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Study of Water Distribution Pipe Network Using Epanet2.0

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ABSTRACT

With the increase in population, demand of water supply on the civic amenities including water supply for domestic purposes, irrigation, industry etc. has increased. Therefore, identification of sources of water supply, their conservation and optimal utilization is of utmost importance. Pipe water system is one of the best systems to supply water safely, adequately and continuously. To supply adequate, safe and continuous water in areas, regional water supply schemes are formed in which city are served from a common water source through pipe system. They have potential to operate at economy of scale, provide quality service and can also offer long term feasible solution in areas with acute water shortage. In this current paper we present the study of water distribution network for south zone of Surat city and it is carried out using EPANET 2.0.

KEYWORDS :

Introduction

Water is the most precious gift of nature. It is the most crucial for sustaining life and is required in almost all the activities of mankind i.e., domestic, industrial and irrigation to meet the growing food and fiber needs, power generation, navigation, recreation etc. and also is required for animal consumption. The common source of water mainly comprises of Rain water, Surface water, Ground water and Water obtained from reclamation. The development, conservation and use of water form one of the main elements in country's development planning. With the increase in population, demand of water supply on the civic amenities including water supply for domestic purposes, irrigation, industry etc. has increased. Therefore, identification of sources of water supply, their conservation and optimal utilization is of utmost importance. Traditionally, the people in rural areas have obtained water from unprotected ponds or tanks, wells, cisterns and sometimes streams and rivers. Mostly this water is unsafe for consumption due to contamination by fecal matters as well as by their heavy use. Consequently, the populations suffer from frequent epidemics. To supply potable water to all such communities by an adaptable water supply system that supplies water with a quality matching international standards, is feasible. Pipe water system is one of the best systems to supply safe, adequate and continuous water. To supply adequate, safe and continuous water in rural areas, regional water supply schemes are formed in which more than one village are served from a common water source through pipe system. Such schemes have potential to operate at economy of scale, provide quality service and can also offer long term feasible solution in areas with acute water shortage. However they may require significantly higher investment, substantial technical capabilities and coordinated involvement of multiple agencies.

In the present study we find pressure, head for nodes, velocity and flow for pipes for south west zone of Surat city using EPANET 2.0. Detailed implementation procedure and the outcomes are presented in the subsequent sections.

EPANET SOFTWARE 2.0

Originally designed in 2000, the Environmental Protection Agency (EPANET) is "a computer program that performs extended period simulation of hydraulic and water quality behavior within pressurized pipe networks."

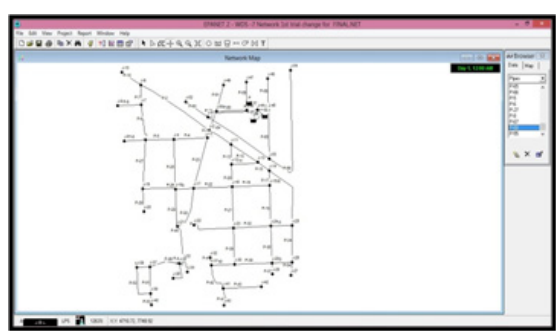
Steps in Using EPANET

One typically carries out the following steps when using EPANET to model a water distribution system:

1. Draw a network representation of your distribution system
2. Edit the properties of the objects that make up the system
3. Select a set of analysis options
4. Run a hydraulic analysis
5. View the results of the analysis

Encoding of Input Data

Figure 1: EPANET Window



Most of the hydraulic analysis software has common input data requirements. These data are grouped into pipe data and node data. Pipe data are the assigned pipe number, pipe diameter (mm), C-value, length (m) and diameter (mm). Node data are the assigned node number, elevation (m) and water demand (lps). Pump curve data are the assigned head (m) and flow (lps). Fig. shows process from starting of the program up to Input data inserted in software.

The analysis of any water distribution network includes determining quantities of flow and velocity in the various pipe lines, and resulting residual pressure at various demands in the network junctions.

The results obtain for the network are described below:

Table 1: Network Table - Nodes (Junctions)

Node ID	E* (m)	D** (LPS)	H*** (m)	P**** (m)
J-2	8.00	16.26	22.72	14.72
J-3	8.00	1.89	22.63	14.63
J-4	7.60	9.12	21.42	13.82
J-6	7.00	4.71	20.28	13.28
J-7	7.00	4.86	21.07	14.07
J-8	7.00	6.39	20.91	13.91

Node ID	E* (m)	D** (LPS)	H*** (m)	P**** (m)
J-9	7.00	21.75	21.97	14.97
J-10	7.00	5.55	21.86	14.86
J-11	7.00	6.78	22.11	14.11
J-12	8.00	4.86	21.47	13.47
J-13	8.00	15.93	21.02	13.02
J-14	8.00	3.84	20.51	12.51
J-15	8.00	13.83	20.32	12.32
J-16	8.00	16.11	20.63	12.13
J-17	8.50	13.14	21.25	12.25
J-18	9.00	17.46	20.33	12.33
J-19	8.00	20.82	19.49	13.49
J-20	6.00	5.82	19.36	13.36
J-21	6.00	20.82	20.33	12.33
J-22	8.00	11.88	17.20	9.60
J-23	7.60	42.96	18.18	10.38
J-24	7.80	20.79	18.34	10.54
J-25	7.80	24.63	18.22	10.62
J-26	7.60	15.84	17.35	10.35
J-27	7.00	2.58	17.34	10.34
J-28	7.00	19.47	17.49	10.79
J-29	6.70	2.58	17.48	10.78
J-30	6.70	9.27	17.49	11.19
J-31	6.30	6.39	17.21	11.21
J-32	6.00	1.98	17.21	11.21
J-33	6.00	9.21	17.47	11.47
J-34	6.00	3.06	17.45	11.35
J-35	6.10	1.35	17.21	11.11
J-36	6.10	6.21	17.06	10.96
J-37	6.10	8.13	16.18	10.08
J-38	6.10	3.45	16.05	10.05
J-39	6.00	17.52	15.92	9.82
J-40	6.10	2.88	15.91	9.71
J-41	6.20	7.56	16.65	10.55
J-42	6.10	11.34	16.44	10.24
J-43	6.20	5.10	16.56	10.46
J-44	6.10	5.31	23.62	15.62
J-45	8.00	9.72	23.36	15.36
J-46	8.00	9.99	23.16	15.16
J-47	8.00	24.39	23.33	15.33
J-48	8.00	26.85	23.11	15.11
J-49	8.00	23.49	22.43	14.43
J-50	8.00	28.17	22.47	14.47
J-51	8.00	11.04	22.33	14.33
J-52	8.00	24.00	22.30	14.30
J-53	8.00	108.63	21.78	13.78
J-54	8.00	116.16	20.15	12.15

