

# Practicability of Study on Substitution of Canal Distribution Network by Pressurized Pipeline Distribution Network for Effective Water Management

Mr. A.P.Jathar<sup>1</sup>, Prof. S. S. Deshmukh<sup>2</sup>

<sup>1</sup>Department of Civil Engineering, T.A.E, Pune.

Assistant Professor, Department of Civil Engineering, T.A.E Pune,

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**Abstract**— Water, which is a valuable, finite, renewable and shared resource required by various sectors, must be managed optimally. Stress due to scarcity of water is growing at an alarming rate. To reduce this stresses and to meet water demand of all the sectors, construction of new water projects is essential, but it involves huge investment and social problems like land acquisition, rehabilitation etc. Therefore, it is essential to search innovative alternative for modernization of existing water distribution system. The Pipe Distribution Network (PDN) system is one of the best possible alternatives to overcome the limitations of conventional gravity flow Canal Distribution Network (CDN) system. To developed this system to remove water losses, land acquisition is less, at some point water meter connect then to define the actual discharge at that point. It can be beneficial for the management of cost of construction and some losses related to canal and solve the water discharge problem. In this research to finalized some factors related to CDN and PDN. the data of this study were collected using a web survey. The responses are selected of offline and online will be 20, sent to 82 respondent related to irrigation project, water resources department. To find some important factors related to project. then to implement over there to some problem problems from open canal.

To avoid the water losses in CDN to design the pipeline network to the overall length of canal. Then to design the pipeline network for irrigation purpose and feasibility on cost and time parameters. To observed the friction losses in pipeline network to calculate in design.

**Key words** – Canal Distribution Network(CDN), Pipe Distribution Network (PDN)

## INTRODUCTION

Water is life for existence of all living being on the earth. Water ensures food security, feed livestock, maintain organic life and fulfill domestic and industrial needs (Kolhe 2012). The population of mankind is increasing at distressing rate and human is tapping natural resources to cater his need. The available resources including water and food are falling shorter to cope up with the need of mankind. To overcome this problem it is very essential to conserve the water in many ways and utilize it so that food production should be sufficient to serve for mankind need at reasonably low cost.<sup>12</sup> To increase food production from agriculture land, irrigation

is one of the tool to conserve the water and utilize it for agriculture production. Irrigation of agriculture land is done using various methods such as flow through open channel, lift irrigation, drip irrigation, underground pipelines et. Irrigation sector is the biggest consumer of water as more than 80% of available water resources in India are being presently utilized for irrigation purposes.

The following major reasons have been identified for low Water Use Efficiency of Irrigation projects. (1) Poor or no maintenance of canals/distributaries/minors of irrigation systems resulting in growth of weed & vegetation, siltation, damages in lining etc. (2) Distortion of canal sections due to siltation or collapse of slopes resulting in some channels carrying much less and some other channels carrying much more than their design discharges. (3) Non Provision of lining in canal reaches passing through permeable soil strata. (4) Leakages in gates and shutters. (5) Damaged structures. (6) No regulation gates on head regulators of minors causing uneven distribution of water. (7) Over irrigation due to non-availability of control structures and facilities for volumetric supply of irrigation water to farmers. (8) Poor management practices. (9) Lack of awareness among farmers about correct irrigation practices and cropping pattern.

## II. LITERATURE REVIEW

**Skogerboe V. Gaylord, Walker R. Wynn, Austin H. Lloyd, (1969)** Analysis of Small Water Management Structures in Irrigation Distribution System. This paper gives the measures and controls for management of the water structure which are affected over year due to wear and tear. Also it gives the factors for the affecting the water holding structures. The measures which are very effective in controlling the wear and tear. In this paper, we studied the control measures and management is for the water structures are given.<sup>[1]</sup>

**Swamee Prabhata K., Mishra Govinda C., Chahar Bhagu R. (2003)**, The study shows the canal water losses constituting seepage and evaporation losses which broadly depends upon the channel geometry and area of free surface respectively. The geometry and the area of the canal helps in designing minimum water loss in the section of canal. The loss of water is substantial part of useable water. Also it gives the measures to prevent the losses with

due course of time which are mainly responsible for the failure purposes. The paper gives us the brief explanation about the effects of the canal system. We studied the effects and how to measure the losses observed in the canal irrigation. [2]

