



IJRASET

International Journal For Research in
Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 Issue: XII Month of publication: December 2021

DOI: <https://doi.org/10.22214/ijraset.2021.39476>

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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 | - <u>I</u> ndian <u>S</u> tandard |
| BM | - <u>B</u> ending <u>M</u> oment |
| BIS | - <u>B</u> ureau of <u>I</u> ndian <u>S</u> tandards |
| cm | - <u>C</u> enti <u>M</u> eters |
| mm | - <u>M</u> illi <u>M</u> eters |
| m | - <u>M</u> eter |
| C | - <u>C</u> elsius |

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 through 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 hydrodynamic 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.

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*

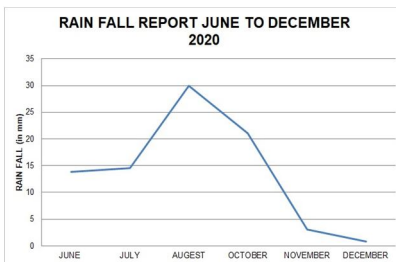


FIG 4: RAINFALL REPORT OF SECOND HALF OF THE YEAR 2020.

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.

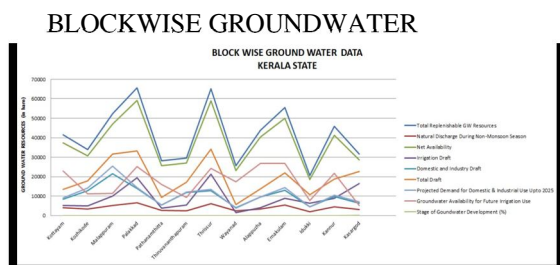


FIG 5: Blockwise Groundwater Kerala.

GROUNDWATER IDUKKI DISTRICT

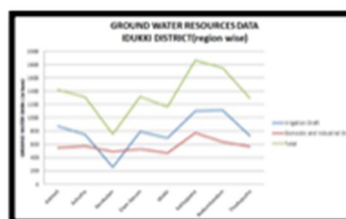


FIG 6: GROUNDWATER IDUKKI DISTRICT.

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

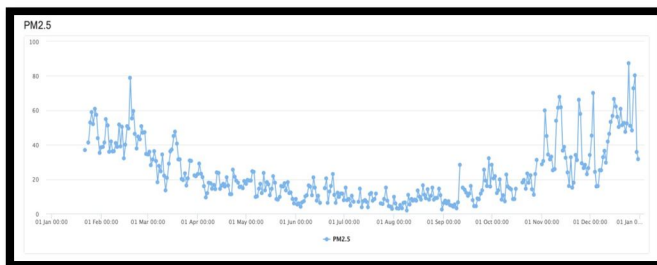


FIG 7 : PM2.5 DATA – SOURCE :- CPCB

The obtained value for PM_{2.5} is 4.99 µg/m³ and the safe limit given by WHO is 10 µg/m³.

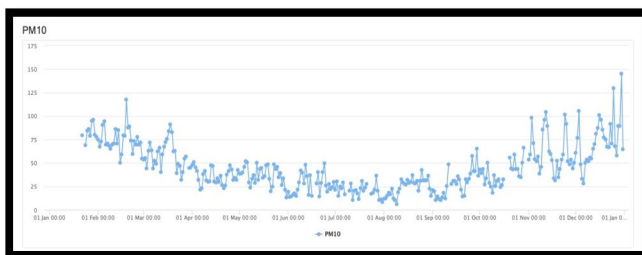


FIG 8 : PM10 DATA- SOURCE :- CPCB

The obtained value for PM₁₀ is 14.42 µg/m³ and the safe limit given by WHO is 20 µg/m³.

