GOVERNMENT OF ANDHRA PRADESH
Engineer-in-Chief Office, RWS&S Dept, Hyderabad.
Memo No AEE1/DEE (P-2)/Adilabad/ Mudhole/Project-Designs/2013-14, dated 21/04/2014

Sub: RWS &S Circle Adilabad – "Providing protected water Supply Scheme to 223 Habitations in 6 mandals of Mudhole Assembly Constituency in Adilabad District" estimate cost Rs.16850.00lakhs,– Approval of design & drawings of various structures – For approval requested – Regarding.

Ref: Lr.No.AEE1/Structural-designs/CPWSS-Mudhole/2013-14, dated 29.01.2014, of the Superintending Engineer RWS&S circle Adilabad.

The approved structural designs and drawings of various structures for the "Providing protected water Supply Scheme to 223 Habitations in 6 mandals of Mudhole Assembly Constituency in Adilabad District", under NRDWP Grant are communicated for taking necessary action.

1. 14m dia Intake-well cum pump house.
2. 60KL Capacity OHBR with 30m staging.
3. 40KL Capacity OHBR with 30m staging.
4. 20KL Capacity OHBR with 15m staging.
5. 500Kl Capacity Clear Water Sump.
6. 400Kl Capacity Clear Water Sump.
7. 300Kl Capacity Clear Water Sump.
8. 250KL Capacity Sump.
9. 200KL Capacity Sump.
10. 120KL Capacity Sump.
11. 100KL Capacity Sump.
12. 60KL Capacity Sump.
13. 40KL Capacity Sump.
14. 30KL Capacity Sump.
15. 20KL Capacity Sump.
16. 5KL Capacity Sump.

The Superintending Engineer RWS&S circle Adilabad, is requested to notice the modifications in design and drawings and execute the structures as per the approved designs and drawings. And he should personally satisfy the SBC before execution.

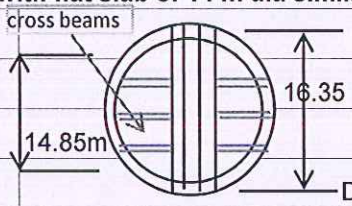
Sd/-
R. Chakrapani,
Engineer-in-chief
RWS&S, Hyderabad.

To
The Superintending Engineer, RWS&S Circle, Adilabad.

//T.C.F.B.O//

G. Rajeshwar 21/4/14.
Deputy Executive Engineer

	Stability Analysis of the JACK WELL for CPWSS mudhole			
DATA	mudhole			
1	Dia of inner well=	14	m	
2	r relief proposed @ level of Back waters of Resvr,above GL=	**1**	m	
3	Thickness of sidewall below the GL=	0.60	m	
4	The depth of GL from top of Raft slab	**12.895**	m	
5	The total depth of Raft beam	1.5	m	
6	Thickness of sidewall above the GL=	0.45	m	
7	ht of JACK well above GL=	**2.325**	m	
8	Thickness of sidewall pump room=	0.2	m	
9	ht of well pump room=	**6**	m	
10	Top slab /Dome projection =	0.75	m	
11	Top slab dome dia=	14.4	m	
12	Top slab thickness=	0.15	m	
13	Raft Beam web dia=	14.45	m	
14	Raft Beam web width=	0.60	m	
15	Raft Beam web height=	0.30	m	
16	Raft offset from beam outer edge=	**1.100**	m	
17	Raft outer dia=	17.40	m	
18	Raft thickness=	1.20	m	
19	wt of water replaced by well for Raft slab=	2853	kN	
20	wt of water replaced by well for Raft beam web portion=	534	kN	
21	wt of water replaced by well for side walls upto GL=	22940	kN	
22	wt of water replaced by well for side walls upto relief=	1744	kN	
23	Total wt of water replaced by well, upto Relief provision =	**0**	kN	
24	wt of raft slab=	7134	kN	
25	wt of web of the raft beam=	204	kN	
26	wt of side walls below GL =	8781	kN	
27	wt of side walls above GL 15% openings , =	1009	kN	
28	wt of side walls pump room =	1362	kN	
29	wt of Top slab of pump room =	611	kN	
30	wt of parapet wall of pump room =	113	kN	
31	effective wt of submersed soil above raft projection =	5811	kN	
	total wt of RESISTANCE=	25024	kN	
33	wind movement=	2550	kN-m	
34	Resisting moment=	95137	kN-m	
	FS=	33.58	kN-m	>= 1.4
				O.K

DESIGN OF JACK WELL FOR CPWS Scheme to mudhole						
Dia of the well	above GL	=	**14**	m		
Height of the side wall Total upto Bottom of pump room		=	**15.22**	m		
MWL		=	363.21	MSL		
GL at Proposd site		=	360.88	MSL		
Jachwell pump room Level		=	363.21	MSL		
Pipe delevery slab level		=	361.21	MSL		
DEAD STORAGE LEVEL		=	348.99	MSL		
water relief proposed @ level of Back waters of Resvr,above G		=	**1**	m		
Height of the side wall below G.L		=	**12.895**	m		
Thickness of side wall below G.L		=	**0.6**	m		
Height of the side wall above G.L		=	2.325	m		
Thickness of side wall ABOVE GL		=	**0.45**	m		
Height of the pump house		=	**6**	m		
Thickness of side wall		=	**0.2**	m		
Note : Top roof proposed with flat slab of 14 m dia similar to floor slab						
Design of Floor SLABS						
Dia of top slab		=	14.45	m		
Length max ly		=	6.73	m		
Middle Width lx		=	3.36	m	D/ 4	
ly/lx		=	2.00			
Assume Floor slab thickness	200	mm	0.200	m		
Loads						
Self weight of slab		=	5.000	kn/m^2		
Live load		=	2.00	kn/m^2		
Miscellaneous (Roof finish)		=	1.00	kn/m^2		
Total load		=	**8.00**	kn/m^2		
Slab is continuously supported on beams (partial load distribution)						
Top slab projection=		=	0.75	m		
Span of the slab		=	3.36	m		
Max BM	wL^2/12	=	7.54	knm	dist	
Size of reinforcement		=	12	mm	10	mm
Overal depth required	sqrt(6*7.54*10^6)/(2*1000))	=	150	mm		
Overal depth provided		=	200	mm	>150 O.K	
Effective depth provided		=	149	mm		
Main Steel required (As)	(7.54*10^6)/(0.87*130*149)	=	447	mm^2		
Spacing of reinforcement		=	253	mm		
Min steel as dist		=	400	mm^2		
Spacing of min reinforcement	required	=	283	mm		
for impact lods acts while pun	proposed	=	200	mm	<253 O.K	
Provide 200mm thick Floor slab			floor to	50		
Provide slab steel with Y12 - 200 c/c main, and Y10 - 150 dist						

Check for deflection						
Ast provided			565	mm2		
Percentage of steel			0.4	%		
From chart			26			
Effective depth required			99	mm	OK	
FLOOR L BEAMS (2 NOS)						
BEAM extended to projection slab end		Span=	11.20	m		
Load from slab		=	36.65	kn/m		
Beam size Width	600	mm	0.60	mm		
web Depth	1000	mm	1.00	mm		
Depth	1200	mm	1.20	mm		
Effective depth	1162.5	mm	1.163	m		
Self weight	0.6*1*25	=	15.00	kn/m		
Total load		=	51.65	kn/m		
Max +ve B.M udl instead of p	51.65*11.2^2/10	=	647.92	knm		
Max -ve B.M partial fixity	51.65*11.2^2/16	=	404.95	knm		
Let +ve Mu /b d^2 =		1.20	appx. =	1.20	N /mm ^{2}	
Let -ve Mu /b d^2 =		0.75	appx. =	0.75	N /mm ^{2}	
	for + ve reinforcement	for -ve reinforcement				
From sp-16, %Ast =	**0.617**	**0.379**				
Required ,Ast =	4304	mm ^{2}				
Proposed with ,	Nos	Dia	Area			
St.Bars	9	25	4417	mm^2		
			0	mm^2		
		Total=	4417	mm^2		
	BOT 9 Y 25	=	4417	mm^2		
Area of steel provided		=	4417	mm^2	>4304 O.K	
From sp-16, %Ast =	0.379	for -ve reinforcement				
Required ,Ast =	2644	mm ^{2}				
Proposed with ,	Nos	Dia	Area			
St.Bars	9	20	2827	mm ^{2}		
			0	mm ^{2}		
		Total=	2827	mm ^{2}		
	TOP 9 Y 20	=	2827	mm^2		
Area of steel provided		=	2827	mm^2	>2644 O.K	
Percentage of steel		=	0.63	%		
Max shear force	51.65*11.2/2	=	289.25	kn		
Shear stress	289.25*1000/(600*1162.5)*1.5	=	0.62	N/mm^2		
Permissible shear stress (Pt = 0.63 %)		=	0.56	N/mm^2		

Shear to be carried by stirrups	(0.62/2 ,(0.62-0.56))*600*1162.5	=	216938	N		
Dia of stirrups		=	12	mm		
Spacing (Aw*0.87*fy**d/Vs)	*12^2)*0.87*235*1162.5/216938	=	248	mm		
Spacing for min shear (least c	0.75*d = 872 mm	&				
MIN OF	Aw*fy/0.4/b		122.52	mm		floor to
Provide 600*1200 Beam ; BOT 9 Y 25 ;TOP 9 Y 20-Y12-115 STPS					Y12-115 STPS	5
Design of side wall of the pump house						
Max load due to top slab		=	1690	kN		
Steel Girder and chain pully & wall mountings		=	21	kN		
Assume wt of pumpsets assembly 50% of load on chain pully =		=	10	kN		
self wt of side walls upto pump room base		=	1385	kN		
Total loads on just above the pump room base		=	3107	kN		
Load per Rmt		=	68435	N/m		
Sectional area of the side wall		=	200000	mm2/m		
Max compressive stress on the wall		=	0.34	N/mm^2		
			< 7.0	N/mm^2		
Ast required min	min of 0.24% for horizontal stee	=	480	mm2/m		
for dia of steel in mm=	min dia verticals =	=	10	mm		
spacing required	s=	=	163.62	mm	floor to	
spacing proposed	min spacings=	=	150	mm	50	
Provide 200 mm thick side wall with Y10 - 150 mm c/c for verticals & hoops on Each Face						
Design of side wall section just above the GL						
Dia of the well			=	14	m	
Thickness of the wall assumed		450	=	0.45	m	
Depth of side wall just above gl			=	2.32	m	
Free board available above MFLat the site foot bridge level		0.5	=	0.50	m	
Total loads on just above the pump room base		3107	=	3107	kN	
loads on pump room base slab(wooden or iron),IB,purlins,LL e		100	=	100	kN	
Pumps with water and pipe out let systems, supporting slab		9	=	9	kN	
p/m outlet supporting slab		577	=	577	kN	
load due wt of FLOOR beams		236	=	236	kN	
Reactions of supports for Foot bridge		50	=	50	kN	
self wt of side walls of jack well above GL=		1187	=	1187	kN	
				5266	kN	
Load per Rmt			=	116005	N/m	
Sectional area of the side wall per 1m length of wall dia			=	450000	mm2/m	
Max compressive stress on the wall			=	0.26	N/mm^2	
				< 7.0	N/mm^2	

condition & section considerd			section just above the Raft Beam	section just above the GL		
Total Dead fixed wt at section,	Wfixed= in kN	=	12329	3548		
Total whole load at section,	W = in kN	=	14381	5266		
Dia at section	d= in m	=	14	14		
ht of pump room=hp	hp = in m	=	6	6		
ht water above GL, When emptying the jackwell for removal of settled matter , considered this level for Raft design only but not for stability (at 361.88 MSL)	hw=above GL, 361.88 MSL	=	1	1		
ht below GL, for section =he	he =	=	12.895	0		
Thickness at section	t= in mm	=	600	450		
Dia of steel	ϕ_s= in mm	=	16	16		
spacing of steel	s = in mm	=	200	200		
% of steel for one layer	As%= % per 1m height or per 1m wibth		0.17	0.22	> 0.24/2 % o.k	
Area of steel, As	As= sqmm per 1m height or per	=	1005	1005		
Area of concrete for , A	A= sqmm per entire cross sectio	=	26389378	19792034		
Area of concrete, Ac	Ac=sqmm per per 1m wibth	=	600000	450000		
concrete area eqivalent Ae	Ae= sqmm per 1m height or per	=	612064	462064		
Direct compression -ve side	W fixed / A= in N/sqmm	=	0.47	0.18		
Modulus of concrete area eqivalent	Ze= in mm^3	=	7.546E+10	5.55E+10		
height at section to wind P	h= in m, above GL	=	9.325	9.325		
Lateral wind force at section	P= 1.5*h*(d+t*2) in kN	=	146	146		
wind moment=	M= P*h/2 in kN-m	=	680	680		
Bending compression/tension	M/Ze= in N/sqmm	=	0.01	0.01		
Direct compression	W/A= in N/sqmm	=	0.54	0.27		
Unit weight of saturated soil a	γ_{sat} in kn/m3	=	18	18		
Angle of internal friction	θ in deg	=	25	25		
Coeff. Of active Earth pr	Ka	=	0.41	0.41		
lateral earth pressure	$q_e = k_a * \gamma_{sat} * h_e + 10 * h_w$ in kn/m^2	=	104	10		
hoop compression in N/sqmm	q_e*d/2/(1000*t+12*As) in N/sqm	=	1.19	0.15		
For hoop tension by inside water column below GL in N/sqmm	q_w= h below GL* 10 in kN /m^2	=	125.95	50.00	surge head load	
hoop tension for only inside water below GL in N/sqmm	q_w*d/2/(1000*t+8.33*As) in N/sc	=	1.43	0.76		
Overall compression=	W/A+ M/Z+ q e*d/2/(1000*t+8.33	=	1.75	0.43	< 7 N/sqmm o.k	
Overall tension=	-Wf/A+ M/Z+ qw*d/2/(1000*t+12*As) in N/		0.97	0.60	< 1.5 N/sqmm o.k	
As H^2/Dt >30 , Bending effect on side walls not considered.						

Design of Raft Beam and Raft Slab						
Raft Beam Dia			=	14.60	m	
Raft Beam Web depth		**300**	=	0.30	m	
Raft Beam Web width		**600**	=	0.60	m	
width of the footing projection		**3300**	=	3.30	m	
thickness of the Raft slab		**1200**	=	1.20	m	
Outer Dia of Raft slab			=	17.40	m	
Inner Dia of Raft slab			=	10.80	m	
Assuming the S B C of soil	0.15	N/ sqmm	=	150	kN/ sqm	
Loads						
Total load above the Raft Beam			=	14381	kn	
Wt of Raft slab			=	4385	kn	
Wt of Raft Beam			=	206	kn	
Total wt on soil			=	**18973**	kn	
Load on soil			=	**130**	kN/ sqm	< SBC ok
Moment due to wind pressure at base			=	1730	kn m	
Area of the footing			=	1.E+08	mm2	
Outer dia of footing			=	17400	mm	
Section modulus			=	1.E+20	mm3	
Pmax			=	0.100	n/mm2	< 1.25*SBC ok
Pmin for fixed dead structure			=	0.084	n/mm2	+ve ok
Max upward pressure reactior	induced BM ,	p=	=	99.79	kn/m2	
uplift pressure emptying of jackwell while water level @1above GL		0.00	=	0.00	kn/m2	
Net uplift pressure for Raft	uplift-(wt found)/Area of Foudn	0.00	=	0.00	kn/m2	
Udl for Max BM inner span raft continuous supported under sid		99.79	=	99.79	knm/m	
Radial BM @ centre of span	+ve	0.00	=	0.00	knm/m	
Radial BM @ end of span	-ve	164.66	=	164.66	knm/m	
Max BM @ support for hoops	-ve	164.66	=	164.66	knm/m	
Raft depth required		703	=	703	mm	
Overall thickness proposed			=	1200	mm	ok
size of the bar	radials & hoops		=	20	mm	
Effective depth provided		d=	=	1115	mm	
Ast required			=	1306	mm2	
Spacing of the reinforcement required			=	241	mm	
Spacing provided			=	150	mm	
As provided=			=	2094	mm2	
		As% proposed		0.19	%	
dist of crical shear= r=	at d/2 dist. from the face of raft beam		=	0.56	m	
Max shear in Raft slab=	V=u*inside slab area away from distance ,		=	274	kn/m	
Max shear stress in Raft slab=	V/d/1		=	0.25	N/sqmm	
This value is admissible for A	sp 16	0.3%	<=	0.19	As% proposed	
					o.k	

Raft footing with thick of 1200 mm, and outer Dia of footing 17400 mm , inner Dia of footing 10800 mm, steel Bottom radials & Bottm hoops with Y20 - 150c/c and top steel Radials & hoops with Y 20mm @ 150mm c/c

Design of the Raft beam a thickend shaft Bottom						
Raft Beam Web depth			=	300	mm	
Raft Beam Web width			=	600	mm	
Total Depth of raft Beam=			=	1500	mm	
Effective depth=			=	1380	mm	
min sides hoops dia=			=	20	mm	
Nos			=	5	nos	
Ast proposed=			=	1571	sqmm	>Ar
	For each sides		As%=	0.87	> 0.10%	o.k
hoop compression on Beam=			=	4.23	N/mm2	
				< 7.0 kN/sqmm o.k		
hoop tenstion on Beam=			=	275.83	kN	
Ast required=	For each sides	Ar	=	919	mm2	
hoop tensile stress on Beam=			=	0.31	N/mm2	
				< 1.5N/sqmm o.k		
Even though the Raft beam designed for hoop tention, the following reinforcement proposed for the Beam						
Top hoops	dia= mm	20	5 nos			
Bot hoops	dia= mm	20	5 nos			
each sides hoops	dia= mm	20	5nos			
stirrups	dia= mm	12	@ 150 mm c/c			
Note :Verticals for side walls placed from the bottom of the footing with legs						

DEE/MWS
Dy. Executive Engineer
R W S & S (Projects)
Division. Adilabad.

Executive Engineer
R W S & S Division Adilabad

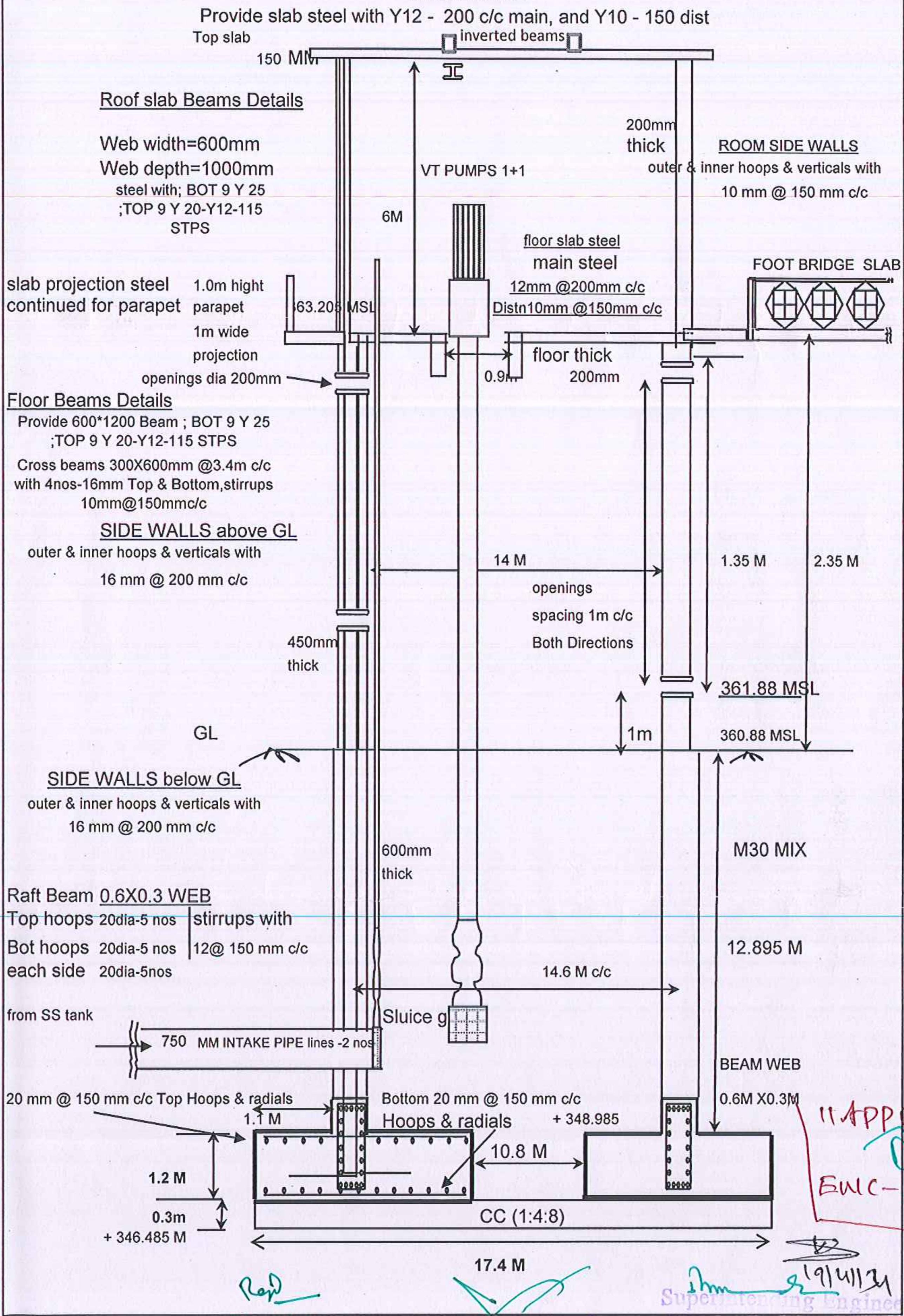
Superintending Engineer
R W S & S Circal Adilabad

"APPROVED"
21/4/14
BMC-RWS&S, Hyd.

19/4/14

19/4/14

JACK WELL



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EWC-RWS&S
Hyd

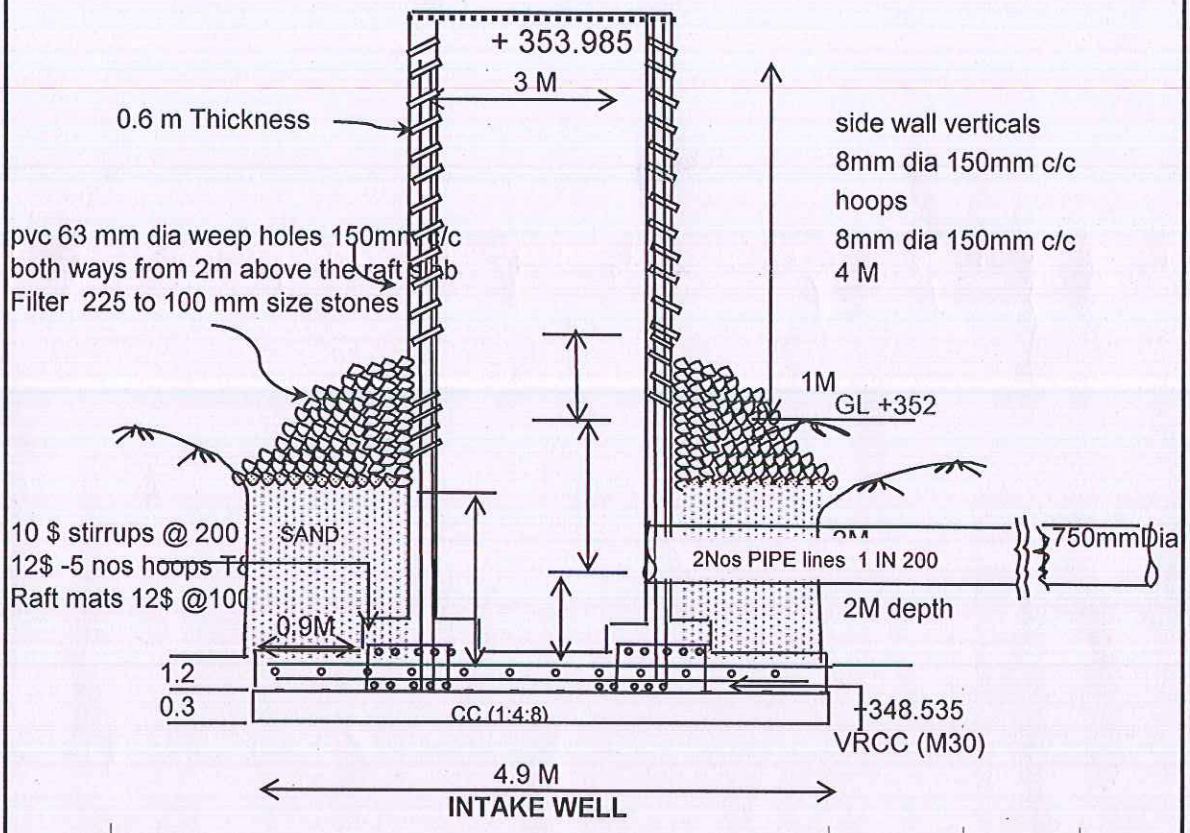
Rcd
DEE/RWS

Dy. Executive Engineer
R W S & S (Projects)
Division. Adilabad.

Executive Engineer
RWS & S Division Adilabad

Superintending Engineer
R W S & S Circal Adilabad

INTAKE WELL for CPWSS



RSFCAP	**30**	MLD		
25000	**LPM**			
		min pipe slope required	1 in 600	
q DESIG	**25000**	length pipe	hf	v=
Pipe dia	**750**	200	0.3	0.94

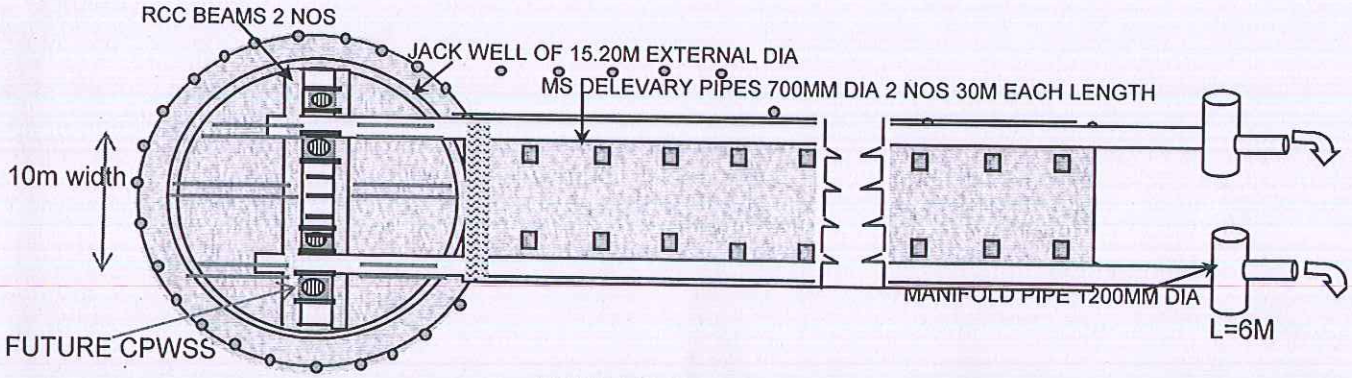
By. Executive Engineer
R W S & S (Projects)
Division. Adilabad.

Excutive Engineer
RWS & S Division Adilabad

Superintending Engineer
R W S & S Circal Adilabad

"APPROVED"
ENC-RWS&S, Hyd.

