STABILITY ANALYSIS OF INTERNAL DRAGLINE DUMP SLOPE USING NUMERICAL MODELLING

Thesis submitted in partial fulfilment for the

Award of Degree

Doctor of Philosophy

by

ASHUTOSH KUMAR BHARATI

MINING ENGINEERING DEPARTMENT
INDIAN INSTITUTE OF TECHNOLOGY
(BANARAS HINDU UNIVERSITY)
VARANASI – 221005

16151004 **2023**

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Supervisor

Dr. Rajesh Rai

Associate professor

Department of Mining Engineering

IIT (BHU) Varanasi

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I, "***ASHUTOSH KUMAR BHARATI***", certify that the work embodied in this thesis is my own bona fide work and carried out by me under the supervision of "***Dr. RAJESH RAI***" from "***JULY 2016***" to "***JUNE 2023***", at the "***DEPARTMENT OF MINING ENGINEERING***", Indian Institute of Technology (B.H.U), Varanasi. The matter embodied in this thesis has not been submitted for the award of any other degree/diploma. I declare that I have faithfully acknowledged and given credits to the research workers wherever their works have been cited in my work in this thesis. I further declare that I have not willfully copied any other's work, paragraphs, text, data, results, etc., reported in journals, books, magazines, reports dissertations, theses, etc., or available at websites and have not included them in this thesis and have not cited as my own work.

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Place: IIT (BHU) Varanasi

Ashutosh Kumar Bharati

(ASHUTOSH KUMAR BHARATI)

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Supervisor
Dr. Rajesh Rai
Associate professor
Department of Mining Engineering
IIT (BHU) Varanasi

Co-Supervisor
Prof. B K Shrivastva
Professor
Department of Mining Engineering
IIT (BHU) Varanasi

Signature of Head of Department
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(Ashutosh Kumar Bharati)

DEDICATION

To

my father, *Late Chhangur Prasad*,

and

my mother, *Shrimati Kanti Devi*

Contents

Symbols and Abbreviations

HEMM	Heavy Earth Moving Machineries
FOS	Factor of safety
LEM	Limit Equilibrium Method
FEM	Finite Element Method
FDM	Finite Difference Method
DEM	Distinct Element Method
ANN	Artificial Neural Network
MLR	Multiple Linear Regression
MRA	Multiple Regression Analysis
PFC	Particle Flow Code
SMR	Slope Mass Rating
CSMR	Chinese Slope Mass Rating
SSR	Slope Stability Rating
RSR	Rock Slope Rating
DSR	Dump Stability Rating
DSCR	Dump Stability Classification Rating
AHP	Analytic Hierarchy Process
FDM	Fuzzy Delphi Method
RMR	Rock Mass Rating
ξ	Slope height factor
λ	Discontinuity factor
LDA	Linear discriminant Analysis
φ	Friction angle
c	Cohesion
PE	Processing Element
I	Sensitivity Index
BW1	Berm width at coal-rib roof level
BW2	Berm width at dragline sitting level
A1	Slope angle of the bench between coal-rib top and dragline sitting level
H1	Height of the bench between the coal-rib top and dragline sitting level
A2	Slope angle between the dragline sitting level and the peak of dragline dump
H2	Height between the dragline sitting level and the peak of dragline dump
CR-Height	Coal-rib height
CR-Width	Coal-rib width
Dip	Strata dipping
OB	Overburden
MDD	Maximum Dry Density
OMC	Optimum Moisture Content
MLP	Multilayer Perceptron
SOS	Sum Of Square
BFGS	Broyden-Fletcher-Goldfarb-Shanno
RMSE	Root Mean Square Error
VAF	Variance Accounted For