

**Submitted sir,**

**Sub:** RWS&S-TDWSP- Koddugudagutta 40KL GLBR in Asifabad Mandal-  
Komarambheem Asifabad Segment-Adilabad District-Designs -Approval-Reg.

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Kindly puruse the Designs of the following 40KL GLBR at Koddugudagutta (V) ,Asifabad (M), submitted by the Executive Engineer TDWSP Asifabad Division ,Adilabad district for approval.

**1. 40 KL GLBR.**

The Executive Engineer TDWSP Asifabad Division has submitted Structural Designs & Drawings of 40KL GLBR based on the field conditions and as per the estimate provisions , the structural designs & drawings for the above structure is verified and submitted for approval.

The following design parameters were considered:

- Capacity : 40KL
- Net SBC of Soil : 15.0 t/sqm
- Grade of concrete & Steel : M 30 & Fe 500
- Dia of GLBR Inner to Inner : 4.50m
- Sidewall Height : 3.00mts
- Sidewall Thickness: 200mm
- Top Slab thickness: 150 mm
- Raft Slab thickness: 200mm


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


The additional points noted after checking the designs are:

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

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

  
AEE (Designs)  
TDWSP, Nirmal Circle

  
DEE (Designs)  
TDWSP, Nirmal Circle

  
Superintending Engineer,  
TDWSP, Nirmal Circle



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

**TELANGANA WATER GRID**



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

<b>CLIENT:</b> RURAL WATER SUPPLY AND SANITATION DEPARTMENT (WATER GRID), TELUNGANA.	<b>CONSULTANT :</b> WAPCOS LIMITED
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<b>PROJECT :</b>	PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT
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<b>SUPPLIER / CONTRACTOR:</b>	L&T Construction, Water, Smart World and Communication
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<b>JOB Ref. No. :</b> LE150883	<b>TITLE :</b>																
<table border="1"><thead><tr><th></th><th>NAME</th><th>SIGN</th><th>DATE</th></tr></thead><tbody><tr><td>DSGN</td><td></td><td></td><td></td></tr><tr><td>CHKD</td><td></td><td></td><td></td></tr><tr><td>APPD</td><td></td><td></td><td></td></tr></tbody></table>		NAME	SIGN	DATE	DSGN				CHKD				APPD				<b>DESIGN OF GLBR - 40KL CAPACITY KODDUGUDAGUTTA AT ASIFABAD MANDAL</b>
	NAME	SIGN	DATE														
DSGN																	
CHKD																	
APPD																	

<b>DOC./DRG. No.</b> L E 1 5 0 8 8 3 - C - W S - R W - D C - 1 4 7 1	<b>SIZE</b> A4	<b>REV.</b> A
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<b>RELEASED FOR</b>	<input type="checkbox"/> PRELIMINARY	<input type="checkbox"/> INFORMATION	<input checked="" type="checkbox"/> APPROVAL	<input type="checkbox"/> CONSTRUCTION
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# **DESIGN CALCULATION**

## **PROJECT TITLE**

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

## **UNIT**

**40 KL GLBR**

**DCI NO: - LE150883-C-WS-RW-DC-1502**

## **PRINCIPAL CLIENT**

**RURAL WATER SUPPLY  
AND  
SANITATION DEPARTMENT,  
TELANGANA**

## **CONTRACTOR**

**L&T CONSTRUCTION  
WATER & EFFLUENT TREATMENT SBG**

## DESIGN OF GLBR

### BASIC DATA

Diameter = 4.5 m  
Water depth = 2.7 m  
Free board = 0.3 m

### CAPACITY CHECK

Required capacity = 40 KL

Capacity of section

Clear diameter = 4.5 – 2 x plaster thickness  
= 4.5 – 2 x 0.012  
= 4.476 m

Water depth = 2.70 m

Volume =  $(\pi * d * d / 4) * H$   
=  $(\pi * 4.476 * 4.476 / 4) * 2.7 = 42.48 \text{ m}^3$  (including dead storage)

Volume-Dead storage = 42.48 – 2.36 = 40.12 m<sup>3</sup>

Net volume = 40.12 m<sup>3</sup> > 40 m<sup>3</sup> hence O.K.

ELEMENT:

Inside tank: (1) Cylindrical wall  
(2) Top Slab

SBC – 15 t/m<sup>2</sup>

GROUND WATER TABLE: NO GWT

Tank type : Ground storage reservoir				
Tank Geomtry : Circular with slab				
40 KL GLBR				
Basic data				
General				
No	Description	Notation	Value	Unit
(A)	Unit weight			
	Unit weight of concrete	Uwc	25.0	kN/m <sup>3</sup>
	Unit weight of water	Uww	10.00	kN/m <sup>3</sup>
	Unit weight of plaster	Uwp	21.0	kN/m <sup>3</sup>
	Unit weight of IPS	Uips	21.0	kN/m <sup>3</sup>
	Unit weight of soil	Uws	18.0	kN/m <sup>3</sup>
(B)	Material			
	Grade of concrete of container	Fck	30	N/mm <sup>2</sup>
	Grade of Steel	Fy	500	N/mm <sup>2</sup>
	Mass & Wt relation factor	g	9.81	
(C)	Loading			
	Finishing load on top slab	Fl	1.00	kN/m <sup>2</sup>
	Live load on top slab	LI	1.50	kN/m <sup>2</sup>
(D)	Other			
	Plaster thickness	Pt	20	mm
	Bottom IPS thickness	Bips	20	mm
	Free board	Fb	300	mm
(E)	Capacity			
	Required volumn of water	Vw	40	m <sup>3</sup>
		Vwl	40000	liter
(F)	Geometry data			
	Height between Bottom slab & FSI	Hw	2.7	m
	Depth below ground	Dbgl	0.6	m
	Water depth	Wd	2.7	
	Diameter of tank required	Diar	4.38	m
	Diameter of tank provide	Diat	4.5	m
	Actual capcity of tank	Tcap	42.182	m <sup>3</sup>
		Tcapl	42182	liter
(G)	RCC geometry data			
	Bottom slab thickness	Thkbs	200	mm
	Top Slab thickness	Thkts	150	mm
	Wall thickness	Thkw	175	mm
	Progection of bottom slab	Prjbs	300	mm
	Projection of PCC	prjpcc	100	mm
	Thickness of PCC	Thkpcc	100	mm
(H)	Earthquake data			
	Zone	Eqzone	2	
	Soil type (1,2,3)	typesoil	2	
	soft soil : Soil type 1			
	Medium soil : Soil type 2			
	Hard soil : soil type 3			
	Importance Factor	Impfac	1.5	

Tank Geomtry : Circular with slab				
40 KL GLBR				
Mass & Weight Calculation				
	RCC			
(A)	Bottom slab			
	Out to out dia of bottom slab	Bso	5.45	m
	Thickness of bottom slab in m	thkbsm	0.20	m
	Volume of bottom slab	Vbs	4.67	m <sup>3</sup>
	Weight of bottom slab	wtbs	116.64	kN
	Mass of bottom slab	Mbs	11890	kg
(B)	Side wall			
	C/C wall dia	Wdiacc	4.68	m
	Total height of wall	Wht	3.00	m
	Thickness of wall in meter	thkwm	0.18	m
	Volume of side wall	Vw	7.71	m <sup>3</sup>
	Weight of side wall	Ww	192.77	kN
	Mass of side	Mw	19650	kg
(C)	Top slab			
	Out to out dia of top slab	Tso	4.85	m
	Thickness of top slab in m	thktsm	0.150	m
	Surface area of top slab		18.47	
	Volume of top slab	VTs	2.77	m <sup>3</sup>
	Weight of top slab	wts	69.28	kN
	Mass of top slab	Mts	7062	kg
(D)	bottom IPS			
	Area of Bottom IPS	Arips	15.90	m <sup>2</sup>
	Weight of bottom IPS	Wips	6.68	kN
	Mass of bottom IPS	Mips	681	kg
(E)	Plaster			
	Area of Plaster on wall	Arpsw	42.41	m <sup>2</sup>
	Weight of plaster on wall	Wpsw	17.81	kN
	Mass of plaster on wall	Mpsw	1816	kg
	Area of Plaster top slab	Arpsts	15.90	m <sup>2</sup>
	Weight of plaster on top slab	Wpsts	6.68	kN
	Mass of plaster on top slab	Mpsts	681	kg
(F)	Finishing load			
	Area of Finishing load	Arfl	18.47453	m <sup>2</sup>
	Weight of finishing load	Wfl	18.47453	kN
	Mass of finishing load	Mfl	1883.234	kg
(H)	Water			
	Weight of water up to FSL	Wwfsl	421.82	kN
	Mass of water upto FSL	Mwfsl	42999	kg
	Weight of water in free board	Wwfb	46.87	kN
	Mass of water in free board	Mwfb	4778	kg
	Total weight of water	Tww	468.68	kN
	Total mass of water	Tmw	47776	kg
	Total mass		91439	kg
	Total wt		897	kN

Tank Geomtry : Circular with slab				
40 KL GLBR				
Parameter of spring mass Model				
(A)	H/D calculation			
	Height of tank including Freeboard	H	3	m
	Inside Diameter of tank	D	4.5	m
	H/D ratio - Ra	Ra	0.667	
	D/H ratio Rb	Rb	1.50	
(B)	Mass calculation			
	Total mass of water	M	47776	kg
	Calculation of Impulsive mass			
	$mi/m = \frac{\tanh(0.866d/h)}{0.866 d/h}$			
	Mi/m - Ratio Rd	Rd	0.6632	
		Mi	31684	kg
	Calculation of Convective mass			
	$mc/m = 0.23 * \frac{\tanh(3.68h/d)}{h/d}$			
	Mc/m - Ratio Re	Re	0.340	
		Mc	16241	kg
	Total mass of water	Tm	47925	
(C)	Calculation of Height Hi & Hc for hydrodynamic pressure on tank wall only			
	For H/D < 0.75 , hi = 0.375			
	For H/D > 0.75			
	$hi/h = 0.5 - 0.09375 / (h/d)$ -Ratio Rf	Rf	0.375	
		hia	1.125	m
	$hc/h = \frac{1 - \cosh(3.68 h/d) - 1}{3.68 h/d \sinh(3.68 h/d)}$	Rg	0.657	
		Hca	1.971	m
(D)	Calculation of Height Hi* & Hc* Hi for hydrodynamic pressure on tank wall and base slab			
	For H/D < 1.33			
	$hi^*/h = \frac{0.866d/h * - 0.125}{2 \tanh(0.866 d/h)}$			
	For H/D > 1.33			
	hi*/h =0.45	Rh	0.629	
		hib	1.887	m
	$hc^*/h = \frac{1 - \cosh(3.68 h/d) - 2.01}{3.68 h/d \sinh(3.68 h/d)}$	Ri	0.728	
		Hcb	2.185	m
(E)	Calculation of spring stiffness			
	$kc = 0.836 * mg/h * \tanh^2(3.68 h/d)$	Kc	126799	

