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

TELANGANA WATER GRID

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

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

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

JOB Ref. No. : LE150883

	NAME	SIGN	DATE
DSGN			
CHKD			
APPD			

TITLE :

DESIGN OF OHBR(BPT) - 300KL CAPACITY AT BELLAMPALLY MANDAL KATTERLA

DOC./DRG. No.

LE150883-C-WS-RW-DC-1601

SIZE: A4 | REV.: A

RELEASED FOR

- [ ] PRELIMINARY
- [ ] INFORMATION
- [x] APPROVAL
- [ ] CONSTRUCTION

Submitted sir,

Sub: RWS&S-TDWSP- Katterla 300KL OHBR in Bellampally Mandal– Komarambheem Asifabad Segment-Adilabad District-Designs -Approval-Reg.

*****

Kindly pursue the Designs of the following 300KL OHBR at Katterla (V), Bellampally (M), submitted by the Executive Engineer TDWSP Asifabad Division, Adilabad district for approval.

1. 300 KL OHBR.

The Executive Engineer TDWSP Asifabad Division has submitted Structural Designs & Drawings of 300KL OHBR based on the field conditions and as per the estimate provisions , the structural designs & drawings for the above structure is verified with RWS&S standard Type Designs and submitted for approval.

The following design parameters were considered:

- Capacity : 300KL
- Net SBC of Soil : 25.0 t/sqm
- Grade of concrete & Steel : M 30 & Fe 500
- Height of staging : 30 mts
- Dia of Shaft Inner to Inner : 7 mts
- Dia of Tank Inner to Inner : 10.5mts
- Thickness of shaft :300mm
- Dome Top Slab thickness: 125mm
- Bottom dome Slab thickness : 200 mm
- Raft Slab thickness: 700mm

As per the above parameters the structural design and drawings of the OHBR is verified, as per similar Type designs available and approved by the RWS&S Department considering the SBC and type of soil, duly following IS codes, IS: 456-2000, SP:16, 34, IS:3370 and IS 1893-2002 (seismic codes).The sizes and steel proposed in the designs and drawings of all components are safe and sufficient.

The additional points noted after checking the designs are:

- The staging of above structures subjected to approval only after confirmation of hydraulics and should then be grounded.

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

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

AEE (Designs) TDWSP,Nirmal Circle	DEE (Designs) TDWSP,Nirmal Circle	30/4/16 Superintending Engineer, TDWSP,Nirmal Circle

DESIGN CALCULATION

PROJECT TITLE

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

UNIT

300 KL ESR

DCI NO: -

PRINCIPAL CLIENT

RURAL WATER SUPPLY
AND
SANITATION DEPARTMENT,
TELANGANA

CONTRACTOR

L&T CONSTRUCTION
WATER & EFFLUENT TREATMENT SBG

DESIGN OF 300 KL E.S.R AT KATTERLA

BASIC DATA:

CAPACITY = 300 KL

HEIGHT OF STAGING = 30 M

ESR on Shaft

FREE BOARD = 0.3 M

DEAD STORAGE = 0.3 M

WIND SPEED = 44 M/Sec

SBC: 250 KN/M2 AT 3.0 M DEPTH AS PER SOIL REPORT

CONTAINER DESIGN

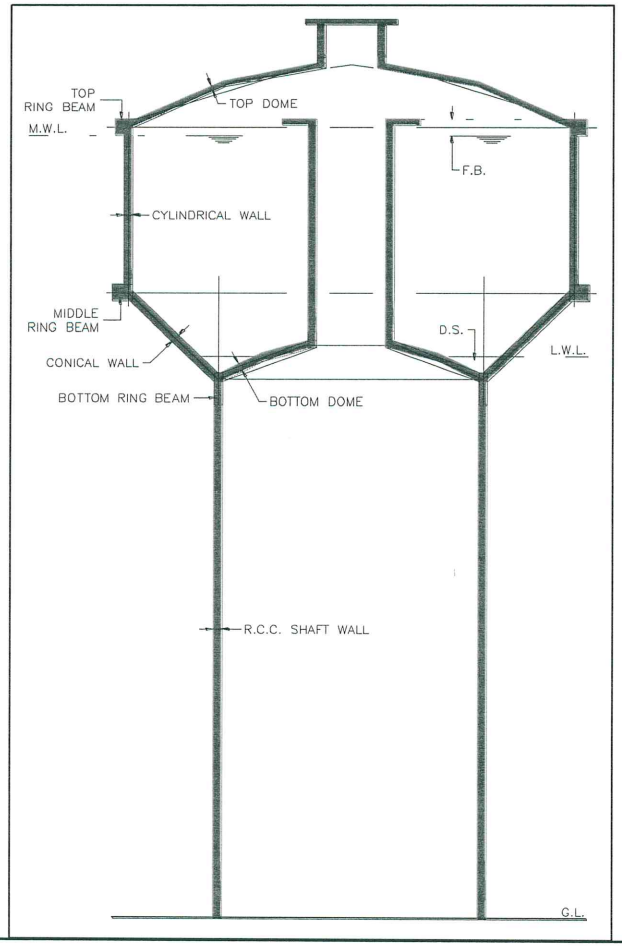
ESR : 300 LAC CAPACITY - 30M HIGH					FORMULA
EPC CONTRACTOR					
PROJECT: PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT (30 MLD WTP)	ESR AT	CLIENT			
	KATTERLA	RURAL WATER SUPPLY AND SANITATION DEPARTMENT, TELANGANA			
STRUCTURE	DESIGN CALCULATION FOR ESR	DATE		REV	
		4/2/2016		0	

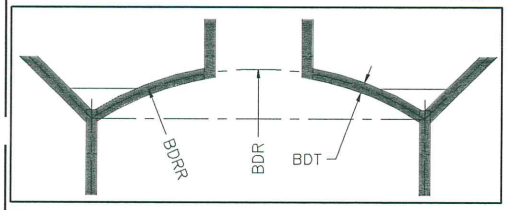
DESIGN CALCULATION

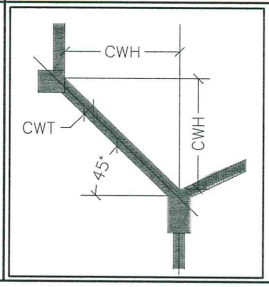
DATA

General Data				
Required Capacity of ESR	ESRcap	**300.000**	m3	As per tender Specification
Staging Height required	ESRstgh	**30.000**	m	As per tender Specification
Location				
Hydraulic Features				
Ground Level	GL	**0.00**	m	
Low Water Level (LWL)	LWL	30.00	m	
Maximum Water Level (MWL)	MWL	**34.413**	m	
Dead Storage	Ds	**0.30**	m	
Free Board	FB	**0.30**	m	
Basic Shape :	Intze type ESR of Shaft staging			REFER SKETCH ON NEXT PAGE
Material Data				
unit weight of concrete	uwc	**25.000**	kN/m3	
unit weight of water	uww	**10.000**	kN/m3	
unit weight of plaster	uwp	**21.000**	kN/m3	
grade of concrete of container	fck	**30.000**	N/mm2	As per IS 3370 -2009
grade of concrete of Shaft	fcks	**30.000**	N/mm2	
grade of concrete of raft	fckr	**30.000**	N/mm2	

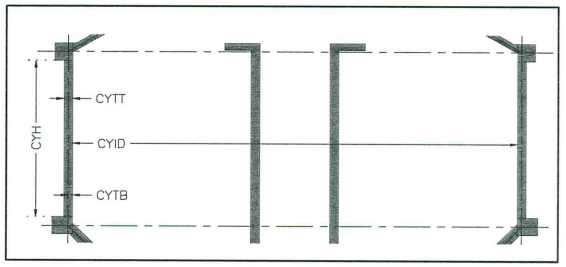
ESR : 300 LAC CAPACITY - 30M HIGH	FORMULA
load Data	
A> LIVE LOAD	
live load at roof (top dome) llf **1.500** kN/m2	(As per IS 875 - part 2)

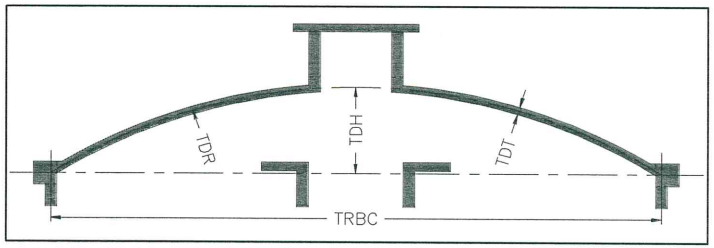


ESR : 300 LAC CAPACITY - 30M HIGH				FORMULA
Geometry Data				
SHAFT				
height above FGL	sha	30.000	m	As per tender Specification
depth of foundation below FGL	shb	3.000	m	
diameter c/c	sd	**7.000**	m	
thickness	st	**0.250**	m	
BOTTOM DOM				
thickness	bdt	**0.200**	m	
central rise	bdr	**1.100**	m	
radius of bottom dome	bdrr	6.118	m	
				= ((sd/2)^2 + bdr^2) / 2/ bdr
Theta1 in angle		34.894	Degree	
theta1 in radian	th1	0.609	radian	=ACOS((bdrr-bdr)/bdrr)
depth of dead storage	dds	0.300	m	
CONICAL WALL				
height	cwh	**1.750**	m	
thickness	cwt	**0.300**	m	
angle with horizontal	cwa	**45.000**	degree	

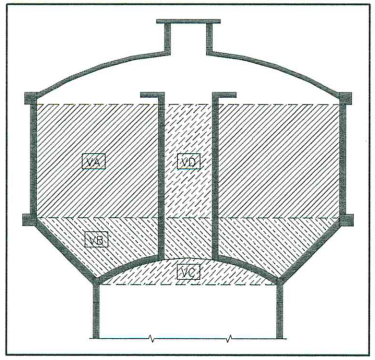


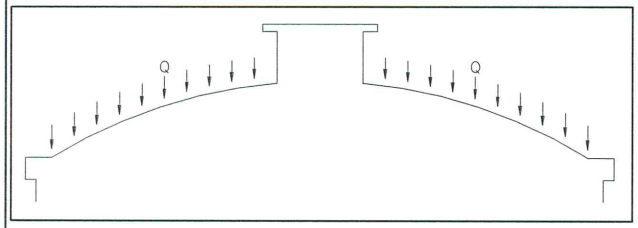
ESR : 300 LAC CAPACITY - 30M HIGH				FORMULA
CYLINDRICAL WALL				
inner diameter	cyid	10.500	m	
top thickness	cytt	**0.200**	m	
bottom thickness	cybt	**0.200**	m	
height between ring beam	cyh	**2.600**	m	
coefficient of constant height	cyc	**0.000**		
free board		0.300	m	
	fbchk	2.000		
TOP DOM				
central rise	tdh	**1.600**	m	
top dome thickness	tdt	**0.125**	m	



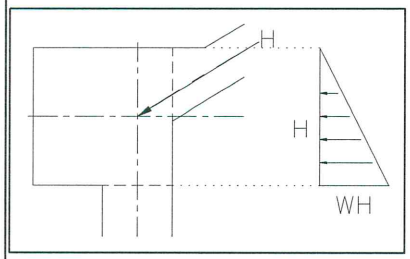


ESR : 300 LAC CAPACITY - 30M HIGH				FORMULA
CENTRAL SHAFT				
inner dia	csd	**1.900**	m	
height	csh	3.825	m	=cyxb+fb+cwh-ad
wall thickness	cst	**0.150**	m	
TOP RING BEAM				
diameter	trd	10.700	m	=cyid+cytt
width	trw	**0.350**	m	
depth	trdd	**0.300**	m	
MIDDLE RING BEAM				
diameter	mrd	10.700	m	=cyid+cytt
width	mrw	**0.550**	m	
depth	mrdd	**0.350**	m	
BOTTOM RING BEAM				
diameter	brd	7.000	m	=sd
width	brw	**0.400**	m	
depth	brdd	**0.600**	m	
plaster thickness	pt	**0.012**	m	
Permissible stress (As per IS 456 & IS 3370)				
Concrete				
Concrete grade -FCK		30	N/mm2	
per. stress in con. for direct comp	fckc	8.0	N/mm2	
per. stress in con in com.due to bending	fckbc	10.0	N/mm2	
per. stress in con. for direct tension	fckt	1.5	N/mm2	
per. stress in con. In ten due to bending	fcktb	2.0	N/mm2	
modulus of elasticity for container	em	2.74E+04	N/mm2	=5000*(fck)^0.5*100
Modulus of elasticity for shaft	ems	2.74E+04	N/mm2	=5000*(fcks)^0.5*100
per. tensile stress in steel - crack	fy	230	N/mm2	
per. Ten. str.- steel tension due to bending	fyc	130	N/mm2	
per. Ten. str.- steel tension due to direct ten	fyuc	130	N/mm2	
Modular ratio	md	9.33		
Dimension for minimum steel	Dmin	15.0	m	
Mass & Wt relation factor	g	9.810		

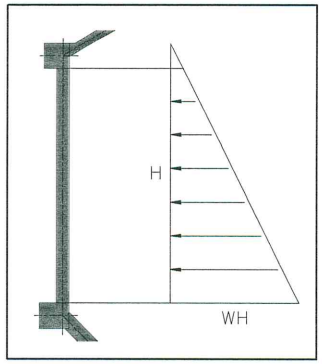
ESR : 300 LAC CAPACITY - 30M HIGH				FORMULA
[A] CAPACITY OF CONTAINER				
Volume Calculation				
Val = Volume of cylindrical portion Vb - Volume of frustum of cone Vc = Volume of bottom dome Vd = Volume of central shaft V = Va + Vb - Vc - Vd				
Detail calculation with effect of plaster thickness and thickness of RCC member is as under				
vertical level difference between center line and cylindrical wall inside starting point	cyxa	0.112	m	=cwt/2/0.7 0711 - cytt/2
depth of water in cylindrical portion	cyxb	2.66	m	=mrdd/2+cyh+trdd-fb-cyxa
volume of cylindrical portion	**va**	**229.53**	m3	=PI()/4 * (cyid-(pt*2))^2 * cyxb
volume of frustum of cone	**vb**	**105.33**	m3	=(cwh-pt)/3 *(vba1 +vba2+(vba1*vba2)^0.5)
top area of frustum of cone	vba1	86.19	m2	=PI()/4*(cyid-(pt*2))^2
bottom area of frustum of cone	vba2	38.22	m2	=PI()/4*(sd-(pt*2))^2
less for bottom dome	**vc**	**16.21**	m3	=PI() *vcad * ((vcae^2/8) + (vcad^2/6))
bottom dome volume calculation	vcaa	0.21	m	=((cwt/2)^2 * 2)^0.5
bottom dome volume calculation	vcab	0.12	m	=(bdt/2)/COS(th1)
bottom dome volume calculation	vcac	0.13	m	=(vcaa-vcab)/TAN(th1)
bottom dome volume calculation	vcad	0.89	m	=bdr-vcaa
bottom dome volume calculation	vcae	6.74	m	=sd-vcac*2
less for central shaft	**vd**	**13.69**	m3	=PI() /4*((csd+cst *2+pt*2)^2)*(csh-fb)
total volume	**vt**	**304.95**	m3	=va+vb-vc-vd
dead storage	vdd	2.80	m3	=PI()*sd*dds*(2*vcaa)
net volume	vn	302.15	m3	

ESR : 300 LAC CAPACITY - 30M HIGH				FORMULA
[C] TOP DOM DESIGN				
radius of top dome	Tdr	9.745	m	=(((cyid+cytt)/2)^2+tdh^2)/(2*tdh)
Center line diameter of top ring beam = in to in cylindrical wall + top thickness of cylindrical wall				
trbc = cyid + cytt		10.700	m	
central rise = tdh =		1.600	m	
theta at top ring beam lvl	Tdth1	0.581	radian	=ACOS((Tdr-tdh)/Tdr)
theta at top opening level	Tdth2	0.098	radian	=ASIN((csd/2)/Tdr)
self weight	Tddl	3.125	kN/m2	=tdt*uwc
Self wt = Thickness x density				
finish load	Tdfl	0.252	kN/m2	=pt*uwp
live load	Tdll	1.500	kN/m2	=llf
Total load = Self wt + Finish load + Live load	tdtt	4.877	kN/m2	=Tddl+Tdfl+Tdll
meridian force at ring beam				
				
due to udl	mftd1	-25.9	kN/m	=-(tdtt*Tdr)/(1+COS(Tdth1))
meridian force at crown opening level				
due to udl	mftd3	-23.8	kN/m	=-(tdtt*Tdr)/(1+COS(Tdth2))
hoop force at ring beam				
due to udl	hftd1	-13.8	kN/m	=(tdtt*Tdr)*(1/(1+COS(Tdth1))-COS(Tdth1))
hoop force at crown opening level				
due to udl	hftd3	-23.5	kN/m	=(tdtt*Tdr)*(1/(1+COS(Tdth2))-COS(Tdth2))

