

**STABILISATION OF CLAY-STONEDUST COMPOSITE USING  
CALCIUM CARBIDE RESIDUE AND ZEOLITE FOR ROAD  
APPLICATION**

**BY**

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MEng/SIPET/2018/9240**

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FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA**

**AUGUST, 2023**

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CARBIDE RESIDUE AND ZEOLITE FOR ROAD APPLICATION**

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**A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL FEDERAL  
UNIVERSITY OF TECHNOLOGY, MINNA, NIGERIA IN PARTIAL  
FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF THE  
DEGREE OF MASTER OF CIVIL ENGINEERING (TRANSPORTATION  
ENGINEERING)**

**AUGUST, 2023**

## DECLARATION

I hereby declare that this thesis titled: **“Stabilisation of clay-stone dust composite using calcium carbide residue and zeolite for road application”** is a collection of my original research work and has not been presented for any other qualification anywhere. Information from other sources (published and unpublished) has been duly acknowledged.

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.....  
Signature & Date

## CERTIFICATION

The thesis titled: **“Stabilisation of clay-stone dust composite using calcium carbide residue and zeolite for road application”** by: **ALAKA, Esther Omolara** (MEng/SIPET/2018/9240) meets the regulations governing the award of the degree of M.Eng. of the Federal University of Technology, Minna and it is approved for its contribution to scientific knowledge and literary presentation.

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## **DEDICATION**

This work is dedicated to Almighty God, the owner of life, whom made it possible for this project to be successful. Also to my late Father Mr Iyiola Alabi Alaka who died during the course of the program. He encouraged and supported me despite my marital responsibility to embark on this program. Also to my husband and children for all their patience and love all through the course of this program.

## ACKNOWLEDGMENTS

All praise and adoration are due to God Almighty, the creator of Heaven and Earth, for His love, kindness and blessings. My gratitude goes to my major supervisor Engr. Prof. M. M. Alhaji for his support, guidance and relentless effort towards the completion of the program; through you, my knowledge on this subject has broadened. Thank you, Sir. Millions of words are not enough to thank my Co-supervisor, Engr. Dr. M. Alhassan who despite his tight schedules, he is always available to attend to me. I cannot forget to mention Engr. Dr. T. E. Adejumo, who is the P.G coordinator, Civil Engineering Department, for all his advices, inputs and encouragement towards the completion of the program. Your contribution to this work is immeasurable. My appreciations goes to the Dean School of Infrastructure, Process Engineering and Technology, also to the Dean Postgraduate School and all those involved in Post Graduate matters in the University for their Job well done. Thank you all. My thanks also goes to the other staffs of Civil Engineering Department, Federal University of Technology, Minna: Engr. Prof. S. Sadiku, Engr. Prof. M. Abdullahi, Engr. Prof. J. I. Aguwa, Engr. Prof. A. A. Amadi, Engr. Prof. T. Y. Tsado, Engr. Prof. S. M. Auta, Engr. Dr. M. Saidu, Engr. Dr. T. E. Adejumo, Engr. Dr. S. F. Oritola, Engr. A. O. Ibrahim, Engr. I. O. Jimoh, Engr. Dr. A. O. Busari, Engr. Dr. R. A. Adesiji, Mr. J. Olayemi, Engr. Mrs. O. Gbadebo, Engr. Dr. B. A. Abbas, Engr. Dr. D. N. Kolo, Engr. Dr. A. Abdullahi, Engr. Dr.M. Abubakar, Engr. Dr. A. Yusuf, Engr. Dr. H. S. Abdulrahman, Engr.Dr. H. O. Aminullai, Engr. E. O. Asogwa, Mrs. H. N. Adamu, Mr. E. Eze. I am profoundly grateful for all your encouragement and support. My appreciation also goes to the technical staff of the Department, headed by Engr. S. Adeniyi, his colleagues, Mr. A. A. Mohammed, Mr. S. Iliyasu, Mr D. Zango, Mr. E. Agbese, Mr. E. Bechila, Mr. B. Gunna and Mal. U. Mohammed. I am not also

forgetting the Non-Academic staffs Mrs. R. A. Salako and Mal. Saidu Minin of the Department. May God bless you all. I am greatly indebted to my family, particularly my parents Late Mr I. A. Alaka and Mrs. I. O. Alaka who painstakingly laid the foundation for my education, giving it all it takes, from the depth of my heart, I love you so much. To my mentors: Olusegun Iyiola and Ayo Ajayi. I sincerely appreciate your prayers and courage. I lack words to express profound gratitude to my great uncles Mr. Keyinde Olabisi, Mr. Olushola Olabisi and many more, I cannot exhaust the list. Let me acknowledged my number one and world best teacher, Mr. Philip Andrew for imparting, supporting and given tireless words of courage during throughout my academic pursuit. I am and will forever be grateful to my loving and charming Husband; Bolaji Ajibike and my Children; Jesushetemi Ajibike, Jesushefunmi Ajibike and Jesushefemi Ajibike, who gave up their time to make sure I achieve this feat. I appreciate all the sacrifice and prayers. Permit me to use the opportunity to acknowledge my siblings, Sister Funmi, Brother Kunle, Brother Femi, Brother Segun. And to my fellow students Engr. M. I. Suleiman, Mr. Joseph Ogunlaye, Engr. Yahaya Abdullahi, Bala Innocent, Sadiq, Engr. Mrs. E. A. Omolara, Engr. Mrs. Azih Mercy, Alfa Umar, Mrs. Ruth, Elder Anteyi Owoicho.

## ABSTRACT

Clay soils are one of the major problem soils encountered during road construction activities. Construction of road on clay subgrade of the use of clay as road construction material are both discouraged due to peculiar behaviour of clay soils. Studies have shown that the cause of early damage and failure of most highway pavements in the world today especially in Nigeria is poor subgrade soil conditions. This study is aimed at treating clay soils with stone dust and Calcium Carbide Residue (CCR) admixed with zeolite to enhance its strength and durability. To achieve this purpose, index properties and preliminary test were carryout on the samples. Other test such as compaction characteristics, Unconfined Compressive Strength (UCS), durability and micro-structural characteristics at varying composition of stone-dust admixed with CCR and zeolite were also conducted. The results revealed that the clay soil falls under clay of high plasticity (CL) based on Unified Soil Classification System, which is not suitable in its natural state for any component of flexible pavement structure. The micro-structural analysis of the clay using X-ray Diffraction and Scan Electron Microscopy (SEM) revealed that the clay consists of both primary and secondary minerals including montmorillonite. The SEM showed the morphology of the compacted clay as flaky in nature with pore spaces. Maximum UCS of 2425 kN/m<sup>2</sup>, which satisfy a soil material to be used as base course material for highly trafficked road bases. This was achieved at 2% zeolite and 10% CCR at 10% stone dust replacement at 28 days curing. The optimal CCR required for effective stabilisation of clay-stone dust lies between 5 to 10% with at 2% and 4% zeolite additions for 1, 7 and 28 days curing. The highest UCS value obtained for clay- stone dust stabilized with CCR and zeolite only increased by 7times the strength of the natural clay, which has a highest UCS of 359 kN/m<sup>3</sup>.



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## **ABBREVIATIONS, GLOSSARIES AND SYMBOLS**

CCR	Calcium Carbide Residue
EDS	Electron Dispersion Spectroscopy (EDS)
SEM	Scan Electron Spectroscopy (SEM)
XRF	X-ray Florescence
XRD	X-ray Diffraction