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Planning, Analysis and Design of Advanced Township at Thodupuzha in Kerala

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Abstract: ***Due to the rise in population and increase in urbanisation levels in our country, most of the settlements are in urban areas. As the cities that already existing are heavily populated along with a great deal of limitations in the infrastructure, emergence of an advanced township away from the vicinity of these overpopulated urban areas offer safer and better accommodation for the people. The planning and layout of the project is shown using autoCAD and for the structural analysis we use STADD Pro V.18i. Demographic analysis is done among specific clientele. Development of roof top rainwater harvesting(sump)has been carried out in order to provide source of water for the whole population of the township. Use of intze tank which is a circular overhead tank to meet the daily water requirement of the population inside the township.For the proper disposal and processing of the waste generated, almost 30 acres of land is being used to hold the per capita waste generated which managed after calculating factors like total waste generated, estimated landfill, total area required for land etc. The salient features a major advantages of this township is discussed in detail.***

Keywords:

IS - ***Indian Standard***
BM - ***Bending Moment***
BIS - ***Bureau of Indian Standards***
cm - ***CentiMeters***
mm - ***MilliMeters***
m - ***Meter***
C - ***Celsius***

I. INTRODUCTION

A. Objective

1) To plan an advanced micro township.
2) To do demographic analysis for micro township project among specific clientele.
3) To do planning, analysis and design for over head water tank , design of rainwater harvesting sump and layout for the micro township , potential study of rainwater harvesting and Municipal Solid Waste Management.

B. Necessity

1) Township gives the potential shift towards maximum use of the land.
2) Using methods of construction that gives long project life to the structures and components.
3) Utilising every matter produced inside the township project into itself with zero to negligible throw away waste.
4) Compact planning of Infrastructure.

C. Scope

1) AutoCAD Layout of the advanced micro township project.
2) To analyse the structural behaviour of the Over head water tank.
3) To design the over head tank, Centralised Solid Waste Management, Rain Water Harvesting Potential Study , Solar Potential Study and design of rainwater harvesting sump.

II. GENERAL

A. At a time when the world is looking towards building a community in Mars, we thought about creating a super sustainable micro township back on Earth.
B. We chose a natural resource rich site with proposal to build a total standalone township which can survive without the constant supply from the outside world.

C. The location of the project area is at 76°44'50.1"E latitude and 9°51'26.5"N longitude.
D. The ground slope is towards South and South-West directions of the project area. We expect to take advantage of maximum wind energy and natural lighting for the project.
E. Average altitude of project area is 40 m above the mean sea level.
F. Average Rainfall per year is about 3713mm, and the site area is abundantly rich with fresh water as its in banks of Periyar River and water from Idukki reservoir flows thought centre of the project area.
G. The area consists of Lateritic soil, Brown hydromorphic soil and Alluvial soil.
H. In summer, the maximum temperature is 28°C whereas the minimum temperature is 20°C and in winter, the maximum temperature is 24°C whereas the minimum temperature is 16°C.

III. LITERATURE REVIEW

A. Solar energy: Potential and future prospects.

The improvement of novel sun based power headways is seen as one of many key plans toward fulfilling a by and large extending interest for energy. Fast improvement inside the field of sun arranged progressions is notwithstanding standing up to various specific limits, for instance, low sun based cell efficiencies. The advantages and awful signs of daylight based energy propels are both inspected in this article. Different specific issues affecting feasible force research are moreover highlighted.

B. A Review Paper on Electricity Generation from Solar Energy.

Sun arranged Energy is made by the Daylight is a non-vanishing economical wellspring of energy which is freed from eco-friendly. Reliably light energy shows up at the earth to fulfil the world's energy need for a whole year. This Sun oriented Energy is made by as per applications like mechanical, business, and private.

C. Study on potential uses of rainwater harvesting in urban areas.

Water gathering is the grouping of water volume from raindrops. Water harvesting has been the essential wellspring of water supply for consumable and non-consumable businesses. Water supply systems have improved anyway the interest is extending a result of the general population improvement, and progression.

D. The Potential of Roof Top Rain Water Harvesting as a Water Resource in Jordan: Featuring Two Application Case Studies.

Housetop top water harvesting (RWH) research targets evaluating the capacity of roof top deluge water gathering as a resource in Jordan. Two context oriented examinations at Al-Jubiha and Shafa-Badran zones in Amman city were picked. All current roofs in the two districts were perceived by digitising 2012 satellite photos of the two area.

E. From satellite townships to smart townships: evolution of township development in Pune, India.

This paper discusses the ascent of district headway around there and its connecting areas by playing out an examination of existing regions as cases. The paper finds that the district progression of Pune has been genuinely formative: from satellite regions to 'fused regions' and splendid regions. The striking features and critical advantages of these districts are discussed thoroughly.

F. Participatory Urban Development in India : A tale of Two Townships.

This paper hopes to offer an essential understanding of occupant responsibility during the time spent city advancing using two guard concentrates inside the Indian setting, to be explicit, Magarpatta City in Maharashtra and Auroville in Tamil Nadu. As a fundamental prologue to the issue, it attracts with contemporary discussions on the expansion and nature of public interest in metropolitan progression inside the arrangement of a neoliberal economy. This is followed by an emotional assessment subject to unstructured gatherings, which get the live experiences of the local landowners and tenants around there.

G. A parametric study to analyze the severity of hydrodunamic pressure for intze tank.

In the current examination, attempts are made to understand the lead of intze tank maintained on round shaft, when it is presented to hydrodynamic squeezing factor. Diverse parametric assessments have been finished to ponder the reality of hydro- dynamic squeezing factor by fluctuating as far as possible. It is seen that hydrodynamic pressure isn't fundamental if of intze tank.

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H. Interaction analysis of Intze tank fluid layered soil system.

Genuinely, the development is maintained by deformable soil layers which twists unevenly under the action of weights. This causes modification of forces in the pieces of overhead water tank. 3-D participation examination of intze type water tank-fluid layered soil structure is finished using ANSYS programming.

I. Harvested Rainwater Treatment Rainwater harvesting and primary treatment for non-portable use.

Two examination corridor roofs were set up to get water in a common school in India. A water sump was attempted to hold and store 58,000 L of water. Sodium hypochlorite (4% strength) was used for the disinfection association. The fact of the matter was to keep up chlorine development at the WHO level (0.2-0.5 mg/l)

J. Rainwater Management in Urban Areas.

The Exceptional Issue includes nine articles and a study and spotlights on stormwater overflow sum and quality. frameworks and strategies to mitigate the unfriendly outcomes of such natural change impacts utilizing compressed water. Testing procedure and shows for SQIDs are moreover considered. One paper examinations the blocking of porous media in the usage of stormwater for regulated spring re-empower

IV. RESULTS AND DISCUSSION

A. Planning

FIG 3 : Satellite Image of Selected Township Site ->

1) Data Collected

a) Rainfall Report

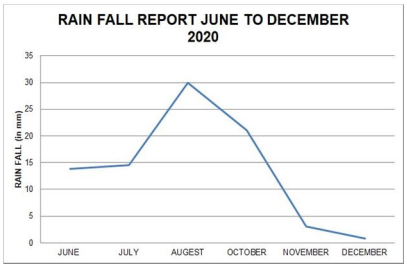


FIG 4: RAINFALL REPORT OF SECOND HALF OF THE YEAR 2020.

The rainfall report shows that the month of December is recorded with least rainfall and the month of august is said to have the peak rainfall on the second half of the year.