ESR : 300 LAC CAPACITY - 30M HIGH							FORMULA
	load due to udl of dome self wt of vent.		stress	perm. str in comp =	per. Stress in tension		
	A		B=A/tdt/10	C	D		
	kN		N/mm2	N/mm2	N/mm2		-Ve strees value = compression
meridian force at ring beam	-25.9		-0.207	8.0			+Ve strees value = tension
meridian force at crown opening level	-23.8		-0.191	8.0			
hoop force (circumferntial) at ring beam	-13.8		-0.111	8.0			
hoop force (circumferntial) at crown opening lev	-23.5		-0.188	8.0	1.5		
load calculation of top dome							
self wt	tdsw		306.1	kN			=Tdr*2*PI()*tdh*Tddl
finishing	tdtlf		24.7	kN			=Tdr*2*PI()*tdh*Tdfl
live load	tlltd		146.9	kN			=Tdr*2*PI()*tdh*Tdll
total load of dome	tdtl		477.8	kN			=tdsw+tdtlf+tlltd
reinforcement design							
Maximum out to out dia			11.200	m			
as moment is very small provide min r/f	tdf		0.240	%			=IF(cyid+2*trw<Dmin,0.24,0.35)
area of steel required	tdfar		3.000	cm2			=tdf * tdt * 100
area of steel provided	tdfap		3.351	**8**	dia	**150** c/c	=PI()*I219^2/4*1000/K219/100

ESR : 300 LAC CAPACITY - 30M HIGH						FORMULA
[D]TOP RING BEAM DESIGN						
diameter	trd	10.700	m			=+trd
width	trw	0.350	m			=+trw
depth	trdd	0.300	m			=+trdd
						0.83581
hoop force due to dome wt.	trbh1	115.757	kN/m			=-(mftd1)*COS(Tdth1)*(cyid+cytt)/2
hoop force - due to water	trbh2	2.363	kN/m			=trdd^2*cyid/2/2
total hoop force	trbh	118.119	kN/m			=Trbh1+Trbh2
area of steel - required	trastr	909	mm2			
dia of bar in top ring beam	tbdia	**12.000**	**0.000**		mm	
nos of bars in top ring beam	tbnos	**10.000**	**0.000**		nos	
Beam stirrups		dia	Spc			
		8 dia		**150** c\c		
area of steel - provided	trastp	1131	mm2			=PI()/4*tbdia^2*tbnos/100
actual Tensile stress in conc.		1.032	N/mm2			=+Trbh*1000/((trw*trdd*10000)+13*Trastp)
Tensile stress = Force / (Ac + (m-1)Ast)						
F= Hoop force						
Ac = Area of concrete						
m= Modular ratio						
Ast = Area of steel provided						
weight of top ring beam	tltrb	89.476	kN			=PI()*(cyid+trw)*trdd*trw*uwc

ESR : 300 LAC CAPACITY - 30M HIGH				FORMULA
[E]CYLINDRICAL WALL DESIGN				
height of wall	cyhh	2.600	m	=cyh+trdd
increment in thickness	cyith	0.000	m	=(cybt-cytt)/(1-cyc)/10
Hoop Force ; Wall free at Top and hinge at bottom condition				
F = coe x H x D / 2				
F= Hoop force				
H = Height of water above that section				
D = Diameter of wall at that section				
Ration H^2/DT		3.219		
Enter Value for Auto serach		**6.000**		
h				



hoop force

	sr. no	depth from top in meter	thickness at section	coeiffient	hoop force in wall = Coe. X rad * height * unit wt of liquid	area of steel required = force / 1300 in cm2	actual tensile stress in concrete = force/(thk*width+m*ast)	Minimum Area of steel in mm2 on each face
		m	mm		kN	mm2		
	1	0.260	0.200	0.062	8.4	65	0.040	240
Minimun % steel as per IS 3370-2009	2	0.520	0.200	0.170	23.2	178	0.110	240
	3	0.780	0.200	0.275	37.5	289	0.178	240
Maximum Dimension	4	1.040	0.200	0.373	50.9	392	0.242	240
11.600	5	1.300	0.200	0.453	61.9	476	0.294	240
Permissible dimension for 0.24 % steel	6	1.560	0.200	0.515	70.2	540	0.334	240
15.000	7	1.820	0.200	0.532	72.6	559	0.345	240
Minimum Steel	8	2.080	0.200	0.495	67.6	520	0.321	240
0.240	9	2.340	0.200	0.391	53.3	410	0.253	240
	10	2.600	0.200	0.220	30.0	231	0.143	240

ESR : 300 LAC CAPACITY - 30M HIGH						FORMULA
	sr. no	area of steel requd	dia of bar	bar spacing	area of steel prod	
	1	240.000	**10**	**125**	1257	
	2	240.000	**10**	**125**	1257	
	3	288.610	**10**	**125**	1257	
	4	391.910	**10**	**125**	1257	
	5	476.050	**10**	**125**	1257	
	6	540.270	**10**	**125**	1257	
	7	558.750	**10**	**125**	1257	
	8	519.970	**10**	**125**	1257	
	9	410.310	**10**	**125**	1257	
	10	240.000	**10**	**125**	1257	

weight of wall				
straight part	cyspw	437.0	kN	=PI()*(cyid+cytt)*cyh*cytt*uwc
tapered part	cytpw	0.0	kN	=PI()*(cyid+cytt+(cybt-cytt)/3)*cyh*(1-cyc)*(cybt-cytt)/2*uwc
plaster	cyppw	24.6	kN	=(cyid-pt)*PI()*pt*(trdd+cyh+mrdd/2-cyxa)*uwp
total weight	tlcy	461.6	kN	=cyspw+cytpw+cyppw

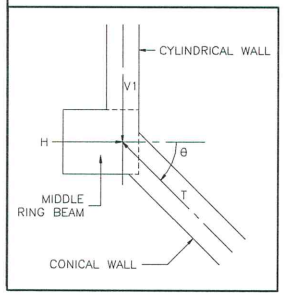
Maximum moment in wall

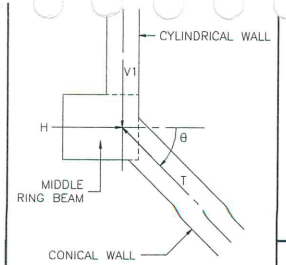
	sr. no	depth from top in meter	thickness at section	coeiffient	moment in wall = Coe. X height^3 * unit wt of liquid	effective depth	Aera of steel required	Minimum Area of steel in mm2
		m	m		kN-m	m		
	1	0.260	0.200	0.00053	0.094	0.145	6	240
Minimun % steel as per IS 3370-2009	2	0.520	0.200	0.00220	0.387	0.145	23	240
	3	0.780	0.200	0.00428	0.753	0.145	44	240
Maximum Dimension	4	1.040	0.200	0.00657	1.155	0.145	68	240
11.600	5	1.300	0.200	0.00847	1.489	0.145	88	240
Permissible dimension for 0.24 % steel	6	1.560	0.200	0.00926	1.628	0.145	96	240

ESR : 300 LAC CAPACITY - 30M HIGH							FORMULA		
15.000	7	1.820	0.200	0.00752	1.323	0.145	78	240	
Minimum Steel	8	2.080	0.200	0.00144	0.253	0.145	15	240	
0.240	9	2.340	0.200	-0.01105	-1.941	0.145	-114	240	
	10	2.600	0.200	-0.03188	-5.603	0.145	-330	240	
	sr. no	area of steel requd	dia of bar	bar spacing	area of steel prod	distance			
	1	240.000	**12**	**200**	565	0.260			
	2	240.000	**12**	**200**	565	0.520			
	3	240.000	**12**	**200**	565	0.780			
	4	240.000	**12**	**200**	565	1.040			
	5	240.000	**12**	**200**	565	1.300			
	6	240.000	**12**	**200**	565	1.560			
	7	240.000	**12**	**200**	565	1.820			
	8	240.000	**12**	**200**	565	2.080			
	9	240.000	**12**	**200**	565	2.340			
	10	240.000	**12**	**200**	565	2.600			

[F] MIDDLE RING BEAM DESIGN

Width of middle ring beam	0.550	m
Depth of middle ring beam	0.350	m

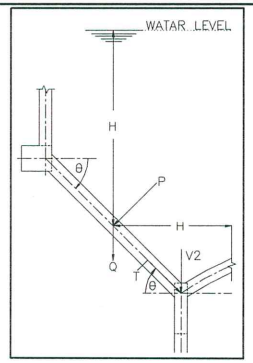




ESR : 300 LAC CAPACITY - 30M HIGH						FORMULA
weight of ventilator		10.0	kN			=Vtlt
weight of top dome		477.8	kN			=Tltd
weight of top ring beam		89.5	kN			=tltrb
weight of cylindrical wall		461.6	kN			=tlcy
self weight of beam	tlmrb	167.1	kN			=PI()*(cyid+mrw)*mrdd*mrw*uwc
weight of structure up to m.r.b.	tlmrb1	1205.9	kN			=Vtlt+Tltd+tltrb+tlcy+tlmrb
weight per meter	mrbwt1	35.9	kN			=tlmrb1/PI()/mrd
			kN			
hoop force due to self wt. of str	mrbh1	191.9	kN			=mrbwt1*mrd/2
hoop force - due to water	mrbh2	56.5	kN			=(trdd+cyh+mrdd/2)*cyid/2*mrdd
total hoop force	mrbh	248.4	kN			=mrbh1+mrbh2
area of steel - required	mrastr	1911	mm2			=+mrbh*1000/fyuc
middle beam bar dia	mbdia	**16.000**	**0.000**	mm		
middle beam nos of bars	mbnos	**10.000**	**0.000**	nos		
Beam stirrups		dia	Spc			
		8 dia		**150** c\c		
area of steel - provided	mrastp	2011	mm2			=PI()/4*mbdia^2*mbnos/100
actual tensile stress in conc.		1.187	N/mm2 <		1.500	=+mrbh*1000/((mrw*mrdd*10000)+13*mrastp)

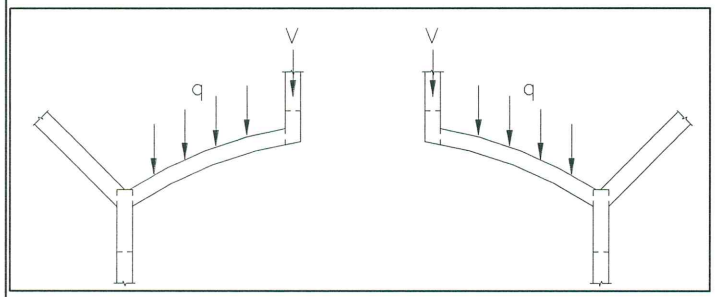
ESR : 300 LAC CAPACITY - 30M HIGH				FORMULA
[G] CONICAL WALL DESIGN				
Thickness of conical wall		0.3	m	
average diameter of wall	cwad	8.8	m	=(+sd+cyid)/2
average water height	cwah	3.5	m	=+cyhh+cwh/2+(mrdd/2-cyxa)
slanting length of wall	cwsl	2.5	m	=(2*cwh*cwh)^0.5
self wt of wall	tlcw	510.2	kN	=(cwsl*cwt)*cwad*PI()*uwc
plaster weight	tlcwpp	17.1	kN	=cwad*cwsl*PI()*uwp*pt
wt.of water above	tlcww	1701.9	kN	=cwad*cwah*PI()*cwh
total weight at shaft lv	tlcws	3435.2	kN	=tlmrb1+tlcw+tlcww+tlcwpp
total weight at shaft lvl / m	tlcwsm	156.2	kN/m	=tlcws/PI()/sd
meridional compressive force	cwcf	220.9	kN/m	=tlcwsm/COS(cwa*PI()/180)
meridional compressive stress	cwcs	0.736	N/mm2	=cwcf*1000/(cwt*100*100)
Minimum steel	ptmincon	0.240		=IF(cyid+2*mrw<Dmin,0.24,0.35)

hoop force in conical wall



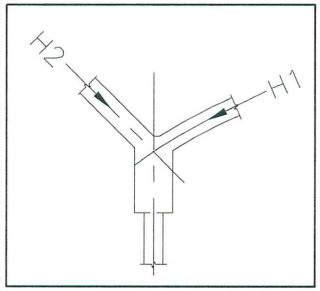
sr no	dia at section in meter	height of water at section in meter	force in kN/m	steel required in mm2/m	tensile stress in concrete N/mm2	Minimun steel in cm2
1.000	10.500	2.600	232	1788	0.711	7.200
2.000	10.150	2.775	237	1825	0.726	7.200
3.000	9.800	2.950	241	1855	0.738	7.200
4.000	9.450	3.125	244	1879	0.747	7.200
5.000	9.100	3.300	246	1896	0.754	7.200
6.000	8.750	3.475	248	1906	0.758	7.200
7.000	8.400	3.650	248	1910	0.760	7.200
8.000	8.050	3.825	248	1907	0.759	7.200
9.000	7.700	4.000	247	1897	0.755	7.200
10.000	7.350	4.175	245	1881	0.748	7.200
11.000	7.000	4.350	242	1858	0.739	7.200

ESR : 300 LAC CAPACITY - 30M HIGH								FORMULA
	sr. no	area of steel requd	dia of bar	bar spacing	area of steel prod			
	1	1788	**16**	**125**	3217			
	2	1825	**16**	**125**	3217			
	3	1855	**16**	**125**	3217			
	4	1879	**16**	**125**	3217			
	5	1896	**16**	**125**	3217			
	6	1906	**16**	**125**	3217			
	7	1910	**16**	**125**	3217			
	8	1907	**16**	**125**	3217			
	9	1897	**16**	**125**	3217			
	10	1881	**16**	**125**	3217			
	11	1858	**16**	**125**	3217			
reinforcement design								
as compression only,I provide min r/f	cwrf	0.240	%					
area of steel required	cwrfr	720	mm2					=cwrf * cwt * 100
area of steel provided at top	cwrfpt	393	**10**	dia	**200**	c/c		=PI()*I349^2/4*1000/K349/100
area of steel provided at bottom	cwrfpb	393	**10**	dia	**200**	c/c		=PI()*I350^2/4*1000/K350/100
total steel	cwrfp	785	mm2					=cwrfpt+cwrfpb
Incline length of conical wall		2.475	m					
[H] CENTRAL SHAFT DESIGN								
max. comp. Hoop force	csmhf	42.075	kN					=(csd+2*cst)*csh/2
max. comp. Hoop stress	csmhs	28.050	kN					=csmhf*1000/(100*cst*100)
reinforcement design								
as compression only,I provide min r/f	csrf	0.240	%					
area of steel required	csrfar	360	mm2					=csrf * cst * 100
area of steel provided	csrfap	1131	**12**	dia	**200**	c/c		=PI()*I340^2/4*1000/K340/100
			on both face					
wt of Shaft	Tlcs	92.4	kN					=(csd+cst)*PI()*cst*csh*uwc
plaster weight	cspp	6.7	kN					=(csd+2*cst+pt)*pt*PI()*uwp*csh
total shaft weight	tlcss	99.1	kN					=cspp+Tlcs
punching shear stress	csps	0.657	N/mm2	<	0.876	N/mm2		=tlcss*1000/((PI()*(csd+2*cst+bdt)*bdt*10000))
								< '=0.16*(fck)^0.5*10

ESR : 300 LAC CAPACITY - 30M HIGH				FORMULA
[I] BOTTOM DOME DESIGN				
weight of water above dome	bdww	1375.023	kN	=(bdwl1-bdwl2-bdwl3)*uww
				
total volumn as per cyld. Shape	bdwl1	167.4	m3	=PI()/4*(cyhh+cwh)*sd^2
less volume of bottom dome	bdwl2	16.2	m3	=+vc
less for central shaft	bdwl3	13.7	m3	=+vd
self wt of bottom dome	tlbdc	197.3	kN	=(2*PI()*bdrr*bdr-PI()/4*csd^2)*bdt*uwc
plaster weight	tlbdpp	9.9	kN	=(2*PI()*bdrr*bdr-PI()/4*csd^2)*pt*uwp
total weight	tlbd	207.2	kN	=tlbdpp+tlbdc
plan area of dome	bdpa	35.6	m2	=(PI()*sd^2/4)-(PI()/4*csd^2)
udl load on dome - empty condition	bdudle	5.8	kN/m2	=(tlbd)/bdpa
udl load on dome - full condition	bdudl	44.4	kN/m2	=(bdww+tlbd)/bdpa
theta at top ring beam lvl	bdth1	0.609	radian	=ACOS((bdrr-bdr)/bdrr)
theta at top opening level	bdth2	0.156	radian	=ASIN((csd/2)/bdrr)