19/4/14 19/4/14



PUMP ROOM SLAB LEVEL SECTION

ISMB 300 X 150 X 8MM 1m c/c FOR SUPPORTING THE MOTORS

PEDESTAL RCC 200MM DIA
COLUMN RCC 450MM SIDE
GI PIPE RAILING 3 ROWS
DOOR SHUTTERS
PUMP MOTOR 300 HP 2 NOS

Design of Shaft type supporting structure for 60KL capacity OHBR

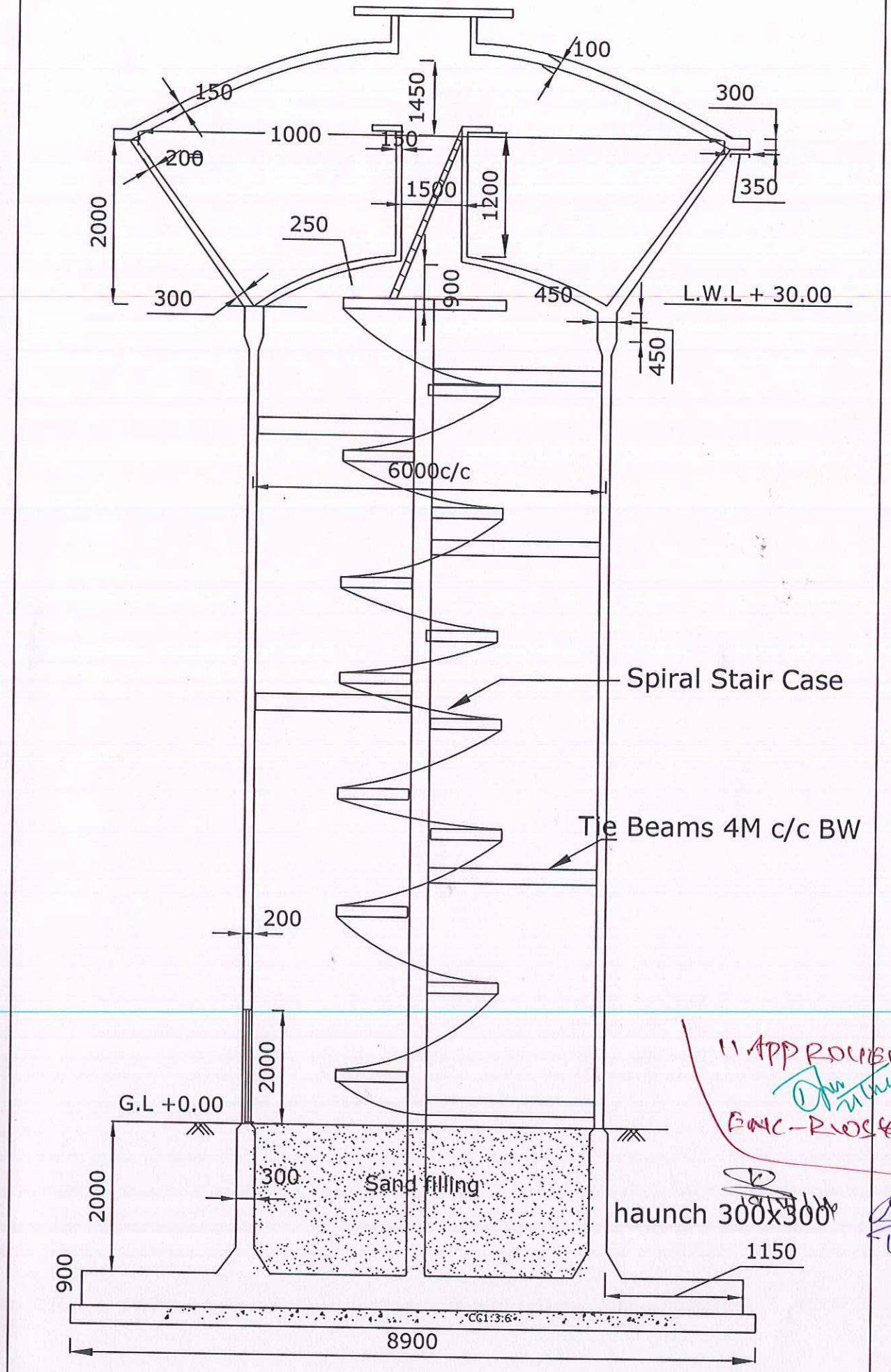
Staging height		30	m					
Location of tank								
DATA :	Location of tank		Plain Ground					
Basic Wind speed	44	m/s	65	kM away from sea				
Net SBCof the Soil assumed				15	t/m2			
Depth of foundation up to top of raft			df	2.00	m			
TANK DETAILS				total net water volume				
Capacity of tank			v	60	kl	64	kL	
Height of staging			hs	30.00	m			
Dia of stagging/ Shaft			ds	6.00	m	compression		
Dia of tank			td	10.00	m			
Top slab / Dome	tst	0.125	h	1.45	m	R2=9.35		
Top ring beam	trd	0.300	trb	0.350				
Side wall ht incl. middle RB	swh	0.000	swt	0.000				
Middle ring beam	mrd	0.000	mrb	0.000				
Dia of central opening	copt	0.15	copdi	1.5				
Inclined slab	Ist	0.250	ish	2.000	2.828			64
Bottom ring beam	brd	0.450	brb	0.450				
Bottom Dome	bst	0.250	bdh	0.900	R1=	5.45	m	
Wind constants	ki	1.000	kii10	1.050				
	kii15	1.090	kii20	1.120				
	kii30	1.150	kiii	1.000				
Basic wind speed	158.4	Km/h	vb	44	m/sec			

Shaft details

Grade of concrete			g	30	n/mm2	WS	
Grade of steel medium ass	Fe415		equivallent fy	343	n/mm2 ← ~~190~~		n/mm2
Thick ness of shaft	>=0.2m	Safe	ts	0.2	m		
opening width			wp	1	m		
Dia of vertical steel bars proposed			di	10	mm		
Spacing of vertical reinforcement on both the fac			sp	200	mm	209	
Dia of circumferencial steel bars proposed			cdi	10	mm		
Spacing provided horizontally on both the faces			sph	200	mm	200	
Height of shaft above raft	hs-brd-0.15+df		sh	31.4	m		
Stress in the shell	compression			2.28	kg/cm2		
Nature of stress				Comp			
Tensile stress due to ring moment		safe		0.83	Kg/cm2	21.00	
	No Comparision of eri and er needed						
	er	0.306	eri	scv Governs			
			alpa	168.00			
Maximum compressive stress in shaft		safe		22.83	Kg/cm2	114.0	
Area of vertical steel required				5.00	cm2		
spacing required				300	mm		
Area of circumferential steel required				4.80	cm2		
spacing required				200	mm		

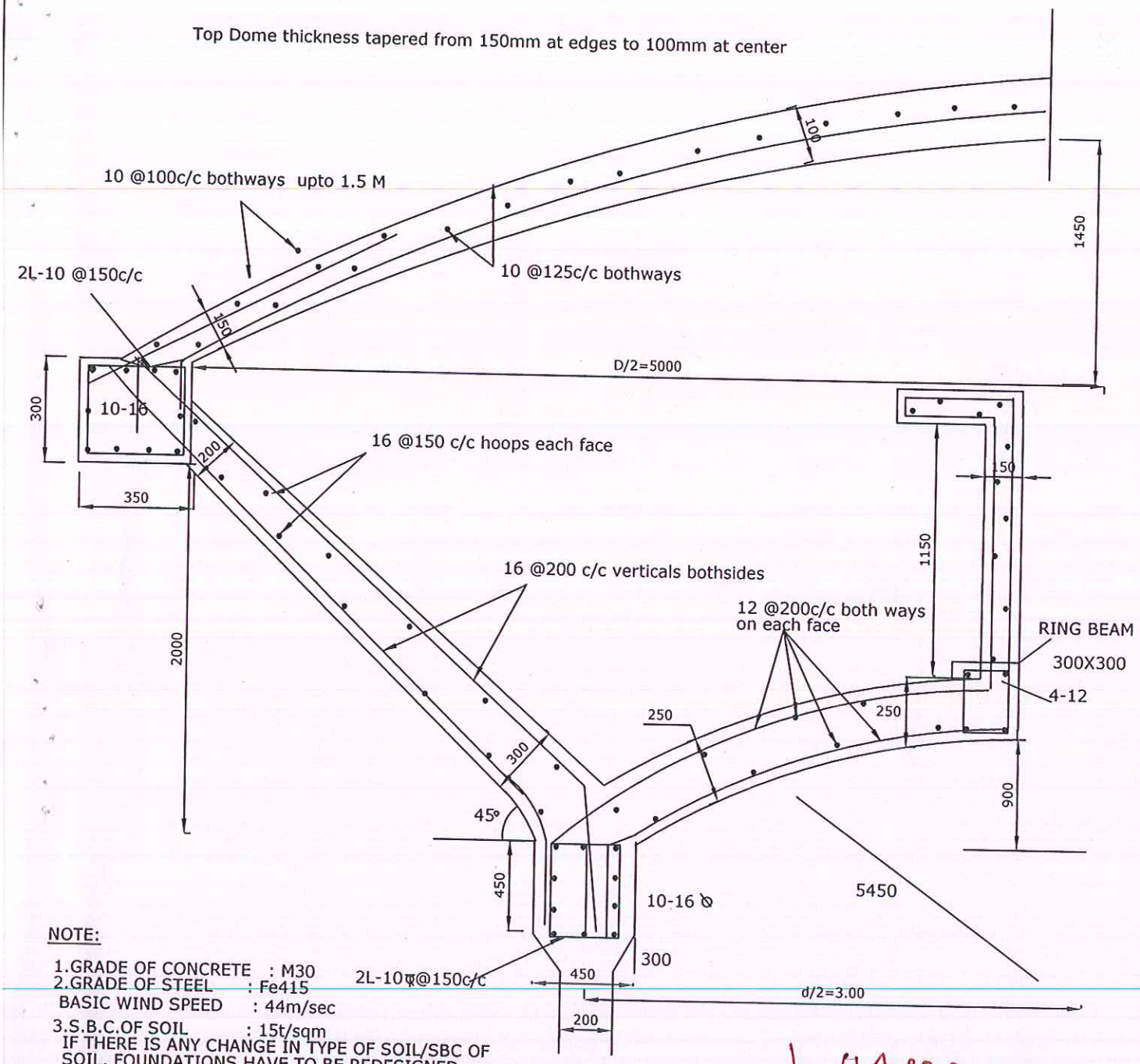
Ring beam(thickend shaft) on Raft								
Width of ring beam @ bottom of shaft			rb	0.30	m		
Depth of ring beam @ bottom of shaft			rd	2.00	m		
Dia of vertical bars			rsdi	10	mm		
Spacing of bars			rbsi	200	mm	209	
Dia of circumferencial bars			rsdii	10	mm		
Spacing of bars			rbsii	200	mm	209	
	Design of raft						
Raft slab projection=	1		Safe	Safe	dia cc		
CC layer below the raft	thickness	0.3	projection	0.30	8.9	8.84	
Dia of raft provided	< 9.3 m	Safe	d	8.30	m	8.24	
Overall depth of raft		Safe	dr	0.90	m	0.59	
Dia of bottom bars			db	20	mm		
Spacing of bottom bars arranged as mesh			space	150	mm	165	1.15
Dia of top bars			dbi	12	mm		
Spacing of top bars arranged as mesh			spacei	150	mm	188	
Effective depth provided (de)			de	0.83	m		
Radial Moments							
Radial distance from centr	0.00	1.50	3.00	3.58	4.15	m	
Radial moments M	-7.94	2.53	25.98	7.85	0.00	tm	
Area of steel in cm2	6.0	2.0	19.0	6.0	0.0		
	Moment in tm	Ast in cm2	Spacing in mm				
Maximum negative moment	-7.94	6.0	188	mm			
Maximum positive moment	25.98	19.0	165	mm			
Minimum area of steel	mas	10.80	cm2				
Circumferencial Moments							
Radial Distance from centr	0.00	1.50	3.00	3.58	4.15	m	
Circumferencial moment M	-7.94	-7.44	-6.67	1.86	0.93	tm	
Area of steel in cm2	6	5.5	5	1.5	1		
	Moment in tm	Ast in cm2	Spacing in mm				
Maximum negative moment	-7.94	6.0	188	mm			
Maximum positive moment	1.86	1.5	291	mm			

"APPROVED"
ENG- ROSES Hyd.
19/4/14
19/4/14



60 KL OHBR SHAFT

60KL OHBR 30M
44m/s wind speed
SBC 15T /SQM



NOTE:

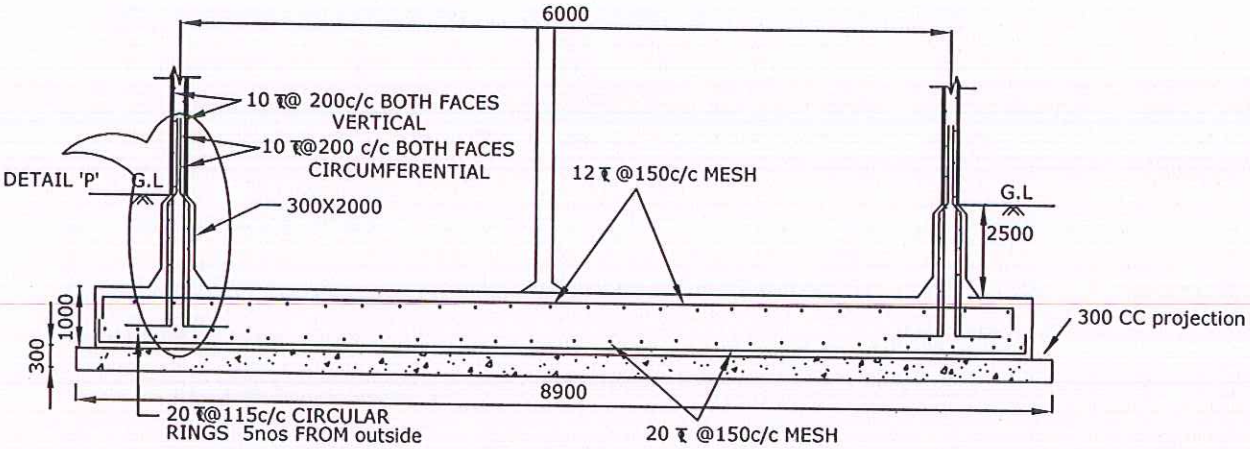
1.GRADE OF CONCRETE : M30
2.GRADE OF STEEL : Fe415
BASIC WIND SPEED : 44m/sec
3.S.B.C.OF SOIL : 15t/sqm
IF THERE IS ANY CHANGE IN TYPE OF SOIL/SBC OF SOIL, FOUNDATIONS HAVE TO BE REDESIGNED
4.DEPTH OF FOUNDATION :2.0m BELOW GL UPTO RAFT TOP

5. FOR DETAILING OF REINFORCEMENT IS SP-34 SHALL BE FOLLOWED
6. PROVISIONS GIVEN IN IS 456-2000, IS 3370(PART-IV) SHALL BE FOLLOWED

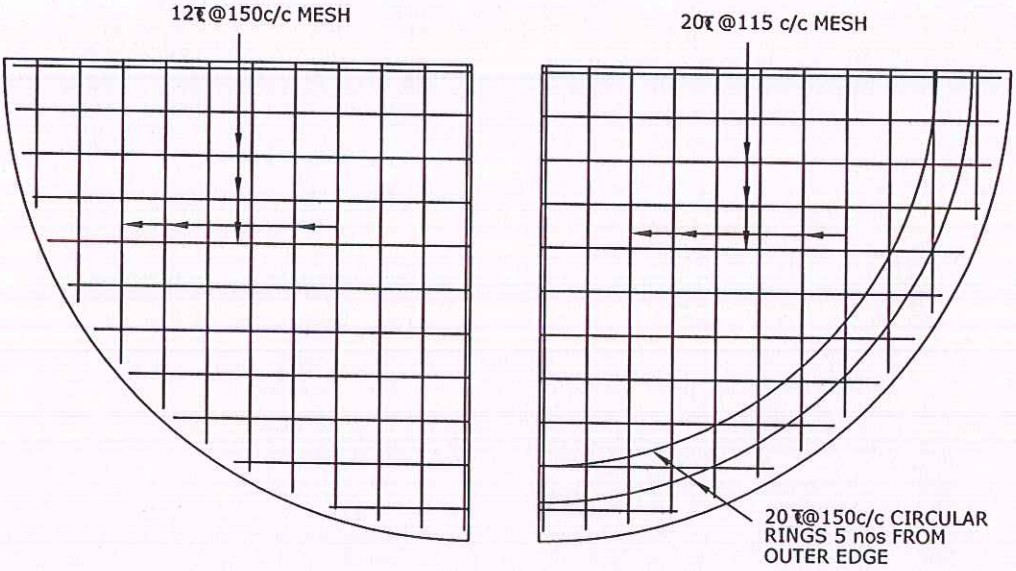
"APPROVED"
21/4/14
BMC-RWS&SLtd.

19/4/14
19/4/14

60 KL OHBR 30 m
44m/s WIND speed
SBC 15 T/SQM

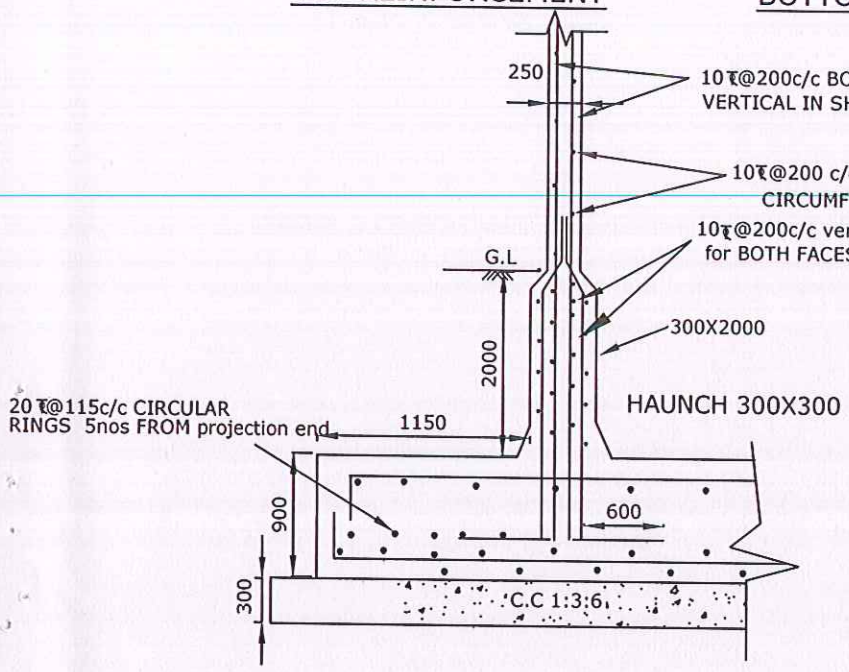


SECTIONAL ELEVATION OF RAFT



TOP REINFORCEMENT

BOTTOM REINFORCEMENT



DETAIL 'P'

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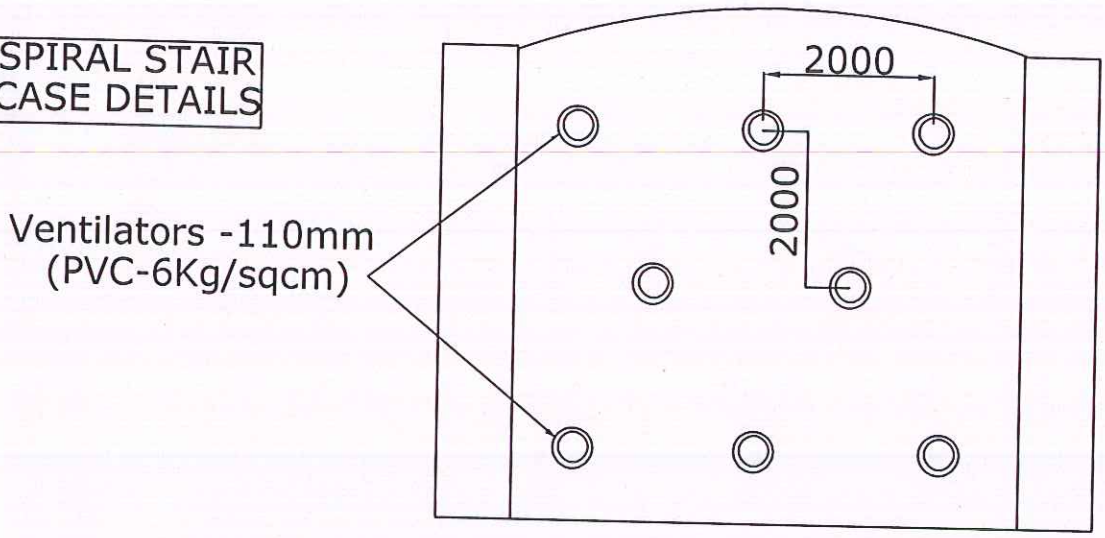
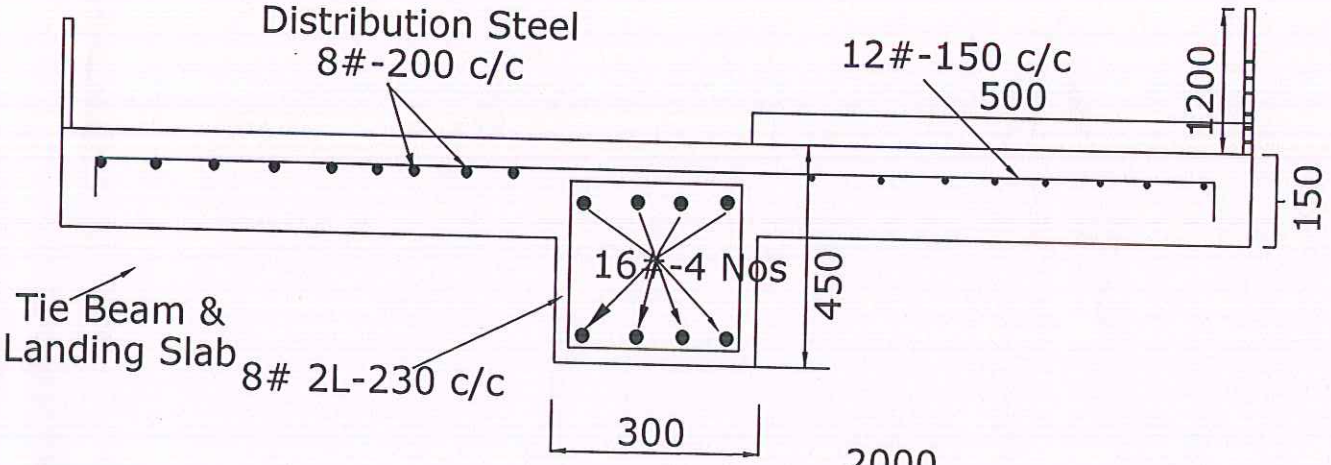
BNC-RWSS&SH(N).

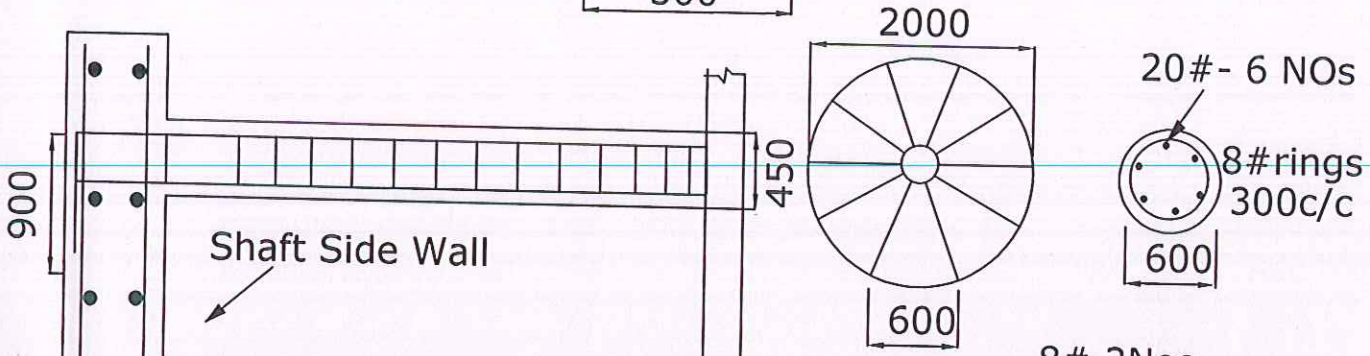
19/4/14 19/4/14

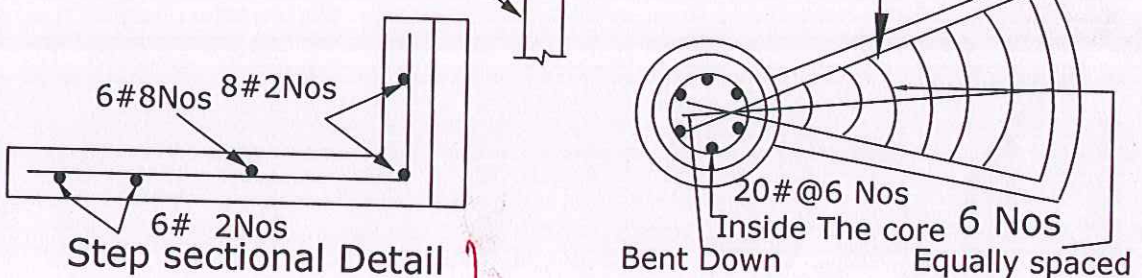
60 KL OHBR 30M
44m/s WIND
SBC 15T/SQM

SPIRAL STAIR CASE DETAILS









"APPROVED"
ENC-RWSS&S Hyd
19/4/14
19/4/14

Design of Shaft type supporting structure for 40KL capacity OHBR

Staging height		30	m				
Location of tank							
DATA :	Location of tank		Plain Ground				
Basic Wind speed	44	m/s	200	kM away from sea			
Net SBCof the Soil assumed				15.0	t/m2		
Depth of foundation up to top of raft			df	2.00	m		
TANK DETAILS				total net water volume			
Capacity of tank			v	40	kl	43	kL
Height of staging			hs	30.00	m		
Dia of stagging/ Shaft			ds	5.50	m	compression	
Dia of tank			td	9.00	m		
Top slab / Dome	tst	0.125	h	1.30	m	R2=8.44	
Top ring beam	trd	0.300	trb	0.350			
Side wall ht incl. middle RB	swh	0.000	swt	0.000			
Middle ring beam	mrd	0.000	mrb	0.000			
Dia of central opening	copt	0.15	copdi	1.5			
Inclined slab	Ist	0.200	ish	1.750	2.475		43
Bottom ring beam	brd	0.350	brb	0.350			
Bottom Dome	bst	0.200	bdh	0.800	R1=	5.13	m
Wind constants							
	ki	1.000	kii10	1.050			
	kii15	1.090	kii20	1.120			
	kii30	1.150	kiii	1.000			
Basic wind speed	158.4	Km/h	vb	44	m/sec		
Shaft details							
Grade of concrete			g	30	n/mm2	WS	
Grade of steel medium assure	Fe415		equivallent fy	343	n/mm2	~~190~~	n/mm2
Thick ness of shaft	>=0.2m	Safe	ts	0.2	m		
opening width			wp	1	m		
Dia of vertical steel bars proposed			di	10	mm		
Spacing of vertical reinforcement on both the faces			sp	200	mm	209	
Dia of circumferencial steel bars proposed			cdi	10	mm		
Spacing provided horizontally on both the faces			sph	200	mm	200	
Height of shaft above raft to	hs-brd-0.15+df		sh	31.5	m		
Stress in the shell	compression			0.94	kg/cm2		
Nature of stress				Comp			
Tensile stress due to ring moment		safe		0.84	Kg/cm2	21.00	
	No Comparision of eri and er needed						
	er	0.359	eri	scv Governs			
			alpa	168.00			
Maximum compressive stress in shaft		safe		22.10	Kg/cm2	114.0	
Area of vertical steel required				5.00	cm2		
spacing required				300	mm		
Area of circumferential steel required				4.80	cm2		
spacing required				200	mm		

DESIGN OF 40 KL OHBR

Data

Volume of tank	**40**	KL
Hieght of staging	**30**	m
Basic wind speed	**159**	kmph
Safe bearing capacity of the soil	**15**	t/m2

Permissible stress

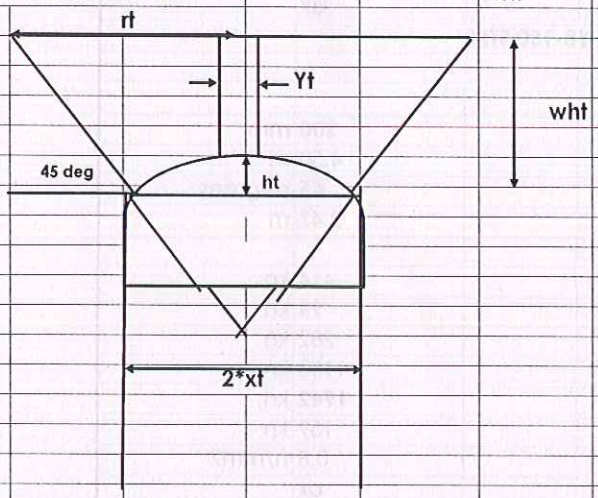
	compresstion		tension				
Mix M	cbc	cdc	cbt	cdt	M	**30**	
30	10	7.5	2	1.5	Fe 415 σst	**130**	n/mm2

working stress co-efficients

Mix M	m	k	j	Q
30	9.33	0.42	0.86	1.80

Dimensions of the tank

Dia of supporting saft	ds	**5.50**	m
Dia of the tank @ top	dt	**9.00**	m
Radius of the tank @ top	rt	**4.50**	m
Radius of the supporting shaft	xt	**2.75**	m
Dia of inner shaft	Yt	**1.50**	m
Rise of the bottom dome	ht	**0.92**	m
	hist	**0.83**	m
Hieght of inclined side wall	wht	**1.75**	m



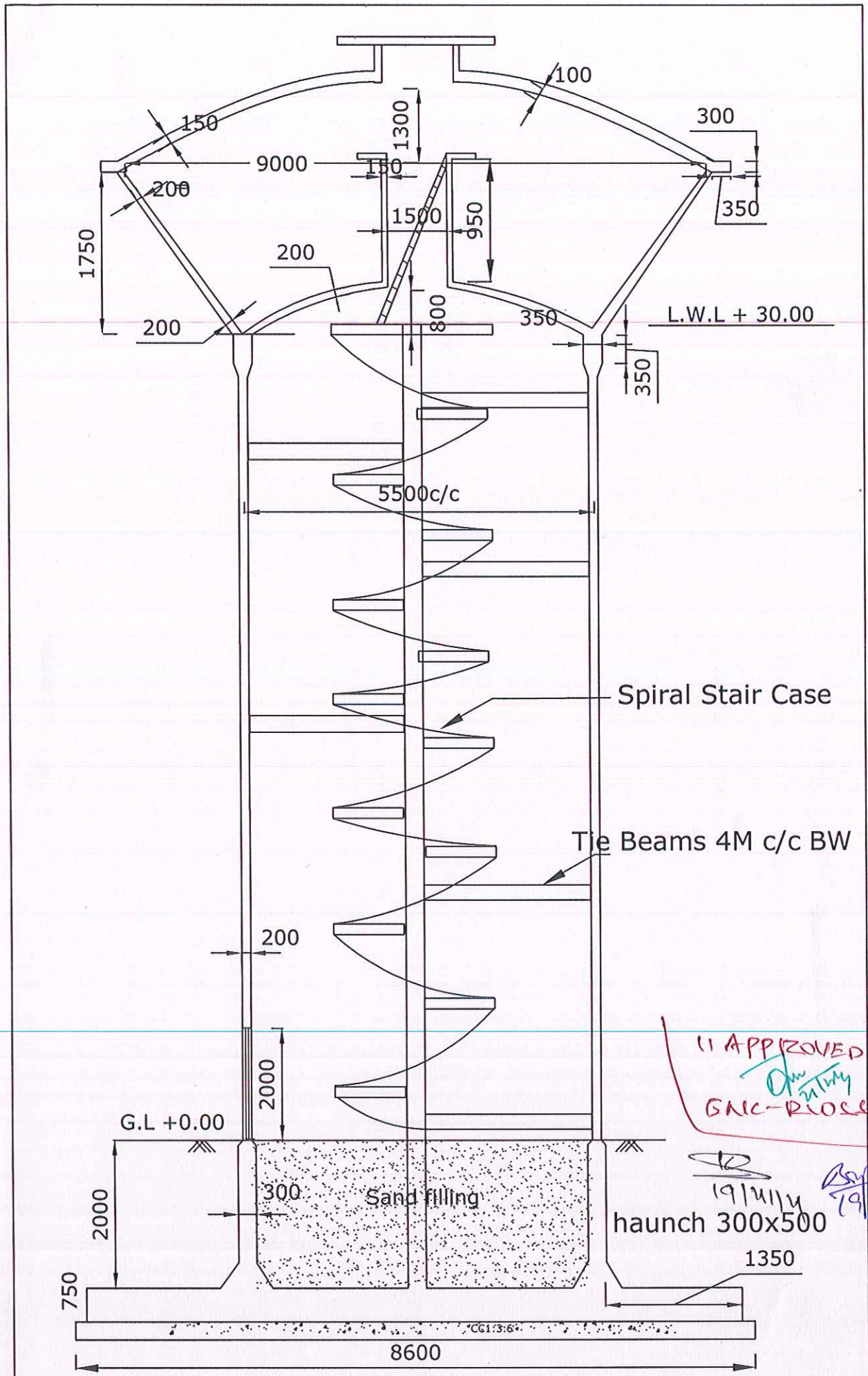
Volume	v1	95	Cum	
Volume	v2	-22	Cum	
Volume	v3	-11	Cum	
Volume	v4	-1	Cum	
Volume of the tank		**61**	**Cum**	
	41.8 >	**40**	**Cum**	

