Design And Analysis of Drainage Line for An Area Using Bentley's SewerGems

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Abstract- SewerGems is a comprehensive modelling software program for design and analysis of drainage sewer system. This paper presents the study and analysis of sewerage system for the Bhilarewadi village situated in Pune district, Maharashtra. SewerGems is a computer software which was developed by the Bentley's for design and analysis of sewer networks. Bentley SewerGEMS is the first and only fully-dynamic, multi-platform (GIS, CAD and Stand-Alone) sanitary and combined sewer modeling solution. With this software we can analysis the sewer system for combined and separately as well. The hydraulic design consists in the computation of the transit and total flow and hydraulic modelling for network pipes diameters or slopes. The network consists of pipes of varying diameters, manholes and outfall. SewerGEMS offers a full range of possibilities for the designer to draw, label, dimension and plotting the drawings of the sewage networks.

Keywords- Bhilarewadi, SewerGems, Sewerage System, AutoCad

I. INTRODUCTION

In modern cities the storm water drainage system is the essential part of urban infrastructure, Basically the most important use of the sewerage drainage system is to carry the sewer from its origin to the sewage treatment plant .There are limitations for certain existing drainage system so there comes a need where need to provide an efficient and economical. Sewage is a wastewater which comes from the domestic and industry. Mostly domestic wastage generates by washing clothes, dish washing, sinks, showers etc, are usually in greyish colour and toilet waste which includes human waste are in black colour. Industrial waste comes from the industry includes washing, processing, production etc. It includes all types of industries such as Paper industry, iron and steel industry, textile industry etc. Sewerage system or sewer network is a basic infrastructure which is provided to transport the wastewater from its origin to sewage treatment plant. The maintenance cost and laying cost of sewer network is very high. It requires daily maintenance and operational cost is also one major outlay. Sewerage system is a network of pipes, pumps and force mains for the collection of waste water from a community. It needs to be ensured that no leakage should take place which can lead to ground water pollute and soil pollution as well. In this paper the bentley's Sewergems software was used for design and analysis of drainage system.

1.1 Study Area

Mangadewadi village in Haveli taluka, Pune, Maharashtra was the area taken up for the study. The area taken up for the study. The area is about 377 Hectare. The latitude and longitude of the place is 18o25'29" and 73o51'04". Figure shows the study area.
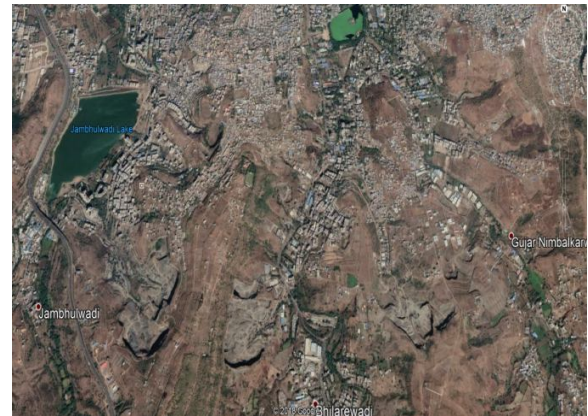

Fig-1 Google earth map of Mangadewadi village, Pune, Maharashtra.

1.2 Background

The village contains open drainage system for the flow of domestic sewage which is not good for public health and bad in aesthetical view as well. The existing drainage system was not constructed properly and not carry sewage to the outfall. Therefore, there is a need of proper distribution sewage distribution system.

II. METHODS AND MATERIAL

2.1 Survey

At the starting, data collection survey was conducted on January 2019 in Mangadewadi village, Pune, Maharashtra. The latitude and longitude of the place is 18o25'29" and 73o51'04" respectively and having an area around 377 hectare (3.77 sq km).The survey provides the data regarding the

location of various houses, obstructions (if any), levels of ground, alignments of roads etc. Simple survey was done with the help of the theodolite which gives the detail information of the elevations, and detail study of location of sewage treatment plant, topography of an area etc. The following data was collected.

  (a) Data of the old structure and its condition.

  (b) The topographical levels of the catchment area (contours).

  (c) The amount of generation of sewage from a particular area.

  (d) Outfall of the sewage in nearby sewage treatment plant

2.2 Future Population Forecasting

The number of people living in an area is called as population of an area, comes from the official survey was conducted in every decade (10 years) by the committee of central government. The last censes of India was done in 2011. This data help for calculating the future population for an area. The village authorities such as gram panchayat have the records of decades of the population. The future population forecasting are done by arithmetic mean method, by Geometric increase method and incremental increase method. The average of these method is adopted.

2.3 SewerGems

SewerGems is unique software which is used for the design and analysis of sewerage system of particular specified area with considerable amount of future population. The Sewergems software was developed by the bentley's system. It can perform multiple networks at a time by creating plans profile sheets etc.

III. RESULTS

3.1 Survy

The detailed survey which was carried out in Mangadewadi area by using theodolite, in that alignment of roads are marked and should be presented in the autocad and converted that file into shape file, because SewerGems can read shape files easily.

3.2 Future population forecasting

For this work, the arithmetic mean method, geometric mean method and incremental increase method were used for future population forecasting, average value of these method was adopted. The population was forecasted of 20461 for next 3 decades till 2049

3.3 Design of sewer network using SewerGems

The results of sewer network was derived from SewerGems and was analysed as per standard design and guidelines prescribed by CPHEEO (Central Public Health And Environmental Engineering Organisation). The results derived were well within the design parameters and they were in acceptable manner so as to implement on the field without much difficulty. The summary of the results are narrated in table.

The typical analysis of sewer network for the village was represented in the form of graphs, Profiles with respect to elevation invert level versus length

3.4 SewerGems results

The result of network was derived from the 'SewerGems' according to the parameters given by the CPHEEO. The d/D ratio of 80% is fixed for the present study as recommended by CPHEEO guidelines. The results obtained are within the parameters.

Sr No	Parameters	Total	Units
1.	Manholes	178	Numbers
2.	Sewer line length	3503	Meter
3.	Area	377	Hectare

Table 1: Summary of sewer network the   village

The table 1 shows the length of the sewer line which was analysed in the project and Number of manholes were provided in catchment area.

Table 2: Details of the diameter with the length

Sr No	Diameter (mm)	Length (m)	Percentage
1.	450	2630	75.07%
2.	600	873	24.93%
3.	**Total**	3503	

From the design outcomes it is seen that about 75.07% of the pipes is of 450 mm diameter, and remaining is

of 600 mm diameter. Due to high load generated per manhole 450 mm and 600 mm diameter pipes were sufficient for the design as represented in Table 2

Table 3 Details of velocity in Sewer lines

Sr No	Velocity (m/s)	Number of Manholes	Percentage
1.	>1.0	107	60.12%
2.	1.0-1.5	59	33.14%
3.	<1.5	12	6.74%

IV. CONCLUSION

The following are the conclusion based on the work carried out on network design for sewerage system at Mangadewadi village.

- This software is very simple for the design of sewerage network. And also helpful for designing large network.
- The minimum velocity is more than the 0.61m/s, Therefore there is no need for providing extra velocity for self cleansing velocity.
- As 75.07% of pipes are containing of 450mm diameter and rest of 600mm diameter, Since CPHEEO prescribes 450mm minimum diameter and area consists of more number of initial branches of sewer lines, the minimum of 450mm diameter was considered in the design.
- The software is very useful alternative method for designing of sewer network, because of it's accuracy and time saving
- Thus, the final results comes in the dwg file which is easily readable for all applications.

V.ACKNOWLEDGEMENT

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