ESR : 300 LAC CAPACITY - 30M HIGH							FORMULA
TANK FULL CONDITION							
meridian force at ring beam							
due to udl	mfbd1	-149.2	kN/m				=-(bdudl*bdrr)/(1+COS(bdth1))
due to central shaft at crown	mfbd2	-7.9	kN/m				=-tlcss/(2*PI()*bdrr*SIN(bdth1)^2)
meridian force at crown opening level							
due to udl	mfbd3	-136.6	kN/m				=-(bdudl*bdrr)/(1+COS(bdth2))
due to central shaft at crown	mfbd4	-106.9	kN/m				=-tlcss/(2*PI()*bdrr*SIN(bdth2)^2)
hoop force at ring beam							
due to udl	hfbd1	-73.5	kN/m				=(bdudl*bdrr)*(1/(1+COS(bdth1))-COS(bdth1))
due to central shaft at crown	hfbd2	7.9	kN/m				=tlcss/(2*PI()*bdrr*SIN(bdth1)^2)
hoop force at crown opening lvl							
due to udl	hfbd3	-131.6	kN/m				=(bdudl*bdrr)*(1/(1+COS(bdth2))-COS(bdth2))
due to central shaft at crown	hfbd4	106.9	kN/m				=tlcss/(2*PI()*bdrr*SIN(bdth2)^2)
		due to udl on dom + shaft self wt	stress = force / bdt	perm. str in comp	perm. str in tension		
		kN	N/Sqmm	N/Sqmm	N/Sqmm		-Ve strees value = compression
meridian force at ring beam	=mfbd1+mfbd2	-157.1	-0.79	8.00	1.5		+Ve strees value = tension
meridian force at crown opening level	=mfbd3+mfbd4	-243.5	-1.22	8.00			
hoop force at ring beam	=hfbd1+hfbd2	-65.7	-0.33	8.00			
hoop force at crown opening level	=hfbd3+hfbd4	-24.8	-0.12	8.00			

ESR : 300 LAC CAPACITY - 30M HIGH								FORMULA
TANK EMPTY CONDITION								
meridian force at ring beam								
due to udl	mfbd1e	-19.5	kN/m					=-(bdudle*bdrr)/(1+COS(bdth1))
due to central shaft at crown	mfbd2e	-7.9	kN/m					=-tlcss/(2*PI()*bdrr*SIN(bdth1)^2)
meridian force at crown opening level								
due to udl	mfbd3e	-17.9	kN/m					=-(bdudle*bdrr)/(1+COS(bdth2))
due to central shaft at crown	mfbd4e	-106.9	kN/m					=-tlcss/(2*PI()*bdrr*SIN(bdth2)^2)
hoop force at ring beam								
due to udl	hfbd1e	-9.6	kN/m					=(bdudle*bdrr)*(1/(1+COS(bdth1))-COS(bdth1))
due to central shaft at crown	hfbd2e	7.9	kN/m					=tlcss/(2*PI()*bdrr*SIN(bdth1)^2)
hoop force at crown opening level								
due to udl	hfbd3e	-17.240	kN/m					=(bdudle*bdrr)*(1/(1+COS(bdth2))-COS(bdth2))
due to central shaft at crown	hfbd4e	106.896	kN/m					=tlcss/(2*PI()*bdrr*SIN(bdth2)^2)
allowable comp. Stress in bottom dome	bdacs	5.680	N/mm2					=(IF(bdt<0.1,57,IF(bdt>=0.3,85,57+(bdt-0.1)*140))) /100*50
		due to udl on dome + shaft self wt	stress = force / bdt / 10	perm. str in comp	perm. str in tension			
		kN	N/mm2	kg/sqsm	kg/sqsm			-Ve strees value = compression
meridian force at ring beam	=mfbd1+mfbd2	-27.4	-0.14	8.0				+Ve strees value = tension
meridional force at crown opening level	=mfbd3+mfbd4	-124.8	-0.62	8.0				
hoop force at ring beam	=hfbd1+hfbd2	-1.8	-0.01	8.0				
hoop force at crown opening level	=hfbd3+hfbd4	89.7	0.45	8.0	1.5			
reinforcement design								
as compression only,I provide min r/f	bdrf	0.240	%					=IF(sd+st<Dmin,0.24,0.35)
area of steel required	bdrfar	480	mm2					=bdrf * bdt * 10000
area of steel provided at top	bdrfapt	393	**10**	dia	**200**	c/c		=PI()*D558^2/4*1000/F558
area of steel provided at bottom	bdrfapb	393	**10**	dia	**200**	c/c		=PI()*D559^2/4*1000/F559
total steel	bdrfap	785	mm2					=bdrfapt+bdrfapb

ESR : 300 LAC CAPACITY - 30M HIGH									FORMULA
[J] BOTTOM RING BEAM DESIGN									
Bottom beam - width			0.400	m					
Bottom beam - depth			0.600	m					
									
TANK FULL CONDITION	force in kN	angle in radin		V - comp	H - comp				
axial force due to conical wall	220.9	2.4		156.2	-156.2	kN			
thrust due to bottom dome	157.1	0.6		89.8	128.8	kN			
total				246.1	-27.4	kN			
TANK EMPTY CONDITION	force in tonne	angle in radian		V - comp	H - comp				
axial force due to conical wall	111.5	2.4		78.8	-78.8	kN			
thrust due to bottom dome	27.4	0.6		15.7	22.5	kN			
total				94.5	-56.3	kN			
max. Comp. Hoop force for B.R.B			56.3	kN					
max. Comp. Hoop stress for B.R.B			0.235	N/mm2	<	8.000	N/mm2		
reinforcement design									
as compression only, min r/f	brrf1		0.240	%					=IF(sd+2*st<Dmin,0.24,0.35)
area of steel required	brrfar1		576	mm2					=brrf1 * brw * brdd * 100
area of steel provided	brrfap1		1206	**16**	dia	**6**	no		=PI()*I453^2/4*K453/100
stirrups				**8**	dia	**100**	c\c		

ESR : 300 LAC CAPACITY - 30M HIGH							FORMULA
[K] TOTAL WEIGHT OF CON. MEMBER							
		rcc wt	live load	plaster wt	total wt	unit	
ventilator	ww1	10.0	0.0		10.0	kN	
top dome	ww2	306.1	146.9	24.7	477.8	kN	
top ring beam	ww3	89.5			89.5	kN	
cylindrical wall	ww4	437.0		24.6	461.6	kN	
middle ring beam	ww5	167.1			167.1	kN	
conical wall	ww6	510.2		17.1	527.4	kN	
central shaft	ww7	92.4		6.7	99.1	kN	
bottom dome	ww8	197.3		9.9	207.2	kN	
Bottom ring beam	ww9	131.9			131.9	kN	
total		1941.5	146.9	83.1	2171.5	kN	
container weight	wcdl	2024.6	kN				
Live load	wcll	146.9	kN				
Water load	wcwl	3049.5	kN				
emtpy wt of container	wce	2171.5	kN				=wcdl+wcll
full wt. of container	wcf	5221.0	kN				=wcdl+wcll+wcwl
load /m on shaft		237.4	kN				

	Summary			
	ESR : 300 LAC CAPACITY - 30M HIGH			
	DATA			
1	ESR Capacity	=	300	m3
2	Staging Height	=	30	m
A	**Capacity check**			
	Required capacity	=	300.00	m3
	Provided capacity	=	302.15	m3
	check =		O.K	
B	**Top Dome**			
	Thickness	=	125	mm
	Central rise	=	1600	mm
	Radius of Top dome	=	9745	mm
	Steel required	=	3.00	cm2/m
		Dia	Spc in mm	
	Steel provided	8	150	
		=	3.35	cm2/m
	Check for Reinforcement		O.K	
C	**Top ring beam**			
	Beam Width	=	350	mm
	Beam Depth	=	300	mm
	Beam steel required	=	908.61	mm2
		Dia	No	
	Beam Steel provided	12	10	
		0	0	
		=	1130.97	mm2
	Check for Reinforcement		O.K	
	Actual Tensile stress in concrete	=	1.03	N/mm2
	Per. tensile stress in concrete	=	1.50	N/mm2
	Check for Stresses		O.K	
	Beam stirrups	=	Dia	Spc
			8	150

Summary

ESR : 300 LAC CAPACITY - 30M HIGH

D **Cylindrical wall**

Inside diameter of tank	=	10500	mm
Wall thickness at top	=	0.2	m
Wall thickness at bottom	=	0.2	m
Distance between two ring beam	=	2600	mm
Wall type	=	straight wall	
Per. tensile stress in concrete	=	1.50	N/mm2

depth from top in meter	thickness at section	area of steel required	Dia	Spc	area of steel provided	Tensile stress in concrete	Check of tensile stress
0.26	0.2	240.00	10	125	1256.64	0.04	O.K
0.52	0.2	240.00	10	125	1256.64	0.11	O.K
0.78	0.2	288.61	10	125	1256.64	0.18	O.K
1.04	0.2	391.91	10	125	1256.64	0.24	O.K
1.3	0.20	476.05	10	125	1256.64	0.29	O.K
1.56	0.20	540.27	10	125	1256.64	0.33	O.K
1.82	0.20	558.75	10	125	1256.64	0.35	O.K
2.08	0.20	519.97	10	125	1256.64	0.32	O.K
2.34	0.20	410.31	10	125	1256.64	0.25	O.K
2.6	0.2	240.00	10	125	1256.64	0.14	O.K

Summary

ESR : 300 LAC CAPACITY - 30M HIGH

E **Middle ring beam**

Beam Width	=	550	mm
Beam Depth	=	350	mm
Beam steel required	=	1910.99	mm2
	Dia	No	
Beam Steel provided	16	10	
	0	0	
	=	2010.62	mm2
Check for Reinforcement		O.K	
Actual Tensile stress in concrete	=	1.19	N/mm2
Per. tensile stress in concrete	=	1.50	N/mm2
Check for Stresses		O.K	
Beam stirrups	=	Dia	Spc
		8	150

F **Conical wall**

Thickness	=	300	mm
Height of conical wall	=	1750	mm
Per. Comp. stress in concrete	=	8	N/mm2
Actual comp. stress in concrete	=	0.74	N/mm2
Check for compressive stress	=	O.K	
Per. tensile stress in concrete	=	1.50	N/mm2

Hoop steel

Dia at section in meter	depth from top in meter	area of steel required	Dia	Spc	area of steel provided	Tensile stress in concrete	Check of tensile stress and area of
10.5	2.6	1787.81	16	125	3216.99	0.71	O.K
10.15	2.775	1824.83	16	125	3216.99	0.73	O.K
9.8	2.95	1855.19	16	125	3216.99	0.74	O.K
9.45	3.125	1878.88	16	125	3216.99	0.75	O.K
9.1	3.3	1895.92	16	125	3216.99	0.75	O.K
8.75	3.475	1906.29	16	125	3216.99	0.76	O.K
8.4	3.65	1909.99	16	125	3216.99	0.76	O.K
8.05	3.825	1907.03	16	125	3216.99	0.76	O.K
7.7	4	1897.41	16	125	3216.99	0.75	O.K
7.35	4.175	1881.13	16	125	3216.99	0.75	O.K

Summary ESR : 300 LAC CAPACITY - 30M HIGH								
	Conical wall							
	7	4.35	1858.18	16	125	3216.99	0.74	O.K
	Vertical steel							
	Area of steel required			=	720.00			
	Area of steel provided			=	Dia	Spa		
			top		10	200.00		
			bottom		10	200.00		
			Nos at top		165			
			Nos at bottom		165			
G				**Bottom Dome**				
	Thickness			=	200	mm		
	Central rise			=	1100	mm		
	Radius of bottom dome			=	6118	mm		
	Steel			=	Dia	Spa		
			top		10	200.00		
			bottom		10	200.00		
	Per. Comp. stress in concrete			=	5.68	N/mm2		
	Actual comp. stress in concrete			=	1.22	N/mm2		
	Check for compressive stress			=	O.K			
	Steel required			=	480.00	mm2/m		
	Steel provided			=	785.40	mm2/m		
	Check for Reinforcement				O.K			
H				**Bottom ring beam**				
	Beam Width			=	400	mm		
	Beam Depth			=	600	mm		
	Per. Comp. stress in concrete			=	8	N/mm2		
	Actual comp. stress in concrete			=	0.23	N/mm2		
	Check for compressive stress			=	O.K			
	Beam steel required			=	576.00	mm2		
				Dia	No			
	Beam Steel provided			16	6			
				=	1206.37	mm2		
	Beam stirrups			=	Dia	Spc		
					8	100		
	Check for Reinforcement				O.K			
	Check for Beam compression			=	O.K			

Summary			
ESR : 300 LAC CAPACITY - 30M HIGH			
I	**Central Shaft**		
Inside diameter	=	1900	mm
Wall thickness	=	150	mm
Steel required	=	360.00	mm2/m
	Dia	Spc in mm	
Steel provided	12	200	
	=	1130.97	mm2/m
Check for Reinforcement		O.K	

SHAFT

&

RAFT

DESIGN

ESR : 300 LAC CAPACITY - 30M HIGH					FORMULA
EPC CONTRACTOR					
PROJECT: PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT (30 MLD WTP)	ESR AT	CLIENT			
	KATTERLA	RURAL WATER SUPPLY AND SANITATION DEPARTMENT, TELANGANA			
STRUCTURE	DESIGN CALCULATION FOR ESR	DATE		REV	
		4/2/2016		0	

BASIC DATA

Capacity of tank	v	**300**	kl			
Staging height	H	**30**	m			
Dia of stagging/shaft c/c	ds	**7**	m			
Height of staging	hs	30	m			
Location of tank						
Basic wind speed		**44**	m/s			
Net SBC of Soil		**25**	t/m2			
Depth of foundation up to top of raft	df	**2**	m			
Material						
Concrete grade of Shaft	Fcks	**30**	N/mm2			
Concrete grade of raft	Fckr	**30**	N/mm2			
Reinforcement	Fy	**500**	N/mm2			
Raft Diameter	Rdia	**9.3**	m			
Raft Thickness	Rthk	**0.7**	m			

TANK DETAILS

Dia of tank	td	**10.5**	m			
Top slab/dome	tst	**0.125**	h	**1.6**	m	
Top ring beam	trd	**0.3**	trb	**0.35**		
Side wall ht above middle RB	swh	**2.6**	swt	**0.2**		
Middle ring beam	mrd	**0.35**	mrb	**0.55**		
Dia of central opening	copt	**0.15**	copdi	**1.9**		
Inclined slab	Ist	**0.3**	ish	**1.75**		
Bottom ring beam	brd	**0.6**	brb	**0.4**		
Bottom dome	bst	**0.2**	bdh	**1.1**	rii	6.1

Wind load			
wind Constants	vb	**44**	m/sec
Basic wind speed	Vbkmh	158.4	km/h
	ki	**1.07**	
	kii10	**1.03**	
	kii15	**1.07**	
	kii20	**1.1**	
	kii30	**1.13**	
	kiii	**1**	

Shaft Summary Detail

Grade of concrete	g	30		N/mm2	
Grade of Steel	fy	500		N/mm2	
Thickness of shaft	ts	**0.3**		m	
opening width	wp	**1**		m	
Dia of vertical steel bars proposed	di	**12**		mm	
Spacing of vertical reinforcement on both the faces	sp	**150**	mm		
Dia of circumferencial steel bars proposed	cdi	**10**	mm		
Spacing of Horizontally reinforcement on both the faces	sph	**200**	mm		
Height of shaft above raft	Sh	31.25			
Stress in the shell		**4.31**		kg/cm2	
Nature of stress		comp			
Tensile stress due to ring moment		safe		kg/cm2	
	er	0.21	eri	scv governs	
			alpa	168	
Maximum compressive stress in shaft		22.88		kg/cm2	114
area of vertical steel required on both face		6.25	cm2		
spacing required		361.91	mm		
area of circumferential steel required on both face		7.2	cm2		
spacing required		218	mm		

Ring beam (thickned shaft) on raft

Width of ring beam @Bottom of shaft	rb	**0.4**	m
Depth of ring beam @Bottom of shaft	rd	**2**	m
Dia of vertical bars	rsdi	**10**	
Spacing of bars	rbsi	**200**	
Dia of Circumferencial bars	rsdii	**10**	
Spacing of bars	rbsii	**200**	

Design of raft

Haunch width on raft		**0.3**	m
Dia of raft provided <=11.4m	d	9.3	m
overall depth of raft	dr	0.7	m
Effective depth provided	de	0.635	
Dia of bottom bars	db	**16**	
spacing of bottom bars arranged as mesh	space	**150**	
Dia of top bars	dbi	**16**	
spacing of top bars arranged as mesh	spacei	**150**	

Radial moments

Radial distance from centre	0	1.75	3.3	3.7	4.65
Radial moements, Mr	-25.49	-10.68	25.21	21.60	-1.40
Area of steel in cm2	16	7	16	14	1

	Moments in tm	Ast in cm2	Spacing in cm
Max. Negative moment	-25.49	16	**17**
Max. positive moment	25.21	16	**16**
Min area of steel	mas	7	

Circumferential Moments

Radial distance from centre	0	1.75	3.3	3.7	4.65
Radial moements, Mr	-25.49	-24.71	-21.94	1.55	0.11
Area of steel in cm2	16	15	14	1	0

	Moments in tm	Ast in cm2	Spacing in cm
Max. Negative moment	-25.49	16	**17**
Max. positive moment	1.55	1	**251**

Design calculation

weight of tank

DL+Finishings on dome / m2	Wdl	**0.3875**	t/m2
Top slab/ Dome		**30.61**	t
Top ring Beam		**8.95**	t
side wall		**43.70**	t
Middle ring beam		**16.70**	t
Inclined wall		**51.02**	t
Bottom ring beam		**13.2**	t
Bottom slab/Dome		**17.26**	t
Total weight of tank portion		**181**	t

Staging

Weight of shaft		515.42	t
Weight of ring beam over raft		11.00	t
Total weightof Staging		526	t
Total weight of tank + Staging	wt	708	t

