

**“AN EXPERIMENTAL STUDY ON RED MUD BASED GEO
POLYMER BRICKS WITH GGBS AND METAKAOLIN.”**

A Minor Project Report

Submitted by

**VASANTH KUMAR V H
(20202BCT0002)**

In partial fulfillment for the award of the degree

of

MASTER OF TECHNOLOGY

in

BUILDING CONSTRUCTION TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

SCHOOL OF ENGINEERING

Under the Guidance of

Mrs. SOWMYASHREE T



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PRESIDENCY UNIVERSITY

2021-2022





PRESIDENCY UNIVERSITY

Private University Estd. in Karnataka State by Act No. 41 of 2013



DEPARTMENT OF CIVIL ENGINEERING

BONAFIDE CERTIFICATE

Certified that this report “AN EXPERIMENTAL STUDY ON RED MUD BASED GEO POLYMER BRICKS WITH GGBS AND METAKAOLIN.” is a bonafide work of “VASANTH KUMAR V H (20202BCT0002)”, who has successfully carried out the Minor project work under my supervision.

Mrs. Sowmyashree T
Project Guide
Civil Engineering
Presidency University

Dr. Nakul Ramanna
HOD
Civil Engineering
Presidency University

Dr. Shrishail Anadinni
Associate Dean
School of Engineering
Presidency University

Dr. Abdul Sharief
Dean
School of Engineering
Presidency University

Name and Signature of the Examiners

- 1) Mrs. Sowmyashree T
- 2) Mr. Jagadish Biradar

REGISTRAR

DECLARATION

I VASANTH KUMAR V H, pursuing M. Tech in Building Construction Technology, in the Department of Civil Engineering at Presidency University, Bengaluru, hereby declare that the Minor project work titled “AN EXPERIMENTAL STUDY ON RED MUD BASED GEO POLYMER BRICKS WITH GGBS AND METAKAOLIN.” has been independently carried out by me and submitted in partial fulfillment for the award of the degree of Master of Technology in Building Construction Technology during the academic year 2021-22.

Vasanth Kumar

VASANTH KUMAR V H (20202BCT0002)

PLACE: BENGALURU

DATE: 31 - Jan - 2022

Jasme
REGISTRAR
PRESIDENCY UNIVERSITY
Registrar
BANGALORE

ABSTRACT

AN EXPERIMENTAL STUDY ON RED MUD BASED GEO POLYMER BRICKS WITH GGBS AND METAKAOLIN.

Rapid urbanization and industrialization have led to generation of abundant quantity of industrial wastes. Red mud (RM), Fly ash (FA) and Ground Granulated Blast Furnace Slag (GGBS) are a few amongst the wastes that are generated in huge quantities and are indiscriminately disposed on to open lands which not only occupy space but also leads to soil and ground water pollution. Also increased construction activities have increased the use of conventional construction materials. Production of conventional construction materials such as cement poses a lot environmental threat during its production. Thus, there is a need to find sustainable alternate materials for a better future.

Red mud emerges as the major waste material during production of alumina from bauxite by the Bayer's process. It comprises of oxides of iron, titanium, aluminium and silica along with some other minor constituents. This study investigates on "Experimental Study on Red Mud Based Geo-Polymer Bricks". This study carried out on 50 x 50 x 50 mm size of geo-polymer cubes.

Red mud, GGBS and Metakaolin is used as a binder material. Alkaline solution of sodium hydroxide and sodium silicate were used for process. Red mud used up to 50% replacement of clay. Metakaolin was used for strength enhancement. With red mud content is from 45 to 50 % and alkaline activator content, compressive strength obtains in range of 38.2 N/mm², water absorption gets 8.38% to 4.04%. It can be concluded that geo polymerization of red mud, GGBS and Metakaolin can be used as sustainable alternative material for conventional bricks.


REGISTRAR


“AN EXPERIMENTAL STUDY ON RED MUD BASED GEOPOLYMER PAVER BLOCKS WITH FLY ASH AND GGBS”

A Minor Project Report

Submitted by

**SANJAY T R
(20202BCT0003)**

In partial fulfillment for the award of the degree

of

MASTER OF TECHNOLOGY

in

BUILDING CONSTRUCTION TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

SCHOOL OF ENGINEERING

Under the Guidance of

Mrs. SOWMYASHREE T



PRESIDENCY UNIVERSITY

2021-2022





PRESIDENCY UNIVERSITY

Private University Estd. in Karnataka State by Act No. 41 of 2013



DEPARTMENT OF CIVIL ENGINEERING

BONAFIDE CERTIFICATE

Certified that this report “AN EXPERIMENTAL STUDY ON RED MUD BASED GEOPOLYMER PAVER BLOCKS WITH FLY ASH AND GGBS” is a bonafide work of “SANJAY T R (20202BCT003)”, who has successfully carried out the Minor project work under my supervision.