BLOCKWISE GROUNDWATER

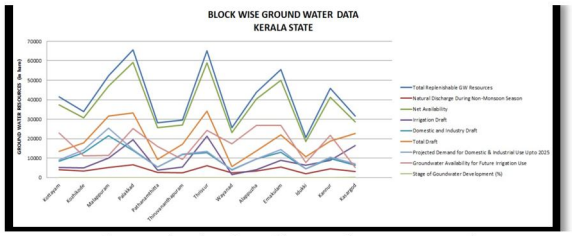


FIG 5: Blockwise Groundwater Kerala.

GROUNDWATER IDUKKI DISTRICT

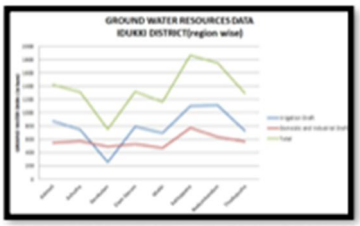


FIG 6: GROUNDWATER IDUKKI DISTRICT.

The figure shows the block-wise groundwater Kerala with all the districts.

The groundwater of Idukki district is displayed with respect to the each TALUK , the irrigation and the domestic and industrial draft.

2) Groundwater Thodupuzha

GROUNDWATER RESOURCES DATA OF THODUPUZHA	in mm
RESOURCE	
ANNUAL REPLENISHABLE GROUNDWATER RESOURCES	2065.264
NET GROUNDWATER AVAILABILITY	1859.062
ANNUAL GROUNDWATER DRAFT	1294.497
ANNUAL GROUNDWATER DRAFT AND INDUSTRIAL DRAFT	567.367
ANNUAL GROUND WATER DRAFT IRRIGATION	727.13
STAGE OF GROUND WATER PERCENTAGE	69.632
CATEGORIZATION	SAFE

Table 4 : Groundwater Thodupuzha

The groundwater of Thodupuzha is given as 2065.264 mm and the net groundwater level is said to be 1859.062 mm . The area is SAFE for water for human consumption.

3) Air Pollution

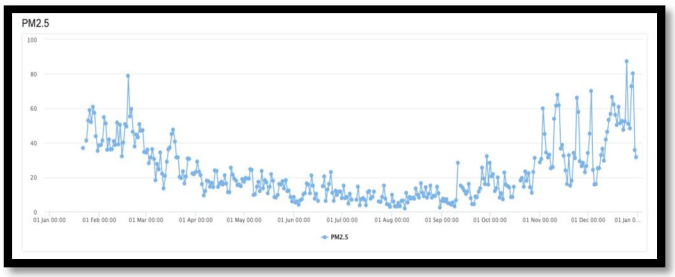


FIG 7 : PM2.5 DATA – SOURCE :- CPCB

The obtained value for PM $_{2.5}$ is 4.99 µg/m^3 and the safe limit given by WHO is 10 µg/m^3.

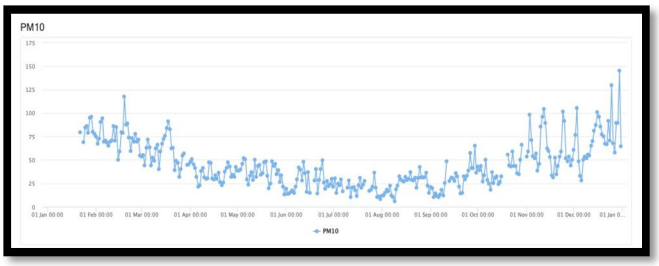


FIG 8 : PM10 DATA- SOURCE :- CPCB

The obtained value for PM $_{10}$ is 14.42 µg/m^3 and the safe limit given by WHO is 20 µg/m^3.

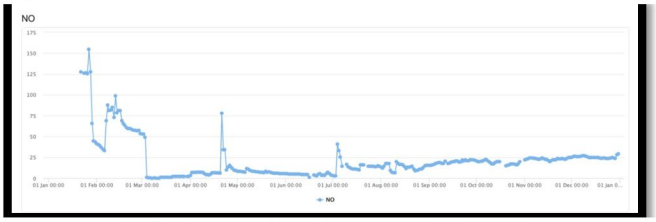


FIG 9: NO DATA-SOURCE :- CPCB

The obtained value for NO is 13.51 µg/m^3.

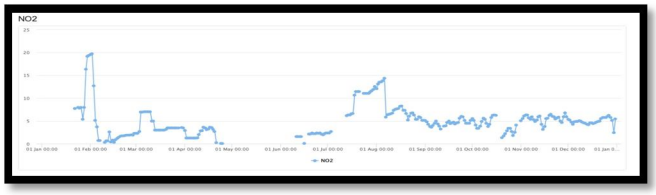


FIG 10: NO $_2$ DATA-SOURCE :- CPCB

The obtained value for NO_2 is 2.56 µg/m^3 and the safe limit given by WHO is 40 µg/m^3.

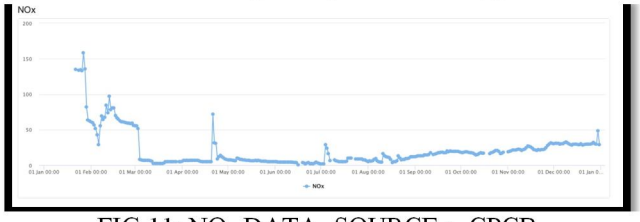


FIG 11: NO_X DATA- SOURCE :- CPCB

The obtained value for NO_x is 0.58 mg/m^3 and the safe limit given by WHO is 40 µg/m^3.

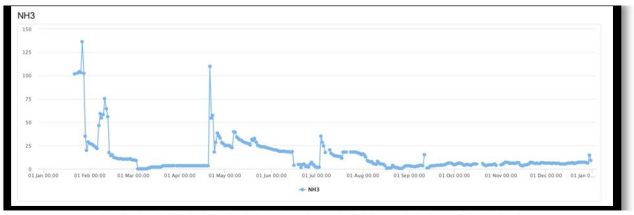


FIG 12: NH_3 DATA-SOURCE:- CPCB

The obtained value for NH_3 is 3.4 µg/l and the safe limit given by WHO is 50 µg/l.

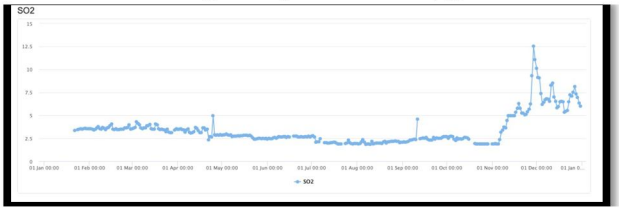


FIG 13:SO_2 DATA – SOURCE :- CPCB

The obtained value of SO_2 is 6.76 µg/m^3 and the safe limit is given by 20 µg/m^3.

