



**BUSITEMA
UNIVERSITY**
Pursuing Excellence

FACULTY OF ENGINEERING
DEPARTMENT OF WATER RESOURCES AND MINING ENGINEERING
FINAL YEAR PROJECT REPORT
**PRODUCTION OF CARBON NEGATIVE CONCRETE FOR JOINTED PLAIN
CONCRETE ROAD SLAB CONSTRUCTION**

BY

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Abstract

Under the context of elevated greenhouse gases emission, how to reduce carbon emissions and increase carbon absorption is the focus of current research on climate change. Concrete is a convection building material the second most consumed material on earth after water which is in its production characterized with significant quantities of emissions and with little lifecycle carbon dioxide absorption through a process of carbonation.

This project mainly focused on the production of carbon negative concrete through the utilization pozzolana cement and incorporation of steel slag an industrial in concrete. The materials were obtained from various places and characterized to obtain there properties. The concrete mix design was carried out and there after the life cycle carbon footprint of the concrete was obtained. The amount of steel slag that is need to be incorporated in the concrete to make the carbon neutral concrete was obtained and it was 903.35Kg. Mix ratios incorporating steel slag and using the pozollana cement were obtained. Different test were carried out on the concrete to be produced to assess it strength properties and it was realized that upon the incorporation of steel slag in the mix the compressive and tensile strength increased upto 80% replacement of steel slag and later on decreased. The durability of the samples was assessed and found that it decreased with the increase in the replacement of steel slag for coarse aggregates.

Carbonation tests were carried out and it was found that the incorporation of steel slag increases the amount of carbon dioxide uptake which thus confirm the participation of steel slag in the carbon uptake. The optimum mix that was considered after performing all those test was the one with an 80% replacement of coarse aggregates with steel slag and it had a compressive strength of 38.9N/mm^2 at 28 days and the normal concrete had a compressive strength of $33.\text{N/mm}^2$ at 28 days. The carbon uptake by the optimum mix ratio obsereved was 0.29% and for the normal concrete was 0.075% after seven days of exposure.

The sample with the optimum mix ratio was assessed for its durability upon cyclic loading and it was noticed that the durability increases until when a stress of 20% the compressive strength is applied and when exceeded, the durability of the carbon negative concrete decreases as cracks start developing.

The plain concrete slab was designed in accordance to the ACI 318 for both the carbon negative concrete and normal concrete and later on simulated using ansys to confirm the safety of the designs. An economic analysis was carried out on the project to assess it worth and it was found out that it is more worth and cheaper to construct a carbon negative concrete road slab than a normal concrete road slab.

Key words: carbon negative concrete, normal concrete, pozzolana cement, steel slag, carbonation.

DECLARATION

I, **MOMBWE SAMUEL** hereby certify and confirm that the information I have written in this project is as a result of my own effort, research and has not been submitted before to any university or institution of higher learning for any academic award.

MOMBWE SAMUEL

Signature date

APPROVAL

This project on production of carbon negative concrete for jointed concrete road slab construction has been written under the supervision of,

Mr. Tumusime Godias

Signature Date

Mr. Bagaala Brian Ssempijja

Signature Date

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Contents

Abstract.....	2
DECLARATION	3
APPROVAL	4
ACKNOWLEDGEMENT	5
1.0 CHAPTER ONE	11
1.1 Background.....	11
1.2 Problem statement.....	12
1.3 Justification.....	12
1.4 Significance of the project	13
1.5 Objectives	13
1.5.1 Main objective	13
1.5.2 Specific objectives.	13
1.6 Scope.....	13
1.6.1 Conceptual scope.	13
1.6.2 Time scope	13
CHAPTER TWO	14
2.0 Literature review.....	14
2.1 concrete.....	14
2.1.1.0 definition and overview	14
2.1.2 important Physical tests done on aggregates.....	14
2.1.3 Chemical composition of steel slag (Yi et al., 2012)	16
2.1.4Composition of pozolana Portland tororo cement CEM II/BP/32. EAS 18-1: 2017	16
2.2.1 Steps taken in the preparation of concrete	16
2.2.2 Test done on concrete mixture to determine its efficient use.....	17
2.2.2.1Compressive strength.....	17
2.2.3 Concrete carbonation	17
2.2.3.1 Testing for concrete carbonation.....	18
2.2.4 Assessment of lifecycle carbon footprint for concrete.....	18
2.2.5 Concrete ratio mix design using ACI Method.	19
2.2.5.1 ACI method.....	19
2.2.5.2 Procedure for ACI Method of Concrete Mix Design.....	20