Mrs. SOWMYASHREE T
Project Guide
Civil Engineering
Presidency University

Dr. Nakul Ramanna
HOD
Civil Engineering
Presidency University

Dr. Shrishail Anadinni
Associate Dean
School of Engineering
Presidency University

Dr. Abdul Sharief
Dean
School of Engineering
Presidency University

Name and Signature of the Examiners

- 1) Mrs. SOWMYASHREE T
- 2) Mr. JAGADISH BIRADAR

Jiradar

REGISTRAR

DECLARATION

I SANJAY T R, pursuing M.Tech in Building Construction Technology, in the Department of Civil Engineering at Presidency University, Bengaluru, hereby declare that the Minor project work titled “AN EXPERIMENTAL STUDY ON RED MUD BASED GEOPOLYMER PAVER BLOCKS WITH FLY ASH AND GGBS” has been independently carried out by me and submitted in partial fulfillment for the award of the degree of Master of Technology in Building Construction Technology during the academic year 2021-22.



SANJAY T R (20202BCT0003)

PLACE: BENGALURU

DATE: 04 - FEB - 2022



REGISTRAR



PRESIDENCY UNIVERSITY
Registrar
BANGALORE

ABSTRACT

“AN EXPERIMENTAL STUDY ON RED MUD BASED GEOPOLYMER PAVER BLOCKS WITH FLY ASH AND GGBS”

Geopolymerisation technology opens up a new avenue of utilizing the industrial wastes and by-products in the construction industry. The technology not only consumes the waste mineral materials, but also the percentage of greenhouse gas emission is lesser as compared to OPC. Hence the cementitious product of geopolymerisation is also called “green cement”. Generation of this inorganic industrial waste in India is estimated to be about 290 million tons annually. Treatment, handling, transportation and disposal of these non-hazardous industrial wastes are a major global concern. Their increasing annual production together with already accumulated solid waste poses a serious environmental threat. Use of industrial wastes and by-products as a raw material is of great practical significance for developing building material components as substitutes for the traditional materials and providing an alternative material to the construction industry in a cost effective manner.

The cement industry is one of the prime producers of carbon-di-oxide. It is estimated that about 7% of greenhouse i.e. Carbon-di-oxide gas is being emitted into atmosphere on account of production of OPC alone at global level. On other hand disposal of solid waste is a major problem. Coal power plants produce solid waste called fly ash whose disposal is difficult. Therefore urgent changes are required relating to emissions, production and application of sustainable and eco-friendly materials. Many investigations are already done by utilizing fly ash in geopolymerisation. This research is carried out to find out the possibility of using red mud, the by-product of aluminium industry in geopolymerisation. This led to concept of Red mud based geo polymer paver blocks. This study aims to develop geo-polymer paver blocks. The developed paver blocks are tested for their compressive, split tensile, flexural and abrasive strength as per Indian Standards 15658:2006. The strength properties of red mud based binder was investigated by varying the molarity and red mud percentage. The results were interpreted by analysis of molar ratios. It was found that the addition of GGBS up to 50% increased the strength of red mud – GGBS geopolymer paste. Geopolymer paste containing 30% and 50% red mud in as collected state had sufficient strength to be used in structural applications.


REGISTRAR


**AN EXPERIMENTAL STUDY ON RED MUD BASED
GEO POLYMER BRICKS WITH FLY ASH AND
SILICA FUME**

A Minor Project Report

Submitted by

**AMITH GOWDA B R
(20202BCT0005)**

In partial fulfillment for the award of the degree

of

MASTER OF TECHNOLOGY

in

BUILDING CONSTRUCTION TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

SCHOOL OF ENGINEERING

Under the Guidance of

Mrs. SOWMYASHREE T



PRESIDENCY UNIVERSITY

2021-2022





PRESIDENCY UNIVERSITY

Private University Estd. in Karnataka State by Act No. 41 of 2013



DEPARTMENT OF CIVIL ENGINEERING

BONAFIDE CERTIFICATE

Certified that this report “AN EXPERIMENTAL STUDY ON RED MUD BASED GEO POLYMER BRICKS WITH FLY ASH AND SILICA FUME” is a bonafide work of “AMITH GOWDA B R (20202BCT0005)”, who has successfully carried out the Minor project work under my supervision.

