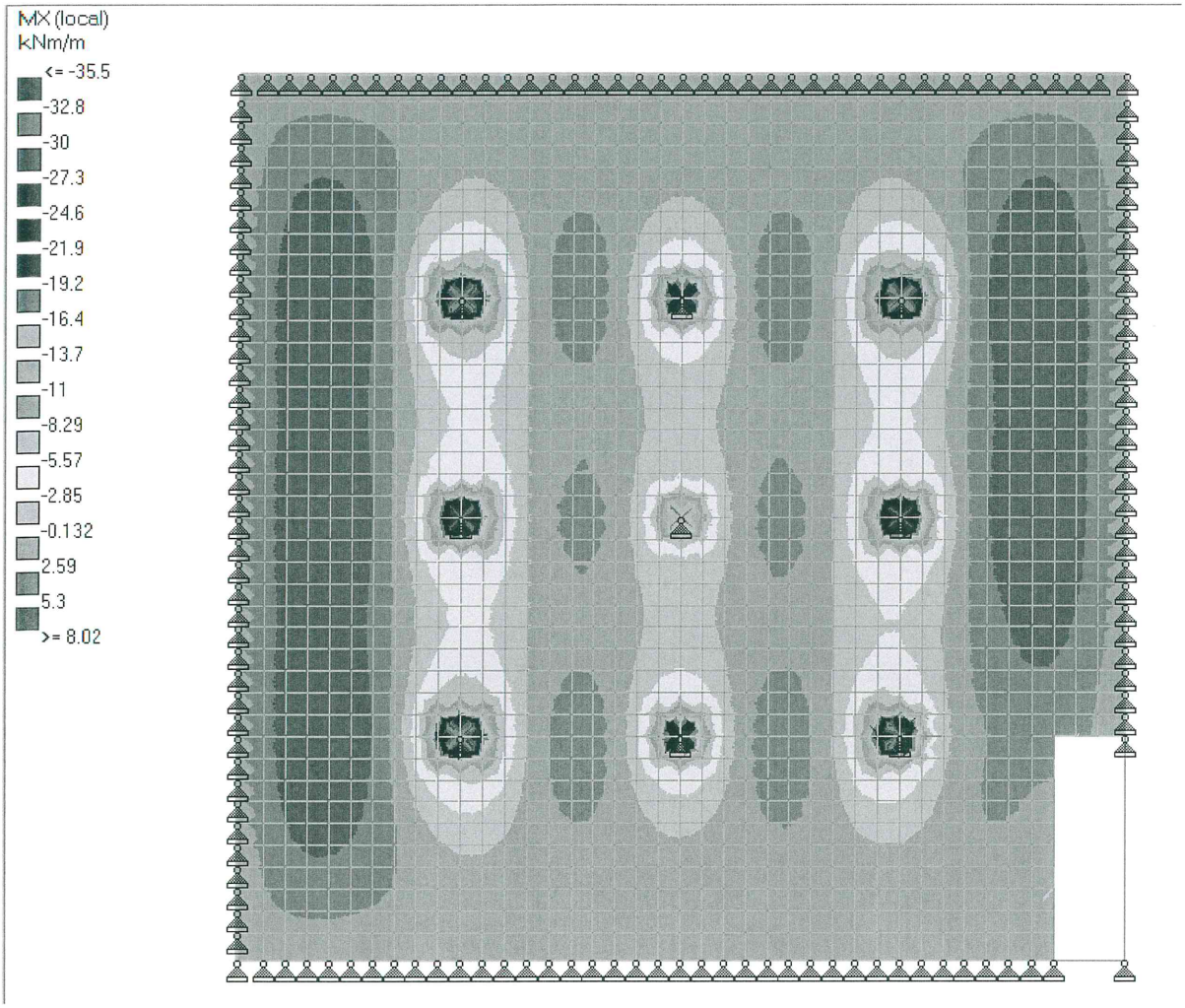
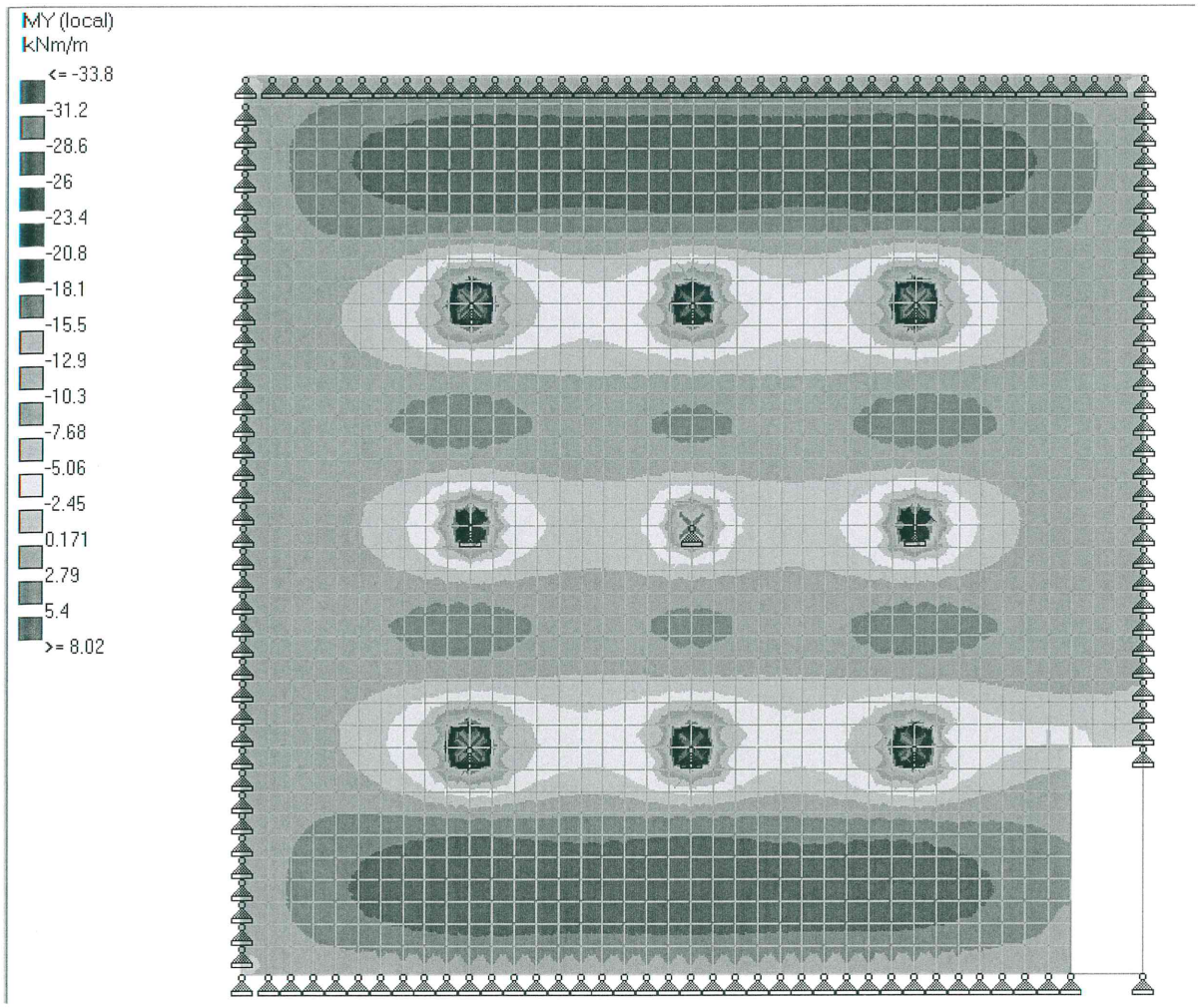


