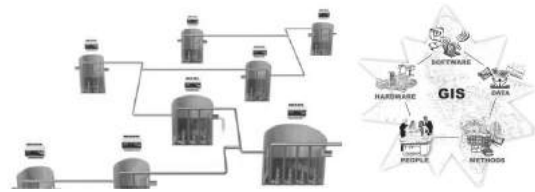# E-Monitoring of Sewerage Activities by using GIS technology

Information Management

Information management is gathering and storing at one place, the information relating to the Government and Governing process. It is the systematic arrangement/classification of information. If the information of the Government is gathered at one place without any arrangement or management, it would prove difficult for the users to find the required information. Managing information is an important aspect of E-governance. Information management addresses the issues like – How to provide? What to provide? Whom to Provide? When to provide? Where to provide? Why to provide?

The process of information management may further be divided into three aspects – (1) Database Management, (2) Indicator Management, and (3) Knowledge Management. Database Management involves bare compilation and organization of data and information at one place. Indicator Management involves storing with the information the catch words, labels, tags, meanings and context relating to the information. Knowledge Management involves managing the skills and know-how of the employees/experts of the Government for benefit of the Government.

Information management is an integral aspect of **E-commerce**. It also proves essential for E-Governance. It helps transform the governing process in a business-like efficient and cost-effective process. Information management aims at reducing cost, improving performance, differentiating of products and services of Government, specialized /customized information, and citizen focus.

Information management involves following stages –

Gathering – gathering all the available information of the government

Creating – creating information which is lost or not available

Storing – storing the gathered information in one place

Accessing – accessing of stored information by the people

Distributing – distributing required information to the public

Ignoring – ignoring the information not publicly important

Discarding – discarding ignored and insignificant information

Updating – continuous updating information

Securing – securing the information with latest technology so as to give access to information to those who really require it.

Use of Geographical Information Technology (GIS) for Sewerage Network-

In Big Metro cities Proper Sewerage Disposal System is as important as Water Supply System. For that purpose large Sewerage Network is provided. This sewerage networks is passing underground and not visible. It is interesting to note that this sewerage Network needs regular maintenance and there is lot of Data attached with this network. The data attached with

sewerage is huge and very difficult to handle. The maintenance activities of sewerage can be compared broadly with any Engineering activities i.e. Preventive Maintenance and Breakdown Maintenance. Hence the input required for any other Maintenance activity is applicable to sewerage maintenance also i.e. Men, Material & Machinery. Automatically issues like planning, optimum utilization, productivity, monitoring, and control and so on are applicable here also. This sewerage system is maintained by local Municipal Corporation of a particular city. The major stake holder of any Municipal Corporation is General Public for whom Municipal Corporation is providing the services. They are the Customers of the Municipal Corporation. For ease of maintenance and for providing effective services to the General Public Municipal Corporation needs lot data in hand, which can be used as and when required. Further this data needs regular update. In the age of e-commerce, any organization would like to have their data in the electronic format which will help them to use the data for making their core activities effective.

As shown in the following figure, the final aim should be to convert data into Wisdom of the organization. The GIS technology is the solution to all problems. The GIS technology can be used to handle the sewerage data and it can prove very much helpful to any Municipal Corporation for improving their organizational activities related to Sewarage.

Application of GIS technology for Sewerage activities of Municipal Corporation of Greater Mumbai (MCGM).-

MCGM is a local Municipal Body of Mumbai is spread over 437 sq. km. and having population 12.4 million (Census 2011). The issue of unauthorized population and floating population in Mumbai is well known; which adds problems for regular functioning of city. Sewerage services is one of the obligatory duty of MCGM and separate Department viz. Sewerage Operation is looking after all activities related to sewerage.

The sewer operations department maintains the sewer network of entire Mumbai City & suburbs, which comprises of appx. 1,500 km of sewer lines & about 55,000 manholes. Broadly speaking, there are two type of maintenances carried out in this department;

i)   Preventive Maintenance

ii   Complaint based maintenance.

Preventive Maintenance includes periodical cleaning of lines, repairs to damaged manholes, replacing worn out manhole covers etc.

In Complaint based maintenance the staff receives complaint from citizens, it is then analysed /categorized then manpower & machinery to be used is planned and finally it is attended at site.