2.2.6 Design of Experiments.....	21
2.3.0 JOINT PLAIN CONCRETE PAVEMENT	21
2.3.1 COMPONENTS OF A JOINT PLAIN CONCRETE PAVEMENT (JPCP).....	21
CHAPTER THREE	24
3.0 Methodology.....	24
3.1 Materials.	24
3.1.1 Sourcing and Preparation of the material.....	24
3.1.2 Material characterisation.....	24
3.1.2.1 Chemical composition of steel slag and cement	25
3.1.2.2 Test that were done on aggregates	25
3.1.2.2.1 Sieve Analysis(IS: 2386 (Part I) – 1963)	25
3.1.2.2.2 Moisture content (BS 1377, PART 2 1990).....	25
3.1.2.2.3 Water absorption test (IS 2386(Part 3):1963)	26
3.2.1 Determination of break even replacement.	26
3.2.1.1 Concrete mix design (ACI design).....	26
3.2.1.2 Estimation of carbon dioxide emission (Kim et al., 2016).....	27
3.2.1.3 Calculation of the maximum carbon dioxide uptake by the concrete.(Miguel et al., 2020) ...	27
Obtaining the break even replacement percentage.....	27
3.2.1.6 Adjustment in the water content of the design mix (Nielsen, 2015).....	28
3.2.3 TESTS:.....	28
3.2.3.1 Compressive strength test (ASTM C39).....	28
Testing for concrete carbonation.....	29
3.2.3.3 OPTIMUM MIX RATIO.....	29
3.3 Design and simulation of physical model of the carbon negative concrete road slab system	29
3.3.1 Design of the slab road system.	30
3.3.2 Simulation.	31
3.4 to carryout and economic analysis.	31
Economic analysis criteria	31
CHAPTER FOUR.....	33
4.0 Results and discussion of results.....	33
4.1 Specific objective one	33

4.1.1 CHARACTERIZATION OF MATERIAL.....	33
4.1.1.1 Chemical composition test.....	33
4.1.1.1.1 Chemical composition of steel slag.....	33
4.1.1.1.2 Chemical composition of cement(pozolana Portland tororo cement CEM II/BP/32.5).....	34
4.1.1.1.3 AGGREGATE MOISTURE CONTENT	34
4.1.1.1.4 Aggregate Water absorption test results	34
4.1.1.1.5SIEVE ANALYSIS.....	35
4.2.0 Specific objective two.....	38
4.2.1 Concrete Mix Design using ACI method Characteristic strength $f_c = 30 \text{ N/mm}^2$ at 28 days	38
4.2.2 Estimation of carbon dioxide emission (Kim et al., 2016).....	39
4.2.3 Calculation of the maximum carbon dioxide uptake by the concrete.(Miguel et al., 2020)	40
4.2.4 the life cycle carbon foot print of concrete from the design mix.	40
4.2.5 The break even replacement percentage.	40
4.2.6 Design of experiment.	41
4.2.7 CONCRETE TESTS.....	41
4.2.7.1 Compressive strength test	41
4.2.7.2 Tensile strength test	42
4.2.7.3 Water absorption test	43
4.2.8 Assessment of the durability of the carbon negative concrete upon Cyclic loading and fatigue stress.....	44
4.2.7.4 Carbonation tests.....	45
PH test.....	46
Mass gain test.....	46
4.2.7.6 Maximum carbon dioxide uptake for the carbon negative concrete per cubic meter of concrete	47
Specific objective three.....	48
4.3.1 Design of jointed carbon negative concrete slab.....	48
4.3.2 Simulation results.....	53
4.4 Specific objective four	62
4.4.1 Economic analysis of the project.	62
4.4.1.1 Carbon negative concrete.....	62
4.4.1.2 Convectional concrete road.....	65