STRESS DIAGRAM – MX



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	md	9.33	N/mm2
Permissible stress in concrete : Direct tension	Pstt	15	N/mm2
Permissible stress in concrete : bending	Pstb	20	N/mm2
Permissible stress in steel	Pstt	1300	kg/cm2
Cover	Cv	45	mm
wall thickness	wth	0.16	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 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	9.3	0.1	270	0.3	159	160	115	966	931	8.7	6.67	0.72	7.39	3.62
bottom	3	9.0	0.0	9.0	9.3	0.1	270	0.3	159	160	115	966	931	8.7	6.67	0.72	7.39	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 = 4 x 4 x 0.675 = 10.8 T

Net load at critical section

= 10.8 – 0.94x0.94 x 0.625

= 10.21 T

Net load at critical section = 10.21 T

Actual shear stress = $10.21 \times 10^4 / (0.94 \times 4 \times 110)$

$= 0.246 \text{ N/mm}^2$

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

$Tc = 0.87 * 1 = 0.87 \text{ N/mm}^2 >> 0.246$ 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	140.345	0	0	0	0
231	3	0	115.274	0	0	0	0
341	3	0	140.474	0	0	0	0
561	3	0	115.177	0	0	0	0
661	3	0	85.847	0	0	0	0
761	3	0	114.722	0	0	0	0
971	3	0	140.333	0	0	0	0
1071	3	0	115.474	0	0	0	0
1171	3	0	144.118	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*1206

= 89.7 T > > 15.5 T O.K

STAIR DESIGN

Project : **Proj. No**

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	**5.00**	m		fckt	1.5	N/mm2
				modular			
Width	B	**1000**	mm	ratio	m	9.33	
Depth of Waist slab	D	**180**	mm		K	0.25	
Riser	R	**194**	mm		j	0.92	
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	5.70	kN/m2				
Weight of step	WS	3.08	kN/m2				
Total Load	TI	13.28	kN/m2				
Effective depth	De	150	mm				

Design

Moment	M	41.50	kN-m			
Required area of steel	Ast(req)	695	mm^2			
Provide area of steel	Ast(pro)	785	mm^2	**10**	**100**	O.K
Distribution steel	Ast(min)	216	mm^2			
Provide Distribution steel	DAst(pro)	251	mm^2	**8**	**200**	O.K

Shear Check

Maximum shear	V	33.2	kN		
Facotred Shear	Vu	49.8	kN		
Actual Shear stress	Tv	0.332	N/mm2		
% Ast	pt	0.52	%		
beta	beta	6.65			
Value of K for Solid slab					
Overall Depth		180.00	mm		
	K	1.24			
permissible shear for pt	Tc	0.647	N/mm2		OK

CHECK FOR DEFLECTION

basic span /deph ratio	bsd	26			
fs	fs	257	N/mm2		
% steel provided	ptt	0.52	%		
Moification factor	mf	1.15			
permissible span/ depth ratio	psd	29.79			
actual span /depth ratio	sdr	27.78			OK

LARSEN & TOUBRO LIMITED Construction - Chennai

APPROVED 6/4/16 SE, NIRMAL

WAPCOS LIMITED हैदराबाद Hyderabad

"Designs Vetted"

M/s. S.K. Associates HYD-8

Asst. Executive Engineer TDWSP Asifabad

Dy. Executive Engineer TDWSP Asifabad

Executive Engineer TDWSP Asifabad

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

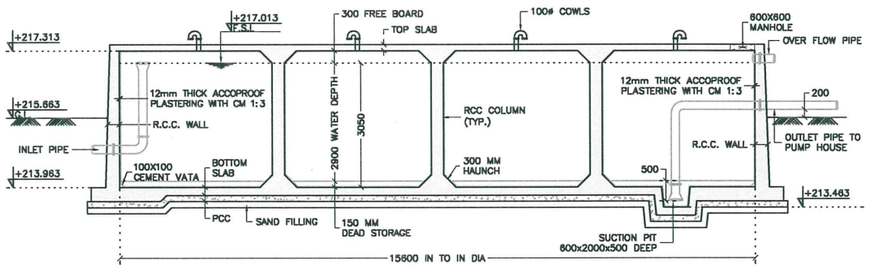
SCHEDULE OF PIPE	
INLET PIPE SIZE	–
OUTLET PIPE SIZE	–
OVER FLOW PIPE SIZE	–

NOTES :