**Mr.S.B.Kulavmode, Dr.S.S.Valunjkar, (2017)** The use of Pipe Distribution Network (PDN) instead of Canal Distribution Network (CDN) to increase the overall project efficiency of irrigation project and thereby reducing the stresses due to water scarcity. In order to achieve maximum benefits from PDN, planning, designing, and construction of it should be carefully done. This paper provides a guideline for planning, designing and construction of PDN system for irrigation. It is recommended that PDN system could be economical and feasible over conventional CDN and this system is so flexible that it can be implemented as a new scheme or used to convert the existing CDN. Demand of water for civilization and industrialization is increasing at an alarming rate. This increase in demand reduces the water availability for irrigation. To overcome this water scarcity, optimum utilization of irrigation water is necessary which will help in irrigating maximum area and for this purpose there is need to modernization of existing conventional CDN system. PDN system is recommended for irrigation in command area. PDN system saves water over conventional CDN system and should be preferred where land cost is comparatively high and farmers are unwilling to handover their valuable land. The pipe line distribution system would be more suitable for implementation of modern techniques like sprinkler and drip irrigation etc. The planning and design of PDN should be carefully done so that maximum benefits of the system can be utilized. [3]

**Fort Denise and Nelson Barry (2011),** The study provides brief introduction to some of the pipeline projects proposed recently in the West of Mexico. Also it provides a summary of issues that have often been overlooked in proposed pipeline project and recommendations which address broad range of issues such as 'New Water Supply Projects, Federal Funds, A Beneficiary – Pays Approach to Financing Water Projects. In this paper, we studied that minute detailing of the existing and new projects concerning pipelines. [4]

**S.Chandewar, D.Sonwane, A.Ahire, P.Meshram, (2018),** This project describes comparative study on the use of pipeline system & canal system. The canals enhanced irrigation water losses and the annual cost of maintenance became uneconomical for the long term. In pipes easy maintenance, durability, modification and flexibility give them term potential to be an economical alternative to replace the canal. Due to the availability of plastic Irrigation pipe and reinforced concrete pipes and their common use in irrigation, they were selected to construct network pipeline. The conveyance and the distribution efficiencies can be increased due to the installation of pipeline and the water use with illegal outlet can also be

reduced by the pipeline system. However, in many cases the replacement of open channels is done with pipes. The various report noted the advantages of pipeline systems over open-channel system. they are study design only one minor i.e. Kani Mirzapur Minor-2 off taking from R.D.1020 m from main canal for pipeline system which is feasible in case of saving water and money for term. So if we can replace overall canals, distributor and minors by pipeline system it will be more feasible to reduce water logging it's fertility, in addition to increase in command area and optimum use of water. Hence, the further detailed study by water resource department may validate the conclusion. The disadvantage of PDN is the possible disruption and losses due to earthquakes and considering the protection from the earthquakes. Also take a special care when the silt content in water is more, to avoid the blockages in pipeline. [5]

Water is a precious commodity. open canal system conveys water from dam to the agriculture land for irrigation. The average water use efficiency of Irrigation Projects is assessed to be only of the order of 30 - 35%. Thus there is gap between irrigation potential created and utilized, and it is up most important to minimize the gap. The conveyance and the distribution efficiencies can be increased due to the installation of pipeline and the water use with illegal outlet can also be reduced by the pipeline system. The benefits for farmers to increased efficiency of water.

### III. OBJECTIVE

- I. To study the canal distribution system and its problems.
- II. To study about the pipeline distribution network system.
- III. To identify and analyze factors related to losses in water distribution system.
- IV. To do feasibility study of replacing canal distribution network by pipeline distribution network to design the pipeline network.

### IV. Need of Study

Open canals are used to convey the water from storage reservoir to the agricultural land for irrigation. Water has to travel from its head to fulfill the needs of agriculture; irrigation channels with poor maintenance causes heavy losses during its conveyance phase. It is observed that the losses due to evaporation, infiltration, percolation and water thefts in open canal reduce the efficiency and yield of irrigation. Therefore it is necessary to check these conveyance losses in case of canals Installation of pipeline to convey water use with illegal outlets can also be reduced by the pipeline system. to used pipeline network than to reduced water losses, reduce time of water flow through field, the land acquisition is less, and also to reduced the total cost of project.

