

Necessity of Upgradation of Sewerage System of Gandhinagar City

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Abstract

Gandhinagar is next well planned city after Chandigarh in India. This remarkable City was planned in 1970s. After that no upgradation were made in Sewerage System. The laid network of sewerage system in the city is too old. Sewer line has crossed its life period limit, which is more than 40 years. Ample amount of complaints are registered daily from every sector. Annual expenditure for the maintenance of sewer line and manhole is much more than the revenue generation from the sewerage system. It is beneficial from environmental and economical point of view to change the existing sewerage system and redevelop it newly. As the Gandhinagar City has more importance the method of collection of Sewer and the design should be in most techno-economic way. Most effective method of collection of sewer is Separate Sewer line from all others for the Gandhinagar City. Design can be made in Sewer GEMS Software by most effective, economic and rapidly.

Keywords: Sewerage System, Sewer line, Separate Sewer line, Sewer GEMS, techno-economic

I. INTRODUCTION

Sewerage networks are an important part of the infrastructure of any society. The main purpose of providing the sewer network is to carry away sanitary waste from an area in such a way that it does not cause any public health related problems. It is known that urban sewerage system provide one of the basic infrastructure facilities to transport wastewater to sewage treatment plant. Sewerage network infrastructure conveys wastewater used by individuals, commercial and industrial establishments to wastewater treatment facilities, ultimately to be returned to the natural environment. A sewerage network is just a reverse action of water supply network. The cost of laying a sewerage system is considerably high compared to the water supply system. It involves a large cost with need for daily maintenance, and operational cost is one of the major expenditures. Hence, design of sewerage network should be cost effective with all given constraints and guidelines. The method adopted for collection of sewer should be best suited for the location. The computer software package Sewer GEMS V8i is the most helpful tool for the purpose of designing an economic sewer network because it can give the optimum cost and practically feasible layout which can handle a large network.

II. GANDHINAGAR AT A GLANCE

Gandhinagar is the capital of Gujarat state, west-central India. Gandhinagar lies on banks of the Sabarmati River. The concept of the city is based on the grid iron pattern similar to that of historical Jaipur and Chandigarh, the grid being formed by seven roads in each direction cutting each other perpendicularly. The rectangular blocks of land measuring 1 km x 0.75 km formed sequential to this pattern are known as sectors. Gandhinagar is known as second planned city in India after Chandigarh.

Gandhinagar occupies an area of 57 sqkm. It is about 24 km to the north east of Ahmedabad. It has 30 sectors with each have its own shopping, health, housing colonies and community centres. The city is the administrative centre, the power block of the state of Gujarat, as it encompasses almost all the important offices of the state.

Table 1. Fact File of Gandhinagar

Geographical location	72.3 to 73.7 East (Longitude) 23.0 to 23.6 North (Latitude)
Temperature	45 ° Centigrade (Maximum) 7.5 ° Centigrade (Minimum)
Average Rainfall	667 mm
River	4 (Sabarmati, Khari, Meshwo & Vatrak)
Area	2,163.48 sq.km
District Head quarters	Gandhinagar
Talukas	4
Population	292797 (as per 2011 Census)
Language	Gujarati, Hindi, English
Seismic Zone	Zone III

2.1 Geology

Physiographical the Sabarmati Plain is an alluvial plain claimed by river Sabarmati. The region has a maximum height of 75 m above M.S.L. The geology of the region of this region pertains to alluvium blow sand etc.

2.2 Water Supply & Sanitation Facility

As per the information of Capital Project Division, Gandhinagar, the current water supply in the city is 75 MLD. From which 55 MLD is collected from surface water and 20 MLD is sourced from groundwater source. Sewerage system was designed and constructed in 1970

in the city. The whole wastewater from city is taken by underground pipes and collected in Sargasan Drainage Pumping Station. From this Pumping Station Wastewater is pumped and transferred to Jaspur Wastewater Treatment Plant through Rising Main & Sargasan STP. But Sargasan STP utilizes 50% of its total Capacity.

The Capital Project's information points that available treatment capacity in the Jaspur wastewater treatment plant is 90 MLD. Considering that 80 percent of water supplied gets generated as wastewater, the wastewater in the Gandhinagar comes to 60 MLD.

