"TO STUDY THE PLANNING AND DESIGNING OF PIPE DESTRIBUTION NETWORK"

Mr. Y. B. Survase, Dr. M. G. Deshmukh, Tank Gaurav, Kusumade Harshal, Misal Mandar, Padavale Amar, Bagal Ganesh, Thorbole Mahesh.

1. Assistant professor Department of Civil engineering, SVERI's College of Engineering Pandharpur . Maharashtra
2. Associate professor Department of Civil engineering, SVERI's College of Engineering Pandharpur, Maharashtra
3. UG Student Department of Civil engineering, SVERI's College of Engineering Pandharpur, Maharashtra

ABSTRACT: 66.67% of farmland relies on pandharpur and groundwater sources for irrigation, and global warming and climate change often lead to drought conditions. Sewerage distribution network systems have various drawbacks such as uneconomical water loss and maintenance costs in the long run. This shortcoming can be overcome with the latest alternative pipe distribution network system.Pipe distribution network systems have advantages over traditional methods. The study area is the Kudari Medium Irrigation Project in the Krishna River basin in the Satara district of Maharashtra. This study focuses on the design of some PDNs in the Kudari Medium Irrigation Project and the hydraulic modeling of irrigation networks designed for effective water management systems. To minimize this problem, this research contributes through an approach to the planning and design of pipe distribution networks used for irrigation purposes. Pipe distribution network (PDN) for irrigation is one of the best solutions to significantly improve design and actual OPE (efficiency of the entire facility). Pipe Distribution Network (PDN) is a technique for irrigating command areas through a network of HDPE pipes under gravity rather than open channels. This document describes the need for a PDN system, the benefits and scope of PDN, the basic requirements for PDN implementation, general PDN installation guidelines, and PDN planning and design principles. This treatise also discusses the magical improvement of OPE in irrigation projects with the introduction of PDN. This paper compares the project efficiency improvement rate and other parameters of the illustrated project in the village of Dapawadi in Satara, Maharashtra.

Keywords:-Pipe water distribution network, project efficiency, HDPE pipes

1. Introduction:

This project uses a pipe distribution network system instead of a channel distribution system. Domestic irrigation development has been carried out as a canal distribution network that exits rivers, dams and reservoirs, mainly by gravity to carry water to drains, and then through waterways and channels to drains to farmland. Previously the canal was unlined. Later, these unlined canals were reinforced with lining to increase water transport efficiency, resulting in extended water supply to additional fields that were not previously irrigated. Faucet irrigation systems, when properly implemented, can reduce irrigation water requirements without impacting net irrigation demand (NIR), but offer one option to improve water utilization efficiency.The estimated overall efficiency of tubular irrigation networks is on the order of 70-80%. The OPE of pipe distribution networks ranges from 70 to 90%. PDNs have many advantages over traditional CDN systems. The Amravati Nagthana-2 project shows that using a pipe distribution network instead of traditional canal distribution increases the cultivable command area by 88%, making the pipe distribution network more efficient and more than the canal distribution network. We have confirmed that it is an excellent solution. 1st objective: Hydropower design for Kudari irrigation projects . Efficient distribution network. Irrigation plays an important role in meeting the growing population's grain demand. 2nd Objective: Piping distribution network design. Greater demand with limited water supply to improve overall efficiency. Velocity & drainage from pipes. Dimension the diameter of the pipe.

2. OBJECTIVES:

- To design the Pipe Distribution Network.
- To Increase total efficiency & greater demand on limited water supply.
- To design The Velocity & release of water through pipe.
- To design the diameter of pipe.

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3. MATERIALS USED:

The various materials used are: - **High Density Polyethylene Pipe (HDPE Pipe) :-** HDPE material is a thermoplastic polyethylene derived from petroleum, which is suitable for high pressure piping due to its high impermeableness and strong molecular bond. .. Polyethylene pipes are not made of metal, so once filled with a metal detector locator is ineffective. Metal tracer tape or copper wire can be attached to the sides of the pipe to help locate the buried polyethylene pipe.The retaining strap / wire is attached just above the crown of the pipe before the final backfill.

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2. Mild Steel Pipe (MS Pipe): Mild steel pipes can be manufactured in open hearth or electric furnaces or from mild steel produced by any basic oxygen process. Tubes must be manufactured using either a seamless (S) process, an electrical resistance induction welding (ERW) process, or a submerged arc welding (SAW) process.