5.0 CHAPTER FIVE	69
5.1.0 Conclusions and recommendations.....	69
5.1.1 Conclusion.	69
5.1.1.2 Recommendation	69
APPENDIX.....	71

List of tables

Table 1: chemical composition of steel slag	33
Table 2:chemical composition of cement.....	34
Table 3: moisture content of aggregates.....	34
Table 4: water absorption of aggregates.....	35
Table 5: gradation of fine aggregates	35
Table 6: gradation of coarse aggregates.....	35
Table 7:gradation of steel slag aggregates	37
Table 8: design mix	39
Table 9:design of experiment	41
Table 10: compressive strength test results	41
Table 11:tensile strength test results	42
Table 12: 28 days cured cubes water absorption test results	43
Table 13:stresses for cyclic loading.....	44
Table 14:water absorption test results for samples from cyclic loading.....	45
Table 15: pH test results	46
Table 16: mass gain test results.....	46
Table 17: subgrade coefficient.....	48
Table 18:table showing the trucks and their loads and spacing.....	49
Table 19:table showing factors of safety for different concrete applications.....	50
Table 20:a table for the determination of the sizes of the dowel bars	53
Table 21: cost of one cubic meter of carbon negative concrete	62
Table 22:cost of one kilometer of carbon negative road construction	62
Table 23:cost of one cubic meter of convectional concrete.....	65
Table 24:cost of one kilometer of convectional concrete road construction.....	65

List of figures

Figure 1: graph showing the gradation of coarse aggregates.....	36
Figure 2: graph showing gradation of steel slag	37

Figure 3: graph showing the compressive strength values of the concrete samples.....	42
Figure 4:graph showing the tensile strength of the samples	43
Figure 5:a graph showing the water absorption of the samples at 28 days of curing	44
Figure 6: a graph showing water absorption of samples from cyclic loading	45
Figure 7: mass gain results.....	47
Figure 8: a graph for choosing the thickness of concrete slab	51
Figure 9: a graph for determination of the joint spacing	52
Figure 10: a table for the determination of the sizes of the dowel bars	Error! Bookmark not defined.
Figure 11: jointed concrete pavement.....	53
Figure 12: graph showing deformation of carbon negative concrete in the X direction	54
Figure 13: a graph showing the deformation of carbon negative concrete in the Y direction.....	54
Figure 14: a graph showing the deformation of carbon negative concrete in the Z direction	55
Figure 15: a graph showing the strain energy of carbon negative concrete.....	55
Figure 16:a graph showing the stress imposed on the carbon negative concrete slab	56
Figure 17: a graph showing the elastic strain of the carbon negative concrete.....	56
Figure 18a graph showing the total deformation of the carbon negative concrete	57
Figure 19: a graph showing the stress in the conventional concrete slab	57
Figure 20: a graph showing the strain of the conventional concrete.....	58
Figure 21: a graph showing the deformation of concrete in the Z direction.....	58
Figure 22: a graph showing the deformation of conventional concrete in Y direction.....	59
Figure 23: a graph showing the deformation of conventional concrete in the /y direction	59
Figure 24: a graph showing the deformation of conventional concrete in the X direction.....	60
Figure 25: a graph showing the total deformation of conventional concrete.....	60
Figure 26: a graph showing the strain energy of the conventional concrete.....	61
Figure 27: engineering drawing of carbon negative concrete slab	71
Figure 28:3D drawing of carbon negative concrete slab	72
Figure 29: engineering drawing of conventional concrete slab	73
Figure 30: 3D drawing of conventional concrete slab	74