Table 2 Existing STP Details

STP Location	Capacity	Used by Gandhinagar City	Use of wastewater
Jaspur	90 MLD	55 MLD	Agricultural
Sarghasan	10 MLD	5 MLD	Gardening purpose

Source: Capital Project Division, Gandhinagar

III. NEED OF THE STUDY

Sewerage system was designed and constructed in 1970. As per CPHEEO Manual design period of sewerage system is 30 years. The laid network is very old. Drainage line has crossed its age limit (more than 40 years). The City requires replacement of Sewerage System for-

- Proper sewage disposal and management
- For better hygienic condition
- For better development of area
- Economic design and planning of sewer

3.1 Economic Point of view

Annual Expenditure for maintenance of existing sewerage system is approximate about 7 Crore (as per annual records of Capital Project, Gandhinagar). This is mainly include expenditure of machinery, electricity, labour salary, Operator Salary for maintenance of Sewer line as well as pumping Station and other Component. Annual revenue generation from sewerage system is between 60 to 70 Lacks (as per annual records of Capital Project, Gandhinagar).

This records shows that the existing system needs to modify as it is not economic viable.

3.2 Major Problems identified

All complaints related to sewerage system are registered in drainage inquiry offices situated in Sector-3, Sector-22 and Sector-24 in Gandhinagar City. Complaints contains problems like-

- Cleaning of drainage line/ Manhole
- Sewage Chock up in main line
- Drain overflow
- It creates unhygienic condition for people residing in surroundings

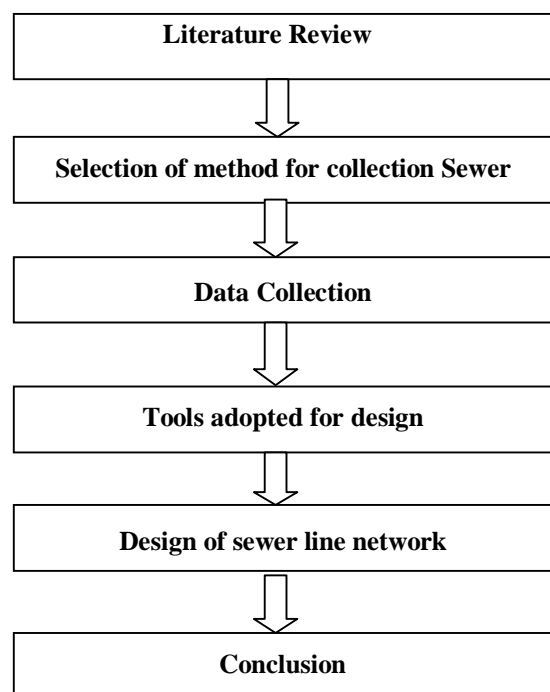


Figure 1. Wastewater logged area



Figure 2. Solid waste liftering

IV. METHODOLOGY

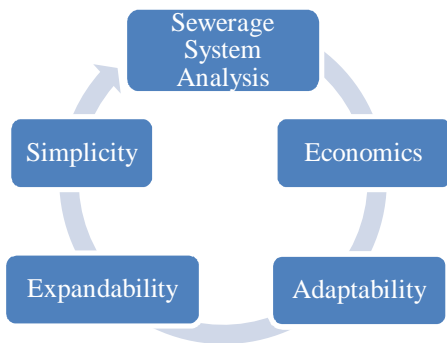


4.1 Selection of method for collection of sewer

These can be classified as-

- Combined Sewer
- Separate Sewer
- Simplified Sewer
- Vacuum Sewer
- Pressure Sewer

These Sewerage systems have been analysed considering four criteria



4.1.1 Choice of Collection System

Separate Sewer design is chosen for replacement of sewerage system in Gandhinagar city. The costs of sewerage system will less as compare to vacuum and pressure sewer. Existing Sewer Collection system is Separate Sewer, so it is more adaptable to modify it rather to change it fully. So, it makes work simpler and rapid. It can accommodate the future flow increase due to increase in population. Being comparatively large in diameter and capacity, Separate sewers are often seen as being growth inducing.

4.2 Data Collection

The data was collected from Capital Project, Gandhinagar and the preliminary studies were carried out. Land use, Road Map, Existing Drainage System, Existing Storm Water, Sector wise population distribution (Census Bhavan, Gandhinagar), Sector wise household, Existing water supply & sewage generation and trends in the population variations data were collected. Digital Elevation Model (DEM, from Bisag, Gandhinagar) is collected and contour map is generated in ArcGIS software. Location of roads and adjacent areas likely to be merged were studied.