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

<2> LOCATION OF SUCTION PIT SHALL BE DECIDED AS PER SITE CONDITION BEFORE EXECUTION

<3> LOCATION & LEVELS OF INLET,OUTLET & OVERFLOW PIPE SHALL BE VARIFIED WITH ENGINEER INCHARGE BEFORE EXECUTION



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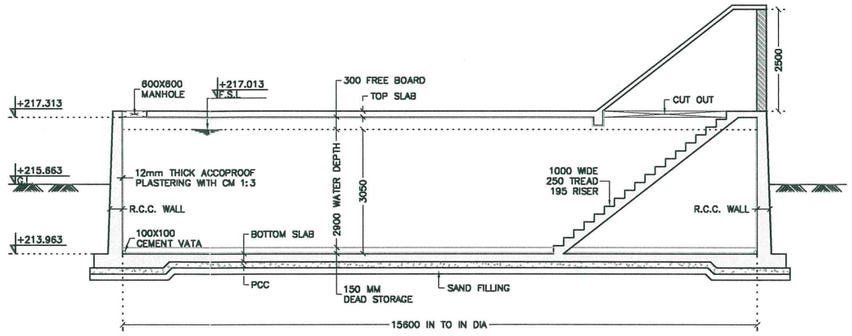

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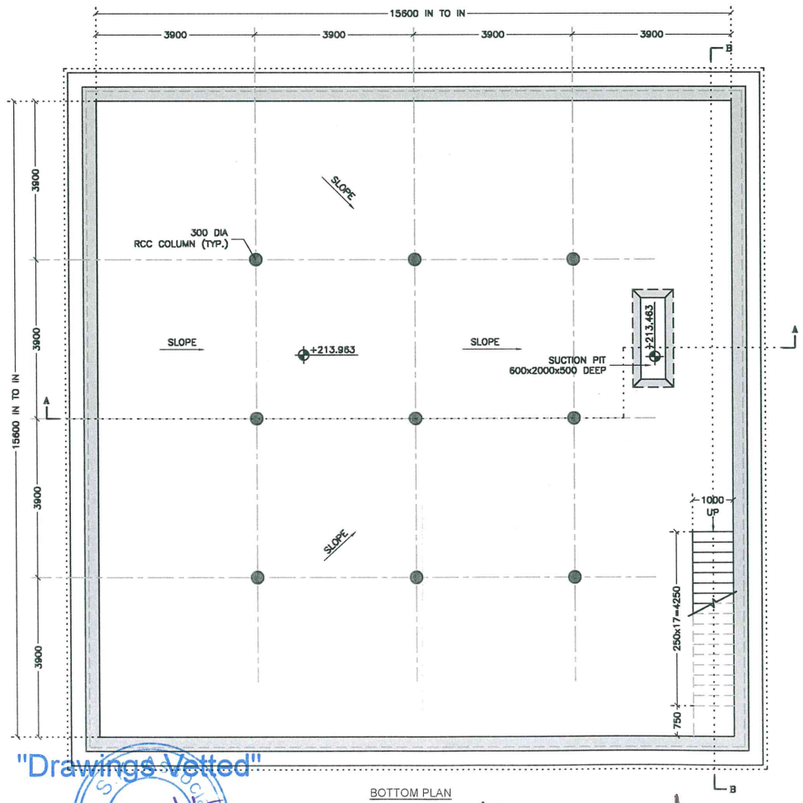
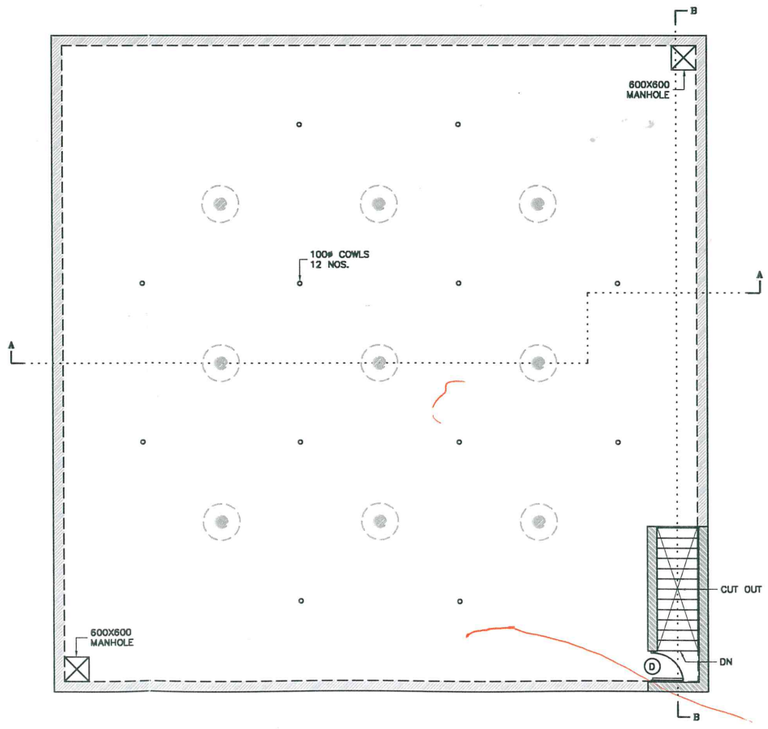


BOTTOM PLAN



TOP PLAN

"Drawings Vetted"
M/S. Sai Associates
HYD-8

Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad

APPROVED
16/4/16
SE, NIRMAL

L&T Construction
Chennai

REV. No	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED
A	FOR APPROVAL	18/01/16	–	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		18-01-16
DRWN	NSP		18-01-16
CHKD	RMM		18-01-16
APPD	–		18-01-16