Design of the top dome

Thickness of the top dome		**0.125**	m
Rise of the top dome		1.30	m
Radius of the dome		8.44	m
Live load		1.50	kn/m2
Dead load		3.13	kg/m2

Distribution steel						
		Percentage of steel			**0.24**	%
		Area of steel			480	mm2
		Dia of bar provided			**12**	
Provide 12 mm @ 200 mm c/c on both faces					236	mm
Design of bottom dome						
Radius of base					2.75	m
Rise of the dome					0.80	m
Thickness of bottom dome					**0.2**	m
Radius of the dome					5.13	m
Internal Dia of the shaft opening					1.20	m
Thickness of the shaft opening					0.15	m
External dia of the shaft					1.50	m
Wt of water					406	kn
wt of the dome					129	kn
wt of the vertical shaft					15	kn
Total wt. On the dome					549	kn
Load for unit area					21	kn/m2
				cos(O)	0.80	
Meridional thrust					61	kn/m
Meridional stress					0.30	n/mm2
Circumfrential stress					0.55	n/mm2
Provide minimum reinforcement				**0.24**	%	
Area of the steel				2.40	cm2	
dia of steel proposed				**10**	mm	
Spacing				33	cm	
Provide 10mm bars @ 200 mm c/c as meridional and circumfrential steel						
Internal shaft						
Max hoop compression in the in internal shaft					6.25	kn
Provide 10 mm bars @ 200 mm c/c as mesh in both faces						
Design of bottom ring beam						
Horizontal component of thrust from conical shell					112	kn
Horizontal component of thrust from from bottom dome					49	kn
Net force					64	kn
Hoop compression					175	kn
Assuming size of the ring beam				300	350	
Compressive stress					1.67	n/mm2
					OK	
Provide minimum reinforcement				**0.24**	%	
Area of the steel required				525	mm2	
dia of steel proposed				**10**	mm	
	Top	**3**	**16**		603.19	
	Bottom	**3**	**16**		603.19	
			Total area=		**1206.37**	> 810 n/mm2 ok
			Beam size	**350**	**350**	
				Ac	105000	
Direct Tensile Stress in concrete					0.00	n/mm2
Y10-200					OK	
Provide Beam size 350x350mm and 3Y16+3Y16 and Y10-200 STP for shaft support						

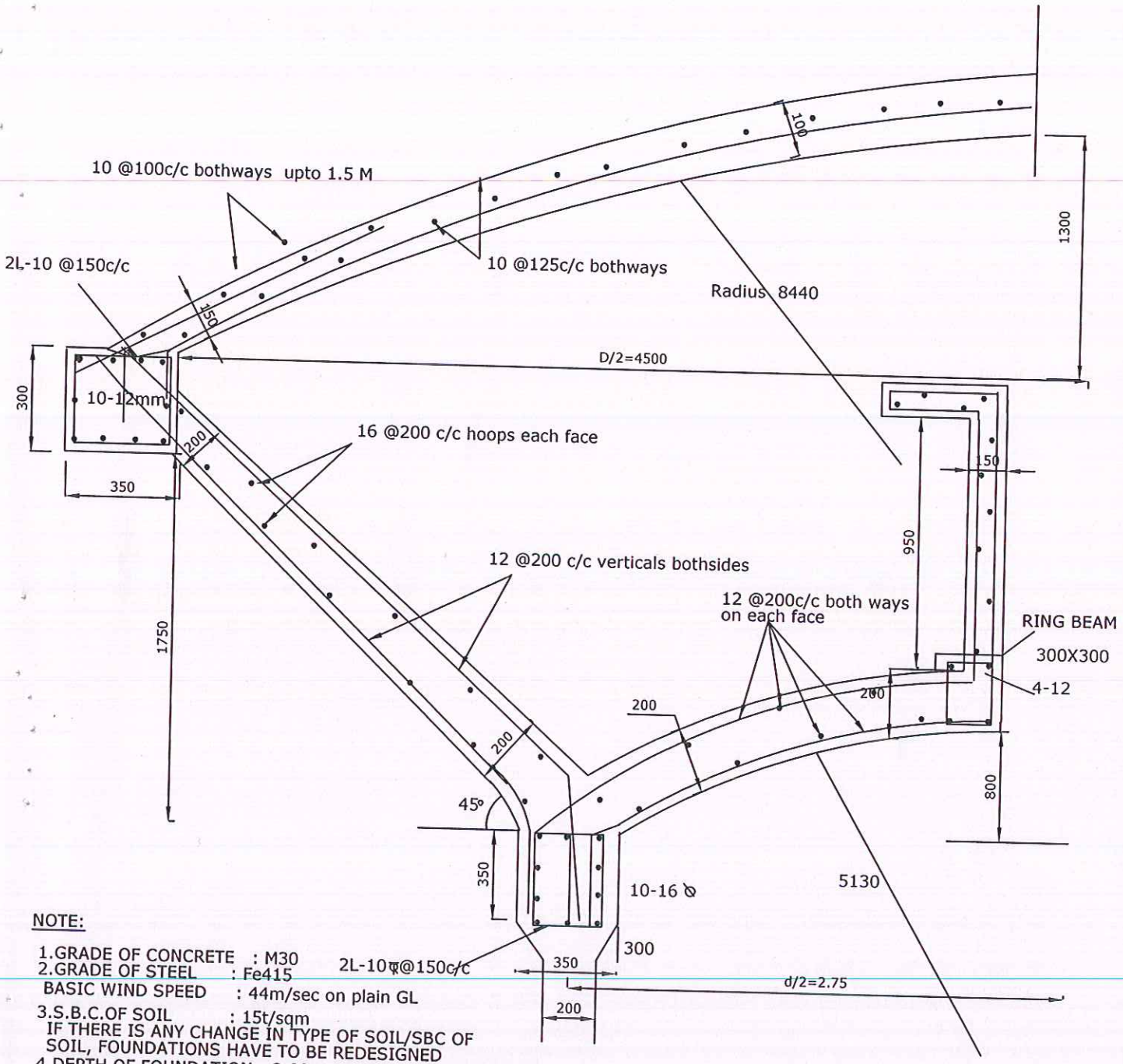
"APPROVED"
BMC-RWS&S Hyd.
19/4/14 19/4/14



40 KL OHBR SHAFT

40KL OHBR 30M
44m/s wind speed
SBC 15T /SQM

(1) APPROVED
GMC-ROORKEE
19/4/14
19/4/14



NOTE:

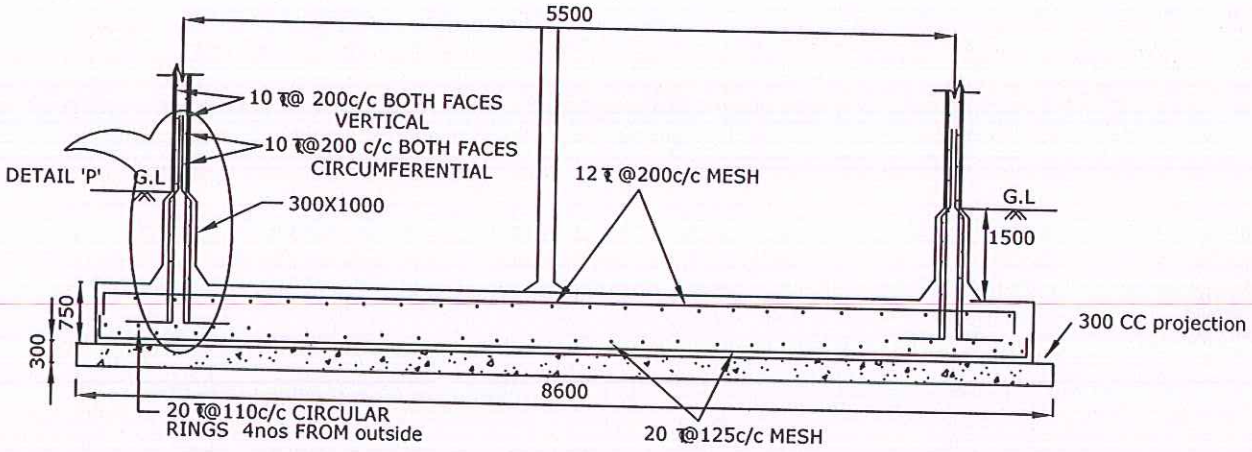
1.GRADE OF CONCRETE : M30
2.GRADE OF STEEL : Fe415
BASIC WIND SPEED : 44m/sec on plain GL
3.S.B.C.OF SOIL : 15t/sqm
IF THERE IS ANY CHANGE IN TYPE OF SOIL/SBC OF SOIL, FOUNDATIONS HAVE TO BE REDESIGNED
4.DEPTH OF FOUNDATION :2.00m BELOW GL UPTO RAFT TOP

5. FOR DETAILING OF REINFORCEMENT IS SP-34 SHALL BE FOLLOWED
6. PROVISIONS GIVEN IN IS 456-2000, IS 3370(PART-IV) SHALL BE FOLLOWED

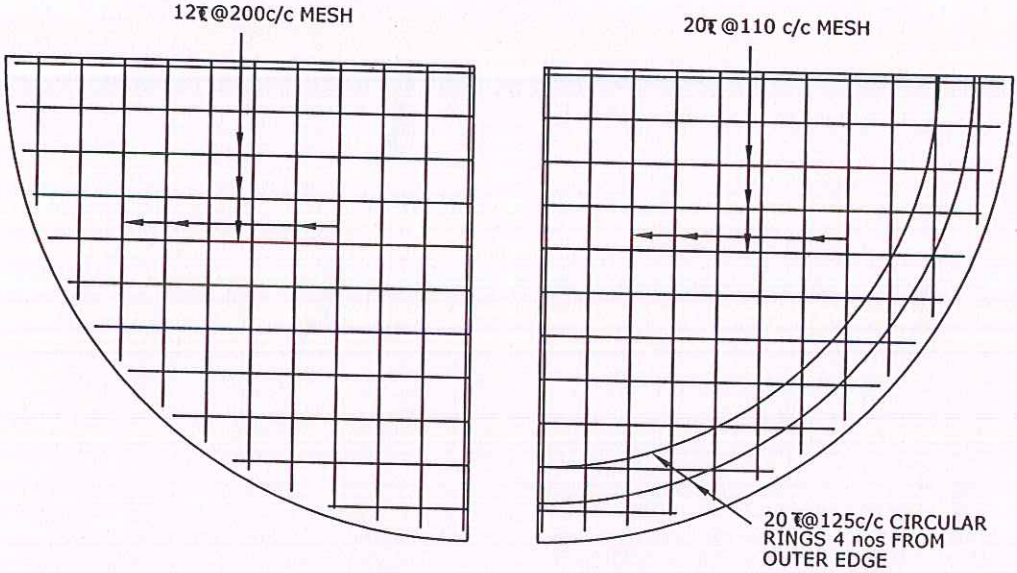
"APPROVED"
GVC-RJ0545/HYD

19/4/14 19/4/14

40 KL OHBR 30 m
44m/s WIND speed
SBC 15 T/SQM

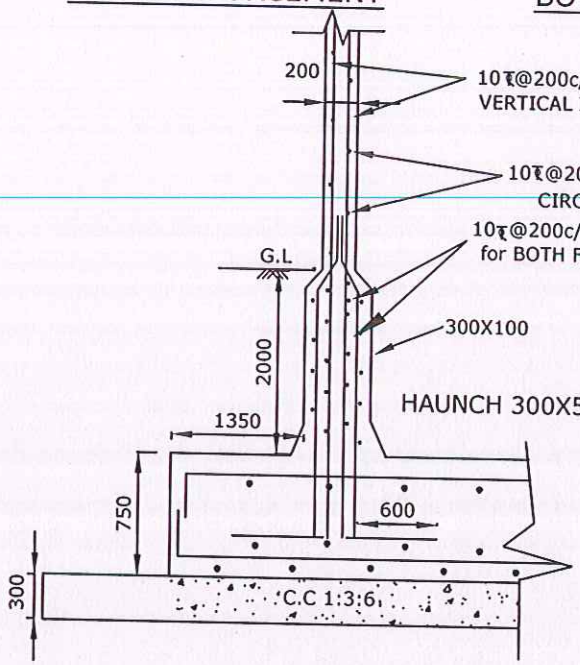


SECTIONAL ELEVATION OF RAFT



TOP REINFORCEMENT

BOTTOM REINFORCEMENT

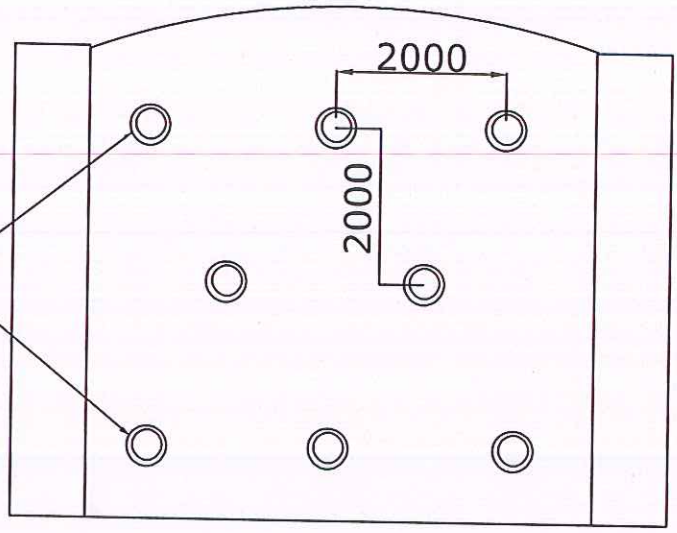


DETAIL 'P'

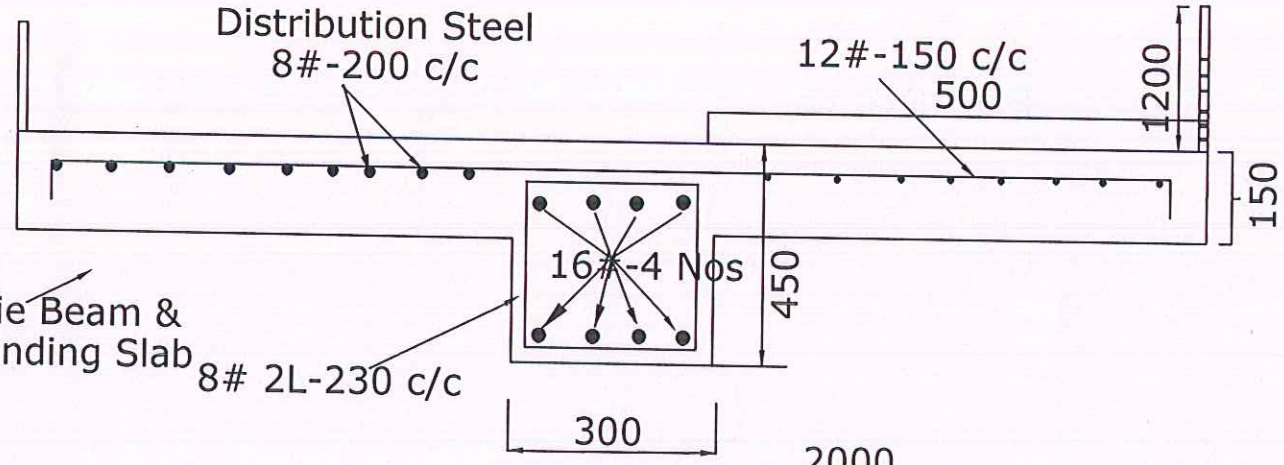
"APPROVED"
EMC-RWSS&S, Hyd
19/4/14
19/4/14

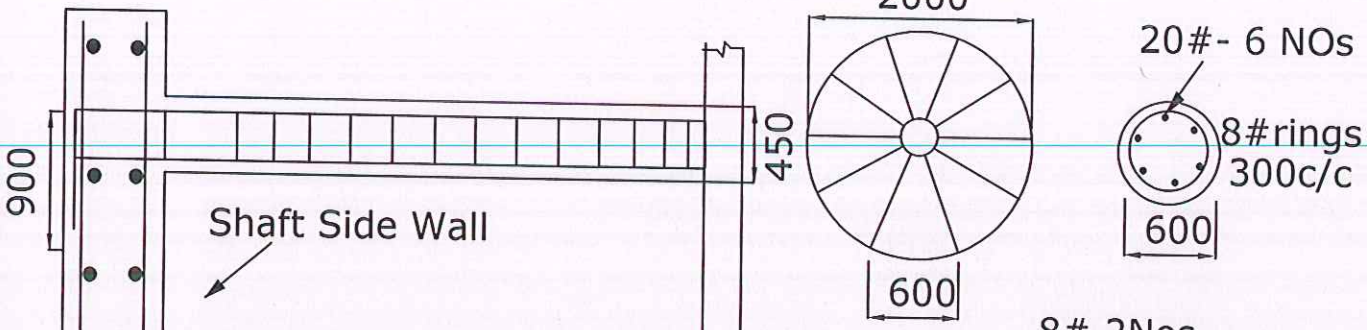
40 KL OHBR 30M
44m/s WIND-on plain
SBC 15T/SQM

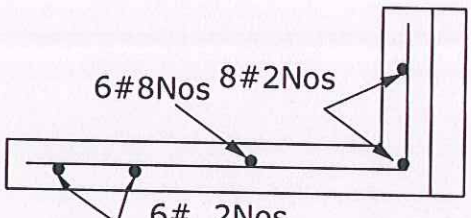
SPIRAL STAIR CASE DETAILS



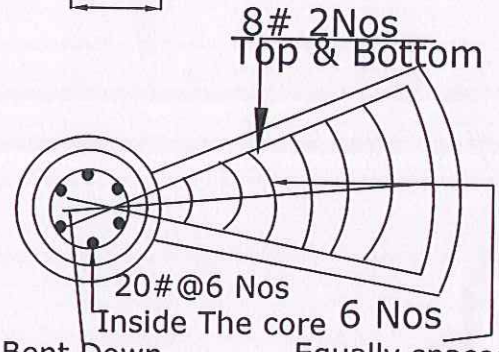
Ventilators -110mm
(PVC-6Kg/sqcm)







Step sectional Detail



Bent Down

Equally spaced
'L' Shaped Rods

"APPROVED"
EARTHQUAKE
19/4/14
24/4/14

Design of Column type supporting structure for OHBR solid raft

DATA :	**Staging height**			**15.00**	**m**		M 30	
Net SBC of the Soil			sbc	15	t/m2	on plain ground		
Depth of foundation up to top of raft			df	2.00	m			
Tank details								
Capacity of tank			v	20	kl		21.6 kl	
Height of staging			sh	15.00	m			
Dia of stagging			ds	4.00	m			
Height of each stage	OK for short columns		hs	2.52	m	2.52		
No. of stagings			ns	5	nos			
No. of columns			nc	4	nos			
Dia of tank			td	**4.00**	m			
Dead storage ht			hds	0.15	m		R	
Top slab / Dome		tst	0.125	Dome ht		0.600	3.84	2.063
Top ring beam		trd	0.200	trb		0.300	θ =	32
Side wall		swh	2.000	swt		0.150		
Middle ring beam		mrd	0.000	mrb		0.000		
Inclined slab		lst	0.000	ish		0.000		
Bottom ring beam		brd	0.450	brb		0.300	R	
Bottom slab / Dome		bst	0.150	bdh		0.550	3.64	1.925
Brace		brcd	0.450	brcb		0.250	θ =	32
Wind constants		ki	1.000			1.050		
		kii15	1.090	kii20		1.120		
		kii30	1.150	kiii		1.000		
Basic wind speed		158	Km/hr	Vb		44	m/sec	
Size of column		cbxcb	0.30	m				
		effective cover	0.061	m		d'/D	ratio=	0.20
Seismic Coefficient								
Beeta(from table 3 of IS 1893)				sbe		1.00		
(from table 4 of IS 1893)				sei		1.50		
Alpha0(from table 2 of IS 1893)				a0		0.01		
Design of column								
Leeward column								
Load on leeward column			factcl	49.27	t			
Design Column Moment			cm	2.23	tm			
Pu/(fck*BD)			lr	0.18				
Mu/fckBD^2				0.04		d'/D↓		
Refering SP 16	P/fck		ps	0.02		0.20	from SP16 chart-43-46	
Windward column								
Load on windward column			nfc	1.25	t			
Design Column Moment			cm(windward)	2.08	tm			
Tu/fckBD	column under compression			0.00		(-ve indicates column in tension)		
Mu/fckBD2				0.00		d'/D↓		
Ref. to SP-16 chart 78 to 81, for tension			P/fck=	0.02		0.20	from sp16 chart 78 to 81	
Dia of main steel		sd		16	mm			
No of bars		nb		4		3.6		
Area of steel provided			clasp	8.04	cm2		7.20 cm2	
			Safe			Steel within 4%		
Check for biaxial moment				*leeaward*				
		Puz		145.45	t			
Pu =factcl				49.27	t			
Pu/Puz =				0.34				
α_n=, 1 to 2	0.667+1.667*Pu/Puz			1.23				
Pu/fckBD			lr	0.18				
p/fck			p/fck	0.03	%			
enter this value from sp16-43 to 46 & 78 to 81			spb	0.050				
% of steel provided	clasp/(cb*cb*100)		pc	0.89	%			
p/fck provided	pc/g			0.03				
	read from charts		spb	0.05				
Mux1, or Muy1 =	spb*g*(cb*1000)^3/10^6,		Mux1, Muy1=	4.05	tm			
			Mux =	2.71	tm			

Circumferencial reinforcements

Radial Distance	0.00	1.00	1.78	2.50	3.00
Radial moment	-0.44	-0.27	-0.16	0.43	0.23
	Mt in tm	Ast in cm2	Spacing(mm)		
Maximum negative moment	-0.44	0.75	386		
Maximum positive moment	0.43	0.73	386		

Total quantity of concrete	cq	**35.01**	**m3**
Tota quantity of steel	qs	**2.77**	**t**

Design Calculations

Weight of tank

Top slab / Dome	IF(h=0,(pi*(td+2*swt)^2/4*tst*2.5),(2*pi*((td/2)^2+h^2)/(2*h)*h*tst*2.5))	4.28	t
Top ring beam	pi*(td+trb)*trb*trd*2.5	2.03	t
Side wall	pi*(td+swt)*swh*swt*2.5	9.78	t
Middle ring beam	pi*(td+mrb)*mrb*mrd*2.5	0.00	t
nclined wall	pi*((td+ist)+ds)/2*ist*sqrt(ish^2+((td+ist-ds)/2)^2)*2.5	0.00	t
Bottom ring beam	pi*ds*brb*brd*2.5	4.24	t
Bottom slab / Dome	@if(bdh=0,pi*(td+2*swt)^2/4*bst*2.5,2*pi((ds/2)^2+bdh^2)/(2*bdh)*bdh*bst*2.5)	5.07	t
Add for ladder railing etc.,		5.00	t
Total	tw	**30**	**t**

Weight of staging

Weight of brace	brl*nc*brcd*brcb*ns*2.5	15.91	
Weight of columns	nc*cb*cb*((hs+brcd)*ns-brd+df)*2.5	14.76	
Total	wwi	**31**	
Total weight of tank & staging	wt	**61**	**t**

Volume of tank

Cylindrical portion	pi*td^2/4*swh	25.13	
Volume of inclined portion	1/3*pi*((td/2)^2+td*ds/4+(ds/2)^2)*ish	0.00	
Volume of bottom dome	pi/6*(3*(ds/2)^2+bdh^2)*bdh	3.54	
Total	ww	**21.59**	**t**
Inclination of slant wall	ATAN(ish/((td+ist-ds)/2))*180/pi	th	#DIV/0!

Wind analysis

Design pressure	pz10	0.6*(ki*kii10*kiii*vb)^2	1281	n/sqm
	pz15	0.6*(ki*kii15*kiii*vb)^2	1380	n/sqm
	pz20	0.6*(ki*kii20*kiii*vb)^2	1457	n/sqm
	pz30	0.6*(ki*kii30*kiii*vb)^2	1536	n/sqm

Moment due to wind on tank @ top of footing

	Ht.	Area	pressure	force	LA	Moment
	m	m2	n/m2	n	m	tm
Top slab / Dome	17.58	1.65	1457	1680	19.10	3.21
Top ring beam	16.85	0.92	1457	938	18.75	1.76
Side wall	16.85	7.74	1457	7895	17.85	14.09
Middle ring beam	0.00	0.00	0	0	0.00	0.00
Inclined wall	0.00	0.00	0	0	0.00	0.00
Bottom ring beam	14.85	1.94	1380	1869	16.63	3.11
			wfi	12383	wmt	**22.17**

Moment due to wind on staging

	Ht.	Area	pressure	force	LA	Moment
On braces	m	m2	n/m2	n	m	tm
1st brace from top	11.88	2.55	1380	3513	13.655	4.80
2nd brace from top	8.91	2.55	1281	3260	10.685	3.48
3rd brace from top	5.94	2.55	1281	3260	7.715	2.52
4th brace from top	2.97	2.55	1281	3260	4.745	1.55
5th brace from top	0	0.00	0	0	0	0.00
6th brace from top	0	0.00	0	0	0	0.00
7th brace from top	0	0.00	0	0	0	0.00
On columns	14.4	17.28	1330	22989	9.2	21.15
			wfii	36282	wms	**33.49**

Total moment @ top of footing	mbw	**56.00**	**tm**

Moment in the columns	short columns	**UNIAXIAL**		leeward	wind ward	
applied moment (wind)	hwr*(hs+brcd)/2	***applied moment (wind)***		**1.81**	**1.81**	tm
min. eccentricity moments	=cl *0.02	**0.69** <1.81		**0.69**	**0.69**	tm
			max Mx	1.81	1.81	tm
As per DEVDAS MENON ,		total My	My	0.69	**0.03**	tm
design M=1.15*sqrt(Mx^2+My^2)		Design M	cm	**2.23**	**2.08**	tm
Load on Leeward column	w/nc+rw	full load	cl	34.65	1.25	t
Design of leeward column						
Pu/(fck*BD)	factcl*10*10^3/(g*cb^2*10^6)			0.18		
Mu/fckBD^2	cm*10*10^6*1.5/(g*cb^3*10^9)			0.04		
Area of steel						
(MAX((factcl*10000-0.4*g*cb*1000*cb*1000)/(0.87*415-0.4*g),0.8*cb*cb*10^4,ps*g*cb^2*10^4))/100						
			ast	7.2	cm2	
Spacing of 8 mm dia lateral steel		8 mm		256	mm	
Load on wind ward column		wt/nc-rw	wcl	1.25	t	
			ten	0.00	t	
Design of wind ward column (Empty condition)						
Tu/fckBD	ten*10^6*0.015/(g*bc^2)			0.00		
Mu/fckBD2	cm(windward)*10*10^6*1.5/(g*cb^3*10^9)			0.00		
Ast required	sp*g*cb*cb/100		astr	5.40	cm2	
Area of steel required			clas	7.20	cm2	
Area provided	pi*(sd/10)^2/4*nb		clasp	8.04	cm2	
Tensile stress in concrete	ABS(ten)*10000/(cb^2*10^6-clasp*100+(mi-1)*clasp*100)					
			ts	0.0	n/mm2	
			column under compression			
Check for biaxial moment			**leeaward**			
Puz	=0.45*g*cb*cb*100+(0.75*Fy-0.45*g)*clasp/100		145.45	t		
Pu =factcl			49.27	t		
Pu/Puz =			0.34			
α_n= 1 to 2	0.667+1.667*Pu/Puz		1.23			
Pu/fckBD		lr	0.18			
% of steel provided	clasp/(cb*cb*100)	pc	0.89	%		
p/fck provided	pc/g		0.03			
	read from charts	spb	0.05			
Mux1, or Muy1	= spb*g*(cb*1000)^3/10^6,	Mux1, Muy1=	4.05	tm		
		Mux =	2.71	tm		
		Muy =	1.04	tm		
$(Mux/Mux1)^{\alpha_n}+(Muy/Muy1)^{\alpha_n}$ =		Mr	0.797			
		Safe				

Design of brace						
central angle by brace chord		**in radians**	qang	1.57	90	deg
Moment in the brace (Ultima	2*cm/sin(qang)*10*1.5		bm	66.76	knm	
effective depth			bred	0.40	m	
	(0.36*g*brcb*1000*0.479*((bred)*1000)^2*0.8)/10^6					
	Limitting Moment of resistance of proposed section		Mulim	163	Knm	
Area of compression steel reqd						
	IF(bm>mulim,(bm-mulim)*10^3/(fsc*(bred-ccb-dib/2000)),0)		asc	0	mm2	
	(bred)*brcb*g/415*10^6		aai	7175	mm2	
	brcb*g*10^9/(0.87*415^2)		aaii	50055		
area of min steel reqd	0.85/415*brcb*(bred)*10000			2.03	cm2	
Area of tension steel reqd						
MAX((aai-SQRT(aai^2-(4*aaii*MIN(bm,mulim))))/2+asc*fsc/(0.87*415),0.85/415*brcd*brcb*10^6)						
			asb	501	mm2	
Ast provided			asbp	603	mm2	
			O.K.			
Shear in the brace						
	bm*2/brl+(brl*brcd*brcb*2.5*1.5)		sfb	48.40	Kn	
eff. Length of brace	ds*SIN(qang/2)		brl	2.83	m	
Shear stress	sfb*10^3/(brcb*bred*10^6)		towu	0.49	n/mm2	

Spacing of stirrups	IF(@max(tow,towii)<towc,asv*415/(rb*10^3*0.4),MIN(0.87*415*asv*(dp)/vus,asv*415/(rb*10^3*0.4)))	si	200	mm
minimum transverse steel	(asv/(T*1.5*10000000/((rb*1000-50)*(dp*1000-25)*.87*415)+vus*1000/(2.5*(dp*1000-25)*.87*415)))	sv	367	mm
Spacing of stirrups required	MIN(si,sv,0.75*(dp)*1000,200)		200	mm
Side face reinforcement on e	0.1*rb*rd/2*100		**1.35**	cm2