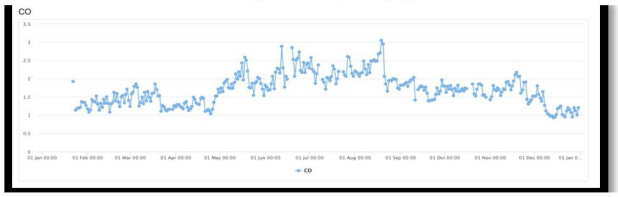


FIG 14: CO DATA – SOUCE :- CPCB

The obtained value is CO is 0.58 mg/m^3 and the safe limit is given by 40 mg/m^3

4) Demographic Analysis

S.No	DESCRIPTION	FIGURE ASSUMED	REFERENCE SOURCE	CALCULATED FIGURE
1	PROPOSED AREA	1000 ACRES		1000 ACRES
2	TOTAL POPULATION ASSUMED			12060
3	TOTAL NUMBER OF HOUSEHOLDS ASSUMED	avg 5 person/house and a increase of 1.2% everyyear for next 100 years		1648
	POPULATION DISTRIBUTION AS PER AGE GROUPS			
4	AGE 0-4	10.7% of population	cesusindia.gov.in	1337.5
5	AGE 5-9	12.5% of population	cesusindia.gov.in	1507.5
6	AGE 10-19	21.8% of population	cesusindia.gov.in	2629.08
7	AGE 20-44	36.3% of population	cesusindia.gov.in	4377.78
8	AGE 45-64	13.5% of population	cesusindia.gov.in	1628.1
9	AGE 65+	4.8% of population	cesusindia.gov.in	578.88
	GENDER CLASSIFICATION			
10	MALE	51.96% of population	cesusindia.gov.in	6266.376
11	FEMALE	48.04% of population	cesusindia.gov.in	5793.624

TABLE 5: Demographic Analysis

Demographic analysis is carried with the client base specification and according to this data building layout is made in AutoCAD 2021.

5) Building Layout

S.No	Content	No.of. BUILDINGS	Population Assumed	Plot Size	Plint area	Roof Area	Total Land req
1	SINGLE VILLA	24	96	25000 sqft	12000 sqft	8000 sqft	600000 sqft
2	G+9 RESIDENTIAL BUILDING	2	288	44000 sqft	20000 sqft	20000 sqft	88000 sqft
3	TWIN VILLA	18	144	30000 sqft	13000sqft	11000 sqft	540000 sqft
4	AMPHITHEATER	2	200	4000sqft	-	-	8000 sqft
5	HARDWARE STORE	1	50	8000 sqft	8000 sqft	7500 sqft	8000 sqft
6	HYPER MARKET	1	150	8000 sqft	8000 sqft	7800 sqft	8000 sqft
7	RECREATION CENTER	2	400	5000 sqft	4000 sqft	3500 sqft	10000 sqft
8	VETERINARY CLINIC	1	100	5000 sqft	4000 sqft	3500 sqft	5000 sqft
9	OUTDOOR PATIO 1	6	-	3000 sqft	3000 sqft	3000 sqft	18000 sqft
10	OUTDOOR PATIO 2	4	-	2500 sqft	2500 sqft	2500 sqft	10000 sqft
11	CAFETERIA	4	700	10000 sqft	7000 sqft	6500 sqft	40000 sqft
12	SEMI ROOF AMPHITHEATER	1	60	5000 sqft	2000 sqft	2000 sqft	5000 sqft
13	TOWN HALL	1	150	7500 sqft	4000 sqft	4000 sqft	7500 sqft
14	OPEN AIR GYM	1	75	4000 sqft	-	-	4000 sqft
15	DAY CARE	1	200	10000 sqft	8000 sqft	8000 sqft	10000 sqft
16	PRAYER HALL	1	600	10000 sqft	5000 sqft	3000 sqft	10000 sqft
17	CHILDRENS PARK	1	150	5000 sqft	-	-	5000 sqft
18	GENERAL CLINIC	1	750	19500 sqft	8000 sqft	8000 sqft	19500 sqft
19	DIGITAL GAME CENTER	1	50	8000 sqft	5000 sqft	5000 sqft	8000 sqft
20	COMMON POOL	1	20	5000 sqft	1500 sqft	1500 sqft	5000 sqft
21	CLUB HOUSE	1	1500	480000 sqft	120000 sqft	120000 sqft	480000sqft
22	MSW PLANT	1	-	1320000 sqft	8000 sqft	4500 sqft	1320000 sqft
23	POWER STATION	1	-	400000 sqft	-	-	400000 sqft
24	SCHOOL	1	2500	150000 sqft	100000 sqft	98000 sqft	150000 sqft
25	PLAYGROUND	1	300	181000 sqft	-	-	181000 sqft
26	COMMERCIAL BUILDING	1	5000	2500000 sqft	1550000 sqft	1550000 sqft	2500000 sqft
						TOTAL LAND USED	6420500 sqft
	TOTAL LAND ESTIMATED FOR PROJECT		1000 ACRES				
	GREEN CORRIDOR		500 ACRES				
	ESTIMATED ROAD AREA (by consulting an industry expert)		65 ACRES				
						REMAINING AREA WILL BE USED FOR FUTURE NEEDS OF THE TOWNSHIP	

TABLE 6: Building Layout.

Using the demographic analysis the required infrastructure for the population is designed in the layout and shown with the total area of the specific type of building , its roof size, plinth area are derived in the building layout

6) AutoCAD.

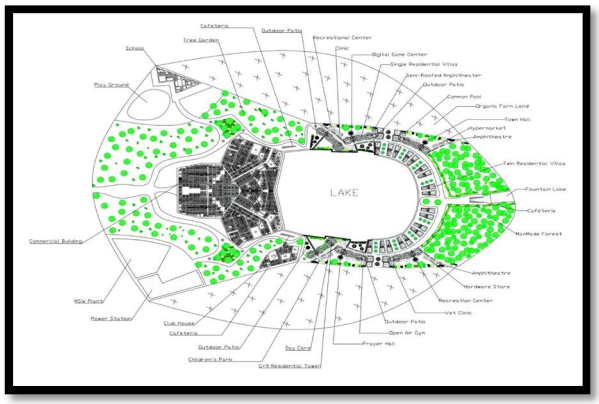


FIG 15: Layout of the Township

Whole layout to the 1000 acre large township project. Looking like an eye its centred around a lake which takes in excess rainwater and act as a freshwater source for the project area. The region around it marked "x" would be used for organic farming. Filled with trees the township side have a green cover of more than 50% of total area in use. Being an advanced township concept, this helps in replenishing the oxygen level inside the project site. The layout is designed as such the commercial region is near to the main entrance in left hand side while the right hand side have the residential area keeping both virtually aside to reduce unnecessary traffic in-turn reducing carbon footprint.

Single Villa Layout

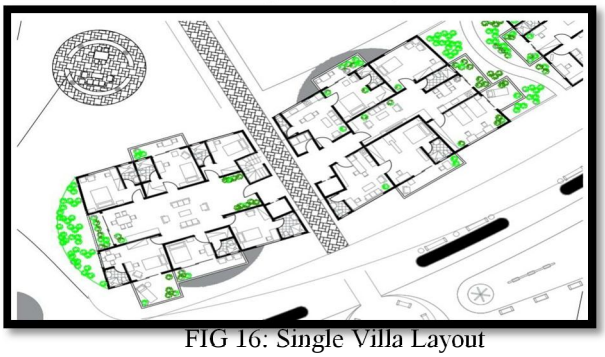


FIG 16: Single Villa Layout

There are 24 single villas in this whole project site. With 12000 square feet of plint area, they're the most posh residential offerings inside the township. These single floor homes are build with extra spacious rooms. The buildings are surrounded with trees, submerging them with nature.

Commercial Building Layout

FIG 17: COMMERCIAL BUILDING LAYOUT

The commercial building is designed to give maximum open sides to reduce usage of artificial lighting in maximum possible ways. Filled with hundred of shop stands for the mall part and thousands of office cabins this building would be the largest single structure inside the township. The corridors are designed giving in mind for emergency evacuation. With green tree filled artificial forest on three sides and lake on the fourth this site is build to utilise light and wind at maximum possible ways. This building will also house the largest solar roof plant in the whole township with highest surface area.

