



**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>  <b>DESIGN OF SUMP - 40KL CAPACITY ENOLI AT AT WANKIDI MANDAL</b>																
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**Submitted sir,**

**Sub:** RWS&S- TDWSP- Enoli 40KL clear water sump in Wankidi Mandal–Komarambheem Asifabad Segment-Adilabad District-Designs -Approval-Reg.

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Kindly puruse the Designs of the following 40KL Clear Water sump at Enoli(V) ,Wankidi (M), submitted by the Executive Engineer TDWSP Asifabad Division ,Adilabad district for approval.

### 1. 40 KL Clear Water Sump.

The Executive Engineer TDWSP Asifabad Division has submitted Structural Designs & Drawings of 40KL Clear Water sump 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 : 40KL
- Net SBC of Soil : 10.0 t/sqm
- Grade of concrete & Steel : M 30 & Fe 415
- Dia of sump Inner to Inner : 5.00m
- Sidewall Height : 2.65mts
- Sidewall Thickness:150mm
- Top Slab thickness: 150 mm
- Raft Slab thickness: 250mm

As per the above parameters the structural design and drawings of the clear water sump 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: 456-4000, SP:16, 34, IS:3370 and IS 1893-4002 (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

## Design Of 40 KL Capacity Sump at (WITH FLAT TOP SLAB)

Not more than 5m Span

### Data

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

### Top Slab

Radius of Top slab	rs		2.50	slab projection	0.3 m
Thickness of Slab	td	Min 150mm thick	OK	0.15 m	0.121 mm is required
Effective depth of slab	d		100 mm		
Total Load on slab		Self wt	3.75 kN/sqm		
		Live load	1.5 kN/sqm		
		Finishings	1 kN/sqm		
		Total load	<u>6.25 kN/sqm</u>		
Bending Moment	bm	(2/16*w*rs <sup>2</sup> )	4.88 kN-m/m		
Area of Steel required	ast	(bm/( $\sigma$ st)d)	436 sqmm/m		
		$\sigma$ st	N/mm <sup>2</sup>	130.00	N/sqmm
		j=1-k/3	0.86		
		k=1/1+ $\sigma$ st/m $\sigma$ cbc	0.42		
		m=280/3 $\sigma$ cbc	9.33		
		$\sigma$ cbc	10	N/sqmm	
		Grade of steel	Fe 415 , $\sigma$ st=	130	N/sqmm
		Grade of Concrete	M 30		
Dia of Reinforcement	db	10mm			
Spacing required	min of	150 mm	170 mm	floor to	10mm
Spacing provided			OK	150 mm	c/c
Provide 10 mm dia Tor @ 150 mm C/c both radially and in the form of circular rings					

### Side Wall

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

### Moments

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

### Hoop force

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

### Reinforcement

			Dia	Spacing Provided	floor to
Inner face	Vertical	(Min 10mm dia)	240 mm <sup>2</sup>	10 mm	150 mm
	Horizontal		183.5 mm <sup>2</sup>	10 mm	150 mm
Outer face	Vertical	(Min 10mm dia)	240 mm <sup>2</sup>	10 mm	150 mm
	Horizontal		183.5 mm <sup>2</sup>	10 mm	150 mm

### Bottom slab

Min 150mm thick

Safe bearing Capacity	sbc		100 Kn/m <sup>2</sup>		
Th. Of Bottom Slab	bsth	thick is Sufficient	0.250 m	0.090 m	
Dia of Bottom Slab	db		6.00 m		
Size of Haunch	bh		0.25 m		
effective cover to reinforcement for raft slab		covraft	65 mm		
Moments	Radial		4.18 Kn-m		
	Circumferential		4.14 Kn-m		
		Ast (Min 10mm dia)	Dia	Provided	floor to
Reinforcement Top	mesh	300 mm <sup>2</sup>	10 mm	225 mm	25
Bottom	mesh	300 mm <sup>2</sup>	10 mm	200 mm	50

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

**Design Of Bottom Slab**

**CASE-1**

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

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

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

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

**Base Slab Th for Uncracked Condition**

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

**Check For SBC**

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

APPROVED  
M. Y. H. H.  
SE, NIRMAL

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

**Load on Bottom Slab (Uplift)**

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

**Base Slab Th for Uncracked Condition**

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

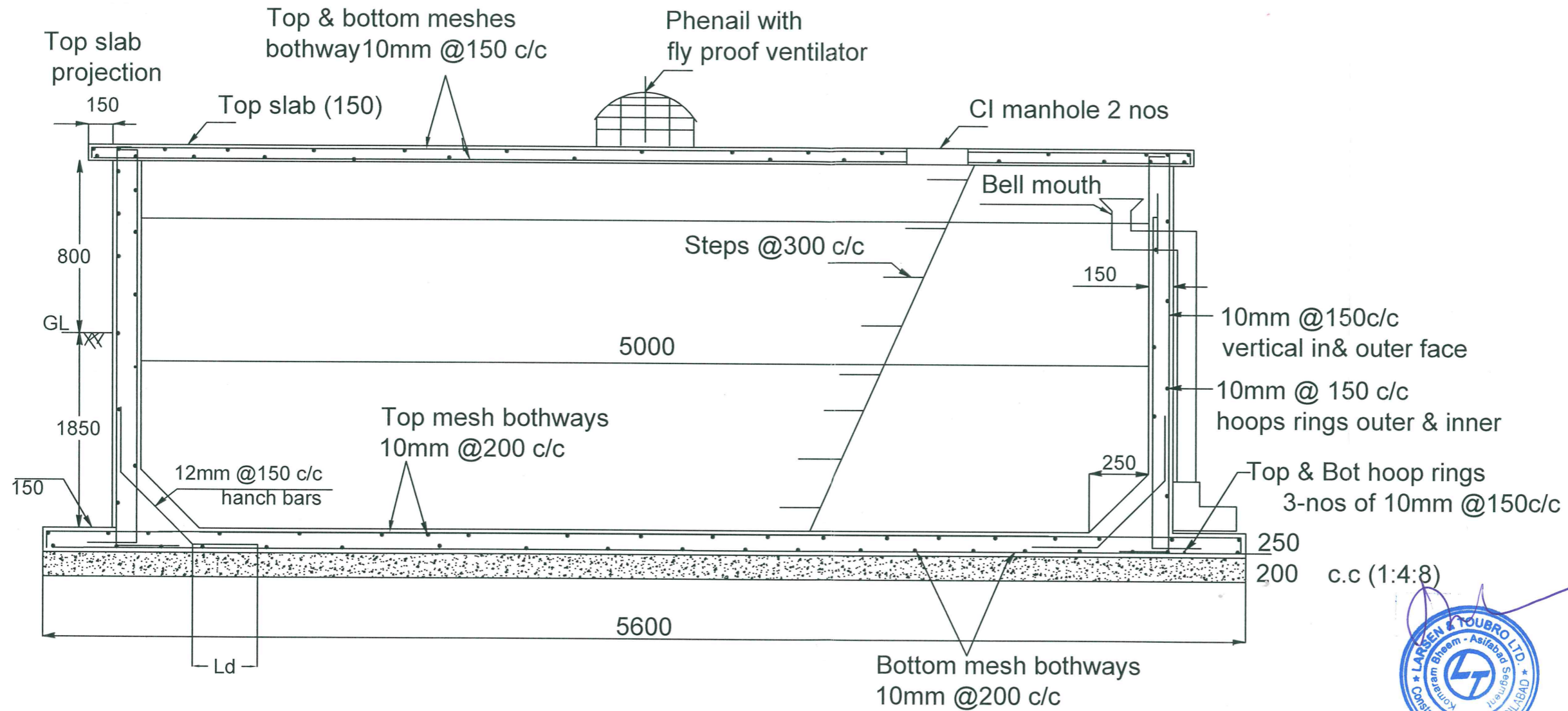


*Y. A. Ahmed*  
**Asst. Executive Engineer**  
TDWSP Asifabad

*Dr*  
**Dy. Executive Engineer**  
TDWSP Asifabad

*nae*  
**Executive Engineer**  
TDWSP Asifabad

# 40KL SUMP



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

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 Asst. Executive Engineer  
 TDWSP Asifabad

*Dy. Executive Engineer*  
 Dy. Executive Engineer  
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*Executive Engineer*  
 Executive Engineer  
 TDWSP Asifabad

APPROVED  
*M. Nirmal*  
 SE, NIRMAL

REV.NO.	DESCRIPTION	DESIGNED	DRAWN	CHECKED	APPROVED

<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 ( PRIMARY GRID)	
SUPPLIER/CONTRACTOR : <b>L&amp;T Construction</b> Water & Effluent Treatment SBG	
JOB No. : LE150883	SCALE :
TITLE : ENOLI AT WANKIDI MANDAL SUMP - 40KL	PROJECTION :

CHECKED BY	SIGN	DATE
CIVIL & STRUCTURAL		
MECHANICAL		
ELECTRICAL		
INSTRUMENTATION		

DRAWING No. LE150883-C-WS-RW-DC-1402	SIZE REV. A3 A
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**GEOTECHNICAL INVESTIGATION REPORT**

**TELANGANA DRINKING WATER SUPPLY PROJECT**

**KOMARAM BHEEM - ASIFABAD- SEGMENT 22**

**ASIFABAD , ADILABAD DISTRICT**

**40KL SUMP AT ENOLI, WANKIDI MANDAL IN ADILABAD DISTRICT**

***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**

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**TELANGANA DRINKING WATER SUPPLY PROJECT**  
**40KL SUMP AT ENOLI, WANKIDI MANDAL AT ADILABAD DISTRICT**

**1. INTRODUCTION**

M/s. L & T Construction, Water & Effluent Treatment is proposing to construct 60 KL Sump Kammargaon (V), Bejjur (M), Asifabad (Dt) .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 Sump for Enoli, Wankidi (M) Asifabad (Dt)
- Conducting SPT at regular intervals, where feasible
- Collection of undisturbed / disturbed samples from the Bore holes

  
  
M.E., Ph.D., U.S.A.  
Consulting Geotechnical Engineer

- Preparation of Technical Report recommending suitable foundations and safe bearing capacity

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 22-23 Jan ,2016.

The following relevant data was recorded during Rotary drilling operations.

- Nature of strata
- Details of samples

  
**Dr. D. BABU RAO**  
M.E., Ph.D.(USA)  
Consulting Geotechnical Engineer



- Core Recovery (CR)
- Rock Quality Designation (RQD)

**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

  
 DR. D. DADA  
 M.E., Ph.D. (USA)  
 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.

From GL to 6 m , weathered rock was seen. N value exceeded 100 blows ( Refusal) .. Few small rock pieces were procured .

**5. SUB SOIL PROFILE**

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

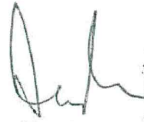

Depth	Strata	N value
0 – 6 m	Weathered rock	>100

. 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.

  
  
**Dr. D. BABU RAO**  
M.E., Ph.D. (US)  
Consulting Geotechnical Engineer

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

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

**SHEAR CRITERIA:**

The first criterion is depends on shear strength. The calculations are based on "TERZAGHI" bearing capacity equation as recommended by IS: 6403 (with factor of Safety) which takes care of L/B ratio (shape), foundation depth etc., along with other parameters.

**SETTLEMENT CRITERIA:**

The intensity of loading that will cause a permissible settlement or specified settlement of the structure is termed as allowable bearing pressure. The settlement in this type of layer will be elastic settlement.

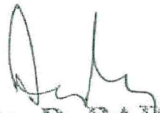
These foundation settlements are evaluated using elastic theory. The pressure distribution below the footing is assumed as 2 V: 1 H for estimating the settlement. Since rock formation is available at shallow depth. The settlement will be within the permissible limit. Hence open foundation is suitable.

**ALLOWABLE BEARING CAPACITY:**

Allowable Bearing capacity (ABC) is the net intensity of the loading which the foundation will carry without undergoing settlement in excess of the permissible value for the structure under consideration but not exceeding the net safe bearing capacity (SBC).

**7.0 DISCUSSION ON FOUNDATION OPTIONS :**

From sub soil profile and laboratory test data, it can be seen that weathered rock exists from GL to 6 m depth . Hence shallow foundation is feasible and same is recommended.

  
**Dr. D. BABU RAO**  
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Consulting Geotechnical Engineer

## 8.0 RECOMMENDATIONS

Based on Field Investigations and laboratory testing, the following Recommendations are made for construction of 40KL Sump at Enoli, Wankidi (M), Asifabad (Dt)

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

b) SBC is recommended as follows :

Location		BH 1
S. No.	Depth (m)	Recommended SBC t/ sq m
1	2.0	10
2	3.0	11
3	4.5	13

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

*For ANJI DRILLING AND GROUTING WORKS*



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

Former Professor of Civil Engineering

Consulting Geotechnical Engineer

MCH Panelist No. 2490/TP/2000-2



**TELANGANA DRINKING WATER SUPPLY PROJECT**

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


40KL Sump at Enoli, Wankidi Mandal at Adilabad District


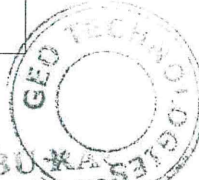
Type of Boring: Core drilling

Dia of Boring: NX

Date : 22-23 Jan 2016

Drilled depth :6 m

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

  
  
**MR. A. BABU KASIBABU**  
 M.E., Ph.D. (USA)  
 Consulting Geotechnical Engineer

APPENDIX

**CALCULATION OF SBC**

**40KL Sump At Enoli, Wankidi Mandal at Adilabad District**

TYPICAL CALCULATIONS FOR OPEN FOUNDATIONS 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 .

**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

  
  
**Dr. D. BABU**  
M.E., Ph.D. (USA)  
Consulting Geotechnical Engineer

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 25 t / sq m , for settlement less than 12 mm.

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



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**APPROVED**

**SE, NIRMAL**