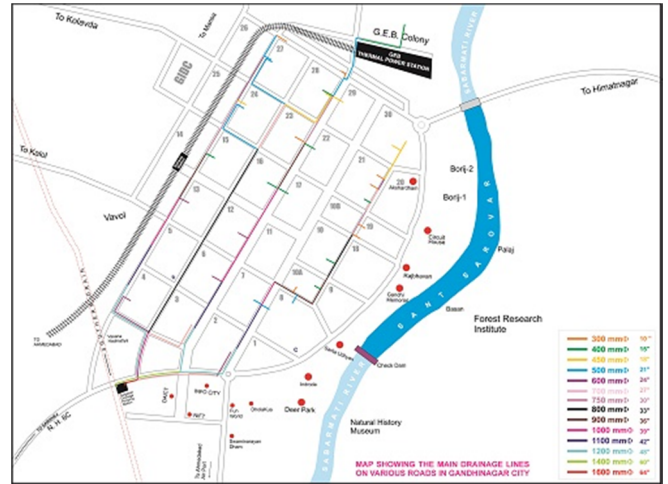


Figure 3. Existing Drainage Map

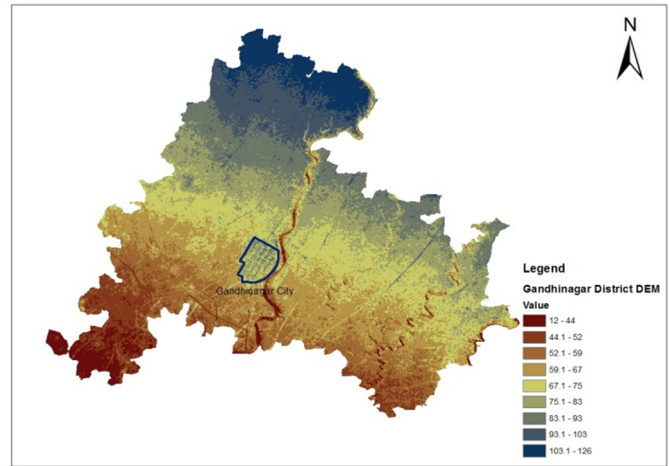


Figure 4. Digital Elevation Model of Gandhinagar District

Table 3. Population Census details- Gandhinagar City

Sr.No.	Year	Population
1	1971	24,055
2	1981	62,443
3	1991	1,67,219
4	2001	1,95,985
5	2011	2,02,776

Source: Census Bhavan, Gandhinagar

V. TOOLS AND TECHNIQUE

For the design of sewer network, a computer aided design tool named ‘Sewer GEMS’ software was utilized along with ‘ArcGIS’ for the mapping. The details of the design tools adopted are as described below-

5.1 Sewer GEMS

Well organized design software named ‘Sewer GEMS’ is given by ‘Bentley systems’ in collaboration with ‘Haestad Methods Solution Center. Sewer GEMS can perform multiple design iterations by creating plans and

profile sheets that will meet a set of constraint. There are some of main functions of Sewer GEMS Software-

- **Interoperability without sacrifices with many other software like Arc GIS, AutoCAD, Micro Station, and stand-alone.**
 - ✓ **Model any type of collection system**
- **Sanitary sewer load estimation**
 - ✓ Use the Load Builder module to leverage water consumption, flow monitoring, land use, or census data in your GIS to automatically estimate and import sanitary loads for our SewerGEMS model.
- **Jumpstart our model with existing data if there is**
 - ✓ If we already have CAD drawings, GIS files, or existing SWMM, SewerCAD, or CivilStorm model files, we can only a few clicks away from having a SewerGEMS model of your network.
- **Find more time for engineering**
- **Understand results easily**

5.2 ArcGIS

Well organized design software named 'ArcGIS' is given by ESRI (Environmental Systems Research Institute).

ArcGIS is a geographic information system (GIS) for working with maps and geographic information. It is used for: creating and using maps; compiling geographic data; analyzing mapped information; sharing and discovering geographic information; using maps and geographic information in a range of applications; and managing geographic information in a database.

The system provides an infrastructure for making maps and geographic information available throughout an organization, across a community, and openly on the Web.

VI. CONCLUSION

Following conclusion are made from the above study-

1. The performance of existing sewerage system is very poor because of pipeline life span is outdated as it is constructed in 1970.
2. Population is increasing day by day, it may lead to generate more outflow in sewerage system.
3. It is preferable to replace the existing sewerage system rather to maintain the existing sewerage system as per economic point of view.
4. For Particular Gandhinagar City it is advisable to provide Separate Sewerage System.
5. Designing of Sewerage System can be done most techno-economically by using "SewerGEMS" Software.

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VIII. REFERENCES

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