AIN SHAMS UNIVERSITY

FACULTY OF ENGIEERING

Public Works Department

"Techno – economic Comparison among Pipe Materials used in Water Networks"

A Thesis Submitted in Partial Fulfillment for the Requirements of the

Degree of Master of Science in Civil Engineering

(Public Works – Sanitary Engineering)

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Cairo - 2018

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DEDICATION

I wish to dedicate this work to who suffered to educate, prepare, build capacity and help myself to be as I am,

TO

MY HUSBAND

MY FATHER & MY MOTHER

For their encouragement and support to complete this work.

STATEMENT

This dissertation is submitted to Ain Shams University, Faculty of Engineering for the degree of M.Sc. in Civil Engineering. The work included in this thesis was carried out by the author in the department of Public Works, Faculty of Engineering, Ain Shams University.

No part of the thesis has been submitted for a degree or qualification at any other university or institution. The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

Date 2/1/2018

Signature

Marwa Thabet Abd Aleem

ACKNOWLEDGMENT

First of all, ***thanks to God*** for his grace and mercy, and for giving me the effort to complete this work.

It is an honor to work under the supervision of eminent professors, who I appreciate their whole hearted support and immense facilities. To them, I owe more than I can record.

The candidate is deeply gratefully to my supervisors ***Prof. Dr. Mohamed Hassan Abdel Razik, Dr. Mohamed Sobhy and Dr. Hosam Mostafa*** Professors of Sanitary & Environmental Engineering, Faculty of Engineering, AinShams University, for their guidance, faithful supervision, helpful suggestions, great support, cooperation and help in thesis.

Last but not least, I would like to thank ***my Father, my Mother, my Friends*** for their invocation and encouragement to finish this thesis. Special thanks to ***my husband*** for his support, kindness and help.

ABSTRACT

Name: Marwa Thabet Abdel Aleem

Title: Techno–economic Comparison among Pipe Materials used in Water Networks

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Specialty: Public Works, Sanitary and Environmental Engineering

Currently different pipe materials are used in a variety of applications in municipal water networks such as DI, ST, PSC, GRP, HDPE, and uPVC. Recently, many problems have emerged because of the use of an inappropriate pipe material in a certain application. The objective of this research is to develop a flow chart that can be used for the selection of the most appropriate pipe material in a certain application of water networks taking into consideration design parameters, local experience, environmental conditions, construction, operation, maintenance, and financial evaluation. Technical evaluation considers structural properties, environmental conditions, construction, operation, and maintenance. The impact of these parameters varies from project to another depending on project severity factor. Financial evaluation considers the cost of supply and installation for all the acceptable pipe materials.

Keywords: Pipe Selection, Ductile Iron Pipe, GRP Pipe, HDPE Pipe, uPVC Pipe, ST Pipe

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Summary of M.Sc. Thesis Prepared by
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Titled

"Techno – economic Comparison among Pipe Materials Used in Water Networks"

Nowadays, the most commonly used pipe materials in water networks are Ductile Iron (DI), Steel (ST), Pre-Stressed Concrete (PSC), Glass Reinforced Plastic (GRP), High-Density Polyethylene (HDPE), and unPlasticized Polyvinyl Chloride (uPVC).

A flow chart is proposed for the selection of the optimal pipe material in a certain application of water supply projects. The process is carried out in four steps as follows:

- **Step (1) - Exclusion Diagram** is developed to exclude the pipe materials that cannot be used in a certain applica**t**ion, based on design parameters (diameter and pressure) and local experience.
- **Step (2) - Technical Evaluation** is conducted among acceptable pipe materials, taking into consideration: structural properties, environmental conditions, construction, operation, and maintenance. The technical score is adjusted for each project according to its circumstances.
- **Step (3) - Financial Evaluation** is conducted among acceptable pipe materials taking into consideration the cost of supply and installation.
- **Step (4) - Overall Evaluation**, technical and financial evaluations are merged for the final selection of the appropriate pipe material for a certain application. Two methods are presented for merging: Method 1 assumes certain merging

ratio (e.g. 70% technical and 30% financial), and in Method 2 the financial score is divided by the technical score.

The proposed method has been applied on three case studies (transmission pipeline, main distribution pipe, and minor distribution pipe). It is noted that pipe materials ranking varies between Method 1 (which gives preference to technical score) and Method 2 (which gives preference to financial score).

Therefore, it is important that the merging evaluation criteria be stated in the project documents, and it is generally recommended to follow Method 1 with higher weight for technical evaluation.

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