Tank Geomtry : Circular with slab				
40 KL GLBR				
Time Period				
(A)	Ci			
	Coefficient for Calculation of Time period in Impulsive mode time			
	$Ci = \frac{1}{(h/d)^{0.5} * (0.46 - 0.3 * h/d + 0.067 * (h/d)^2)}$	Ci	4.226	
(B)	Cc			
	Coefficient for Calculation of Time period in Convective mode time			
	$Cc = \frac{2 * \pi}{(3.68 * \tanh(3.68 * h/d))^{0.5}}$	Cc	3.300	
(C)	Time period in Impulsive mode			
	$Ti = Ci * H * (mdwt)^{0.5} / (tw/D)^{0.5} (E)^{0.5}$			
	mass density of water	mdwt	1019.368	kg/m3
		Ti	0.012	second
(D)	Time period in Convective mode			
	$Tc = Cc * (D/g)^{0.5}$	Tc	2.235	second

Tank Geomtry : Circular with slab			
40 KL GLBR			
Horizontal seismic coefficient			
(A)	Zone factor Z		
	Earthquake zone	2	
	Zone Factor : Z	Z	0.1
	Imporatnce factor	I	1.5
	Soil type	st	2
(B)	Response reduction factor		
	Response reduction factor for ground supported tank	Grfac	2
	Response reduction factor for under ground tank	Ugrfac	4
	Response factor for partial under ground Tank above ground		1.30 m
	Tank below ground		0.60
	Total heighth of tank		3.00
	Ratio for partial burried	Rpb	0.200
	Partial R	Prfac	2.400
(C)	Calculation for Sa/g : for impulsive mode		
	Time Period Ti		0.0124 second
	Sa/g : For Soft soil	saga	2.5
	Sa/g : For Medium soil	sagb	2.5
	Sa/g : For hard soil	sagc	2.5
		sag	2.5
(D)	Seismic coefficient for implusive mode		
	$A_{hi} = Z / 2 * I / R * Sa/g$	Ahi	0.078125
(E)	Calculation for Sa/g : for convective		
	Time Period Tc		2.23 second
	Sa/g : For Soft soil	saga1	0.747
	Sa/g : For Medium soil	sagb1	0.609
	Sa/g : For hard soil	sagc1	0.447
	Sag for 0.5 % damping = sag * 1.75	sag1	1.06
(F)	Seismic coefficient for implusive mode		
	$A_{hc} = Z / 2 * I / R * Sa/g$	Ahc	0.033
(G)	Calculation of base shear due to implusive mode		
	$V_i = A_{hi} * ( \text{Mass of tank} + \text{Mass of water in impulsive mode} ) * G$		
		Vi	48.11 kN
(H)	Calculation of base shear due to convective mode		
	$V_c = A_{hc} * ( \text{Mass of water in convective mode} ) * G$		

Tank Geomtry : Circular with slab				
40 KL GLBR				
Horizontal seismic coefficient				
		Vc	5.30	kN
(I)	Total base shear			
	$V = (V_i^2 + V_c^2)^{0.5}$	V	48	
(J)	Moment at bottom of wall Impulsive mode Mombti : $A_{hi} * (m_i * h_i + M_w * h_w + M_t * h_t) * G$			kn-m
	Impulsive mass of water	31684	1.13	35645
	Mass of wall	19650	1.50	29475
	Mass of plaster	1816	1.50	2724
	Mass of top slab	7062	3.08	21716
	Mass of topslab finishing	1883	3.15	5932
				95491
	Moment = $A_{fi} * (\Sigma M * H) * G$	mombti	73.2	
	Center of gravity of slab =slab thickness /2		0.075	
(K)	Moment at bottom of wall Convective mode Mombtc : $A_{hc} * (m_c * h_c) * G$	mombtc	10.45	kn-m
(L)	Total bending moment momto $= ((mombti^2 + mombtc^2))^{0.5}$	Momto	73.93	kn-m

Tank Geomtry : Circular with slab			
40 KL GLBR			
Horizontal seismic coefficient			
(M)	Over turning moment		
	Impulsive mode		
	$a_{hi} * (m_i * (h_i + t_{hkbs}) + m_w (h_w + t_{hkbs}) + m_t (h_w + t_{hkbs} + t_{hkts}/2) + m_b * t_{hkbs}/2)$		
	Item	mass	distance
	Impulsive mass of water	31684	2.09
	Mass of wall	19650	1.70
	Mass of plaster	1816	1.70
	Mass of top slab	7062	3.28
	Mass of topslab finishing	1883	3.35
	Mass of bottom slab	11890	0.10
	Mass of Bottom Ips	681	0.20
			133373.9
	Moment = $A_{fi} * (\Sigma M * H) * G$	momovei	102.22
			kn-m
(N)	Over turning moment		
	Convective mode		
	moment = $A_{hc} * M_c * (h_c + t_{hkbs}) G$	momovec	12.65
	Total Moment of overturining	Momovrto	103.00
	P/A	preaa	38.45
	M/z	Prebb	6.48
	P/a+m/z	Pmax	44.93 < SBC O.K
	Pa/-m/z	Pmin	31.97 > 0 O/K
(P)	Sloshing Wave Height		
	$W_{avh} = A_{hc} * R * D/2$	Wavh	0.180
(Q)	Anchore Requiriment		
	h/d ratio	0.6667	
	1/a <sub>hi</sub>	12.8000	
	h/d < 1/a <sub>hi</sub>	No anchorage required	

Tank Geomtry : Circular with slab						
40 KL GLBR						
Hydrodynamic Pressure						
A	Impulsive hydrodynamic pressure at base of wall					Piw
B	Impulsive hydrodynamic pressure at base slab					Pib
C	Convective hydrodynamic pressure at base of wall					Pcw
D	Impulsive hydrodynamic pressure at base of wall					Pcb
E	Pressure due to wall inertia					Pww
F	Pressure due vertical excitation					Pv
A	Impulsive hydrodynamic pressure at base of wall					
Pressure on wall due to impulsive load						
$P_{iw} = Q_{iw} * (y) * a_{hi} * \rho * G * h * \cos \phi$						
for maximum value angle $\phi = 0$ , $\cos \phi = 1$						
$Q_{iw} = 0.866 * (1-(y/h)^2 * \tanh(0.866D/h))$						
Table						
Diameter of Tank = 4.50 m						
Total Height of tank = 3.00 m						
D/h = 1.50 ratio						
$\tanh(0.866D/h) = (A)$ 0.861						
$A_{hi} * \rho * G * h * \cos \phi = (C)$ 2299						
No	y/h	Y	$(1-(y/h)^2$	$Q_{iw} =$ $0.866 * A * B$	Piw	
			(B)			kn/m2
1	0	0.00	1	0.746	1.7	
2	0.1	0.30	0.99	0.739	1.7	
3	0.2	0.60	0.96	0.716	1.6	
4	0.3	0.90	0.91	0.679	1.6	
5	0.4	1.20	0.84	0.627	1.4	
6	0.5	1.50	0.75	0.560	1.3	
7	0.6	1.80	0.64	0.477	1.1	
8	0.7	2.10	0.51	0.380	0.9	
9	0.8	2.40	0.36	0.269	0.6	
10	0.9	2.70	0.19	0.142	0.3	
11	1	3.00	0	0.000	0.0	
Pressure on wall due to impulsive load at Y = 0					1.7	

Tank Geomtry : Circular with slab						
40 KL GLBR						
Hydrodynamic Pressure						
B	Impulsive hydrodynamic pressure at base slab					
Pressure on slab due to impulsive load						
$P_{ib} = 0.866 \times a_{hi} \times \rho \times g \times h \times \sinh(1.732 x/h) / \cosh(0.866 l/h)$						
y = 0 at base slab						
at center x = D/2 = 2.250						
L' = 2.250						
$\sinh(1.732 \times x/h) = 1.696$						
$\cosh(0.866 \times l/h) = 1.218$						
Pib = 2.772 kn/m2						
C	Convective hydrodynamic pressure at base of wall					
Pressure on wall due to convective mode						
$P_{cw} = Q_{cw}(y) (A_{hc}) \times \rho \times G \times D \times (1 - 1/3 \cos^2 \phi) \times \cos \phi$						
$Q_{cw} = 0.5625 \times \cosh(3.674 y/d) / (\cosh 3.674 h/d)$						
for maximum value angle phi = 0, cos phi = 1						
$\cosh(3.674 \times H/d) : (A) = 5.8334874$						
$A_{hc} \times \rho \times G \times D \times (1 - 1/3 \cos^2 \phi) \times \cos \phi = (C) = 979$						
No	y/d	Y	$\cosh(3.674 y/d)$ (B)	$Q_{cw} = 0.5625 \times A / B$	Pi kn/m2	
1	0	0.00	1.000	0.096	0.094	
2	0.1	0.45	1.068	0.103	0.101	
3	0.2	0.90	1.282	0.124	0.121	
4	0.3	1.35	1.671	0.161	0.158	
5	0.4	1.80	2.289	0.221	0.216	
6	0.5	2.25	3.218	0.310	0.304	
7	0.6	2.70	4.588	0.442	0.433	
8	0.7	3.15	6.583	0.635	0.622	
9	0.8	3.60	9.477	0.914	0.895	
10	0.9	4.05	13.664	1.318	1.291	
11	1	4.50	19.717	1.901	1.862	
Pressure on wall due to convective load at Y = 0				Pcw	0.09	