Design of Raft

Using the equations from the book RCC by Dayaratnam

aa= 3.00 cc= 2

Radial moment

Due to w

r<cc Mrw=w*(3*((r/aa)^2-1)+2*(2*ln(aa/cc)+1-(cc/aa)^2))/(16*pi)

r>cc Mrw=w*(3*((r/aa)^2-1)+2*(2*ln(aa/r)-(cc/aa)^2+(cc/r)^2))/(16*pi)

Due to moment Mbi

r<cc Mrm=mbi*r*(3*aa^2-2*cc^2-cc^4/aa^2)/(4*pi*aa^2*cc^2)-5*mbi*r*(aa^2-r^2)/(12*pi*aa^4)

r>cc Mrm=mbi*(2*(aa^2-r^2)+cc^2*(aa^4-r^4)/(aa^2*r^2))/(4*pi*aa^2*r)-5*mb*r*(aa^2-r^2)/(12*pi*aa^4)

circumferential moment

Due to w

r<cc Mtw=w*(((r/aa)^2-3)+2*(2*ln(aa/cc)+1-(cc/aa)^2))/(16*pi)

r>cc Mtw=w*(((r/aa)^2-3)+2*(2*ln(aa/r)-(cc/aa)^2-(cc/r)^2+2))/(16*pi)/(16*pi)

Due to moment Mbi

r<cc Mtm=mbi*r*(3*aa^2-2*cc^2-cc^4/aa^2)/(24*pi*aa^2*cc^2)-5*mb*r*(5*aa*r-3*r^2)/(36*pi*aa^4)

r>cc Mtm=mbi*(2*(3*aa^2-r^2)-cc^2*(3*aa^4+r^4)/(aa^2*r^2))/(24*pi*aa^2*r)-mb*r*(5*aa*r-3*r^2)/(36*pi*aa^4)

Summary of moments

Radial Distance from center	0	1	1.775	2.5	3
Radial moments					
Due to W	-0.44	0.11	1.29	0.33	0.00
Due to M	0.00	1.40	2.83	1.05	0.00
Total	**-0.44**	**1.51**	**4.12**	**1.38**	**0.00**
Circumferential Moments					
Due to W	-0.44	-0.26	0.14	0.01	0.01
Due to M	0.00	-0.01	-0.30	0.42	0.22
Total	**-0.44**	**-0.27**	**-0.16**	**0.43**	**0.23**

Maximum moment Mmax **4.12** tm

Effective depth of raft require sqrt(Mmax*1.5*10^7/(.137*g*1000)) 0.12 m

de*1*g/415*10^6 aairs 17639

1*g*10^9/(0.87*415^2) aaiirs 200219

Area of radial Steel Required

Radial Distance	0	1	1.775	2.5	3
Radial steel required in cm^2	0.75	2.60	7.32	2.39	0.00

Circumferencial steel

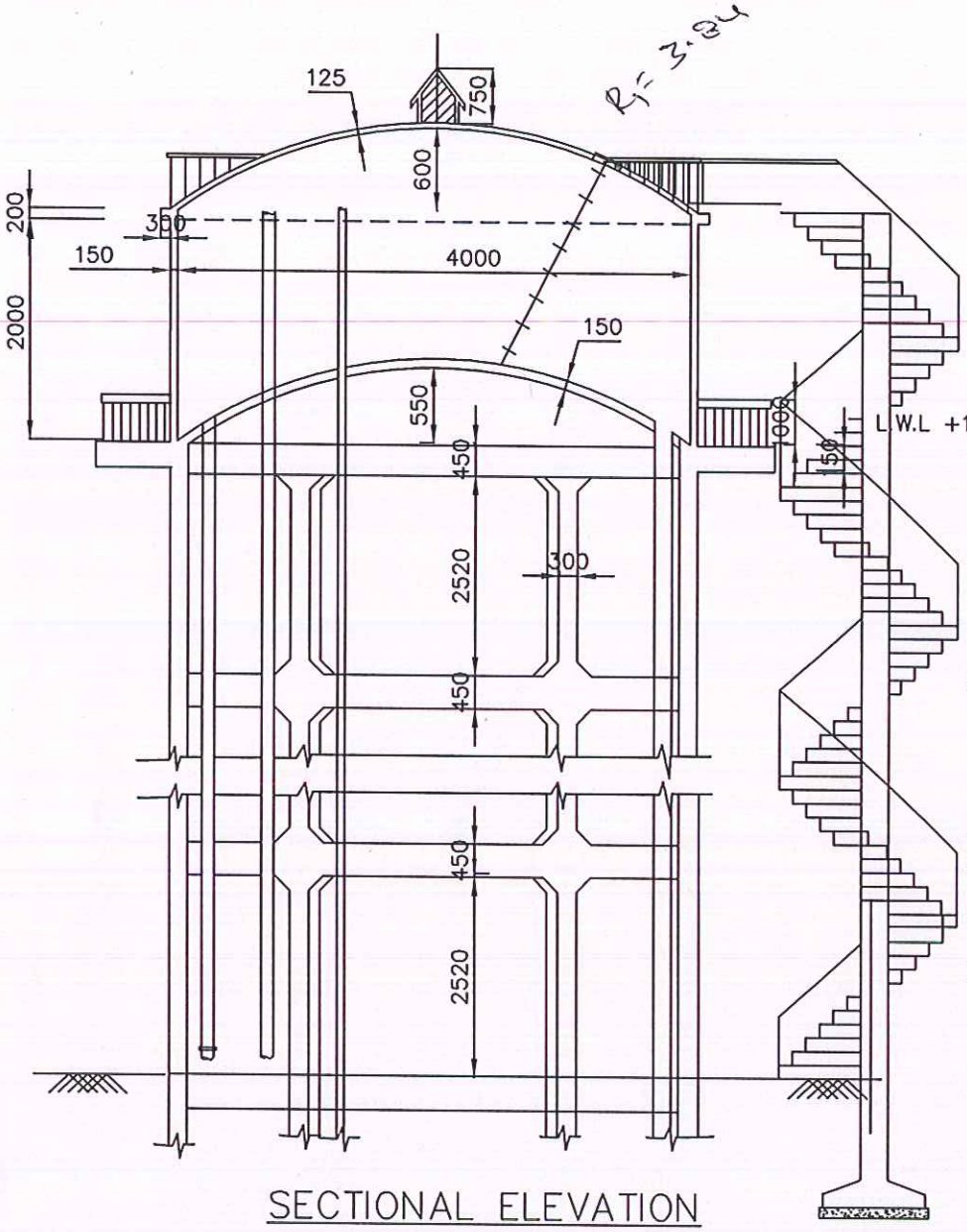
Radial Distance	0	1	1.775	2.5	3
Circumferencial steel require	0.75	0.46	0.28	0.73	0.39

Check for Shear

critical section for shear		rcri	2.12	m from center
Shear force at critical sectior	w*(1-rcri^2/aa^2)	qc	41.27	t
Shear stress tv	qc*1.5/(2*pi*rcri*de)/100	tv	0.19	N/mm2
% of steel, pt		ptr	0.31	
	MAX(0.8*g/(6.89*ptr),1)	beetai	11.27	
allowable shear stress in cor	0.85*sqrt(.8*g)*(sqrt(1+5*beetai)-1)/(6*beetai)			
		tc	0.40	N/mm2 Safe

"APPROVED"
ENC-DWGS attached.

19/4/14 19/4/14

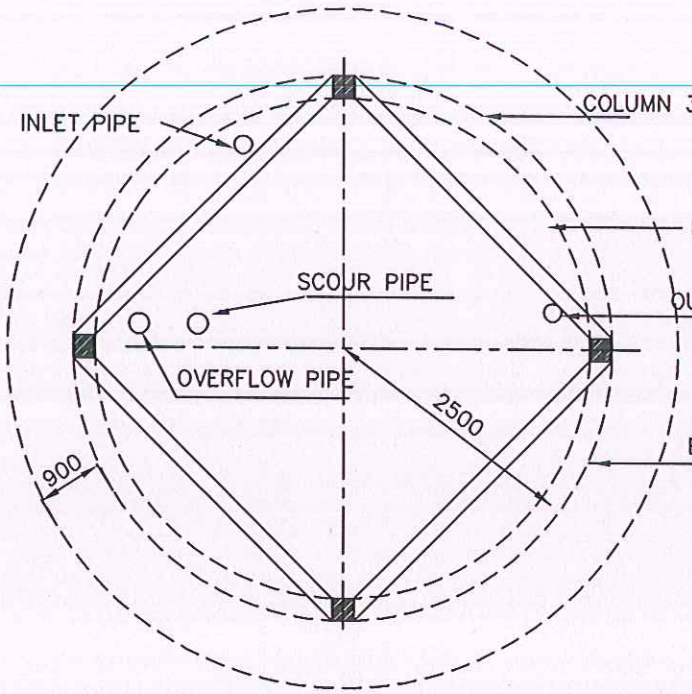


SECTIONAL ELEVATION

CONDITIONS

1. Concrete(All members) : M30
2. Steel : Tor 40,Fe415
3. Clear minimum cover
   - Side walls : 45MM
   - Top & Bottom slabs : 45MM
   - Beams : 45MM
   - Columns : 45MM
   - Footings : 50MM
4. All dimension are in 'mm' unless specified.
5. The steel should not be overlapped at the junction points
6. Not more than 1/3rd of the bars should be lapped at a given section
7. Provide Staircase with RCC landing slab

RADIUS OF CURVATURE IS 3.64MTS

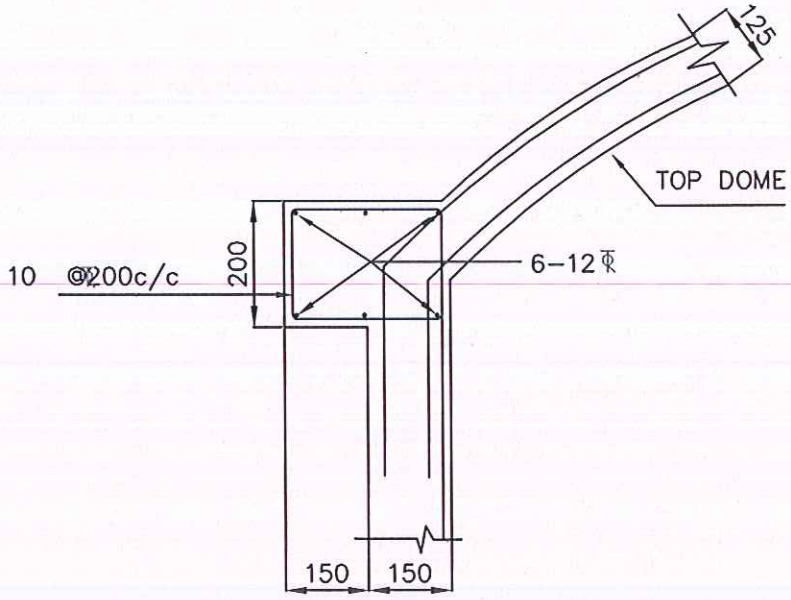


PLAN

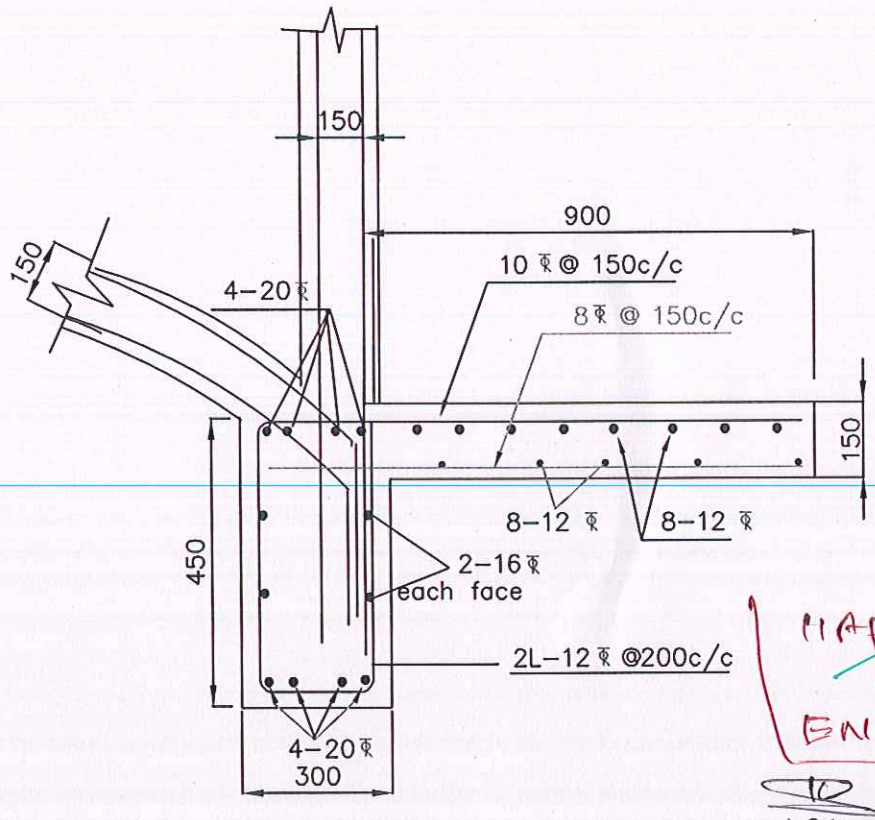
"APPROVED"
EAIC-RWSS&H,HYD
19/11/14
19/11/14

Grade of concrete : M30

STAGING=15.0M
20KL O.H.B.R
wind speed 44m/s



DETAILS OF TOP RING BEAM



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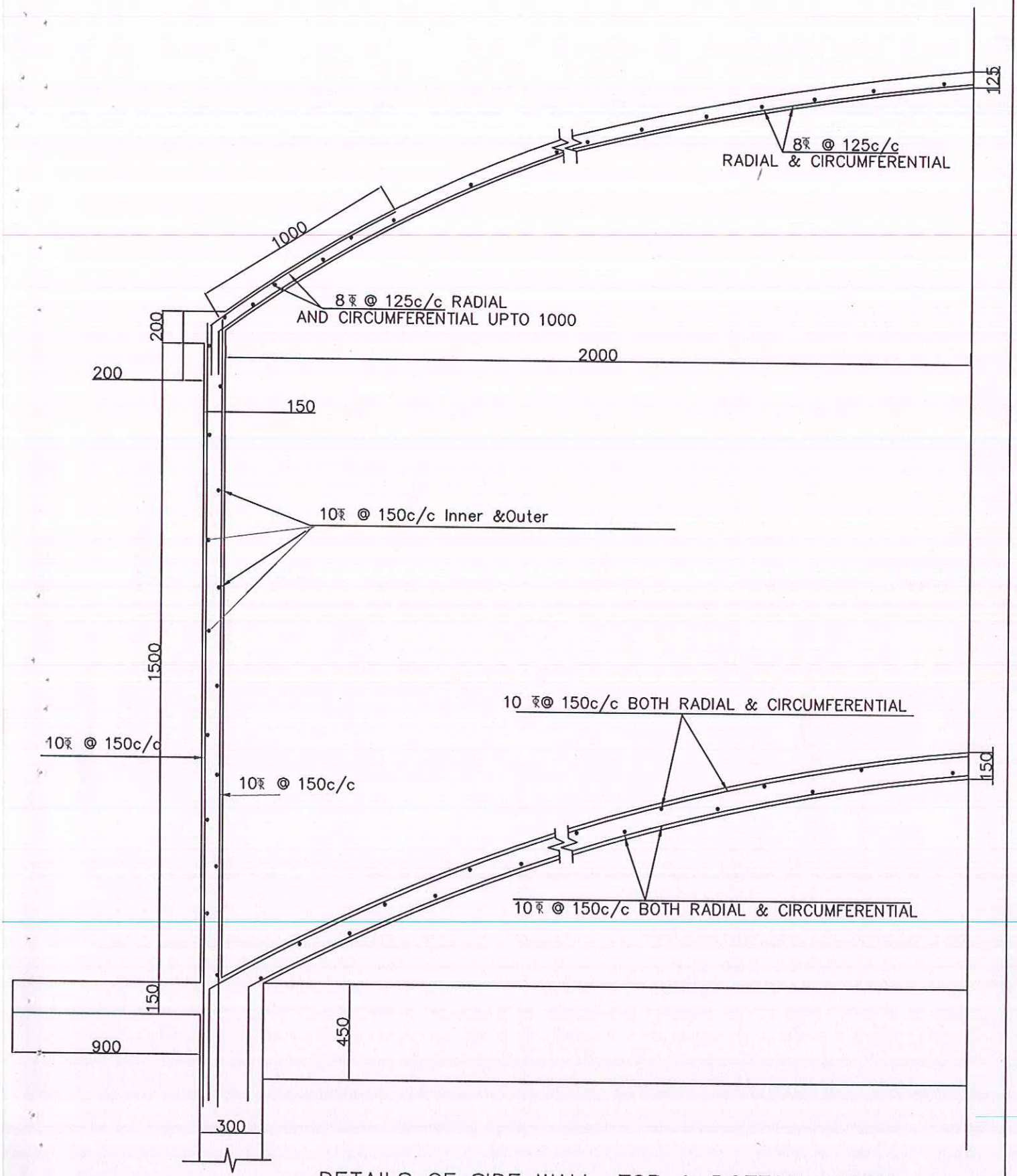
EIC-RWS&S/Hld
19/11/14
19/4/14

BOTTOM RING BEAM CUM LANDING

Grade of concrete : M30

STAGING 15M, SBC 15T/m2
20 KL OHBR
wind speed 44m/s



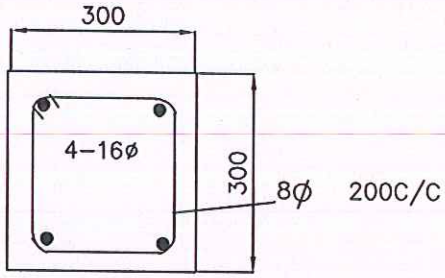
DETAILS OF SIDE WALL, TOP & BOTTOM DOMES

"APPROVED"
ENG-INCHARGE

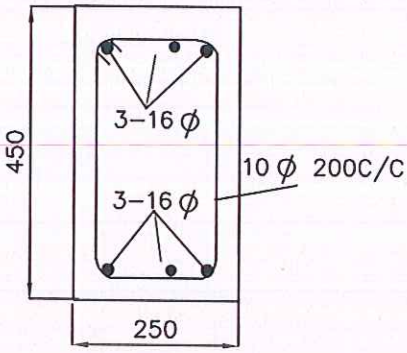
19/4/14 18/4/14

Grade of concrete : M30

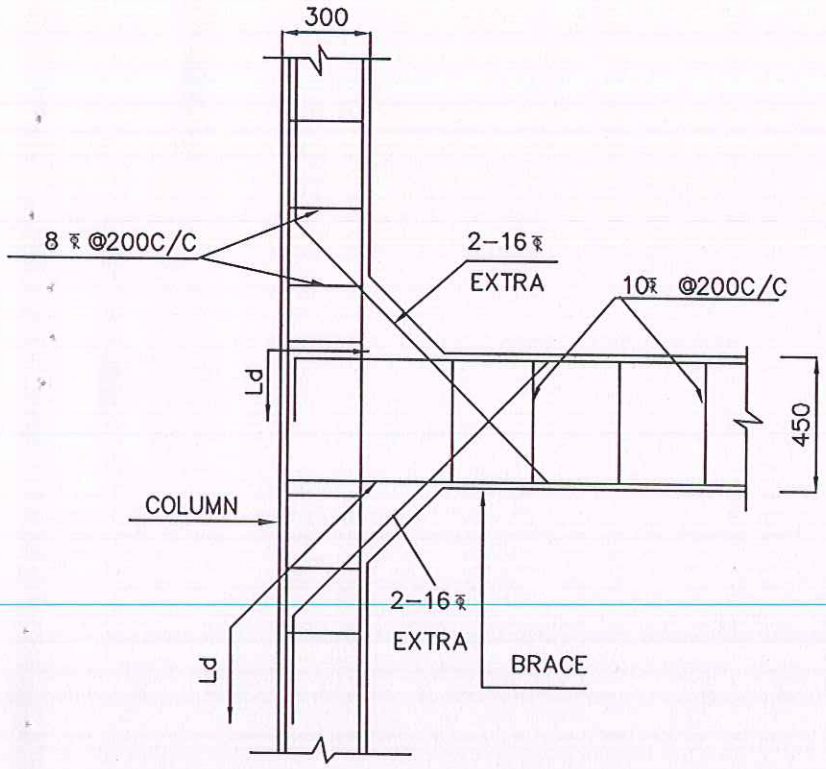
STAGING 15M, SBC 15T/m2
20 KL OHBR
wind speed 44m/s



SECTION OF COLUMN



SECTION OF BRACE



COLUMN BRACE JUNCTION

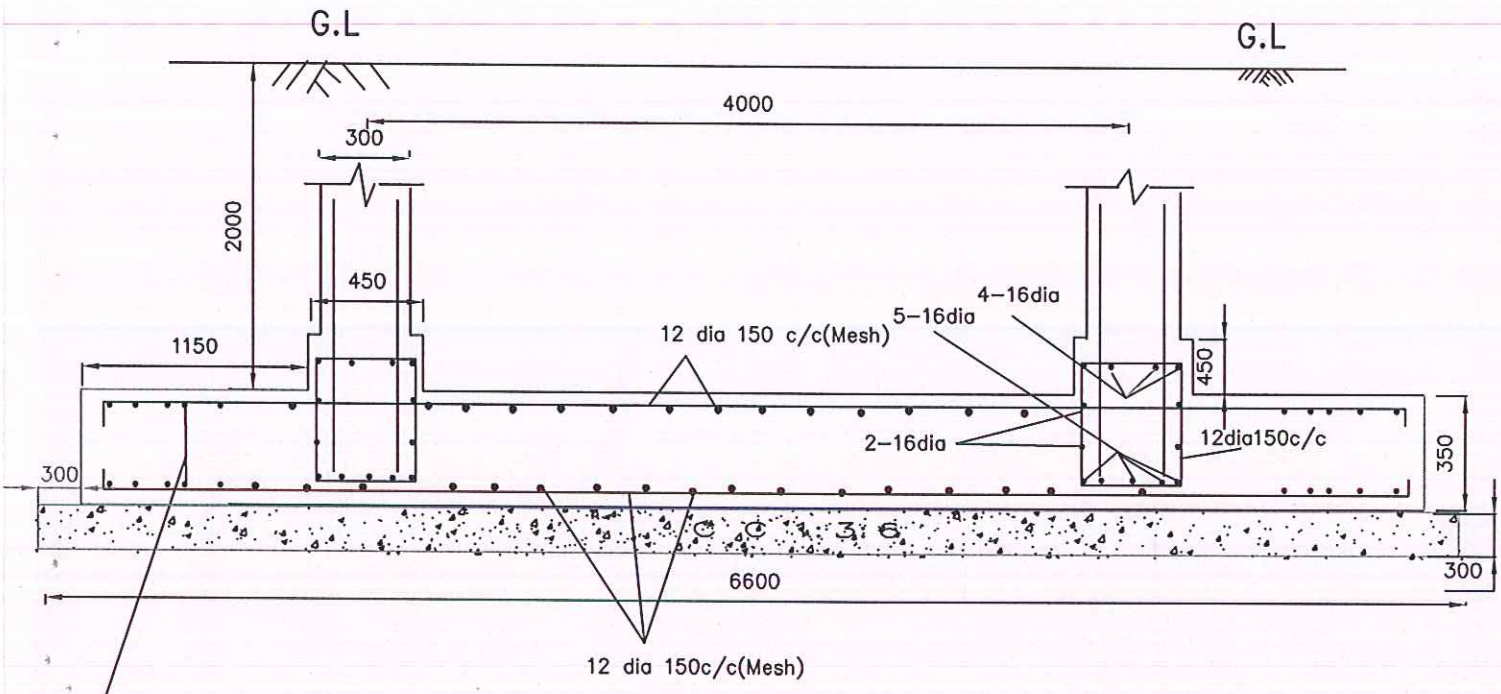
"APPROVED"
ENC-RWSS&S, Held
19/4/14
19/4/14

CONDITIONS

1. Concrete(All members) : M30
2. Steel : Tor 40,Fe415
3. Clear minimum cover
   - Side walls : 45MM
   - Top & Bottom slabs : 45MM
   - Beams : 45MM
   - Columns : 45MM
   - Footings : 50MM
4. All dimension are in 'mm' unless specified.
5. The steel should not be overlapped at the junction points
6. Not more than 1/3rd of the bars should be lapped at a given section
7. Provide RCC stair case

Grade of concrete : M30

STAGING 15M, SBC 15T/m2
20 KL OHBR
wind speed 44m/s



12dia 150c/c (in the form ofcircular rings upto 0.6m length extra over the mesh)

SECTION OF RAFT SLAB

NOTES

1. Grade of concrete :M30
   Grade of steel :Fe415
2. Basic wind speed :44m/s
3. Depth of foundation :2.00 M
   below GI upto top of Raft
4. Staging height :15 M
   Clear height between the braces :2.52M
   No of stagings :5
5. 8 Nos of 16ϕ diagonal bars shall be provided at column brace junction
6. For detailing of reinforcement IS SP–34 shall be followed
7. All dimensions are in 'mm' unless specified

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EXC-RWS&S, Hyd
19/4/14
19/4/14

STAGING 15M

DRG NO:
20KL O.H.B.R
S.B.C 15T/M^2

Design Of 500 KL Capacity Sump at

Data

Location						
Safe bearing Capacity	sbc		Safe	100	Kn/m^2	
Capacity	v			500	KL	
Free Board	fb			0.25	m	
Dead Storage	ds			0.30	m	
Dia of sump	d			13.00	m	
Projection from side wall	ps			0.60	m	
Depth of the tank	h			4.35	m	
Depth of tank above GL	dgl			0.80	m	
Depth of tank below GL				3.55	m	
thickness of PCC (lean mix cc1:6:10)		couter wt		0.00	m	
Th. Of Bottom Slab	bsth	Provided th is Sufficient		0.300	m	0.25 m
Depth of Water table below GL	wl	Safe Against Uplift		2.80	m	

Top Dome

Rise of the dome				2.00		
Radius of the dome				11.56		
Thickness of Dome	td	150 to 100	0.1	0.125	m	
Dia of Reinforcement	db			10	mm	
Reinforcement						
Spacing				125	mm	c/c

Provide 10 mm dia Tor @ 125 mm C/c both radially and in the form of circular rings

Top Ring Beam

Width of ring beam	rb		350	mm		
Depth of ring Beam	dtrb	Provided size is sufficient	300	mm	253	mm
Dia of hoop bars	dbrb		16	mm	8	Nos
Dia of Stirrups			8	mm	200	mm 225

Side Wall

Depth of the tank	h		4.35	m	
Th. Of Side wall	sth		0.300	m	263 mm
Depth of tank above GL	dgl		0.80	m	
Moments					
	Inner Side		18.81	Kn-m	
	Outer Side		22.891	Kn-m	
Hoop force					
	Inner Side		172.96	Kn	(Tension)
	Outer Side		198.41	Kn	(Compression)

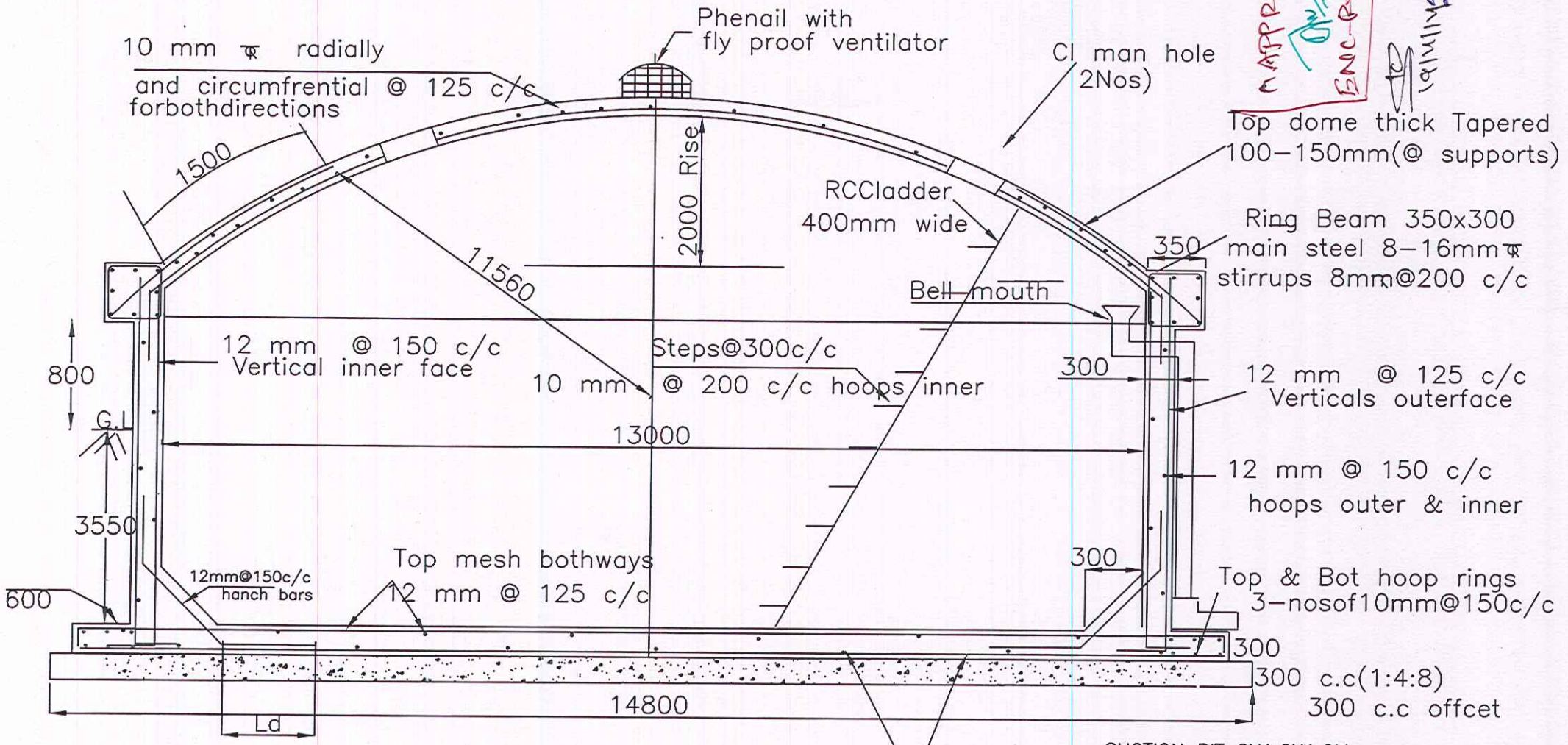
Reinforcement			Dia	Spacing Provided	Required
Inner face	Vertical	668 mm^2	12 mm	150 mm	160
	Horizontal	666 mm^2	12 mm	150 mm	160
Outer face	Vertical	813 mm^2	12 mm	125 mm	130
	Horizontal	666 mm^2	12 mm	150 mm	160

