Design Of 150 KL Capacity Sump at

Data						
Location						
Safe bearing Capacity	sbc		Safe	100 Kn/m^2		
Capacity	v			150 KL		
Free Board	fb			0.25 m		
Dead Storage	ds			0.20 m		
Dia of sump	d			9.00 m		
Projection from side wall	ps			0.15 m		
Depth of the tank	h			2.85 m		
Depth of tank above GL	dgl			0.50 m		
Depth of tank below GL				2.35 m		
thickness of PCC (lean mix cc1:6:10)		couter wt		0.00 m		
Th. Of Bottom Slab	bsth	Provided th is Sufficient		0.200 m		0.13 m
Depth of Water table below GL	wl	Safe Against Uplift		2.00 m		
Top Dome						
Rise of the dome				1.40		
Radius of the dome				7.93		
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		140 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		2.85 m			
Th. Of Side wall	sth		0.200 m		144 mm	
Depth of tank above GL	dgl		0.50 m			
Moments						
		Inner Side	5.65 Kn-m			
		Outer Side	6.873 Kn-m			
Hoop force						
		Inner Side	76.8 Kn	(Tension)		
		Outer Side	89.19 Kn	(Compression)		

Reinforcement			Dia	Spacing Provided	Required
Inner face	Vertical	334 mm^2	10 mm	200 mm	200
	Horizontal	296 mm^2	10 mm	200 mm	200
Outer face	Vertical	406 mm^2	10 mm	175 mm	190
	Horizontal	296 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		0.200 m		0.13 m
Dia of Bottom Slab	dbs			9.70 m		
Size of Haunch.	bh			0.25 m		
effective cover to reinforcement for raft slab			covraft	67 mm		
Moments	Radial			5.54 Kn-m		
	Circumferential			5.54 Kn-m		

Reinforcement		Ast	Dia	spacing Provided	Required
	Top mesh	369 mm^2	12 mm	200 mm	200
	Bottom mesh	240 mm^2	10 mm	200 mm	200

Design Calculations

Top Dome				
Chord Dia of the Dome	dcd		9.00 m	
Rise of the Dome	hd		1.40 m	
Radius of the Dome	rd		7.93 m	
Theta	th	$\sin^{-1}$(dcd/(2*rd))	34.56 Degrees	
Sin(theta)			0.57	
Cos(theta)			0.83	
Dead load on dome			3.13 Kn/m^2	
Live Load			1.50 Kn/m^2	
Total Load	wd		4.63 Kn/m^2	
Meridinal Stress	Ts	wd*rd*10^3/((1+cos(th))*td*10^6)	0.17 N/mm^2	Safe
Maximum Hoop Stress	Hs	wd*rd*10^3/(2*td*10^6)	0.15 N/mm^2	Safe
Ast			300 mm^2	
Top Ring Beam				
Maximum Hoop Tension	Ht	Ts*td*cos(th)*dcd/2	79.37 Kn	
Area of steel required	asttrb	Ht/130	610.53 mm^2	
No of bars		asttrb/(pi*dbrb^2/4)	6 Nos	
Provide 8 Nos of 12 mm dia tor and provde 8 mm dia stirrups @ 200 C/c				
Actual Area of Steel Provided	aastrb		905 mm^2	
Area of ring beam required	Arb	(Ht*1000-(m-1)*aastrb*1.5)/1.5	42052.50 mm^2	
Assuming a Square section				
Size of beam		Arb/rb	140.18 mm	
			Provided size is sufficient	
Side Wall				
Depth of the tank	h		2.85 m	
Dia of inner face bars	dbi		10 mm	
Dia of outer face bars	dbo		10 mm	
Dia of bars for hoop	dbh		10 mm	
H^2/Dt			4.52	

CASE I : Inside Water and Outside no Earth

From Table of IS 3370 Coefficients

For H^2/Dt			4	4.52	5
Max BM	bmcf		0.0268	0.02441	0.0222
	bmcfp		0.0077	0.00677	0.0059
Max Ring Tension	rtcf		0.5790	0.59876	0.6170
Max. -ve BM	mbm	(bmcf*10*h^3)			5.65 Kn-m
Max +ve BM	mpbm	(bmcfp*10*h^3)			1.57 Kn-m
Max. Ring Tension	mrt	(rtcf*10*h*d/2)			76.8 Kn

CASE II OUT SIDE SATURATED EARTH AND INSIDE EMPTY

Unit weight of Soil	γ_s		18	Kn/m^3
Angle of Repose	Phi		30	°
Side wall ht below GL	hbgl	h-dgl	2.35	m
Coeff. Of actie Earth pr	Ka	(1-sin(Phi))/(1+sin(Phi))	0.34	
	Pa	IF(wl>hbgl,Ka*gs*hbgl,Ka*gs*hbgl+hbg	37.88	Kn/m^2
			3.07	