G+9 Building Layout

FIG 18: G+9 Building Layout

The G+9 residential complexes are the only tower dwelling units in the township. With fours individual houses in each floor and an extra spacious lift with opening to the lake these buildings too are surrounded with tress making them more green than any high rise.

Twin House

FIG 19: TWIN HOUSE LAYOUT

The twin villas are around the lake, with extra spacious surroundings. They are build with open studio apartment design in mind giving a no wall home concept. With 6500Sq. Ft. size for each house, combined a twin villa makes 13000Sq. Ft. of space. There are 18 such buildings inside the township.

Power Control Station And Msw Plant Layout

Fig 20: Power Control Station And MSW Plant Layout

The municipal Solid waste plant is an integral part of the township as this is the place where all the waste generated is being treated. The proposed area for the plant is around 30 acres and the total area required for landfill and the processing site 5318.5 sq. meters.The power station is used to produce enough power for the residents of the entire township.It is constructed at a safe distance from the residential area.

School Building Layout

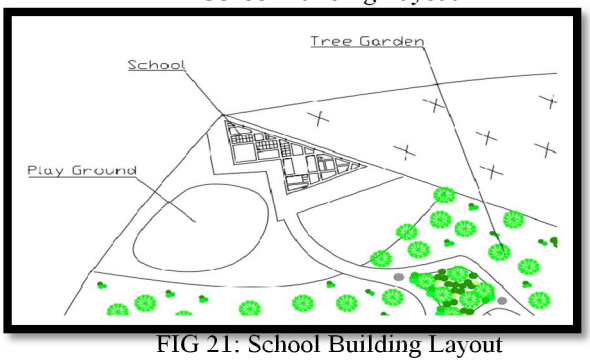


FIG 21: School Building Layout

The school shown here is primarily for the children residing in the township.The use of a school in the township is that it makes sure that there is a school nearby for children and parents spend less time to drop and pick up their wards from the school. A school which is close make sure less commute time and thus more time for productivity.A play ground is constructed next to the school for the children to spend their leisure hour.

7) Solar Roof Potential

S.No	CONTENT	BUILDING NUMBER	ROOF AREA AVAILABLE	SOLAR COVER PERCENTAGE	PV PANEL AREA
1	SINGLE VILLA	24	8000 sqft	25%	48000 sqft
2	G+9 RESIDENTIAL BUILDING	2	20000 sqft	25%	10000 sqft
3	TWIN VILLA	18	11000 sqft	25%	49500 sqft
4	AMPHITHEATER	2	-	-	-
5	HARDWARE STORE	1	7500 sqft	75%	5625 sqft
6	RECREATION CENTER	2	3500 sqft	75%	5250 sqft
7	VETERINARY CLINIC	1	3500 sqft	75%	2250 sqft
8	OUTDOOR PATIO 1	6	3000 sqft	0%	-
9	OUTDOOR PATIO 2	4	2500 sqft	0%	-
10	HYPER MARKET	1	7800 sqft	75%	5850 sqft
11	OPEN AIR GYM	1	-	-	-
12	DAY CARE	1	8000 sqft	75%	6000 sqft
13	PRAYER HALL	1	3000 sqft	45%	1350 sqft
14	CHILDRENS PARK	1	-	-	-
15	CAFETERIA	4	6500 sqft	75%	4875 sqft
16	CLUB HOUSE	1	120000 sqft	75%	90000 sqft
17	COMMERCIAL BUILDING	1	1550000 sqft	75%	1162500 sqft
18	MSW PLANT	1	4500 sqft	20%	900 sqft
19	SCHOOL	1	98000 sqft	60%	58800 sqft
20	PLAYGROUND	1	-	-	-
21	GENERAL CLINIC	1	8000 sqft	75%	6000 sqft
22	DIGITAL GAME CENTER	1	5000 sqft	75%	3750 sqft
23	SEMI ROOF AMPHITHEATER	1	2000 sqft	-	-
24	COMMON POOL	1	1500 sqft	50%	750 sqft
25	TOWN HALL	1	4000 sqft	75%	3000 sqft
26	POWER STATION	1	-	-	-
			TOTAL		1464400 sqft

TABLE 7 : SOLAR ROOF POTENTIAL.

a) Roof area used for solar panels is 1464400 sqft which is 63.25% of the total roof area available.
b) For 20.06 Sq.ft of solar panels, it is said to produce 425W of electricty each hour
c) At our selected site we get 7.8 sun hours avg each day, so 5 bright sun hour is possible in our area.
d) With the area we have for our Solar panels we can produce 365086 KW of electricity each day.
e) Sun Solar panels used with 22.3% sunlight to energy conversion.

8) Roof Rainwater Potential

S.No	CONTENT	TOTAL NO OF BUILDINGS	ROOF AREA AVAILABLE
1	SINGLE VILLA	24	8000 sqft
2	G+9 RESIDENTIAL BUILDING	2	20000 sqft
3	TWIN VILLA	18	11000 sqft
4	AMPHITHEATER	2	-
5	HARDWARE STORE	1	7500 sqft
6	RECREATION CENTER	2	3500 sqft
7	VETERINARY CLINIC	1	3500 sqft
8	OUTDOOR PATIO 1	6	3000 sqft
9	OUTDOOR PATIO 2	4	2500 sqft
10	HYPER MARKET	1	7800 sqft
11	OPEN AIR GYM	1	-
12	DAY CARE	1	8000 sqft
13	PRAYER HALL	1	3000 sqft
14	CHILDRENS PARK	1	-
15	CAFETERIA	4	6500 sqft
16	CLUB HOUSE	1	120000 sqft
17	COMMERCIAL BUILDING	1	1550000 sqft
18	MSW PLANT	1	4500 sqft
19	SCHOOL	1	98000 sqft
20	PLAYGROUND	1	-
21	GENERAL CLINIC	1	8000 sqft
22	DIGITAL GAME CENTER	1	5000 sqft
23	SEMI ROOF AMPHITHEATER	1	2000 sqft
24	COMMON POOL	1	1500 sqft
25	TOWN HALL	1	4000 sqft
26	POWER STATION	1	-
		TOTAL	1877300 sqft

TABLE 8: Roof Rainwater Potential.

a) Total roof area available is 1877300 Sq.ft, with this roof area we get 1.2 x 10^7 Galons.
b) With respect to this value underwater sump is deigned 10020litres under each house.

9) Municipal Solid Waste Management

CONTENT	RESULT
PROPOSED AREA	30 ACRES
WASTE GENERATED PERCAPITA PERDAY AS PER CPCB	0.5 kg/ day /person
CALCULATED WASTE FOR PROPOSED POPULATION	6000 kg/day
CALCULATED WASTE FOR PROPOSED POPULATION FOR ONE YEAR	2190 ton/yr
ESTIMATED LANDFILL IN 20 YEARS	92495.65m^3
HEIGHT OF THE LANDFILL TAKEN IN CONSIDERATION	20m
THE TOTAL AREA REQUIRED FOR LANDFILL AND THE PROCESSING SITE (15% of the landfill)	5318.5 m^2

Table 9: Municipal Solid Waste Management.