Mrs. Sowmyashree T
Project Guide
Civil Engineering
Presidency University

Dr. Nakul Ramanna
HOD
Civil Engineering
Presidency University

Dr. Shrishail Anadinni
Associate Dean
School of Engineering
Presidency University

Dr. Abdul Sharief
Dean
School of Engineering
Presidency University

Name and Signature of the Examiners

- 1) Mrs. Sowmyashree T
- 2) Ms. Aashi Agarwal

REGISTRAR

DECLARATION

I AMITH GOWDA B R, pursuing M.Tech in Building Construction Technology, in the Department of Civil Engineering at Presidency University, Bengaluru, hereby declare that the Minor project work titled “AN EXPERIMENTAL STUDY ON RED MUD BASED GEO POLYMER BRICKS WITH FLY ASH AND SILICA FUME” has been independently carried out by me and submitted in partial fulfillment for the award of the degree of Master of Technology in Building Construction Technology during the academic year 2021-22.

Amith Gowda

AMITH GOWDA B R (20202BCT0005)

PLACE: BENGALURU

DATE: 04 - Feb - 2022

Janu
REGISTRAR
PRESIDENCY UNIVERSITY
Registrar
BANGALORE

ABSTRACT

AN EXPERIMENTAL STUDY ON RED MUD BASED GEO POLYMER BRICKS WITH FLY ASH AND SILICA FUME

Geopolymerisation technology opens up a new avenue of utilizing the industrial wastes and by products in the construction industry. The technology not only consumes the waste mineral materials, but also the percentage of greenhouse gas emission is lesser as compared to OPC. Hence the cementitious product of geopolymerisation is also called “green cement”. Generation of this inorganic industrial waste in India is estimated to be about 290 million tons annually. Treatment, handling, transportation and disposal of these non-hazardous industrial wastes are a major global concern. Their increasing annual production together with already accumulated solid waste poses a serious environmental threat. Use of industrial wastes and by-products as a raw material is of great practical significance for developing building material components as substitutes for the traditional materials and providing an alternative material to the construction industry in a cost-effective manner.

Red mud emerges as the major waste material during production of alumina from bauxite by the Bayer’s process. It comprises of oxides of iron, titanium, aluminium and silica along with some other minor constituents. This study investigates on “Experimental Study on Red Mud Based Geo-Polymer Bricks”. This study carried out on 50 x 50 x 50 mm size of geo-polymer cubes.

Red mud, Fly ash and Silica fume is used as a binder material. Alkaline solution of sodium hydroxide and sodium silicate were used for process. With red mud content is from 60 to 80 % and alkaline activator content, compressive strength obtains in range of 5.2 N/mm², water absorption in the range 15.42% to 16.49%. It can be concluded that geo polymerization of red mud, fly ash and silica fume can be used as sustainable alternative material for conventional bricks.

Keywords: Red mud; Geopolymerisation; Bayer’s process; Compressive strength


REGISTRAR


**“AN EXPERIMENTAL STUDY ON RED MUD BASED GEO
POLYMER MORTAR WITH GGBS , M SAND AND
METAKAOLIN”**

A Minor Project Report

Submitted by

**CHARAN KUMAR K C
(20202BCT0006)**

In partial fulfillment for the award of the degree

of

MASTER OF TECHNOLOGY

in

BUILDING CONSTRUCTION TECHNOLOGY

DEPARTMENT OF CIVIL ENGINEERING

SCHOOL OF ENGINEERING

Under the Guidance of

Mrs. SOWMYASHREE T



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2021-2022





PRESIDENCY UNIVERSITY

Private University Estd. in Karnataka State by Act No. 41 of 2013



DEPARTMENT OF CIVIL ENGINEERING

BONAFIDE CERTIFICATE

Certified that this report “AN EXPERIMENTAL STUDY ON RED MUD BASED GEO POLYMER MORTAR WITH GGBS, M SAND AND METAKAOLIN” is a bonafide work of “CHARAN KUMAR K C (20202BCT0006)” who has successfully carried out the Minor project work under my supervision.

Mrs. SOWMYASHREE T
Project Guide
Civil Engineering
Presidency University

Dr. Nakul Ramanna
HOD
Civil Engineering
Presidency University

Dr. Shrishail Anadinni
Associate Dean
School of Engineering
Presidency University

Dr. Abdul Sharief
Dean
School of Engineering
Presidency University

Name and Signature of the Examiners

1) Mrs. Sowmyashree T

2) Ms. Aashi Agarwal

REGISTRAR

DECLARATION

Myself, **CHARAN KUMAR K C**, pursuing M.Tech in Building Construction Technology, in the Department of Civil Engineering at Presidency University, Bengaluru, here by declare that the Minor project work titled “**AN EXPERIMENTAL STUDY ON RED MUD BASED GEO POLYMER MORTAR WITH GGBS , M SAND AND METAKAOLIN**” has been independently carried out by me and submitted in partial fulfillment for the award of the degree of Master of Technology in Building Construction Technology during the academic year 2021-22.