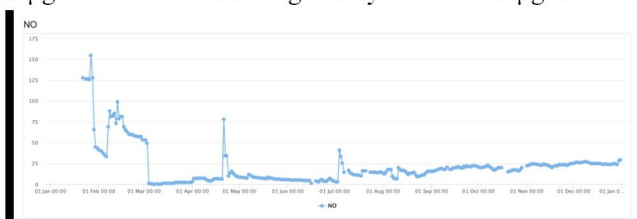


FIG 9: NO DATA-SOURCE :- CPCB

The obtained value for NO is 13.51 µg/m³.

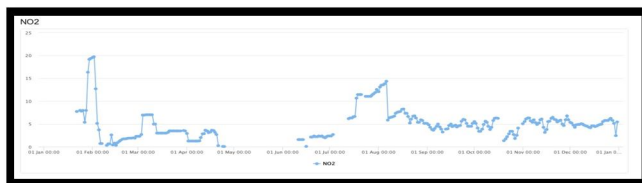


FIG 10: NO₂ DATA-SOURCE :- CPCB

The obtained value for NO₂ is 2.56 µg/m³ and the safe limit given by WHO is 40 µg/m³.

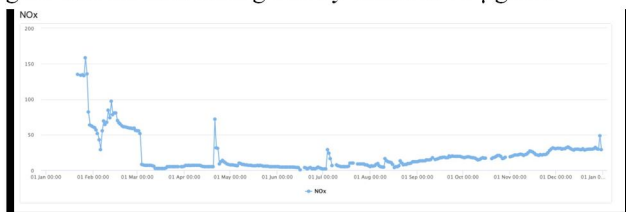


FIG 11: NO_x DATA- SOURCE :- CPCB

The obtained value for NO_x is 0.58 mg/m³ and the safe limit given by WHO is 40 µg/m³.

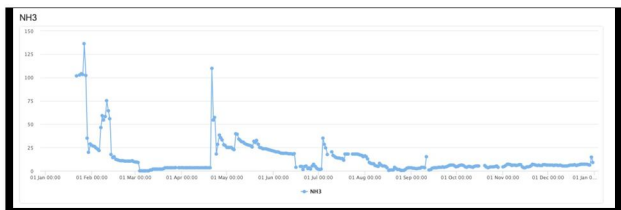


FIG 12: NH₃ DATA-SOURCE:- CPCB

The obtained value for NH₃ is 3.4 µg/l and the safe limit given by WHO is 50 µg/l.

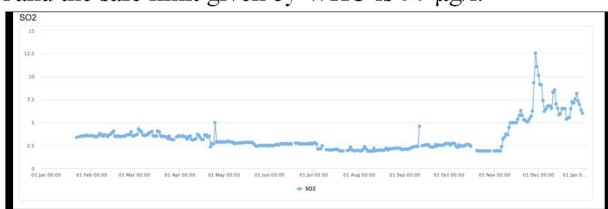


FIG 13:SO₂ DATA – SOURCE :- CPCB

The obtained value of SO₂ is 6.76 µg/m³ and the safe limit is given by 20 µg/m³.

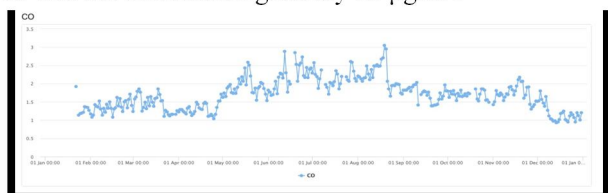


FIG 14: CO DATA – SOURCE :- CPCB

The obtained value is CO is 0.58 mg/m³ and the safe limit is given by 40 mg/m³

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 | | REMAINING AREA WILL BE USED FOR FUTURE NEEDS OF THE TOWNSHIP | | |
| GREEN CORRIDOR | | | 500 ACRES | | | | |
| ESTIMATED ROAD AREA (by consulting an industry expert) | | | 65 ACRES | | | | |

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.