Bottom slab

Safe bearing Capacity	sbc			100	Kn/m^2	
Th. Of Bottom Slab	bsth	Provided th is Sufficient		0.300	m	0.25 m
Dia of Bottom Slab	dbs			14.80	m	
Size of Haunch	bh			0.30	m	
effective cover to reinforcement for raft slab			covraft	67	mm	
Moments	Radial			12.05	Kn-m	
	Circumferential			20.54	Kn-m	

		Ast	Dia	spacing Provided	Required
Reinforcement	Top mesh	780 mm^2	12 mm	125 mm	140
	Bottom mesh	240 mm^2	10 mm	250 mm	300

	bmcfps		0.0097	**0.00922**	0.0077		
Max Ring Tension	rtcfs		0.519	**0.5334**	0.579		
Max. -ve BM	mbms	(bmcfs*pas*hbgl^2)			22.89	Kn-m	
Max +ve BM	mpbms	(bmcfps*pas*hbgl^2)			6.65	Kn-m	
Max. Ring compression	mrts	rtcfs*pas*d/2			198.41	Kn	
Th. Of Side Wall		(MAX(mbm,mbms)*10^6*6/(2*1000))^0.			263	mm	
					Th. Provided is Sufficient		
Eff Th. Of Side wall	edswi				249	mm	
Max Inner face moment	bmi	MAX(mpbms,mbm)			18.81	Kn-m	
Max outer face moment	bmo	MAX(mpbm,mbms)			22.89	Kn-m	
Area of Steel							
Reinforcement							
Min Steel	pt	0.24% for <15m span 0.35%		0.24	0.12	%	
Area of BendingSteel inner side	Astm	MAX(pt*sth*10^4,bmi*10^6/(130*0.87*e			668	mm^2	on each side
Area of steel outer face	Astpbm	MAX(pt*sth*10^4,(bmo*10^6/(130*0.87			813	mm^2	on each side
Area of Steel for Hoop	Asth	MAX(pt*sth*10^4,CEILING(mrt*1000/13			1331	mm^2	for two sides
Vertical Steel Spacing							
inner face	vsp						
Spacing		FLOOR(pi*dbi^2/4*1000/Astm,25)			160	mm	
Provide 12 mm dia TOR @ 160 mm C/c							
Outer face	vspo	FLOOR(pi*dbo^2/4*1000/astpbm,25)			130	mm	
Provide 12 mm dia TOR @ 130 mm C/c spacing							
Horizontal Steel							
Spacing	hsp	FLOOR(pi*dbh^2/2*1000/Asth,25)			160	mm	
Provide 12 mm dia TOR @ 160 mm C/c on both faces in staggered fashion							
Design Of Bottom Slab							
Projection from side wall	ps				0.6	m	
Dia of Bottom Slab	dbs	d+2*sth+2*ps			14.80	m	
Size of Haunch	bh				0.3	m	
Dia of Bar top	dbbs				12	mm	
bottom	dbbsb				10	mm	
Load on Bottom Slab							
Wt of Top Dome		2*pi*rd*hd*wd			672.02	Kn	
Wt of Ring Beam		pi*(d+rb/1000)*rb*drb*25/10^6			110.09	Kn	
Wt Of Side wall		pi*(d+sth)*sth*(h-dtrb)*25			1269.13	Kn	
Wt of Haunch		pi*(d-bh)*bh^2/2*25			44.89	Kn	
Total Load	wbs				2096.13	Kn	
					20.96	sq m	0.5944
Max Pr on Soil	prb	Wbs/(pi*(d)*1)			51.33	Kn/m^2	
Bottom Slab is designed as circular Slab loaded with UDL and Simply Supported on edges							
				r	6.65		6.4
Radial moment	mri	3/16*prb*((dbs/2)^2-((d+sth)/2)^2)-wbs/			-12.05	mrb	-10.49 Kn-m
Circuferential Moment	mti	1/16*prb*(3*(dbs/2)^2-((d+sth)/2)^2)-wb			-10.51	mtb	-10.49 Kn-m
for uplift Net uplift load on bottom slab					3	Kn/m^2	
for uplift		max Radial moment			20.54		20.54 Kn-m
		max Circuferential Moment			20.54		20.54 Kn-m
Max Radial Moment	mr	IF(wl>hbgl,0,CEILING(3*prb*(dbs/2)^2/			12.05	Kn-m	20.54 Kn-m
Max Circumferential moment	mt	IF(wl>hbgl,0,CEILING(prb*(dbs/2)^2/16			10.51	Kn-m	20.54 Kn-m



All dimensions are in 'mm'

Concrete mix V.R.C.C M30

Steel Fe–415

Reinforcement Details shall be as per IS – SP34

500 KL SUMP

Designed for uplift GWT @ 2.8 below GL
SCHEME : CPWSS
LOCATION:
SBC 10T/SQM

Design Of 400 KL Capacity Sump at

Data

Location						
Safe bearing Capacity	sbc		Safe	100 Kn/m^2		
Capacity	v			400 KL		
Free Board	fb			0.25 m		
Dead Storage	ds			0.30 m		
Dia of sump	d			12.00 m		
Projection from side wall	ps			0.60 m		
Depth of the tank	h			4.1 m		
Depth of tank above GL	dgl			0.80 m		
Depth of tank below GL				3.30 m		
thickness of PCC (lean mix cc1:6:10)		couter wt		0.00 m		
Th. Of Bottom Slab	bsth	Provided th is Sufficient		0.300 m		0.18 m
Depth of Water table below GL	wl	Safe Against Uplift		2.80 m		

Top Dome

Rise of the dome				1.90		
Radius of the dome				10.42		
Thickness of Dome	td	150 to 100	0.1	0.125 m		
Dia of Reinforcement	db			10 mm		
Reinforcement						
Spacing				125 mm	c/c	

Provide 10 mm dia Tor @ 125 mm C/c both radially and in the form of circular rings

Top Ring Beam

Width of ring beam	rb		350 mm			
Depth of ring Beam	dtrb	Provided size is sufficient	300 mm	203 mm		
Dia of hoop bars	dbrb		16 mm	8 Nos		
Dia of Stirrups			8 mm	200 mm		225

Side Wall

Depth of the tank	h		4.1 m			
Th. Of Side wall	sth		0.300 m	240 mm		
Depth of tank above GL	dgl		0.80 m			
Moments						
		Inner Side	16.35 Kn-m			
		Outer Side	19.181 Kn-m			
Hoop force						
		Inner Side	148.7 Kn	(Tension)		
		Outer Side	166.23 Kn	(Compression)		

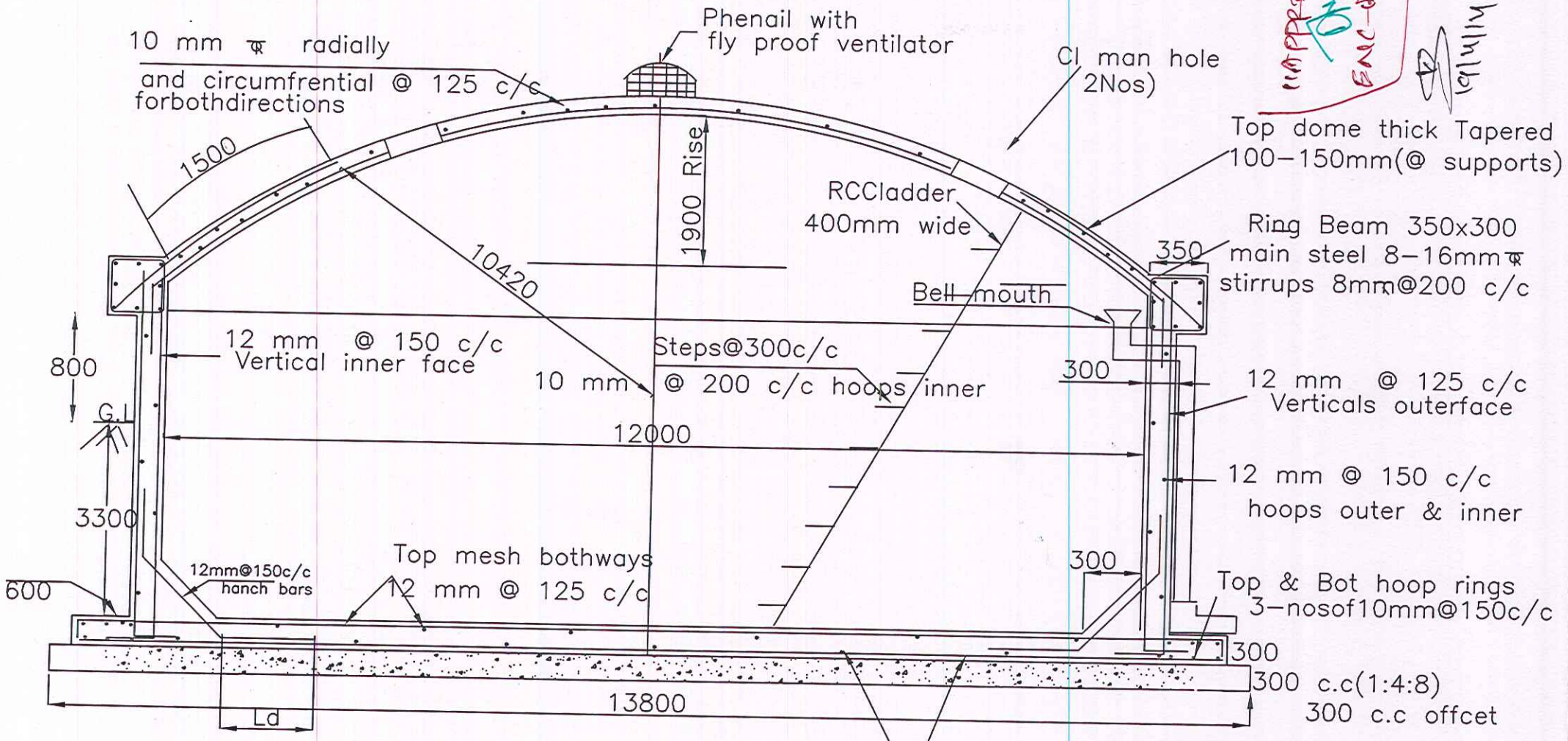
Reinforcement			Dia	Spacing Provided	Required
Inner face	Vertical	581 mm^2	12 mm	150 mm	190
	Horizontal	572 mm^2	12 mm	150 mm	190
Outer face	Vertical	682 mm^2	12 mm	125 mm	160
	Horizontal	572 mm^2	12 mm	150 mm	190

Bottom slab

Safe bearing Capacity	sbc			100 Kn/m^2		
Th. Of Bottom Slab	bsth	Provided th is Sufficient		0.300 m	0.18 m	
Dia of Bottom Slab	dbs			13.80 m		
Size of Haunch	bh			0.30 m		
effective cover to reinforcement for raft slab			covraft	67 mm		
Moments	Radial			11.17 Kn-m		
	Circumferential			9.73 Kn-m		

		Ast	Dia	spacing Provided	Required
Reinforcement	Top mesh	424 mm^2	12 mm	125 mm	150
	Bottom mesh	240 mm^2	10 mm	250 mm	300

		bmcfps		0.0097	**0.00964**	0.0077	
Max Ring Tension		rtcfs		0.519	**0.5208**	0.579	
Max. -ve BM		mbms	(bmcfs*pas*hbgl^2)			19.18 Kn-m	
Max +ve BM		mpbms	(bmcfps*pas*hbgl^2)			5.59 Kn-m	
Max. Ring compression		mrts	rtcfs*pas*d/2			166.23 Kn	
Th. Of Side Wall			(MAX(mbm,mbms)*10^6*6/(2*1000))^0.			240 mm	
						Th. Provided is Sufficient	
Eff Th. Of Side wall		edswi				249 mm	
Max Inner face moment		bmi	MAX(mpbms,mbm)			16.35 Kn-m	
Max outer face moment		bmo	MAX(mpbm,mbms)			19.18 Kn-m	
Area of Steel							
Reinforcement							
Min Steel		pt	0.24% for <15m span 0.35%		0.24	0.12 %	
Area of BendingSteel inner side		Astm	MAX(pt*sth*10^4,bmi*10^6/(130*0.87*e			581 mm^2	on each side
Area of steel outer face		Astpbm	MAX(pt*sth*10^4,(bmo*10^6/(130*0.87			682 mm^2	on each side
Area of Steel for Hoop		Asth	MAX(pt*sth*10^4,CEILING(mrt*1000/13			1144 mm^2	for two sides
Vertical Steel	Spacing						
inner face		vsp					
	Spacing		FLOOR(pi*dbi^2/4*1000/Astm,25)			190 mm	
Provide 12 mm dia TOR @ 190 mm C/c							
Outer face		vspo	FLOOR(pi*dbo^2/4*1000/astpbm,25)			160 mm	
Provide 12 mm dia TOR @ 160 mm C/c spacing							
Horizontal Steel							
	Spacing	hsp	FLOOR(pi*dbh^2/2*1000/Asth,25)			190 mm	
Provide 12 mm dia TOR @ 190 mm C/c on both faces in staggered fashion							
Design Of Bottom Slab							
Projection from side wall		ps				0.6 m	
Dia of Bottom Slab		dbs	d+2*sth+2*ps			13.80 m	
Size of Haunch		bh				0.3 m	
Dia of Bar	top	dbbs				12 mm	
	bottom	dbbsb				10 mm	
Load on Bottom Slab							
Wt of Top Dome			2*pi*rd*hd*wd			575.53 Kn	
Wt of Ring Beam			pi*(d+rb/1000)*rb*drb*25/10^6			101.85 Kn	
Wt Of Side wall			pi*(d+sth)*sth*(h-dtrb)*25			1101.26 Kn	
Wt of Haunch			pi*(d-bh)*bh^2/2*25			41.35 Kn	
Total Load		wbs				1819.99 Kn	
						18.20 sq m	0.5161
Max Pr on Soil		prb	Wbs/(pi*(d)*1)			48.28 Kn/m^2	
Bottom Slab is designed as circular Slab loaded with UDL and Simply Supported on edges							
					r	6.15	5.9
Radial moment		mri	3/16*prb*((dbs/2)^2-((d+sth)/2)^2)-wbs/			-11.17 mrb	-9.71 Kn-m
Circuferential Moment		mti	1/16*prb*(3*(dbs/2)^2-((d+sth)/2)^2)-wb			-9.73 mtb	-9.71 Kn-m
for uplift	Net uplift load on bottom slab					0.5 Kn/m^2	
for uplift			max Radial moment			2.98	2.98 Kn-m
			max Circuferential Moment			2.98	2.98 Kn-m
Max Radial Moment		mr	IF(wl>hbgl,0,CEILING(3*prb*(dbs/2)^2/			11.17 Kn-m	2.98 Kn-m
Max Circumferential moment		mt	IF(wl>hbgl,0,CEILING(prb*(dbs/2)^2/16			9.73 Kn-m	2.98 Kn-m



SUCTION PIT 6X1.0X1.0M

All dimensions are in 'mm'

Concrete mix V.R.C.C M30

Steel Fe–415

Reinforcement Details shall be as per IS – SP34

400 KL SUMP

Designed for uplift GWT @ 2.8 below GL
SCHEME : CPWSS
LOCATION:
SBC 10T/SQM

Design Of 300 KL Capacity Sump at

Data

Location						
Safe bearing Capacity	sbc		Safe	100	Kn/m^2	
Capacity	v			300	KL	
Free Board	fb			0.25	m	
Dead Storage	ds			0.30	m	
Dia of sump	d			11.00	m	
Projection from side wall	ps			0.60	m	
Depth of the tank	h			3.75	m	
Depth of tank above GL	dgl			0.80	m	
Depth of tank below GL				2.95	m	
thickness of PCC (lean mix cc1:6:10)		couter wt		0.00	m	
Th. Of Bottom Slab	bsth	Provided th is Sufficient		0.300	m	0.21 m
Depth of Water table below GL	wl	Safe Against Uplift		2.80	m	

Top Dome

Rise of the dome				1.70		
Radius of the dome				9.75		
Thickness of Dome	td	150 to 100	0.1	0.125	m	
Dia of Reinforcement	db			10	mm	
Reinforcement						
Spacing				125	mm	c/c

Provide 10 mm dia Tor @ 125 mm C/c both radially and in the form of circular rings

Top Ring Beam

Width of ring beam	rb		350	mm		
Depth of ring Beam	dtrb	Provided size is sufficient	300	mm	162	mm
Dia of hoop bars	dbrb		16	mm	8	Nos
Dia of Stirrups			8	mm	200	mm 225

Side Wall

Depth of the tank	h		3.75	m	
Th. Of Side wall	sth		0.250	m	200 mm
Depth of tank above GL	dgl		0.80	m	

Moments

	Inner Side	11.49	Kn-m
	Outer Side	13.326	Kn-m

Hoop force

	Inner Side	127.9	Kn (Tension)
	Outer Side	138.42	Kn (Compression)

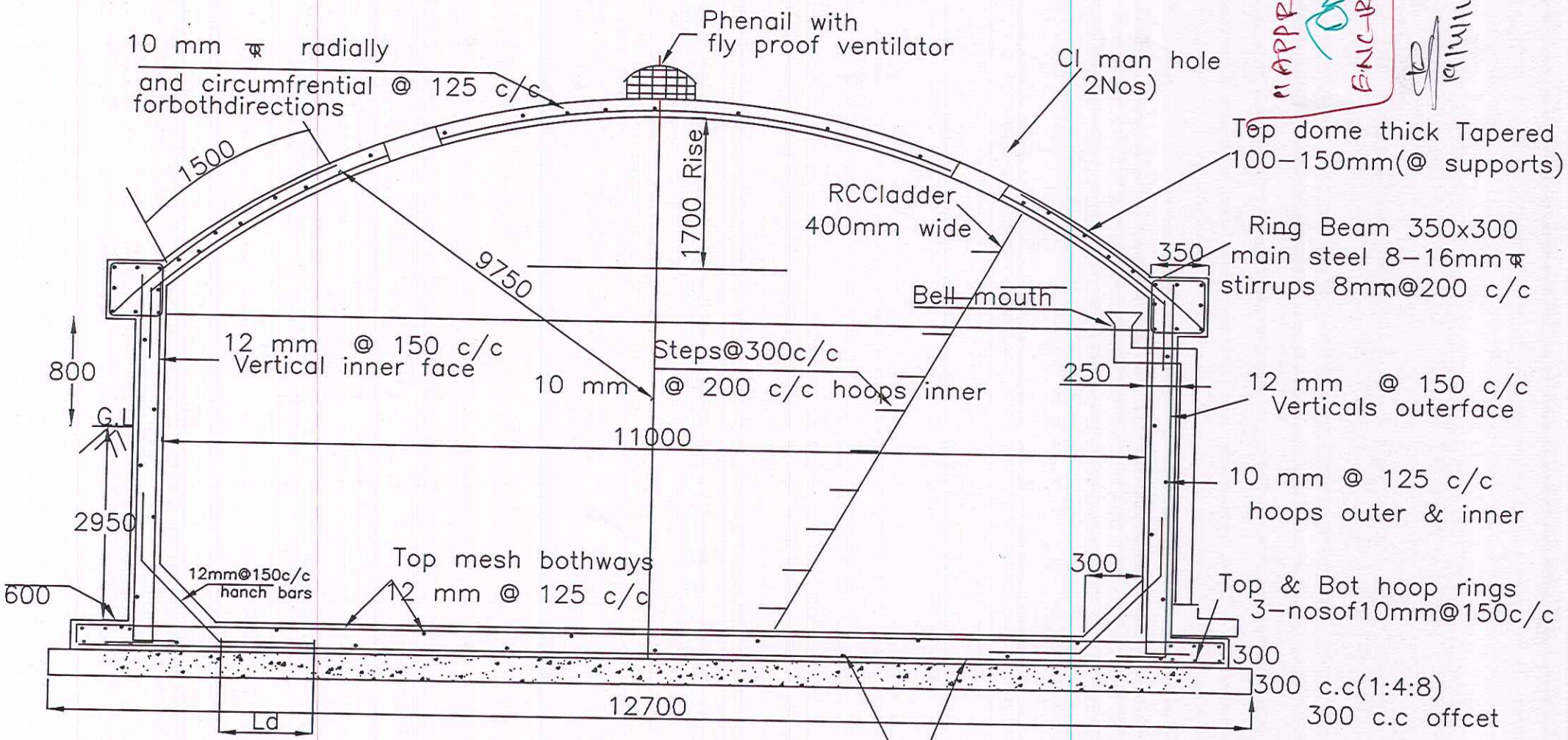
Reinforcement			Dia	Spacing Provided	Required
Inner face	Vertical	508 mm^2	10 mm	125 mm	150
	Horizontal	492 mm^2	10 mm	125 mm	150
Outer face	Vertical	590 mm^2	12 mm	150 mm	190
	Horizontal	492 mm^2	10 mm	125 mm	150

Bottom slab

Safe bearing Capacity		sbc		100	Kn/m^2	
Th. Of Bottom Slab		bsth	Provided th is Sufficient	0.300	m	0.21 m
Dia of Bottom Slab		dbs		12.70	m	
Size of Haunch		bh		0.30	m	
effective cover to reinforcement for raft slab			covraft	67	mm	
Moments	Radial			8.66	Kn-m	
	Circumferential			15.12	Kn-m	

		Ast	Dia	spacing Provided	Required
Reinforcement	Top mesh	574 mm^2	12 mm	125 mm	150
	Bottom mesh	240 mm^2	10 mm	200 mm	250

		bmcfps		0.0097	**0.00936**	0.0077		
Max Ring Tension		rtcfs		0.519	**0.5292**	0.579		
Max. -ve BM		mbms	(bmcfs*pas*hbgl^2)			13.33	Kn-m	
Max +ve BM		mpbms	(bmcfps*pas*hbgl^2)			3.87	Kn-m	
Max. Ring compression		mrts	rtcfs*pas*d/2			138.42	Kn	
Th. Of Side Wall			(MAX(mbm,mbms)*10^6*6/(2*1000))^0.			200	mm	
						Th. Provided is Sufficient		
Eff Th. Of Side wall		edswi				200	mm	
Max Inner face moment		bmi	MAX(mpbms,mbm)			11.49	Kn-m	
Max outer face moment		bmo	MAX(mpbm,mbms)			13.33	Kn-m	
Area of Steel								
Reinforcement								
Min Steel		pt	0.24% for <15m span 0.35%		0.24	0.12	%	
Area of BendingSteel inner side		Astm	MAX(pt*sth*10^4,bmi*10^6/(130*0.87*e			508	mm^2	on each side
Area of steel outer face		Astpbm	MAX(pt*sth*10^4,(bmo*10^6/(130*0.87			590	mm^2	on each side
Area of Steel for Hoop		Asth	MAX(pt*sth*10^4,CEILING(mrt*1000/13			984	mm^2	for two sides
Vertical Steel	Spacing							
inner face		vsp						
	Spacing		FLOOR(pi*dbi^2/4*1000/Astm,25)			150	mm	
Provide 10 mm dia TOR @ 150 mm C/c								
Outer face		vspo	FLOOR(pi*dbo^2/4*1000/astpbm,25)			190	mm	
Provide 10 mm dia TOR @ 190 mm C/c spacing								
Horizontal Steel								
	Spacing	hsp	FLOOR(pi*dbh^2/2*1000/Asth,25)			150	mm	
Provide 10 mm dia TOR @ 150 mm C/c on both faces in staggered fashion								
Design Of Bottom Slab								
Projection from side wall		ps				0.6	m	
Dia of Bottom Slab		dbs	d+2*sth+2*ps			12.70	m	
Size of Haunch		bh				0.3	m	
Dia of Bar	top	dbbs				12	mm	
	bottom	dbbsb				10	mm	
Load on Bottom Slab								
Wt of Top Dome			2*pi*rd*hd*wd			481.56	Kn	
Wt of Ring Beam			pi*(d+rb/1000)*rb*drb*25/10^6			93.60	Kn	
Wt Of Side wall			pi*(d+sth)*sth*(h-dtrb)*25			762.06	Kn	
Wt of Haunch			pi*(d-bh)*bh^2/2*25			37.82	Kn	
Total Load		wbs				1375.04	Kn	
						13.75	sq m	0.38992
Max Pr on Soil		prb	Wbs/(pi*(d)*1)			39.79	Kn/m^2	
Bottom Slab is designed as circular Slab loaded with UDL and Simply Supported on edges								
					r	5.625		5.35
Radial moment		mri	3/16*prb*((dbs/2)^2-((d+sth)/2)^2)-wbs/			-8.66	mrb	-7.2 Kn-m
Circuferential Moment		mti	1/16*prb*(3*(dbs/2)^2-((d+sth)/2)^2)-wb			-7.23	mtb	-7.2 Kn-m
for uplift	Net uplift load on bottom slab					-3	Kn/m^2	
for uplift			max Radial moment			-15.12		-15.12 Kn-m
			max Circuferential Moment			-15.12		-15.12 Kn-m
Max Radial Moment		mr	IF(wl>hbgl,0,CEILING(3*prb*(dbs/2)^2/			8.66	Kn-m	15.12 Kn-m
Max Circumferential moment		mt	IF(wl>hbgl,0,CEILING(prb*(dbs/2)^2/16			7.23	Kn-m	15.12 Kn-m



SUCTION PIT 6X1.0X1.0M

All dimensions are in 'mm'

Concrete mix V.R.C.C M30

Steel Fe–415

Reinforcement Details shall be as per IS – SP34

300 KL SUMP

Designed for uplift GWT @ 2.8 below GL
SCHEME : CPWSS
LOCATION:
SBC 10T/SQM

Design Of 250 KL Capacity Sump at

Data

Location						
Safe bearing Capacity	sbc		Safe	100	Kn/m^2	
Capacity	v			250	KL	
Free Board	fb			0.25	m	
Dead Storage	ds			0.20	m	
Dia of sump	d			10.00	m	
Projection from side wall	ps			0.15	m	
Depth of the tank	h			3.65	m	
Depth of tank above GL	dgl			0.50	m	
Depth of tank below GL				3.15	m	
thickness of PCC (lean mix cc1:6:10)		couter wt		0.00	m	
Th. Of Bottom Slab	bsth	Provided th is Sufficient		0.300	m	0.18 m
Depth of Water table below GL	wl	Safe Against Uplift		3.00	m	

Top Dome

Rise of the dome				1.60	
Radius of the dome				8.61	
Thickness of Dome	td	150 to 100	0.1	0.125	m
Dia of Reinforcement	db			10	mm
Reinforcement					
Spacing				125 mm	c/c

Provide 10 mm dia Tor @ 125 mm C/c both radially and in the form of circular rings

Top Ring Beam

Width of ring beam	rb		300	mm		
Depth of ring Beam	dtrb	Provided size is sufficient	300	mm	169	mm
Dia of hoop bars	dbrb		12	mm	8	Nos
Dia of Stirrups			8	mm	200 mm	225

Side Wall

Depth of the tank	h		3.65	m	
Th. Of Side wall	sth		0.200	m	184 mm
Depth of tank above GL	dgl		0.50	m	

Moments

Inner Side		8.43	Kn-m
Outer Side		11.256	Kn-m

Hoop force

Inner Side	120.65	Kn	(Tension)
Outer Side	156.37	Kn	(Compression)

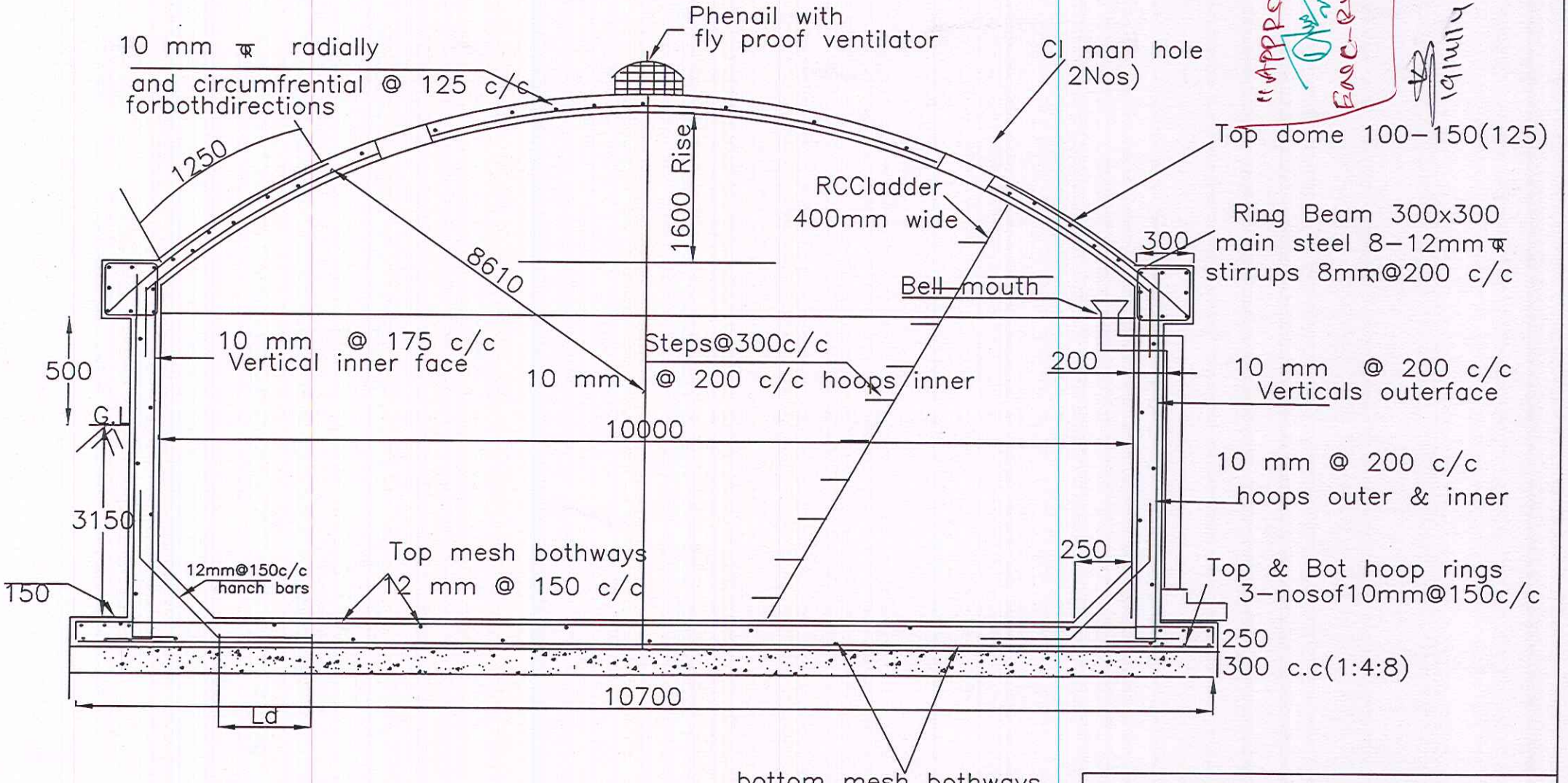
Reinforcement			Dia	Spacing Provided	Required
Inner face	Vertical	497 mm^2	10 mm	150 mm	150
	Horizontal	465 mm^2	10 mm	150 mm	160
Outer face	Vertical	664 mm^2	10 mm	100 mm	110
	Horizontal	465 mm^2	10 mm	150 mm	160