To carry out above mentioned activities maintenance staff needs lot of information such as sewerage Network, Manhole location, depth of sewer line, flow direction etc. This information traditionally kept on paper i.e. Maps, Registers, etc. Entire planning, organizing, …. to controlling the maintenance activities are based on this paper information . The correctness and timely availability of information decides the effectiveness of maintenance activities. This method has following disadvantage;

1. The paper data becomes 'static data' i.e. it cannot not updated easily

2. The paper maps get deteriorated due to mishandling / aging etc.

3. Data remains in respective offices (in isolation / scattered) hence it cannot be shared for any analysis / planning

4. The amount of time required for retrieve information whenever required for any analysis is very high

5. Monitoring of progress of various works / complaints of sewer lines are extremely difficult

6. It is very difficult & time consuming to calculate assets of entire sewer network

Implementation of GIS technology has provided the solution to all the problems. The Sewerage Operation Department of MCGM has implemented GIS technology successfully. By doing this, the paper back information was not only converted into digital form but also a new dimension is attached to it in the form of Geography. In this project following activities were carried out;

1. A base map of entire Mumbai of appx. 437 sq.km. was prepared (see Figure-1)

2. Topographic survey was carried out of sewer network of entire Mumbai where appx. 35 attributes of manholes and 20 attributes of sewer lines were captured (see Figure-2)

3. The data so collected was put on GIS software platform using ESRI's ArcGIS software (see Figure-3)

4. Various customized tools were developed for querying, generating reports, carrying out analysis etc.

5. To sustain this GIS system a foolproof data updation protocol is prepared and put in effect where every work carried out on sewer network is recorded in the GIS database (see Figure-4)

The department has got tremendous benefits by adopting this GIS technology. The efficiency of the department increased as well as achieved greater transparency in the working of the department. Some major benefits of using GIS are as follows;

1. A seamless sewer network is now available which is helpful in Operation & Maintenance & planning activities

2. Various analysis & queries on sewer network are now possible e.g. 'L' section of a particular alignment can be generated and many more (see Figure-5, 6 & 7)

3. Complaint monitoring is now effectively done on GIS in real time

4. Maintenance history of all the sewer appurtenances are available in this system which helps in finding out chronic problems in the network

5. Upto date Asset records are available with the department

6. A layer of Planned maintenance of the sewer network is put in the system every year enabling higher authority to monitor the progress of the work as and when required

Keeping in line with the advancement in Information Technology, the Sewerage Operation Department of MCGM has adopted "Cloud Computing" technology for its data capturing and data updation process. In this system sewer network data is directly captured at site on a "Tablet Computer" with geo-tagging i.e. along with its geographical location in the form of latitude and longitude. It is then submitted to a temporary database residing on third party server using internet. The data is then verified, approved and finally updated using cloud computing technology using web application. The major benefits gained from such a system are;

1. A protocol is developed for working on this "Cloud Computing" based system (see Figure-8)

2. The data is captured right at the point of generation eliminating the data duplication and human errors (see Figure-9 & 10)

3. The data can be accessed using web applications anytime from anywhere by all the concerned staff

4. The whole process, right from data capturing to data updation in department's main server, can be monitored accurately (see Figure-11)

5. In this case data capturing process is monitored on "Google Map" in real time (see Figure-12)

In this fashion the sewerage operation department achieved great amount of accuracy and transparency in maintaining its sewer network data on GIS platform. All the MIS reports are now generated instantly from this system. Various complex analysis e.g. pipe burst analysis, upstream trace / downstream trace analysis, generation of hydraulic profile of a particular stretch, hydraulic modeling of the system etc are now possible with ease. MCGM has already initiated the process of putting all its utility layers on common GIS which would increase greater co-ordination amongst them which would result in better service delivery to the citizens of Mumbai.

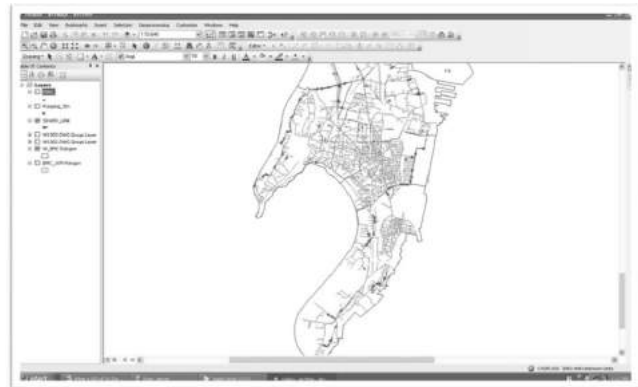Figure – 2
(Attributes of manholes)
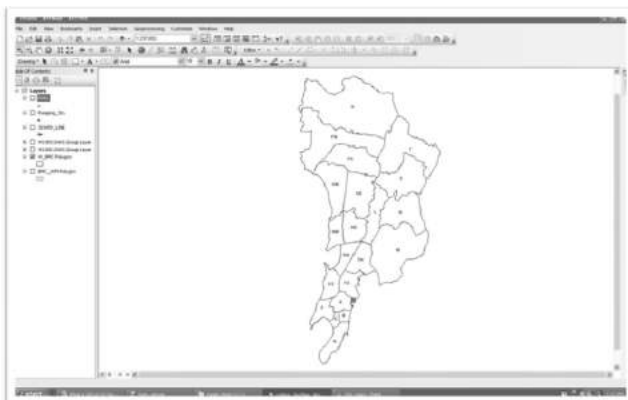