Tank Geomtry : Circular with slab				
40 KL GLBR				
Hydrodynamic Pressure				
D	Convective hydrodynamic pressure at base of slab			
Pressure on slab due to convective mode				
	ahc	0.0332803		
$P_{cb} = Q_{cb} \cdot a_{hc} \cdot \rho \cdot g \cdot D$				
	Ahc *ro * G * D	1469		
$Q_{cb} = 1.125(x/D - 4/3(x/d)^3) \text{sech}(3.674h/d)$				
x = d /2				
	h	3.00		
	d	4.50		
	x	2.25		
	x/d	0.5		
	cosh(3.675h/d)	5.8334874		
	sech(3.674 h/d)	0.171424		
qcb		0.064284		
Pcb		0.0944433	kn/m2	
Final summary				
1	Impulsive hydrodynamic pressure at base of wall	Piw	1.715	kn/m2
2	Impulsive hydrodynamic pressure at base slab	Pib	2.772	kn/m2
3	Convective hydrodynamic pressure at base of wall	Pcw	0.094	kn/m2
4	Impulsive hydrodynamic pressure at base of wall	Pcb	0.094	kn/m2
E	Pressure due to wall inertia			
$P_{ww} = a_{hi} \cdot t \cdot \rho_m \cdot G$				
Ahi	hor. Seismic coef. In impls	0.078125		
t	wall thickness	0.175	m	
$\rho_m \cdot G$	mass density* G	25	kn/m3	
Pww			Pww	0.341797 kn/m2

Tank Geomtry : Circular with slab					
40 KL GLBR					
Hydrodynamic Pressure					
F	Pressure due vertical excitation				
	$P_v = a_v * (\rho * g * h * (1-y/h))$				
	$a_v = 2/3 * (Z/2 * I/R * S_a/g)$				
z	zone factor		0.1		
I	Importance factor		1.5		
R	response factor		2.400		
sa/g	acceleration		2.5		
			Av	0.052	
for y = 0 at base level					
	$\rho * g * h * (1-y/h)$	29.43			
			Pv	1.532813	kn/m2
F	Maximum hydrodynamic pressure				
Pmax	$=((P_{iw}+P_{ww})^2+P_{cw}^2+p_v^2)^{0.5}$				
			Pmax	2.567	kn/m2
Pmax is about	8.5570089	%	<	33.33	%
Maximum hydraudyamic froce in normal condition				30.00	kn/m2
As hydraudyamic force < 33 % it will not govern in design					

SUMP : 40 KL				FORMULA
PROJECT: PROVIDING DRINKING WATER TO HABITATIONS IN KOMARAMBHEEM ASIFABAD SEGMENT IN ADILABAD DISTRICT (30 MLD WTP)	SUMP AT	CLIENT	RURAL WATER SUPPLY AND SANITATION DEPARTMENT, TELANGANA	
	Different village			
STRUCTURE	DESIGN CALCULATION FOR GLBR	DATE	REV	
		23/03/2016	0	
<b>DESIGN CALCULATION</b>				
<b>DATA</b>				
<b>General Data</b>	Required Capacity of Sump	Sumpcap	40.000	m <sup>3</sup>
Location				
<b>Hydraulic Features</b>				
Ground Level	GL	0.00		m
Dead Storage	Ds	0.15		m
Free Board	FB	0.30		m
Basic Shape :	Circular with flat slab			
unit weight of concrete	uwc	25.000		kN/m <sup>3</sup>
unit weight of water	uww	10.000		kN/m <sup>3</sup>
unit weight of plaster	uwp	21.000		kN/m <sup>3</sup>
live load at roof slab	lrf	1.500		kN/m <sup>2</sup>
Finish load	Fl	1.000		kN/m <sup>2</sup>
<b>Geometry Data</b>				
Diameter	Dia	4.50		m
Depth of tank above GL		2.40		
Depth of tank below GL		0.60		
Water depth : With Dead storage	Wd	2.70		m
Top Slab thickness	Tstfk	0.150		m
				As per tender Specification

Bottom slab thickness	Bsthk	0.200	m
plaster thickness	pt	0.012	m
<b>Permissible stress ( As per IS 456 &amp; IS 3370)</b>			
Concrete	fck	30	N/mm <sup>2</sup>
Concrete grade -FCK	fckc	8.0	N/mm <sup>2</sup>
per. stress in con. for direct comp	fckbc	10.0	N/mm <sup>2</sup>
per. stress in con. in com.due to bending	fckt	1.5	N/mm <sup>2</sup>
per. stress in con. for direct tension	fcktb	2.0	N/mm <sup>2</sup>
per. stress in con. in ten due to bending	em	2.74E+04	N/mm <sup>2</sup>
modulus of elasticity for container	fy	500	N/mm <sup>2</sup>
Reinforcement	fyc	130	N/mm <sup>2</sup>
per. Ten. str.- steel tension due to bending	fyc	130	N/mm <sup>2</sup>
per. Ten. str.- steel tension due to direct ten	md	9.33	
Modular ratio	Dmin	15.0	m
Dimension for minimum steel	g	9.810	
Mass & Wt relation factor	=5000*(fck) <sup>0.5</sup> *100		
<b>[A] CAPACITY OF CONTAINER</b>			
<b>Volume Calculation</b>			
Water Depth with Dead Storage	Wdd	2.700	
Inside Diameter		4.500	
Clear Inside Diamater without plaster	Diac	4.476	
total volume	vt	42.48	m <sup>3</sup>
dead storage	vdd	2.36	m <sup>3</sup>
net volume	vn	40.12	m <sup>3</sup> > 40.000 OK
<b>[B] TOP SLAB DESIGN</b>			
Concrete grade	Fck	30	N/mm <sup>2</sup>
Steel	Fy	500	N/mm <sup>2</sup>
Clear cover	Cv	45	mm
Slab Diameter	Lx	4.500	m
Slab type	St	1	Simply supported

Width	B	1000 mm
Depth	D	150 mm
Maximum Bar dia	Db	10 mm
Density of concrete	Wd	25 kN/m <sup>3</sup>
Loading		
Live load	LI	1.5 kN/m <sup>2</sup>
Finishing load	FI	1 kN/m <sup>2</sup>
CALCULATION		
Calculation of loading		
Self wt ( Dead load)	DI	3.75 kN/m <sup>2</sup>
Total Load	TI	6.25 kN/m <sup>2</sup>
Effective depth	De	100 mm
Bending Moment	Bm	3.955 kN-m
Modular ratio		9.33
K		0.42
J = 1-k/3		0.9
Ast		353.5 mm <sup>2</sup>
Provide : 10 dia - 200 c/c		
<b>[C] CYLINDRICAL WALL</b>		
inner diameter	cyid	4.500 m
top thickness	cytt	0.175 m
bottom thickness	cybt	0.175 m
Water depth	cyh	2.700 m
coefficient of constant height	cyc	0.000
free board		0.300 m
height of wall fir design	cyhh	3.000 m
increment in thickness	cyith	0.000 m
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<sup>2</sup>/DT 11.429  
 Enter Value for Auto serach 11.000

h

hoop force

sr. no	depth from top in meter	thickness at section	coefficient	hoop force in wall = Coe. X rad * height * unit wt of liquid	area of steel required = force / 1300	actual tensile stress in concrete = force/(thk*wid	Minimum Area of steel in mm2 on each face
1	0.300	0.175	0.004	0.3	2	0.001	210
2	0.600	0.175	0.096	6.5	50	0.036	210
3	0.900	0.175	0.198	13.4	103	0.074	210
4	1.200	0.175	0.305	20.6	158	0.113	210
5	1.500	0.175	0.420	28.4	218	0.156	210
6	1.800	0.175	0.544	36.7	283	0.202	210
7	2.100	0.175	0.665	44.9	345	0.247	210
8	2.400	0.175	0.744	50.2	386	0.277	210
9	2.700	0.175	0.708	47.8	368	0.263	210
10	3.000	0.175	0.464	31.3	241	0.173	210
sr. no	area of steel requd	dia of bar	bar spacing	area of steel prod			
1	210.000	10	200	785			
2	210.000	10	200	785			
3	210.000	10	200	785			
4	210.000	10	200	785			
5	218.151	10	200	785			
6	282.536	10	200	785			
7	345.066	10	200	785			
8	386.456	10	200	785			
9	367.615	10	200	785			
10	241.146	10	200	785			

weight of wall		cyspw		173.5		kN		=PI()* (cyid+cytt)*cyh*cytt*uw	
straight part		cyspw		0.0		kN		=PI()* (cyid+cytt+(cybt-cybt)/3)*cyh*(1-cyc)*(cybt-cytt)/2*uw	
tapered part		cytpw		10.7		kN		= (cyid-pt)*PI()*pt*(trdd+cyh+mrdd/2-cyxa)*uwp	
plaster		cyppw		184.1		kN		=cyspw+cytpw+cyppw	
total weight		ticy							
Maximum moment in wall									
	sr. no	depth from top in meter	thickness at section	coefficient	moment in wall = Coe. X height^3 * unit wt of liquid	effective depth	Area of steel required	Minimum Area of steel	in mm2
Minimum % steel as per IS 3370-2009 Maximum Dimension #REF! Permissible dimension for 0.24 % steel 15.000 Minimum Steel #REF!	1	0.300	0.175	0.00000	0.000	0.120	0	210	
	2	0.600	0.175	-0.00007	-0.019	0.120	-1	210	
	3	0.900	0.175	0.00010	0.027	0.120	2	210	
	4	1.200	0.175	0.00026	0.069	0.120	5	210	
	5	1.500	0.175	0.00041	0.112	0.120	8	210	
	6	1.800	0.175	0.00147	0.397	0.120	28	210	
	7	2.100	0.175	0.00247	0.667	0.120	48	210	
	8	2.400	0.175	0.00266	0.717	0.120	51	210	
	9	2.700	0.175	-0.00070	-0.189	0.120	-13	210	
	10	3.000	0.175	-0.01091	-2.947	0.120	-210	210	
	sr. no	area of steel requrd	dia of bar	bar spacing	area of steel prod	distance			
	1	210.000	10	200	393	0.300			
	2	210.000	10	200	393	0.600			
	3	210.000	10	200	393	0.900			
	4	210.000	10	200	393	1.200			
	5	210.000	10	200	393	1.500			
	6	210.000	10	200	393	1.800			
	7	210.000	10	200	393	2.100			
	8	210.000	10	200	393	2.400			
	9	210.000	10	200	393	2.700			
	10	210.000	10	200	393	3.000			
Vertical steel									
as compression only, I provide min r/f		0.240	%						
area of steel required total on both face		4.200	cm2						