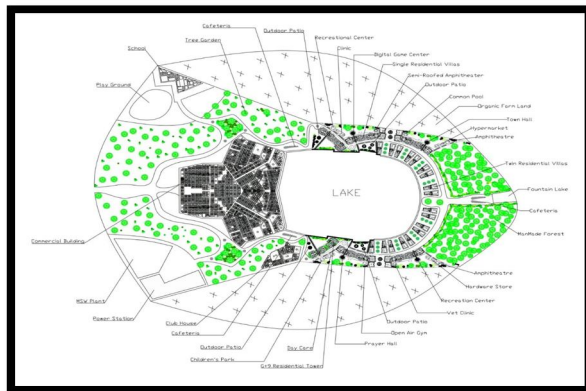


FIG 15: Layout of the Township

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 four individual houses in each floor and an extra spacious lift with opening to the lake these buildings too are surrounded with trees 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 built 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

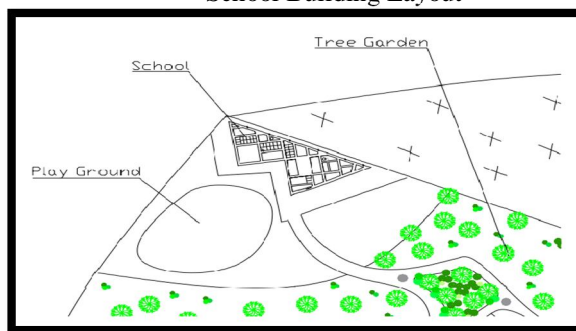


FIG 21: School Building Layout

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 electricity 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 1.2×10^7 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.

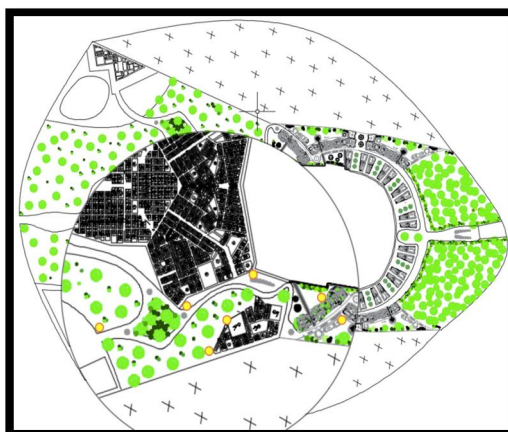


Fig 27: Zoomed Picture Of MSW Collection In A Section Of Our Township(Yellow Dots)

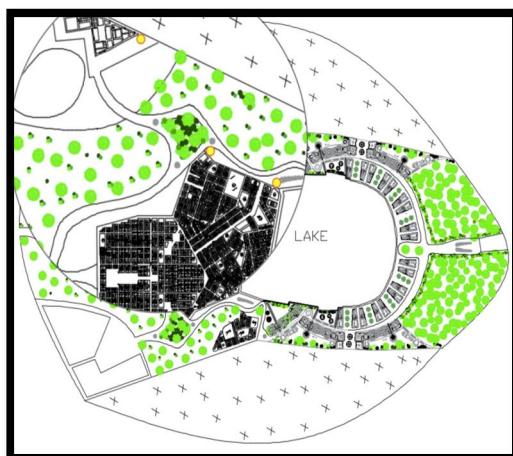


Fig 28 : Commercial Establishment MSW Collection Points (Yellow Dots)

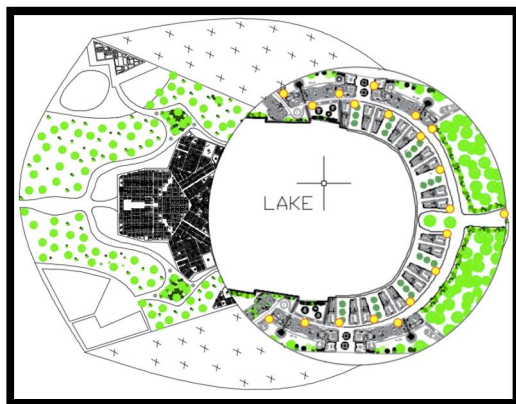


FIG 29 : Residential Area MSW Collection Points (Yellow Dots)

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 4624.78m² and the processing site is of the area of 15% of the area 693.72 m² , total area required for the Municipal Solid Waste Management is 5318.5m².