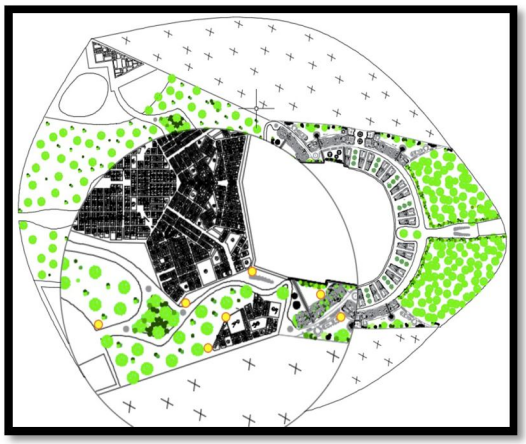


Fig 27: Zoomed Picture Of MSW Collection In A Section Of Our Township(Yellow Dots)

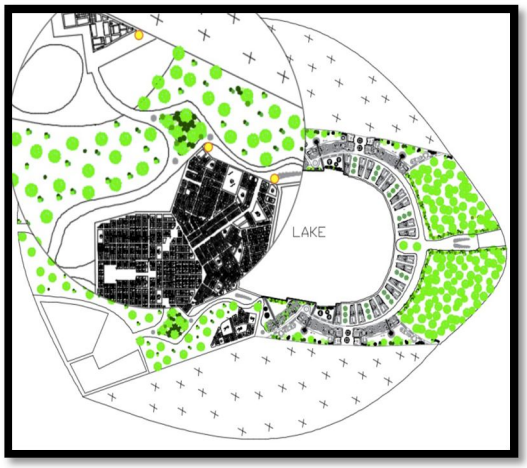


Fig 28 : Commercial Establishment MSW Collection Points (Yellow Dots)

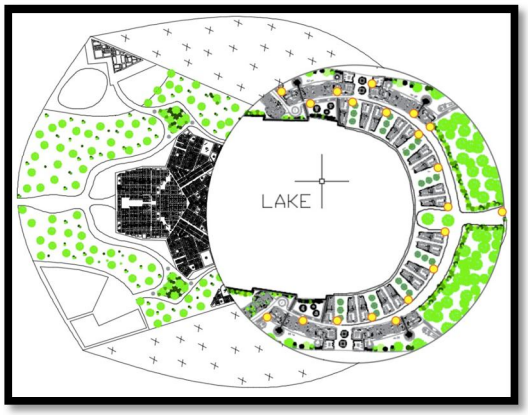


FIG 29 : Residential Area MSW Collection Points (Yellow Dots)

Total population is 12060 so the estimated landfill for one day is calculated as 6000 kg/day.

a) The landfill height suggested is 2m.

b) Total landfill with an increase of 4% every year in next 20 years is 4624.78m^2 and the processing site is of the area of 15% of the area 693.72 m^2 , total area required for the Municipal Solid Waste Management is 5318.5m^2.

B. Design

1) Design Of Intze Water Tank

FIG 30: INTZE WATER TANK.

a) Height of the tank is 12m, height of top and bottom dome is 2m each.

b) Width of the tank is 12 m.

c) Distance between the brace is 4m.

d) Total length of the footing is 11m, length of each footing is 3m.

e) Diameter of the columns are 650mm.

f) Size of circular grinder for raft is 750 * 1000mm.

g) M30 Grade Concrete and Fe415 steel.

h) Supports – Fixed.

2) Design Of Rainwater Sump

INPUT DETAILS

SUMP CAPACITY	**10020**	Ltrs	
FREE BOARD	**0.15**	Mtr	
HEIGHT OF SUMP BELOW FREE BD(H)	**1.82**	Mtr	
LENGTH OF SUMP (L)	**4.00**	Mtr	
CALCULATED WIDTH OF SUMP	**1.38**	Mtr	
PROVIDE SUMP WIDTH (W)	**1.50**	Mtr	**1.50**
RATIO = HEIGHT/ LENGTH	**0.46**		
RATIO = LENGTH/WIDTH	**2.67**	**CHECK FOR L/W>2**	**OK**

DENSITY OF WATER	**10.0**	KN/CUM
DENSITY OF SOIL	**16.0**	KN/CUM
RATIO = HEIGHT/WIDTH	**1.21**	
ASSUMED THICHNESS OF WALL	**0.115**	Mtr
GRADE OF CONCRETE M	**25**	
GRADE OF STEEL Fe	**415**	
SAFE BEARING PRESSURE SBC	**150**	KN/SQM

FORCE IN LONG WALL

PRESSURE DUE TO SATURATED SOIL ACTING FROM OUTSIDE ON LONG WALL AND NO WATER FROM INSIDE

Earth pressure at the base due to water+submerged soil (P)	**21.84**	KN/SQ M	pw*h+(pw-ps)*h/3	
Max BM at Base of Long wall due to water + Submerged Soil Mc1	**8.19**	KN-M	Mc=P*H^2/6	Reinforcement for outside of long wall

PRESSURE DUE WATER ACTING FROM INSIDE ON LONG WALL AND NO EARTH PRESSURE FROM OUTSIDE

Water pressure at the base due to water	**18.20**	KN/SQ M	pw*h	
Max BM at Base of Long wall due to water Mc2	**10.05**	KN-M	Mc=P*H^2/6	Reinforcement for inside of long wall

DIRECT COMPRESSION IN LONG WALL

Direct Compression in Long wall at 1 m above base due to soil	**11.94**	KN

DIRECT TENSION IN LONG WALL

Direct Tension in Long wall at 1 m above base due to water	**7.46**	KN

FORCE IN SHORT WALL

Short wall is designed as L/B < 2 Method

PRESSURE DUE TO SATURATED SOIL ACTING FROM OUTSIDE ON SHORT WALL AN NO WATER FROM INSIDE

Water pressure above one mtr ht above base slab	**13.12**	KN/SQ M	pw*h/3+(pw-ps)*h/3
Max BM at Support in short span	**4.10**	KN-M	**Mc=P*H^2/12**
Direct Tension in Short wall at 1 m above base due to water	**2.52**	KN	
BM at Centre of Short span Mb=	**3.07**	KN-M	**Mc=P*H^2/16**
Net BM at centre of Wall	**1.50**	**KN**	

Bottom one meter designed as cantilever

The wall of tank to be designed as Continuous Slab

H/4
Value **0.455**

Bottom 1 m will be designed as cantilever

Pressure above 1 m from bottom P	**13.12**	KN/SQ M	p=(h-1)*w
Cantilever Moment 1m above base Mc	**2.19**	KN-M	pws*1/2*1*1/3

PRESSURE DUE WATER ACTING FROM INSIDE ON SHORT WALL AND NO EARTH PRESSURE FROM OUTSIDE

Above one mtr ht from base acts as slab supported on long wall

Water pressure above one mtr ht above base slab	**8.20**	KN/SQ M	pw*h
Max BM at Support in short span	**2.26**	KN-M	Mc=P*H^2/12
Direct Tension in Short wall at 1 m above base due to water	**1.28**	KN	
BM at Centre of Short span Mb=	**1.15**	**KN-M**	**Mb= p*W^2/16**
Net BM at centre of Wall	**0.17**	**KN**	