Where; *E = Elevation, **D = Demand, ***H = Head, ****P = Pressure.

Table 2: Network Table - Links (Pipes)

Link ID	Length (m)	Diameter (mm)	Flow (LPS)	Velocity (m/s)	Unit Headloss (m/km)
P-1	424.00	600	444.12	1.57	3.03
P-2	567.00	300	45.63	0.65	1.31
P-3	49.00	450	159.64	1.00	1.85
P-4	238.00	200	32.57	1.04	5.05
P-7	127.00	150	18.33	1.04	7.08
P-9	167.00	150	6.39	0.36	1.01
P-10	145.00	150	5.55	0.31	0.77
P-11	177.00	450	222.60	1.40	3.42
P-12	227.00	150	14.89	0.84	4.82
P-13	127.00	400	200.92	1.60	5.02
P-14	188.00	350	95.46	0.99	2.43
P-15	100.00	300	94.42	1.34	5.04
P-16	468.00	200	32.03	1.02	4.90
P-17	92.00	300	58.55	0.83	2.08
P-18	273.00	250	71.19	1.45	7.26
P-19	269.00	250	-26.47	0.54	1.16
P-20	148.00	300	100.61	1.42	5.67
P-21	278.00	250	79.15	1.61	8.83
P-22	272.00	200	-21.12	0.67	2.27
P-23	343.00	350	-125.18	1.30	4.01
P-24	131.00	150	18.23	1.03	7.01
P-25	324.00	150	12.27	0.69	3.36
P-26	222.00	150	13.09	0.74	3.80
P-28	152.00	150	5.82	0.33	0.85
P-29	247.00	150	-0.05	0.00	0.00
P-30	296.00	300	72.68	1.03	3.10
P-31	310.00	150	11.88	0.67	3.17
P-32	269.00	250	-18.52	0.38	0.60
P-33	174.00	150	5.26	0.30	0.70
P-34	243.00	150	12.67	0.72	3.57
P-35	170.00	150	-5.75	0.33	0.83
P-36	244.00	200	26.62	0.85	3.48
P-37	67.00	150	2.58	0.15	0.19
P-38	264.00	200	-1.18	0.04	0.01
P-39	242.00	250	42.82	0.87	2.83
P-40	166.00	250	32.37	0.66	1.69
P-41	52.00	150	1.98	0.11	0.11
P-42	197.00	200	24.00	0.76	2.87
P-43	296.00	200	11.34	0.36	0.72
P-44	133.00	150	5.10	0.29	0.66
P-45	240.00	200	51.81	1.65	11.94
P-46	35.00	200	39.54	1.26	7.24
P-47	80.00	150	3.06	0.17	0.26
P-48	162.00	150	6.21	0.35	0.95

Link ID	Length (m)	Diameter (mm)	Flow (LPS)	Velocity (m/s)	Unit Headloss (m/km)
P-49	212.00	200	31.98	1.02	4.89
P-50	90.00	150	7.66	0.43	1.41
P-51	183.00	200	16.19	0.52	1.39
P-52	274.00	150	4.21	0.24	0.46
P-53	75.00	150	2.88	0.16	0.23
P-54	67.00	150	2.58	0.15	0.19
P-56	75.00	400	161.53	1.29	3.35
P-57	77.00	400	220.91	1.76	5.99
P-58	207.00	350	26.85	0.28	0.23
P-59	188.00	350	24.39	0.25	0.19
P-60	217.00	350	127.42	1.32	4.14
P-61	181.00	350	23.49	0.24	0.18
P-62	85.00	350	75.76	0.79	1.58
P-63	185.00	350	24.00	0.25	0.19
P-64	516.00	300	40.72	0.58	1.06
P-65	321.00	400	184.07	1.46	4.27
P-66	895.00	400	116.16	0.92	1.82
P-5	224.00	150	11.18	0.63	2.83
P-6	123.00	100	4.71	0.60	4.12
P-27	321.00	150	13.55	0.77	4.04
P-8	236.00	150	-7.08	0.40	1.22
P-55	67.00	500	387.75	1.97	5.72

III. Conclusion

The modern software like EPANET provide the extended period simulation by providing the user friendly and dynamic wizards for analyzing the user input networks by following hydraulics and qualitative theories. Moreover, the defects in the design can be predetermined and rectified, saving the cost of reworks and time extension of the project having high capital investments. Also the software like EPANET have exceptional qualities indicating the analyzed hydraulic parameters at each members, increasing the ease of scrutinizing analysis, saving of time and subsequently money.

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