Bottom slab

Safe bearing Capacity	sbc			100	Kn/m^2	
Th. Of Bottom Slab	bsth	Provided th is Sufficient		0.300	m	0.18 m
Dia of Bottom Slab	dbs			10.70	m	
Size of Haunch	bh			0.25	m	
effective cover to reinforcement for raft slab			covraft	67	mm	
Moments Radial				6.76	Kn-m	
Circumferential				10.73	Kn-m	

		Ast	Dia	spacing Provided	Required
Reinforcement	Top mesh	408 mm^2	12 mm	150 mm	150
	Bottom mesh	240 mm^2	10 mm	200 mm	200

		bmcfps		0.0077	**0.00596**	0.0059	
Max Ring Tension		rtcfs		0.579	**0.61586**	0.617	
Max. -ve BM		mbms	(bmcfs*pas*hbgl^2)			11.26	Kn-m
Max +ve BM		mpbms	(bmcfps*pas*hbgl^2)			3.00	Kn-m
Max. Ring compression		mrts	rtcfs*pas*d/2			156.37	Kn
Th. Of Side Wall			(MAX(mbm,mbms)*10^6*6/(2*1000))^0.			184	mm
						Th. Provided is Sufficient	
Eff Th. Of Side wall		edswi				150	mm
Max Inner face moment		bmi	MAX(mpbms,mbm)			8.43	Kn-m
Max outer face moment		bmo	MAX(mpbm,mbms)			11.26	Kn-m
Area of Steel							
Reinforcement							
Min Steel		pt	0.24% for <15m span 0.35%		0.24	0.12	%
Area of BendingSteel inner side		Astm	MAX(pt*sth*10^4,bmi*10^6/(130*0.87*e			497	mm^2 on each side
Area of steel outer face		Astpbm	MAX(pt*sth*10^4,(bmo*10^6/(130*0.87			664	mm^2 on each side
Area of Steel for Hoop		Asth	MAX(pt*sth*10^4,CEILING(mrt*1000/13			929	mm^2 for two sides
Vertical Steel	Spacing						
inner face		vsp					
	Spacing		FLOOR(pi*dbi^2/4*1000/Astm,25)			150	mm
Provide 10 mm dia TOR @ 150 mm C/c							
Outer face		vspo	FLOOR(pi*dbo^2/4*1000/astpbm,25)			110	mm
Provide 10 mm dia TOR @ 110 mm C/c spacing							
Horizontal Steel							
	Spacing	hsp	FLOOR(pi*dbh^2/2*1000/Asth,25)			160	mm
Provide 10 mm dia TOR @ 160 mm C/c on both faces in staggered fashion							
Design Of Bottom Slab							
Projection from side wall		ps				0.15	m
Dia of Bottom Slab		dbs	d+2*sth+2*ps			10.70	m
Size of Haunch		bh				0.25	m
Dia of Bar	top	dbbs				12	mm
	bottom	dbbsb				10	mm
Load on Bottom Slab							
Wt of Top Dome			2*pi*rd*hd*wd			400.46	Kn
Wt of Ring Beam			pi*(d+rb/1000)*rb*drb*25/10^6			72.81	Kn
Wt Of Side wall			pi*(d+sth)*sth*(h-dtrb)*25			536.73	Kn
Wt of Haunch			pi*(d-bh)*bh^2/2*25			23.93	Kn
Total Load		wbs				1033.93	Kn
						10.34	sq m 0.29319
Max Pr on Soil		prb	Wbs/(pi*(d)*1)			32.91	Kn/m^2
Bottom Slab is designed as circular Slab loaded with UDL and Simply Supported on edges							
					r	5.1	4.35
Radial moment		mri	3/16*prb*((dbs/2)^2-((d+sth)/2)^2)-wbs/			-1.61	mrb 6.76 Kn-m
Circuferential Moment		mti	1/16*prb*(3*(dbs/2)^2-((d+sth)/2)^2)-wb			6.34	mtb 6.76 Kn-m
for uplift	Net uplift load on bottom slab					-3	Kn/m^2
for uplift			max Radial moment			-10.73	-10.73 Kn-m
			max Circuferential Moment			-10.73	-10.73 Kn-m
Max Radial Moment		mr	IF(wl>hbgl,0,CEILING(3*prb*(dbs/2)^2/			6.76	Kn-m 10.73 Kn-m
Max Circumferential moment		mt	IF(wl>hbgl,0,CEILING(prb*(dbs/2)^2/16			6.76	Kn-m 10.73 Kn-m



All dimensions are in 'mm'

Concrete mix V.R.C.C M30

Steel Fe–415

Reinforcement Details shall be as per IS – SP34

250 KL SUMP

Designed for uplift GWT @ 2.0 below GL
SCHEME : CPWSS
LOCATION:
SBC 10T/SQM

Design Of 200 KL Capacity Sump at

Data

Location					
Safe bearing Capacity	sbc		Safe	100	Kn/m^2
Capacity	v			200	KL
Free Board	fb			0.25	m
Dead Storage	ds			0.20	m
Dia of sump	d			10.00	m
Projection from side wall	ps			0.15	m
Depth of the tank	h			3	m
Depth of tank above GL	dgl			0.50	m
Depth of tank below GL				2.50	m
thickness of PCC (lean mix cc1:6:10)		couter wt		0.00	m
Th. Of Bottom Slab	bsth	Provided th is Sufficient		0.250	m 0.14 m
Depth of Water table below GL	wl	Safe Against Uplift		2.00	m

Top Dome

Rise of the dome				1.60	
Radius of the dome				8.61	
Thickness of Dome	td	150 to 100	0.1	0.125	m
Dia of Reinforcement	db			10	mm
Reinforcement					
Spacing				125 mm	c/c

Provide 10 mm dia Tor @ 125 mm C/c both radially and in the form of circular rings

Top Ring Beam

Width of ring beam	rb		300	mm	
Depth of ring Beam	dtrb	Provided size is sufficient	300	mm 169	mm
Dia of hoop bars	dbrb		12	mm 8	Nos
Dia of Stirrups			8	mm 200	mm 225

Side Wall

Depth of the tank	h		3	m
Th. Of Side wall	sth		0.200	m 157 mm
Depth of tank above GL	dgl		0.50	m
Moments				
	Inner Side		6.62	Kn-m
	Outer Side		8.176	Kn-m
Hoop force				
	Inner Side		89.7	Kn (Tension)
	Outer Side		106.16	Kn (Compression)

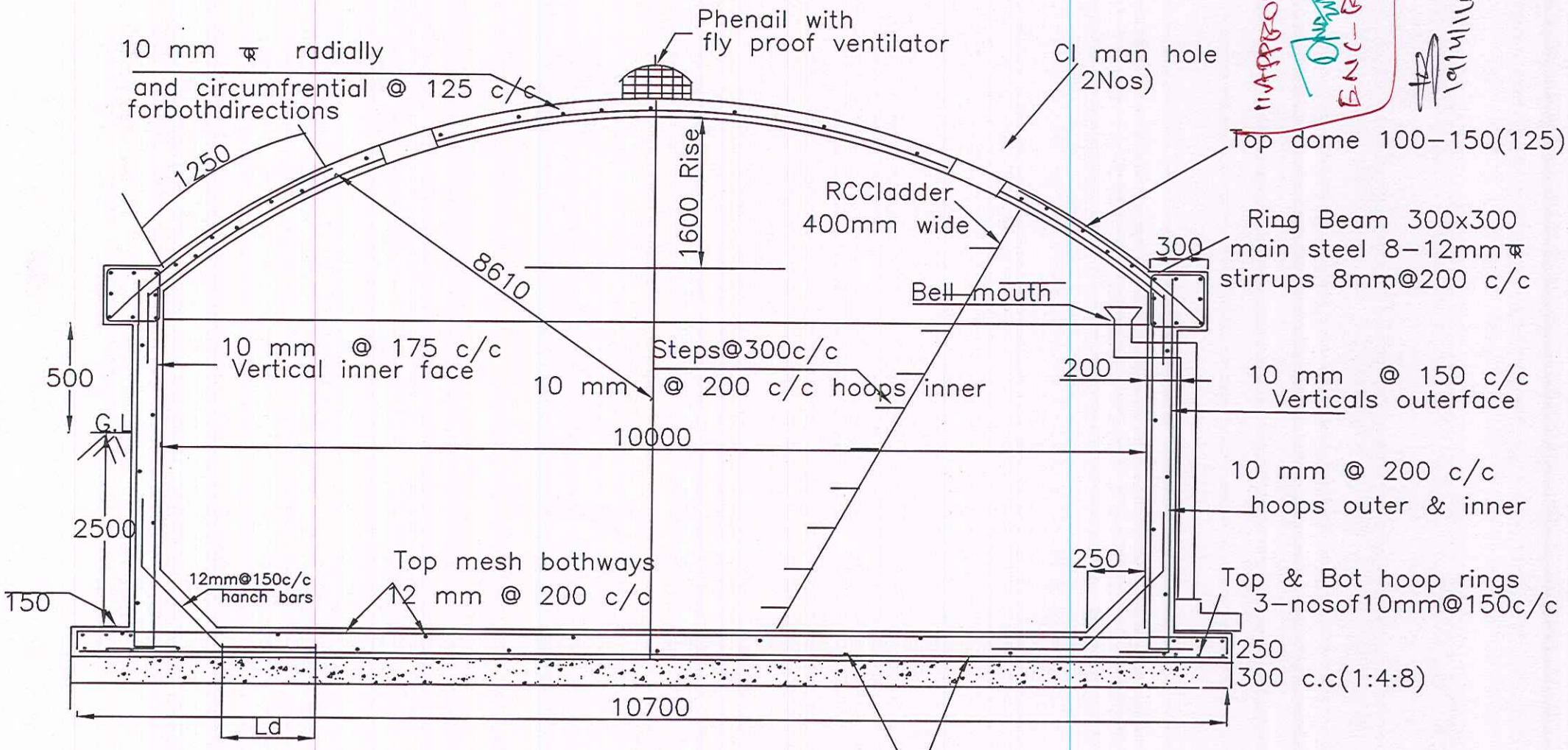
Reinforcement			Dia	Spacing Provided	Required
Inner face	Vertical	390 mm^2	10 mm	200 mm	200
	Horizontal	345 mm^2	10 mm	200 mm	200
Outer face	Vertical	482 mm^2	10 mm	150 mm	160
	Horizontal	345 mm^2	10 mm	200 mm	200

Bottom slab

Safe bearing Capacity	sbc			100	Kn/m^2
Th. Of Bottom Slab	bsth	Provided th is Sufficient		0.250	m 0.14 m
Dia of Bottom Slab	dbs			10.70	m
Size of Haunch	bh			0.25	m
effective cover to reinforcement for raft slab			covraft	67	mm
Moments	Radial			6.08	Kn-m
	Circumferential			6.08	Kn-m

		Ast	Dia	spacing Provided	Required
Reinforcement	Top mesh	294 mm^2	12 mm	175 mm	180
	Bottom mesh	240 mm^2	10 mm	200 mm	200

	bmcfps		0.0097	**0.00944**	0.0077		
Max Ring Tension	rtcfs		0.519	**0.5268**	0.579		
Max. -ve BM	mbms	(bmcfs*pas*hbgl^2)			8.18	Kn-m	
Max +ve BM	mpbms	(bmcfps*pas*hbgl^2)			2.38	Kn-m	
Max. Ring compression	mrts	rtcfs*pas*d/2			106.16	Kn	
Th. Of Side Wall		(MAX(mbm,mbms)*10^6*6/(2*1000))^0.			157	mm	
					Th. Provided is Sufficient		
Eff Th. Of Side wall	edswi				150	mm	
Max Inner face moment	bmi	MAX(mpbms,mbm)			6.62	Kn-m	
Max outer face moment	bmo	MAX(mpbm,mbms)			8.18	Kn-m	
Area of Steel							
Reinforcement							
Min Steel	pt	0.24% for <15m span 0.35%		0.24	0.12	%	
Area of BendingSteel inner side	Astm	MAX(pt*sth*10^4,bmi*10^6/(130*0.87*e			390	mm^2	on each side
Area of steel outer face	Astpbm	MAX(pt*sth*10^4,(bmo*10^6/(130*0.87			482	mm^2	on each side
Area of Steel for Hoop	Asth	MAX(pt*sth*10^4,CEILING(mrt*1000/1			690	mm^2	for two sides
Vertical Steel Spacing							
inner face	vsp						
Spacing		FLOOR(pi*dbi^2/4*1000/Astm,25)			200	mm	
Provide 10 mm dia TOR @ 200 mm C/c							
Outer face	vspo	FLOOR(pi*dbo^2/4*1000/astpbm,25)			160	mm	
Provide 10 mm dia TOR @ 160 mm C/c spacing							
Horizontal Steel							
Spacing	hsp	FLOOR(pi*dbh^2/2*1000/Asth,25)			200	mm	
Provide 10 mm dia TOR @ 200 mm C/c on both faces in staggered fashion							
Design Of Bottom Slab							
Projection from side wall	ps				0.15	m	
Dia of Bottom Slab	dbs	d+2*sth+2*ps			10.70	m	
Size of Haunch	bh				0.25	m	
Dia of Bar top	dbbs				12	mm	
bottom	dbbsb				10	mm	
Load on Bottom Slab							
Wt of Top Dome		2*pi*rd*hd*wd			400.46	Kn	
Wt of Ring Beam		pi*(d+rb/1000)*rb*drb*25/10^6			72.81	Kn	
Wt Of Side wall		pi*(d+sth)*sth*(h-dtrb)*25			432.59	Kn	
Wt of Haunch		pi*(d-bh)*bh^2/2*25			23.93	Kn	
Total Load	wbs				929.79	Kn	
					9.30	sq m	0.26366
Max Pr on Soil	prb	Wbs/(pi*(d)*1)			29.60	Kn/m^2	
Bottom Slab is designed as circular Slab loaded with UDL and Simply Supported on edges							
				r	5.1		4.35
Radial moment	mri	3/16*prb*((dbs/2)^2-((d+sth)/2)^2)-wbs/			-1.44	mrb	6.08 Kn-m
Circuferential Moment	mti	1/16*prb*(3*(dbs/2)^2-((d+sth)/2)^2)-wb			5.71	mtb	6.08 Kn-m
for uplift Net uplift load on bottom slab					1.25	Kn/m^2	
for uplift		max Radial moment			4.47		4.47 Kn-m
		max Circuferential Moment			4.47		4.47 Kn-m
Max Radial Moment	mr	IF(wl>hbgl,0,CEILING(3*prb*(dbs/2)^2/			6.08	Kn-m	4.47 Kn-m
Max Circumferential moment	mt	IF(wl>hbgl,0,CEILING(prb*(dbs/2)^2/16			6.08	Kn-m	4.47 Kn-m



All dimensions are in 'mm'

Concrete mix V.R.C.C M30

Steel Fe–415

Reinforcement Details shall be as per IS – SP34

200 KL SUMP

Designed for uplift GWT @ 2.0 below GL
SCHEME : CPWSS
LOCATION:
SBC 10T/SQM

Design Of 120 KL Capacity Sump at

Data

Location						
Safe bearing Capacity	sbc		Safe	100	Kn/m^2	
Capacity	v			120	KL	
Free Board	fb			0.25	m	
Dead Storage	ds			0.20	m	
Dia of sump	d			7.50	m	
Projection from side wall	ps			0.15	m	
Depth of the tank	h			3.2	m	
Depth of tank above GL	dgl			0.50	m	
Depth of tank below GL				2.70	m	
thickness of PCC (lean mix cc1:6:10)		couter wt		0.00	m	
Th. Of Bottom Slab	bsth	Provided th is Sufficient		0.25	m	0.14 m
Depth of Water table below GL	wl	Safe Against Uplift		2.00	m	

Top Dome

Rise of the dome				1.20		
Radius of the dome				6.46		
Thickness of Dome	td	150 to 100	0.1	0.125	m	
Dia of Reinforcement	db			8	mm	
Reinforcement						
Spacing				125	mm	c/c

Provide 8 mm dia Tor @ 125 mm C/c both radially and in the form of circular rings

Top Ring Beam

Width of ring beam	rb		300	mm		
Depth of ring Beam	dtrb	Provided size is sufficient	250	mm	101	mm
Dia of hoop bars	dbrb		12	mm	4	Nos
Dia of Stirrups			8	mm	150	mm 175

Side Wall

Depth of the tank	h		3.2	m	
Th. Of Side wall	sth		0.150	m	130 mm
Depth of tank above GL	dgl		0.50	m	
Moments					
	Inner Side		4.35	Kn-m	
	Outer Side		5.623	Kn-m	
Hoop force					
	Inner Side		85.84	Kn	(Tension)
	Outer Side		107.07	Kn	(Compression)

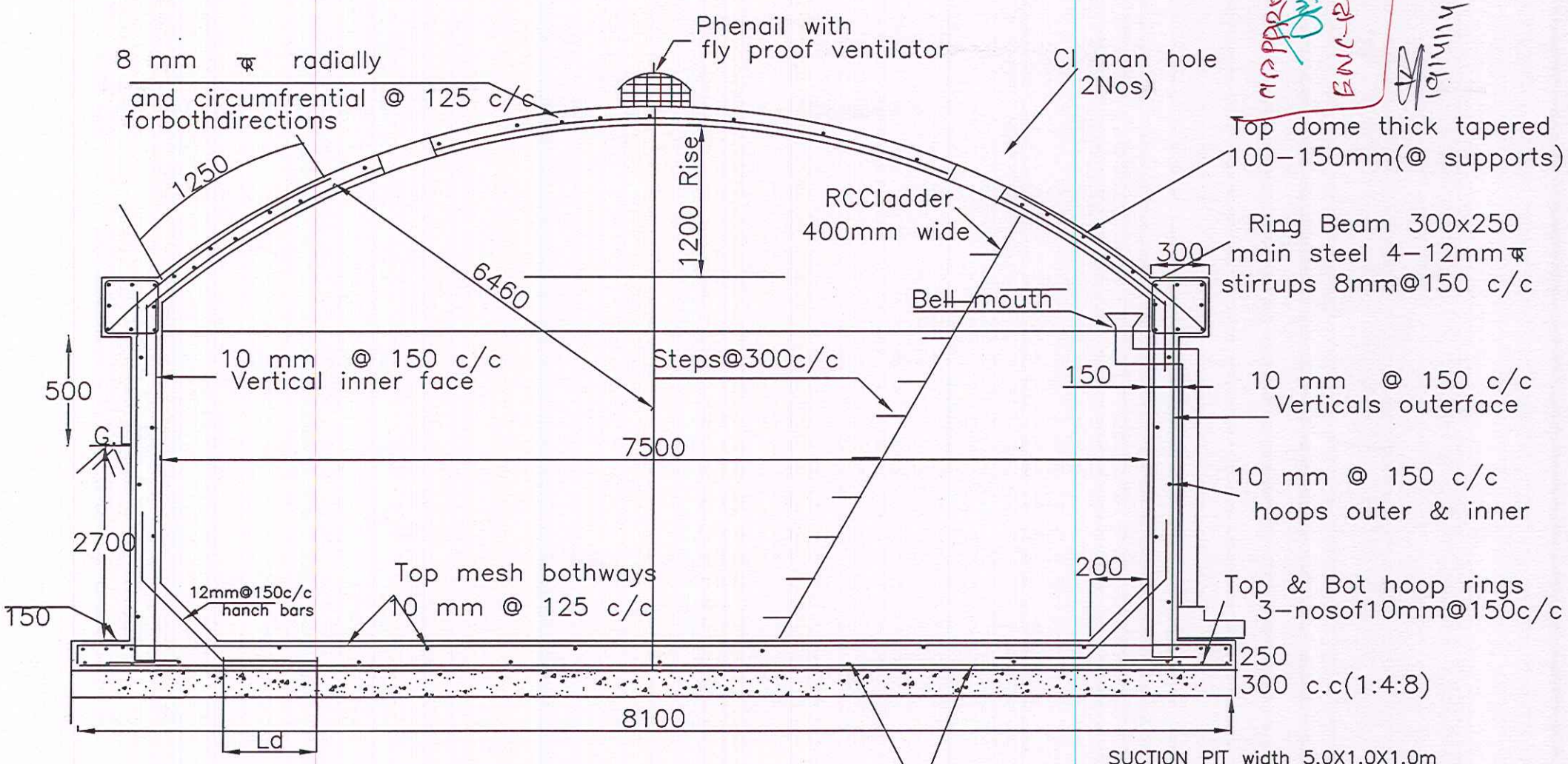
Reinforcement			Dia	Spacing Provided	Required
Inner face	Vertical	385 mm^2	10 mm	150 mm	150
	Horizontal	331 mm^2	10 mm	150 mm	150
Outer face	Vertical	498 mm^2	10 mm	150 mm	150
	Horizontal	331 mm^2	10 mm	150 mm	150

Bottom slab

Safe bearing Capacity	sbc			100	Kn/m^2	
Th. Of Bottom Slab	bsth	Provided th is Sufficient		0.250	m	0.14 m
Dia of Bottom Slab	dbs			8.10	m	
Size of Haunch	bh			0.20	m	
effective cover to reinforcement for raft slab			covraft	65	mm	
Moments	Radial			4.93	Kn-m	
	Circumferential			6.66	Kn-m	

		Ast	Dia	spacing Provided	Required
Reinforcement	Top mesh	319 mm^2	10 mm	125 mm	130
	Bottom mesh	240 mm^2	10 mm	125 mm	150

		bmcfps		0.0051	**0.00479**	0.0038	
Max Ring Tension		rtcfs		0.643	**0.65596**	0.697	
Max. -ve BM		mbms	(bmcfs*pas*hbgl^2)			5.62	Kn-m
Max +ve BM		mpbms	(bmcfps*pas*hbgl^2)			1.52	Kn-m
Max. Ring compression		mrts	rtcfs*pas*d/2			107.07	Kn
Th. Of Side Wall			(MAX(mbm,mbms)*10^6*6/(2*1000))^0.			130	mm
						Th. Provided is Sufficient	
Eff Th. Of Side wall		edswi				100	mm
Max Inner face moment		bmi	MAX(mpbms,mbm)			4.35	Kn-m
Max outer face moment		bmo	MAX(mpbm,mbms)			5.62	Kn-m
Area of Steel							
Reinforcement							
Min Steel		pt	0.24% for <15m span 0.35%		0.24	0.16	%
Area of BendingSteel inner side		Astm	MAX(pt*sth*10^4,bmi*10^6/(130*0.87*e			385	mm^2 on each side
Area of steel outer face		Astpbm	MAX(pt*sth*10^4,(bmo*10^6/(130*0.87			498	mm^2 on each side
Area of Steel for Hoop		Asth	MAX(pt*sth*10^4,CEILING(mrt*1000/1:			661	mm^2 for two sides
Vertical Steel	Spacing						
inner face		vsp					
	Spacing		FLOOR(pi*dbi^2/4*1000/Astm,25)			150	mm
Provide 10 mm dia TOR @ 150 mm C/c							
Outer face		vspo	FLOOR(pi*dbo^2/4*1000/astpbm,25)			150	mm
Provide 10 mm dia TOR @ 150 mm C/c spacing							
Horizontal Steel							
	Spacing	hsp	FLOOR(pi*dbh^2/2*1000/Asth,25)			150	mm
Provide 10 mm dia TOR @ 150 mm C/c on both faces in staggered fashion							
Design Of Bottom Slab							
Projection from side wall		ps				0.15	m
Dia of Bottom Slab		dbs	d+2*sth+2*ps			8.10	m
Size of Haunch		bh				0.2	m
Dia of Bar	top	dbbs				10	mm
	bottom	dbbsb				10	mm
Load on Bottom Slab							
Wt of Top Dome			2*pi*rd*hd*wd			225.27	Kn
Wt of Ring Beam			pi*(d+rb/1000)*rb*drb*25/10^6			45.95	Kn
Wt Of Side wall			pi*(d+sth)*sth*(h-dtrb)*25			265.86	Kn
Wt of Haunch			pi*(d-bh)*bh^2/2*25			11.47	Kn
Total Load		wbs				548.55	Kn
						5.49	sq m 0.15555
Max Pr on Soil		prb	Wbs/(pi*(d)*1)			23.28	Kn/m^2
Bottom Slab is designed as circular Slab loaded with UDL and Simply Supported on edges							
					r	3.825	3.05
Radial moment		mri	3/16*prb*((dbs/2)^2-((d+sth)/2)^2)-wbs/			-1.14 mrb	4.93 Kn-m
Circuferential Moment		mti	1/16*prb*(3*(dbs/2)^2-((d+sth)/2)^2)-wb			4.51 mtb	4.93 Kn-m
for uplift	Net uplift load on bottom slab					3.25	Kn/m^2
for uplift			max Radial moment			6.66	6.66 Kn-m
			max Circuferential Moment			6.66	6.66 Kn-m
Max Radial Moment		mr	IF(wl>hbgl,0,CEILING(3*prb*(dbs/2)^2/			4.93 Kn-m	6.66 Kn-m
Max Circumferential moment		mt	IF(wl>hbgl,0,CEILING(prb*(dbs/2)^2/16			4.93 Kn-m	6.66 Kn-m



All dimensions are in 'mm'

Concrete mix V.R.C.C M30

Steel Fe–415

Reinforcement Details shall be as per IS – SP34

120 KL SUMP

Designed for uplift GWT @ 2.0 below GL
SCHEME : CPWSS
LOCATION:
SBC 10T/SQM

Design Of 100 KL Capacity Sump at

Data

Location					
Safe bearing Capacity	sbc		Safe	100 Kn/m^2	
Capacity	v			100 KL	
Free Board	fb			0.25 m	
Dead Storage	ds			0.20 m	
Dia of sump	d			7.50 m	
Projection from side wall	ps			0.15 m	
Depth of the tank	h			2.75 m	
Depth of tank above GL	dgl			0.50 m	
Depth of tank below GL				2.25 m	
thickness of PCC (lean mix cc1:6:10)		couter wt		0.00 m	
Th. Of Bottom Slab	bsth	Provided th is Sufficient		0.25 m	0.12 m
Depth of Water table below GL	wl	Safe Against Uplift		2.00 m	

Top Dome

Rise of the dome				1.20	
Radius of the dome				6.46	
Thickness of Dome	td	150 to 100	0.1	0.125 m	
Dia of Reinforcement	db			8 mm	
Reinforcement					
Spacing				125 mm	c/c

Provide 8 mm dia Tor @ 125 mm C/c both radially and in the form of circular rings

Top Ring Beam

Width of ring beam	rb		300 mm		
Depth of ring Beam	dtrb	Provided size is sufficient	250 mm	101 mm	
Dia of hoop bars	dbrb		12 mm	4 Nos	
Dia of Stirrups			8 mm	150 mm	175

Side Wall

Depth of the tank	h		2.75 m		
Th. Of Side wall	sth		0.150 m	117 mm	
Depth of tank above GL	dgl		0.50 m		
Moments					
	Inner Side		3.58 Kn-m		
	Outer Side		4.499 Kn-m		
Hoop force					
	Inner Side		68.35 Kn	(Tension)	
	Outer Side		81.34 Kn	(Compression)	

