

Design of Sewer Network: A Review

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Abstract: *Sewerage Networks are an important part of the infrastructure of any society. A systematic sanitation system is basic key to environment sustainability. The main purpose of providing sewer network is to carry away sanitary waste from the area in such a way that it does not cause any public health issues. This study includes the use of SewerGEMSV8i for the design and analysis of the sewage system. SewerGEMSV8i is the first and only fully dynamic, multi-platform (GIS, CAD & Stand-Alone) sanitary and combined sewer modelling solution.*

Keywords: Sewerage system, SewerGEMSV8i, Sewer Network Design, CPHEEO, ArcGIS and CAD

I. INTRODUCTION

Water is one of the most important factors for the sustainability of life. Water covers about 70% of earth's surface and the fresh water available is about 1.7% as surface and ground water sources. The supplied water is used for domestic, industrial, recreational purposes. This water is likely to be generated as waste water. In practice around 80% of the water supplied is likely to be converted in to wastewater. A sewerage network is just a reverse action of water supply network. The sewer networks are also having to be ensured so that they are not leaking which may lead to ground water contamination and soil pollution. In respect of this view, many research works are being done to design a cost effective sewerage network with the given constraints and guidelines. These difficult problems can be solved by using the computer software package SewerGEMS V8i. The computer software package SewerGEMS V8i is the most helpful tool of the purpose of designing an economic sewer network since it can give the optimum cost and practically feasible layout which can handle a large network. The program selects automatically pipe diameters by considering the flow in the pipe velocity and slope requirements.

INTRODUCTION ABOUT THE SOFTWARE

SewerGEMS V8i, which allows projects to be accomplished in a short time, with high efficiency and low costs. Bentley SewerGEMS V8i is the first and only fully-dynamic, multi-platform (GIS, CAD and Stand-Alone) sanitary and combined sewer modeling solution. With Bentley SewerGEMS V8i, we will analyze all sanitary and combined sewer system elements in one package and have the option of performing the analyses with the SWMM algorithm or our own implicit solution of the full Saint Venant equations. The hydraulic design consists in the computation of the transit and total flow and hydraulic modeling for network pipes diameters or slopes. With specific tools and features included, SewerGEMS V8i offers a full range of possibilities for the designer to draw, label, dimension and plotting the drawings of the sewage networks. Sewer GEMS v8i is provided sufficient time for solving wastewater engineering problems, such as improving capacity and limiting sewer overflows, which ultimately enable utilities to comply with sewer regulations set by regulatory agencies. To plan, design, maintain and operate sewer system SewerGEMS are provided engineering tools.

APPLICATIONS OF SEWERGEMSv8i SOFTWARE

- Runoff flows are computed using the most appropriate runoff method for the project.
- SewerGEMS manage your model effectively so that you can focus on making the best engineering decisions
- The application provides reports, layouts, longitudinal or transversal cross sections of the pipe network, displayed in an advanced graphic system based on AutoCAD technology.
- This software allows projects to be accomplished in a short time, with high efficiency and low costs.



- SewerGEMS V8i software is main advantages is it is freely version software, so that it is easily downloaded.
- Final drawings produced into a .dwg format which is the most generally accepted file format for engineers.

LITERATURE REVIEW STUDY

G. Seet, S.H. Yeo, W.C. Law, Burhan, C.Y. Wong, S. Sapari, K.K. Liau, (2018), has been studied the Singapore used water transport infrastructure comprises of three sewage systems: trunk sewer, link sewer network and the Deep Tunnel Sewerage System (DTSS). It is a solution towards Singapore's long-term water needs such as used water collection, treatment, reclamation and disposal. The use of robots is one of the options being explored to assess underground spaces and to achieve enhanced inspection and maintenance capabilities. In result, the depth of service tunnels approaches 50 m with distances between adjacent accesses points approaching 2 km. keeping the robots supplied with power is challenging and with conflicting operational advantages and disadvantages between on-board battery and surface supplied power. The paper provides insights to the identification of design considerations and field trial for our tunnel inspection robot.