TITLE : 700KL CAPACITY SUMP AT SIRPUR-U VILLAGE (GENERAL ARRANGEMENT DRAWING)

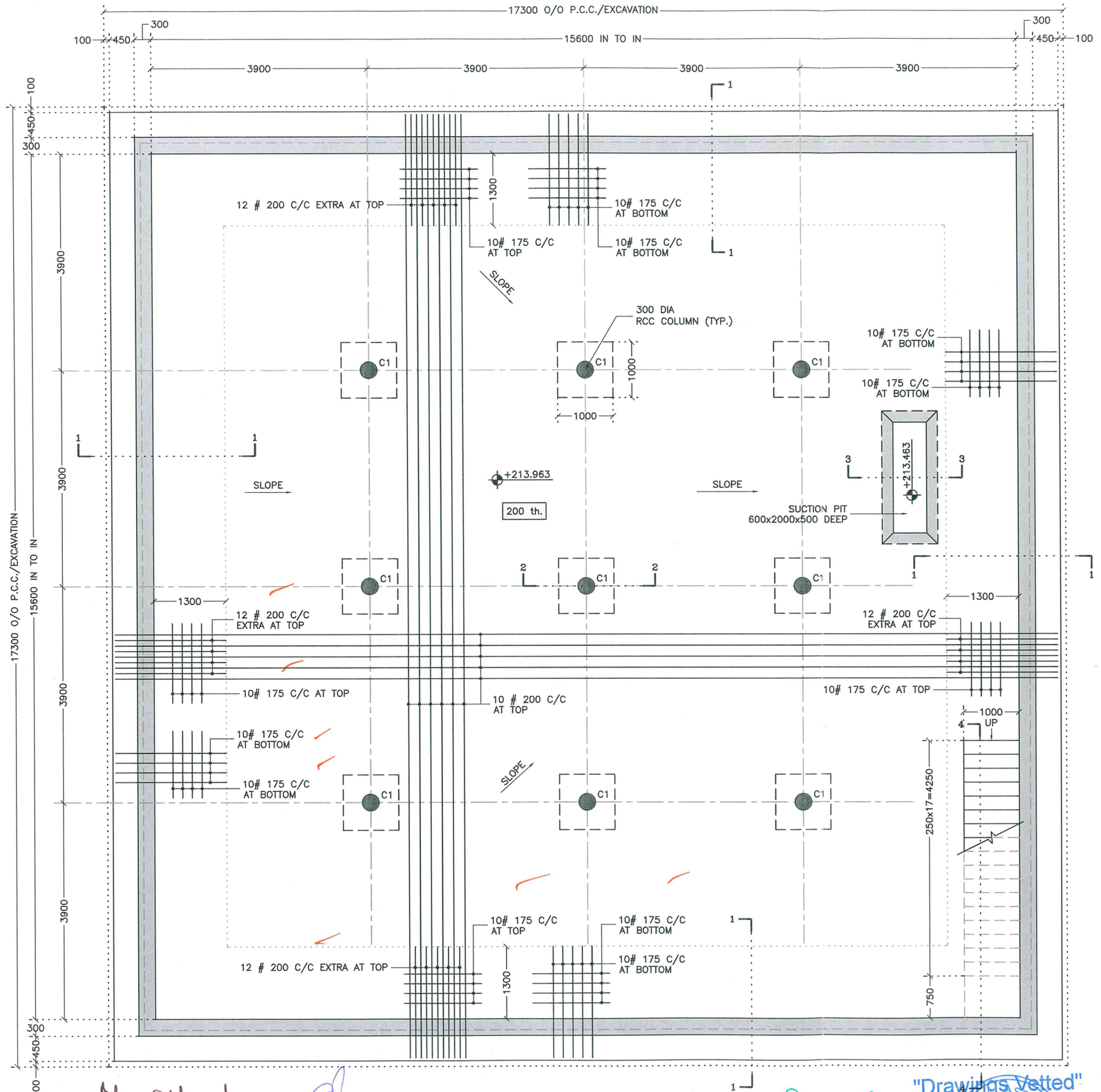
SCALE 1:100

PROJECTION

DRAWING No. LE1508883-C-WS-CW-GA-1151 | SIZE A2 | REV. A

COMP. DATA : P16-02_101-01-02 | SHEET 2 OF 2

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

LARSEN & TOUBRO LIMITED Construction - Chennai

APPROVED 6/4/16 SE, NIRMAL

REV. No	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED
A	FOR APPROVAL	10/03/16	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		10–03–16
DRWN	NSP		10–03–16
CHKD	RMM		10–03–16
APPD	–		10–03–16

TITLE : 700KL CAPACITY SUMP AT SIRPUR-U VILLAGE (FOUNDATION PLAN & DETAIL)

