ADVANCED SLOPE MONITORING SYSTEM TO DEVELOP TRIGGER ACTION RESPONSE PLAN (TARP) IN OPENCAST COAL MINES USING INTERNET OF THINGS (IOT)

Thesis

Submitted in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

by

M. SATHISH KUMAR



DEPARTMENT OF MINING ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA
SURATHKAL, MANGALURU – 575 025

SEPTEMBER, 2024

DECLARATION

by the Ph.D. Research Scholar

I hereby declare that the Research Thesis entitled **"Advanced Slope Monitoring System to Develop Trigger Action Response Plan (TARP) in Opencast Coal Mines using Internet of Things (IoT)"** which is being submitted to the **National Institute of Technology Karnataka, Surathkal** in partial fulfillment of the requirements for the award of the Degree of **Doctor of Philosophy in Mining Engineering** is a bonafide report of the research work carried out by me. The material contained in this Research Thesis has not been submitted to any University or Institution for the award of any degree.

M Sathish Kumar
Registration Number: 207527
Roll Number: 207MN502
Department of Mining Engineering

Place: NITK-Surathkal

Date: 25.09.2024

CERTIFICATE

This is to certify that the Research Thesis entitled "**Advanced Slope Monitoring System to Develop Trigger Action Response Plan (TARP) in Opencast Coal Mines using Internet of Things (IoT)**" submitted by **Mr. M Sathish Kumar**, (**Registration Number**: 207527 and **Roll Number**: 207MN502), as the record of the research work carried out by him, is accepted as the Research Thesis submission in partial fulfillment of the requirements for the award of degree of **Doctor of Philosophy**.

Prof. K. Ram Chandar
Research Guide
Date: 26.09.2024

Prof. Harsha Vardhan
Chairman - DRPC
Date: 26/9/2024

Chairman - DRPC
Department of Mining Engineering
National Institute of Technology Karnataka, Surathkal
P.O. Srinivasnagar-575 025, Mangalore.
Karnataka State, India.

Dedicated to the Almighty

ACKNOWLEDGEMENTS

I would like to express my deepest thanks and sincere gratitude to my project guide, **Dr. K. Ram Chandar**, Professor, Department of Mining Engineering, National Institute of Technology Karnataka (N.I.T.K), Surathkal, throughout my project journey. **Prof**. **K. Ram Chandar** has been an unwavering and consistent beacon of guidance. A person with patience, commitment, systematic, hard work, motivation, perfection, immense knowledge and positive disposition with at most amicability. His mentorship and insightful advices have been instrumental in shaping my understanding and refining my skills. The time he spent patiently explaining concepts and sharing his wealth of experience has not only enriched my project but also broadened my perspective. I am truly grateful for the opportunity to learn from such a knowledgeable mentor, and I am confident that the lessons learned under his guidance will continue to resonate in my future. His belief in my potential has inspired me to continue even during challenging times.

Besides my research guide, I would like to thank the Research Progress Assessment Committee (RPAC), Dr. Vijay Mihir Kunar, Associate Professor, Department of Mining Engineering, and Dr. D. Kishan, Assistant Professor, Department of Electrical and Electronics Engineering. I extend my thanks to the Doctoral Research Programme Committee (DRPC) members. I extend my special thanks to, Prof. Harsha Vardhan, Head of Department of Mining Engineering, N.I.T.K., Surathkal, for extending the department facilities, which ensured the successfully completed of my research work. I extend my gratitude to the authorities of NITK, Surathkal and staff of Department of Mining Engineering for their help provided during my research work.

I am grateful to The Singareni Collieries Company Limited (SCCL) for allowing me to pursue my Ph.D. while working. The flexibility and encouragement provided by the company have been crucial in balancing my professional responsibilities and academic aspirations. Special thanks to CMD, Director (Operations), Director (P&P), and other Directors of SCCL, and I am also obliged to thank GM (CDN), GM (HRD), Mr. Jaffer & MRGK Murthy for helping me to obtain NOC. I sincerely extent my

gratitude to my co-employees Mr. D. Venkatesham, Mr. Dundra Ramesh, Mr. Ch. Venkataramana and others who have been supportive to me throughout this journey.