3) Reinforcement Details Underwater Sump

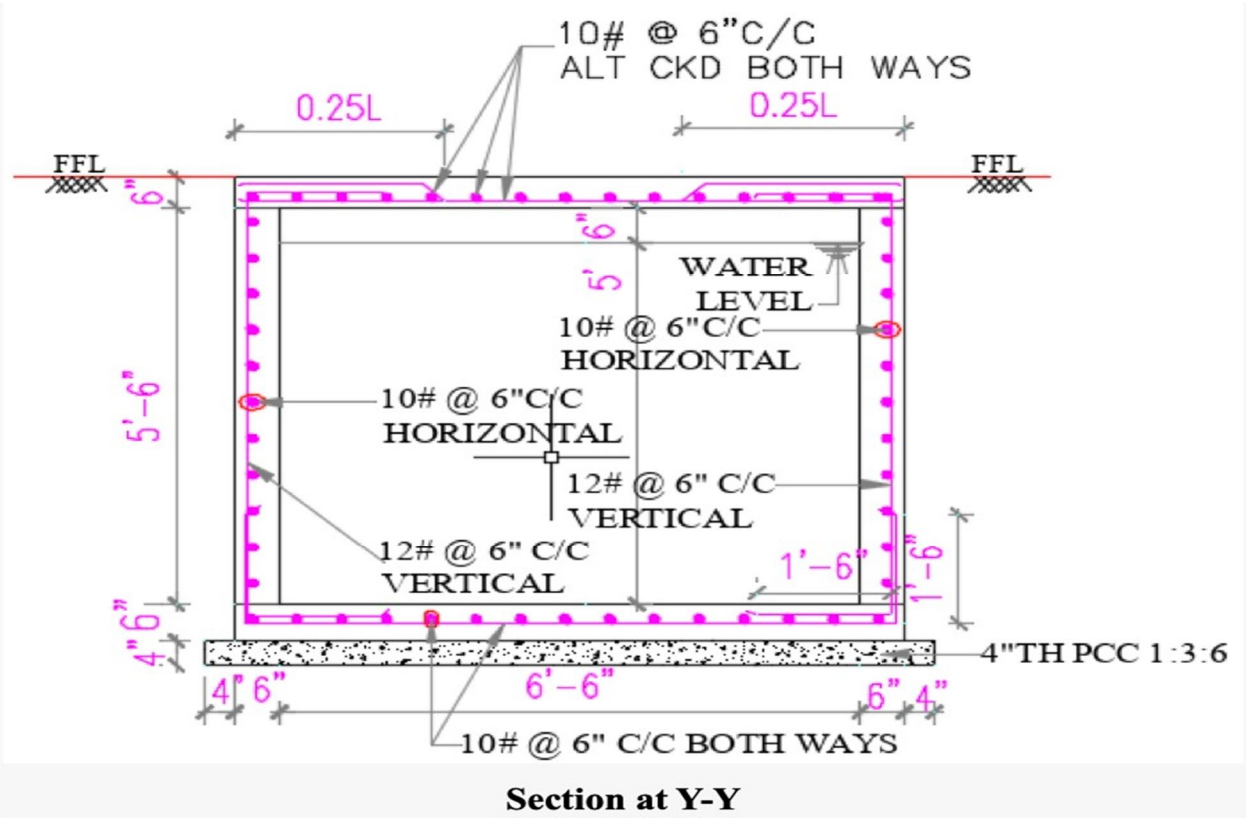


FIG 33: Section AT Y-Y Reinforcement Details.

C. Analysis

Using the STAAD PRO V8i the Intze tank is a ANALYSED. The reults obtained are Bending moment, Shear force and the principal stress is obtained.

The following are the pictorial representation of the reults.

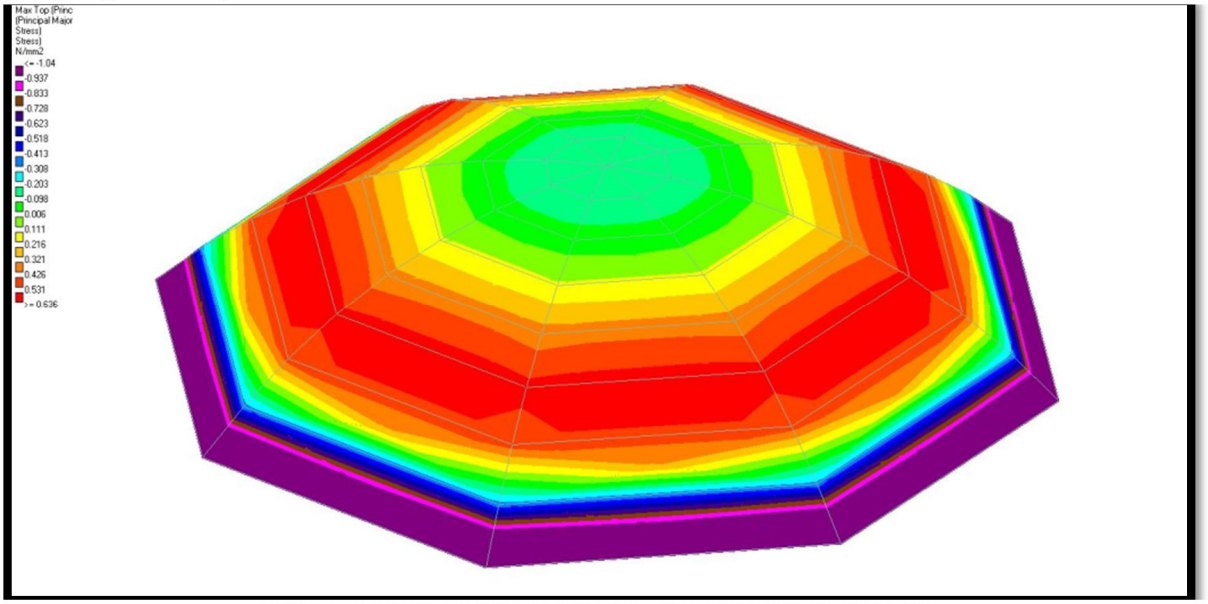


FIG 34: BOTTOM DOME MAXIMUM PRINCIPAL STRESS

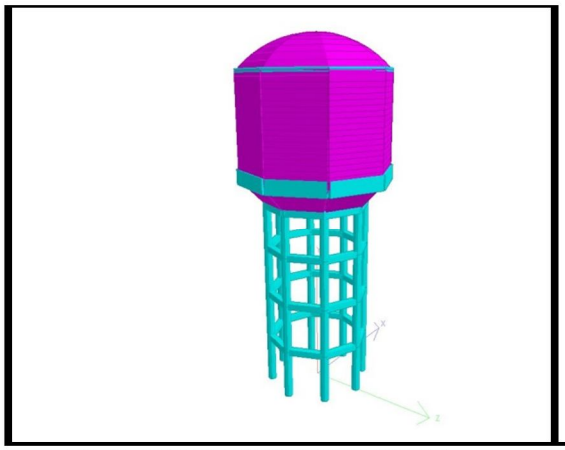


FIG 63: TANK-RENDERED VIEW

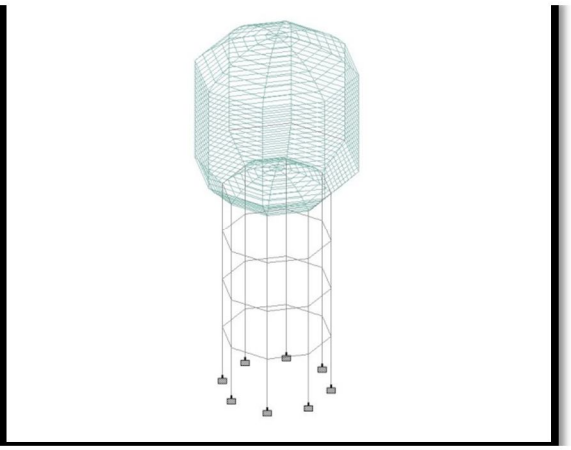


FIG 64: TANK-WIRED MODEL

The FIG above shows the RENDERED VIEW and WIRED VIEW.

