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Assessment of Underground Water Utility Renovation in Uttam Nagar Area, Pune A Review

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ABSTRACT: Water pipeline fails due to various reasons. As per consideration most of the pipeline fail due to pipe aging problems but one more important factor for failing is over stressing due to increasing in demand of water. According to observations pipe can fail due increase water pressure which results to rise in maintenance cost. This paper based on renewal of water pipeline by considering risk factor and cost factor. Renewal planning is complicated by the many factors that must be considered when choosing which pipelines to replace, and when. This paper introduces the principles of pipeline renewal and focuses on two of the key factors that are at the foundation of any renewal program; data collection and condition assessment. Understanding and effective implementation of these two steps will greatly assist the efficient and sustainable planning of pipeline renovation. The decision support systems used by many overseas utilities are also introduced and briefly discussed.

Key Words: Risk profiles, PARAMS Theory, Pipeline Renewal planning, Data collection.

I. INTRODUCTION

Uttamnagar area comes under Haweli Taluka and located West side of Pune city on NDA Road. Before sone months there was gram panchayat raj but now working authority comes under Pune Muncipal Corporation. This is great cheng towards the development of Uttan nagar area better transportation facility to go anywhere in pune and large space to grow people due to surrounding industrial area affecting migration of people towards Uttam Nagar.

Failures of water pipeline is not only have a great impact on people routine life but also cause significant wastage of water which is an essential and valuable resource to human beings. As a result, deterrent maintenance for water pipeline, particularly in urban networks, which having great importance for a sustainable society. To achieving effective replacement of water pipeline failure prediction aims to proactively find those most likely to fail or damage pipes. It is important and has been attracting more attention from both academic and industrial, especially for the civil engineering field. Sufficient quantity of clean water, distributed through a complex and growing network of water pipes, is essential for people daily life. In fact, the large-scale urban water pipe networks are in fast growth to meet the increasing demand arising from the fast developing urban areas failure prediction.

1.1 OBJECTIVES

The main objective of this work is to evaluate the effectiveness of conventional as well as fabrication method for construction:

- Assessing current and future risk levels of a particular pipe and groups of pipes compare the present scenario with past and future scenario for pipeline project by analysis.
- To suggest and discuss various parameter regarding pipeline assessment.

II.LITERATURE SURVEY

[1] Management of Underground Utility by using RS & GIS techniques : A Review
By: Ganesh Ragade, et.al

International Journal of Innovative Research in Science, Engineering and Technology

This paper presents overview of underground utility and their accession by using geo-technology to mapping, monitoring, modelling, measuring, and

managing existing underground pipeline. This paper explores the technique which are implement in the literature, which is used to convert regular infrastructure to smart infrastructure.

Optimization of pipeline comes under management issues. Lots of research has been done in literature on managing pipeline for route optimization. This paper present overview of underground utility and summarize some of them as a paradigm found in literature.

[2] Pipeline Rehabilitation Planning

By Roland Palmer-Jones [1] et.al

An operator faced with an onshore pipeline that has extensive damage must consider the need for assessment, this sorted assessment to be used in the assessment schedule. This paper will consider pipeline assessment based on the authors' experiences from recent projects, and recommend a simple strategy for planning pipeline assessment.

It will also consider assessment options like External re-coating, Internal lining, Internal painting, Programmed repairs.

[3] Reliability-based management of underground pipeline network using genetic algorithm

By Lutfor Rahman Khan et.al Department of Civil Engineering, University of Greenwich, United Kingdom

When the residual ultimate strength of buried pipeline has exceeded the limit due to external loadings, failure becomes imminent and overall reliability is reduced. This paper is concerned with estimating reliability and deciding when and how interventions are needed to prevent unexpected failures of flexible buried metal pipelines subject to externally applied loadings causes stress and corrosion at minimum cost. The probability of failure due to corrosion induced excessive deflection with respect to the varying time has been analysed in this paper. Then intervention year for maintenance is determined and the most appropriate renewal solution is identified by minimizing failure risk and whole life cycle cost using genetic algorithm.

III.RESEARCH METHODOLOGY

3.1 General

The data pertaining of different aspects of the study region is collected from the Talathi office, Grampanchayat, Panchayatsamiti, tahsil office of Uttam Nagar Pune. Some information regarding need of renovation, issues of renovation planning of renovation was collected through reference books.