Special acknowledgment goes to the mine officials of Khakathiya Khani Opencast – 2 project, Khairagura Opencast Project, and Srirampur Opencast-2 Project for granting me access to conduct field investigations. Sincere appreciation to Mr. T. Madhusudan, Mr. I Srinivas, Mr. Rama Krishna, Mr. Vishnu, Mr. Rajaswamy, Mr. Srikanth, Mr. D. Rambabu, Mr. G. Babji and others officials whose support and guidance were instrumental during the data collection phase of my research. Their expertise and willingness to share essential insights significantly enriched my research. Their dedication to ensuring the accuracy and completeness of the data, as well as their prompt and efficient responses to quires, were invaluable. I am grateful for the opportunity to collaborate with such knowledgeable professionals, and I deeply appreciate their contributions to my research.

I am deeply grateful to my fellow research scholars and friends, Mr. P Harish, Mr. Sahas Swamy, Mr. K Sandeep Reddy, Mr. P. Ravi Kiran, Mr. G. Dileep, P. Ram Mohan, B Shiva Kumar, Mr. P.V Vinith Kumar and Mr. R.K Srishail whose support and encouragement have been invaluable throughout my Ph.D. journey. Their willingness to share ideas, discuss concepts, and provide feedback has not only enriched my research but also made the entire experience more fulfilling.

I would like to extent my heartfelt gratitude to Dr. M. S. Venkataramayya, Mr. K. J. Amarnath, Mr. Thayagaraju, Prof. Sriram Venkatesh, Prof. P. Chandrashekar, Prof. N.R. Thote and all other my dear well-wishers, who had been constant source of strength throughout my journey. Their kind words, thoughtful gestures, and belied in my abilities have motivated me to overcome challenges and strive for excellence. I am truly fortunate to have such wonderful individuals in my life, and I deeply appreciate all the love and support they have shown me.

A heartfelt thanks to Dr. K Srinivas, whose exceptional guidance and expertise were instrumental in the writing of my thesis. His insightful feedback and dedication to excellence have not only improved the quality of my work but have also been a source of inspiration throughout this process. Special thanks to Dr. Shyam Sundar and Dr. Harish Gupta for generously sparing their time and expertise, discussing ideas, and assisting me with various aspects of my project. I would also like to thank Dr. G. Karthik, Dr. I. Satyanarayana, Mr. Vishal and Mr. NSRK Prasad for their valuable inputs that helped me construct basic framework of my research.

I would like to express my deepest gratitude to Mr. E. Srinivas, Mr. M Sandeep, Mr. Raj Kumar M, Mr K Harish for being my constant companion and extending support for my research study. Their solid presence, encouragement, and willingness to brainstorm ideas, discuss concepts, and provide constructive feedback have been invaluable. I am truly fortunate to have them by my side, and I cannot thank them enough for their enduring support and belief in me.

Last but not least, to my family, I repay the greatest responsibility of gratitude. I express my heartfelt appreciation to my wife Mrs. M Snehalatha, and my two children Miss M. Sadvika and Master M. Sai Vatsav. Their untiring encouragement, understanding, patience and sacrifices have been the foundation upon which I built my academic pursuits. Their support, both emotional and practical, has sustained me through the challenges of this journey. I thank them for believing in me, for cheering me on, and always being with me irrespective of the situations. Without their support, completing my study would have been an insurmountable task. This accomplishment is as much as theirs as it is mine.

M. Sathish Kumar

ABSTRACT

ABSTRACT

In India, coal is the main energy source used to generate electricity and for other industrial purposes. Since coal-based thermal power plants account for a sizable share of India's electricity generation, the demand for coal rises drastically. India currently imports coal from other nations to meet its domestic needs. In India more than 96% coal is produced from opencast mines. Opencast (OC) mines are progressively becoming deeper to meet the increasing demand of coal. Lager and deeper opencast mines result in unstable slopes, leading to slope failures, which pose a major challenge. Slope stability and its monitoring is a serious issue in OC mines. In current scenario, conventional methods are being used for slope monitoring in opencast mine. Such monitoring typically requires a person to be physically present at the site and can only be carried out during the day.

On the other hand, Slope Stability Radar (SSR) and Light Detection and Ranging (LiDAR) can monitor slope movements effectively but these are expensive, works on day time only and physical presence of persons required. In order to address this ambiguity, an advanced slope monitoring system is essential. This system should utilize low-cost sensors to monitor parameters affecting slope stability and provide early alerts by analyzing sensor data in real-time.

