

24x7 Water Distribution Network (sarsana) Using EPANET

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Abstract- In order to fulfil the water demand of the continuously growing population, it is essential to provide the sufficient and uniform quantity of water through the designed network of pipes. The general features of the area like information about the main water source, population of the area, demand of water, requirement of the pumps, distribution network and water tanks are essential for efficient design of water distribution system. According to the per capita consumption of water by an Individual person is 150litres per day and design has been made accordingly. This work highlights the process carried out on design of water supply system for an area named SARSANA with the help of all this information the design of the water supply scheme for the area with the help of software “EPANET”. This design of the water supply scheme for proper supply of water is efficient to meet the daily requirement of water in this area.

I. INTRODUCTION

In order to fulfill the water demand of the continuously growing population we need to provide the sufficient and uniform quantity of water through the designed network of pipes is known as water supply. Infrastructure for the collection, transmission, treatment, storage, distribution of water for homes, commercial establishments, industry, and irrigation, as well as for such public needs as firefighting and street flushing. Water supply systems must also meet requirements for public, commercial, and industrial activities. In all cases, the water must fulfill both quality and quantity requirements. A plan of water supply system for the Sarsana village of Surat city has been prepared as per “CPHEEO Manual on Water and Water Treatment” and using EPANET software.

Aim-

To update the 3 hour water distribution system into 24/7 water distribution system in Sarsanavillage, SURAT. To provide proper amount of water as per as

demand. To increase the awareness of water usage and supply.

Objectives-

The overall objective of a distribution system is to deliver wholesome water to the consumer at adequate residual pressure in sufficient quantity at convenient points and achieve continuity and maximum coverage at affordable cost. To attain this objective we had to evolve operating procedures to ensure that the system can be operated satisfactorily, function efficiently and continuously, and as far as possible at lower cost.

II. LITERATURE REVIEW

The analysis of hydraulic problems has reviewed considerable attention in the past. This is almost entirely due to the available computer facilities which make it less tedious, iterative calculations were amenable to a quick solution. In addition, obtaining a solution to these problems has important economic and design significance. Many methods have been used in the past to compute flows in network of pipes such methods range from graphical methods to the use of physical analogies and finally to the use of mathematical models. These methods of network analysis have been developed and implemented on the computer over the last fifty years. One of the first and probably the most widely used method of analysis is the Hardy Cross Technique (1936) [3]. This method makes corrections to initial assumed value by using a first order expansion of the energy equation in terms of selection factor for the flow rate in each loop. The process is of course repetitive and is dependent on the accuracy of the initial given which must be reasonably good. If an aimer is to be obtained, reportedly, however the method is suitable for both hand calculation, and also a number of digital programs have been prepared for network flow analysis suing this procedure. In certain cases it

has been found that the Hardy Cross method converges very slowly or not at all. This lead Mc corale and Deliany (1960) [4] to suggest special measures to improve convergence. The method described by Newton and Peter (1963) [5] has also been used by Gludice (1965) and Pitchal (1966) for studied for hydraulic networks. The method has been extended by Shanny and Howard (1968) [6] to include various hydraulic components in the network. Epp and Fowler (1970) [7] late reported an approach to solving hydraulic network problems utilizing the Newton-Rapson method and have offered some details pertaining to a general digital computer program available for this problems. This method adjusts the flow rate in all the loops simultaneously. Convergence using Newton-Rapson approach is much quicker than that obtained using Hardy Cross analysis. This is especially important when analyzing networks involving large number of pipes. Direct electrical analogues are also used for hydraulic network analysis developed by McIlroy (1950) [8]. This and other available direct analog services are described in a proper Mcpherson (1962) [9]. Although, electrical analog are accuracies and no process of convergence exist; equipment and trained operation are required to meet there devices which makes their method of analysis impractical in any situations. Uri Shamir of Israel and Chuck Howard of Canada (1968) [10] demonstrated that the method could also be used to accommodate systems with pumps and valves and also showed how the method could be used to solve for other unknowns. In 1969, Alvin Flower and a graduate student named Robert Epp developed a new approach to network analysis at the University of British Columbia that applied the Newton-Raphson method to simultaneously solve for the flow adjustment factors associated with the original “loop” method of Cross (1936). This had the net benefit of significantly improving the convergence characteristics of the original algorithm.

