REVIEW OF OPTIMAL DESIGN OF WATER PLUMBING SYSTEM IN FIVE-STOREYS BUILDING

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Abstract : Assurance of line measurements is the main issue in plan of water supply organizations. A few creators have zeroed in on the strategies fit for measuring the organization thinking about vulnerability and other significant perspectives. This investigation presents a use of multiobjective dynamic strategies utilizing transformative calculations to produce a progression of nondominated arrangements. Ideal plan of water distribution networks includes an assessment of various angles like financial and specialized examination, mechanical and pressure driven issues, and population based systems. These targets regularly struggle, to a degree that tracking down the ideal answer for one of those destinations lessens the other target's utility. This paper presents a way to deal with select an ideal plan between three pre-indicated situations that records for both monetary and specialized issues to supply the necessary water interest to clients, and furthermore fulfill leaders' rules and meet the plan purposes.

1.INTRODUCTION

Economy in development of housing, particularly for the middle income sector, is of prime importance in India. Optimized and efficient plumbing systems into the buildings are Cost optimization of construction materials and technologies for designing affordable housing for the middle income sector. There are many systems available for water supply, drainage and sanitation. In water supply, one may adopt one of the following systems: Direct supply from mains to ablutionary taps and kitchen with WCs and urinals supplied by overhead tanks

Direct Pumping system : Hydro-pneumatic systems. Overhead Tanks distribution includes Multi-pipe System and One pipe system. Out of these, Overhead Tank distribution system is most common in urban areas and One-pipe system is popularly adopted. In drainage and sanitation, one may adopt any of the following: 1. Single Stack System 2. Single Stack (one pipe) partially ventilated system 3. One pipe system 4. Two Pipe system.

Other than structural stability there are lot of services being emphasized like water supply, sanitary, fire-fighting etc. Some pipes are used below: PVC – (Poly Vinyl Chloride), UPVC – (Unplasticized Polyvinyl Chloride), CPVC – (Chlorinated Polyvinyl Chloride).

Water Piping Systems in Buildings : For plumbing purposes, the expression "multi-story" is applied to structures that are excessively tall to be provided all through by the typical pressing factor in the public water mains. These structures have specific requirements in the plan of their clean seepage and venting frameworks. Central conduit supply pressing factors of 8–12 meters (25–40 feet) can supply a normal two-story building, yet higher structures might require pressure promoter frameworks. In sloping regions, the drinking-water supply pressures will differ contingent upon the ground rise. In these cases, the water authority might need to determine regions where specific stockpile pressing factors can be depended upon for the plan and activity of structures. Where a structure of at least three stories is proposed an authentication ought to be acquired from the drinking-water supply authority ensuring that the present and future public drinkingwater supply pressing factor will be sufficient to serve the structure. On the off chance that the public water pressure is lacking, appropriate means will be given inside the structure to support the water pressure.

2.REVIEW OF LITERATURE

Optimal design of pipe networks for these type of distribution system have been presented late by various researchers such E.Alperovitsl and U. Shamir(1977), Prof.dr.eng. Ioan Sarbu(2009) etc. When we deal with the plumbing systems in buildings, optimal design of water piping system is an important factor for the reduction of cost. The literature dealing with the water distribution pipe networks, traditional and optimal design of pipes in residential buildings is discussed.

Shamir (1979) has briefly explained the structure and operation of water distribution system and has outlined the basic mathematical tool used to analyze their physical behavior. He has investigated and discussed the various methods for optimal planning, design, and operation.

Goulter (1992) has reviewed the use of system analysis technique and n particular optimization based design of water distribution network. He emphasized over the need of more research in future for the development of decision support system incorporating optimization and classical simulation models with an interactive graphic capacity.

The equivalent pipe diameter method for network optimization has been developed by Deb and Sarkar (1971) using the pressure surface profile capital cost functions for pipes, pumps, and reservoirs.

Swamee and Khanna (1974) have shown that this method has two major drawbacks: first it lacks mathematical justification for cost equivalent pipes; and second, a hydraulic pressure surface over the network must be artificially created.

Kessler and Shamir (1989) investigated a theoretical analysis of the linear Programming (LP) gradient method for optimal design of water distribution networks. Bhave and Sonak (1992) investigated on the linear programming gradient (LPG) method originally proposed by Alperovits and Shamir (1997) and later by Kessler and Shamir (1989). Of the several techniques available for optimization of looped water distribution networks.