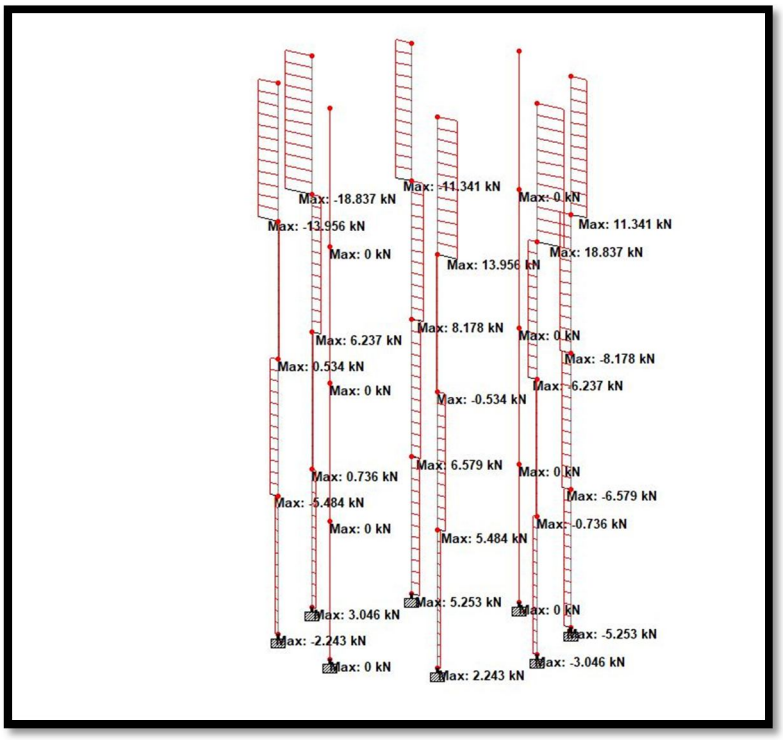


FIG 65: Maximum Bending Moment For Column

The Maximum Bending Moment for Column is 18.837 kN.
The Maximum Axial force in the column is observed is 1074 kN and there will be no Axial Force will be observed in Beam or in the Dome.
The Maximum BM is 128 kNm in Beam , 38.76 kNm in Column , 12 kNm in top ring beam , in bottom ring beam 16 kNm and in Tie Beam is 78 kNm are observed.
The Maximum Shear force in beam is 43 kN, Top Ring Beam it is 17.3 kNm, Bottom Ring Beam is 58.5 kNm and Tie Beam is 36.85 kN are observed.
The Maximum Principal Stress in Top Dome is 2.73 N/mm^2, Bottom Dome is 1.04 N/mm^2, Side wall is 2.08 N/mm^2 and Conical Dome is 2.66 N/mm^2.

The observed values are clearly given in the following table and the values are observed using STAAD PRO V8i.

Description	Maximum Axial Force (kN)	Maximum Bending Moment (kN.m)	Maximum Shear Force(kN)	Maximum Principal Stress (N/mm2)
Column	1074	38.76	-	-
Beam	-	128	43	-
Top Dome	-	-	-	2.73
Bottom Dome	-	-	-	1.04
Top Ring Beam	-	12	17.3	-
Bottom Ring Beam	-	16	58.5	-
Side Wall	-	-	-	2.08
Conical Dome	-	-	-	2.66
Tie Beam	-	78	36.82	-

TABLE 10: ANALYSIS OF INTZE WATER TANK FROM STAAD PRO V8i

V. CONCLUSION

A. Using demographic analysis we found out the population potential of the township.

B. Using the results from demographic analysis we designed our layout for the township.

C. With the layout of the township the roof area used for is derived as **1464400 Sq.ft.** with the derived roof area for solar panels the avg output calculated is **365086 KW** per day.We have an approximate usage of **337680KW** per day in township, the remaining will be sent to the national grid.

D. With available roof area from the design layout we have roof area of **2306300 Sq.ft.** for rainwater harvesting, it is assumed that **$1.2*10^7$ gallons** of rainwater is collected with an annual rainfall of 146inches.

E. With the calculated rainwater harvesting we designed the underwater sump for each house with a capacity of 10020litres.

F. Using demographic analysis we calculated the quantity of water required for the township which is 1628100 litres, with this results we designed an INTZE water tank with a capacity of 1000000 litres and concluded to give 4 of such water tanks in different parts of the township.

G. The Maximum Axial force in the column is observed is 1074 kN and there will be no Axial Force will be observed in Beam or in the Dome.

H. The Maximum BM is 128 kNm in Beam , 38.76 kNm in Column , 12 kNm in top ring beam , in bottom ring beam 16 kNm and in Tie Beam is 78 kNm are observed.

I. The Maximum Shear force in beam is 43 kN, Top Ring Beam it is 17.3 kNm, Bottom Ring Beam is 58.5 kNm and Tie Beam is 36.85 kN are observed.

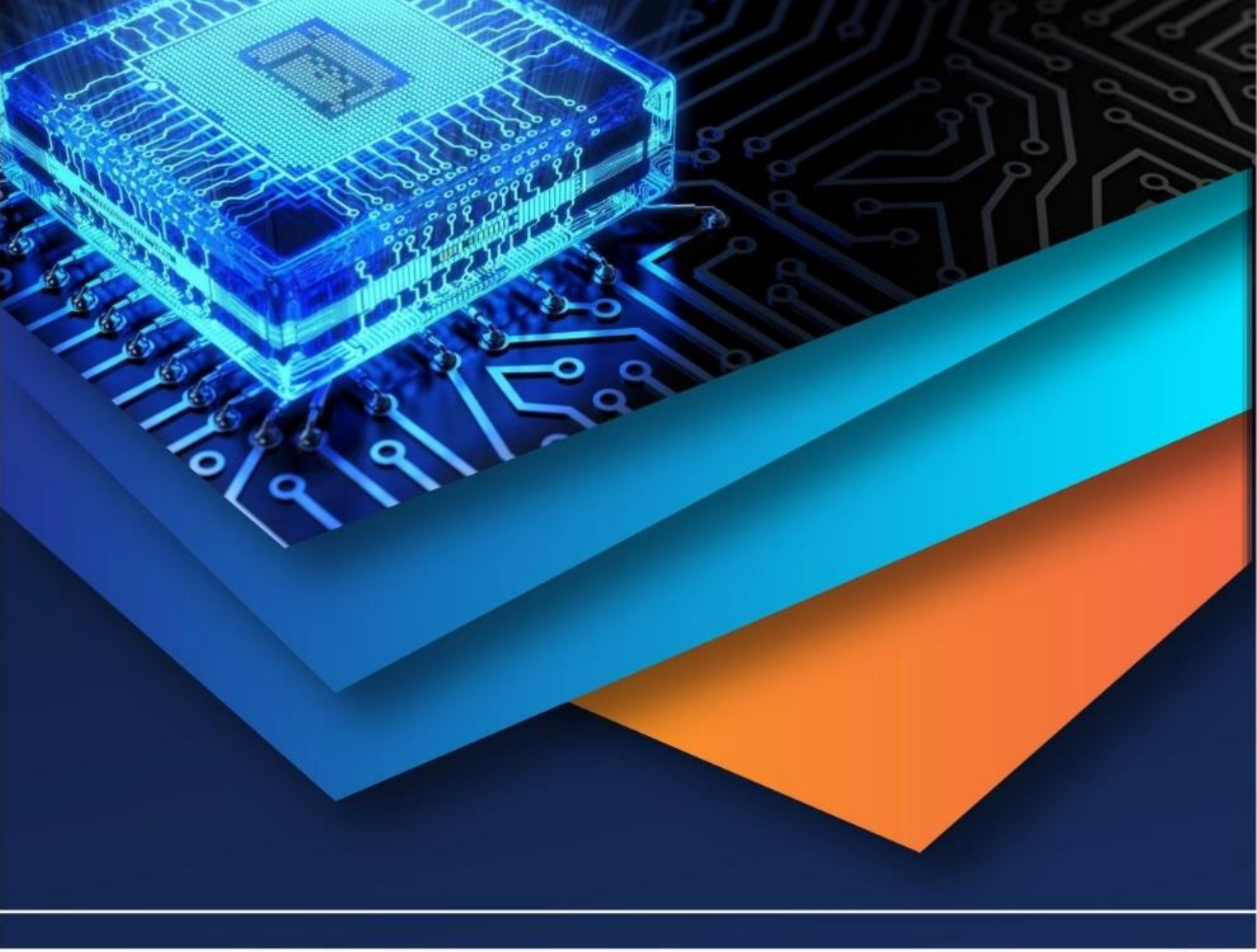
J. The Maximum Principal Stress in Top Dome is 2.73 N/mm^2, Bottom Dome is 1.04 N/mm^2, Side wall is 2.08 N/mm^2 and Conical Dome is 2.66 N/mm^2.