Natalia Duque, Daniel Duque, Juan Saldarriaga, (2017), has been studied sewer network optimal hydraulic design, for a specific layout consisting of a series of pipes, is the combination of diameters and slopes along the series that satisfy all the hydraulic, commercial, and construction constraints, while minimizing the construction costs. The sewer network design problem consists of determining both the layout and the hydraulic design of the system, where the layout is defined by the initial pipes and the flow direction in each pipe. The layout for a series of pipes is given by a unique initial pipe where the series starts and a unique flow direction towards the last manhole (outfall). In result, Costs achieved using the proposed methodology for this series of pipes is 6% cheaper than the one obtained by this method.

A. Kothai, R. Muthu priya, A. Rajkumar, (2018), studied modelling and the hydraulic design of underground sewerage system using SewerCAD software. The data collection for Kalapatti town Panchayat and designing to sewer network in the study area. Kalapatti town Panchayat was taken as a model for the study. The area under consideration was selected based on the existing facility and the prioritized area in need of sanitary facility. The analysis and design were carried out using the macro enabled excel sheet and SewerCAD to find the diameter, type of pipe, slope to be maintained and depth of cutting for manhole. The results of sewer network were derived from SewerCAD and was analysed as per standard design constraints and guidelines prescribed by CPHEEO. 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.

Punam Rajpurohit, J.D. Raol, Ajay Patel, Indra Prakash, (2016), has been studied Gandhinagar city which is fast developing has been selected for the present study. GIS technology and SewerGEMS software has been used in identifying the sewerage network problem and solving the same considering present and future need of the Gandhinagar City. Sector-2D, Gandhinagar city has designed for the large network of 4376 meters, in that 313 meters of sewer network of Manhole 19-35 can be shown in result.

Ms. Harsha S. Bhavimani, 2 Dr. Anand V. Shivapur, (2017), studied SewerGEMSV8i software using for design of sewer network for belagavi city. It allows projects to be complete in an extremely short time, with high efficiency and less prices. In the design of a sewerage system the sewer network is the basic unit taking place repeatedly in the design activity. The hydraulic design consists in the totalling of transit and total flow and hydraulic modeling for network pipes diameters or slopes. The network consists of pipes of varying diameter, manholes and outfalls. The application provides reports, layouts, longitudinal or transversal cross sections of pipe network, displayed in an advanced graphic system based on AutoCAD technology. With detailed tools and features included, sewerGEMSV8i offers a full range of possibilities for the designer to draw, label, dimension and plotting the drawings of sewage networks. In this work, the sewerage networks were designed by considering the rules put forth by leading bodies and using commercially available materials and results obtained are well within range.

Vidhi Bhavsar, Yash Bhavsar, Raj Mehta, Kushal Patel, (2017), studied to design economic sewer network for a village. An analysis is carried out considering Dolarana Vasana (Gandhinagar District, Gujarat) as a study area along with associated environmental impacts and existing waste water management practices. To design a scheme using Bentley SewerGEMS software for collection and transportation of waste water. A sewerage network is designed accordingly for



the provision of manholes as per the analysis carried out in MS Excel software. Considering each analysed data and government provision for the village, total discharge and velocity parameters have been calculated. For calculation of Ground level, Invert level and depth of cut, "Google Earth" software is used and finally Design of sewerage network is carried out using SewerGEMS and AutoCAD software. This design is really beneficial for small villages where waste water is not properly managed. The scheme which is proposed is economical and adoptable as well.

Murugesh katti, Krishna B. M., (2015), studied an advanced modeling and design software application for sewage networks SewerGEMS V8i, which allows projects to be accomplished in a short time, with high efficiency and low costs. In the design of a sewerage system the sewer network is the basic unit occurring repeatedly in the design process. Any savings during the design of this unit will affect the overall cost of the sewerage system. Less time spent to create the drawings by using the tools for labelling the system parts, updating data automatically for layout and longitudinal profile with the modifications we make along the designing process, calculating the pipe diameters automatically, using the features for creating the plotting drawings.