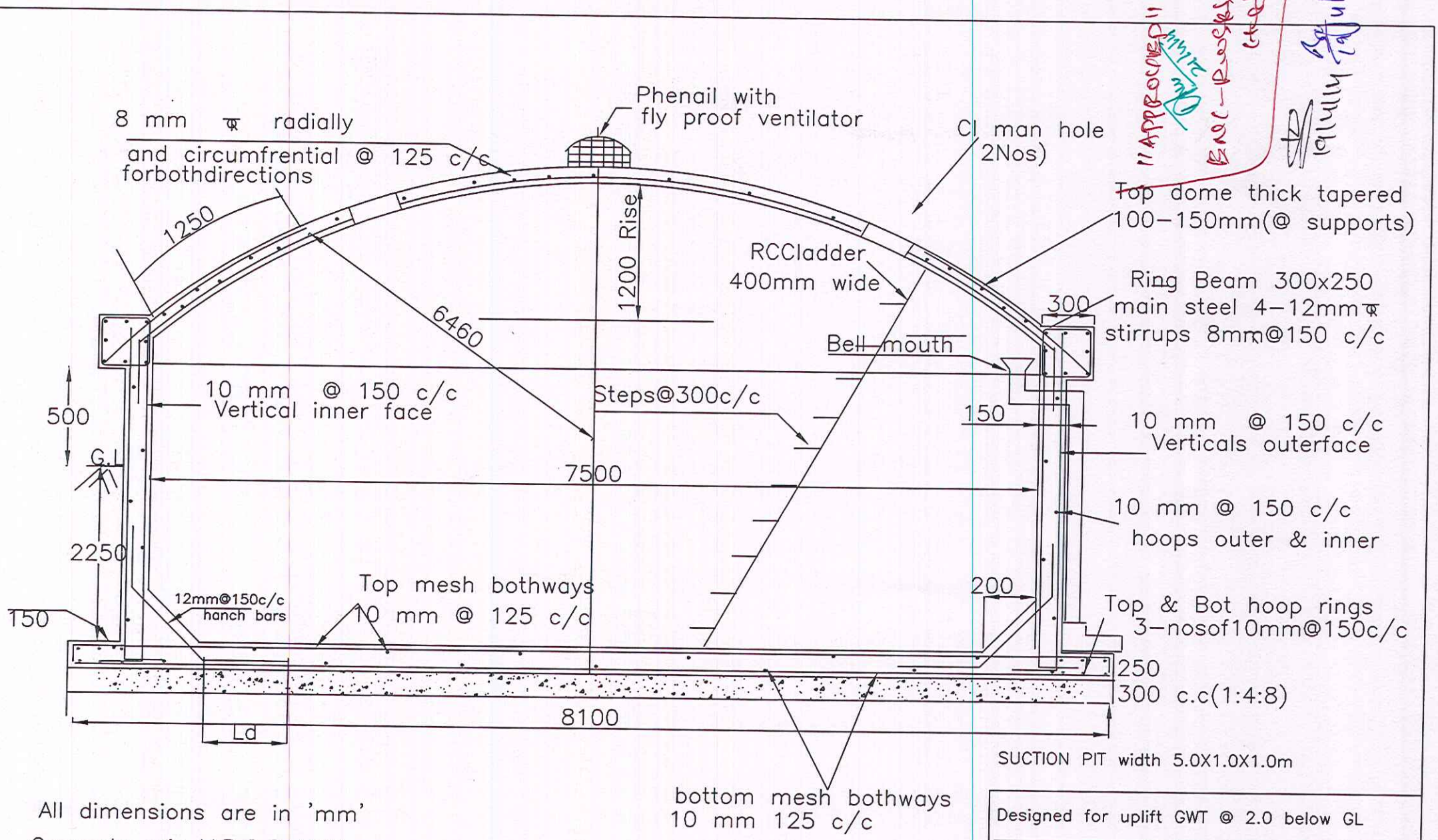
Reinforcement			Dia	Spacing Provided	Required
Inner face	Vertical	317 mm^2	10 mm	150 mm	150
	Horizontal	263 mm^2	10 mm	150 mm	150
Outer face	Vertical	398 mm^2	10 mm	150 mm	150
	Horizontal	263 mm^2	10 mm	150 mm	150

Bottom slab

Safe bearing Capacity	sbc			100 Kn/m^2	
Th. Of Bottom Slab	bsth	Provided th is Sufficient		0.250 m	0.12 m
Dia of Bottom Slab	dbs			8.10 m	
Size of Haunch	bh			0.20 m	
effective cover to reinforcement for raft slab			covraft	65 mm	
Moments	Radial			4.57 Kn-m	
	Circumferential			4.57 Kn-m	

		Ast	Dia	spacing Provided	Required
Reinforcement	Top mesh	219 mm^2	10 mm	125 mm	130
	Bottom mesh	240 mm^2	10 mm	125 mm	150

	bmcfps		0.0077	**0.0068**	0.0059		
Max Ring Tension	rtcfs		0.579	**0.598**	0.617		
Max. -ve BM	mbms	(bmcfs*pas*hbgl^2)			4.50	Kn-m	
Max +ve BM	mpbms	(bmcfps*pas*hbgl^2)			1.25	Kn-m	
Max. Ring compression	mrts	rtcfs*pas*d/2			81.34	Kn	
Th. Of Side Wall		(MAX(mbm,mbms)*10^6*6/(2*1000))^0.			117	mm	
					Th. Provided is Sufficient		
Eff Th. Of Side wall	edswi				100	mm	
Max Inner face moment	bmi	MAX(mpbms,mbm)			3.58	Kn-m	
Max outer face moment	bmo	MAX(mpbm,mbms)			4.50	Kn-m	
Area of Steel							
Reinforcement							
Min Steel	pt	0.24% for <15m span 0.35%		0.24	0.16	%	
Area of BendingSteel inner side	Astm	MAX(pt*sth*10^4,bmi*10^6/(130*0.87*e			317	mm^2	on each side
Area of steel outer face	Astpbm	MAX(pt*sth*10^4,(bmo*10^6/(130*0.87			398	mm^2	on each side
Area of Steel for Hoop	Asth	MAX(pt*sth*10^4,CEILING(mrt*1000/1:			526	mm^2	for two sides
Vertical Steel Spacing							
inner face	vsp						
Spacing		FLOOR(pi*dbi^2/4*1000/Astm,25)			150	mm	
Provide 10 mm dia TOR @ 150 mm C/c							
Outer face	vspo	FLOOR(pi*dbo^2/4*1000/astpbm,25)			150	mm	
Provide 10 mm dia TOR @ 150 mm C/c spacing							
Horizontal Steel							
Spacing	hsp	FLOOR(pi*dbh^2/2*1000/Asth,25)			150	mm	
Provide 10 mm dia TOR @ 150 mm C/c on both faces in staggered fashion							
Design Of Bottom Slab							
Projection from side wall	ps				0.15	m	
Dia of Bottom Slab	dbs	d+2*sth+2*ps			8.10	m	
Size of Haunch	bh				0.2	m	
Dia of Bar top	dbbs				10	mm	
bottom	dbbsb				10	mm	
Load on Bottom Slab							
Wt of Top Dome		2*pi*rd*hd*wd			225.27	Kn	
Wt of Ring Beam		pi*(d+rb/1000)*rb*drb*25/10^6			45.95	Kn	
Wt Of Side wall		pi*(d+sth)*sth*(h-dtrb)*25			225.31	Kn	
Wt of Haunch		pi*(d-bh)*bh^2/2*25			11.47	Kn	
Total Load	wbs				508.00	Kn	
					5.08	sq m	0.14405
Max Pr on Soil	prb	Wbs/(pi*(d)*1)			21.56	Kn/m^2	
Bottom Slab is designed as circular Slab loaded with UDL and Simply Supported on edges							
				r	3.825		3.05
Radial moment	mri	3/16*prb*((dbs/2)^2-((d+sth)/2)^2)-wbs/			-1.06	mrb	4.57 Kn-m
Circuferential Moment	mti	1/16*prb*(3*(dbs/2)^2-((d+sth)/2)^2)-wb			4.18	mtb	4.57 Kn-m
for uplift Net uplift load on bottom slab					-1.25	Kn/m^2	
for uplift		max Radial moment			-2.56		-2.56 Kn-m
		max Circuferential Moment			-2.56		-2.56 Kn-m
Max Radial Moment	mr	IF(wl>hbgl,0,CEILING(3*prb*(dbs/2)^2/			4.57	Kn-m	2.56 Kn-m
Max Circumferential moment	mt	IF(wl>hbgl,0,CEILING(prb*(dbs/2)^2/16			4.57	Kn-m	2.56 Kn-m



All dimensions are in 'mm'

Concrete mix V.R.C.C M30

Steel Fe–415

Reinforcement Details shall be as per IS – SP34

100 KL SUMP

Designed for uplift GWT @ 2.0 below GL

SCHEME : CPWSS

LOCATION:

SBC 10T/SQM

Design Of 60 KL Capacity Sump at

(WITH FLAT TOP SLAB)

Data Not more than 5m Span

Location							
Safe bearing Capacity	sbc		safe for sbc		100	Kn/m^2	
Capacity	v				60	KL	
Free Board	fb				0.30	m	
Dead Storage	ds				0.30	m	
Dia of sump	d				5.00	m	
Projection of Bottom slab from side wall				ps = d/16 to d/8	0.35	m	OK
Depth of tank above GL	dgl		Uplift check required		0.80	m	
Depth of Water table below GL,	wl			Safe Against Uplift	0.90	m	
Depth of the tank	h				3.70	m	
Thickness of Slab	td	Min 150mm thick		OK	0.150	m	0.121 m
Th. Of Side wall	sth	Min 150mm thick		OK	0.150	m	0.110 m
Th. Of Bottom Slab	bsth	Min 150mm thick		thick is Sufficient OK	0.25	m	0.185 m

Top Slab

							slab projection
Radius of Top slab	rs				2.50		0.3 m
Thickness of Slab	td	Min 150mm thick		OK	0.15	m	0.121 mm is required
Effective depth of slab	d				100	mm	
Total Load on slab		Self wt			3.75	kN/sqm	
		Live load			1.5	kN/sqm	
		Finishings			1	kN/sqm	
	w	Total load			**6.25**	kN/sqm	
Bending Moment	bm	(2/16*w*rs^2)			4.88	kN-m/m	
Area of Steel required	ast	(bm/(σstjd)			436	sqmm/m	
		σst	N/mm2		130.00	N/sqmm	
		j=1-k/3			0.86		
		k=1/1+σst/mσcbc			0.42		
		m=280/3σcbc			9.33		
		σcbc			10	N/sqmm	
		Grade of steel	Fe 415 , σst=		130	N/sqmm	
		Grade of Concrete		M 30			
Dia of Reinforcement	db		10mm				
Spacing required	min of		150 mm	170 mm	floor to	10mm	
Spacing provided				OK	150 mm	c/c	

Provide 10 mm dia Tor @ 150 mm C/c both radially and in the form of circular rings

Side Wall

Depth of the tank	h		3.7	m	
Th. Of Side wall	sth	Min 150mm thick	0.15	m	0.11 mm
Depth of tank above GL	dgl		0.80	m	
Moments					
	Inner Side		4.00	Kn-m	
	Outer Side		4.368	Kn-m	
Hoop force					
	Inner Side		71.78	Kn	(Tension)
	Outer Side		86.75	Kn	(Compression)

Reinforcement

				Dia	Spacing Provided	floor to
Inner face	Vertical	(Min 10mm dia)	354 mm^2	10 mm	150 mm	50
	Horizontal		276.5 mm^2	10 mm	150 mm	50
Outer face	Vertical	(Min 10mm dia)	387 mm^2	10 mm	150 mm	50
	Horizontal		276.5 mm^2	10 mm	150 mm	

Bottom slab Min 150mm thick

Safe bearing Capacity	sbc			100	Kn/m^2	
Th. Of Bottom Slab	bsth		thick is Sufficient	0.250	m	0.185 m
Dia of Bottom Slab	dbs			6.00	m	
Size of Haunch	bh			0.25	m	
effective cover to reinforcement for raft slab			covraft	67	mm	
Moments Radial				5.20	Kn-m	
Circumferential				5.15	Kn-m	

				Dia	Spacing Provided	floor to
		Ast (Min 10mm dia)				
Reinforcemer Top	mesh	557 mm^2		12 mm	175 mm	25
Bottom	mesh	300 mm^2		10 mm	200 mm	50

				300 mm^2
Area of Steel	Astru	mru*10^6/(130*0.86*de)		557 mm^2
Spacing				
Top Steel spacing	Asttpu	pi*(dbbs^2/4)*1000/max(Astmn,astr)		204 mm

Provide 12 mm dia TOR @ 175 mm c/c in the form of mesh at top

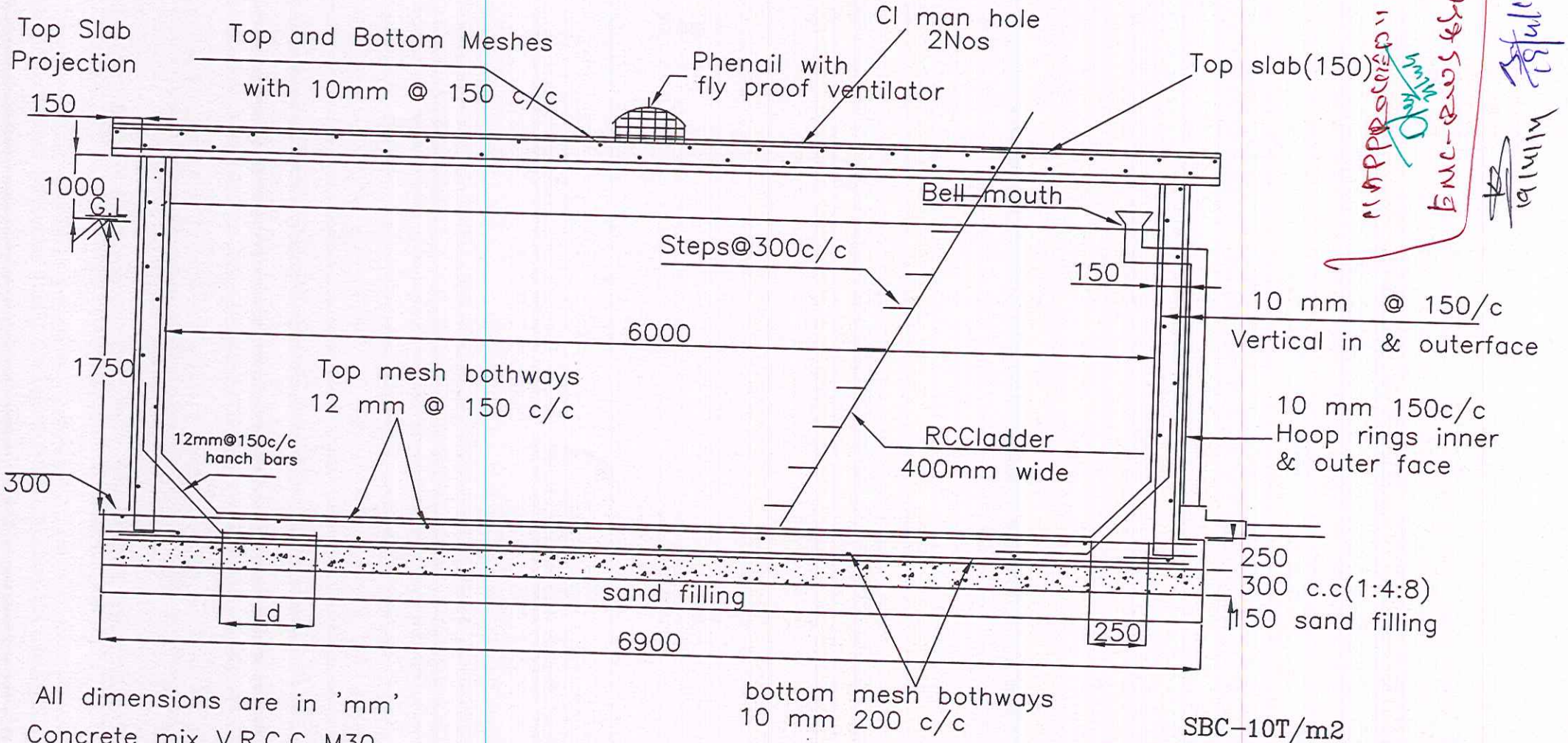
Check For Uplift

Depth of Water uplift	dw	h-hgl-wl+bsth	2.25 m	
Wt of Sump	We	wbs+wbsi	with topslab	503 Kn
Wt of soil backfilling above the bottom slab projection				288 Kn
Wt of Sump incluiding refilled soil				792 Kn
Uplift Pr	Pu	pi*dbs^2/4*dw*10		636 Kn
Factor of Safety against UF		We/Pu		1.25
				Safe Against Uplift

"APPROVED"

EXC-RWSS, Hyd

19/4/14 19/4/14



All dimensions are in 'mm'

Concrete mix V.R.C.C M30

Steel Fe–415

Reinforcement Details shall be as per IS – SP34

60 KL SUMP

SBC–10T/m2

SCHEME :CPWS Schemes
LOCATION: Adilabad District
DWG.NO.

Design Of 40 KL Capacity Sump at

(WITH FLAT TOP SLAB)

Not more than 5m Span

Data

Location						
Safe bearing Capacity	sbc		safe for sbc	100	Kn/m^2	
Capacity	v			40	KL	
Free Board	fb			0.30	m	
Dead Storage	ds			0.30	m	
Dia of sump	d			5.00	m	
Projection of Bottom slab from side wall			ps = d/16 to d/8	0.35	m	OK
Depth of tank above GL	dgl		Uplift check required	0.80	m	
Depth of Water table below GL,	wl		Safe Against Uplift	0.90	m	
Depth of the tank	h			2.65	m	1.85
Thickness of Slab	td	Min 150mm thick	OK	0.150	m	0.121 m
Th. Of Side wall	sth	Min 150mm thick	OK	0.150	m	0.086 m
Th. Of Bottom Slab	bsth	Min 150mm thick	thick is Sufficient OK	0.25	m	0.090 m

Top Slab

						slab projection
Radius of Top slab	rs			2.50		0.3 m
Thickness of Slab	td	Min 150mm thick	OK	0.15	m	0.121 mm is required
Effective depth of slab	d			100	mm	
Total Load on slab		Self wt		3.75	kN/sqm	
		Live load		1.5	kN/sqm	
		Finishings		1	kN/sqm	
	w	Total load		6.25	kN/sqm	
Bending Moment	bm	(2/16*w*rs^2)		4.88	kN-m/m	
Area of Steel required	ast	(bm/(σstjd)		436	sqmm/m	
		σst	N/mm2	130.00	N/sqmm	
		j=1-k/3		0.86		
		k=1/1+σst/mσcbc		0.42		
		m=280/3σcbc		9.33		
		σcbc		10	N/sqmm	
		Grade of steel	Fe 415 , σst=	130	N/sqmm	
		Grade of Concrete	M 30			

Dia of Reinforcement	db	10mm					
Spacing required	min of	150 mm	170 mm	floor to	10mm		
Spacing provided			OK	150	mm	c/c	

Provide 10 mm dia Tor @ 150 mm C/c both radially and in the form of circular rings

Side Wall

Depth of the tank	h		2.65	m	
Th. Of Side wall	sth	Min 150mm thick	0.15	m	0.086 mm
Depth of tank above GL	dgl		0.80	m	

Moments

	Inner Side	2.41	Kn-m	
	Outer Side	2.468	Kn-m	

Hoop force

	Inner Side	47.68	Kn	(Tension)
	Outer Side	44.79	Kn	(Compression)

Reinforcement

				Dia	Spacing Provided	floor to
Inner face	Vertical	(Min 10mm dia)	240 mm^2	10 mm	150 mm	50
	Horizontal		183.5 mm^2	10 mm	150 mm	50
Outer face	Vertical	(Min 10mm dia)	240 mm^2	10 mm	150 mm	50
	Horizontal		183.5 mm^2	10 mm	150 mm	

Bottom slab Min 150mm thick

Safe bearing Capacity	sbc		100	Kn/m^2	
Th. Of Bottom Slab	bsth	thick is Sufficient	0.250	m	0.090 m
Dia of Bottom Slab	dbs		6.00	m	
Size of Haunch	bh		0.25	m	
effective cover to reinforcement for raft slab		covraft	65	mm	
Moments Radial			4.18	Kn-m	
Circumferential			4.14	Kn-m	

			Ast (Min 10mm dia)	Dia	Spacing Provided	floor to	
Reinforcemei	Top	mesh	300 mm^2	10 mm	225 mm	25	150
	Bottom	mesh	300 mm^2	10 mm	200 mm	50	200

Provide 10 mm dia TOR @ 150 mm C/c on both faces in staggered fashion

Design Of Bottom Slab

CASE-1

Projection from side wall	ps			0.35	m
Dia of Bottom Slab	dbs	d+2*sth+2*ps		6.00	m
Size of Haunch	bh			0.25	m
Dia of Bar top	dbbs			10	mm
bottom	dbbsb			10	mm

Net Load on Bottom Slab

Wt of Top Slab		pi/4*(d+sth+topproj)^2*td*25		102.53	Kn
Wt Of Side wall		pi*(d+sth)*sth*(h-dtrb)*25		148.65	Kn
Wt of Haunch		pi*(d-bh)*bh^2/2*25		11.66	Kn
Total Load	wbs			262.84	Kn
LL on TOP slab		pi/4*(d+sth+topproj)^2*LL		58.32	Kn
				3.212	sq m 0.199
Effective foundation width of sidewall load on bottom slab, ewf		ps+sth+bh+bsth=		1.000	m
Max Pr on Soil	prb	Wbs/(pi*(d+sth)*ewf)		16.25	Kn/m^2

Bottom Slab is designed as circular Slab loaded with UDL and Simply Supported on edges

			r	2.575	2.5
Radial moment	mri	3/16*prb*((dbs/2)^2-((d+sth)/2)^2)-wbs/(8*pi)*(2*l		-4.18 mrb	-4.14 Kn-m
Circuferential Moment	mti	1/16*prb*(3*(dbs/2)^2-((d+sth)/2)^2)-wbs/(8*pi)*(2		-4.14 mtb	-4.14 Kn-m
Max Radial Moment	mr	IF(wl>hbgl,0,CEILING(3*prb*(dbs/2)^2/16,0.01))		4.18	Kn-m
Max Circumferential mon	mt	IF(wl>hbgl,0,CEILING(prb*(dbs/2)^2/16,0.01))		4.14	Kn-m

Base Slab Th for Uncracked Condition

Th	bsthr	IF(mr=0,sth*1000,(max(mr,mt)*6*10^6/(2*10^3))^		0.112	m
				Provided th is Sufficient	
Eff Depth	de	bsth*1000-covraft		185	mm
Area of Steel					
Min Steel	Astmin		0.24	0.24	%
				300	mm^2
Area of Steel	Astr	mr*10^6/(130*.87*de)		202	mm^2
Spacing					
Top Steel	Asttp	pi*(dbbs^2/4)*1000/max(Astmn,astr)		262	mm
Provide 10 mm dia TOR @ 225 mm c/c in the form of mesh at top					
Bottom Steel	Astb	pi*(dbbsb^2/4)*1000/(Astmin)		262	mm
Provide 10 mm dia TOR @ 200 mm c/c in the form of mesh at bottom					

Check For SBC

Load from tank Portion	wbs			262.84	Kn
Weight of Bottom Slab	wbsi	pi*(dbs^2/4)*bsth*25		176.71	Kn
Weight of water	ww	pi*(d^2/4)*h*10		520.32	Kn
Total	W	wbs+wbsi+ww		959.87	Kn
Pr on Soil	pr s	w/(pi*dbs^/4)	safe for sbc	33.95	Kn/m^2

CASE-2

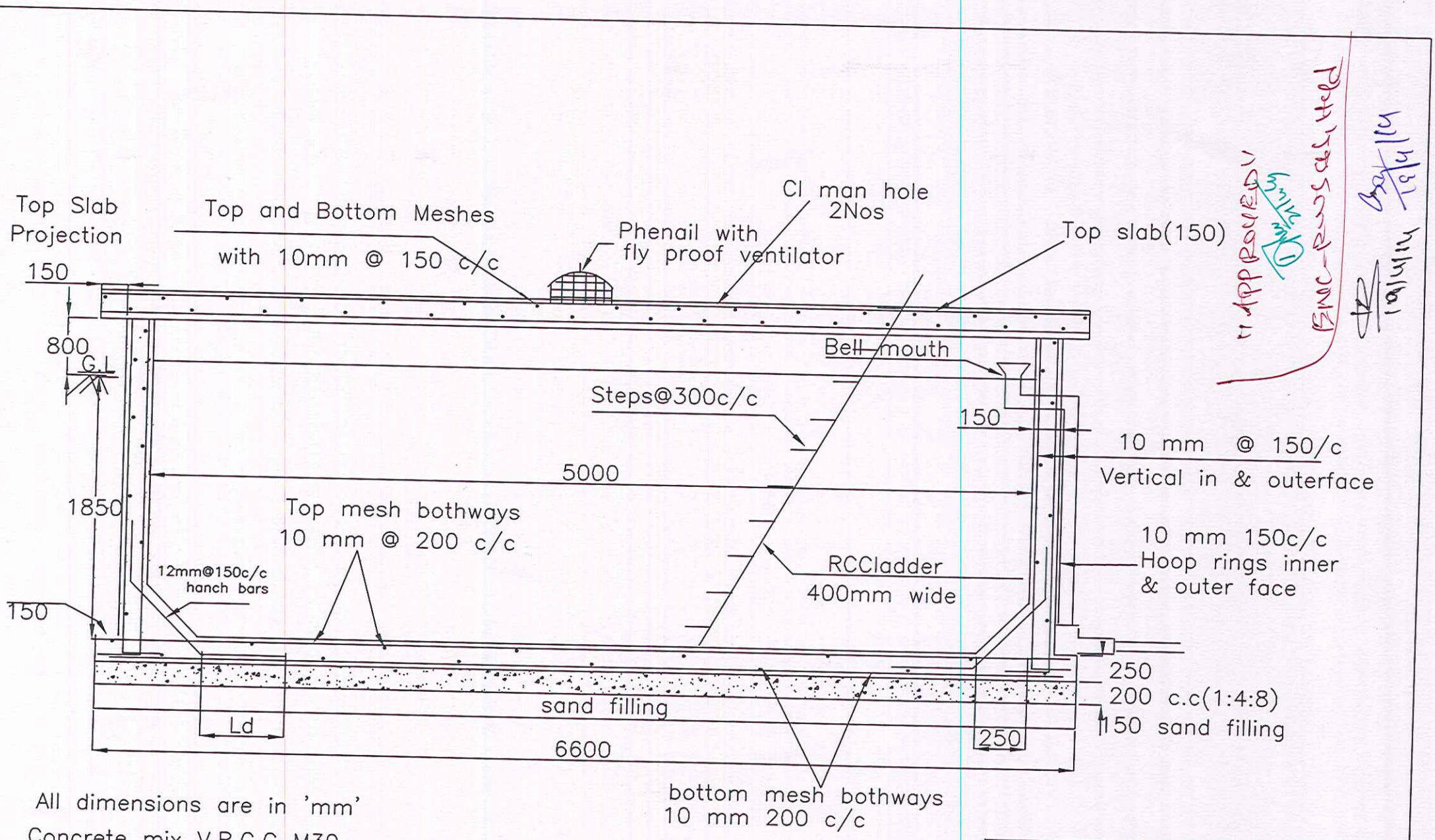
Bottom Slab is designed as circular Slab loaded with Uplift and continuous Supported on edges

Load on Bottom Slab (Uplift)

Max Pr on Soil	pru	10*(h-dgl-wl)-bsth*25	Uplift check requir	3.25	Kn/m^2
			r	2.575	
Radial moment	mru	2/16*pru*(r)^2		2.69	
Circuferential Moment	mtu	1/16*pru*(r)^2		1.35	

Base Slab Th for Uncracked Condition

Th	bsthr	IF(mru=0,sth*1000,(max(mr,mt)*6*10^6/(2*10^3))		0.09	m
				thick is Sufficient	
Eff Depth	de	bsth*1000-covraft		185	mm
Area of Steel					
Min Steel	Astmin		0.24	0.24	%



All dimensions are in 'mm'

Concrete mix V.R.C.C M30

Steel Fe–415

Reinforcement Details shall be as per IS – SP34

40 KL SUMP

SCHEME :CPWS Schemes
LOCATION: Adilabad District
DWG.NO.