K. The observed values are clearly given in the following table and the values are observed using STAAD PRO V8i.

L. With the estimated population the Municipal solid Waste is calculated as 5318.5 m^2 which consist of land and the processing site.

REFERENCES

[1] Divyansh Tewari, Senthil K (2021), Stability of Elevated Retaining Structures under Seismic Loading, International Conference on Futuristic Technologies.
[2] Siavash Papi (2020), Static Analysis of Elevated Composite Water Tank, Innovative Technologies in Science Engineering and Technology.
[3] Minakshi Mishra, Shanthi Sri K, Pragnya Das (2020), Static and Dynamic Analysis of Multistoried Structure by STAAD.Pro, International Journal of Advanced Science and Technology, Vol. No. 29, Issue No. 3.
[4] Ajmal Tokhi, Sahil Arora (2019), Seismic Analysis and Comparison of Overhead Intze Water Tank, Circular Water Tank and Rectangular Water Tank and Response Spectrum Analysis, International Journal of Civil Engineering and Technology (IJCIET), Vol. No. 10, Issue No. 03.
[5] Sunitha Ahuja, Sourabh Dashore (2019), Implementation of Water Tank Design using STAAD.Pro Software, International Journal of Scientific Research & Engineering Trends, Vol. No. 5, Issue No. 6.
[6] Eugene Victor A, Yokesh S, Preethi K (2018) , A Comparative Analysis on Absolute and SRSS Methods of Response Spectrum using STAAD.PRO, International Journal of Engineering Research & Technology (IJERT), Vol. No. 7, Issue No. 12.
[7] Kulvendra Patel(2018), Wind and Seismic Analysis of Elevated Tank using STAAD.Pro, International Research Journal of Engineering and Technology (IRJET), Vol. No. 05, Issue No. 10.
[8] Nithin Tiwari, Rashmi Sakalle, Adithya Kant Shrivastava, Nausheen Akhtar, Piyush Moorjani, Siddharth Shandilya (2018), Static Linear and Non Linear Performance Analysis of Existing G+3 RC Frame Structure, Indian Journal of Technical Research and Science, Vol. No. 3, Issue No. 5.
[9] Manoj Nallanathel, Ramesh B, Jagadessh L (2018), Effective Utilization of STAAD.Pro in the Design and Analysis of Water Tank, International Journal of Pure and Applied Mathematics, Vol. No. 119.
[10] Krishna Raju N, Pranesh R N (2018), Reinforced Concrete Design, Sixth Edition, and New Age International Publishers.
[11] Ullikrishnan Pillai S, Devadas Menon (2017), Reinforced Concrete Design, Third Edition, MC Graw Hill Education.
[12] Mohammed Azgari, Ramya Smruthi N (2017), Design of Circular Water Tank by using STAAD.Pro Software, International Journal of Scientific Engineering and Technology, Vol. No. 06, Issue No.29.
[13] Rajkumar, Shivaraj Mangalgi (2017), Response Spectrum Analysis of Elevated Circular and Intze Water Tank, International Research Journal of Engineering and Technology, Vol. No. 04, Issue No. 10.
[14] Raji Ruth George, Asha Joseph (2016), Dynamic Analysis of Elevated Cement Concrete Water Tank, International Journal for Innovative Research in Science & Technology, Vol. No. 3, Issue No. 03.
[15] Samwail Siddiqui, Birendra Kr Singh, Parmanand Thakur (2016), Performance Seismic Analysis on RCC Framed Elevated Circular Tanks with Flat and Domical Bases, Indian Journal of Science and Technology, Vol. No. 9, Issue No. 10.
[16] Anirudh Gottala, Kintali Sai Nanda Kishore, Shaik Yajdhani (2015), Comparative Study of Static and Dynamic Seismic Analysis of a Multistoried Building, International Journal of Science and Technology & Engineering, Vol. No. 2, Issue No.1.
[17] Nitesh J Singh, Mohammad Ishtiyaque (2015), Design Analysis & Comparison of Intze Type Water Tank for Different Wind Speed and Seismic Zones as per Indian Codes, International Journal of Research in Engineering and Technology, Vol. No. 04, Issue No.09.
[18] Rupachandra J Aware, Vageesha S Mathada (2015), Seismic Performance of Circular Elevated Water Tank, International Journal of Science and Research (IJSR), Vol. No. 4, Issue No. 12.
[19] Mohit Sharma, Savita Maru (2014), Dynamic Analysis of Multistoried Regular Building, IOSR Journal of Mechanical and Civil Engineering, Vol. No. 11, Issue No.1.
[20] Srinivasu A, Panduranga Rao B (2013), Non Linear Static Analysis of Multi Storied Building, International Journal of Engineering Trends and Technology (IJETT), Vol. No. 4, Issue No. 10.
[21] IS 456:2000, Plain and reinforced concrete code of practice (Fourth revision).
[22] IS 875:1987 (Part 1),Code of practice for design loads (Dead load)
[23] IS 875:1987 (Part 2), Code of practice for design loads (Imposed load)
[24] IS 875:1987 (Part 3), Code of practice for design loads (Wind load)
[25] SP 16 :1978 , Design Aids for reinforced concrete to IS 456:2000
[26] IS 1893:2016 (Part 1),Criteria for Earthquake Resistant Design of Structures (General Provisions and Buildings)
[27] IS 1893:2014 (Part 2),Criteria for Earthquake Resistant Design of Structures (Liquid Retaining Tanks)
[28] IS 3370:2009 (Part 1),Concrete Structures for Storage of Liquids-Code of Practice(General Requirements)
[29] IS 3370:2009 (Part 2),Concrete Structures for Storage of Liquids-Code of Practice (Reinforced Concrete Structures)
[30] IS 3370:1967 (Part 4), Code of Practice for Concrete Structures for the Storage of Liquids (Design Tables)
[31] IS 11682 :1985 ,Criteria for Design of RCC Staging for Overhead Water Tanks.
[32] Water Supply Manual, Manual on Water Supply And Treatment by Ministry of Urban Development , New Delhi , May 1999.



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