



**BUSITEMA
UNIVERSITY**
Pursuing excellence

FACULTY OF ENGINEERING AND TECHNOLOGY

DEPARTMENT OF WATER RESOURCES ENGINEERING

FINAL YEAR PROJECT REPORT

**TITLE: USING PLASTIC WASTE IN PERVIOUS ASPHALT ROAD
CONSTRUCTION AS AN ECO-FRIENDLY AND URBAN FLOOD MITIGATION
MEASURE.**

Case study: Kyambogo intersection Kampala jinja highway.

BY

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ABSTRACT

Urbanization and improper waste management practices have led to surge in plastic waste particularly polyethene and PET which pose significant environmental challenges. The improperly disposed plastic waste are carried by running water during heavy down pour blocking the drainage channels causing flash flooding. By diverting plastic waste from landfills and incorporating it in pervious road construction will help reduce the environmental impact of plastic waste disposal while simultaneously enhancing the road's ability to control flash flooding. This study will examine the properties and feasibility of using plastic waste in pervious road construction through the achievement of following three objectives;

Objective one: To determine the effective pervious coefficient using software's such as SWMM for simulation of runoff quantity and quality, Google earth was used for generating the map of study area, objective two: To determine the optimum mix ratios of neat pervious asphalt and test for neat pervious asphalt road properties through carrying out comprehensive literature review, characterization of materials used and laboratory testing of plastic material and mixed plastic pervious asphalt, objective three; To determine the optimum mix ratios of blended pervious asphalt and test for pervious plastic asphalt properties. This helps in predicting the performance of bituminous mixes modified with plastic. comparison of blended pervious asphalt with the neat pervious asphalt was made and the results showed that there was increase in ITS from 79KN to 80.3KN. Therefore, incorporating plastic waste in road construction helps improve on mechanical strength as well as management of plastic waste disposal.

DECLARATION

I **CHEBET CALEB** and **ADIIBA JOSEPH** declare that this report is a result of our own research and has never been submitted before to any institution of higher learning for any academic award. We stand to account for all this information contained in this report and to regret any queries that may arise out of it if there is any.

CHEBET CALEB

Signature

Date

ADIIBA JOSEPH

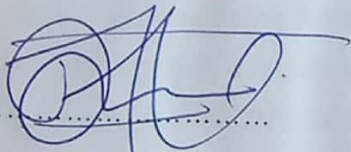
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APPROVAL

This final year research project report has been submitted to the Department of Water Resources Engineering for examination with approval from the following supervisors:

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List of Acronyms

WPB -Waste Plastic Bags

OAC-Optimum Asphalt Content

VMA- Voids in Mineral aggregate

OBM- Optimum Bitumen content

FTIR- Fourier InfraRed Spectrometer

HMA- Hot mix Asphalt

AC- Asphalt Content

AV-Air Void

TGA- Thermographic Analysis

ASTM- American Association of Testing and Materials

NAPA- National Asphalt Pavement Association

AASHTO- American Association of State and Highway Transportation Official.

BS- British Standards

HDPE- High Density Polyethylene

PVC-Polyvinylchloride

PET- Polyethylene terephthalate

PE- Polyethene

PAM -permeable asphalt mix.

SDG's- Sustainable Development Goals

FTIR- Fourier InfraRed Spectrometer

MWE- Ministry of Water and Environment

UNMA- Uganda National Meteorological Authority

CN- Curve Number

DEM- Digital Elevation Model

IDF- Intensity Duration Frequency

SWMM-Storm Water Management Model

GDP- Gross Domestic Product

GIS- Geographic Information System

KCCA- Kampala City Council Authority.

PAM- Permeable Asphalt Mix

CHAPTER ONE

1.0 Introduction

This chapter includes; back ground to the study, statement of the problem, objectives of the study, scope of the study which includes the time scope and finally the significance of the study.

1.1 Back ground

Floods are among the deadliest natural disasters which threaten human life and property worldwide. According to the United state (US) Natural Hazard Statistics, flooding caused the highest weather- related mortality in 2015,2016 and 2017 with 187, 127 and 136 fatalities respectively. The global economic damage resulting from floods was estimated to be more than \$50 billion in 2013 and in 2016, the damages increased to about \$60 billion. (Ahmadalipour & Moradkhani, 2019). As infrastructure and population in flood prone areas grow, the annual economic losses brought on by flash floods increases. In East Africa, Over 210 people died and thousands were made homeless between 2002 and 2006 with countries most affected being Rwanda, Kenya, Burundi, Tanzania and Uganda(Amoako, 2012).

Flash floods a type of floods which has taken many lives and caused great property damage are also known as local floods of great volume and short duration as result of runoff from intense rainfall caused by high flood waves that can destroy roads, bridges, buildings and other community development(Gerard et al, 2021). Furthermore Urban (flash) flooding is caused by accumulation of debris, plastic bags, and poorly maintained drains blocking the flow of water. climate change can be another factor that is attributed to water logging on road after a significant downpour (Nile, 2022). The effects of incidents brought on by floods have a significant impact on the nation's social and economic growth.(Douglas et al, 2008).

In Uganda, there is a high risk of flooding both flash floods and slow-onset floods that can cause damage to low-lying areas, metropolitan areas, places near rivers, and areas near swamps. Floods occurring in Kampala, the capital of Uganda is a result of both natural and artificial reasons. Heavy rains, flat, low-lying terrain, and underlying clayey soil with limited water infiltration are some of the natural causes (Mubangizi, 2023). The structures that are constructed on wetlands, such as buildings and roads, as well as inadequately sized and clogged drainage systems are all man-made factors that have attributed to occurrence of urban floods. Flooding is the biggest risk in the nation since it affects about 50,000 individuals and over \$62 million in GDP annually. More than 300,000 people were affected by floods and landslides in

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