III.METHODOLOGY

1 Issue Identification.

- After conducting survey in rural area Sarsana of Surat we examined that most of the people were using ground water from boring for their basic needs.

- Limited amount of water was supplied which was not enough for their utility.
- Almost every house had boreholes for 24 hours water supply.
- Water supplied by SMC was only for 3 hours per day.

2 Study Area Selection

- After a lot of discussion we selected sarsana as our study area.

3 Data Collection

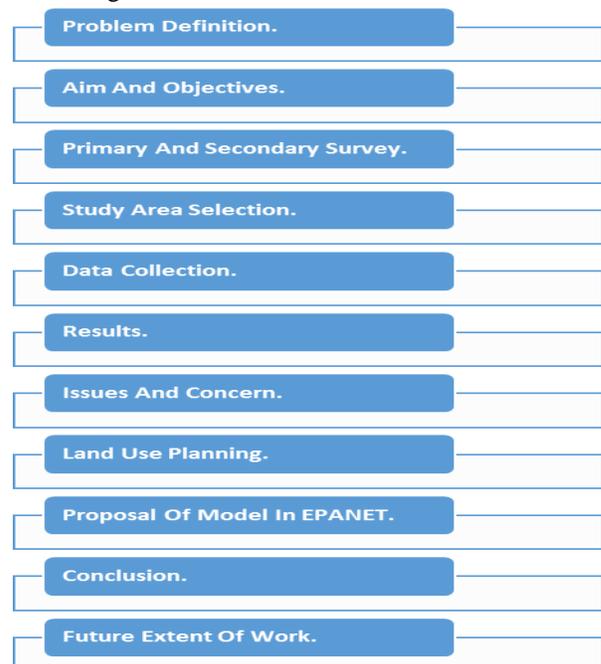
- The data collected in our project is from SMC (Surat Municipal Corporation).
- Usage of water and its distribution networks.
- Brief information about nodes and links.
- Epanet software for distribution and network of water supply.
- Internet and as well as old records.

4 Land Use Planning

- Based on data collected we started our work using Epanetsoftware and designed a 24 hour water distribution network in Sarsana village Surat.

5 Concluding Remarks

- The main task we had to overcome was to measure the water usage of each person at different interval of time during 24 hours based on that we prepared a water supply system which was capable of supplying water 24/7 in Sarsana village



METHODS OF DISTRIBUTION:

Three methods or systems are outlined below: (i) Gravity system (ii) Pumping system (iii) Combined gravity and pumping system

LAYOUT OF DISTRIBUTION NETWORKS

There are four principal methods of layout for distribution systems: (i) Dead end or tree system (ii) Gridiron system (iii) Circular or ring system (iv) Radial system

STEPS IN DESIGNING WATER DISTRIBUTION NETWORKS

(i) Conducting topographic surveys and preparation of maps. (ii) Preparation of tentative layout. (iv) Computation of discharges in pipelines. (iv) Calculation of pipe diameters. (v) Computation of pressures in the pipelines. (vi) Determination and positioning of appurtenances

SURVEYS AND MAPS

The strip of land lying between the source of water supply and the distribution area is surveyed to obtain the levels for fixing up the alignment of the rising main. This main will carry treated water to the distribution reservoir(s) located in the distribution area. The distribution area is also surveyed and detailed maps of are prepared showing the positions of roads, streets, lanes, residential areas, commercial locality, industrial areas, gardens etc. A topographical map of the area is prepared to locate the high and low areas. The cross section of streets, roads, lanes, etc. is prepared, showing the position of existing underground service lines like electric and telephone lines, sewer lines, existing water supply lines (if any), etc.