Figure –3
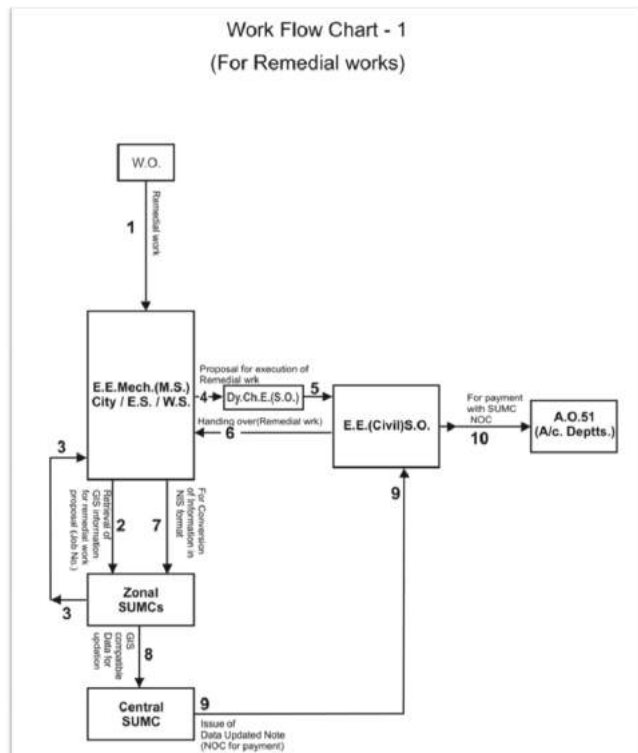(GIS representation of sewer network)

Figure – 1 (Base Map)

Figure-4 (Data Updation Protocol)
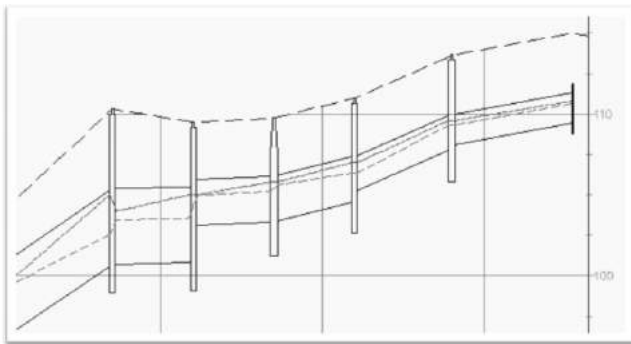
Figure-5
(a typical 'L' section of sewer line)
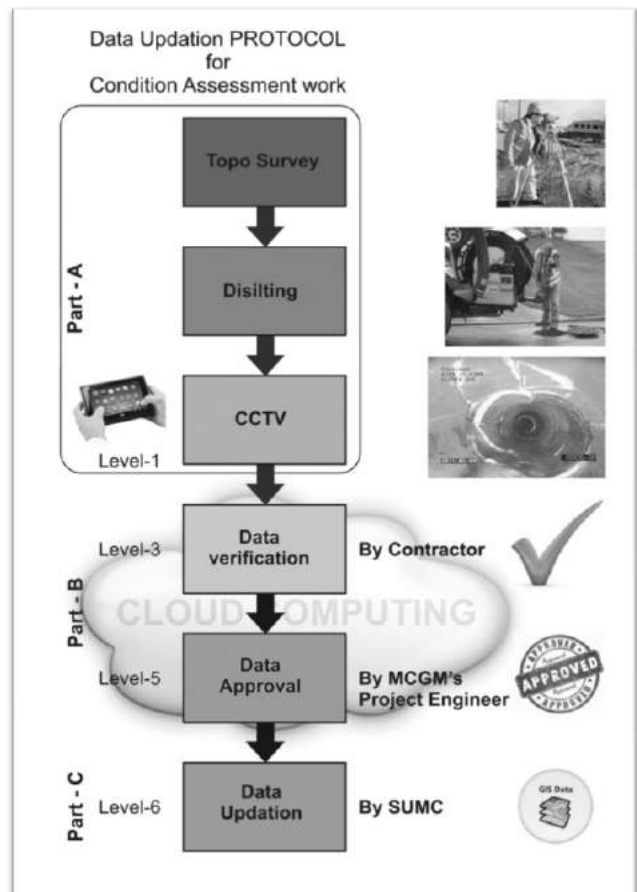