Charan.K.C

CHARAN KUMAR K C (20202BCT0006)

PLACE: BENGALURU

DATE: 04 - FEB - 2022

Janu
REGISTRAR
PRESIDENCY UNIVERSITY
Registrar
BANGALORE

ABSTRACT

AN EXPERIMENTAL STUDY ON RED MUD BASED GEO POLYMER MORTAR WITH GGBS , M SAND AND METAKAOLIN

The aim of the work is to investigate the possibility of replacing the part of Portland cement by Red mud and Fine Aggregates . Because of storing issues, the industrial waste products adversely affects the environment. To solve this problem, an attempt is to made to check the effectiveness of Red mud as a partial replacement of Portland cement, the red mud , ggbS , m sand and metakaolin are used in partial quantities in the mortar. Portland cement will be replaced by Red mud by the weight of cement and checking the compressive strength of mortar as per Indian standards 15658:2006 and this study is to suggest possible percentage of use of red mud , ggb, m sand and metakaolin which will help to reduce the cement consumption in construction industry.


REGISTRAR


GSTIN. No: - 29FGBPS9989GIZB
PAN. No :- FGBPS9989G

Contact No:- +91-9448210367
+91-9880241807

SHINDE ASSOCIATES

Architect, M.Tech(Str), Civil Engineer, Interior Designer & Contractor

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Mr. Anandkumar Arjun Barasakale** has completed satisfactorily the internship from 13-09-2021 to 10-12-2021 at our company.

This certificate is issued at the specific request of the trainee, without any commitment on our part.

Place : Jamkhandi
Date : 03-02-2022

Yours Faithfully

N. A. SHINDE
B. E. (Civil)
Consulting Engineer
Near Jagad Yallamma Galli,
JAMKHANDI - 587301

Address:- Near Basaveshwar Circle, Vijaypur Road, More Plot SNS Plaza, JAMKHANDI-587301 Dist : Bagalkot (Karnataka)





OMKAR CONSTRUCTIONS

Mathapati Building, In front of BLDEA'S Engineering College Vijayapura-
586103

Mail ID: er.rbpatil@gmail.com

Mob: 8123825113

Ref No:

Date:02/02/2022

INTERNSHIP CERTIFICATE

This is to certify that **Mr. Shashikumar Sahebgowd Patil (20202BCT0014)** has done his internship in Building & construction technology (Civil Engineering) At OMKAR Construction & Engg. Vijayapur, from **15-09-2021 to 10-12-2021**. He has worked on a residential building project taken up by the company near Telsang Vijayapur. As part of the project, he has worked as a site Engineer. During His internship he has demonstrated his skills with self-motivation to learn new skills. We wish him all the best for his upcoming career.

Project Engineer
Ravirajgouda Patil (Supervision)
Ravirajgouda.p@gmail.com
8123825113

Student Signature

For OMKAR CONSTRUCTIONS.

Authorised Signature

Mob:9535251391.
Er. R. B. PATIL. M.Tech(Str)

Structural Designer, Planning
& Consulting Engineer.
Aishwarya Nagar, VIJAYAPUR

REGISTRAR





Date: 31-01-2022

INTERNSHIP CERTIFICATE

This is to certify that **Mr. Vinay Kavalur [20202BCT0015]** has done his internship in Building & Construction technology (Civil Engineering) at Adarsh Construction & Engg, Bangalore, from **15-09-2021 to 10-12-2021**.

He has worked on a Commercial Building project taken up by the company near Bannerghatta road. As part of the project, he has worked as a Site Engineer.

During his internship he has demonstrated his skills with self-motivation to learn new skills. His performance exceeded our expectations.

We wish him all the best for his upcoming career.

**Project Engineer
Naveen Garg**

For Adarsh Construction & Engg. Co.
Authorized Signature

Proprietor



Date:27/12/2021

CERTIFICATE OF INTERNSHIP

This is to certify that **Mr. Karthik S**, undergoing a student of M. TECH Building and Construction Technology (20202BCT0019) from **Presidency University Bengaluru**, has successfully completed his internship at Mangalore/ Bijai new road of our The Construction store and Engineering Co, as his curriculum requirement from **20/09/2021** to **10/12/2021**

He has been found sincere and hardworking to the best of our knowledge and satisfaction during his tenure over here.

We wish him all the best for his future endeavours.

Regards,

Site Engineer

Sarvaveer P M (supervisor)

Email : sarvaveerpm@theconstructionstore.in

Contact number : 8660592145

Karthik . S

Student signature


Authorized signature
[Signature]

[Signature]
REGISTRAR