Volume of tank

Radius of bottom dome	rii	6.1	
Weight of water	Q1	281.42	
	Q2	106.63	
	Q3	21.86	
	Q4	10.21	
Total weightof water	ww	356	t

Wind analysis

Design Pressure

	pz10	1411	N/m2
	pz15	1523	N/m2
	pz20	1609	N/m2
	pz30	1698	N/m2

Moment due to wind on tank

	Ht.	Area	Pressure	Force	LA	Moment
	m	m2	N/m2	N	m	
Top slab/Dome	35.92	**11.61**	1798	14614	38.62	56.4
Top ring beam	34.7	3.885	1798	4890	37.40	18.3
Side wall	33.7	28.34	1798	35672	36.4	129.8
Middle ring beam	31.78	4.06	1798	5110	34.48	17.6
Inclined wall	30.73	15.3125	1798	19274	33.43	64.4
Bottom slab/Dome	29.85	0	1698	0	32.43	0.0
Bottom ring beam	29.85	4.4	1698	5278	32.30	17.0
			wfi	84838	wmt	303.7

Moment due to wind on staging

	Ht.	Area	Pressure	Force	LA	Moment
on shaft	29.25	213.525	1698	290081	17.325	502.57
			wfii	290081	wms	502.57

Total wind moment on the base	mb	806	
Weight of conatiner + Staging		708	
Wt of water		356	
Weight of raft	wr	119	t
weight of soil	ws	136	t
when tank full+raft wt	pfull	1183	t
when tank empty (without water & soil weight)	p	827	t

Dia of raft out to out		9.3		
Dia required to avoid tension in raft base		6.70		
Max. Dia required for both factors		9.3		
Tension in base (Empty condition)				
Section modulus of raft	z	78.97	m3	
Area of raft	ai	67.9	m2	
Check for Stability				
Empty condition				
P/A	Epa	14.17	t/m2	
M/Z	Emz	10.21	t/m2	
P/A + M/Z		24.38	t/m2	
P/A - M/Z		3.96	t/m2	
Tank Full Condition				safe
P/A	Fpa	17.41	t/m2	
M/Z	Fmz	10.21	t/m2	
P/A + M/Z		27.62	t/m2	
P/A - M/Z		7.20	t/m2	
Pressure on soil when no wind		17.41	t/m2	safe

Design of shaft

Permissble streess				
Dead + Wind load		11.4	N/mm2	114 kg/cm2
Circumferential tensile stress due to wind		2.1	N/mm2	21 kg/cm2
Shaft C/C		7	m	
Shaft thickness		0.3	m	
Shaft out to out	Sfaftod	7.3	m	
Shaft in to in	Shaftid	6.7	m	
Moment of inretia of shaft	ShaftMI	40.48	m4	
Modulus of section of shaft	ShaftZ	11.09	m3	
Water weight		356		
Staging and container weight		708		
Total Weight of tank & wt of water	w	1064		
Moment due to wind at top of raft	LA	Moment		
Top slab/Dome	37.92	55.41		
Top ring beam	36.70	17.95		
Side wall	35.70	127.35		
Middle ring beam	33.78	17.26		
Inclined wall	32.73	63.07		
Bottom slab/Dome	31.73	0.00		
Bottom ring beam	31.60	16.68		
wind on shaft	16.63	482.26		
Total	mbi	779.98		

Maximum wind pressure		1698	N/m2
Ring moment in the shaft	rm	686.5	kN-m
Tensile stress due to ring moment		0.619	kg/cm2
Allowable circumferential tensile stressb due to ring moment		21	kg/cm2
vertical stress in circular shaft			
Eccentricity	e	0.73	m
e/r	er	0.21	
max. vertical comp. stress in concrete, when e/r<0.5	scv	228.81	t/m2
		22.88	kg/cm2
Allowable compressive stress		114	kg/cm2
Total vertical steel area/total concrete area	scr	0.00503	
"If er>0.5 compare value of eri with er by changing value of alpha			
Angle alpha	alpha	168	degs
	alp	2.93	radian
modular ratio	m	9.33	
AC	ac	79.43	
BC	bc	155.42	
AC/BC	eri	0.5	

	scvi		7.95	kg/cm2
Max. compressive stress for e/r>0.5	scvii		8.12	kg/cm2
Max. Compressive stress in shaft			228.81	
Annular section with one opening				
bita	bita		8.13	degs
	bit		0.14	radian
e/r ratio	ero		0.56	
area of shaft	ars		6.6	
Modulus of section	zi		11.09	
	Fcr		196.24	
Allowable Buckling stress			3.18	
Stress on shaft wall			23.16	
Stress on shaft wall			3.70	
If the stress in the shell is compressive provide Mi. Steel			comp	
	pst		0.25	0.8
Min vertical steel of 0.25% but 0.8% as per IS-456				
Concrete Area required			1182030	mm2
req. area of concrete per 1 mtr, vertical loads only			53750	mm2/m
area of steel 0.8 % of area required		0.80%	430	mm2/m
			4.30	cm2/m
Area of steel		0.25%	7.5	cm2/m
Max steel for both face			6.25	cm2/m
Steel required for one face			3.125	
Provided Dia	di		12	mm
spacing of reinforcement required			361.91	mm
spacing priovided vertically			150	mm
Minimum circumferential steel per m ht	aci		7.2	cm2/m
Steel required for one face			3.6	
Provided dia circumferential	cdi		10	
spacing required circumferential			218	mm
spacing priovided circumferential			200	mm

Design of Raft

Moments due to load	aa	4.5	cc	3.5	
Radial moment					
r<cc @ r = rid	Mriw	-25.49			
r<cc @ r = riid	Mriiw	-15.89			
r=cc @ r = riiid	Mriiiw	8.65			
r>cc @ r = rivd	Mrivw	8.27			
r>cc @ r = rvd	Mrvw	-0.10			
Circumferencial moments					
R<cc @ r =rid	Mtiw	-25.49			
				rid	**0**
r<cc @ r=riid	Mtiiw	-22.29		riid	1.75
				riiid	3.3
r=cc @ r=riiid	Mtiiiw	-14.11		rivd	3.7
				rvd	4.65
r>cc @ r=rivd	Mtivw	-0.23			
r>cc @ r=rvd	Mtvw	-0.17			
Due to wind moment Radial moments					
r<cc @ r = rid	Mrim	0.00			
r<cc @ r = riid	Mriim	5.21			
r=cc @ r = riiid	Mriiim	16.56			
r>cc @ r = rivd	Mrivm	13.33			
r>cc @ r = rvd	Mrvm	-1.30			

Circumferential moments

r<cc @ r = rid	Mtim	0.00
r<cc @ r = riid	Mtiim	-2.42
r=cc @ r = riiid	Mtiiim	-7.82
r>cc @ r = rivd	Mtivm	1.78
r>cc @ r = rvd	Mtvm	0.28

Summary of moments

Radial distance from center	0	1.75	3.3	3.7	4.65 m

Radial Moments

Due to W	-25.49	-15.89	8.65	8.27	-0.10
Due to M	0.00	5.21	16.56	13.33	-1.30
Total	-25.49	-10.68	25.21	21.60	-1.40

Circumferential Moments

Due to W	-25.49	-22.29	-14.11	-0.23	-0.17
Due to M	0.00	-2.42	-7.82	1.78	0.28
Total	-25.49	-24.71	-21.94	1.55	0.11

max. moment from working stress method	Mmax	25.21 tm	
σst	275	N/mm2	0.55*fy
σcbc	10	N/mm2	
K	0.253		
j	0.916		

Effective depth of raft required			0.32			
Radial steel						
Radial Distance		0	1.75	3.3	3.7	4.65
Radial Steel required in cm2		16	7	16	14	1
Dia		16	16	16	16	16
Spacing required in cm		13	30	13	15	230 cm
Circumferebcial steel in cm2						
Radial Distance		0	1.75	3.3	3.7	4.65
Circumferential Steel required in cm2		16	15	14	1	0
Dia		16	16	16	16	16
Spacing required in cm		13	13	15	207	2982 cm
Checkkk For Shear						
Critical section for shear	rcri		3.85			
Shear force at critical section	qc		285.1 t			
Shear stress	tv		0.28 N/mm2			
	ptr		0.4			
	beetai		8.7			
Allowable shear stress	tc		0.45	Safe		

STAIR DESIGN

BASIC DATA:

Span	= 4.25 m
Depth of waist slab	= 150 mm
Riser	= 160 mm
Tread	= 250 mm

LOADING:

Slab load for 150 thick landing = (1.25*0.15*25) DL+ (1.25*3) LL = 8.44 kN/m
Total load from stair = 9.83 kN/m^2 = (9.83*4.2)/2 = 20.89 kN/m

STAIR DESIGN:

STAIR DESIGN						
Project : 30 MLD WTP AT ASIFABAD				**Proj. No P16-02**		
Unit : 300 KL ESR						
DATA						
Concrete grade	Fck	**30**	N/mm2			
Steel	Fy	**500**	N/mm2			
Clear cover	Cv	**25**	mm			
Stair effective span	L	**4.25**	m			
Width	B	**900**	mm			
Depth of Waist slab	D	**150**	mm			
Riser	R	**160**	mm			
Tread	T	**250**	mm			
Density of concrete	Wd	25	kN/m3			
Moment coefficient	Me	**0.125**				
Maximum Dia of Bar	Db	**12**	mm			
Minimum % Steel	ptmin	**0.12**	%			
Basic Span to depth ratio	rat	**26**				
Loading						
Live load	LI	2.00	kN/m2			
Finishing load	FI	1.00	kN/m2			
Calculation						
Calculation of loading						
Self wt (Dead load)	DI	4.45	kN/m2			
Weight of step	WS	2.37	kN/m2			
Total Load	TI	9.83	kN/m2			
Effective depth	De	119	mm			
Design						
Moment	M	22.19	kN-m			
Factor moment	Mu	33.28	kN-m			
Required area of steel	Ast(req)	725	mm^2			
Provide area of steel	Ast(pro)	905	mm^2	**12**	**125**	O.K
Distribution steel	Ast(min)	162	mm^2			
Provide Distribution steel	DAst(pro)	251	mm^2	**8**	**200**	O.K
Shear Check						
Maximum shear	V	20.9	kN			
Facotred Shear	Vu	31.3	kN			
Actual Shear stress	Tv	0.263	N/mm2			
% Ast	pt	0.76	%			
beta	beta	4.58				

Value of K for Solid slab				
Overall Depth		150.00	mm	
	K	1.30		
permissible shear for pt	Tc	0.790	N/mm2	OK
	CHECK FOR DEFLECTION			
basic span /deph ratio	bsd	26		
fs	fs	232	N/mm2	
% steel provided	ptt	0.76	%	
Moification factor	mf	1.12		
permissible span/ depth ratio	psd	29.00		
actual span /depth ratio	sdr	28.33		OK

STAAD INPUT:

```
STAAD SPACE
START JOB INFORMATION
ENGINEER DATE 16-Feb-16
END JOB INFORMATION
INPUT WIDTH 79
UNIT METER KN
JOINT COORDINATES
1 0 0 0; 2 1.8 0 0;
MEMBER INCIDENCES
1 1 2;
DEFINE MATERIAL START
ISOTROPIC CONCRETE
E 2.73e+007
POISSON 0.17
DENSITY 25
ALPHA 1e-005
DAMP 0.05
TYPE CONCRETE
STRENGTH FCU 27579
END DEFINE MATERIAL
MEMBER PROPERTY AMERICAN
1 PRIS YD 0.45 ZD 0.23
CONSTANTS
MATERIAL CONCRETE ALL
SUPPORTS
1 2 PINNED
LOAD 1 LOADTYPE None  TITLE LOAD CASE 1
SELFWEIGHT Y -1
MEMBER LOAD
1 UNI GY -20.89
1 UNI GY -8.44
LOAD COMB 2 COMBINATION LOAD CASE
1 1.5
PERFORM ANALYSIS
LOAD LIST 2
START CONCRETE DESIGN
CODE INDIAN
CLEAR 0.025 ALL
FC 30000 ALL
FYMAIN 500000 ALL
FYSEC 500000 ALL
TRACK 2 ALL
DESIGN BEAM 1
END CONCRETE DESIGN
FINISH
```

BEAM DESIGN:

```
=============================================================================
B E A M  N O.      1   D E S I G N  R E S U L T S

M30                      Fe500 (Main)                Fe500 (Sec.)

LENGTH:  1800.0 mm       SIZE:   230.0 mm X  450.0 mm   COVER: 25.0 mm

DESIGN LOAD SUMMARY (KN MET)
-----------------------------------------------------------------------------
SECTION |FLEXURE  (Maxm. Sagging/Hogging moments)|          SHEAR
(in mm) |     P        MZ        MX   Load Case  |    VY       MX  Load Case
-----------------------------------------------------------------------------
0.0 |     0.00      0.00      0.00     2     |   43.09     0.00      2
|     0.00     -0.00      0.00     2     |
150.0 |     0.00      5.92      0.00     2     |   35.91     0.00      2
|     0.00      0.00      0.00     2     |
300.0 |     0.00     10.77      0.00     2     |   28.73     0.00      2
|     0.00      0.00      0.00     2     |
450.0 |     0.00     14.54      0.00     2     |   21.54     0.00      2
|     0.00      0.00      0.00     2     |
600.0 |     0.00     17.24      0.00     2     |   14.36     0.00      2
|     0.00      0.00      0.00     2     |
750.0 |     0.00     18.85      0.00     2     |    7.18     0.00      2
|     0.00      0.00      0.00     2     |
900.0 |     0.00     19.39      0.00     2     |    0.00     0.00      2
|     0.00      0.00      0.00     2     |
1050.0 |     0.00     18.85      0.00     2     |   -7.18     0.00      2
|     0.00      0.00      0.00     2     |
1200.0 |     0.00     17.24      0.00     2     |  -14.36     0.00      2
|     0.00      0.00      0.00     2     |
1350.0 |     0.00     14.54      0.00     2     |  -21.54     0.00      2
|     0.00      0.00      0.00     2     |
1500.0 |     0.00     10.77      0.00     2     |  -28.73     0.00      2
|     0.00      0.00      0.00     2     |
1650.0 |     0.00      5.92      0.00     2     |  -35.91     0.00      2
|     0.00      0.00      0.00     2     |
1800.0 |     0.00      0.00      0.00     2     |  -43.09     0.00      2
|     0.00      0.00      0.00     2     |
-----------------------------------------------------------------------------

SUMMARY OF REINF. AREA (Sq.mm)
-----------------------------------------------------------------------------
SECTION |          TOP             |          BOTTOM          |    STIRRUPS
(in mm) | Reqd./Provided reinf.    | Reqd./Provided reinf.    |   (2 legged)
-----------------------------------------------------------------------------
0.0 |    0.00/ 226.19( 2-12í )|    0.00/ 226.19( 2-12í )|  8í  @ 300 mm
150.0 |    0.00/ 226.19( 2-12í )|  163.83/ 339.29( 3-12í )|  8í  @ 300 mm
300.0 |    0.00/ 226.19( 2-12í )|  163.83/ 339.29( 3-12í )|  8í  @ 300 mm
450.0 |    0.00/ 226.19( 2-12í )|  163.83/ 339.29( 3-12í )|  8í  @ 300 mm
600.0 |    0.00/ 226.19( 2-12í )|  163.83/ 339.29( 3-12í )|  8í  @ 300 mm
750.0 |    0.00/ 226.19( 2-12í )|  163.83/ 339.29( 3-12í )|  8í  @ 300 mm
900.0 |    0.00/ 226.19( 2-12í )|  163.83/ 339.29( 3-12í )|  8í  @ 300 mm
1050.0 |    0.00/ 226.19( 2-12í )|  163.83/ 339.29( 3-12í )|  8í  @ 300 mm
1200.0 |    0.00/ 226.19( 2-12í )|  163.83/ 339.29( 3-12í )|  8í  @ 300 mm
1350.0 |    0.00/ 226.19( 2-12í )|  163.83/ 339.29( 3-12í )|  8í  @ 300 mm
1500.0 |    0.00/ 226.19( 2-12í )|  163.83/ 339.29( 3-12í )|  8í  @ 300 mm
1650.0 |    0.00/ 226.19( 2-12í )|  163.83/ 339.29( 3-12í )|  8í  @ 300 mm
1800.0 |    0.00/ 226.19( 2-12í )|    0.00/ 226.19( 2-12í )|  8í  @ 300 mm
-----------------------------------------------------------------------------
```

COLUMN DESIGN:

Reaction from beam = (45*6) = 270 kN
Column size = 300mmx300mm
Reinforcement = 8 nos. 16# = 1608 mm^2
Self weight of column = 30*0.3*0.3*25 = 67.5*1.5 = 101.25 kN

P = 0.4*30*(90000-1608) + 0.67*500*1608
= 1599.384 kN > (270+101.25) hence OK

BOTTOM RING BEAM DESIGN at EL 0.0 m

Max. Compressive force acting on beam = 27.4 (Tank Full condition)

Max. Compressive force acting on beam = 56.3 (Tank Empty condition)

Considering max. Comp. Hoop force for B.R.B = 56.3 kN

size of beam = 400 x 600 mm

max. Comp. Hoop stress for B.R.B = 56.3*1000/(0.4*0.6*1000*1000) = 0.235 N/mm2

per. stress in con. for direct comp = 8 N/mm2 > 0.235 N/mm2

Hence, provide min reinforcement = 0.24 %

Area of steel required = 0.24*400*600/100 = 576 mm2

Area of steel provided = 6-16# = 1206 mm2 > 576 , hence o.k.