Figure-6
(Query1 on database)

Figure-7
(Query2 on database)

Figure-8
(Data Updation Protocol in Cloud Computing)

Figure-9
(Data capture using Tablet Computer)

Figure-10
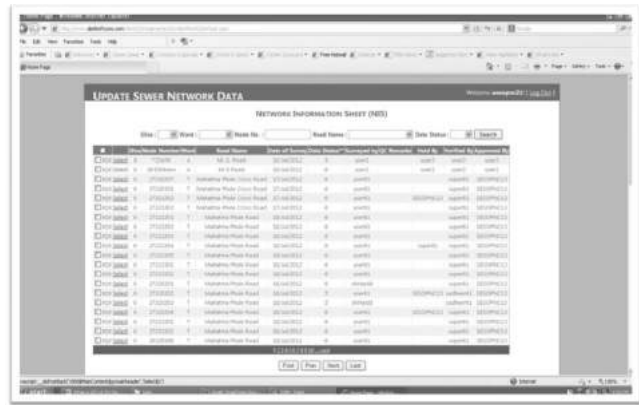**(Data Validation Module)**

Figure-11
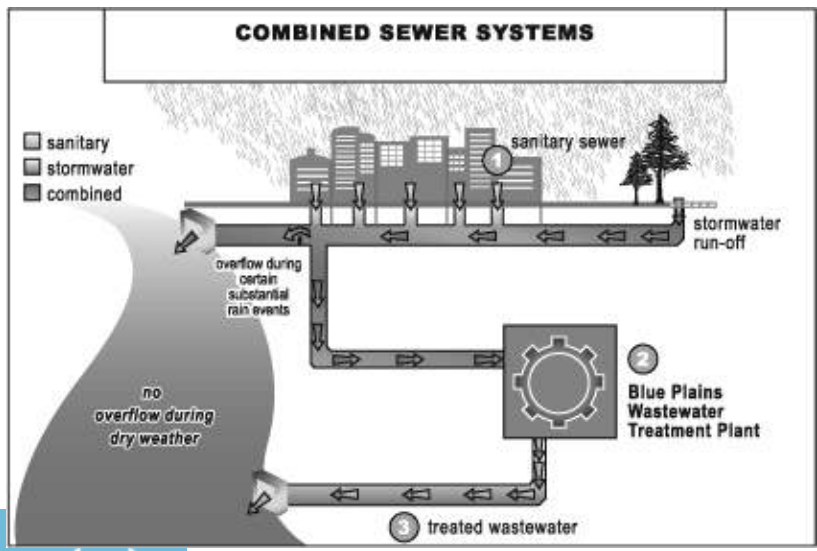**(Data monitoring through web)**
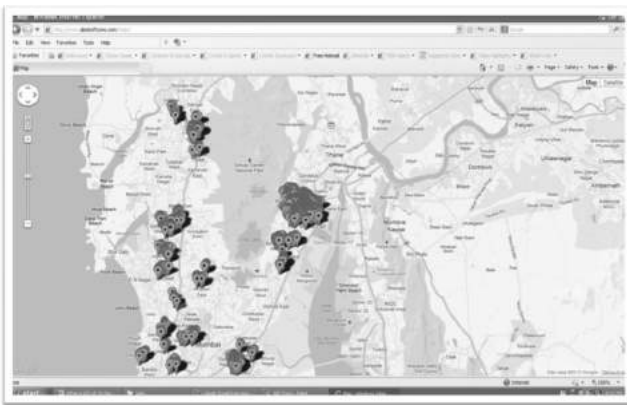
Figure-12
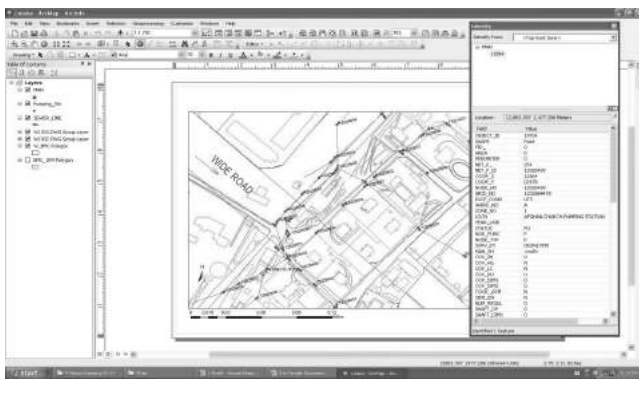
(Data monitoring on Google Map in realtime)

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