## FOUNDATION DESIGN

### WALL FOOTING DESIGN

PROJECT : P16\_02\_Adilabad W.S.S

JOB : P16\_02

UNIT : 40KL GLBR

WALL TYPE 1

**W1**

#### BASIC DATA

Density of water	denwt	<b>10</b>	kN/m3	fyuc	130	N/mm2
Density of soil	denso	<b>18</b>	kN/m3	fyucb	130	N/mm2
Density of concrete	decon	<b>25</b>	kN/m3	fckbc	10.0	N/mm2
Angle of Repose	Phi	<b>30</b>	degree	fckt	1.5	N/mm2
Safe bearing capacity of soil	Sbc	<b>150.0</b>	kN/m2	modular ratio	m	9.33
Concrete grade	Fck	<b>30</b>	N/mm2	K	0.42	
Steel grade	Fy	<b>500</b>	N/mm2	j	0.86	
Depth below GI	Dbg	<b>0.60</b>	m			
Water depth	wtd	<b>2.70</b>	m			
free board	fb	<b>0.30</b>	m			
Wall above Ground		<b>2.40</b>	m			
Clear cover	Cv	<b>50</b>	mm			
Maximum size of bar dia	Db	<b>12</b>	mm			
Water depth with free board	Wd	<b>3.00</b>	m			
minimum % steel	pt	<b>0.24</b>	%			
Moment						
Due to Water	Mtw	<b>2.90</b>	kN-m	( From Analysis Result)		
Due to soil if any	Mts	<b>0.50</b>	kN-m			
Wt from top dome/slab/column/wall	Slabwt	<b>7.10</b>	kN-m			

#### Wall geometry ( Figure 1 )

Straight portion	lb	<b>3.000</b>	m
Tapered portion	lc	<b>0.000</b>	m
	tb	<b>0.175</b>	m
	td	<b>0.175</b>	m
Footing geometry			
Toe projection	ht	<b>0.300</b>	m
Heel straight projection	hh1	<b>0.450</b>	m
Heel tapered projection	hh2	<b>0.000</b>	m
Heel portion for soil stability	hh3	<b>0.450</b>	m
Thickness at toe (free end)	tta	<b>0.200</b>	m
Thickness at toe (fwall face)	tth	<b>0.200</b>	m
Thickness at heel (wall end)	tha	<b>0.200</b>	m
Thickness at heel (free face)	thb	<b>0.200</b>	m
Total Height of Wall	Tlw	3.000	m
Total length of wall footing	wf	0.925	m

#### CASE 1 : TANK FULL CONDITION WITH NO SOIL OUTSIDE

Total load & Moment calculation  
Taking moment @ toe

Component	Wt kN	Lever Arm m	Moment kN-m
	W	Dist	W * dist
Wall Straight portion	W1	13.13	0.39
Wall Tapered portion	W2	0.00	0.30
			5.09
			0.00

Walkway/slab	P	7.10	0.39	2.75
Footing				
Footing : toe	W3	1.50	0.15	0.23
Footing center	W4	0.88	0.39	0.34
Footing : heel (straight)	W5	2.25	0.70	1.58
Footing : heel ( tapered)	W6	0.00	0.93	0.00
Water	W7	13.50	0.70	9.45

Total downward load		38.35		19.43
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Total restoring moment @ toe	TRM	19.4	kN-m	
Total over turning moment		2.9	kN-m	
F.S.against over turning		6.7		
Check for over turning	Hense o.k			
Total moment due to vertical load	Tmv	19.4	kN-m	
Total moment due to horizontal load	Tmh	2.9	kN-m	
Total vertical load	TPv	38.4	kn	
Net Moment	Tmn	16.5	kN-m	
M/p	E	0.43	m	
Ecc	Ecc	0.032	m	
b/6	Aec	0.15	m	
Net moment From ECC	Mdg	1.211		

#### Property of footing

Width of footing		1.00	m
Depth of footing		0.93	m
Footing Area	Fare	0.93	m <sup>2</sup>
Modulus of section	Fz	0.14	m <sup>3</sup>

Pressure distribution				
Pressure due to direct load =P/A	prea	41.46	kN/m <sup>2</sup>	
Pressure due to moment =M/Z	Preb	8.49	kN/m <sup>2</sup>	

Pressure				
Maximum pressure - P/A + M/Z	Pmax	49.95	kN/m <sup>2</sup>	
Minimum pressure - P/A + M/Z	Pmin	32.97	kN/m <sup>2</sup>	
Check for SBC				

Maximum pressure < SBC	OK
Minimum pressure > 0	OK
Pressure difference	16.98
Pressure difference / m	18.36

Pressure at outer Wall face - A	preow	44.44	kN/m <sup>2</sup>
Pressure at inner Wall face B	preiw	41.23	kN/m <sup>2</sup>
Pressure at point C	preiw1	32.97	kN/m <sup>2</sup>

#### Design of Toe - At Point A

Moment at face of outer wall			
Due to rectangle diagram	Mreco	2.00	kN-m
	Mtrio	0.17	kN-m
Total moment due to upward pressure		2.17	kN-m
Net moment at A from Toe side	Toem	2.17	kN-m
Thickness at toe		200	mm
Effective depth	Deftoe	144	mm

Ast required =	134	mm2
Check for minimum steel		
top	240	mm2
bottom	0	mm2
Design Steel		
Main steel - Top	240	mm2
Main steel - bottom	134	mm2
Distribution steel - top	240	mm2
Distribution steel - bottom	0	mm2

**Design of heel : At point B & C**

**Design at point B**

Due to rectangle diagram (upward)	Mreci	3.3	kN-m
	Mtrii	0.3	kN-m
Total Upward moment		3.6	kN-m
Due to water (down ward)		3.0	kN-m
Net downward moment at B from heel side	heelm	0.6	kN-m
Thickness Provided		200	mm
	defheel	144	mm
Ast required =		36	mm2
Check for minimum steel - straight portion			
top		240	mm2
bottom		0	mm2
Design Steel			
Main steel - Top		240	mm2
Main steel - bottom		0	mm2
Distribution steel - top		240	mm2
Distribution steel -bottom		0	mm2

**Design at point C**

Due to rectangle diagram (upward)	Mreci	0.00	kN-m
	Mtrii	0.00	kN-m
Total Upward moment		0.00	kN-m
Due to water (down ward)		0.00	kN-m
Net downward moment at B from heel side	heelm	0.00	kN-m
Thickness Provided		200	mm
	defheel	144	mm
Ast required =		0	mm2
Check for minimum steel - tapered portion			
Average thickness	thav	0.20	m
top		240	mm2
bottom		0	mm2
Design Steel			
Main steel - Top		240	mm2
Main steel - bottom		0	mm2
Distribution steel - top		240	mm2
Distribution steel -bottom		0	mm2

SUMMARY							
Pressure Check							
1>	P/A + M/Z	49.9	<	150	OK		
2>	P/A - M/Z	33	>	0	OK		
Reinforcement							
	AstR					Astp	
<b>Toe</b>		dia	spc	+	dia	spc	
Top - main	240	10	200		0	0	393 OK
Bottom main	134	10	200		0	0	393 OK
Top - Dist	240	10	200		0	0	393 OK
Bottom - Dist	0	10	200		0	0	393 OK
<b>Heel Straight portion</b>							
Top - main	240	10	200		0	0	393 OK
Bottom main	0	10	200		0	0	393 OK
Top - Dist	240	10	200		0	0	393 OK
Bottom - Dist	0	10	200		0	0	393 OK
<b>Heel tapered portion</b>							
Top - main	240	10	200		0	0	393 OK
Bottom main	0	10	200		0	0	393 OK
Top - Dist	240	10	200		0	0	393 OK
Bottom - Dist	0	10	200		0	0	393 OK

CASE 2 : TANK EMPTY CONDITION WITH SOIL OUTSIDE				
Total load & Moment calculation				
Taking moment @ toe				
Component		Wt kN W	Lever Arm m Dist	Moment kN-m W * dist
Wall Straight portion	W1	13.13	0.54	7.05
Wall Tapered portion	W2	0.00	0.63	0.00
Walkway/slab	P	7.10	0.54	3.82
Footing				
Footing : toe	W3	1.50	0.78	1.16
Footing center	W4	0.88	0.54	0.47
Footing : heel	W5	2.25	0.23	0.51
Soil on toe	W6	3.24	0.78	2.51
Total downward load		<b>28.09</b>		<b>15.52</b>
Total restoring moment @ heel	TRMs	15.5	kN-m	
Total over turning moment due to soil		0.5	kN-m	
F.S.against over turning		31.0		
Check for over turning	Hense o.k			
Total moment due to vertical load	Tmv1	15.5	kN-m	
Total moment due to horizontal load	Tmh1	0.5	kN-m	