3.2 Data Preparation

Only assured source for this Regional Rural water Supply Scheme is Khadakwasla Dam Previously Pune Muncipal Corporation had agreed to supply raw water to village by providing connection to each rising main of 1500 mm diameter laid from Khadakwasla dam to Warje W.T.P.

The rate of water supply and daily water requirement is proposed to provide water supply at 90 LPCD. Floating population is served to be 10 LPCD daily.

Accordingly gross water requirement of Uttam Nagar in year 2025 is up-to 1.214 ML.

3.3 Data Analysis

Population Projections by Conventional Methods

- **Arithmetical Increase Method**

In this method the average increase of population per decade is calculated from the past record and added to the present population to find out population in the next decade as per requirement.

Formula : Pn = Po + nx

n = (2047-2035) / 10 = 1.2

P2047 = 17220 + 1.2 * 2154 = 19804

The calculated population are shown in Table No. 1 (Source censes 2008)

Censes Year	Population	x
2001	6450	----
2008	**10475**	4025
2011	11683	1208
2017	13253	1569
2025	**15066**	1813
2035	17220	2154
2047	19804	

- **Incremental Increase Method**

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In this method the increment in arithmetical increase is determined from the past decades and the average of that increment is added to the average increases in population forecasting.

n = (2047-2035) / 10 = 1.2

Formula : Pn = Po + n*x+ n *(n+1) /2 * y
P2047 = 17220+ 1.2* 2154+ 1.2 *(1.2+1)/2 * 940
= 21045
The calculated population are shown in Table No.

Senses Year	**Population**	**X**	**y**
2001	6450	----	----
2008	**10475**	4025	---
2011	11683	1208	2817
2017	13253	1569	361
2025	**15066**	1813	244
2035	17220	2154	341
2047	21045		

3.4 Project Duration

Pipeline Project design in 2008 for population 10475 up-to period of 2025 for expected population 11350 but due to rapid urbanization in Uttam Nagar this cross the limit and reached up-to 13253 in 2017 which is serious issue for design pipeline life.

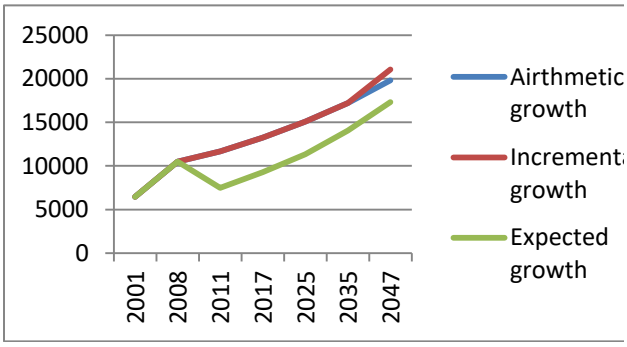

Fig.1 Population Forecasting

3.5 Water Demand
The domestic water demand for various stages for the design period is calculated based on the following considerations-

The Net and the Gross Domestic water demand for the Pune Municipal Corporation area, in various stages of the design period is given in Table No. 3 and Table No. 4

A) Domestic Water Demand

	Year 2008	Year 2017	Year 2047
Population	10475	13253	21045
Rate of Water	90 LPCD	90 LPCD	90 LPCD
Daily Demand	1.2 ML	1.4 ML	ML
Yearly Demand	942750	1192770	1894050

B) Other Water Demand

Floating Population	**10000**	**12000**	**15000**
Rate of Water	10 LPCD	10 LPCD	10 LPCD
Rate of Water	0.1 ML	0.12 ML	0.14 ML
Total of A + B	1.3 ML	1.52	1.74

IV. RESULTS AND DISCUSSIONS
1) Daily Demand 1.40 ML
2) Design Capacity of Rising Main =6.60 ML
(1.5 volume : 16 Hours)
Q = 275000 Lit/Hour
Q = 0.0764 cum/sec
3) Proposed 200 mm diameter D.I. K-9 Pipe
A = 0.031 m^2
4) Velocity of Flow = Q/A = 0.0764/0.031
V = 2.465 m/sec

4.1 PROCESS AND MODULES

The key modules within PARMS-PRIORITY are the following:

- Risk calculation,
- Failure predictions,
- Cost assessment,
- Scenario evaluation

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MODULE 1: RISK CALCULATION

In Uttam nagar water pipeline was design in 2008 by forecasting up-to 2025 population but probability of failure is occur due to rise in population which was not expected at the time of pipeline design.