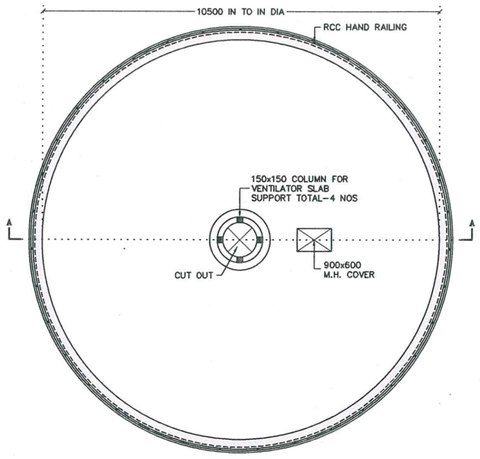
Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

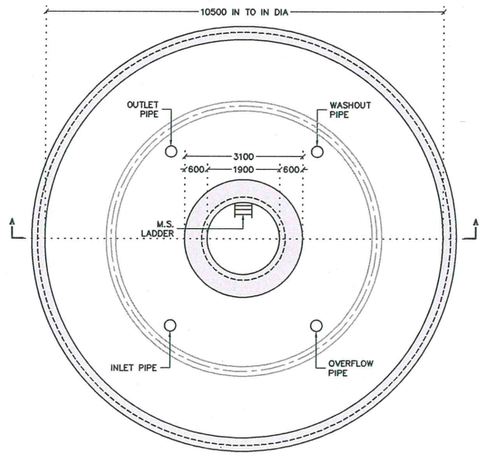
Executive Engineer
TDWSP Asifabad

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

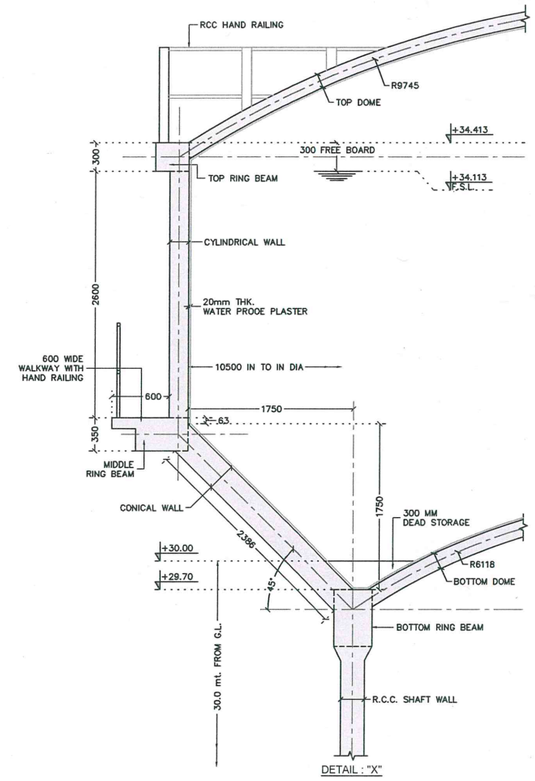
APPROVED
SE, NIRMAL 30/4/16



PLAN : 4 - 4



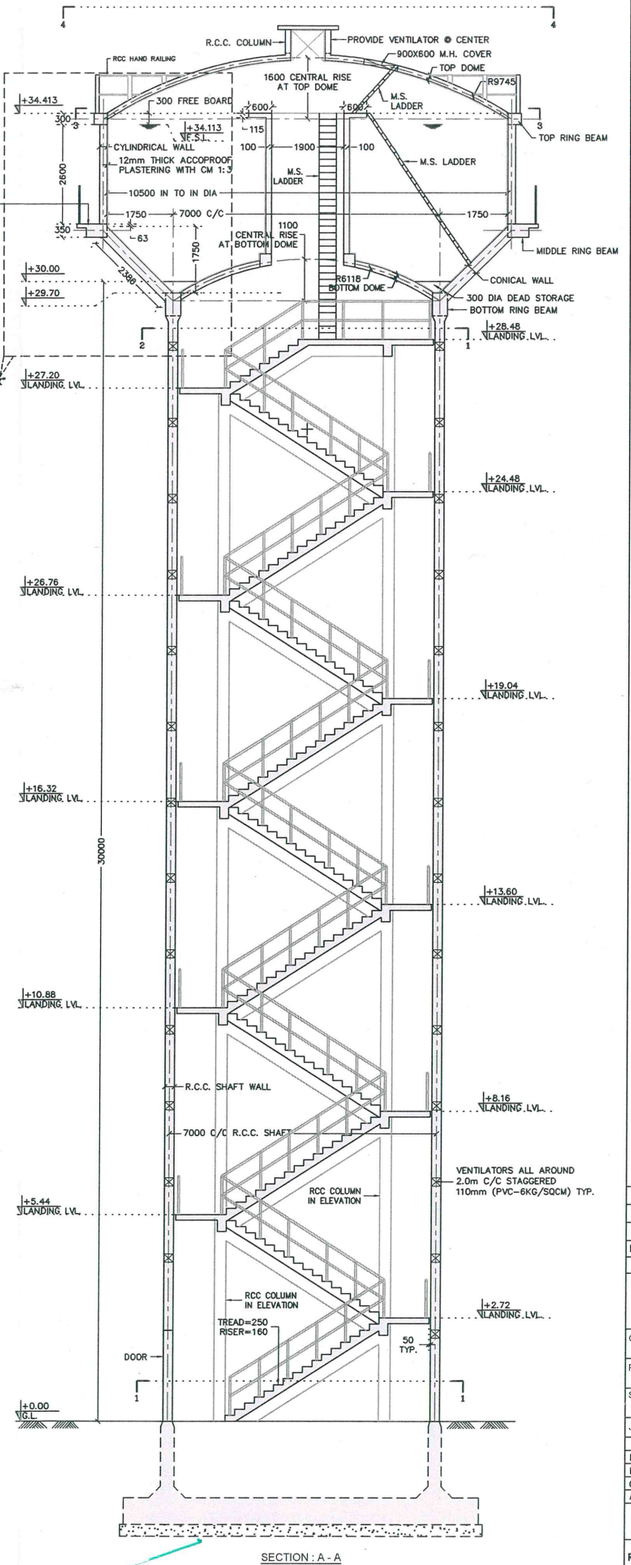
PLAN : 3 - 3



DETAIL : "X"

PLAN : 2 - 2

PLAN : 1 - 1



SECTION : A - A

NOTES

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

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

APPROVED
30/4/16
SE, NIRMAL

REV. No	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED
B	REVISED STAIR CASE	17/02/16	HMP	PMD	RMM	–
A	FOR APPROVAL	10/02/16	HMP	PMD	RMM	–

REVISIONS

L&T Construction
Water, Smart World & Communication.

CLIENT : RURAL WATER SUPPLY AND SANITATION DEPARTMENT, TELANGANA.

CONSULTANT : -

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

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

JOB No : LE150883

	NAME	SIGN	DATE
DSGN	HMP		10-02-16
DRWN	PMD		10-02-16
CHKD	RMM		10-02-16
APPD	–		10-02-16

TITLE : 300 KL CAPACITY 30M HEIGHT ESR KATTERLA (GENERAL ARRANGEMENT DRAWING)

SCALE 1:100,25

PROJECTION

DRAWING No. LE150883-C-WS-RW-GA-1601

SIZE A2 REV. B

COMP. DATA : P16-02_01-01-01

SHEET 1 OF 1

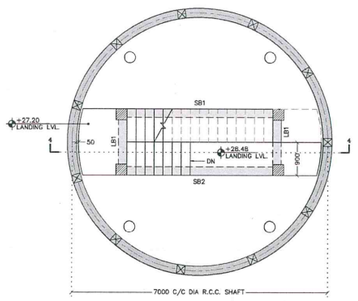
RELEASED FOR ☐ PRELIMINARY ☐ TENDER ☐ INFORMATION ☑ APPROVAL ☐ CONSTRUCTION

L&T Construction - TDWSP - ADILABAD

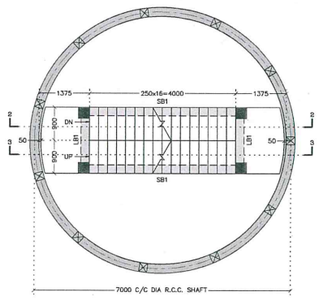
Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

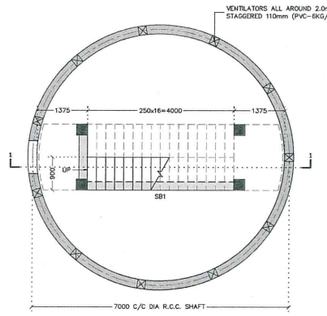
Executive Engineer
TDWSP Asifabad



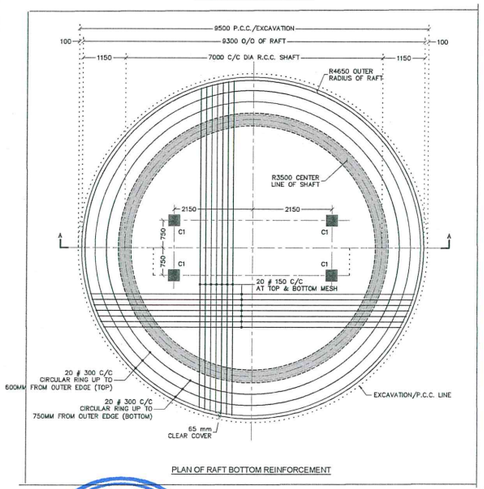
PLAN OF STAIR CASE AT +27.20 & +28.48 LANDING LEVEL



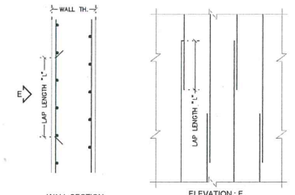
TYPICAL PLAN FOR STAIR CASE



PLAN OF SHAFT AT +0.00 LEVEL

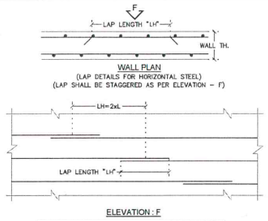


PLAN OF RAFT BOTTOM REINFORCEMENT



WALL SECTION
LAP DETAILS FOR VERTICAL STEEL
(LAP SHALL BE STAGGEREDAS PER ELEVATION – E)

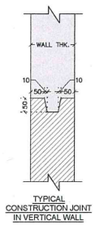
ELEVATION : E



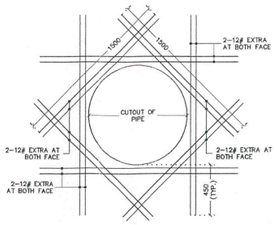
WALL PLAN
(LAP DETAILS FOR HORIZONTAL STEEL)
(LAP SHALL BE STAGGERED AS PER ELEVATION – F)

ELEVATION : F

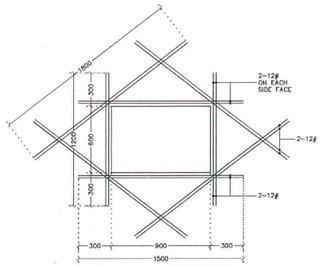
FOR CONTAINER STEEL (WALL,CONICAL WALL & BEAM)
LAP LENGTH LH : 2 X L FOR HORIZONTAL STEEL



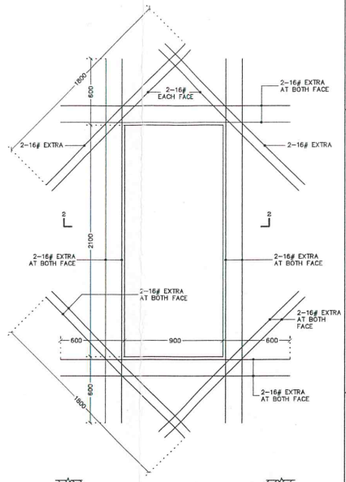
TYPICAL
CONSTRUCTION JOINT
IN VERTICAL WALL



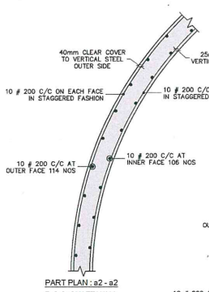
EXTRA REINFORCEMENT
OPENING FOR PIPE IN SHAFT



EXTRA REIN. AROUND OPENING OF MANHOLE

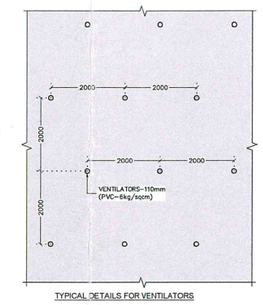


EXTRA RE'IN. AROUND DOOR OPENING
PLAN : 2-2



PART PLAN : a2 - a2
R.C.C. SHAFT WALL

SECTION : A - A



TYPICAL DETAILS FOR VENTILATORS

IMPORTANT NOTES

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

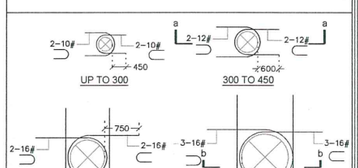
2 FOUNDATION SHALL REST ON GOOD SOIL. IT SHOULD NOT REST ON BLACK COTTON SOIL OR SOIL HAVING EXPANSIVE PROPERTY.

3 AFTER EXCAVATION UP TO 3.0m DEPTH, SOIL STRATA SHALL BE VERIFIED BY SOIL CONSULTANT FOR GIVEN FOUNDATION SYSTEM. AFTER WRITTEN CONFORMATION & APPROVAL FROM SOIL CONSULTANT EXECUTION SHALL BE START

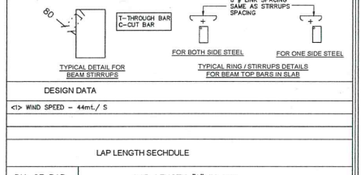
4 RECOMMENDATION OF SOIL CONSULTANT SHALL BE STRICTLY FOLLOWED

NOTES :-

1 ALL DIMENSION ARE IN MM AND LEVELS ARE IN METER.
2 CONCRETE MIX
(a) CONTAINER M:30
(b) SHAFT, CENTRAL COLUMN & TIE BEAM M:30
(c) RAFT M:30
ALL CONCRETE MIX M:30 WITH MAXIMUM FREE WATER CEMENT RATIO OF 0.45 FOR WATER RETAINING STRUCTURE
3 ALL CONCRETE SHALL BE MACHINE MIXED AND MACHINE VIBRATED
4 ϕ – INDICATE HYSD–TMT FE–415 GRADE CONFORMING TO I.S 1786–LATEST REVISION, HOWEVER STEEL GRADE AND TYPE SHALL BE VERIFIED WITH TENDER SPECIFICATION
5 CLEAR COVER TO MAIN STEEL
(a) RAFT : 65mm
(b) SHAFT : 40mm OUTSIDE, 25mm INSIDE
(c) COLUMN : 40mm
(d) TIE BEAM : 30mm
(e) CONTAINER SLAB & DOME, WALL, BEAM : 45mm
6 FOUNDATION SHOULD BE IN–SITU SOIL AND IT SHOULD NOT BE ON FILLING MATERIAL i.e. MADE UP SOIL
7 BACK FILLING SHALL BE DONE IN WELL COMPACTED AND WELL WATER LAYER NOT EXCEEDING 300mm IN DEPTH
8 SBC OF SOIL IS 25 t/m2 AT 3.0mt. DEPTH AS PER SOIL REPORT
9 LOCATION & SIZE OF SUCTION PIT SHALL BE DECIDED AS PER SITE CONDITION BEFORE EXECUTION
10 INLET & OVERFLOW PIPE SHALL BE DECIDED AS PER SITE CONDITION
11 LOCATION & LEVELS OF INLET,OUTLET & OVERFLOW PIPE SHALL BE VERIFY WITH ENGINEER INCHARGE BEFORE EXECUTION
12 READ THIS DRAWING ALONG WITH SHEET NO. 2 OF 3 & 3 OF 3.



TYPICAL DETAIL FOR EXTRA STEEL BAR AT CUT-OUT



DESIGN DATA

<1> WIND SPEED – 44mt./ S

LAP LENGTH SECHDULE

DIA OF BAR	LAP LENGTH "L" IN mm
	M:30 CONCRETE
8	320
10	400
12	480
16	640
20	800
25	1000

APPROVED
20/4/16

REV. No	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED
B	REVISED STAIR CASE	17/02/16	HMP	PMD	RMM	–
A	FOR APPROVAL	04/02/16	HMP	PMD	RMM	–

REVISIONS

L&T Construction
Water, Smart World & Communication.