Total vertical load	TPv1	28.1	kn
Net Moment	Tmn1	15.0	kN-m
M/p	E1	0.53	m
Ecc	Ecc1	-0.072	m
b/6	Aec1	0.15	m
Net moment From ECC	Mdg1	-2.0294	
Property of footing			
Width of footing		1.00	m
Depth of footing		0.93	m
Footing Area	Fare1	0.93	m <sup>2</sup>
Modulus of section	Fz1	0.14	m <sup>3</sup>
Pressure distribution			
Pressure due to direct load =P/A	prea1	30.37	kN/m <sup>2</sup>
Pressure due to moment =M/Z	Preb1	-14.2	kN/m <sup>2</sup>
Pressure			
Maximum pressure - P/A + M/Z	Pmax1	16.14	kN/m <sup>2</sup>
Minimum pressure - P/A + M/Z	Pmin1	44.60	kN/m <sup>2</sup>
Check for SBC			
Maximum pressure < SBC		OK	
Minimum presure > 0		OK	
Pressure difference		-28.46	kN/m <sup>2</sup>
Pressure difference / m		-30.77	kN/m <sup>2</sup>
Pressure at outer Wall face - A	preow1	35.37	kN/m <sup>2</sup>
Pressure at inner Wall face B	preiw1	29.98	kN/m <sup>2</sup>
<b>Design of Toe - At Point A</b>			
Moment at face of outer wall			
Due to rectangle diagram	Mreco1	2.01	kn-m
Due to triabgular diagram	Mtrio1	-0.14	kn-m
Total moment due to upward pressure		1.87	kn-m
Total downward moment due to soil		0.49	kn-m
Net moment at A from Toe side	Toem1	-1.38	kn-m
Thickness at toe		200	mm
Effective depth	DefToe1	144	mm
Ast required =		-85.80	mm <sup>2</sup>
Check for minimum steel			
top		240	mm <sup>2</sup>
bottom		0	mm <sup>2</sup>
Design Steel			
Main steel - Top		240	mm <sup>2</sup>
Main steel - bottom		0	mm <sup>2</sup>
Distribution steel - top		240	mm <sup>2</sup>
Distribution steel - bottom		0	mm <sup>2</sup>
<b>Design of heel : At point B</b>			
<b>Design at point B</b>			
Due to rectangle diagram (upward)	Mrecl1	3.04	kn-m
	Mtril1	-0.93	kn-m
Total Upward moment	heelm1	2.10	kn-m
Net downward moment at B from heel side			
Thickness Provided		200	mm
Steel required at bottom	defheel1	144	mm
Ast required =		130	mm <sup>2</sup>
Check for minimum steel - straight portion			
top		240	mm <sup>2</sup>
bottom		0	mm <sup>2</sup>
Design Steel			

Main steel - Top	240	mm2
Main steel - bottom	130	mm2
Distribution steel - top	240	mm2
Distribution steel -bottom	0	mm2

**SUMMARY**

**Pressure Check**

1>	P/A + M/Z	16.1	<	150.0	OK
2>	P/A - M/Z	44.6	>	0	OK

**Reinforcement**

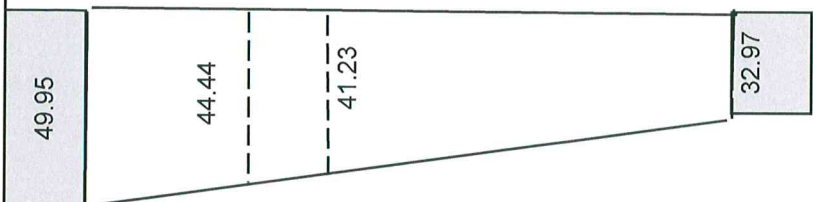
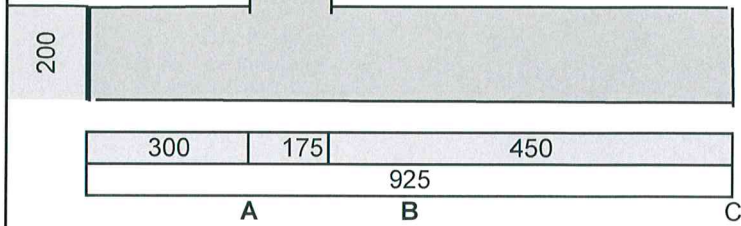
	AstR	dia	spc	+	dia	spc	Astp	
Toe								
Top - main	240	10	200				393	OK
Bottom main	0	10	200		0	0	393	OK
Top - Dist	240	10	200		0	0	393	OK
Bottom - Dist	0	10	200		0	0	393	OK

**Heel Straight portion**

Top - main	240	10	200		0	0	393	OK
Bottom main	130	10	200		0	0	393	OK
Top - Dist	240	10	200		0	0	393	OK
Bottom - Dist	0	10	200		0	0	393	OK

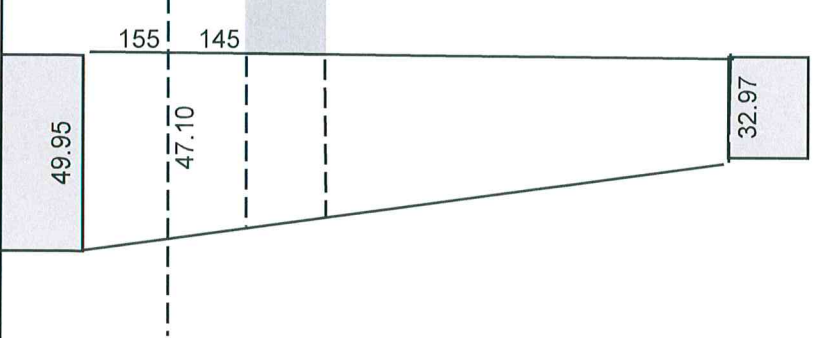
SHEAR CHECK FOR WATER

Cover 50  
Dia 10



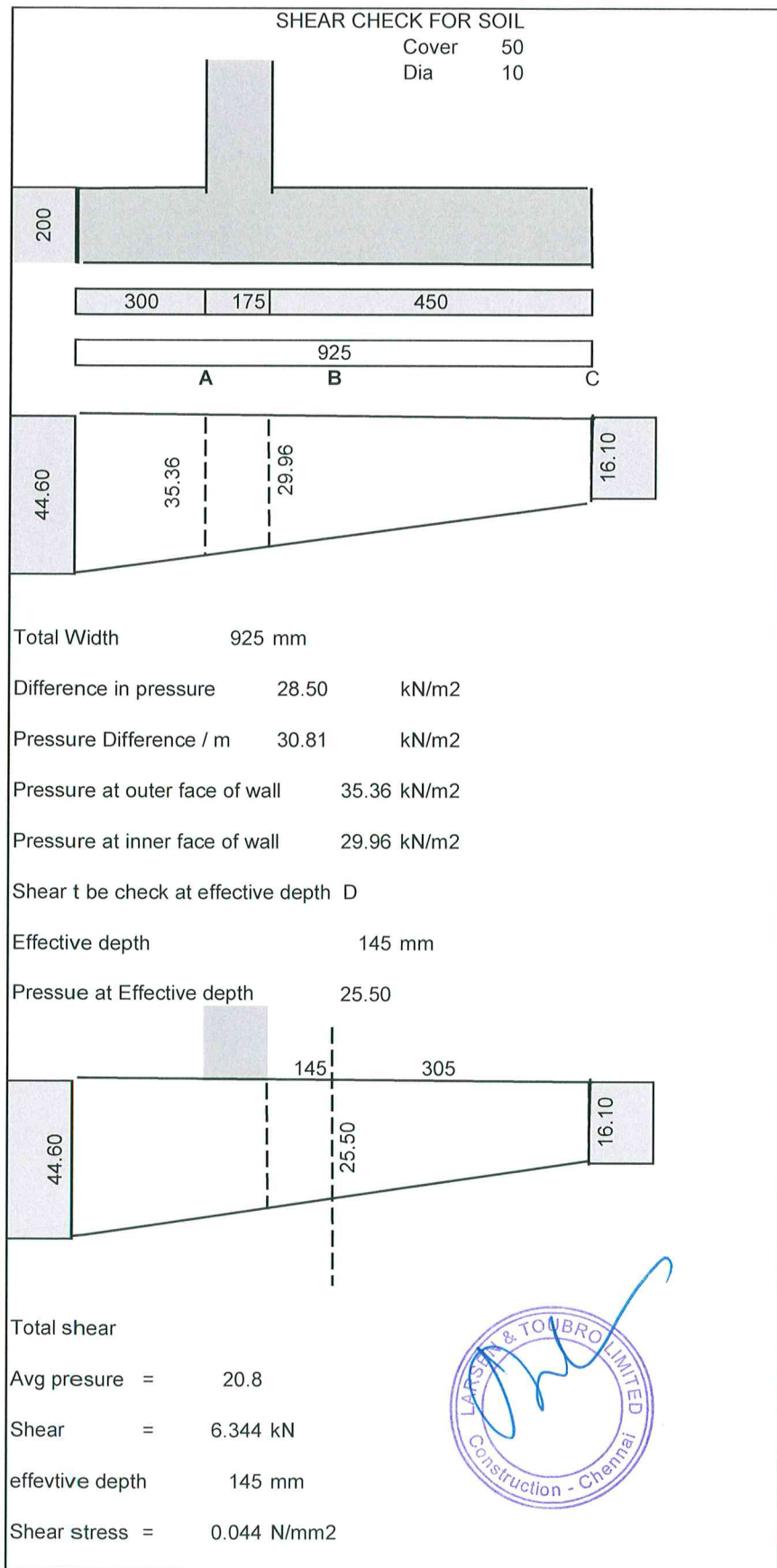
Total Width 925 mm  
 Difference in pressure 16.98 kN/m<sup>2</sup>  
 Pressure Difference / m 18.36 kN/m<sup>2</sup>  
 Pressure at outer face of wall 44.44 kN/m<sup>2</sup>  
 Pressure at inner face of wall 41.23 kN/m<sup>2</sup>  
 Shear to be check at effective depth D  
 Effective depth 145 mm

Pressure at Effective depth 47.10



Total shear

Avg pressure = 48.53  
 Shear = 7.522 kN  
 effective depth 145 mm  
 Shear stress = 0.052 N/mm<sup>2</sup>