IS 3370 Coefficients

For H^2/Dt		3.0	3.1	4.0
	bmcfs	0.0333	0.03285	0.0268

	bmcfps		0.0097	0.00956	0.0077			
Max Ring Tension	rtcfs		0.519	0.5232	0.579			
Max. -ve BM	mbms	(bmcfs*pas*hbgl^2)			6.87	Kn-m		
Max +ve BM	mpbms	(bmcfps*pas*hbgl^2)			2.00	Kn-m		
Max. Ring compression	mrts	rtcfs*pas*d/2			89.19	Kn		
Th. Of Side Wall		(MAX(mbm,mbms)*10^6*6/(2*1000))^0.			144	mm		
					Th. Provided is Sufficient			
Eff Th. Of Side wall	edswi				150	mm		
Max Inner face moment	bmi	MAX(mpbms,mbm)			5.65	Kn-m		
Max outer face moment	bmo	MAX(mpbm,mbms)			6.87	Kn-m		
Area of Steel								
Reinforcement								
Min Steel	pt	0.24% for <15m span 0.35%		0.24	0.12	%		
Area of BendingSteel inner sid	Astm	MAX(pt*sth*10^4,bmi*10^6/(130*0.87*e			334	mm^2	on each side	
Area of steel outer face	Astpbm	MAX(pt*sth*10^4,(bmo*10^6/(130*0.87			406	mm^2	on each side	
Area of Steel for Hoop	Asth	MAX(pt*sth*10^4,CEILING(mrt*1000/13			591	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)			190	mm		
Provide 10 mm dia TOR @ 190 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			9.70	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			322.74	Kn		
Wt of Ring Beam		pi*(d+rb/1000)*rb*drb*25/10^6			65.74	Kn		
Wt Of Side wall		pi*(d+sth)*sth*(h-dtrb)*25			368.5	Kn		
Wt of Haunch		pi*(d-bh)*bh^2/2*25			21.48	Kn		
Total Load	wbs				778.46	Kn		
					7.78	sq m	0.22075	
Max Pr on Soil	prb	Wbs/(pi*(d)*1)			27.53	Kn/m^2		
Bottom Slab is designed as circular Slab loaded with UDL and Simply Supported on edges								
				r	4.6		3.85	
Radial moment	mri	3/16*prb*((dbs/2)^2-((d+sth)/2)^2)-wbs/			-1.39	mrb	5.54	Kn-m
Circuferential Moment	mti	1/16*prb*(3*(dbs/2)^2-((d+sth)/2)^2)-wb			5.15	mtb	5.54	Kn-m
for uplift Net uplift load on bottom slab					0.5	Kn/m^2		
for uplift		max Radial moment			1.47		1.47	Kn-m
		max Circuferential Moment			1.47		1.47	Kn-m
Max Radial Moment	mr	IF(wl>hbgl,0,CEILING(3*prb*(dbs/2)^2/			5.54	Kn-m	1.47	Kn-m
Max Circumferential moment	mt	IF(wl>hbgl,0,CEILING(prb*(dbs/2)^2/16			5.54	Kn-m	1.47	Kn-m

