

Responses to the Editor's and Reviewers' Comments

We appreciate very much the editor and the reviewers for the constructive comments. We also thank the editor and the reviewers for the effort and time put into the review of the manuscript. Each comment has been carefully considered point by point and responded. Responses to the reviewers and changes in the revised manuscript are as follows.

There is nothing about to emphasize 24x7 water supply system (WSS), it has its own advantages which is appreciated worldwide. And as I said in the paper this research is purely applied research so whatever advantages I have mention in the case study (Malkapur, India) all are proven after its detail study by government and concern authority, which is in cited references. So, not even a single point has been added to just emphasize the system.

1. We appreciate your detail comments. You are right that 7 m may not be sufficient for higher floor but here in design for both the ward Sabarmati and old Wadaj scenario has been taken from real census data, in design 7m pressure is for low rise area (Bungalow or tenement) as design has been done with census data so detail has been taken from the AMC (Ahmedabad Municipal Council). so, wherever there is 7 m pressure means development is in horizontal way.

In India, for the designing of water supply guideline, we are following the CPHEEO manual on, "Water Supply and Treatment", published by Ministry of Urban Development, New Delhi, constituted by Government of India. To make the system economical and reduce the water loss (With increasing the pressure by 1 unit i.e. 1 to 2 kg/cm² or 1 to 2 bar, water loss increases by 10%), we have designed the water network in such a manner than residual pressure can be maintained between 7 m to 30m. As per CPHEEO manual in any case the residual pressure should not exceed the 22 m. (30 m is only near to the overhead water tank.)

I agree with you that the residual pressure of 7 m may not be sufficient for supply of water directly to consumers located on second and higher floors, in this case there is need to provide the booster system. Provision of booster system at consumer end is more economical than designing the water network with higher residual pressure.

2.Thank you so much for brings our attention on that, we will change and re arrange it such a way so that it can be easily understand and sounds like in a sequence.

"The type of the research is applied research hence, the more weightage has been given to the literature study, literature study has been done on related case studies respectively to the India context. From that Malkapur, Maharashtra- India has been selected for the detail case study.

Then for designing for 24x7 water supply system, data has been collected from the Ahmedabad Municipal Council (AMC) – Water department. Then on basis of given parameter pilot ward has been selected for the 24x7 water design. With help of WaterGEMS software design has been done and from the design proposal has been raised and then on result of the design and selected proposal, economic analysis has been done.”

3. Your suggestions are well accepted, we will change and shift the paragraph about information and software to the next section. Hours of supply, per capita supply, residual pressure, frequency of supply of existing system, all this will be inserted to this section.

| Criteria | Existing Scenario |
|----------------------------|--|
| Hours of Supply | 2.5 Hours |
| Per capita supply | 140 to 160 LPCD |
| Frequency of supply | Daily |
| Residual pressure | Varies 7 m to 30 m |
| Pipe Material | Ductile Iron & Cast Iron |
| Mode of Recovery | Water Tax at 30% of General Tax, Yearly. |

4. Thanks for your detail observation. Yes, design has been done with reliable criteria for 24x7 WSS according to CPHEO manual only. WaterGEMS software apart from design for steady state flow, also models the system according to the given pattern of usage of water at the different time of the day in the 24 x 7 availability. This gives the design of the system as a whole i.e. ESR and distribution network. The WaterGEMS software uses Darwin designer which is a generic algorithm. It provides multi criteria optimization. The solutions provided by the software are ranked. This allows the user to choose the best solution which suits to his requirement of pressure and availability of water. Criteria has been used for the design of 24x7 WSS is as follow:

| Criteria | 24x7 WSS |
|----------------------------|--------------------|
| Hours of Supply | 24 Hours |
| Per capita supply | 150 LPCD |
| Frequency of supply | Daily |
| Residual pressure | Varies 7 m to 30 m |
| Pipe Material | HDPE pipes |
| Mode of Recovery | Telescopic Tariff |

For strengthening the existing pipe parallelly is not possible throughout the network due to insufficient width especially in street areas as all utility has to go through beneath the road only.

we have taken existing water distribution map from AMC and pasted on ArcGIS and then by using satellite raster image and with help of Thiessen polygon method created water boundary for the WaterGEMS software and then started 24x7 design with existing water distribution map and after all these process when run the design it gives all the errors in the distribution network by solving all that we come to the final design of 24x7 WSS for selected wards. From that design we come to know that 85% of the existing network has to be replaced for continuous WSS.