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 THICKNESS 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 | $pw \cdot h + (pw - ps) \cdot h / 3$ | |
| Max BM at Base of Long wall due to water + Submerged Soil Mc1 | 8.19 | KN-M | $Mc = P \cdot H^2 / 6$ | 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 | $pw \cdot h$ | |
| Max BM at Base of Long wall due to water Mc2 | 10.05 | KN-M | $Mc = P \cdot H^2 / 6$ | 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 AND NO WATER FROM INSIDE

| | | | |
|---|--------------|------------|---|
| Water pressure above one mtr ht above base slab | 13.12 | KN/SQ M | $p_w \cdot h/3 + (p_w - p_s) \cdot h/3$ |
| Max BM at Support in short span | 4.10 | KN-M | $M_c = P \cdot H^2 / 12$ |
| Direct Tension in Short wall at 1 m above base due to water | 2.52 | KN | |
| BM at Centre of Short span $M_b =$ | 3.07 | KN-M | $M_c = P \cdot H^2 / 16$ |
| 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

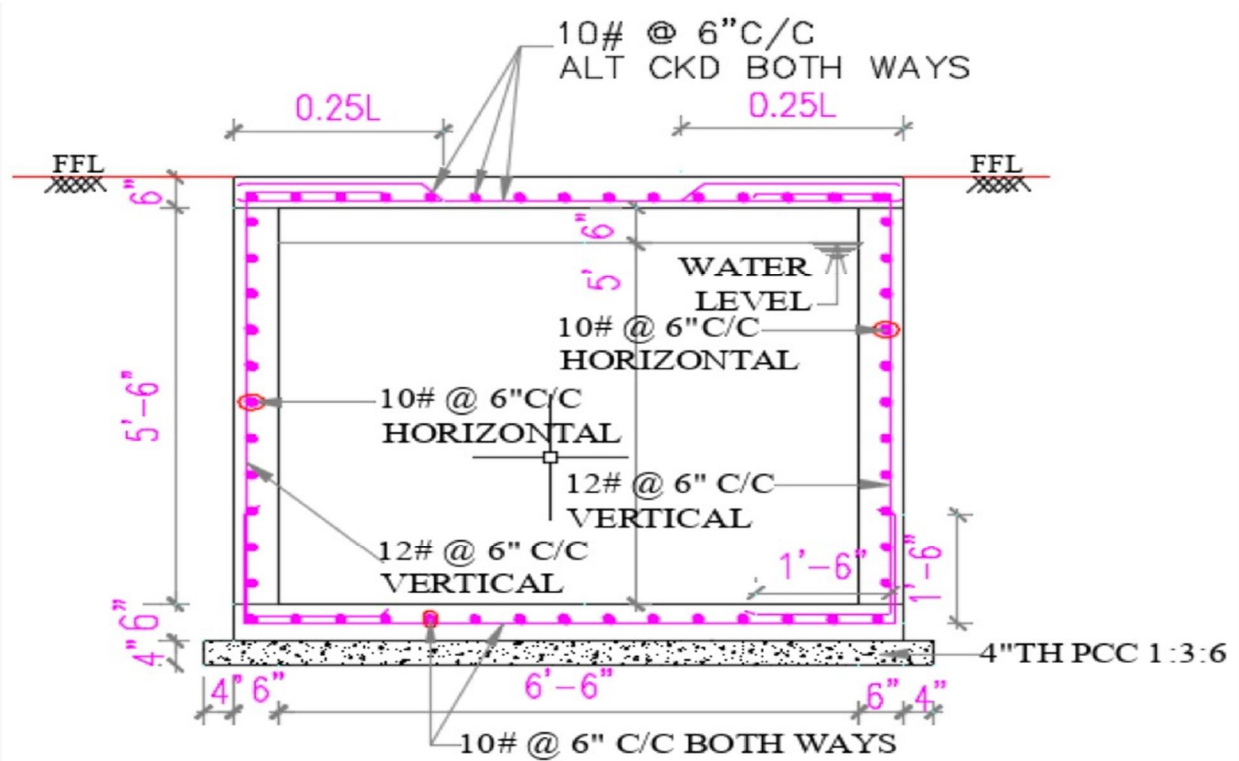
| | | | |
|---------------------------------------|--------------|------------|---|
| Pressure above 1 m from bottom P | 13.12 | KN/SQ M | $p = (h - 1) \cdot w$ |
| Cantilever Moment 1m above base M_c | 2.19 | KN-M | $p_w \cdot s \cdot 1/2 \cdot 1 \cdot 1/3$ |

