

DESIGN OF SEWER PIPELINE OF GULMOHAR RESIDENCY SECTOR-35 FARIDABAD

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ABSTRACT - Gulmohar Residency is located in the sector 35 of Faridabad Harvana. It is the first sector when one comes from New Delhi. Due to the close vicinity from New Delhi this area is rapidly growing and in fact it is the eighth fastest growing city in the world and third fastest growing city in India. Due to rapid urbanization and population growth the Water demand and sewage generation has been increased. The target goal of this research is to design an efficient sewerage system. To fulfil this aim proper survey, proper population projection, and proper design with all the key constraints has been performed. Sewer Pipeline design presented in this paper is a result of Sewer Modelling Software i.e. Bentley Sewer Gems Connect Edition. The Sewer Gems application provides reports, layouts, longitudinal or transversal cross sections of the pipe network, displayed in an advanced graphic system based on AutoCAD technology. With specific tools and features included, SewerGEMS Connect Edition gives full range of possibilities for the designer to draw, label, analyse, dimension, optimise and plotting the drawings of the sewage networks.

Key Words: Peak Factor, Water Demand, Design period, Population Projection, Slope, Diameter.

1. INTRODUCTION

The Total area chosen for the present project Gulmohar Residency is 06 acres and 2.43 Hectares. Here the type of living style is plots system. Currently there are 68 Plots. In each plot there are 03 flats. Therefore the total flats are 204 in Nos.

The present population is approximately 1020. There is Cement Concrete Road inside the colony and its condition is also very good. Gulmohar residency comprises of 100% residential structures. There are 03 Parks and ample greenery with many huge trees are present in the society. The scope and objective of the present project was to design an efficient sewerage system for catering to the present population and also the future estimated growth.



Fig -1 Google Earth View of Gulmohar Residency

2. METHODOLOGY AND DESIGN CRITERIA

In this project the adopted methodology consists of survey of houses of the projected area for data collection. Then using this data and Residents Welfare Association data, the population Projection of the area is performed by the standard method i.e. Arithmetic Progression Method. The Mid year and Ultimate year are taken as 2036 and 2051 which forms the basis of the current project. The water demand is 135 lpcd, sewage generation shall be 80 percent of water demand i.e. 108 lpcd. The Peak factor of 3 is taken as the population is 1020 nos.

Design Steps and Constraints are as follows-:

•	Design Period – 30 Years
•	Water Demand – 135 LPCD
•	Sewage Generation – 108 LPCD
•	Infiltration – 500 L/day/manhole
•	Peak Factor – 03
•	Pipe Cover – 0.9 m to 5 m
•	Slope – As per CPHEEO,
•	1/250 – 200 mm dia,
•	1/360 – 250 mm dia.
•	Manning's Coefficient – 0.010
•	Velocity (m/s) – 0.6 to 3m/s
•	Material of Construction of Pipe DWC –
	Double wall Corrugated Pipe.

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The Manning's formula is used for the design of sewers under gravity flow.

 $V = 1 \times R^2/3 \times S^1/2$ n

Where,

- V = Velocity in m/s
- N = Manning's Roughness Coefficient
- S = Slope or Hydraulic Gradient
- R = Hydraulic Radius in m
- Q = Flow rate in m3/s
- A = Cross Sectional Area of pipe in Sq. Meters

3. RESULTS

- Depth of Sewer Pipe -1. Ranging from 1.12m to 2.1m
- Designed Pipe Dia -2. 200 mm, 250 mm
- 3. Designed Population 1680
- 4. Outfall Septic Tank
- 5. Outfall Invert Level 201.44 m
- 6. Outfall Ground Level 203.00 m
- 7. Designed Flow – 563320 L/D
- 8. Manhole – Circular Shape
- 9. Total Manholes – 40
- **10.** Total Pipe Length 1010 m