3.Connection Material:-Commonly used connections are:

1. Fusion welding

2. Butt fusion

3. Socket fusion

4. Electrical fusion

In this project, various pipe joints were joined mainly using butt fusion.

Filler:-. In this project, the pipes will be laid underground, so the following natural materials are needed to fill the pipes: B. Earth, Malam Earth, gravel, etc. 3.1 Pipe Type Selection: - In a pipe distribution system, pipe type selection plays an important role in keeping the cost of the pipe network as low as possible. There are different types of commonly used pipes such as MS pipes, HDPE and PVC. To do this, you need to consider the following factors: Modified Hazen-William Coefficient (C) Internal and External Pressure in Pipe Durability of Pipe Material The ease of jointing and durability at the workplace, as the design life span for pipe distribution network is considered as 50years.Ease of availability of many types of diameter and its viability. Availability of skilled workers for setting up at work place. The pipes and its fittings should be easy. Fittings should also be able to tolerate the pressure of water in the pipes .If the soil in which the sulfate content is more than 1%, then do not use metal pipes and cement pipes.

Table No-1 Pipe Selection as per Diameter

Diameter of Pipe	Type of pipe
Up to 450 mm	HDPE
500 mm to 800 mm	MS Pipe
Above 900 mm	Concrete Pipe

3.2 Designation of grade of HDPE pipe:-

The pipes shall be designated by the method of manufacture followed by the grade number corresponding to the minimum specified tensile strength in MPs following the symbol Fe as given in Table. Fe 410 indicates electric resistance welded or induction welded steel pipe having a minimum tensile strength of 410 MPa

Table No-2 Designation of grade of pipe

Method of manufacture of Pipe	Reference	Steel Grades Applicable		
(1)	(2)	(3)	(4)	(5)
Seamless	S	Fe 330	Fe 410	Fe 450
Electric resistance including induction welded	ERW	Fe 330	Fe 410	Fe 450
Submerged arc welded (including spirally welded)	SAW	Fe 330	Fe 410	Fe 450

3.3 Physical Characteristics of HDPE Pipe:-

Table 3: Physical Characteristics of HDPE Pipe

Sr.No	Characteritics	Value
1.	Minimum Required Strength (MRS)	10.0 MPa
2.	Allowable Compressive Strength	7.93 Mpa
3	Tensile Strength at Yield	23 Mpa
4.	Modulus of Elasticity (50 years)	200 Mpa
5.	Poisson's Ratio	0.45

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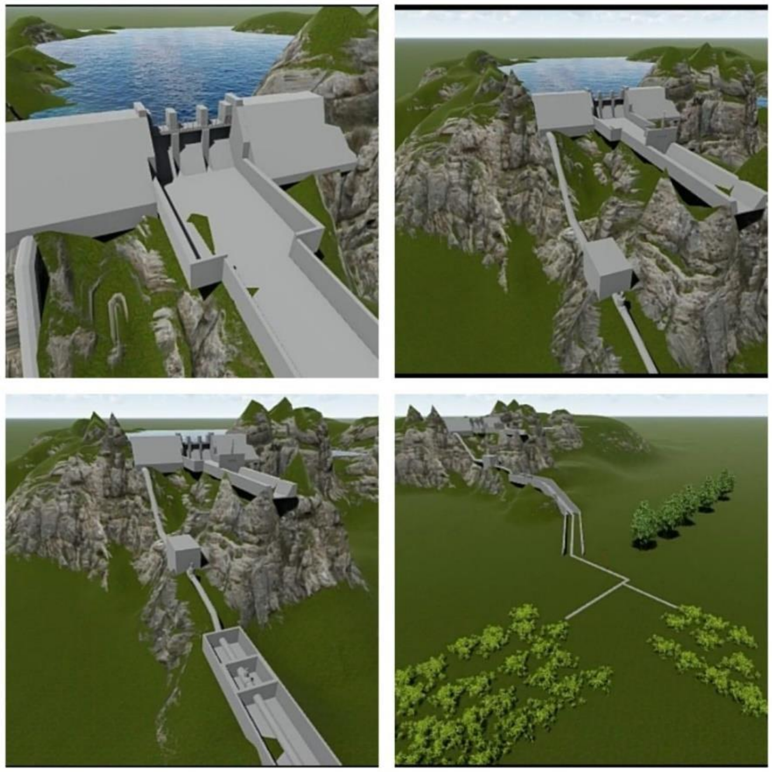
3.4 Model Photos:-