SCALE 1: 75

PROJECTION

DRAWING No. LE150883–C–WS–CW–RC–1154 | SIZE A3 | REV. A

COMP. DATA : P16–02_101–02–01 SHEET 1 OF 4

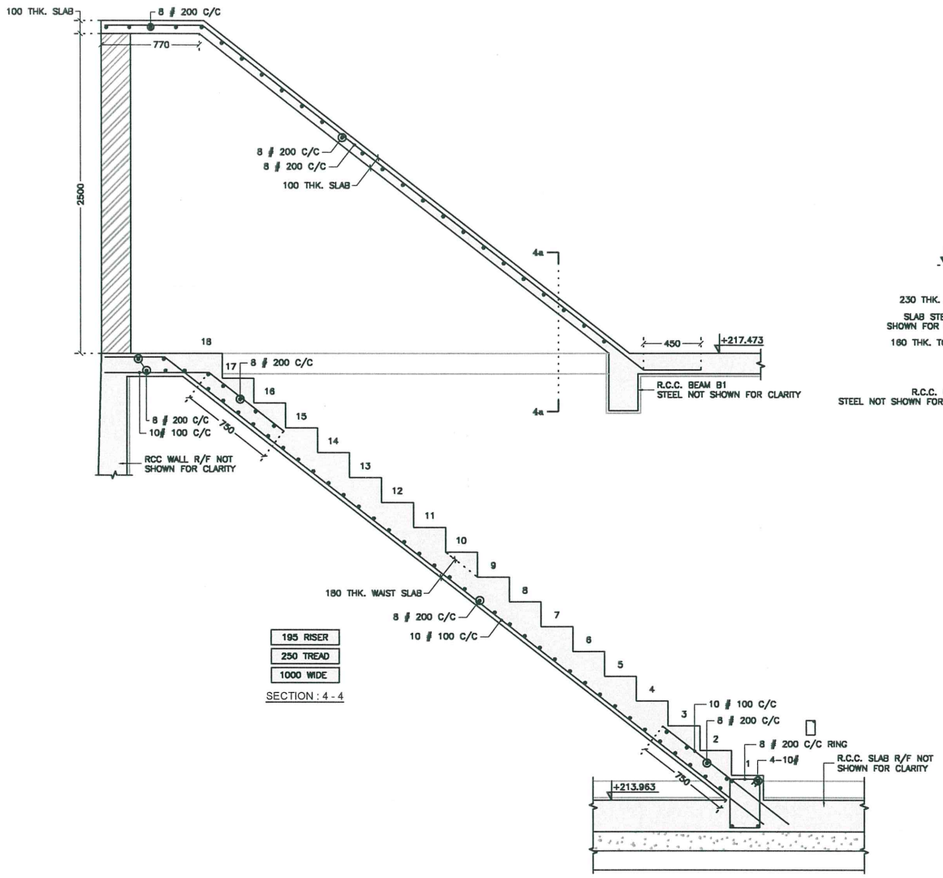
RELEASED FOR ☐ PRELIMINARY ☐ TENDER ☐ INFORMATION ☑ APPROVAL ☐ CONSTRUCTION

Asst. Executive Engineer TDWSP Asifabad

Dy. Executive Engineer TDWSP Asifabad

Executive Engineer TDWSP Asifabad

"Drawings Vetted" S.R. Associates HYD-8



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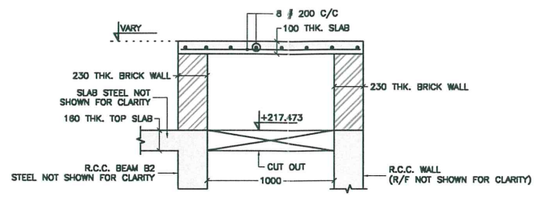

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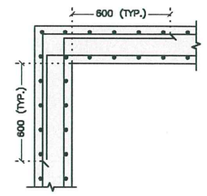
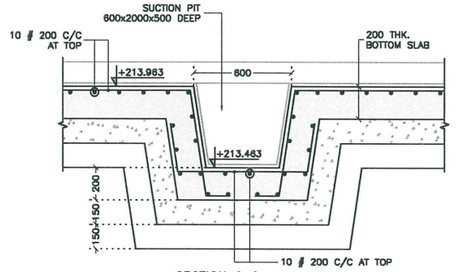


TYPICAL ENLARGE DETAIL FOR RCC WALL
(AT CORNER)



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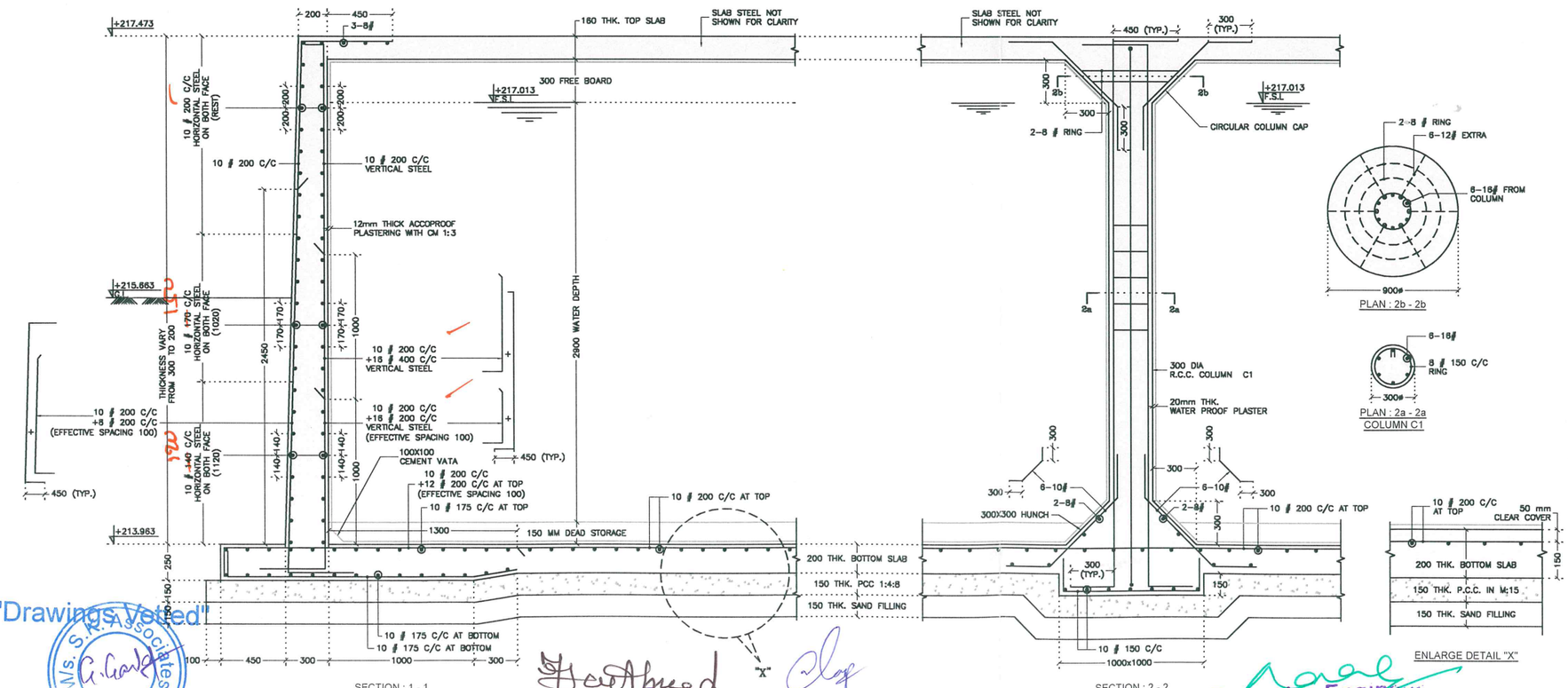