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	Label	Elevation (Ground) (m)	Elevation (invert) (n)	Elevation (Ram) (m)	Sanitary Loads	Inflow (Wet) Collection	Hydraulic Grade Line (Ini)	Hydraule: Grade Lese (Out)		
0599: M-1	M-1	203.40	202.29	203.40	<collection: 1item=""></collection:>	«Collector: 1 iten>	202.30	907.30		
0700: M-2	M-2	203.60	202.17	203.60	<collection: 1="" tem=""></collection:>	<collection: 1="" item=""></collection:>	202.19	302.10		
0715: M-3	M-3	204.70	203.59	204.70	<colection: 1="" item=""></colection:>	«Collection» Litem»	203.60	202.13		
0748: M-4	M-4	204.65	203.48	204.65	<colection: 1="" item=""></colection:>	cColector: 1 dem>	203.50	2012.00		
0717: M-5	M-5	204.80	203.69	204.80	«Collection: 1.item»	<colector: 1="" item=""></colector:>	201.70	201.70		
0780: M-6	M-6	204.78	203.59	204.78	<colection: 1:tem=""></colection:>	<collection: 1="" item=""></collection:>	203.61	201.61		
0668: M-7	M-7	207.20	205.79	207.20	<colection: 1="" item=""></colection:>	<collection: 1="" dem=""></collection:>	205.80	205.80		
10669: M-8	M-8	206.80	205.50	206.80	«Collection: 1 item>	«Collection: 1 item»	205.52	205.52		
0671: M-9	M-9	206.50	205.10	206.50	<colector: 1="" iten=""></colector:>	<collection: 1="" item=""></collection:>	205.12	205.12		
70673: M-10	M-10	206.10	204.80	206.10	«Collection: 1 item»	<colection: 1="" item=""></colection:>	204.83	204.83		
70575: M-11	M-11	205.80	204.51	205.80	<collection: 1="" item=""></collection:>	<collection: 1="" item=""></collection:>	204.53	206.53		
70677: M-12	M-12	205.50	24.01	205.50	«Collection: 1 item»	<collection: 1="" tem=""></collection:>	204.03	204.03		
70679: M-13	M-13	205.00	203.89	205.00	<collection: 1="" item=""></collection:>	<collection: 1="" item=""></collection:>	203.91	203.91	2.8	
70771: M-14	M-14	205.20	203.79	205.20	«Collection: 1 item»	<colection: 1="" item=""></colection:>	203.82	203.82	2.2	
70768: M-15	M-15	204.80	203.56	204.80	«Collection: 1 item>	<colecton: 1="" tem=""></colecton:>	203.59	203.54	7,0	
70687: M-16	M-16	204.60	203.49	204.60	«Collection: 1 item>	<colector: 1="" item=""></colector:>	203.52	203.52	2,2	
70761: M-17	M-17	204.50	203.38	204.50	<colection: 1="" item=""></colection:>	<collectors: 1="" tem=""></collectors:>	203.41	203.41	2,8	
70758: M-18	M-18	204.70	203.27	204.70	<colection: 1="" item=""></colection:>	«Collection: 1 item»	203.31	203.31	2,8	
70755: M-19.	M-19	204.90	203.15	204.90	<colecton: 1="" iten=""></colecton:>	<collection: 1="" item=""></collection:>	203.19	203.19	2,8	
70697: M-20	M-20	205.20	203.04	205.20	<collection: 1="" item=""></collection:>	<collection: 1="" tem=""></collection:>	203.08	203.08	2,8	
70777: M-21	M-21	204.98	202.95	204.98	<collection: 1="" item=""></collection:>	<collection: 1="" tem=""></collection:>	202.99	202.99	2,8	
70718: M-22	M-22	204.75	202.86	204.75	<collection: 1="" item=""></collection:>	<colecton: 1:tem=""></colecton:>	202.90	202.90	2,8	
70712: M-23	M-23	204,60	202.76	204.60	<collection: 1="" item=""></collection:>	<colector: 1="" item=""></colector:>	202.82	202.82	2,8	
70711: M-24	M-24	204.40	202.62	204.40	«Collection: 1 item»	<colectore (tem="" 1=""></colectore>	202.68	202.68	2,9	
70722: M-25	M-25	205.20	203.92	205.20	«Collection: 1/tem»	«Collection: 1 item»	203.93	203.93	2,55	
707451 10-26	M-26	204.95	203.66	204.95	«Collection: 1 item»	<collection: 1="" item=""></collection:>	203.68	203.68	2.8	
70774: M-27	M-27	204.90	203.79	204.90	«Collection: 1 item»	<collection: 1.item=""></collection:>	203.80	203.80		
78794: M-28	M-28	204.80	203.66	204.80	«Collection: 1 /tem»	<collection: 0="" items=""></collection:>	201.68	202,802		
70708: M-29	M-29	204.70	203.55	204.70	<pre>oColection: 1/tem></pre>	<colection: 1.dem=""></colection:>				
70742: M-30	M-30	204.83	203.49	204.60	«Colection: 1/tem>	<colection: 1="" dem.)<="" td=""><td></td><td>202.24</td><td>1.00</td></colection:>		202.24	1.00	
20239-16-21	M-11	204.70	203.42	204.70	«Colection: 1 item>	-Collection: 1 items	223.45			