Advantages of PDN system over CDN system

- As almost entire system is buried, there is considerable saving in land acquisition cost.
- The losses due to seepage, evaporation, thefts can be avoided by implementation of PDN.
- PDN is suitable in any type of strata like hard rock, black-cotton soil, saline land etc.
- By use of PDN, Part of un-command area can be brought under irrigation.
- Low maintenance cost- in PDN continuous maintenance is not required as in case of earthen channel. PDN system requires a minimal maintenance during first seven years.
- Advanced technologies such as drip, sprinklers, sub-surface irrigation system of irrigation can be implemented.
- Water logging can be reduced with the help of this system.
- Irrigation principle may be achieved by equitable water supply from tail to head.
- Minimum manual control is required in operation network.
- Amount of revenues generated will be more as water can be supplied on volumetric basis.

Limitation of PDN system

- Great care in design and construction of PDN is necessary.
- Silt must be removed from water before supplying it to PDN.
- High initial investment in pipeline- but in the long run pipelines are economical, because of saving in water, labour, maintenance, land & permanence of installation.
- This is modern system, more study and experience is required in this field.

Design :

Required Data:

- Slope of channel: 1:4000
  - Velocity of flow = 1 m/s
  - Total Area to be Irrigated = 11868.67 Ha
  - Delta ( $\Delta$ ) = 40 cm
  - Total Duty = (perennial crop + rabbi season crop)
- = 1800 + 1550
- = 3650 Ha/cumec

Hence,

Head required at head of distributaries is equal to,

$$= \text{Total Area} / \text{Total Duty}$$

$$= 11868.67 / 3650.00$$

$$Q = 3.25 \text{ m}^3 / \text{sec}$$

Therefore, Area required For Pipeline can be calculated by,

$$Q = A \times V$$

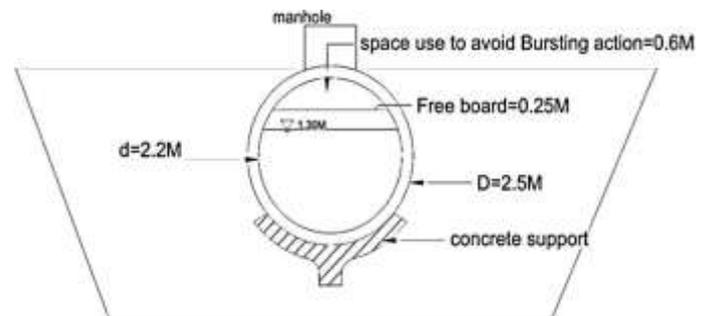
$$A = Q / V$$

$$d = 2.00 \text{ m}$$

Kept free board of 0.5 m

$$\text{Total depth of pipe} = 2.0 + 0.5$$

$$= 2.50 \text{ m}$$



The above fig. gives the cross section of main pipeline.

V. CONCLUSIONS

1. During this study we found out various criteria, which are useful for effective selection of system.
2. Without a proper and accurate method for selecting the most appropriate, the performance of a project might be affected, so study out and chose effective method.
3. Discussion on results of Factors selection - For the selection of factors which are best for the implementation of Replacement of CDN by PDN are ranks by using SPSS descriptive analysis.
4. In the construction of canals the cost is mainly due to the excavation, maintenance cost, cost of hydraulic structures like siphon, cross drainage work etc.
5. The main fact about the canal is it requires more cost for its construction but the benefits are limited.

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## AUTHORS

**Jathar Amit Pralhadrao** is a post-graduation student of Construction and Management in Civil Engineering Department, T.A.E, Pune, Savitribai Phule Pune University.

**S.S.Deshmukh** is an Assistant Professor Civil Engineering Department at T.A.E, Pune, Savitribai Phule Pune University, and Pune Maharashtra.

Prof. S.S. Deshmukh, (Guide), Department of Civil Engineering, T.A.E Pune, Savitribai Phule Pune University, Pune.

Prof. S.S. Deshmukh, (Head of Department), Department of Civil Engineering, T.A.E Pune, Savitribai Phule Pune University, Pune.