SECTION : 1 - 1

SECTION : 2 - 2

PLAN : 2b - 2b

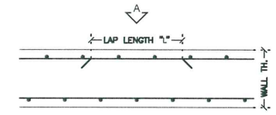
PLAN : 2a - 2a
COLUMN C1

ENLARGE DETAIL "X"

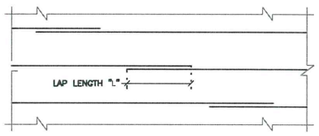
NOTES :
<1> ALL DIMENSION ARE IN MM AND LEVELS ARE IN METER.
<2> FOR ALL OTHER NOTES REFER SHEET NO 1 OF 4.
<3> READ THIS DRAWING ALONG WITH DRG.NO. 1 OF 4 TO 4 OF 4.

LAP LENGTH SECHDULE

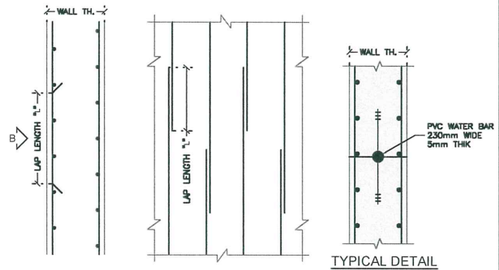
DIA OF BAR	LAP LENGTH "L" IN mm
8	320
10	400
12	480
16	640
20	800
25	1000



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

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A	FOR APPROVAL	10/03/16	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		10-03-16
DRWN	NSP		10-03-16
CHKD	RMM		10-03-16
APPD	–		10-03-16

TITLE : 700KL CAPACITY SUMP AT SIRPUR-U VILLAGE (ENLARGE DETAIL)
SCALE 1:30
PROJECTION

DRAWING No. LE150883-C-WS-CW-RC-1154
COMP. DATA : P16-02_101-02-02
SIZE A2 | REV. A
SHEET 2 OF 4

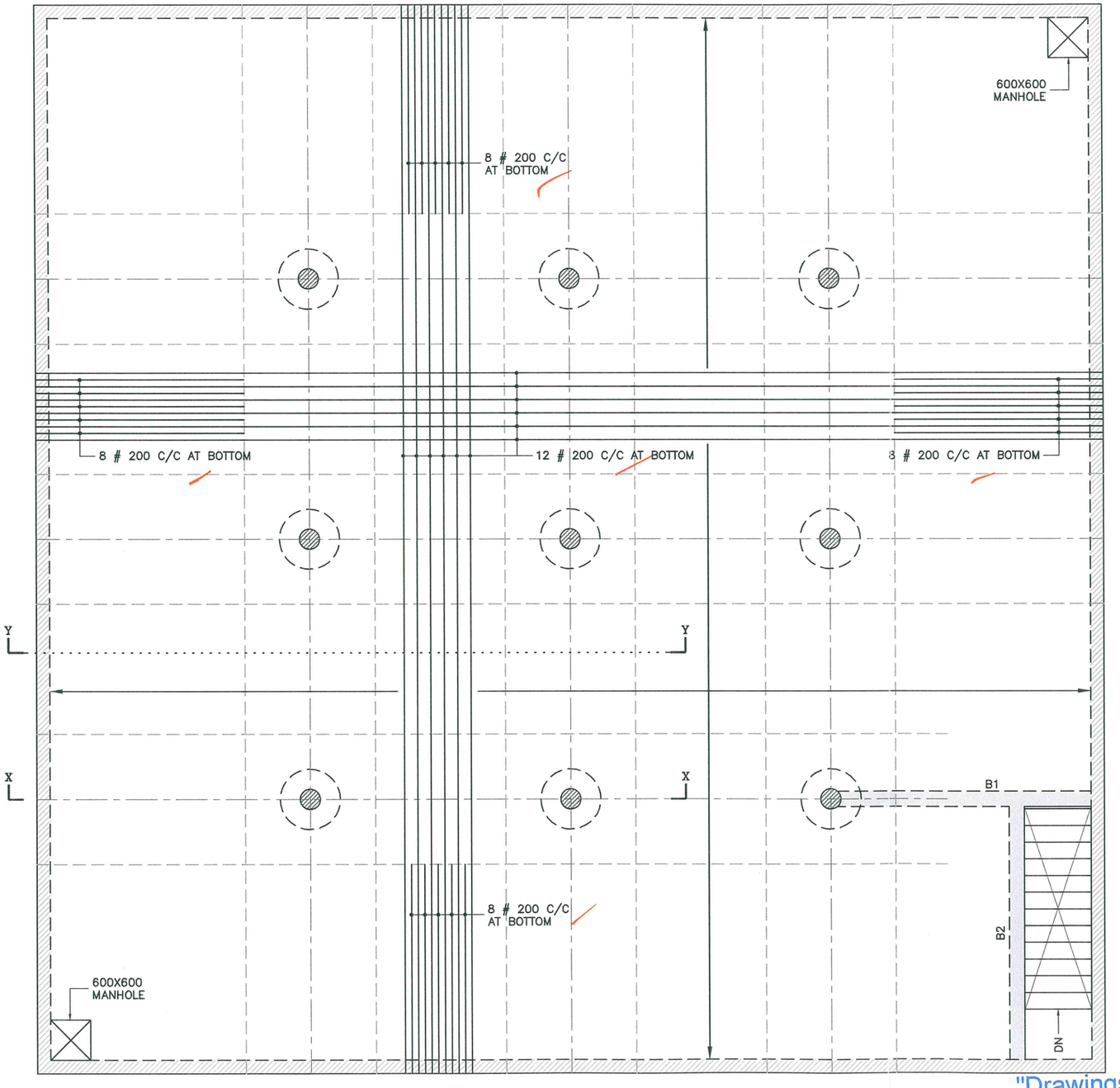
RELEASED FOR ☐ PRELIMINARY ☐ TENDER ☐ INFORMATION ☑ APPROVAL ☐ CONSTRUCTION

"Drawings Vetted"
M/s. S.R. Associates
G. Gopal

Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad



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

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.