TENTATIVE LAYOUT A tentative layout of the distribution line is then marked, showing the location of the treatment plant(s), distribution mains, distribution and balancing reservoirs, valves, hydrants, etc. The whole area is divided into various distribution districts. The density of population (average number of people per hectare area) is also marked. The length of pipelines should be kept as short as possible.

DISCHARGE IN PIPELINES Based on the density of the population, type of distribution district

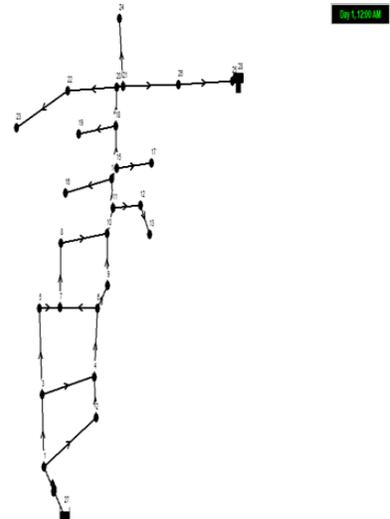
(residential, commercial etc) and firefighting and other requirements, the discharge required from each pipeline is calculated. The fire hydrants are placed at 50 to 100m intervals on straight runs, and on street junctions. The size of the distribution pipes are fixed such that a minimum necessary pressure head is maintained at all points, carrying peak hourly flow through them. The pipes should be designed for a discharge ranging from 2.25 to 3 times the average rate of supply. For populations over 50,000, the distribution mains should have a capacity of 225% of average rate of supply, while for population below 5000; the distribution pipes should have a capacity of 300% for the average rate of supply. The flow required for firefighting should be added to this maximum flow, to get the total flow. The pipes should be able to carry this total flow without excessive pressure drops.

IV. DATA COLLECTION

1. Map of Sarsana Village including water distribution network

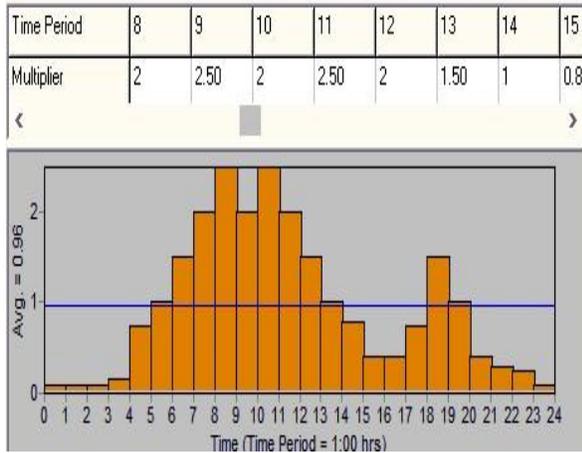


2. Water distribution network of Sarsana Village



Time pattern is mainly use in EPANET software to set the exact amount of water pressure passing through the junctions

3. Time Pattern



V. RESULTS

1. Pipe Report

Network Table - Links at 1:00 Hrs			
Link ID	Length m	Diameter mm	Flow LPM
Pipe 8	665.93	200	8.11
Pipe 9	288.25	150	7.64
Pipe 10	499.58	200	7.23
Pipe 11	863.47	200	-4.81
Pipe 12	623.11	150	-5.23
Pipe 13	271.33	150	11.65
Pipe 14	510.95	150	0.77
Pipe 15	330.68	150	0.35
Pipe 16	281.58	150	10.44
Pipe 17	875.53	150	0.44
Pipe 18	134.2	150	9.62
Pipe 19	650.23	150	0.42
Pipe 20	410.43	12	8.82
Pipe 21	699.59	150	0.31
Pipe 22	372.32	150	8.11
Pipe 23	117.1	150	6.89
Pipe 24	912.79	200	0.75
Pipe 25	1015.15	200	0.33
Pipe 26	656.4	150	0.39
Pipe 27	1026.96	200	6.09
Pipe 28	1003.91	200	5.67

Pipe 30	1000	150	5.28
Pump 29	#N/A	#N/A	15.69

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