CLIENT : RURAL WATER SUPPLY AND SANITATION DEPARTMENT, TELANGANA.
CONSULTANT :
PROJECT : PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT
SUPPLIER / CONTRACTOR : L&T Construction, Water & Effluent Treatment SBG

JOB No. : LE150883
TITLE : 300 KL CAPACITY 30M HEIGHT ESR KATTERLA (FOUNDATION PLAN, STAIR CASE PLAN & DETAILS)
SCALE 1:75,25
PROJECTION

	NAME	SIGN	DATE
DSGN	HMP		04–02–16
DRWN	PMD		04–02–16
CHKD	RMM		04–02–16
APPD	–		04–02–16

DRAWING No. LE15088B3–C–WS–RW–GA–1601
COMP. DATA : P16–02_01–02–01
SIZE A1 REV. B
SHEET 1 OF 3

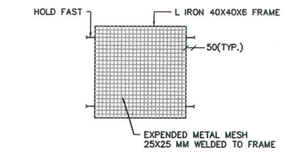
RELEASED FOR ☐ PRELIMINARY ☐ TENDER ☐ INFORMATION ☑ APPROVAL ☐ CONSTRUCTION

LARSEN & TOUBRO LTD. Komarambheem - Asifabad Segment Construction-TDWSP ASIFABAD

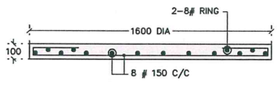
Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

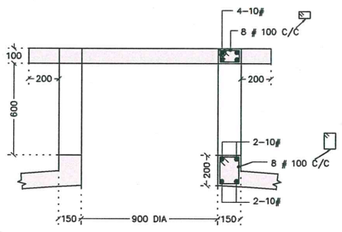
Executive Engineer
TDWSP Asifabad



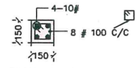
DETAIL OF METAL MESH



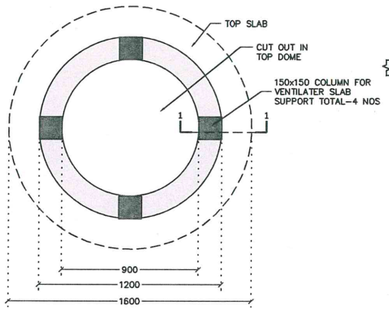
R.C.C .DETAIL AT TOP SLAB



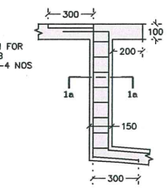
DETAIL OF AIR VENT



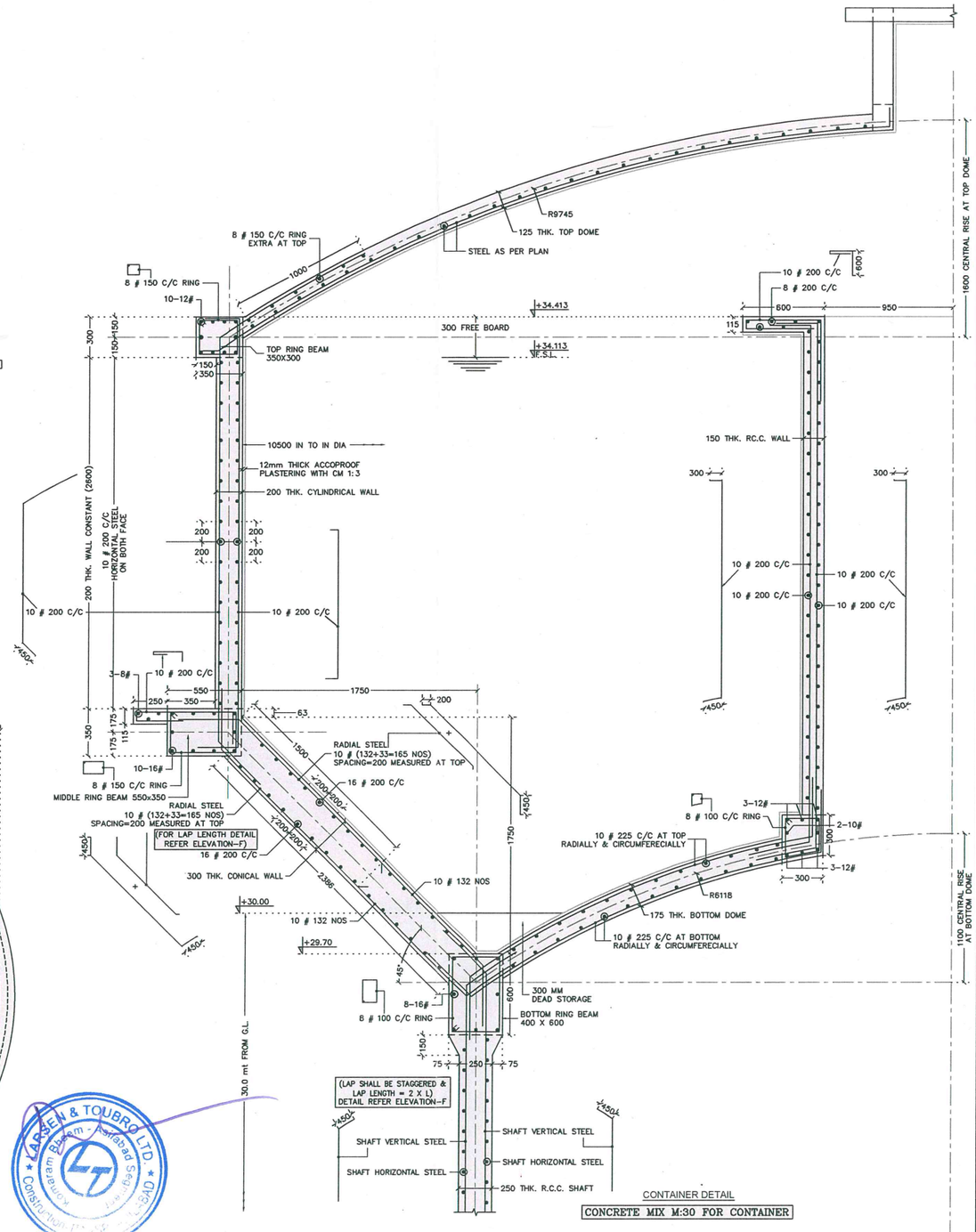
PLAN : 1a - 1a



PLAN OF AIR VENT

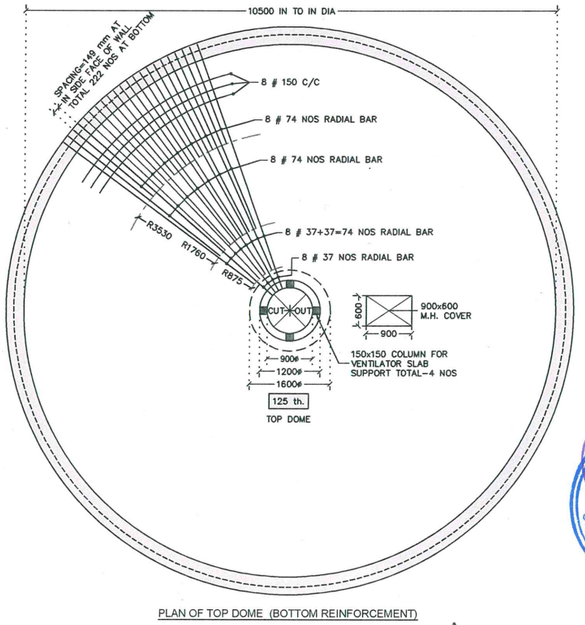


SECTION : 1 - 1



CONTAINER DETAIL

CONCRETE MIX M:30 FOR CONTAINER



PLAN OF TOP DOME (BOTTOM REINFORCEMENT)

CONCRETE MIX M:30 FOR CONTAINER

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

APPROVED
SE, M[illegible]
30/4/16

REV. No	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED
A	FOR APPROVAL	04/02/16	HMP	PMD	RMM	–

REVISIONS

L&T Construction
Water, Smart World & Communication.

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

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

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

JOB No. : LE150883

TITLE : 300 KL CAPACITY 30M HEIGHT ESR KATTERLA (CONTAINER DETAIL)

SCALE 1: 75,25

PROJECTION

	NAME	SIGN	DATE
DSGN	HMP		04-02-16
DRWN	PMD		04-02-16
CHKD	RMM		04-02-16
APPD	–		04-02-16

DRAWING No. LE1508883-C-WS-RW-GA-1601 SIZE A2 REV. A
COMP. DATA : P16-02_01-02-02 SHEET 2 OF 3

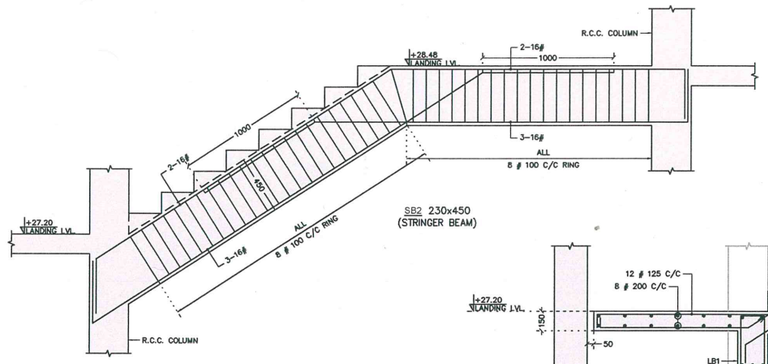
RELEASED FOR ☐ PRELIMINARY ☐ TENDER ☐ INFORMATION ☑ APPROVAL ☐ CONSTRUCTION

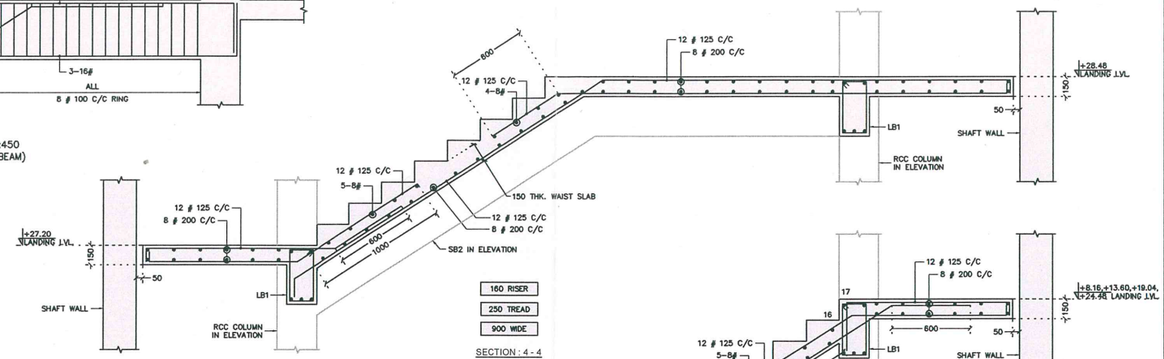
KAREN & TOUBRO LTD. Komaram Bheem - Asifabad Segment

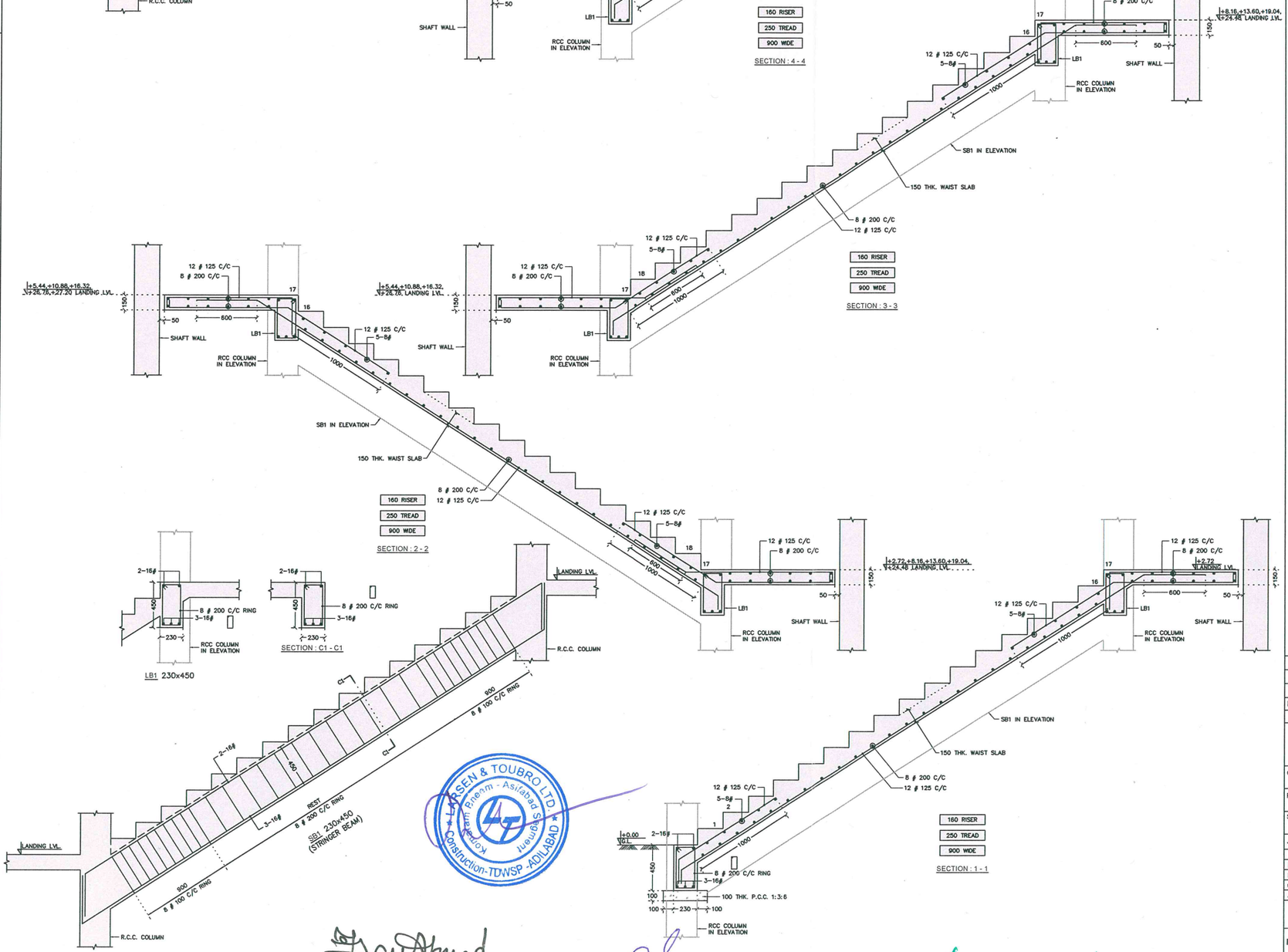
Asst. Executive Engineer
TDWSP Asifabad

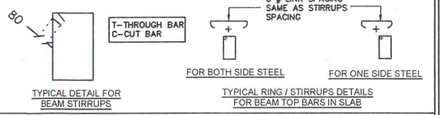
Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad









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

APPROVED
30/4/16

REV. No	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED
A	FOR APPROVAL	17/02/16	HMP	PMD	RMM	–

REVISIONS

L&T Construction
Water, Smart World & Communication.