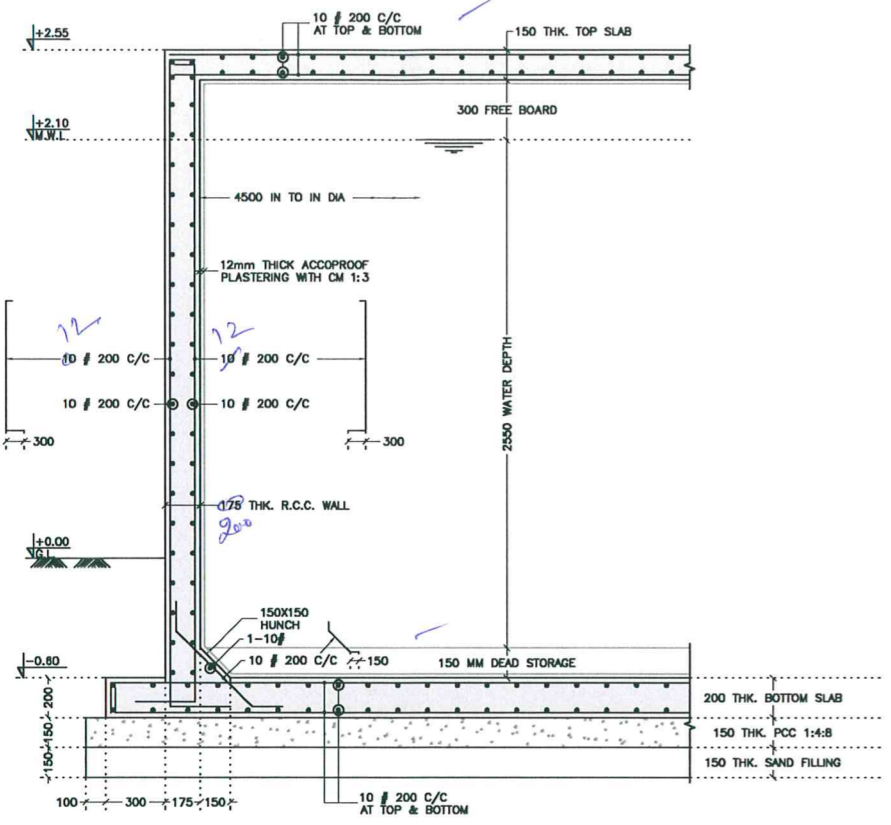
**APPROVED**  
*M. S. K.*  
 SE, NIRMAL

**“Designs Vetted”**

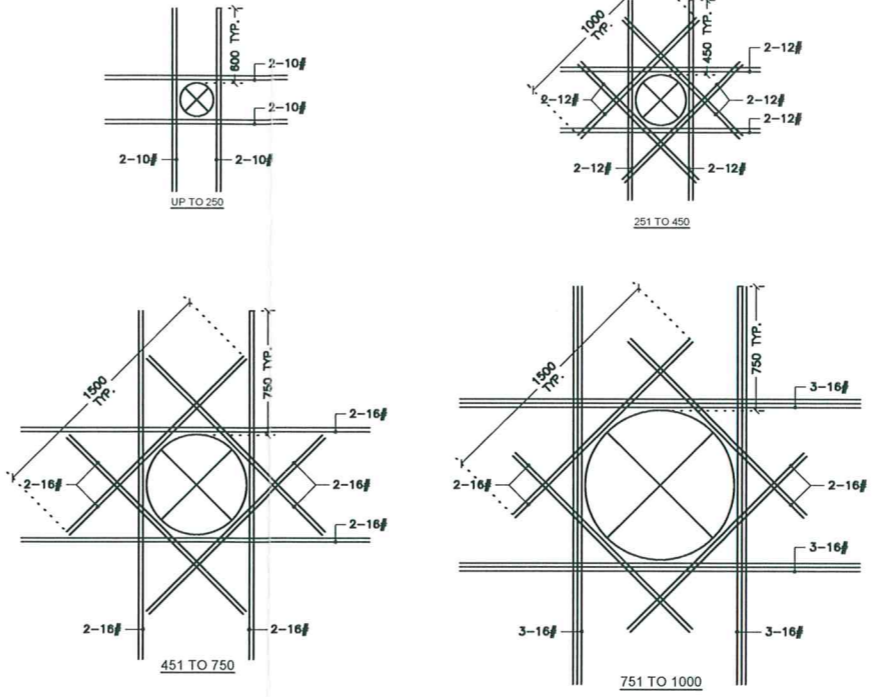
*[Signature]*  
 Asst. Executive Engineer  
 TDWSP Asifabad