Park and Liebman (1993) have quantified the redundancy in a looped water distribution network using the expected shortage due to failure of individual pipes as a surrogate measure of reliability that permits incorporaton of some considerations of frequency, duration, and severity of damage.

Quindry et al (1981) in their investigations addressed potential reductions in the cost of providing water through the development of an improved method of system design. In their study a gradient step is added to the SCHAAKE AND LAI (1969) formulation, resulting in an algorithm which is computationally simpler.

Computation of Energy Head Loss in Pipes

The selection of pipe size involves mainly the computation of energy head loss due to friction in pipes. Different equations are available for computing frictional head loss such as due to Darcy-Weisbach, Hazen-Williams, Scoby etc. We use Darcy-Weisbach and Hazen-Williams formulae for this study. For accuracy, the Darcy-Weisbach Formula is preferred and for simplicity, the Hazen-William's Formula is preferred by field engineers.

Darcy-Weisbach formula relates the frictional head loss with different parameters as: Hf = f L V ^2/2 g d Where, Hf = Frictional energy head loss in metres f = friction factor for pipe material (dimensionless) L= Length of pipe in metres d= Internal diameter of pipes in metres V= Mean velocity of flow through the pipe in m/sec and g = Acceleration due to gravity The friction factor can be calculated using Swami and Jain (1976) formula: f = 0.25 [log10 (ε 3.7d + 5.74 Re .9)] ^2 Where, ε = Average height of roughness elements in metre and Re=Reynolds Number. In this study ε is taken as 0 .00015 m for GI Pipes. 14 7/27/2021 Add a footer

• Hazen-William's formula is given as: Hf = 1/0.094(Q/CH)^1.85 L/d^4.87

Where, CH = Coefficient of hydraulic capacity and Q = Flow rate in pipes in cubic metre per second In addition to energy head loss due to friction there is loss of energy head in pipe fittings, bends, junctions etc.

These energy losses are together known as minor loss. For calculating the minor loss, various type of pipe fittings can be counted and converted into equivalent pipe length. The value of minor loss can be calculated as: hm = K V^2/ 2 g Where, hm = Minor loss in pipe fittings in metre and K = Loss coefficient (dimensionless).

Hot water and other dual supply systems

Double drinking-water supply frameworks are those where two distinct grades of water are accessible in discrete funneling frameworks. A model is the arrangement of a tap at a sink providing water straightforwardly from the approaching water administration while all different apparatuses are taken care of from a capacity tank. In created nations, the most normal is an optional arrangement of funneling conveying boiling water to sink, washbasin also, shower. Incidentally a water conditioner is introduced to treat part of a homegrown framework, yet aside from these cases double drinking-water supply frameworks are seldom found inside single residences. A way to deal with water protection being acquainted in certain networks is with reuse greywater to an external tap for water system employments. A chief worry of all double frameworks is the confirmation that no cross-associations have happened during establishment or fix.

Traditional Design Method

Generally, to plan the water funneling framework in structures, an experimentation strategy is utilized in which line sizes are controlled by adjusting the energy head misfortune with expected energy to meet the pressing factor head and release necessities. The overall plan contemplations are examined before in this part. In the process for plan of lines in building, initially one needs to work upon the water interest in the structure. From Table 3.1, one can take installation unit and pace of stream for installations utilized in the structure. The greatest stream rate among every one of the accessible installations is utilized for the estimation of gross interest of the structure which is determined as the result of number of pads in each floor with number of floors and afterward with greatest stream pace of apparatuses.