Design Of 30 KL Capacity Sump at

(WITH FLAT TOP SLAB)

Data — **Not more than 5m Span**

Location							
Safe bearing Capacity	sbc		safe for sbc		100	Kn/m^2	
Capacity	v				30	KL	
Free Board	fb				0.30	m	
Dead Storage	ds				0.30	m	
Dia of sump	d				4.00	m	
Projection of Bottom slab from side wall				ps = d/16 to d/8	0.25	m	OK
Depth of tank above GL	dgl		Uplift check required		1.00	m	
Depth of Water table below GL,	wl			Safe Against Uplift	0.90	m	
Depth of the tank	h				3.00	m	2.00
Thickness of Slab	td	Min 150mm thick		OK	0.150	m	0.097 m
Th. Of Side wall	sth	Min 150mm thick		OK	0.150	m	0.083 m
Th. Of Bottom Slab	bsth	Min 150mm thick		thick is Sufficient OK	0.25	m	0.088 m

Top Slab

							slab projection
Radius of Top slab	rs				2.00		0.3 m
Thickness of Slab	td	Min 150mm thick		OK	0.15	m	0.097 mm is required
Effective depth of slab	d				100	mm	
Total Load on slab		Self wt			3.75	kN/sqm	
		Live load			1.5	kN/sqm	
		Finishings			1	kN/sqm	
	w	Total load			6.25	kN/sqm	
Bending Moment	bm	(2/16*w*rs^2)			3.13	kN-m/m	
Area of Steel required	ast	(bm/(σstjd)			279	sqmm/m	
		σst	N/mm2		130.00	N/sqmm	
		j=1-k/3			0.86		
		k=1/1+σst/mσcbc			0.42		
		m=280/3σcbc			9.33		
		σcbc			10	N/sqmm	
		Grade of steel	Fe 415 , σst=		130	N/sqmm	
		Grade of Concrete		M 30			
Dia of Reinforcement	db		10mm				
Spacing required	min of		150 mm	280 mm	floor to	10mm	
Spacing provided				OK	150 mm	c/c	

Provide 10 mm dia Tor @ 150 mm C/c both radially and in the form of circular rings

Side Wall

Depth of the tank	h			3	m	
Th. Of Side wall	sth	Min 150mm thick		0.15	m	0.083 mm
Depth of tank above GL	dgl			1.00	m	
Moments						
	Inner Side			2.28	Kn-m	
	Outer Side			2.235	Kn-m	
Hoop force						
	Inner Side			46.11	Kn	(Tension)
	Outer Side			42.63	Kn	(Compression)

Reinforcement				Dia	Spacing Provided	floor to
Inner face	Vertical	(Min 10mm dia)	240 mm^2	10 mm	150 mm	50
	Horizontal		180 mm^2	10 mm	150 mm	50
Outer face	Vertical	(Min 10mm dia)	240 mm^2	10 mm	150 mm	50
	Horizontal		180 mm^2	10 mm	150 mm	

Bottom slab — Min 150mm thick

Safe bearing Capacity	sbc			100	Kn/m^2	
Th. Of Bottom Slab	bsth		thick is Sufficient	0.250	m	0.088 m
Dia of Bottom Slab	dbs			4.80	m	
Size of Haunch	bh			0.25	m	
effective cover to reinforcement for raft slab			covraft	65	mm	
Moments Radial				3.19	Kn-m	
Circumferential				3.05	Kn-m	

			Ast (Min 10mm dia)	Dia	Spacing Provided	floor to	
Reinforcemei Top	mesh		300 mm^2	10 mm	225 mm	25	150
Bottom	mesh		300 mm^2	10 mm	200 mm	50	200

Provide 10 mm dia TOR @ 150 mm C/c on both faces in staggered fashion

Design Of Bottom Slab

CASE-1

Projection from side wall	ps		0.25	m	
Dia of Bottom Slab	dbs	d+2*sth+2*ps	4.80	m	
Size of Haunch	bh		0.25	m	
Dia of Bar top	dbbs		10	mm	
bottom	dbbsb		10	mm	
Net Load on Bottom Slab					
Wt of Top Slab		pi/4*(d+sth+topproj)^2*td*25	70.72	Kn	
Wt Of Side wall		pi*(d+sth)*sth*(h-dtrb)*25	136.9	Kn	
Wt of Haunch		pi*(d-bh)*bh^2/2*25	9.21	Kn	
Total Load	wbs		216.83	Kn	
LL on TOP slab		pi/4*(d+sth+topproj)^2*LL	38.88	Kn	
			2.557	sq m	0.196
Effective foundation width of sidewall load on bottom slab, ewf		ps+sth+bh+bsth=	0.900	m	
Max Pr on Soil	prb	Wbs/(pi*(d+sth)*ewf)	18.48	Kn/m^2	

Bottom Slab is designed as circular Slab loaded with UDL and Simply Supported on edges

		r	2.075		1.95	
Radial moment	mri	3/16*prb*((dbs/2)^2-((d+sth)/2)^2)-wbs/(8*pi)*(2*l	-3.19	mrb	-3.05	Kn-m
Circuferential Moment	mti	1/16*prb*(3*(dbs/2)^2-((d+sth)/2)^2)-wbs/(8*pi)*(2	-3.05	mtb	-3.05	Kn-m
Max Radial Moment	mr	IF(wl>hbgl,0,CEILING(3*prb*(dbs/2)^2/16,0.01))	3.19	Kn-m		
Max Circumferential mon	mt	IF(wl>hbgl,0,CEILING(prb*(dbs/2)^2/16,0.01))	3.05	Kn-m		

Base Slab Th for Uncracked Condition

Th	bsthr	IF(mr=0,sth*1000,(max(mr,mt)*6*10^6/(2*10^3))^	0.098	m
			Provided th is Sufficient	
Eff Depth	de	bsth*1000-covraft	185	mm
Area of Steel				
Min Steel	Astmin	0.24	0.24	%
			300	mm^2
Area of Steel	Astr	mr*10^6/(130*.87*de)	155	mm^2
Spacing				
Top Steel	Asttp	pi*(dbbs^2/4)*1000/max(Astmn,astr)	262	mm
Provide 10 mm dia TOR @ 225 mm c/c in the form of mesh at top				
Bottom Steel	Astb	pi*(dbbsb^2/4)*1000/(Astmin)	262	mm
Provide 10 mm dia TOR @ 200 mm c/c in the form of mesh at bottom				

Check For SBC

Load from tank Portion	wbs		216.83	Kn	
Weight of Bottom Slab	wbsi	pi*(dbs^2/4)*bsth*25	113.1	Kn	
Weight of water	ww	pi*(d^2/4)*h*10	376.98	Kn	
Total	W	wbs+wbsi+ww	706.91	Kn	
Pr on Soil	pr s	w/(pi*dbs^/4) safe for sbc	39.07	Kn/m^2	

CASE-2

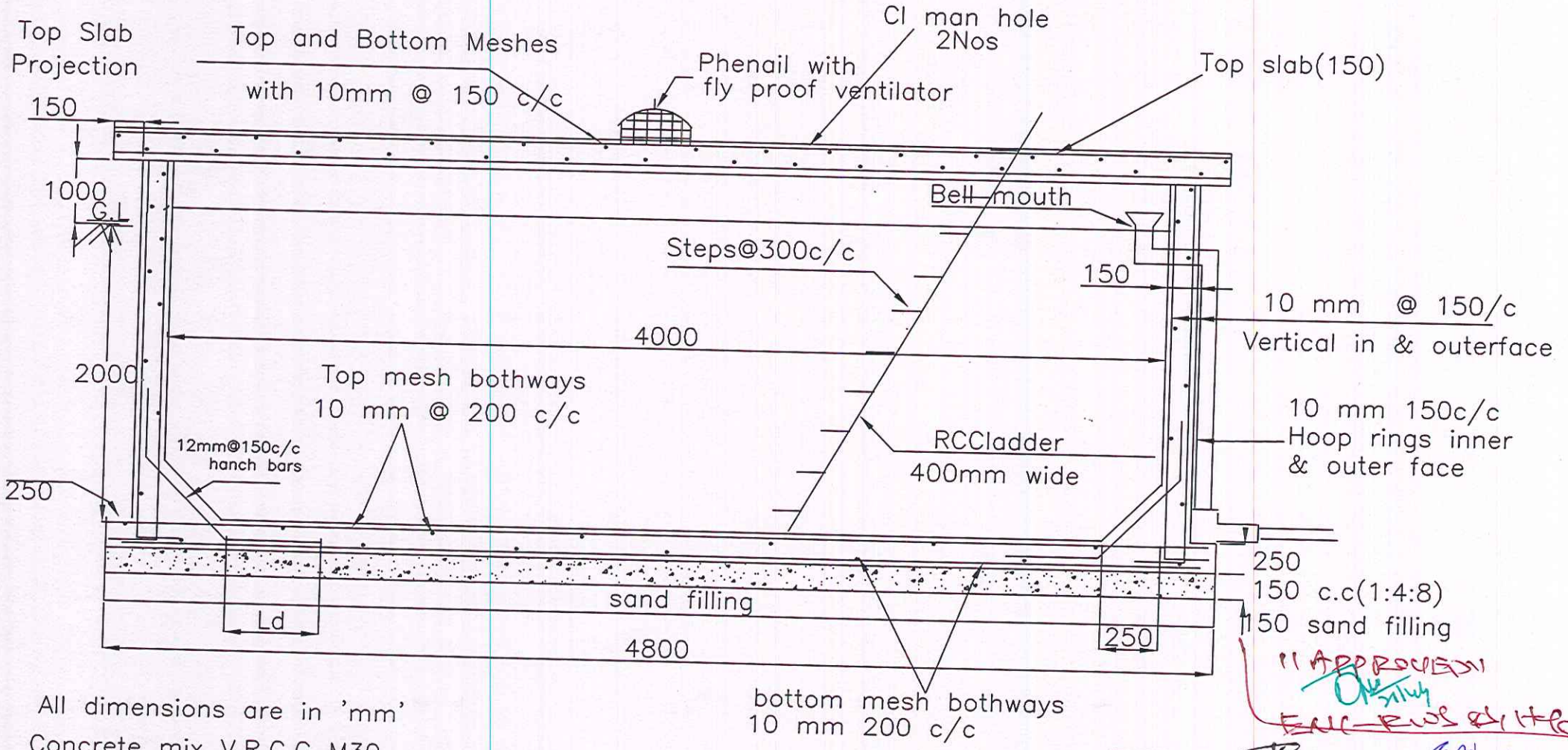
Bottom Slab is designed as circular Slab loaded with Uplift and continuous Supported on edges

Load on Bottom Slab (Uplift)

Max Pr on Soil	pru	10*(h-dgl-wl)-bsth*25	Uplift check requir	4.75	Kn/m^2
			r	2.075	
Radial moment	mru	2/16*pru*(r)^2		2.56	
Circuferential Moment	mtu	1/16*pru*(r)^2		1.28	

Base Slab Th for Uncracked Condition

Th	bsthr	IF(mru=0,sth*1000,(max(mr,mt)*6*10^6/(2*10^3)	0.088	m
			thick is Sufficient	
Eff Depth	de	bsth*1000-covraft	185	mm
Area of Steel				
Min Steel	Astmin	0.24	0.24	%



All dimensions are in 'mm'

Concrete mix V.R.C.C M30

Steel Fe–415

Reinforcement Details shall be as per IS – SP34

30 KL SUMP

SCHEME :CPWS Schemes	
LOCATION: Adilabad District	
DWG.NO.	

"APPROVED" 19/4/14

Design Of 20 KL Capacity Sump at

(WITH FLAT TOP SLAB)

Data Not more than 5m Span

Location						
Safe bearing Capacity	sbc	safe for sbc		100	Kn/m^2	
Capacity	v			20	KL	
Free Board	fb			0.30	m	
Dead Storage	ds			0.30	m	
Dia of sump	d			4.00	m	
Projection of Bottom slab from side wall			ps = d/16 to d/8	0.25	m	OK
Depth of tank above GL	dgl	No uplift check required		1.00	m	
Depth of Water table below GL,	wl		Safe Against Uplift	0.90	m	
Depth of the tank	h			2.20	m	1.20
Thickness of Slab	td	Min 150mm thick	OK	0.150	m	0.097 m
Th. Of Side wall	sth	Min 150mm thick	OK	0.150	m	0.069 m
Th. Of Bottom Slab	bsth	Min 150mm thick	thick is Sufficient OK	0.25	m	0.000 m

Top Slab

						slab projection
Radius of Top slab	rs			2.00		0.15 m
Thickness of Slab	td	Min 150mm thick	OK	0.15	m	0.097 mm is required
Effective depth of slab	d			100	mm	
Total Load on slab		Self wt		3.75	kN/sqm	
		Live load		1.5	kN/sqm	
		Finishings		1	kN/sqm	
	w	Total load		6.25	kN/sqm	
Bending Moment	bm	(2/16*w*rs^2)		3.13	kN-m/m	
Area of Steel required	ast	(bm/(σstjd)		279	sqmm/m	
		σst	N/mm2	130.00	N/sqmm	
		j=1-k/3		0.86		
		k=1/1+σst/mσcbc		0.42		
		m=280/3σcbc		9.33		
		σcbc		10	N/sqmm	
		Grade of steel	Fe 415 , σst=	130	N/sqmm	
		Grade of Concrete	M 30			

Dia of Reinforcement	db	10mm					
Spacing required	min of	150 mm	280 mm	floor to	10mm		
Spacing provided			OK	150	mm	c/c	

Provide 10 mm dia Tor @ 150 mm C/c both radially and in the form of circular rings

Side Wall

Depth of the tank	h		2.2	m	
Th. Of Side wall	sth	Min 150mm thick	0.15	m	0.069 mm
Depth of tank above GL	dgl		1.00	m	
Moments					
	Inner Side		1.55	Kn-m	
	Outer Side		1.1	Kn-m	
Hoop force					
	Inner Side		30.72	Kn	(Tension)
	Outer Side		18.11	Kn	(Compression)

Reinforcement				Dia	Spacing Provided	floor to
Inner face	Vertical	(Min 10mm dia)	240 mm^2	10 mm	150 mm	50
	Horizontal		180 mm^2	10 mm	150 mm	50
Outer face	Vertical	(Min 10mm dia)	240 mm^2	10 mm	150 mm	50
	Horizontal		180 mm^2	10 mm	150 mm	

Bottom slab Min 150mm thick

Safe bearing Capacity	sbc		100	Kn/m^2	
Th. Of Bottom Slab	bsth	thick is Sufficient	0.250	m	0.000 m
Dia of Bottom Slab	dbs		4.80	m	
Size of Haunch	bh		0.25	m	
effective cover to reinforcement for raft slab		covraft	65	mm	
Moments Radial			2.49	Kn-m	
Circumferential			2.39	Kn-m	

			Ast (Min 10mm dia)	Dia	Spacing Provided	floor to	
Reinforcemer Top	mesh		300 mm^2	10 mm	225 mm	25	150
Bottom	mesh		300 mm^2	10 mm	200 mm	50	200

Provide 10 mm dia TOR @ 150 mm C/c on both faces in staggered fashion

Design Of Bottom Slab

CASE-1

Projection from side wall	ps			0.25	m
Dia of Bottom Slab	dbs	d+2*sth+2*ps		4.80	m
Size of Haunch	bh			0.25	m
Dia of Bar top	dbbs			10	mm
bottom	dbbsb			10	mm
Net Load on Bottom Slab					
Wt of Top Slab		pi/4*(d+sth+topproj)^2*td*25		62.32	Kn
Wt Of Side wall		pi*(d+sth)*sth*(h-dtrb)*25		97.78	Kn
Wt of Haunch		pi*(d-bh)*bh^2/2*25		9.21	Kn
Total Load	wbs			169.31	Kn
LL on TOP slab		pi/4*(d+sth+topproj)^2*LL		36.30	Kn
				2.056	sq m 0.158
Effective foundation width of sidewall load on bottom slab, ewf			ps+sth+bh+bsth=	0.900	m
Max Pr on Soil	prb	Wbs/(pi*(d+sth)*ewf)		14.43	Kn/m^2

Bottom Slab is designed as circular Slab loaded with UDL and Simply Supported on edges

			r	2.075		1.95
Radial moment	mri	3/16*prb*((dbs/2)^2-((d+sth)/2)^2)-wbs/(8*pi)*(2*l		-2.49	mrb	-2.38 Kn-m
Circuferential Moment	mti	1/16*prb*(3*(dbs/2)^2-((d+sth)/2)^2)-wbs/(8*pi)*(2		-2.39	mtb	-2.38 Kn-m
Max Radial Moment	mr	IF(wl>hbgl,0,CEILING(3*prb*(dbs/2)^2/16,0.01))		2.49	Kn-m	
Max Circumferential mon	mt	IF(wl>hbgl,0,CEILING(prb*(dbs/2)^2/16,0.01))		2.39	Kn-m	

Base Slab Th for Uncracked Condition

Th	bsthr	IF(mr=0,sth*1000,(max(mr,mt)*6*10^6/(2*10^3))^		0.087	m
				Provided th is Sufficient	
Eff Depth	de	bsth*1000-covraft		185	mm
Area of Steel					
Min Steel	Astmin		0.24	0.24	%
				300	mm^2
Area of Steel	Astr	mr*10^6/(130*.87*de)		121	mm^2
Spacing					
Top Steel	Asttp	pi*(dbbs^2/4)*1000/max(Astmn,astr)		262	mm
Provide 10 mm dia TOR @ 225 mm c/c in the form of mesh at top					
Bottom Steel	Astb	pi*(dbbsb^2/4)*1000/(Astmin)		262	mm
Provide 10 mm dia TOR @ 200 mm c/c in the form of mesh at bottom					

Check For SBC

Load from tank Portion	wbs			169.31	Kn
Weight of Bottom Slab	wbsi	pi*(dbs^2/4)*bsth*25		113.1	Kn
Weight of water	ww	pi*(d^2/4)*h*10		276.46	Kn
Total	W	wbs+wbsi+ww		558.87	Kn
Pr on Soil	pr s	w/(pi*dbs^/4)	safe for sbc	30.89	Kn/m^2

CASE-2

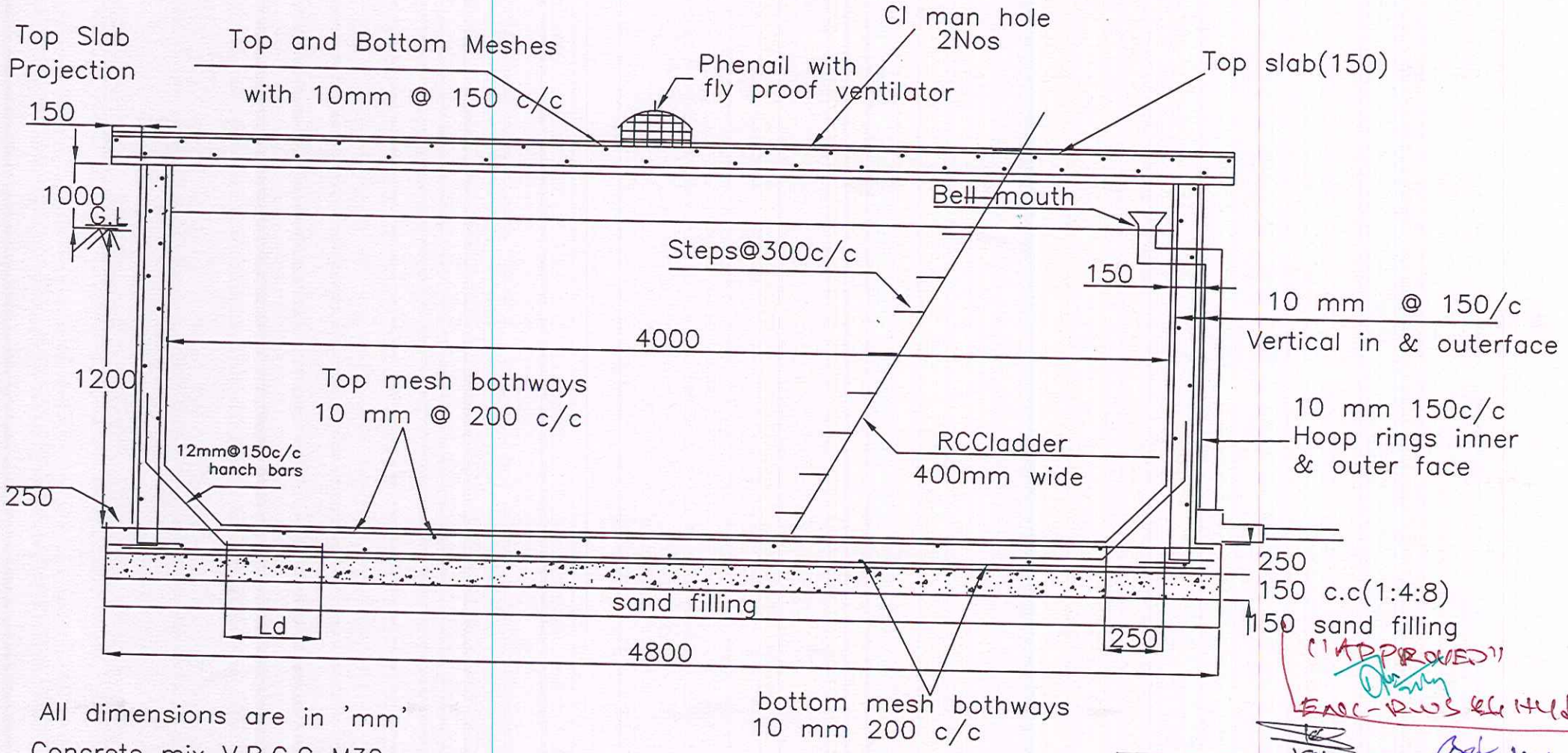
Bottom Slab is designed as circular Slab loaded with Uplift and continuous Supported on edges

Load on Bottom Slab (Uplift)

Max Pr on Soil	pru	10*(h-dgl-wl)-bsth*25	No uplift check rec	0.00	Kn/m^2
			r	2.075	
Radial moment	mru	2/16*pru*(r)^2		0	
Circuferential Moment	mtu	1/16*pru*(r)^2		0	

Base Slab Th for Uncracked Condition

Th	bsthr	IF(mru=0,sth*1000,(max(mr,mt)*6*10^6/(2*10^3))		0	m
				thick is Sufficient	
Eff Depth	de	bsth*1000-covraft		185	mm
Area of Steel					
Min Steel	Astmin		0.24	0.24	%



All dimensions are in 'mm'

Concrete mix V.R.C.C M30

Steel Fe–415

Reinforcement Details shall be as per IS – SP34

20 KL SUMP

SCHEME :CPWS Schemes	
LOCATION: Adilabad District	
DWG.NO.	

"APPROVED"
EE&C-RWS&SH Hyd
19/4/14
19/4/14

Design Of 5 KL Capacity Sump at

(WITH FLAT TOP SLAB)

Not more than 5m Span

Data

Location

Safe bearing Capacity	sbc	safe for sbc		100	Kn/m^2	
Capacity	v			5	KL	
Free Board	fb			0.30	m	
Dead Storage	ds			0.30	m	
Dia of sump	d			2.00	m	
Projection of Bottom slab from side wall			ps = d/16 to d/8	0.15	m	OK
Depth of tank above GL	dgl	No uplift check required		1.00	m	
Depth of Water table below GL,	wl		Safe Against Uplift	0.90	m	
Depth of the tank	h			2.20	m	1.20
Thickness of Slab	td	**Min 150mm thick**	OK	0.150	m	0.048 m
Th. Of Side wall	sth	**Min 150mm thick**	OK	0.150	m	0.051 m
Th. Of Bottom Slab	bsth	Min 150mm thick	thick is Sufficient OK	0.20	m	0.000 m

Top Slab

						slab projection
Radius of Top slab	rs			1.00		0.15 m
Thickness of Slab	td	**Min 150mm thick**	OK	0.15	m	0.048 mm is required
Effective depth of slab	d			100	mm	
Total Load on slab		Self wt		3.75	kN/sqm	
		Live load		1.5	kN/sqm	
		Finishings		1	kN/sqm	
	w	Total load		**6.25**	kN/sqm	
Bending Moment	bm	(2/16*w*rs^2)		0.78	kN-m/m	
Area of Steel required	ast	(bm/(σstjd)		70	sqmm/m	
		σst	N/mm2	130.00	N/sqmm	
		j=1-k/3		0.86		
		k=1/1+σst/mσcbc		0.42		
		m=280/3σcbc		9.33		
		σcbc		10	N/sqmm	
		Grade of steel	Fe 415 , σst=	130	N/sqmm	
		Grade of Concrete	M 30			

Dia of Reinforcement	db	10mm					
Spacing required	min of	150 mm	1120 mm	floor to	10mm		
Spacing provided			OK	150	mm	c/c	

Provide 10 mm dia Tor @ 150 mm C/c both radially and in the form of circular rings

Side Wall

Depth of the tank	h		2.2	m	
Th. Of Side wall	sth	**Min 150mm thick**	0.15	m	0.051 mm
Depth of tank above GL	dgl		1.00	m	

Moments

	Inner Side	0.84	Kn-m	
	Outer Side	0.645	Kn-m	

Hoop force

	Inner Side	17.08	Kn	(Tension)
	Outer Side	11.79	Kn	(Compression)

Reinforcement

				Dia	Spacing Provided	floor to
Inner face	Vertical	(Min 10mm dia)	240 mm^2	10 mm	150 mm	50
	Horizontal		180 mm^2	10 mm	150 mm	50
Outer face	Vertical	(Min 10mm dia)	240 mm^2	10 mm	150 mm	50
	Horizontal		180 mm^2	10 mm	150 mm	

Bottom slab Min 150mm thick

Safe bearing Capacity	sbc		100	Kn/m^2	
Th. Of Bottom Slab	bsth	thick is Sufficient	0.200	m	0.000 m
Dia of Bottom Slab	dbs		2.60	m	
Size of Haunch	bh		0.20	m	
effective cover to reinforcement for raft slab		covraft	65	mm	
Moments Radial			1.36	Kn-m	
Circumferential			1.26	Kn-m	

			Ast (Min 10mm dia)	Dia	Spacing Provided	floor to	
Reinforcemei	Top	mesh	240 mm^2	10 mm	200 mm	25	150
	Bottom	mesh	240 mm^2	10 mm	250 mm	50	200

Provide 10 mm dia TOR @ 150 mm C/c on both faces in staggered fashion

Design Of Bottom Slab

CASE-1

Projection from side wall	ps			0.15	m
Dia of Bottom Slab	dbs	d+2*sth+2*ps		2.60	m
Size of Haunch	bh			0.2	m
Dia of Bar top	dbbs			10	mm
bottom	dbbsb			10	mm
Net Load on Bottom Slab					
Wt of Top Slab		pi/4*(d+sth+topproj)^2*td*25		19.91	Kn
Wt Of Side wall		pi*(d+sth)*sth*(h-dtrb)*25		50.66	Kn
Wt of Haunch		pi*(d-bh)*bh^2/2*25		2.83	Kn
Total Load	wbs			73.4	Kn
LL on TOP slab		pi/4*(d+sth+topproj)^2*LL		10.39	Kn
				0.838	sq m 0.124
Effective foundation width of sidewall load on bottom slab, ewf		ps+sth+bh+bsth=		0.700	m
Max Pr on Soil	prb	Wbs/(pi*(d+sth)*ewf)		15.52	Kn/m^2

Bottom Slab is designed as circular Slab loaded with UDL and Simply Supported on edges

			r	1.075		0.95
Radial moment	mri	3/16*prb*((dbs/2)^2-((d+sth)/2)^2)-wbs/(8*pi)*(2*l		-1.36	mrb	-1.25 Kn-m
Circuferential Moment	mti	1/16*prb*(3*(dbs/2)^2-((d+sth)/2)^2)-wbs/(8*pi)*(2		-1.26	mtb	-1.25 Kn-m
Max Radial Moment	mr	IF(wl>hbgl,0,CEILING(3*prb*(dbs/2)^2/16,0.01))		1.36	Kn-m	
Max Circumferential mon	mt	IF(wl>hbgl,0,CEILING(prb*(dbs/2)^2/16,0.01))		1.26	Kn-m	

Base Slab Th for Uncracked Condition

Th	bsthr	IF(mr=0,sth*1000,(max(mr,mt)*6*10^6/(2*10^3))^		0.064	m
				Provided th is Sufficient	
Eff Depth	de	bsth*1000-covraft		135	mm
Area of Steel					
Min Steel	Astmin		0.24	0.24	%
				240	mm^2
Area of Steel	Astr	mr*10^6/(130*.87*de)		91	mm^2
Spacing					
Top Steel	Asttp	pi*(dbbs^2/4)*1000/max(Astmn,astr)		328	mm
Provide 10 mm dia TOR @ 200 mm c/c in the form of mesh at top					
Bottom Steel	Astb	pi*(dbbsb^2/4)*1000/(Astmin)		328	mm
Provide 10 mm dia TOR @ 250 mm c/c in the form of mesh at bottom					

Check For SBC

Load from tank Portion	wbs			73.4	Kn
Weight of Bottom Slab	wbsi	pi*(dbs^2/4)*bsth*25		26.55	Kn
Weight of water	ww	pi*(d^2/4)*h*10		69.12	Kn
Total	W	wbs+wbsi+ww		169.07	Kn
Pr on Soil	pr s	w/(pi*dbs^/4)	safe for sbc	31.85	Kn/m^2

CASE-2

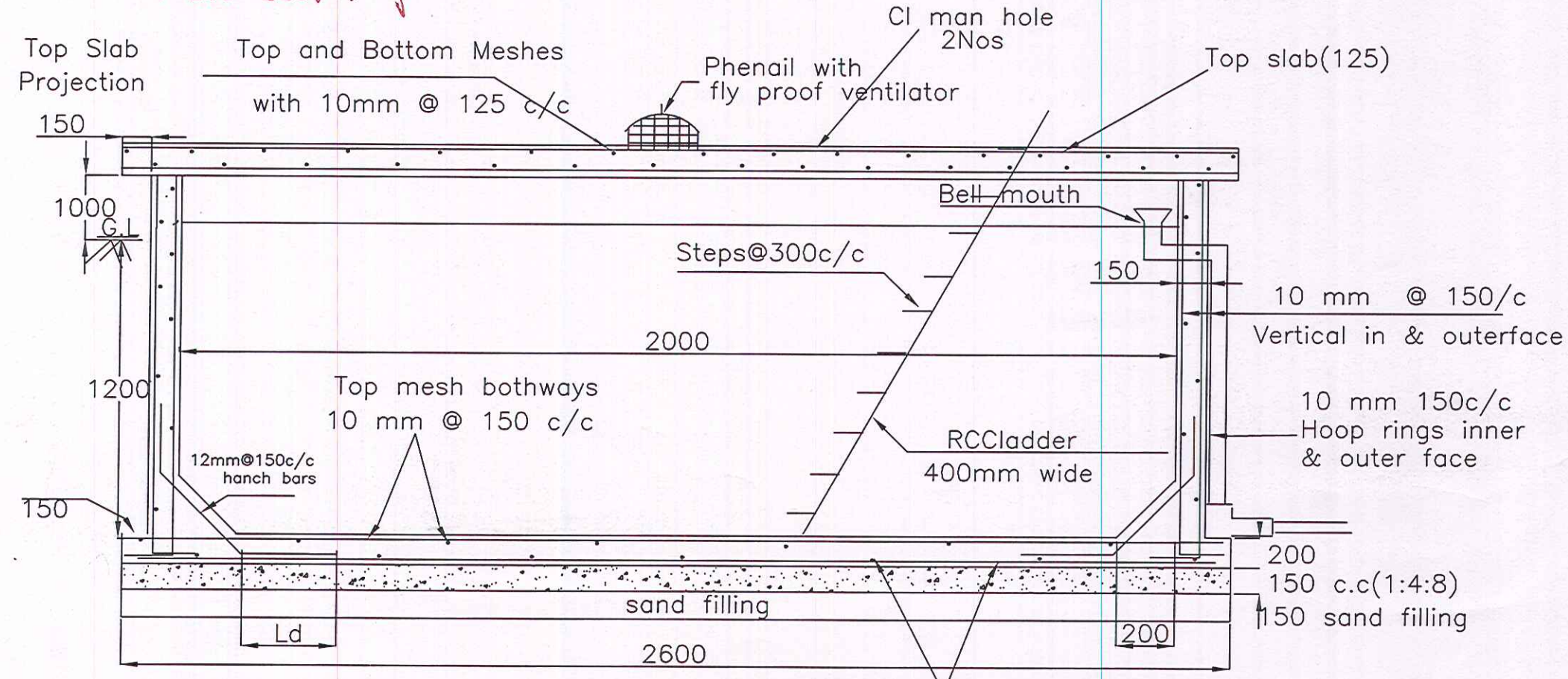
Bottom Slab is designed as circular Slab loaded with Uplift and continuous Supported on edges

Load on Bottom Slab (Uplift)

Max Pr on Soil	pru	10*(h-dgl-wl)-bsth*25	No uplift check rec	0.00	Kn/m^2
			r	1.075	
Radial moment	mru	2/16*pru*(r)^2		0	
Circuferential Moment	mtu	1/16*pru*(r)^2		0	

Base Slab Th for Uncracked Condition

Th	bsthr	IF(mru=0,sth*1000,(max(mr,mt)*6*10^6/(2*10^3))		0	m
				thick is Sufficient	
Eff Depth	de	bsth*1000-covraft		135	mm
Area of Steel					
Min Steel	Astmin		0.24	0.24	%



All dimensions are in 'mm'

Concrete mix V.R.C.C M30

Steel Fe–415

Reinforcement Details shall be as per IS – SP34

5KL SUMP

SCHEME :CPWS Schemes
LOCATION: Adilabad District
DWG.NO.-