*[Signature]*  
 Dy. Executive Engineer  
 TDWSP Asifabad

*[Signature]*  
 Executive Engineer  
 TDWSP Asifabad

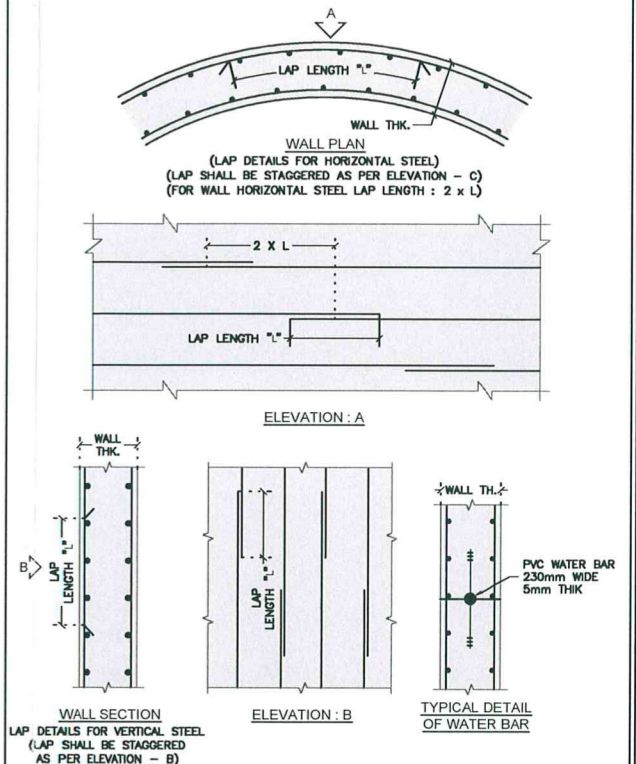


SECTION - A - A

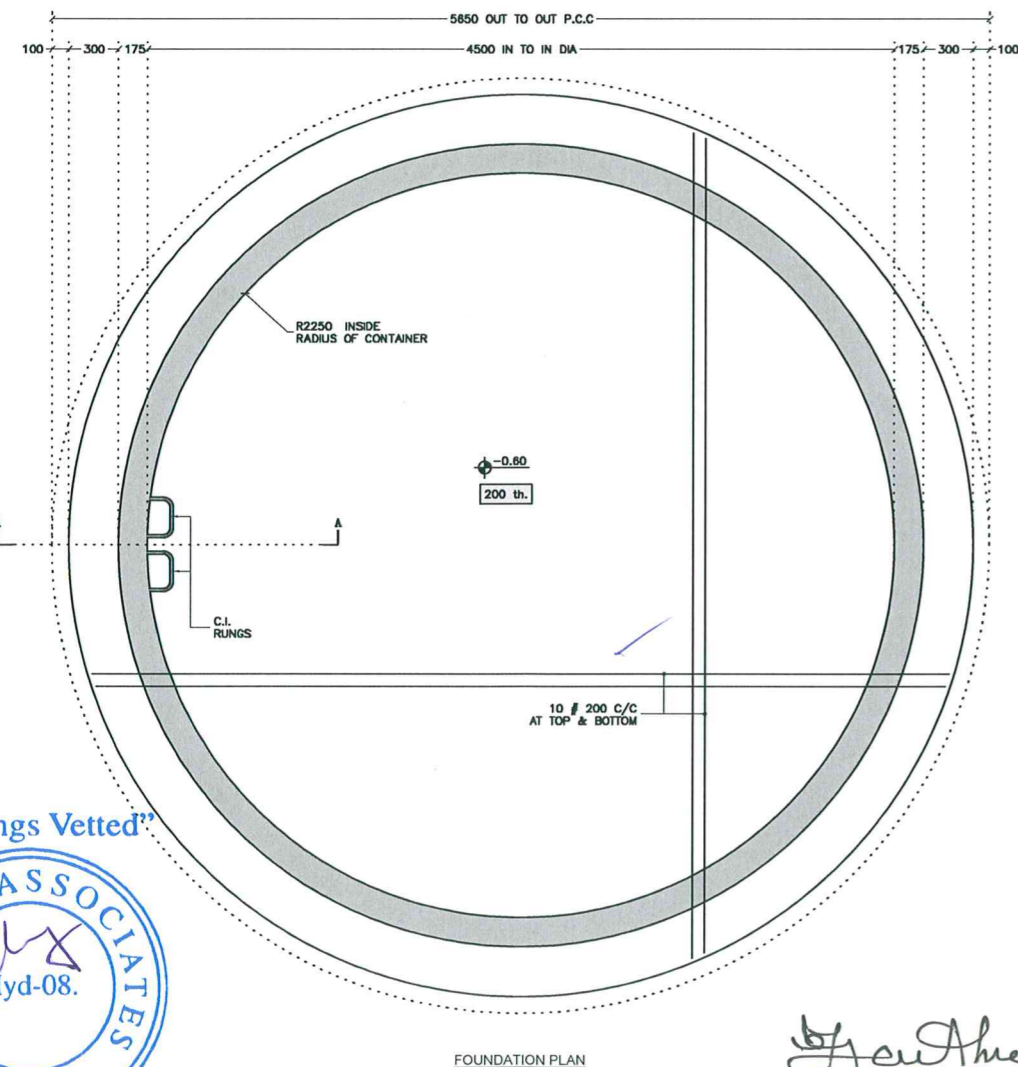


TYPICAL DETAIL FOR EXTRA STEEL BAR AT CUT-OUT

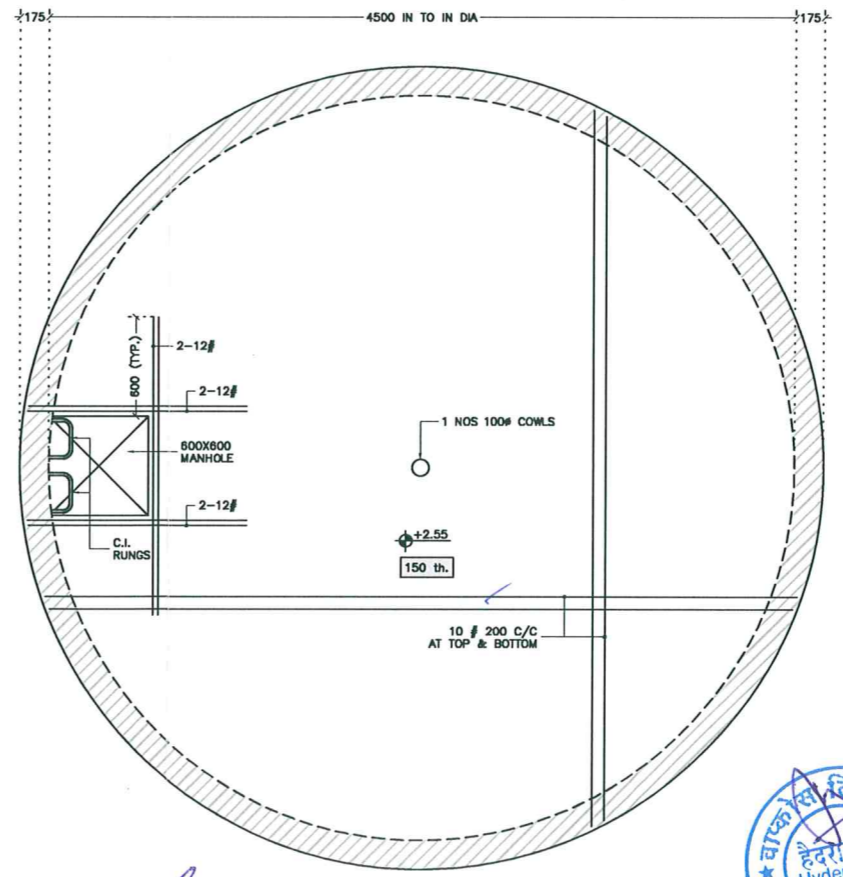
SCHEDULE OF PIPE		LAP LENGTH SECHDULE	
INLET PIPE SIZE	-	DIA OF BAR	LAP LENGTH "L" IN mm
OUTLET PIPE SIZE	-	8	368
OVER FLOW PIPE SIZE	-	10	460
		12	562
		16	736
		20	920
		25	1150



- NOTES -
- ALL DIMENSION ARE IN MM AND LEVELS ARE IN METER.
  - ALL CONCRETE MIX M-30 WITH MAXIMUM FREE WATER CEMENT RATIO OF 0.45 AND MAXIMUM CEMENT CONTENT OF 400kg/m<sup>3</sup> FOR WATER RETAINING STRUCTURE
  - ALL CONCRETE SHALL BE MACHINE MIXED AND MACHINE VIBRATED
  - # - INDICATE HYSD-TMT BAR FE-500 GRADE 1 CONFORMING TO IS 1786-LATEST REVISION
  - CLEAR COVER TO WATER RETAINING STRUCTURE  
(A) BOTTOM SLAB : 50mm  
(B) WALL WATER FACE : 45mm & SOIL FACE : 30mm  
(C) TOP SLAB : 45mm
  - FOUNDATION SHALL REST ON IN-SITU SOIL AND IT SHALL NOT BE ON FILLING MATERIAL i.e. MADE UP SOIL OR HIGHLY COMPRESSIBLE SOIL  
BACK FILLING SHALL BE DONE IN WELL COMPACTED AND WELL WATER LAYER NOT EXCEEDING 150mm IN DEPTH
  - SBC CONSIDERED IN DESIGN IS 15 T/M<sup>2</sup> & NO GROUND WATER TABLE.
  - INLET & OVERFLOW PIPE SHALL BE DECIDED AS PER SITE CONDITION
  - LOCATION & LEVELS OF INLET, OUTLET & OVERFLOW PIPE SHALL BE VERIFY WITH ENGINEER INCHARGE BEFORE EXECUTION



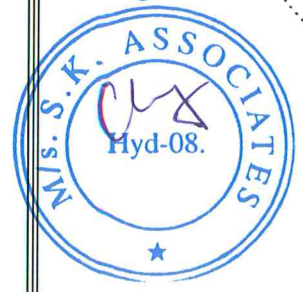
FOUNDATION PLAN



TOP PLAN

NAME OF VILLAGE				
KODDUGUDAGUTTA	HIRAPURGUTTA	RAMNAYAKTHAND	NAVEDARIGUTTA	
 <b>APPROVED</b> <i>SE, NIRMAL</i>				
FOR APPROVAL	28/03/16	RPS	NSP	RMM
REV No	DESCRIPTION	DATE	DESIGNED	DRAWN
<b>L&amp;T Construction</b> 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				
SUPLIER / CONTRACTOR:  L&T Construction Water & Effluent Treatment SBG				
JOI: No. : LE150863	TITLE: 40KL CAPACITY GLBR AT DIFFERENT VILLAGE (STRUCTURAL DETAILS)			SCALE: 1: 30,25
DS IN RPS	NSP	26/03/16		
DR IN NSP	RMM	26/03/16		
CH ID RMM		26/03/16		
AP-D		26/03/16		
DRAWING No. LE150863-C-WS-RW-RC-1504		SIZE: A2	REV. A	
C/MP. DATA : P18-02_57-02-01		SHEET 1 OF 1		
RELEASED FOR <input type="checkbox"/> PRELIMINARY <input type="checkbox"/> TENDER <input type="checkbox"/> INFORMATION <input checked="" type="checkbox"/> APPROVAL <input type="checkbox"/> CONSTRUCTION				

"Drawings Vetted"

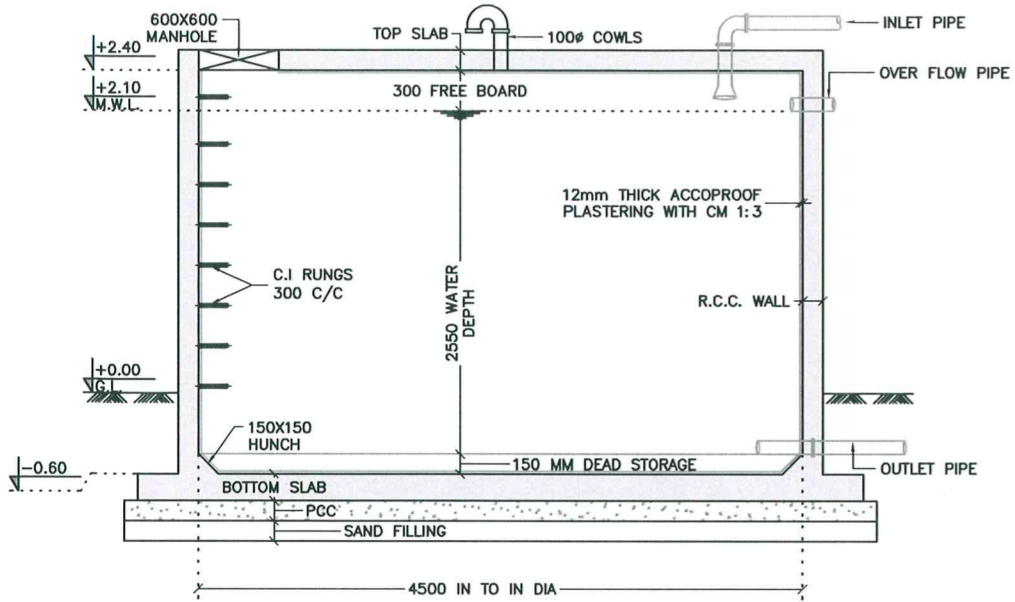


*Asst. Executive Engineer*  
**Asst. Executive Engineer**  
 TDWSP Asifabad

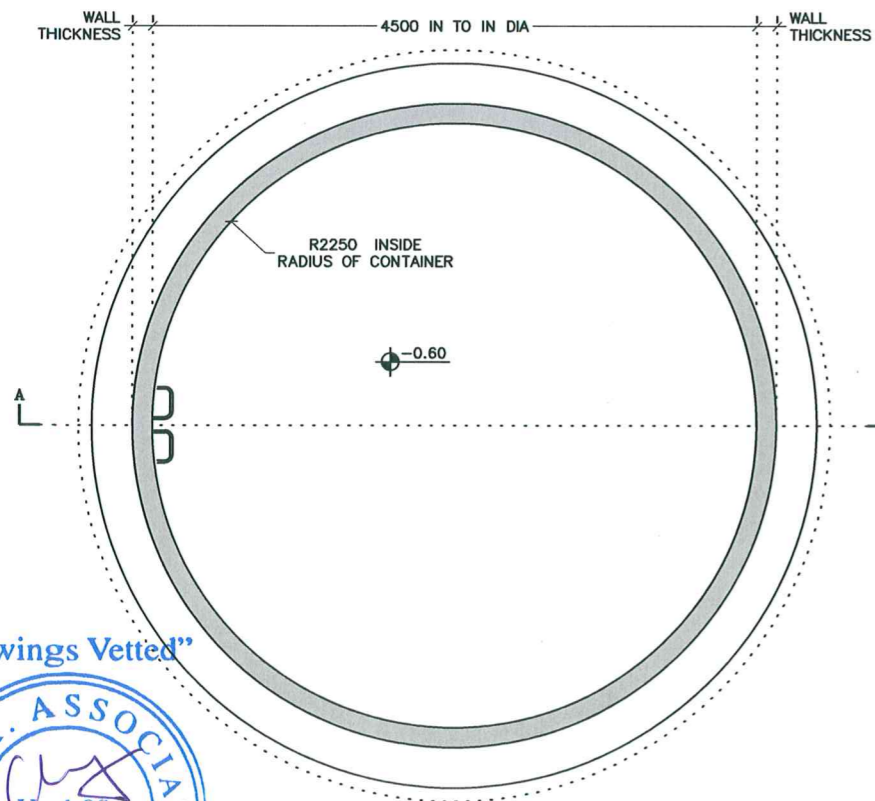
*Uy. Executive Engineer*  
**Uy. Executive Engineer**  
 TDWSP Asifabad