Shruthi S Kannur, Santosh Patil, Satish S Kannur, (2015), SEWERGEMS software using for designing of underground sewer network and hydraulic analysis. Among the latest technologies, 'InfoSewer' is a powerful ArcGIS – based computer program used for the planning, design, analysis & expansion of sanitary, storm & combined sewer collection system. The design attributes considered were - diameter of the pipes, depth of excavation, slopes to achieve desired self-cleansing velocity and commercially available sewer attributes. The design was taken up to satisfy the set of design constraints prescribed by local statutory bodies & regulations. Thus considering all these parameters, an underground drainage system was design and analysed.

Pankaj K. Roy, S. Mallick, S.Pal, G.Banerjee, A.Mazumdar and R. Chakraborti, (2015), studied sewer network design using SewerGEMSV8i software. In this research, for the development of an optimal waste water network system, pattern load is more useful and satisfactory with respect to fixed load to achieve maximum sewer velocity when all other parameters are unchanged and for designing. The result which gets from Bentley SewerGEMS V8i is helpful to develop a network system with different load pattern and treatment plant accordingly.

Nishant Sourabh, P. V. Timbadiya, (2015), studied Sardar Vallabhbhai National Institute of Technology, Surat (SVNIT-Surat) has the sewerage network since its inception and re-design as non-conventional network in year 2001. It is important to check its present performance and its capacity to withstand against future development. In this study, the whole existing sewerage network of 4.79 km with RCC circular pipe of 300 mm diameter is re-surveyed. The levels of all lines and manholes are collected. The sewerage load for whole network was calculated from the water supply of the institute. The total water supply for the connected buildings of the institute in the existing network is 0.664 MLD. The model has been developed for existing network using Bentley SewerGEMS V8i. The existing loading is simulated using developed model and total average and peak sewage flow at outfall of the network is 0.551 MLD and 1.67 MLD respectively. It is found that the minimum velocity, i.e. ≥ 0.6 m/s as per CPHEEO manual, 2012, is not met throughout total length of the said network.

Rushikumar R Prajapati Neha M Joshipura Bhavin Patel, (2016), has been studied design of drainage network by SEWER (Version 3.0) Sewer Network Design Program Software.in this paper data collected from the municipalities. The implementation and maintenance of underground sewerage system will be highly expensive so it is also important to know that the local authority will able to manage the system or not. Thus an attempt is required to study all such problems of the town having existing Drainage system. The social needs of the residents in the towns are increasing day by day and that cause a major problem in services. So that it is very essential to do study and Design of the Ankla towns. Using SEWER design program software for designing for drainage network properly and economically.

J. A. Patil, Dr. Mrs. S. S. Kulkarni, (2014), studied the municipal wastewater management is a critical issue in an urban environment. In small cities do not have proper drainage system, Islampur, Dist. Sangli; Maharashtra, India is one such. As on date all the domestic waste water is either send in open drain or in open area around the houses. This study aim at designing collection system for Islampur town, the work undertaken uses, GIS as a tool for mapping the collection system (primary and secondary) in order to facilitate further works.



II. CONCLUSION

The paper presents an advanced modeling and design software application for sewer network sewerGEMSV8i, it allows projects to be complete in an extremely short time, with high efficiency and less prices. In the design of a sewerage system the sewer network is the basic unit taking place repeatedly in the design activity. Any savings during the design of this unit will affect the overall cost of the sewerage system. Bentley sewerGEMSV8i is the first and only fully dynamic, multi-platform sanitary and collective sewer modeling solution. The hydraulic design consists in the computation of transit flow and total flow and hydraulic modeling for network pipe diameters or slopes. The network consists of pipes of varying diameter, manholes and outfalls. The application provides reports, layouts, longitudinal or transversal cross sections of pipe network, displayed in an advanced graphic system based on AutoCAD technology. With detailed tools and features included in sewerGEMSV8i offers a full range of possibilities for the designer to draw, label, dimension and plotting the drawings of sewage networks.

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