4. METHODOLOGY:

The goal of the project was to study planning and designing of pipe distribution network system instead of canal distribution system. To accomplish this goal, the following objectives were established:

- **Survey**:- As per the Government Resolution dated 02/02/2017; a piped irrigation system should preferably be used for the command areas, having ground slope 1:500 or more. Piped irrigation depends upon hydraulic gradient (H.G.L.) of the source hence piped irrigation system depends upon the topography of the area and H.G.L. of the source
- **Designing of Pipe Network**:- In this we design Diameter of pipe , Velocity of flow and design discharge of pipe.
- **Estimation of project**:-
- **Execution of project:-**

5. SAMPLE CALCULATIONS:

Calculation for Discharge:-

1) C.C.A.(Culturable Command Area) = 232 ha.
2) Fortnightly water demand for a (Dec- II)as per Modified Pennaman Method for Project = 0.591 Mm^3 for 1000 ha.

The water demand is given in Mm^3 and it is for 1000 ha, The C.C.A. for the Chalkewadi Project is = 232 ha.

Hence water demand Volume for this area = $0.591X10^6$ (m^3) x232 (ha)/1000 (ha) =137112 (m^3) (This Net volume of water is required for Dec-IInd fortnight at outlet location and that is to be discharged continuously in 12 days) The above volume of water is to be increased by 5% for water loss and 75% for Field Application Efficiency

Hence Gross Volume of water required = $\frac{137112 \times 1.05}{0.75}$

= 191956.80

≈ 191957 m^3

Hence,

First Discharge for 232 ha = 191957/ (12 days x 24 hrs x 3600 (Sec))

= 0.185 m^3/sec

Discharge/ ha = 0.185/232 (CCA)

= 0.00079

≈ 0.0008 m^3 /sec ≈ 0.8 lit /sec

6. RESULTS:

1. Design diameter of pipe:-

Table No 4 Excel Sheet for PDN Design

Sr. No.	Chainage(m)		G.L. @ start	G.L. @ end	Pipe top		Discharge	Length	Dia provided (Inner)	Dia provided (Outer)
	From	To	m.	m.	At start	At end	cum/ sec	(m)	(m)	(mm)
1	2	3	4	5	6	7	8	9	10	11
1	0	30	93.99	93.95	93.44	93.43	0.185	30	0.409	450
2	30	60	93.95	93.85	93.43	93.41	0.185	30	0.409	450
3	60	90	93.85	93.82	93.41	93.29	0.185	30	0.409	450

2.Design velocity of pipe:-

Table No-1.6 Efficiency for surface & micro irrigation in pipe

Loss of head due to friction by Hazen William's formulae with 10% extra for bends	HGL		Type of pipe	Class of pipe (kg/ cm2)	Head w.r.t G.L		Residual head available @ top of pipe		Velocity in Pipe by Hazen William's Formula.
	At start	At end			At start	At end	At start	At end	
12	13	14	15	16	17	18	19	20	21
0.115	106.00	105.885	HDPE	6	12.010	11.935	12.551	12.451	1.5
0.115	105.88	105.769	HDPE	6	11.935	11.919	12.451	12.350	1.5
0.115	105.76	105.654	HDPE	6	11.919	11.834	12.350	12.360	1.5

3. Overall Result:-

1)	**Discharge of PDN**	**0.0008m^3/sec/ha**
2)	**Velocity of water is**	**1.5m/sec**
3)	**Diameter of pipe**	**0.443 m**
4)	**The total cost of our project**	**7481648 /-**

Conclusion:

The modified Hazen-William equation is suitable for calculating the pressure loss due to friction in PDN systems. With the introduction of the underground PDN system, transmission and distribution losses have been reduced. An assessment of water savings will be carried out by improving efficiency. Saved water from 0.845 cum. The PDN system is one of the best ways to increase efficiency. This study concludes that the water efficiency of traditional CDNs is low d. HOn the other hand, 25% to 40% are improved by gravity-based PDN. H. Overall water efficiency is 70% to 80%. Because the PDN system saves more water than the CDN system. This is convenient when the cost of land is high. It is also the place where the canal passes through deep cuts in black cotton soil, making it suitable for places where the latest technologies such as sprinklers and drip irrigation are used. To improve the overall project efficiency of the irrigation project, the Pipe Distribution Network (PDN) is one of the best solutions with a good perspective. To implement the PDN system, you need to follow some guidelines. To make this system more efficient, we need some new and improved guidelines that can be implemented after project implementation and research. **8.**

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