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

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

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

JOB No. : LE150883

TITLE : 300 KL CAPACITY 30M HEIGHT ESR KATTERLA (STAIR CASE SECTION DETAILS)

SCALE 1: 25

PROJECTION

	NAME	SIGN	DATE
DSGN	HMP		17-02-16
DRWN	PMD		17-02-16
CHKD	RMM		17-02-16
APPD	–		17-02-16

DRAWING No. LE1508B3-C-WS-RW-GA-1601 | SIZE A2 | REV. A
COMP. DATA : P16-02_01-02-03 | SHEET 3 OF 3

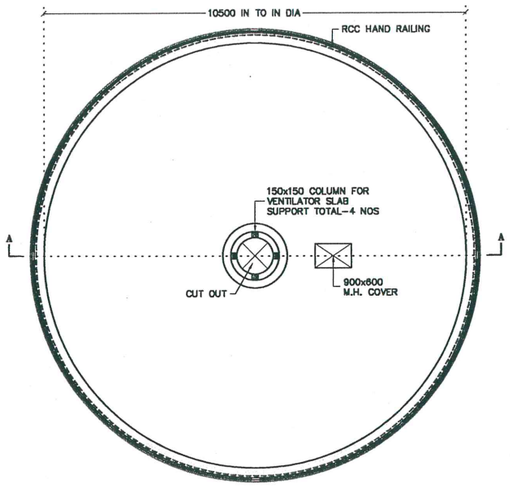
RELEASED FOR ☐ PRELIMINARY ☐ TENDER ☐ INFORMATION ☑ APPROVAL ☐ CONSTRUCTION

LARSEN & TOUBRO LTD. Komarambheem - Asifabad Segment Construction-TDWSP-ADILABAD

Asst. Executive Engineer
TDWSP Asifabad

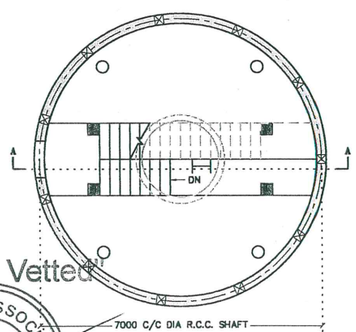
Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad

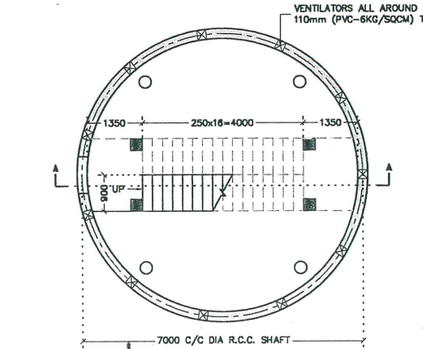


PLAN : 4 - 4

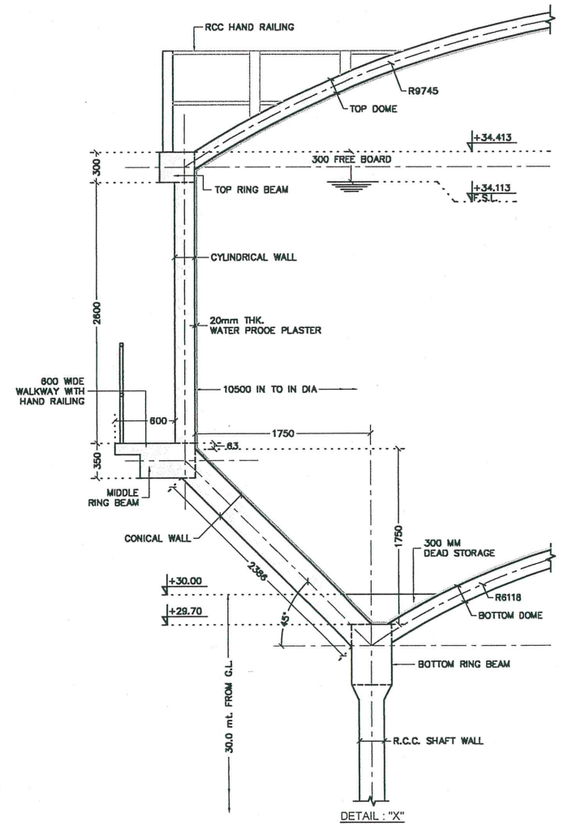
PLAN : 3 - 3



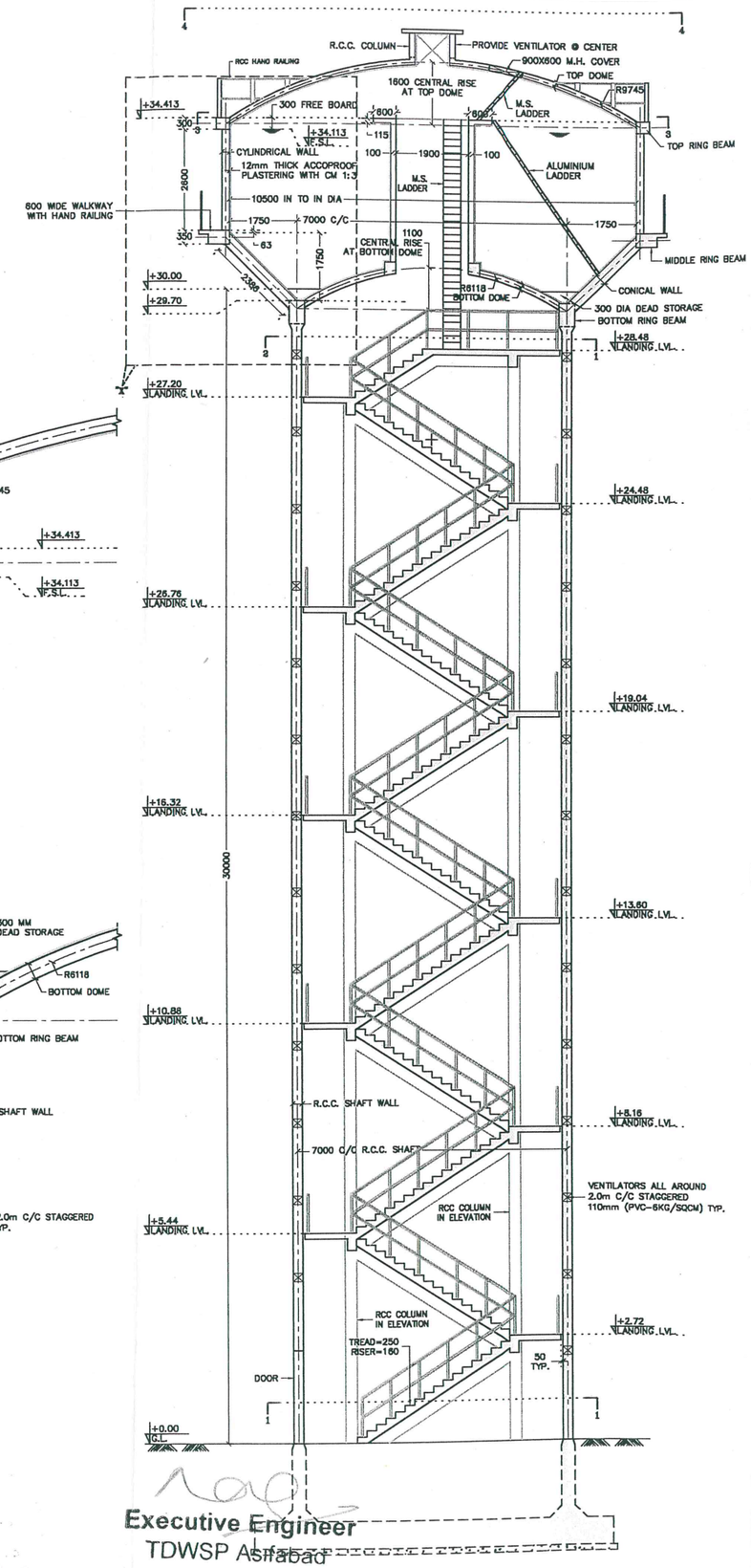
PLAN : 2 - 2



PLAN : 1 - 1



DETAIL : "X"



SECTION : A - A

NOTES :
<1> ALL DIMENSION ARE IN MM AND LEVELS ARE IN METER.
<2> LOCATION & LEVELS OF INLET ,OUTLET CUM WASHOUT & OVERFLOW PIPE SHALL BE VARIFIED WITH ENGINEER INCHARGE BEFORE EXECUTION

APPROVED
5/30/14/16
SE, NIRMAL

REV. No	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED
B	REVISED STAIR CASE	17/02/16	HMP	PMD	RMM	–
A	FOR APPROVAL	10/02/16	HMP	PMD	RMM	–

REVISIONS

L&T Construction
Water, Smart World & Communication.

CLIENT : RURAL WATER SUPPLY AND SANITATION DEPARTMENT, TELANGANA.
CONSULTANT : .
PROJECT : PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT
SUPPLIER / CONTRACTOR : L&T Construction Water & Effluent Treatment SBG

JOB No. : LE150883
TITLE : 300 KL CAPACITY 30M HEIGHT ESR KATTERLA (GENERAL ARRANGEMENT DRAWING)
SCALE 1:100,25
PROJECTION

	NAME	SIGN	DATE
DSGN	HMP		10-02-16
DRWN	PMD		10-02-16
CHKD	RMM		10-02-16
APPD	–		10-02-16

DRAWING No. LE150883-C-WS-RW-GA-1601
COMP. DATA : P16-02_01-01-01
SIZE A2 REV. B
SHEET 1 OF 1

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

"Drawings Vetted" M/s. S.K. Associates HYD-8

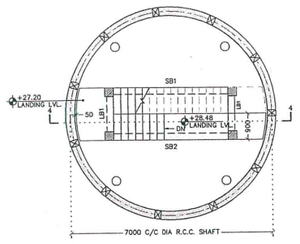
Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

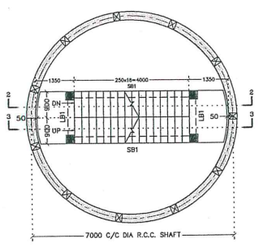
Executive Engineer
TDWSP Asifabad

WAPCOS LIMITED Hyderabad

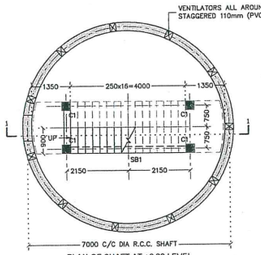
LARSEN & TOUBRO LIMITED Construction - Chennai



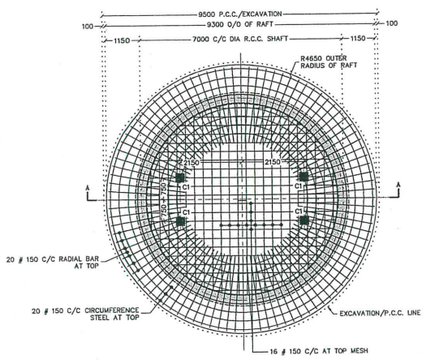
PLAN OF STAIR CASE AT +27.20 & +28.48 LANDING LEVEL



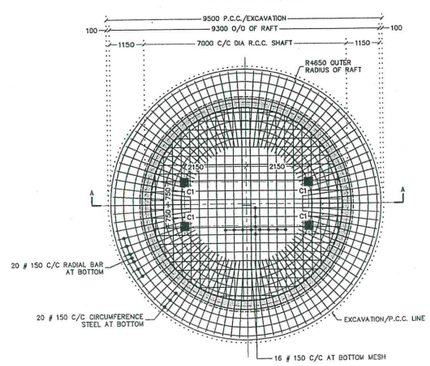
TYPICAL PLAN FOR STAIR CASE



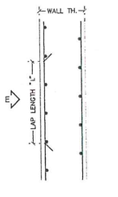
PLAN OF SHAFT AT +0.00 LEVEL



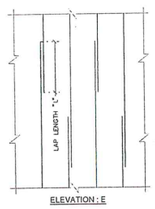
PLAN OF RAFT TOP REINFORCEMENT



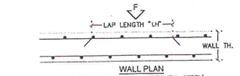
PLAN OF RAFT BOTTOM REINFORCEMENT



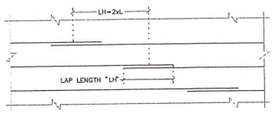
WALL SECTION
LAP DETAILS FOR VERTICAL STEEL
(LAP SHALL BE STAGGEREDAS PER ELEVATION - E)



ELEVATION : E

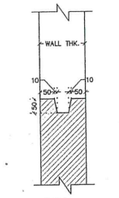


WALL PLAN
(LAP DETAILS FOR HORIZONTAL STEEL)
(LAP SHALL BE STAGGERED AS PER ELEVATION - F)

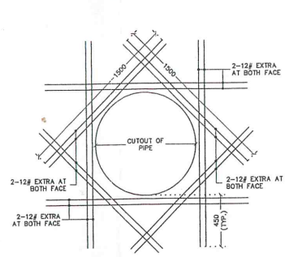


ELEVATION : F

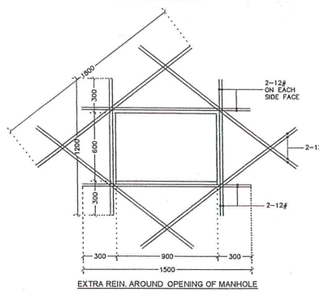
FOR CONTAINER STEEL (WALL,CONICAL WALL & BEAM)
LAP LENGTH LH : 2 X L FOR HORIZONTAL STEEL



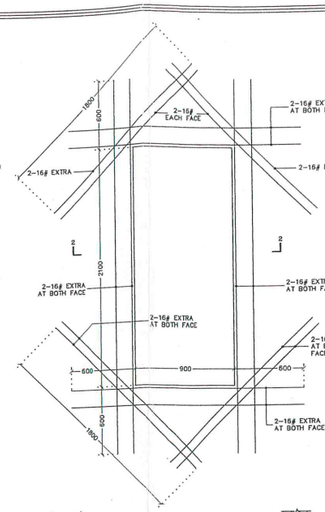
TYPICAL
CONSTRUCTION JOINT
IN VERTICAL WALL

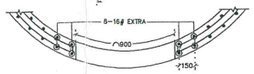


EXTRA REINFORCEMENT
OPENING FOR PIPE IN SHAFT

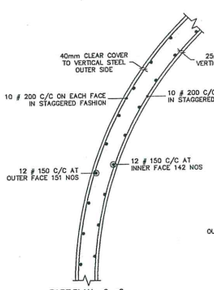


EXTRA REIN. AROUND OPENING OF MANHOLE

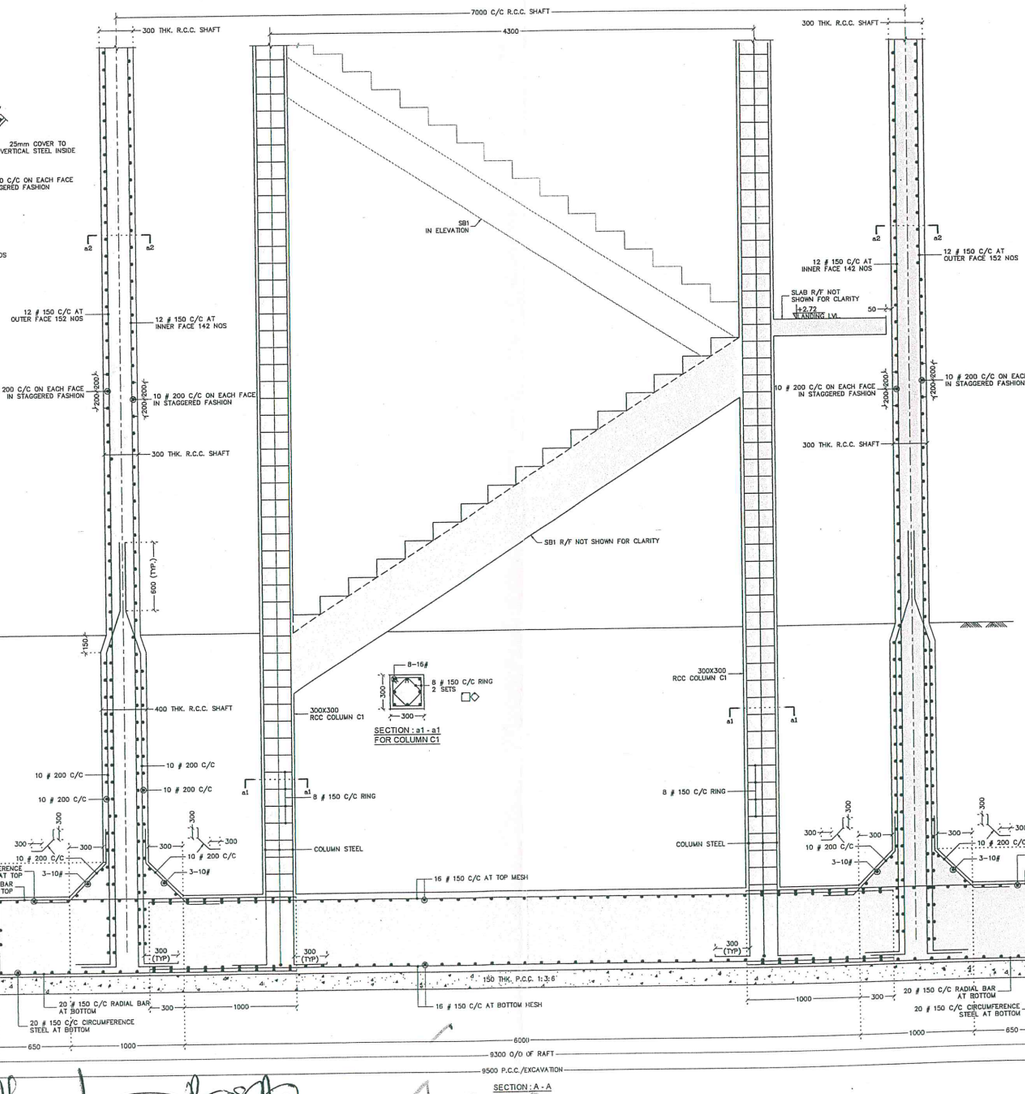




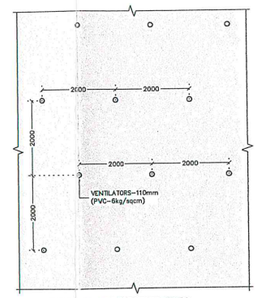
EXTRA REIN. AROUND DOOR OPENING
PLAN : 2 - 2



PART PLAN : a2 - a2
R.C.C. SHAFT WALL



SECTION : A - A



TYPICAL DETAILS FOR VENTILATORS

IMPORTANT NOTES

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

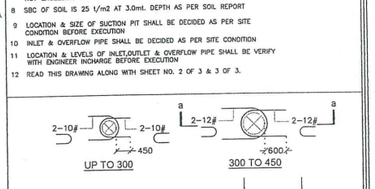
2 FOUNDATION SHALL REST ON GOOD SOIL. IT SHOULD NOT REST ON BLACK COTTON SOIL OR SOIL HAVING EXPANSIVE PROPERTY.