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 | $p_w \cdot h$ |
| Max BM at Support in short span | 2.26 | KN-M | $M_c = P \cdot H^2 / 12$ |
| Direct Tension in Short wall at 1 m above base due to water | 1.28 | KN | |
| BM at Centre of Short span $M_b =$ | 1.15 | KN-M | $M_b = p \cdot W^2 / 16$ |
| Net BM at centre of Wall | 0.17 | KN | |

3) Reinforcement Details Underwater Sump



Section at Y-Y

FIG 33: Section AT Y-Y Reinforcement Details.

C. Analysis

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

The following are the pictorial representation of the results.

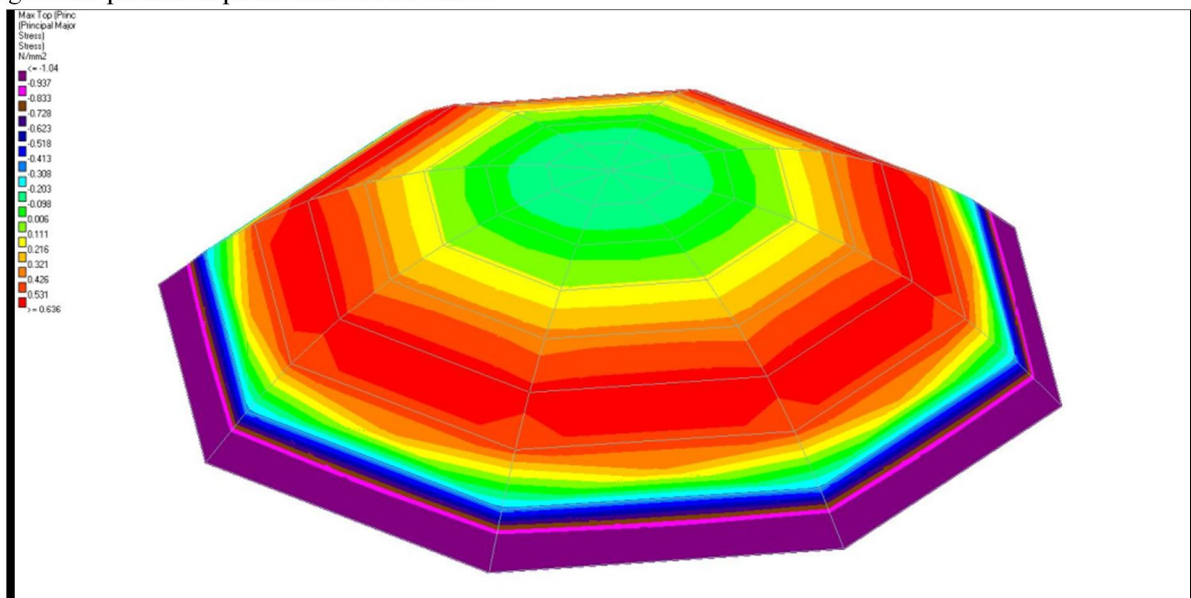


FIG 34: BOTTOM DOME MAXIMUM PRINCIPAL STRESS

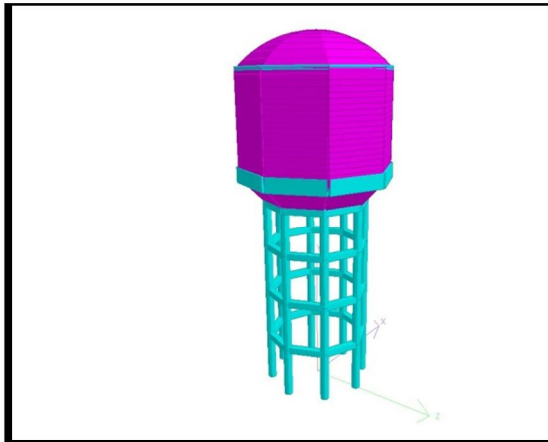


FIG 63: TANK-RENDERED VIEW

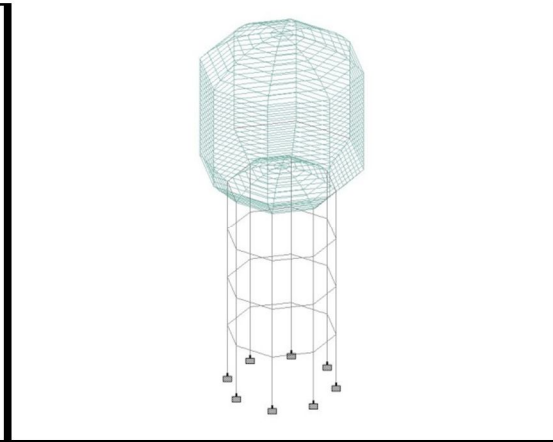


FIG 64: TANK-WIRED MODEL