*Executive Engineer*  
**Executive Engineer**  
 TDWSP Asifabad

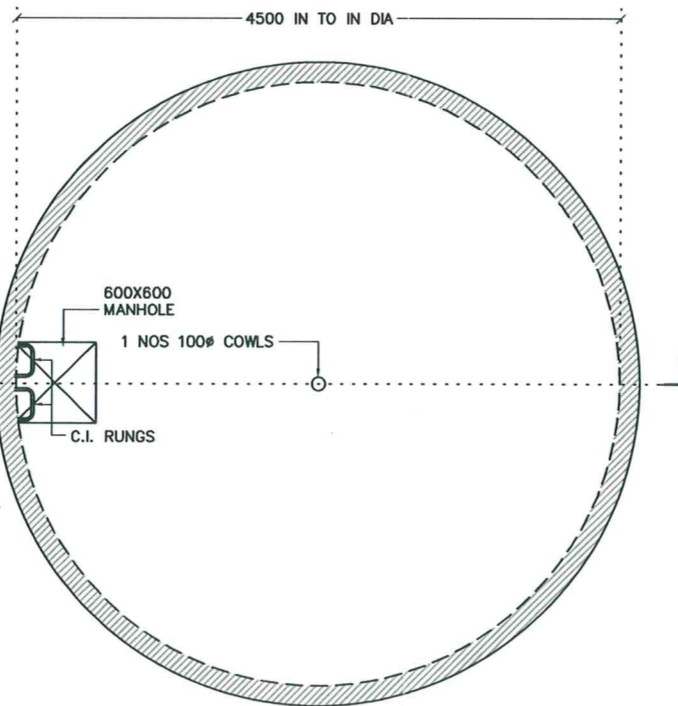




SECTION: A - A



BOTTOM PLAN



TOP PLAN

SCHEDULE OF PIPE

INLET PIPE SIZE	-
OUTLET PIPE SIZE	-
OVER FLOW PIPE SIZE	-

NAME OF VILLAGE

KODDUGUDAGUTTA	HIRAPURGUTTA	RAMNAYAKTHAND	NAVEDARIGUTTA
----------------	--------------	---------------	---------------

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



APPROVED  
 SE, NIRMAL

A	FOR APPROVAL	28/03/16	-	DGP	RMM	-
REV. No	DESCRIPTION	DATE	DESIGNED	DRAWN	CHECKED	APPROVED

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 :

SCALE 1:50

NAME	SIGN	DATE
DSGN HMP		28/03/16
DRWN DGP		28/03/16
CHKD RMM		28/03/16
APPD -		28/03/16

40KL CAPACITY GLBR AT DIFFERENT VILLAGE (GENERAL ARRANGEMENT DRAWING)



DRAWING No. LE150883-C-WS-RW-GA-1501  
 COMP. DATA : P16-02\_57-01-01 SHEET 1 OF 1

SIZE A3 REV. A

RELEASED FOR  PRELIMINARY  TENDER  INFORMATION  APPROVAL  CONSTRUCTION

Drawings Vetted



Asst. Executive Engineer TDWSP Asifabad

Dy. Executive Engineer TDWSP Asifabad

Executive Engineer TDWSP Asifabad

**GEOTECHNICAL INVESTIGATION REPORT**

**TELANGANA DRINKING WATER SUPPLY PROJECT**

**KOMARAM BHEEM - ASIFABAD- SEGMENT 22**

**ASIFABAD , ADILABAD DISTRICT**

**40KL GLBR GANESPURAGUTTA AT ASIFABAD ( M)**

***CONTRACTOR :***

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

**WATER & EFFLUENT TREATMENT SBG, CHENNAI**

***Drilling By:***

***M/s. ANJI DRILLING & GROUTING WORKS***

***Report Prepared by***

**DR. D. BABU RAO,**

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

**MCH Panellist No. 2490 /TP/2000-2**

**GEOTECHNOLOGIES**

**CONSULTING GEO TECHNICAL ENGINEER**

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**OSMANIA UNIVERSITY**

**Phone: 6663 8830, Mobile : 98490 – 39337**

**Email :[dbaburao2000@yahoo.com](mailto:dbaburao2000@yahoo.com)**

## TELANGANA DRINKING WATER SUPPLY PROJECT

### 40 KL GLBR AT GANESPURAGUTTA, ASIFABAD (M) IN ADILABAD DT.

#### 1. INTRODUCTION

M/s. L &T Construction, Water & Effluent Treatment is proposing to construct 40KL GLBR at GANESPURAGUTTA, ASIFABAD (M) .The work is taken up under Segment 22 , Komaram Bheem Project , TDWSP, in Adilabad Dt.

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

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

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

#### 2. SCOPE OF WORK

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

- Drilling Borehole at (1) location for 40KL GLBR at GANESPURAGUTTA in Adilabad Dt.
- Conducting SPT at regular intervals, where feasible
- Collection of undisturbed / disturbed samples from the Bore holes
- Preparation of Technical Report recommending suitable foundations and safe bearing capacity

  
**DR. B. BABU RAO**  
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Consulting Geotechnical Engineer



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

Testing of soil samples in the Laboratory

Preparation of Technical Report

### 3. SUB SOIL INVESTIGATION

The sub soil investigation was carried out to determine:

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

#### FIELD INVESTIGATION PROCEDURE:

The following technique is adopted for sub soil investigations.

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

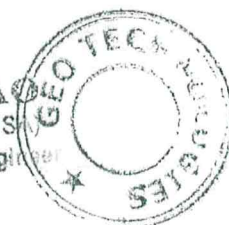
TC bits were employed for the overburden, and Impregnated Diamond Core bits were used for rock formation.

Drilling was performed on 15-20 Jan ,2016.

The following relevant data was recorded during Rotary drilling operations.

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

  
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**b) STANDARD PENETRATION TEST (SPT):**

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

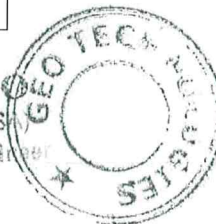
When the number of blows exceeded 50 to penetrate the first or second 15 cm length of the sampler, the SPT 'N' is regarded as more than 100 as described in IS 2131 - 1981. The test is terminated in such case and a record of the penetration of the sampler under 50 blows is made. SPT refusal is recorded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

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

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

BH No	Drilled depth
1	6 m

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Consulting Geotechnical Engineer



#### d) LOG OF BORE HOLE:

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

#### 4. LABORATORY TESTING:

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

Sandstone ( sedimentary ) rock was seen from GL to 05 m depth, No cores were procured in the BH.

#### 5. SUB SOIL PROFILE

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

Depth	Strata	N value
0 – 6 m	Sandstone	>100

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

#### 6.0 SHALLOW FOUNDATIONS

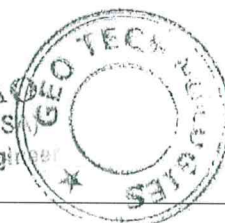
In general, the following pertains to foundations resting in soils.

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

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

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

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## 8.0 RECOMMENDATIONS

Based on Field Investigations and laboratory testing, the following Recommendations are made for construction of GLBR at GANESPURAGUTTA, ASIFABAD (M), Adilabad Dt. ,

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

b) SBC is recommended as follows :

Location		BH 1
S. No.	Depth (m)	Recommended SBC t/ sq m
1	1.0	10
2	2.0	11
3	3.0	12

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

*For ANJI DRILLING AND GROUTING WORKS*

(DR. D. BABU RAO)

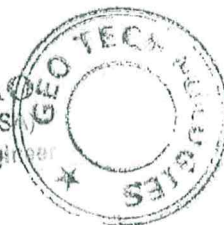
M. E( IIT,R), Ph. D. (USA), MIGS

Former Professor of Civil Engineering

Consulting Geotechnical Engineer

MCH Panelist No. 2490/TP/2000-2

  
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Consulting Geotechnical Engineer



# TELANGANA DRINKING WATER SUPPLY PROJECT

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

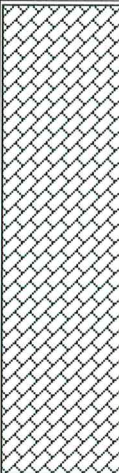
**40KL GLBR AT GANESPURAGUTTA, ASIFABAD (M) IN ADILABAD DT.**

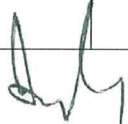
Type of Boring: Core drilling

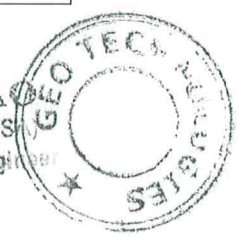
Dia of Boring: NX

Date : 15-20 Jan 2016

Drilled depth = 06 m

Depth, m	Profile	Soil	Sample Depth m	N value	CR, %	RQD%	
0		Sand stone	0	>100			
1.0			1.5	>100			
2.0							
3.0			3.0	>100			
4.0			4.5	>100			
5.0			5	>100			
6.0			6	>100			
7.0							
8.0							
9.0							
10.0							
11.0							
12.0							
13.0							
14.0							
15.0							
16.0							

  
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APPENDIX

**CALCULATION OF SBC**

**GLBR AT GANESPURAGUTTA , ASIFABAD (M) IN ADILABAD DT.**

**TYPICAL CALCULATIONS FOR OPEN FOUNDATIONS RESTING IN**

**SAND STONE AT 2 M DEPTH**

**a) *Shear Criterion :***

Assumed value of N = 50

Assumed width of foundation = 4 m

Assumed depth of foundation = 1,5 m inside rock

Correction factors  $R_q = R_r = 0.5$

With a F.S. of 3.0 ,

Allowable  $q = 1 / 18 [ 2 N^2 B R_r + 6 ( 100 + N^2 ) D R_q ] = 1205 \text{ kN / sq m}$



**b) *Settlement Criterion :***

For permissible settlement of 40 mm,

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

= 658 kN / sq m

Adopt 250 kN / sq m .

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

For  $N = 50$ ,  $B = 4$ ,

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

For a pressure of 25 t / sq m,

Settlement =  $0.0025 \times 4.5 \times 1000 = 11.25$  mm OK

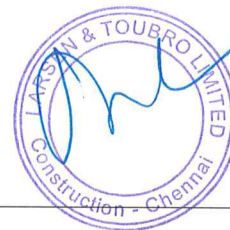
d) As per IS : 12070 ( Code of Practice for Design & Construction of Shallow Foundations on Rocks ) :

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

For this very poor rock , net allowable bearing pressure is recommended as 10 t / sq m , for settlement less than 12 mm.

Keeping the above considerations in view, Recommended Safe Bearing Capacity is 10 t per sq m

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