

**THE EFFECTIVENESS OF ALTERNATIVE STABILIZER
FOR MUD CONCRETE TECHNOLOGY**

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Doctor of Philosophy

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Sri Lanka

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A thesis submitted in fulfillment of the requirements for the degree of
Doctor of Philosophy

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DECLARATION

I here by declare that the thesis entitled “The effectiveness of alternative stabilizer for Mud Concrete Technology” submitted by me, for the award of the degree of *Doctor of Philosophy* to University of Moratuwa is a record of bonafide work carried out by me under the supervision of Prof.Rangika Halwatura.

This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Place: University of Moratuwa

Date: 30/11/2018

.....
(Chameera Dussantha Udawattha)

CERTIFICATE

This is to certify that the thesis entitled “The effectiveness of alternative stabilizer for Mud Concrete Technology” submitted by Chameera Udawattha, University of Moratuwa for the award of the degree of *Doctor of Philosophy*, is a record of bonafide work carried out by him under my supervision, as per the University of Moratuwa code of academic and research ethics.

The contents of this report have not been submitted and will not be submitted either in part or in full, for the award of any other degree or diploma in this institute or any other institute or university. The thesis fulfills the requirements and regulations of the University and in my opinion meets the necessary standards for submission.

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ABSTRACT

The building wall is our third skin. Edifice the third skin out of earth has been practiced since prehistoric era, because of the availability of soil as a raw material. Merely soil have many weakness including its geo technical properties of shrink swell, low density and high permeability. In order to convert geotechnical properties into engineering material, there should be a stabilizer. This study was conducted to study alternative stabilizer for earth based construction particular to mud concrete earth construction.

An inventory of potential alternative stabilizers were arose based on an immense literature survey, inspired from nature and from ancestral folk knowledge. Several mix designs were subjected to a strength development study. Overall engineering properties and total life cycle study was conducted according to engineering standards. The durability, cost, thermal performances, embodied energy and life-cycle cost were studied and compared with most available wall construction units. Finally, the impertinent technology was enhanced to use as residential scale technology for poor people in the country. The application and the manufacturing process was advocated among low income villagers to building their houses.

The study has found that natural polymers such as natural rubber latex, pines resin, dawul kurudu, and sugarcane bagasse can enhance the mechanical properties of a mud concrete block. Industrial waste such as fly ash, bottom ash, and rice husk ash can work as an alternative stabilizer. A more advanced technology of geopolymerizing mud concrete block was invented by this study. In the practical construction world, this novel wall material should be testified in front exiting wall material palette. Found that mud concrete block is a suitable solution to replace existing expensive wall construction technology. Finally, the manufacturing process was optimized into the plenteous production process to manufacture mud concrete block in mass scale. More than all, this thesis has given birth to an affordable wall construction technology for poor people in the country.

Keywords: *Earth building, soil stabilization, engineering properties, walling material, environmental fitness, life cycle analysis.*

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*Once upon a time I was crossing the land of dust and fear
Looking for a land to seed without fear
Then **Dr.Narein Perera** showed me a river,
A river running through the land of dust and fear;
And he showed me a place and taught me how to seed a tree in the fastest gear,
Thank you for allowing me to plant a tree on your soils and let it breathe in your air,
And for bearing my dream topiary that provides you nothing but endeavor,
You provide rivers and streams for me and to nourish my saple,
You ruffle it with your whirly winds for that and much more,
Thank you for the pelts of sand and pours of fine, and thank you for erasing my dull
Leaves with your magical words,
Thank you my dear sir **Prof.Rangika Halwatura** for selflessly giving
All that you do have, although at ; times I dont deserve it,
There upon many others helped me with fertilizers and continuous supplies,
Praneeth Dilshan and Darshana Jayasinghe helped when I planted it.
And then Rasangi Lakmini, Himhansi Galkanda, Isuri Shanika Ariyaratne and Devinda
eranga water the plant.
Rizna Arooz, Kasun Nandapala, and Shakila Pathirana showed the
Way to grow it.
My big brother **Nadheera Udawattha** removed all the moss on the trunk
My younger brother **Sanjaya Udawattha** helped me to root down to the bed rock
I have a long way to go with this tree, and it becomes taller than Eifel tower because
Of my wife **Shanika and Baby Shaven**.
It has many branches because **my father** never ever commanded to trim it.
Thank you, **my first Mother**, for opening my eyes with your elusive warnings,
you are unlucky to see I was growing this tree but another **mother** helped me to grown.
But I promise you all; I will grow more and more.
I will help others to grow their corn.
“Because some trees grow in to heaven”*

Chameera Dussantha Udawattha

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List of Terms and Abbreviations

AWR	Agard wood resin	LCC	Life Cycle Cost
BOQ	Bills of quantities	LS	Linear Shrinkage
BR	Bael Resin	MC	Maintenance Cost
CAB	Hard soil block	MCB	Mud concrete Block
CC	Cleaning Cost	NP	Natural Polymer
CP	Cement slurry plaster	NRL	Natural Rubber Latex
CSEB	Cement stabalized	NPV	Net present values
DK	Dawul Kurudu	OC	Overheads
DCS	Dry Mean Compressive	PR	Pines Resin
DMCS	Dry Mean Compressive Strength	RE	Refurbishment
EC	Energy Cost	RES	Residential Buildings
EE	Embedded energy	RV	Resale value
FC	Fixed Cost	SB	Sugarcane Bagasse
FSEB	Fly Ash stabilized earth blocks	SI	Suitability Index
GHG	Green House Gas	TSS	Tensile splitting strenght
HCB	Hollow cement Block	UC	Utilization Cost
IC	Initial Cost	UCS	Compressive Strength
JR	Jack Resin	WAR	Wood apple resin