As per 2011 census the population was 11683

Water demand = 11683 * 90= 1051470 lpcd

Water demand for 2017 = 13253 * 135

= 1789155 lpcd

Water demand for 2025 = 15066 * 135

= 2033910 lpcd

Water demand for 2035 = 17220 * 135

= 2324700 lpcd

Water demand for 2047 = 21045 * 135

= 2841075 lpcd

$$R = p_f * C$$

Where p_f is the probability of failure and C is the cost of failure.

MODULE 2: FAILURE PREDICTION

The soil is continuously extracts due to fastest growing construction which causes external pressure on pipeline increases a key component of risk assessment and risk calculations is the ability to assess the failure rate or probability of failure. The failure prediction models are based on both a statistical Non-Homogeneous Poisson model as well as a physical/probabilistic model which provide failure rates and failure probabilities for each year into the future.

$$\mu = g(L) * f(\theta) * k(t)$$

where μ is the predicted number of failures, g is a function of the length L, f is a function of θ which consists of covariates, such as pressure, soil type, diameter and material type, while k is a function of t, which is the age of the pipe in years since installation.

Water Supply Arrangement

The pipeline was design in 2008 and on that time there is no well defined water supply system in Uttam Nagar. Total 22 bore wells and illegal drawl from air valve of raw rising main for Warje water works of Pune Municipal Corporation is only available for supply.

For Uttam Nagar Zone I provide 200 mm, 150 mm, and 100 mm diameter pipe was design had length of 2614 M with 1 sluice valve each and Uttam Nagar Zone II same diameter having length 3631 M. The total pipeline length for Uttam Nagar Zone I and II is 6245 M.

According to growth of population the design pipeline will unsatisfactory in future decades. To resolve this issue we need renovation of pipeline with bigger diameter.

MODULE 3: COST MODELS

The costs of trenching or trenchless replacement of an old pipe with a new pipe are termed as Pipeline renewal. This includes the machinery and salary costs, as well as material costs and traffic management costs. The cost of renovation will vary and depends on diameter, surface type (road, footpath or verge), replacement material, and type of traffic conditions.

The total existing pipeline is 6245 M

Now need to proposed new pipeline of 1960 M having 200 MM diameter pipes DIK 7 and 748 M pipeline with 150 MM diameter and 4050 m pipeline for 100 MM diameter . Total pipeline 6758 M .

Table No 5 : Cost Analysis

Quantity	Unit	Description	Rate	Amount
1960	Rm	200 mm	1685	3302600
748		150 mm	1437	1074876
4050		100 mm	977	3956850

(MJP DSR 2017-18)

The components of an interruption that were deemed important in terms of inconvenience will be:

1. Duration of interruption,
2. Advance notification of the interruption,
3. Time and day of the interruption
4. Number of interruptions per year.

Particularly estimated the costs of supply interruptions that are given on a scale increasing with the number of supply interruptions. For instance the cost of two-to-three interruptions to a single customer

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is higher than three supply interruptions for no of customers.