3 AFTER EXCAVATION UP TO 3.0m DEPTH, SOIL STRATA SHALL BE VERIFIED BY SOIL CONSULTANT FOR GIVEN FOUNDATION SYSTEM. AFTER WRITTEN CONFORMATION & APPROVAL FROM SOIL CONSULTANT EXECUTION SHALL BE START

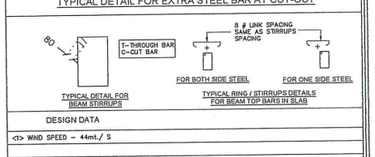
4 RECOMMENDATION OF SOIL CONSULTANT SHALL BE STRICTLY FOLLOWED

NOTES :-

1 ALL DIMENSION ARE IN MM AND LEVELS ARE IN METER.
2 CONCRETE MIX
(a) CONTAINER M:30
(b) SHAFT, CENTRAL COLUMN & TIE BEAM M:30
(c) RAFT M:30
ALL CONCRETE MIX M:30 WITH MAXIMUM FREE WATER CEMENT RATIO OF 0.45 FOR WATER RETAINING STRUCTURE
3 ALL CONCRETE SHALL BE MACHINE MIXED AND MACHINE VIBRATED
4 # - INDICATE HYSD-TMT FE-500 GRADE CONFORMING TO I.S 1786-LATEST REVISION, HOWEVER STEEL GRADE AND TYPE SHALL BE VERIFIED WITH TENDER SPECIFICATION
5 CLEAR COVER TO MAIN STEEL
(a) RAFT : 65mm
(b) SHAFT : 40mm OUTSIDE, 25mm INSIDE
(c) COLUMN : 40mm
(d) TIE BEAM : 30mm
(e) CONTAINER SLAB & DOME, WALL, BEAM : 45mm WATER FACE, 30mm FREE FACE
6 FOUNDATION SHOULD BE IN-SITU SOIL AND IT SHOULD NOT BE ON FILLING MATERIAL i.e. MADE UP SOIL
7 BACK FILLING SHALL BE DONE IN WELL COMPACTED AND WELL WATER LAYER NOT EXCEEDING 300mm IN DEPTH
8 SBC OF SOIL IS 25 t/m2 AT 3.0mt. DEPTH AS PER SOIL REPORT
9 LOCATION & SIZE OF SUCTION PIT SHALL BE DECIDED AS PER SITE CONDITION BEFORE EXECUTION
10 INLET & OVERFLOW PIPE SHALL BE DECIDED AS PER SITE CONDITION
11 LOCATION & LEVELS OF INLET,OUTLET & OVERFLOW PIPE SHALL BE VERIFY WITH ENGINEER INCHARGE BEFORE EXECUTION
12 READ THIS DRAWING ALONG WITH SHEET NO. 2 OF 3 & 3 OF 3.



TYPICAL DETAIL FOR EXTRA STEEL BAR AT CUT-OUT



DESIGN DATA

<1> WIND SPEED - 44mt./ S

LAP LENGTH SECHDULE

DIA OF BAR	LAP LENGTH "L" IN mm
	M:30 CONCRETE
8	320
10	400
12	480
16	640
20	800
25	1000

APPROVED
30/4/16
SE, NIRMAL

L&T CONSTRUCTION & TOUBRO LIMITED Chennai Construction

"Drawings Vetted"
M/s. S.K. Associates
HYD-8

REV. No	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED
B	REVISED STAIR CASE	17/02/16	HMP	PMD	RMM	–
A	FOR APPROVAL	04/02/16	HMP	PMD	RMM	–

REVISIONS

L&T Construction
Water, Smart World & Communication.

CLIENT : RURAL WATER SUPPLY AND SANITATION DEPARTMENT, TELANGANA.
CONSULTANT :
PROJECT : PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT
SUPPLIER / CONTRACTOR : L&T Construction Water & Effluent Treatment SBG
JOB No. : LE150883
TITLE : 300 KL CAPACITY 30M HEIGHT ESR KATTERLA (FOUNDATION PLAN, STAIR CASE PLAN & DETAILS)
SCALE 1:100,25
PROJECTION

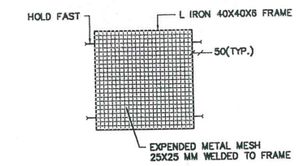
	NAME	SIGN	DATE
DSGN	HMP		04-02-16
DRWN	PMD		04-02-16
CHKD	RMM		04-02-16
APPD	–		04-02-16

DRAWING No. L E 1 5 0 8 8 3 – C – W S – R W – G A – 1 6 0 1
COMP. DATA : P16-02_01-02-01
SHEET 1 OF 3
SIZE A1
REV. B

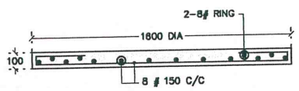
RELEASED FOR ☐ PRELIMINARY ☐ TENDER ☐ INFORMATION ☑ APPROVAL ☐ CONSTRUCTION

Asst. Executive Engineer Dy. Executive Engineer Executive Engineer
TDWSP Asifabad TDWSP Asifabad

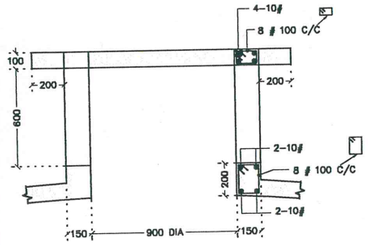
NOTES :
<1> ALL DIMENSION ARE IN MM AND LEVELS ARE IN METER.
<2> FOR ALL OTHER NOTES REFER SHEET NO 1 OF 3.
<3> READ THIS DRAWING ALONG WITH SHEET NO. 1 OF 3 & 3 OF 3.



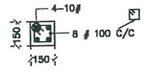
DETAIL OF METAL MESH



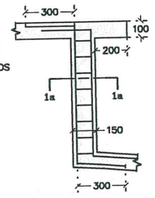
R.C.C .DETAIL AT TOP SLAB



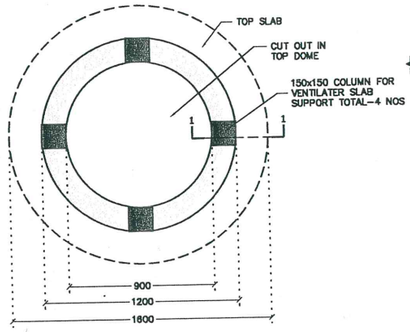
DETAIL OF AIR VENT



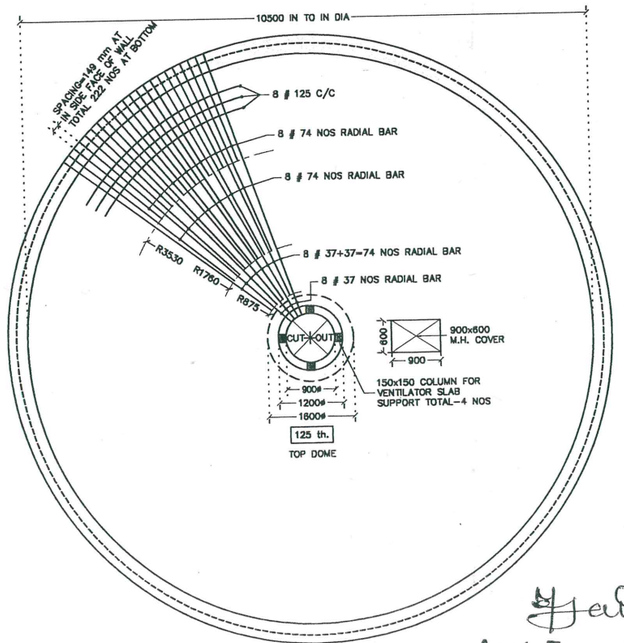
PLAN : 1a - 1a



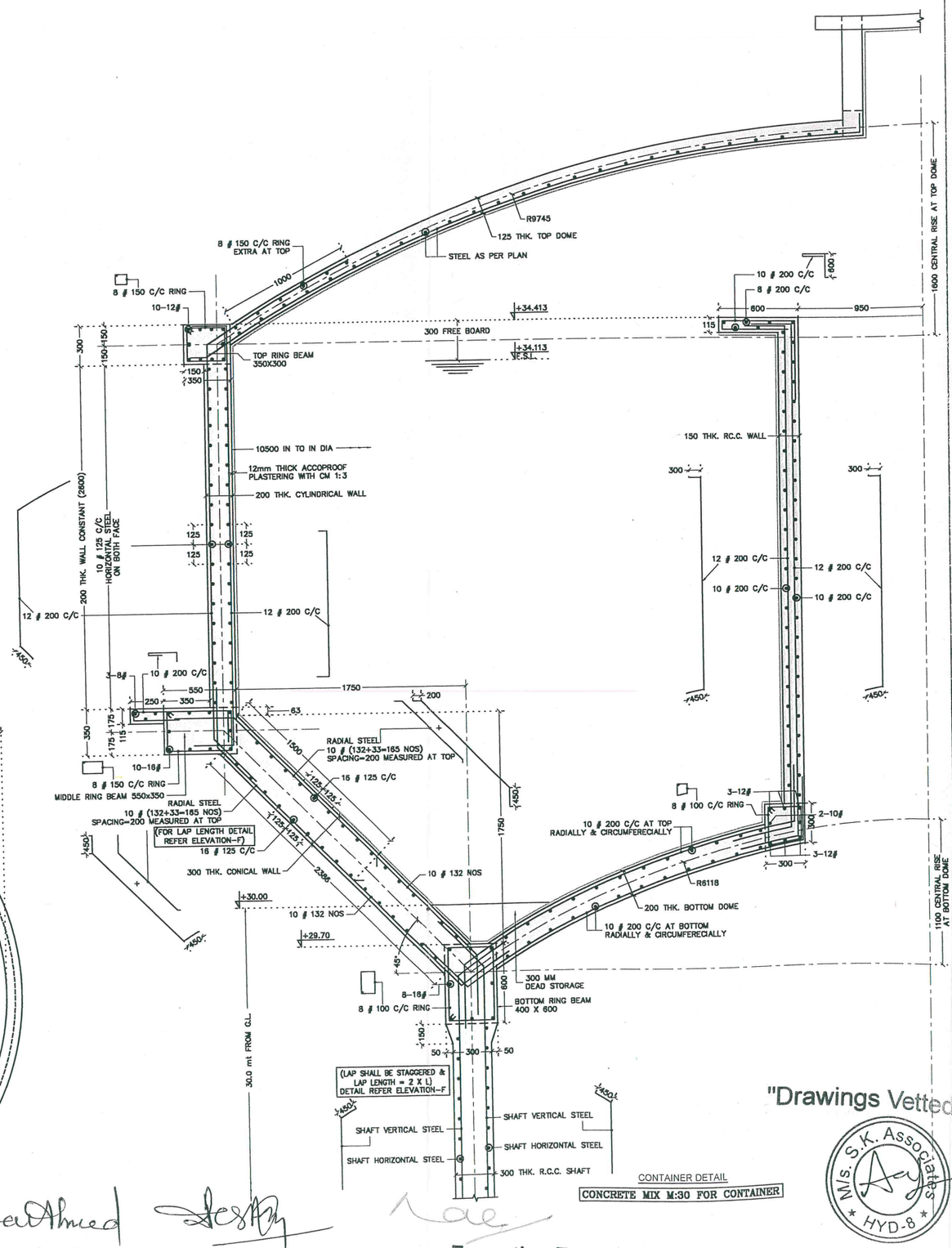
SECTION : 1 - 1



PLAN OF AIR VENT



PLAN OF TOP DOME (BOTTOM REINFORCEMENT)
CONCRETE MIX M:30 FOR CONTAINER



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

Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad

APPROVED
30/4/16
SE, NIRMAL

L&T TOUBRO LIMITED Chennai LARSEN & Construction

REV. No	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED
A	FOR APPROVAL	04/02/16	HMP	PMD	RMM	–

REVISIONS

L&T Construction
Water, Smart World & Communication.

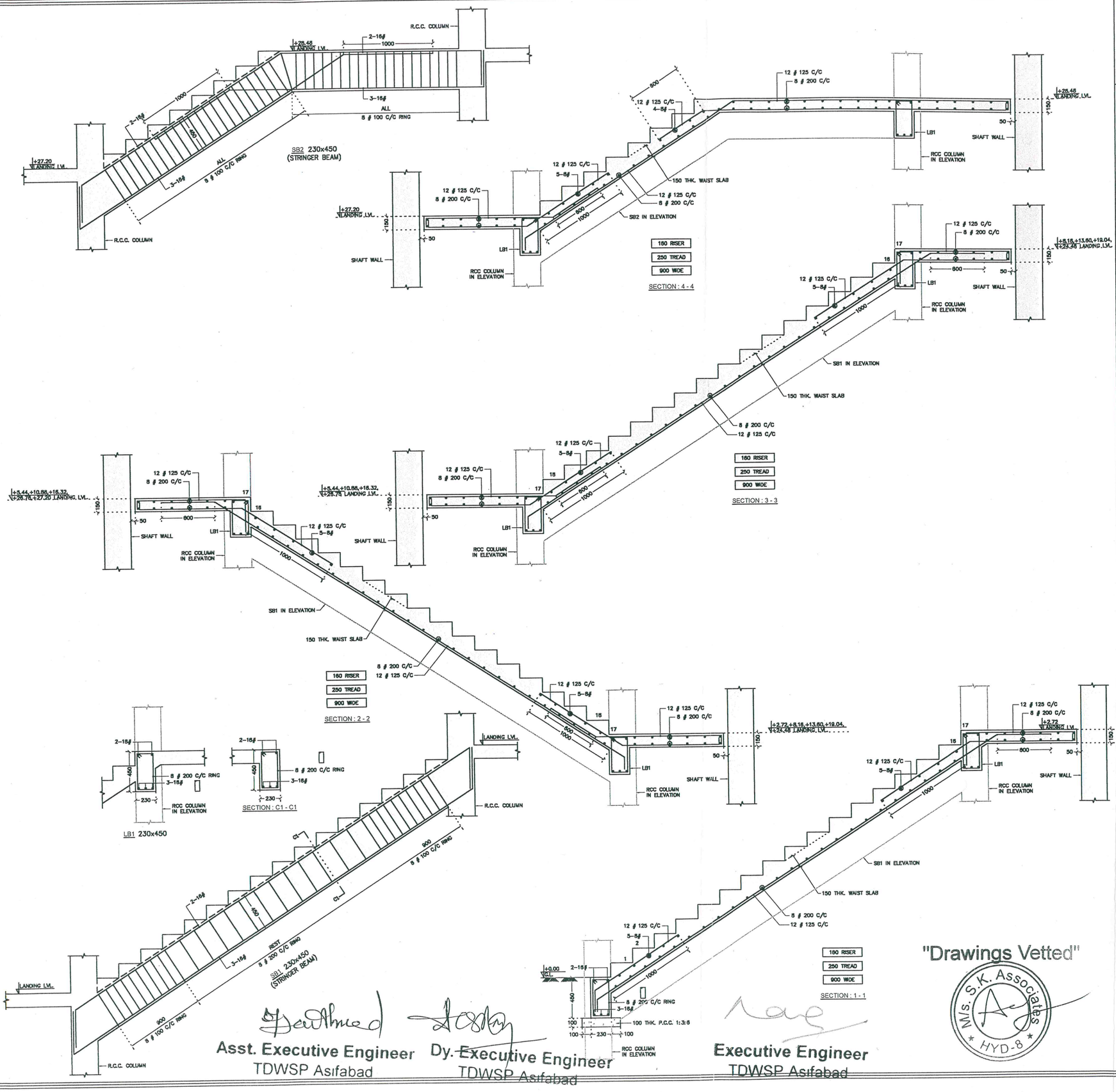
CLIENT : RURAL WATER SUPPLY AND SANITATION DEPARTMENT, TELANGANA.
CONSULTANT : -
PROJECT : PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT
SUPPLIER / CONTRACTOR : L&T Construction, Water & Effluent Treatment SBG
JOB No. : LE150883

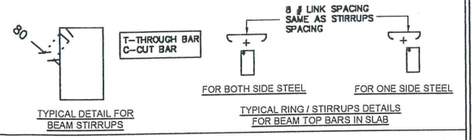
	NAME	SIGN	DATE
DSGN	HMP		04-02-16
DRWN	PMD		04-02-16
CHKD	RMM		04-02-16
APPD	-		04-02-16

TITLE : 300 KL CAPACITY 30M HEIGHT ESR KATTERLA (CONTAINER DETAIL)
SCALE 1: 75,25
PROJECTION

DRAWING No. LE150883-C-WS-RW-GA-1601 | SIZE A2 | REV. A
COMP. DATA : P16-02_01-02-02 | SHEET 2 OF 3

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





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

APPROVED
17/4/16
SE, NIRMAL

W.A.P.COS LIMITED

L&T TOUBRO LIMITED

REV. No	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED
A	FOR APPROVAL	17/02/16	HMP	PMD	RMM	–

REVISIONS

L&T Construction
Water, Smart World & Communication.

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

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

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

JOB No. : LE150883

	NAME	SIGN	DATE
DSGN	HMP		17-02-16
DRWN	PMD		17-02-16
CHKD	RMM		17-02-16
APPD	–		17-02-16

TITLE : 300 KL CAPACITY 30M HEIGHT ESR KATTERLA (STAIR CASE SECTION DETAILS)

SCALE 1:25

PROJECTION

DRAWING No. LE150883-C-WS-RW-GA-1601 | SIZE A2 | REV. A

COMP. DATA : P16-02_01-02-03 | SHEET 3 OF 3

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

"Drawings Vetted"
M/s. S.K. Associates
HYD-8

Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad