GOVERNMENT OF TELANGANA
TELANGANA DRINKIMG 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

TITLE :

DESIGN OF 6MX4M PUMPHOUSE (TYPICAL)

	NAME	SIGN	DATE
DSGN			
CHKD			
APPD			

DOC./DRG. No.

LE150883-C-WS-RW-DC-1901

SIZE	REV.
A4	A

RELEASED FOR

☐ PRELIMINARY	☐ INFORMATION	☑ APPROVAL	☐ CONSTRUCTION

DESIGN OF 6 X 4 M PUMP HOUSE

1 Design of roof slab S1

Length lx			=	3.23 m
Width ly			=	4.23 m
ly/lx			=	1.31
Assume slab thickness		110	mm	0.110 m
Loads				
Self weight of slab			=	3.00 kn/m^2
Live load			=	0.75 kn/m^2
Miscellaneous (Roof finish)			=	0.75 kn/m^2
Weight of CC bed over the slab			=	0.00 kn/m^2
Total load			=	4.50 kn/m^2
Bending Moments (Two adjacent edges discontinuous)				
α_x			=	0.051
α_y			=	0.032
$M_x = \alpha_x w . L_x^2$	0.051*4.5*3.23^2		=	2.39 knm
$M_y = \alpha_y w . L_x^2$	0.032*4.5*3.23^2		=	1.50 knm
Max moment (M)			=	2.39 knm
Steel reinforcement				
Size of reinforcement			=	8 mm
Effective depth required	sqrt(2.39*10^6)/(0.91*1000))		=	51.29 mm
Effective depth for short span			=	91.0 mm
Steel required for short span (As)	(2.39*10^6)/(0.9*230*91)		=	127.11 mm^2
Minimum reinforcement	0.12*1000		=	120.00 mm^2
Spacing of reinforcement	200		=	395.45 mm

Provide 110mm thk slab with Y8 - 200 BW

Check for deflection

Ast provided			223.38 mm2
Percentage of steel			0.25 %
From chart 22			33.00
Effective depth required			75.29 mm
		<	91.00 OK

Design of roof slab S2 (cantilever slab)

Length lx			=	3.23 m
Assume slab thickness		110	mm	0.110 m
Loads				
Self weight of slab			=	3.00 kn/m^2
Live load			=	0.75 kn/m^2
Miscellaneous (Roof finish)			=	0.50 kn/m^2
Weight of CC bed over the slab			=	0.00 kn/m^2
Total load			=	4.25 kn/m^2
Max moment (M)			=	0.77 knm
Steel reinforcement				
Size of reinforcement			=	8 mm
Effective depth required	sqrt(0.77*10^6)/(0.91*1000))		=	28.99 mm
Effective depth for short span			=	91.0 mm
Steel required for short span (As)	(0.77*10^6)/(0.9*230*91)		=	40.61 mm^2
Minimum reinforcement	0.12*1000		=	120.00 mm^2
Spacing of reinforcement	200		=	1237.71 mm

Provide 110mm thk slab with Y8 - 200 BW

2 BEAM -B1

Span			=	4.23 m
Load from slab			=	5.86 kn/m
Beam size Width		230	=	0.23 m
Depth		410	=	0.42 m
Effective depth		389	mm	0.27
Self weight	0.23*0.42*25		=	2.42 kn/m
Total load			=	8.27 kn/m
Load due to secondary beam			=	0.00 Kn
Max B.M	8.27*4.23^2/8+0*4.23/4		=	18.50 knm

Let	Mu /b d^2 =			0.80	appx. =	0.80	N /mm
From sp-16, %Ast =		0.35					
Required ,Ast =		338		mm^2			
Proposed with ,		Nos		Dia	Area		
St.Bars		2		20	628	mm^2	
		0		16	0		
				Total=	628	mm^2	>338 O.K
			2Y20 T& B	=	628.00	mm^2	
Area of steel provided				=	628.00	mm^2	
Percentage of steel				=	0.70	%	
Max shear force			8.27*4.23/2	=	17.49	kn	
Shear stress			17.49*1000/(230*389)	=	0.20	N/mm^2	
Permissible shear stress (Pt = 0.7 %)				=	0.48	N/mm^2	
Shear to be carried by stirrups			(0.2-0.48)*230*389	=	-25454.55	N	
Spacing (Aw*f*d/Vs)			2*50.26*230*389/-25454.55	=	-353.32	mm	
Spacing for min shear (least of)			0.75*d = 292 mm	&	251.30	mm	
			Y8-200 STPS				

Provide 230*420 Beam ; 2Y20 T& B ; Y8-200 STPS

3 BEAM-B2

Span				=	4.23	m	
ly				=	4.23	m	
lx				=	3.23	m	
Load from slab				=	11.71	kg/m	
Beam size Width			230	mm	0.23	mm	
Depth			410	mm	0.35	mm	
Effective depth			320	mm	0.32	mm	
Self weight			0.23*0.35*25	=	2.01	kn/m	
Total load				=	13.72	kn/m	
Max B.M			13.72*4.23^2/10	=	24.55	knm	
Let	Mu /b d^2 =			1.56	appx. =	1.60	N /mm
From sp-16, %Ast =		0.2					
Required ,Ast =		161		mm^2			
Proposed with ,		Nos		Dia	Area		
St.Bars		2		16	402	mm^2	
		0		16	0		
				Total=	402	mm^2	>161 O.K
			2Y16 T& B	=	402.00	mm^2	
Area of steel provided				=	402.00	mm^2	
Percentage of steel				=	0.55	%	
Max shear force			13.72*3.23/2	=	22.16	kn	
Shear stress			22.16*1000/(230*320)	=	0.45	N/mm^2	
Permissible shear stress (Pt = 0.55 %)				=	0.54	N/mm^2	
Shear to be carried by stirrups			(0.45-0.54)*230*320	=	-6501.24	N	
Spacing (Aw*f*d/Vs)			2*50.26*230*320/-6501.24	=	-1137.98	mm	
Spacing for min shear (least of)			0.75*d = 240 mm	&	251.30	mm	
			Y8-200 STPS				

Provide 230*350 Beam ; 2Y16 T& B ; Y8-200 STPS

4 BEAM @ lintel level

Span				=	4.23	m	
ly				=	0.00	m	
lx				=	0.00	m	
Load from wall				=	3.22	kg/m	
Beam size Width			230	mm	0.23	mm	
Depth			300	mm	0.30	mm	
Effective depth			270	mm	0.27	mm	
Self weight			0.23*0.3*25	=	1.73	kn/m	
Total load				=	4.95	kn/m	
Max B.M			4.95*4.23^2/10	=	8.85	knm	
Let	Mu /b d^2 =			0.79	appx. =	0.80	N /mm
From sp-16, %Ast =		0.233					

Required ,Ast =	161			mm^2		
Proposed with ,	Nos			Dia	Area	
St.Bars	2			12	226	mm^2
	1			0	0	
				Total=	226	mm^2 >161 O.K
		3Y12 T& B	=	226.00	mm^2	
Area of steel provided			=	226.00	mm^2	
Percentage of steel			=	0.36	%	
Max shear force		4.95*0/2	=	0.00	kn	
Shear stress		0*1000/(230*270)	=	0.00	N/mm^2	
Permissible shear stress (Pt = 0.36 %)			=	0.48	N/mm^2	
Shear to be carried by stirrups		(0-0.48)*230*270	=	-29808.00	N	
Spacing (Aw*f*d/Vs)		2*50.26*230*270/-29808	=	-209.42	mm	
Spacing for min shear (least of)		0.75*d = 203 mm	&	251.30	mm	
		Y8-200 STPS				

Provide 230*300 Beam ; 3Y12 T& B ; Y8-200 STPS

12 PLINTH BEAM

Span			=	4.23	m	
ly			=	0.00	m	
lx			=	0.00	m	
Load from wall			=	11.04	kg/m	
Beam size Width		230	mm	0.23	mm	
Depth		300	mm	0.35	mm	
Effective depth		267	mm	0.32	mm	
Self weight		0.23*0.35*25	=	2.01	kn/m	
Total load			=	13.05	kn/m	
Max B.M		13.05*4.23^2/10	=	23.35	knm	
Let Mu /b d^2 =			1.49	appx. =	1.50	N /mm
From sp-16, %Ast =	0.46					
Required ,Ast =	370			mm^2		
Proposed with ,	Nos			Dia	Area	
St.Bars	2			16	402	mm^2
	0			16	0	
				Total=	402	mm^2 >370 O.K
		2Y16 T& B	=	402.00	mm^2	
Area of steel provided			=	402.00	mm^2	
Percentage of steel			=	0.55	%	
Max shear force		13.05*0/2	=	0.00	kn	
Shear stress		0*1000/(230*320)	=	0.00	N/mm^2	
Permissible shear stress (Pt = 0.55 %)			=	0.44	N/mm^2	
Shear to be carried by stirrups		(0-0.44)*230*320	=	-32384.00	N	
Spacing (Aw*f*d/Vs)		2*50.26*230*320/-32384	=	-228.45	mm	
Spacing for min shear (least of)		0.75*d = 240 mm	&	251.30	mm	
		Y8-200 STPS				

Provide 230*350 Beam ; 2Y16 T& B ; Y8-200 STPS

COLUMN

Height of column (h)		=	2.48 m
Width of Column		=	0.23 m
Depth of Column		=	0.30 m
Reinforcement % (p)		=	0.80 Assumed
clear cover (d')	40+8+16/2	=	0.056 m
Axial load Pu		=	100.00 kN
Moment in x-dir Mux		=	10 kN-m
Moment in y-dir Muy		=	10 kN-m
Fy		=	415.00 Mpa
Fc		=	20.00 Mpa
Check for min. eccentricity			
emin in x dir.	2.475/500+0.23/30	=	0.013 m
emin in y dir.	2.475/500+0.23/30	=	0.013 m
Consider emin in x dir	20.00	=	0.020 m
Consider emin in y dir.	0.020	=	0.020 m
Mex		=	2.00 kN-m
Mey		=	2.00 kN-m
Check for Slenderness		=	
h/B	2.475/0.23	=	10.76
h/D	2.475/0.23	=	10.76
Select by Table page # 106 SP -16		=	
es/b		=	0.00 m
es/d		=	0.00 m
Mesx		=	0.00 kN-m
Mesy		=	0.00 kN-m
Final loads		=	
Pu		=	100.00 kN
Mfux		=	10 kN-m
Mfuy		=	10 kN-m
Pu/fcbd	100000/ (20*230*230)	=	0.095
p/fc	0.8/20	=	0.040
d'/B	0.056/0.23	=	0.24
d'/D	0.056/0.23	=	0.24
Select by Chart 46 Page # 131 of SP 16		=	
Mux/fcbd^2 by d'/B = 0.2		=	0.085
Mux1 =		=	20.68 kN-m
Select by Chart 45 Page # 130 of SP16			
Muy/fcbd^2 by d'/D = 0.15		=	0.085
Muy1 =		=	20.68 kN-m
Mfux / Mux1		=	0.48
Mfuy / Muy1		=	0.48
By Charct 63 Page # 148 of SP 16		=	
Puz / Ag		=	12.00
Puz		=	634.80 kN
Pu / Puz		=	0.16
From Chart 64 Page # 149 of SP 16			
Mfuy/Muy1		=	0.65
Hence provide		>	0.38 O.K
p		=	0.80
Ast		=	423.20 mm^2
Dia of bar		=	16.00 mm
Area of 20 mm dia. Bar		=	200.96 mm^2
No. of bars required		=	3.00 No
			4 Y 16 MAIN
Spacing for stirrups		=	

Dia of Stirrup		=	8.00 mm
Least lateral dim.		=	230.00 mm
16 x dia of main bar	16*16	=	256.00 mm
48 x dia of stirupps	48*8	=	384.00 mm
least of above		=	230.00 mm
			Y8 - 200

Provide 230 x 230 with 4 Y 16 MAIN & Y8 - 200 Stirrups

DESIGN OF FOOTING

DATA:

Grade of concrete in footing	Fcki	30	N/sqmm			
Grade of concrete in pedestal	Fckii	30	N/sqmm			
Yield strength of steel	Fe	415	N/sqmm			
Size of pedestal(square)	Lii	30	cm			
Size of footing	Li	180	cm		74.16	
Overall depth of footing	D	50	cm		21.99	
Eff. cover to main steel	Ec	6	cm			
Depth at free edge	De	30	cm			
Dia. of main steel bar	dsi	12	mm			
Spacing of main steel bars	Si	15	cm		87.80	

Design Calculations

Loading case I (DL+LL)

Load on the column			Wi	100	kn
Moment on major axis			Mxi	10.00	Knm
Moment on minor axis			Myi	10.00	Knm
Safe bearing capacity of soil			sbci	100.00	Kn/m2
Total load on footing including self weight			Twi	110	Kn
Size of footing required	SQRT(TWI/sbci)*100			74.16	cm
Modulus of section Zx=Zy	(li/100)^3/6		Zx	288.00	m3
			Zy	288.00	m3

Net upward pressure

Loading case I (DL+LL)

wi/(li/100*li/100)+mxi/zx+myi/zy	Pmaxi	0.76	Kn/sqm
wi/(li/100*li/100)-mxi/zx-myi/zy	Pmini	0.63	Kn/sqm
Factored max net upward pressure (1.5*pmaxi)	Pumaxi	1.15	Kn/sqm
	Safe		

DESIGN :

Design max upward pressure			Qu	1.15	Kn/sqm
Bending moment at the face of pedestal qu*(li/100*(li/100-lii/100)^2)/8			Mi	235	Knm
Eff width of footing	(lii+(li-lii)/8)		bi	176	cm
Depth required	@sqrt(Mi*10^6/(0.138*fcki*bi*10))/10			21.99	cm
Provided Eff. depth	D-Ec		di	44	cm

Area of steel required

(bi*10*di*10*50/100)*(1-@sqrt(1-(4.6*mi*10^6)/(fcki*bi*10*di*di*100)))/(fe/fcki)

			Ast	1546	sqmm
Spacing of bars	(@pi*dsi^2/4*li*10/ast)/10			87.80	cm
	Provide	12 mm bars	Si	15.00	cm

Check for one way shear

Critical section for oneway shear is at a distance of "di" from face of the pedestal

Shear force at critical section

qu*li/100*((li-lii)/200-di/100)

Vi	74.39	Kn	

Footing Width at critical section	Lii+(2*di)	bii	118.00	cm	
Depth at critical section					
	di-(di-(de-ec))*(di*2)/((li-lii))	dc	42.50	cm	
Shear stress	Vi*1000/(bii*10*dc*10)	towu	0.15	n/sqmm	
Percentage of steel at critical section					
	bii*10*@pi*dsi^2/4*100/(si*10*bii*10*dc*10)				
		pt	0.18		
	@max((0.8*fcki)/(6.89*pt),1.0)	beeta	13.09		
Permisible shear stress					
	(0.85*@sqrt(0.8*fcki)*(@sqrt(1+5*beeta)-1.0))/(6*beeta)				
		towc	0.31	N/sqmm	
CHECK:	@if(towu<towc,"safe","Not safe")		Safe		
Design for two way shear					
The critical section for two way shear is at di/2					
from the face of the pedastal					
Shear force					
	qu*((Li/100)^2-(Lii/100+(D-Ec)/100)^2)	vii	164.37	kn	
Depth of footing at critical section					
	di-((0.5*di)/((Li-Lii)*0.5))*(D-de)	dci	43.25	cm	
Nominal shear stress					
	vii*1000/((Lii*10+di*10)*4*dci*10)	towui	0.13	N/sqmm	
Shear strength of Concrete					
	beetac= 1 for square pedestals				
	0.25*@sqrt(fcki)	towci	1.12	N/sqmm	
CHECK	@if(towci>towui,"safe","Not safe")		Safe		
Load transfer from Column to Footing:					
Nominal bearing stress in column concrete					
	1.5*Wi*1000/(Lii*10*Lii*10)		1.67	N/sqmm	
Allowable bearing stress					
	0.45*Fckii		9.00	N/sqmm	
CHECK:			Safe		
Permissible Bearing stress on the footing:					
	@min(0.45*Fcki*@sqrt((Li*10)^2/(Lii*10)^2),0.9*Fcki)				
			18.00	N/sqmm	
CHECK:			Safe		
::					

Dy. Executive Engineer
TDWSP Asifabad

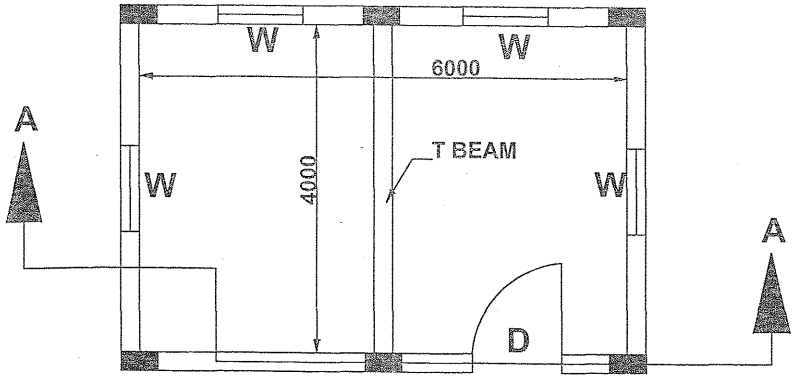
Executive Engineer
TDWSP Asifabad

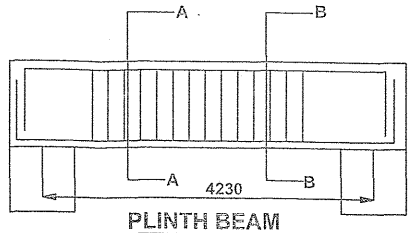
"APPROVED"
SE, TDWSP
NIRMAL

Asst. Executive Engineer
TDWSP Asifabad

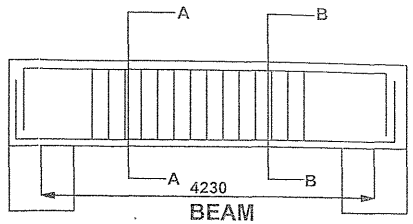
PUMP HOUSE OF 6MX4M SIZE

PLAN





PLINTH BEAM
230X300

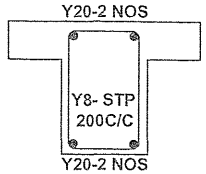


BEAM
B1 230X410

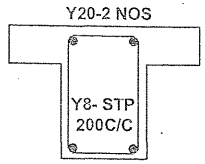
PLINTH BEAM
230X300
SECTION A-A

PLINTH BEAM
230X300
SECTION B-B

LINTEL LEVEL BEAM
230X300



B1 -230X410
SECTION A-A



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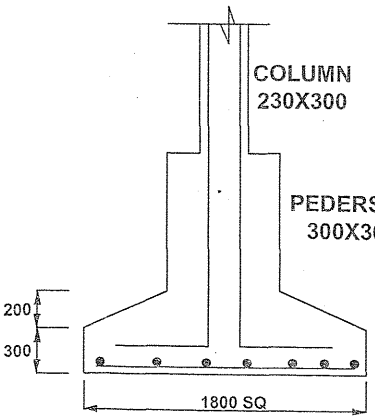
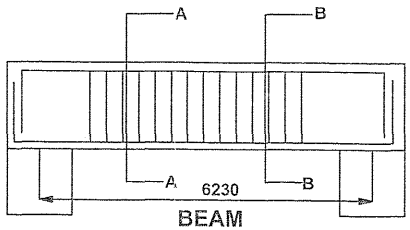
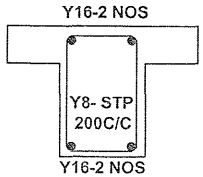
SECTION B-B



FOOTING



BEAM
B2 230X410



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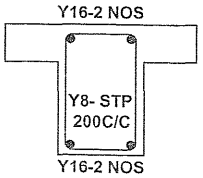
SECTION A-A



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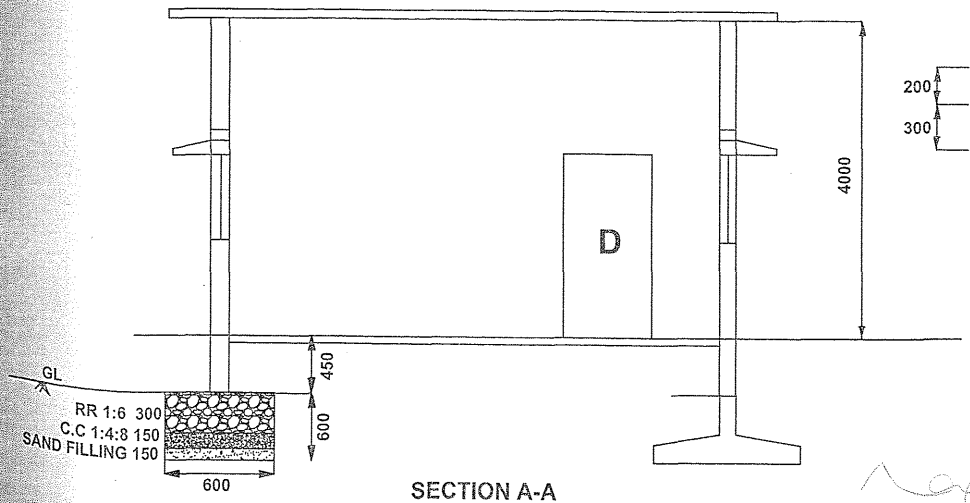
SECTION B-B



SECTION A-A

COLUMN
230X300

Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad

"APPROVED"
SE, TDWSP
NIRMAL

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

REVISIONS

L&T Construction
Water, Smart World & Communication.

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

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

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

JOB No:	LE150883
NAME	SIGN / DATE

TITLE: LODDIGUDA - TRIYANI MANDAL
PUMP HOUSE 6MX4M

SCALE
PROJECTION

LARSEN & TOUBRO LIMITED Construction - Chennai

CHECKED BY	SIGN	DATE
CIVIL & STRUCTURAL		
MECHANICAL		
ELECTRICAL		
INSTRUMENTATION		

DRAWING No. LE150883-C-WS-RW-DC-1901

SIZE A3 | REV. A

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

PUMP HOUSE OF 6 m X 4 m SIZE

SCHEME :

DWG NO 1

SECTION A-A

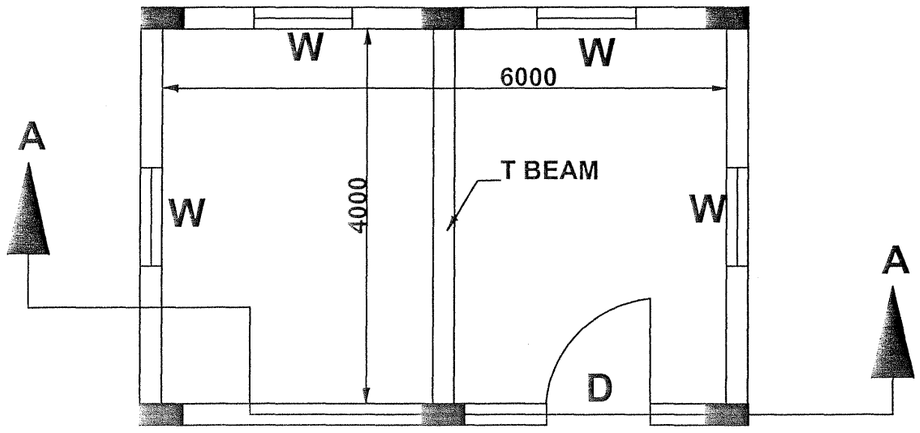
PLAN

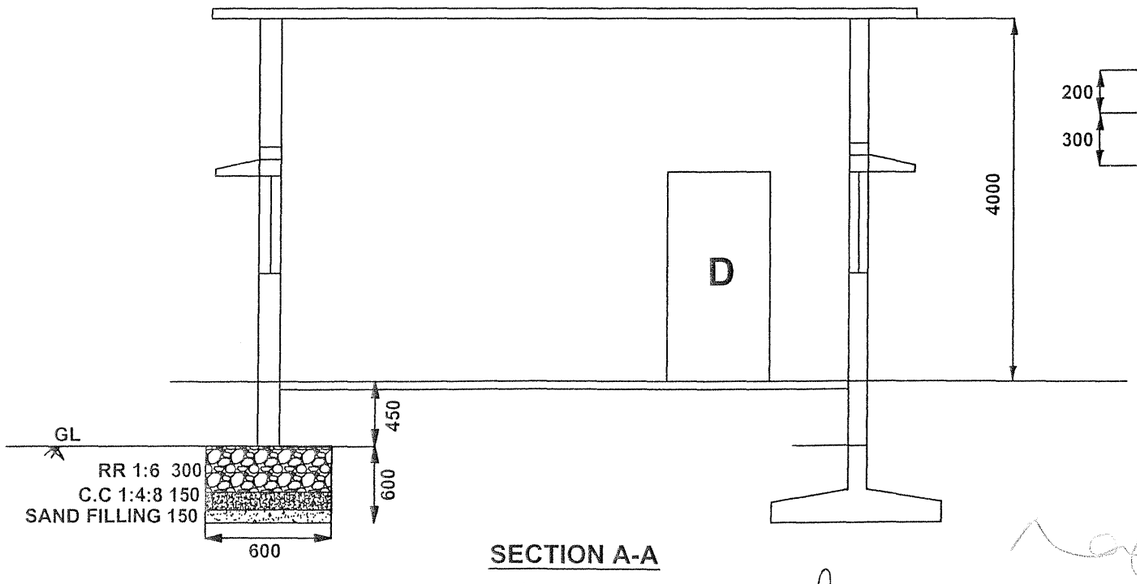
Dy. Executive Engineer
R.W.S. & S.
Sub Division, Bhainsa

Superintending Engineer
R.W.S. & S. Circle, Adilabad

PUMP HOUSE OF 6MX4M SIZE

PLAN





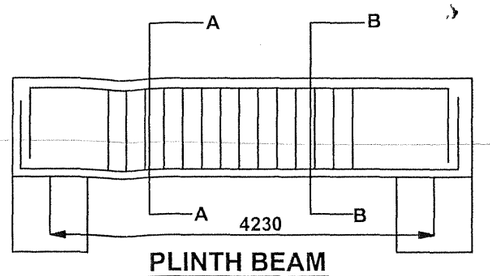
SECTION A-A

Asst. Executive Engineer
TDWSP Asifabad

Dy. Executive Engineer
TDWSP Asifabad

Executive Engineer
TDWSP Asifabad

" APPROVED "
SE, TDWSP
NIRMAL



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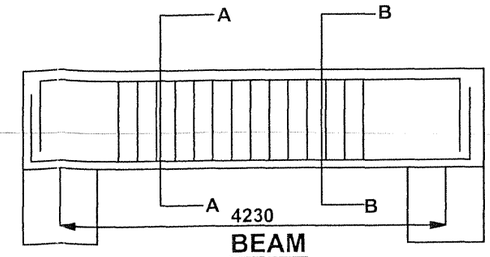

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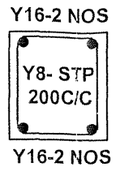

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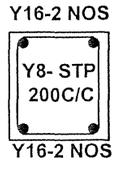
SECTION A-A



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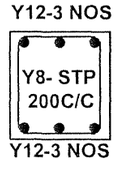
SECTION B-B



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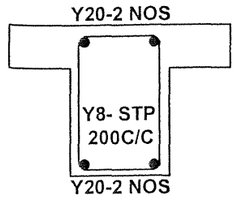

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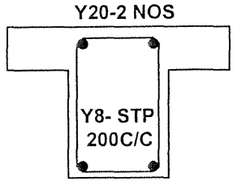
SECTION A-A



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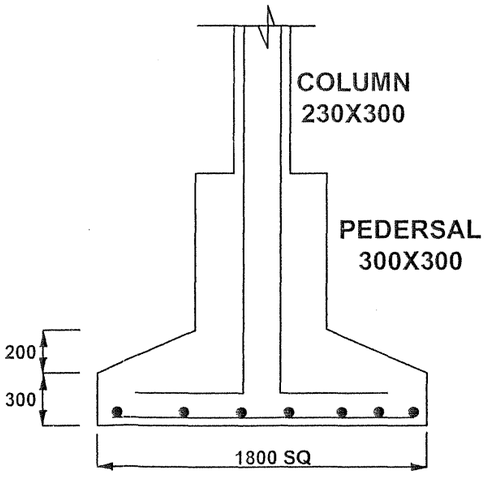
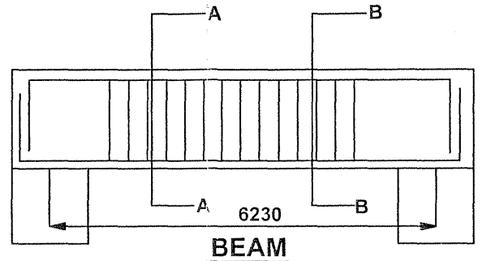
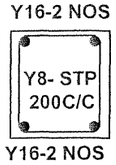
SECTION B-B



FOOTING



BEAM
B2 230X410



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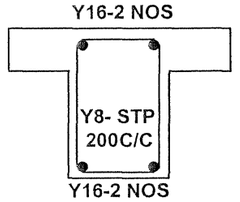
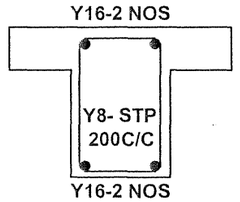


B2 -230X410
SECTION A-A



B2-230X410
SECTION B-B

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

REVISIONS

L&T Construction
Water, Smart World & Communication.

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

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

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

LARSEN & TOUBRO LIMITED Construction - Chennai

JOB No:	LE150883	
NAME	SIGN	DATE

TITLE: LODDIGUDA - TRIYANI MANDAL
PUMP HOUSE 6MX4M

SCALE
PROJECTION

CHECKED BY	SIGN	DATE
CIVIL & STRUCTURAL		
MECHANICAL		
ELECTRICAL		
INSTRUMENTATION		

DRAWING No. LE150883-C-WS-RW-DC-1901 | SIZE A3 | REV. A

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