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CHKD	RMM		10-03-16
APPD	–		10-03-16

TITLE :
700KL CAPACITY SUMP
AT SIRPUR-U VILLAGE
(STRUCTURAL LAYOUT AT BOTTOM REINFORCEMENT OF TOP SLAB)

SCALE 1:75

PROJECTION

DRAWING No. LE150883-C-WS-CW-RC-1154
COMP. DATA : P16-02_101-02-03
SHEET 3 OF 4

SIZE A3 | REV. A

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"Drawings Vetted"
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TDWSP Asifabad

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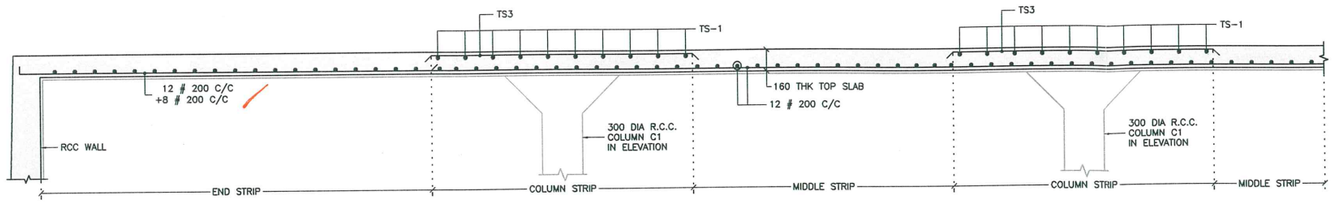
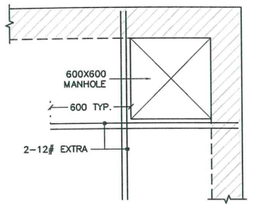
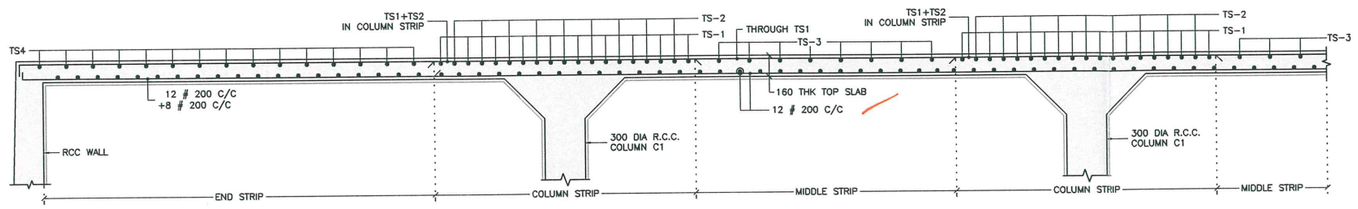