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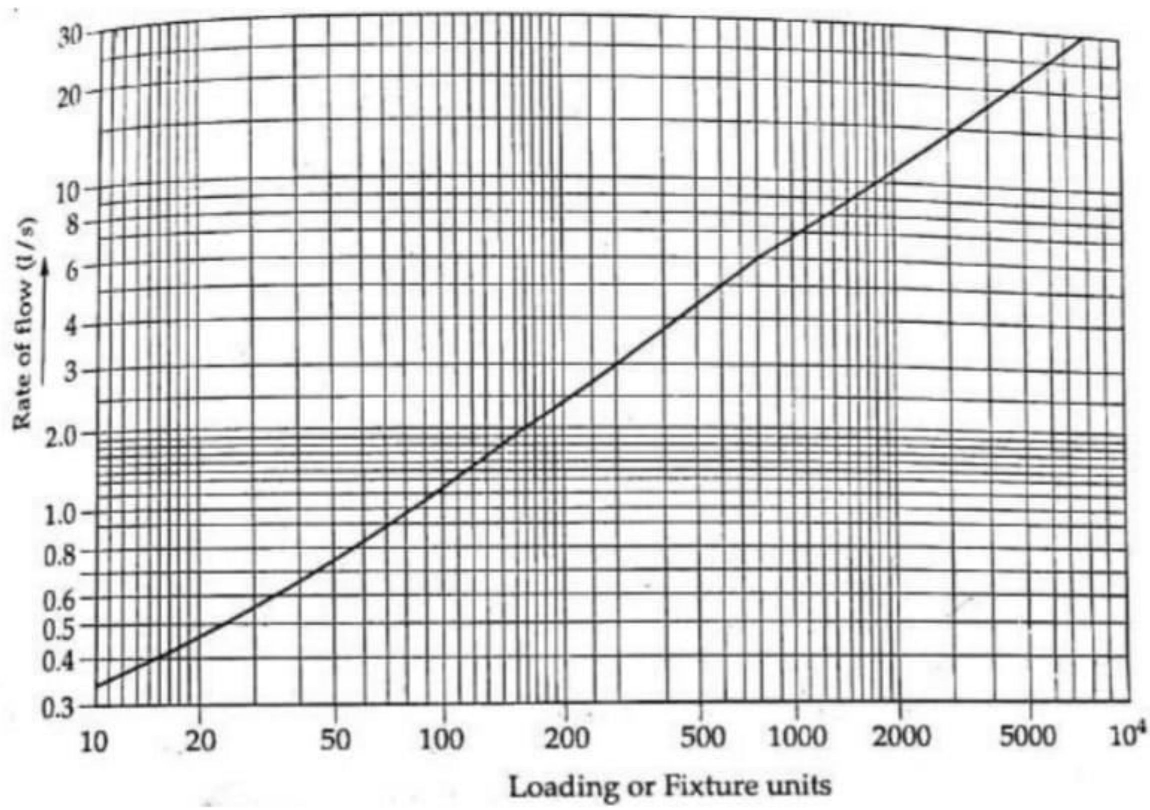
Isometric sketch of the line network in the structure is ready, where the lines in different floors are stamped and numbered. Second step is to assess the likely water interest in pipes.

OPTIMAL DESIGN METHOD

In this investigation a direct programming based strategy is created for planning the downfeed channeling framework in structures. The direct programming based technique includes minimization of absolute expense of the lines in all floors of the structure fulfilling the necessities of the length, least remaining pressing factor head and head misfortunes for assessed release esteems through various lines in various floors. the connections of a line network in private structure are characterized by the upstream hub, I and the downstream hub, j, separately. Then, at that point for each connection ij in an organization being planned an applicant set of widths, m is to be thought of. One bunch of choice factors given by the length of line for every one of the up-and-comer measurements to be utilized in each connection ij. These lengths are communicated as Xijm and they have related costs given by Cijm per unit length.

To begin with, the straight programming based advancement technique created in this investigation is utilized to process the ideal breadth of downfeed pipes. Then, at that point, the customary strategy for pipeline configuration is utilized to decide the measurements of downfeed pipe in various floors of the building. First the stream rates were assessed then the energy head misfortune in downfeed pipes just as branch pipes were registered by both Darcy-Weisbach and Hazen William's conditions.

Standard Graph for Rate of Flow v/s Loading



3.CONCLUSION

Plumbing and waste framework for a multistorey structure is profoundly underlined in designing plan, on the grounds that its everyday help related issue is exact methodology may not bring about great and able assistance. Plumbing configuration is a liquid mechanics issue – Flow through pipes. This includes exactness pressure head and grinding misfortune, computation and precision in execution of different lines, joints, engine and so forth, Only through appropriate designing methodology and plan such assistance is conceivable. Seepage framework is a water driven issue – Open channel stream. This includes difficulties throughout everyday life accomplishing self – purifying velocityand appropriate gravitational stream prompts sewage treatment plant and other channel units. The coordinated pipes and waste framework configuration results conservative and proficient assistance.

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