Fig -2 Manhole Table in Software

RenTable Conduit Table (Current Time: 0.000 hours) (MED: 18033020.ctue)											
<u>□</u> <u>□</u> · <u>□</u> <u>□</u> <u>0</u> , <u>m</u>											
	D	Label	Start Node	Stop Node	Length (Scaled) (n)	Velocity (m/h)	Flow (L,Klay)	Diameter (mm)	Stepe (Calculated) (1/5)	Casadity (Full Plant) (L/Mary)	Contail Pyre
0701: CO-1	70701	CO-1	M-1	M-2	28.8	0.24	14,108.0	200	250	23,29,915.7	Catalog Contu
0703: CO-2	70703	00-2	M-2	M-35	29.2	0.29	28,235.0	200	250	23,29,996.7	Catalog Contil
0749: C0-3	70749	C0-3	M-3	M-4	26.2	0.24	14,108.0	200	250	23,29,995.7	Catalog Conti
0750: C0-4	70750	C0-4	M-4	M-23	19.4	0.29	28,235.0	200	250	23,29,996.7	Catalog Crinck
0781: CD-5	70781	C0-5	M-5	M-6	23.9	0.24	14,108.0	200	250	23,79,915.7	Eatalog Condi
0782: CD-6	70782	C0-6	M-6	M-22	20.6	0.50	28,236.0	200	250	23,29,915.7	Catalog Corell
0670: C0-7	70670	CD-7	M-7 "	M-8	26.4	0.24	14,108.0	290	250	23,29,915.7	Catalog Cond
0677: CD-8	70672	C0-8	54-8	M-9	29,5	0.29	28,216.0	200	250	23,29,935.7	Catalog Cond
0674-00.9	20674	(0-9	M-9	M-10	29.5	0.33	42,324.0	200	250	.23,29,926.7	Catalog Cand
10675 CD-10	70676	C0-10	M-10	M-11	29.7	0.36	\$6,432.0	200	250	23,29,916.7	Catalog Cond
10679: CB-11	206.78	C0-11	M-11	M-12	29.9	0.38	70,540.0	200	230	23,29,915.7	Catalog Cond
20440-00-17	75680	C0-12	M-12	M-13	29.9	0.41	84,648.0	200	250	23,29,915.7	Catalog Cond
BTT1: C0.51	20223	CD-13	M-14	M-13	13.8	0.42	98,756.0	200	250	23,29,935.7	Catalog Cond
MTT1: CO.14	20772	C0-14	M-15	M-14	25.6	0.44	1,12,864.0	200	250	23,29,930.7	Catalog Cons
P0772. C0-14	20269	C0-15	M-16	M-15	18.2	0.46	1,26,972.0	- 200	250	23,29,910.7	Catalog Cons
10703. C0 15	20263	C0-15	M-17	M-16	27.3	0.47	1,41,080.0	200	230	17, 70,016,7	Cutation Cont
20763: 00-19	20262	C0-17	M-18	M-17	28.6	0.49	1,55,188.0	200	100	23,25,5 00,0	Catalog Cond
P1/62: CD-17	20759	C0-18	M-15	M-18	29.7	0.50	1,69,296.0	200	230	23,29,740.3	Cataing Cond
70759: CP-18.	30.754	(0).19	M-20	M-19	27.7	0.51	1,83,404.0	200	230	23, 29, 036, 3	Cataing Cond
70756: CI-19	20776	CD-20	M-21	M-20	22.7	0,52	1,97,512.0	200	250	75.29.915.3	Catalog Cond
707791 00-20	2077	0.01	M-22	M-21	23.6	0.53	2,11,639.0	. 200	350	71,29,916.3	Catalog Cand
70778: C0-21	20770	C0-22	M-23	M-22	23.2	0.56	2,53,944.0	200	250	17.92.243.4	Catalog Cond
70719: CB-22	7072	00.23	M-23	M-24	34.9	0.49	2,90,255.0	200	250	17.92.243.4	Catalog Ound
707931 C0-23	7079.	00-24	M-24	M-33	31.8	0.50	3,10,376.0	200	290	23,29,915.3	Catalog Cond
70792: 00-24	2075	00.15	M-25	M-26	20.8	0.24	14,000.0	200	250	23,29,916.	Catalog Cont
70746: 00-25	707-1	105.36	M-26	H-29	18.7	0.29	10,210.0	200	250	23,29,929.7	Catalog Cond
70747: C4-26	7074	00.27	M-28	M-27	31.1	0.24	14, 108.0	200	250	23,29,955	Catalog Con
70796: CO-27	7579	00.00	M-29	M-28	23.4	0.29	20,715.0	200	250	23,29,936	Catalog Core
79795: CO-28	7079	00.00	M-30	M-29	14.6	0.30	10,040.0	200	250	23,29,3%	Catalog Card
70744: 00-29	2074	100-25	M-11	M-30	17.8	0.41	04,276,0	200	255	23.29.9%	Catalog Cand
70743: CD-30	7074	00-00	M-37	M-31	22.0	0.43	98,299.0				
70740: 00-31	7074		10.46								



4. CONCLUSIONS

Design of Sewer Network on Sewer Gems is efficient as the model has various options. Once all the design constraints are set in the software as mentioned in the table the sewer gems software automatically designs all parts of the Gravity Sewer Network.

With the help of Bentley Sewer Gems software the Hydraulic Design and drawing of Gulmohar Residency Sewer Network was completed within the short span of time and meeting all the technical specifications.

The biggest advantage of using sewer gems software is that it is easy and simple for the design of sewerage networks. Sewer Gems Software is helpful in designing small and large both sanitary sewer network.

A Drawing containing pipe details, Manhole details, velocity, elevations and flow can be directly obtained from SewerGEMS software SewerGEMS Connect edition shall maintain the minimum and maximum velocity condition either by initial design constraint or by optimising with pipe slopes.





Fig 4: Sewer Layout

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