The FIG above shows the RENDERED VIEW and WIRED VIEW.

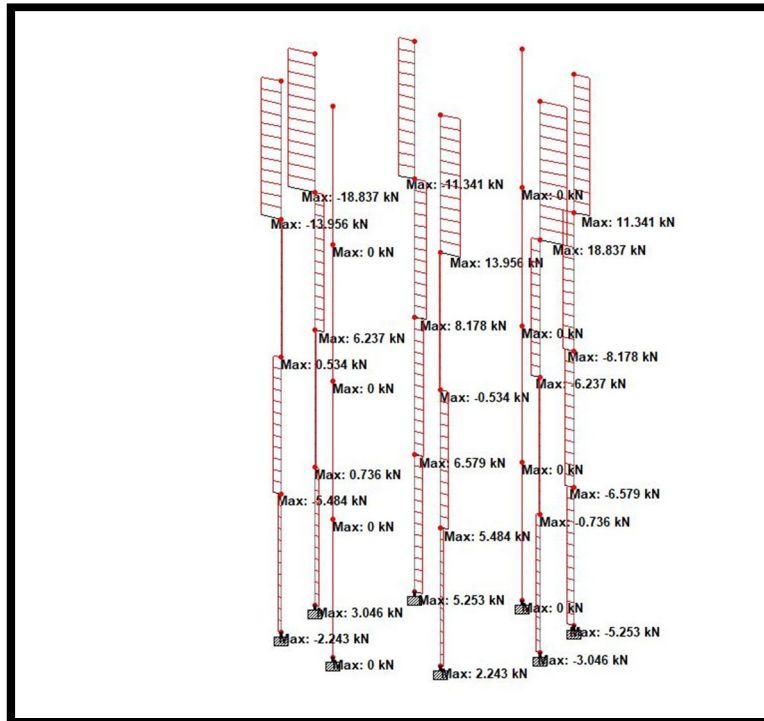


FIG 65: Maximum Bending Moment For Column

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/mm², Bottom Dome is 1.04 N/mm², Side wall is 2.08 N/mm² and Conical Dome is 2.66 N/mm².

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/mm ²) |
|------------------|--------------------------|-------------------------------|-------------------------|---|
| 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*10⁷ 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/mm², Bottom Dome is 1.04 N/mm², Side wall is 2.08 N/mm² and Conical Dome is 2.66 N/mm².
- 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 m² which consist of land and the processing site.

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