Figure 3 & 4 shows the 24x7 WSS design for the Sabarmati and old Wadaj ward which includes the 24x7 hydraulic model of water distribution network with various color coding and shapes where the shapes indicate the water pressure and diameter of the pipes in the distribution network. While the table information reflects the proposed infrastructure from the 24x7 WSS design which justifies the no. of Overhead tank required with exact quantity, Diameter and Material of the pipeline.

5. Yes you are right the option has been selected for the 24x7 mode of water supply is costlier among the all 3 given options. And agree that HDPE pipes and trenchless technology has its own disadvantages too. But the scenario in Ahmedabad city is that all the drainage, water, storm water pipes are of Ductile iron pipe and below table is showing how HDPE pipes are far better than existing ductile iron pipes.,

| HDPE Pipes | DI Pipes |
|---|---|
| <ul style="list-style-type: none"> • High flow characteristic • Light in weight • Excellent flexibility and strength • Minimize frictional losses • Laying length 40' • Pressure 260psi | <ul style="list-style-type: none"> • Rate of corrosion • Heavy in weight • Not that much flexible • High friction • Laying length 18',20' • Pressure 350psi |

All utility pipes and lines pass through the main road network and that too beneath the road line, so if they used trenchless technology, they can save the citizen from suffering lots of traffic jam, noise & air pollution due to excavation. In advance Ahmedabad city has sandy strata and every year in monsoon city has to face land collapsing especially where the land has been opened for the repair or construction of all these utility lines and pipes. By keeping all these

things in HDPE and trenchless technology is the best option for the Ahmedabad city by its social, environmental and sustainable point of view.

6. Public share contributed by public only. Yes, we will definitely make it in more detail and clear thanks for drag our attention.

Total project cost in 72 crores in which 10% would be paid by the public while remaining would be Government shares. In this case scheme is in ratio of (90:10) in between government and public. Once the project has been laid down to running it successfully government will give it on project basis to the private companies. Which shows that project is PPP mode.

7. yes there is some mistake in calculation of table.2 sorry for the inconvenience.

| Sr. No. | Description | Unite No. | Rate Rs. | Total Cost Rs. (Crore) |
|-------------------------------|----------------------------|-------------------|-----------------------|-------------------------------|
| 1 | One-time connection charge | 30,531 households | 2,300.00/House | 7.02 |
| 2 | O & M cost | 30,531 households | 2,400.00/House-Yearly | 7.32 |
| 3 | Average water usage charge | 30,531 households | 3,276.00/House-Yearly | 10.00 |
| TOTAL REVENUE COST Rs. | | | | 24.34/ year |

This final figure shows the revenue would be generated yearly which includes O&M charges, one-time connection charge and telescopic rat of water meter, you have to pay what you have used. This kind of survey also has been carried out in pilot project and its result is very positive.

Design has been done with forecasted population till 2050, so till that there is no issue for increasing in household over the period.

8. yes you are right that many apartments type buildings have several households but not with single connection. And if it is so then there is single connection for the electricity meter also, so they have solution for that also same has to be applied for the water meter too.

As I mention in point 5 if you consider all that point and then make economic calculation it would definitely viable for this option. And what we are telling is also a kind of suggestion if you look forward and think as a whole it would be more convenient.

For willingness to pay, telescopic tariff has been calculated on basis of actual consumption of water, where users have to pay on amount of their water usage. which is appreciated by the public also as they have to pay very nominal amount if they had used nominal quantity of

water. It is very helpful to environment also as there is no unnecessarily wastage of water would be happened.

9. If anyone really wants to do this, it is possible with help of WaterGEMS software you can easily find which pipe has to be replace and with help of ultra sound system you can find its age and leakage condition and with help of GIS you can find out existing coordinates of that pipes.

Again, thank you so much for your valuable time and detail study of our research work, we are sorry that you don't like it worth, we will try to make it worth by making changes which has been suggested by you for sure in manuscript.