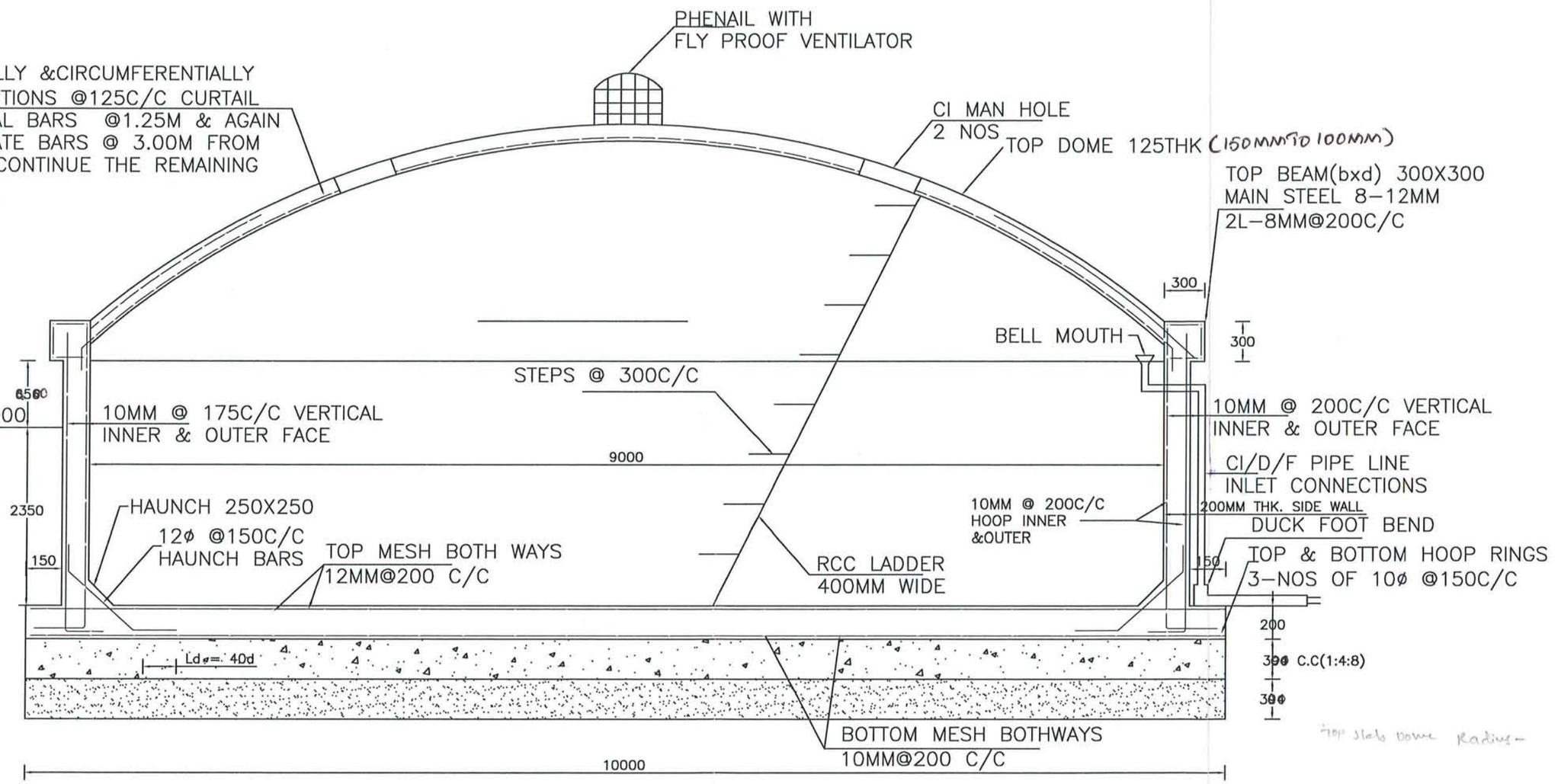
			sump-1	sump
Base Slab Th for Uncracked Condition				
Th	bsthr	IF(mr=0,sth*1000,(max(mr,mt)*6*10^6/(	0.129 m	0.067 m
			Provided th is Sufficient	
Eff Depth	de	bsth*1000-covraft	133 mm	
Area of Steel				
Min Steel	Astmin	0.24% for <15m span 0.35% 0.24	0.24 %	
		min for TOP STEEL =	480 mm^2	
		min for TOP STEEL =	240 mm^2	
Area of Steel	Astr	mr*10^6/(130*.87*de)	369 mm^2	
Spacing				
Top Steel	Asttp	pi*(dbbs^2/4)*1000/max(Astmn,astr)	200 mm	
Provide 12 mm dia TOR @ 200 mm c/c in the form of mesh at top				
Bottom Steel	Astb	pi*(dbbsb^2/4)*1000/(Astminb)	200 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		778.46 Kn	
Weight of Bottom Slab	wbsi	pi*(dbs^2/4)*bsth*25	369.48 Kn	
Weight of water	ww	pi*(d^2/4)*h*10	1813.04 Kn	
Total	W	wbs+wbsi+ww	2960.98 Kn	
Pr on Soil.	pr s	w/(pi*dbs^/4)	40.07 Kn/m^2	Safe
Check For Uplift				
Depth of Water	dw	h-hgl-wl+bsth	0.55 m	
Wt of Sump upto side walls only	We	wbs-wtdome+wbsi	825 Kn	
Uplift Pr	Pu	pi*dbs^2/4*dw*10	406 Kn	
Resisting load		cc wt+str wt	825 Kn	
Factor of Safety against Uplift	F	We/Pu	2.04	
			Safe Against Uplift	

Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad

150KL SUMP



Top slab Dome Radius =

All dimenstions are in 'mm'
Concrete mix V.R.C.C M30
Steel Fe-415
Reinforcement details shall be as per IS-SP34

Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad

"APPROVED"
SE, TDWSP
NIRMAL

LARSEN & TOUBRO LIMITED Construction - Chennai

CHECKED BY	SIGN	DATE
CIVIL & STRUCTURAL		
MECHANICAL		
ELECTRICAL		
INSTRUMENTATION		

REV.NO.	DESCRIPTION	DESIGNED	DRAWN	CHECKED	APPROVED
A	FOR INFORMATION				

REVISIONS

L&T Construction
Water, Smart World & Communication.

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

PROJECT: PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT (PRIMARY GRID)

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

JOB No	LE150883		
NAME	SIGN	DATE	

TITLE: WANKIDI MANDAL - DODDIGUDA
SUMP - 150KL

SCALE | PROJECTION

DRAWING NO. LE150883-C-WS-RW-DC-1202 | SIZE A3 | REV. A

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