SECTION :Y - Y

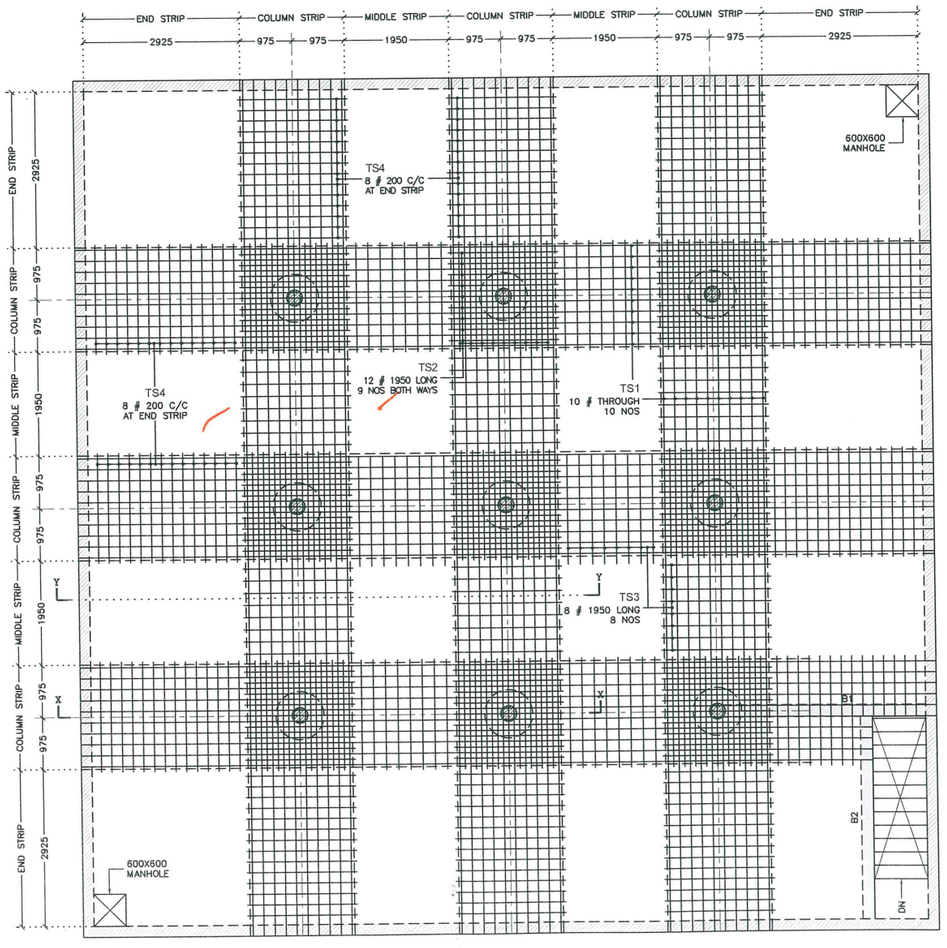


TYPICAL DETAIL FOR MANHOLE

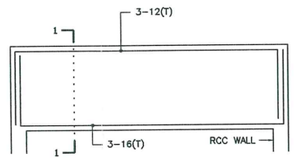


SECTION : X - X

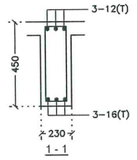
STEEL CHAIRS SHALL BE PROVIDE TO KEPT TOP REINFORCEMENT OF SLAB IN PROPER POSITION



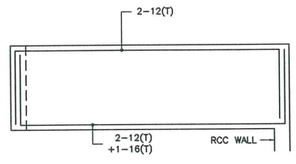
PLAN FOR TOP SLAB TOP REINFORCEMENT
ALL SLAB ARE 160 THK. (CONCRETE MIX M:30)



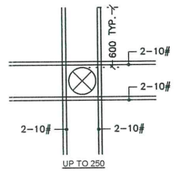
B1 230x450



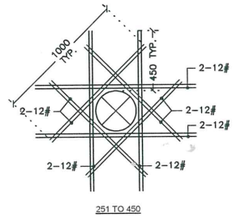
1 - 1



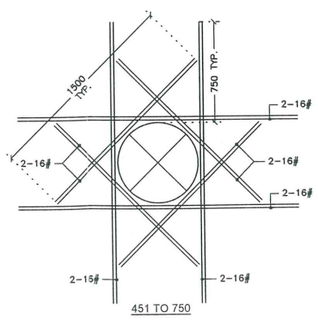
B2 230x450



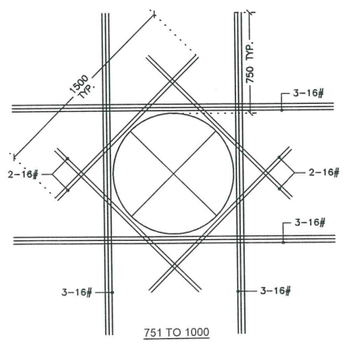
UP TO 250



251 TO 450



451 TO 750



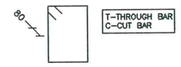
751 TO 1000

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	8 # 1950 LONG 8 NOS
TS - 4	8 # 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
6/4/16
SE, NIRMAL

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REV. No	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED
A	FOR APPROVAL	10/03/16	HMP	NSP	RMM	–

REVISIONS

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CHKD	RMM		10-03-16
APPD	–		10-03-16

TITLE : 700KL CAPACITY SUMP AT SIRPUR-U VILLAGE (STRUCTURAL LAYOUT & DETAILS AT TOP REINFORCEMENT OF TOP SLAB)
SCALE 1:75,30
PROJECTION

DRAWING No. LE150883-C-WS-CW-RC-1154
COMP. DATA : P16-02_101-02-04
SIZE A2 | REV. A
SHEET 4 OF 4

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"Drawings Vetted" M/s. Asst. Associates G.Gankaiah HYD-8

Asst. Executive Engineer TDWSP Asifabad

Dy. Executive Engineer TDWSP Asifabad

Executive Engineer TDWSP Asifabad

WAPCOS LIMITED

GEOTECHNICAL INVESTIGATION REPORT

TELANGANA DRINKING WATER SUPPLY PROJECT

KOMARAM BHEEM - ASIFABAD- SEGMENT 22

ASIFABAD , ADILABAD DISTRICT

700 KL SUMP AT SIRPUR -U

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

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TELANGANA DRINKING WATER SUPPLY PROJECT

700 KL SUMP AT SIPUR-U IN ADILABAD DT.

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 BPT 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

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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)

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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	6 m

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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	Weathered rock	>100
3 – 6 m	Rock	Cores

. 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.

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Consulting Geotechnical Engineer

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 2 m to 6 m depth. Hence shallow foundation is feasible and same is recommended.

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8.0 RECOMMENDATIONS

Based on Field Investigations and laboratory testing, the following Recommendations are made for construction of 700 kL BPT at Sirpur (U)

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
3	4.0	35

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

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Consulting Geotechnical Engineer

TELANGANA DRINKING WATER SUPPLY PROJECT

FIG 1 : Record of Boring, *Bore Hole No : 1*

700 KL SUMP AT SIPUR - U IN ADILABAD DT.

Type of Boring: Core drilling — Dia of Boring: NX

Date : Jan 2016 — Drilled depth = 6 m

Depth, m	Profile	Soil	Sample Depth m	N value	CR, %	RQD%
0		Weathered rock	0	>100		
1.0			1.5	>100		
2.0						
3.0		Rock	3.0		40	18
4.0			4.5		36	12
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						
11.0						
12.0						
13.0						
14.0						
15.0						
16.0						

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Consulting Geotechnical Engineer

GEO TECHNOLOGIES

TABLE 1 : RESULTS OF TESTS ON ROCK SAMPLES

700 KL SUMP AT SIPUR -U IN ADILABAD DT.

BH No.	Depth, m	Specific gravity	Porosity %	Water absorption %	UCS Kg / sq cm
1	3.3	2.71	4.1	2.9	468
	4.7	2.72	3.8	2.2	446

NOTES : Where core Samples are less than 100 mm long, UCC tests are not conducted.

GEO TECHNICAL SERVICES

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APPENDIX

CALCULATION OF SBC

700 KL SUMP AT SIPUR - U IN ADILABAD DT.

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

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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

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