MODULE 4: SCENARIO EVALUATION

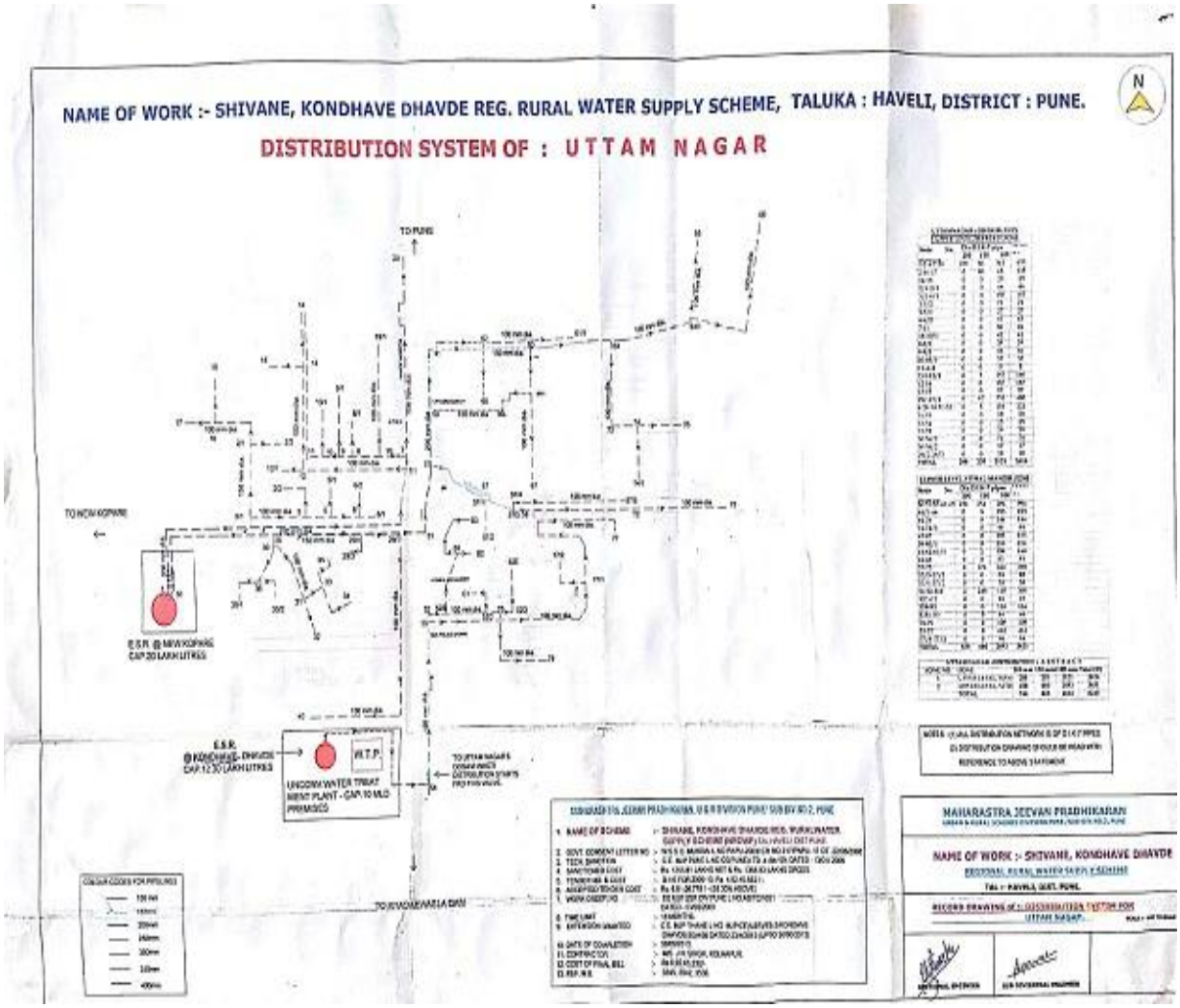

Fig. 2 Uttam Nagar Pipeline Map

Population growth rate for the village in the vicinity of city with higher supply and transportation facility is always much higher than other villages in Pune city. In the present case the villages are situated in the vicinity of Pune city , they are provided with good communication system and sufficient land is available for development only the constraints in the case of Uttam Nagar is on NDA road. Hence while forecasting population growth rate of 60% per decade is considered Shivane and Uttam Nagar.

In developing area populations depends upon following factors.

- Distance from nearest city
- Water Supply availability
- Communication facility
- Availability of Area for development

V. CONCLUSIONS

This work opens up a new space for the water utility failure problem and asset management applications, which is different from conventional learning paradigms and worth future studies:

1) Unexpected growth of population causes unsatisfied supply through water pipeline system.

This paper tackles the different types of failure indiscriminately and all related data like pipeline maps collected from Uttam nagar Gram Panchayat Samiti, Talathi office, population data collected fronTahsil office and most important water related data collected from Maharashtra Jivan Pradhikar Circle Pune Division -1.

2) By comparing present scenario with past decade of 2008 and future decade of 2047 it observe water supply and demand ratio is need to do renewal of pipeline. Reductions in pipe repair costs and initial testing of scenarios indicate that savings superior to achieved with a considerably smaller number of pipeline replacements to archive satisfactory demand and supply of water.

VI. FUTURE SCOPE

Due to the renewal of water pipeline system the Maharashtra Jiwan Pradhikaran can supply sufficient discharge with minimum maintenance charge which also increase the life of pipeline and reduces the aging issues of pipeline. The cost of renewal can be recollecting as a revenue collection in very few decades.

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