Based on a comprehensive literature review identified, moisture content, vibrations, and displacement are the key factors contributing to slope instability. So, in this study, a slope monitoring system was designed using soil moisture, vibration and displacement sensors to detect and monitor these parameters. This system incorporates Wireless Sensor Networks (WSN) and Cloud Computing Technologies (CCT), enabling early warning alerts via email and SMS when pre-set threshold values are exceeded. The system was developed and implemented in three case study opencast mines. Additionally, a Trigger Action Response Plane (TARP) was formulated based on the rate of displacement and total displacement by the means of Wireless Sensor Networks, existing total station monitoring system, numerical modelling parametric study, that provides guidelines for actions to be taken at various levels of slope stability based on alerts from the monitoring system aided to develop a

user-friendly Advanced Slope Monitoring System (ASMS) software.

This system was evaluated for its functions and performance through a laboratory experimentation on a physical slope model after the sensors were calibrated using reliable instruments. Based on the laboratory experiments, soil moisture sensors recorded a maximum of 82% and minimum of 25%. For vibration sensor, a maximum of 80 Hz and minimum of 0 Hz was detected, and 0.25 mm and 5.3 mm displacement is recorded without load and with load condition respectively. While evaluating the effect of soil moisture and vibration on slope displacement, it is identified that the moisture content in the slope has more impact on slope displacement than vibration.

Laboratory investigations gave encouraging results on reliability and effectiveness of the developed system to perform field investigations in three different mines. From the field investigations, Kakatiya Khani Opencast-2 Project case study recorded the highest average rate of displacement of 2.12 mm/day, 75% moisture content and 36 Hz vibration. Khairagura Opencast Project recorded 3.27 mm/day rate of displacement, soil moisture content 78% and 28 Hz vibration, at Srirampur Opencast-2 Project rate of displacement is 3.57 mm/day with moisture 82% and 30 Hz vibration.

Data collected from the mines of existing total station monitoring system and previous slope failure cases revealed the following observations, upto 50 mm displacement slopes are stable, between 50 mm to 100 mm cracks are generated and from 100 mm to 150 mm indicates potential failures are observed and above 150 mm failures observed.

Later, Slope displacement obtained from Wireless Sensor Networks system of case study mines were compared with the displacement readings from the total station and numerical model of the slope that was being monitored. Results obtained at case study-1 mine for displacement through Wireless Sensor Networks system is 25.50 mm (minimum) and 46.80 mm (maximum), through total station monitoring system is 27 mm (minimum) and 49.30 mm (maximum). Similarly, the minimum and maximum displacement through numerical modeling are 29.77 mm and 46.26 mm

respectively. The percentage of error while comparing with Wireless Sensor Networks and Total Station is below 11.47%, and WSN and NMM methods is not more than 16.75%. Hence, Wireless Sensor Networks based slope monitoring system data is very reliable.

Parametric study conducted using numerical modelling studies with varying rock properties and slope geometry. A regression equation is developed for displacement and Factor of Safety (FoS). Advanced Slope Monitoring System (ASMS) software is developed based on the derived equations to track the behavior of slopes in opencast mines.

Trigger Action Response Plan (TARP) has been developed based on the field investigations of case study mines. Level 1 indicates, for displacement rates below 0.3 mm/day and total slope movement under 10 mm, recommends a weekly monitoring. Level 2 indicates, rate of displacement between 0.3 mm/day to 10 mm/day and total displacement between 10 mm to 50 mm suggests weekly monitoring and slope indicates no cracks, Level 3 indicates, rates between 10 mm/day to 50 mm/day, and 50 mm to 100 mm total displacement, suggests monitoring every two days and slope indicates with crack. Level 4, rate of displacement between 50 mm/day to 100 mm/day, and total displacement between 100 mm to 150 mm recommends daily monitoring indicating potential failure. Level 5 for rate of displacement exceeding 100 mm/day and total displacement exceeding 150 mm failure takes place and suggesting clearing the area.

Key words: Displacement, Factor of Safety, Internet of Things, Numerical Modelling, Opencast Mines, Slope Monitoring, Total Station, Wireless Sensor Network.

TABLE OF CONTENTS

ABSTRACT i

TABLE OF CONTENTS v

LIST OF FIGURES xi

LIST OF TABLES xix

ACRONYMS xxiii

CHAPTER 1 1

1 **INTRODUCTION** 1

1.1 General 1

1.1.1 Importance of opencast mining 1

1.1.2 Necessity of deeper opencast coal mining 2

1.1.3 Problem associated with deep opencast mines 2

1.1.4 Factor influencing slope stability 3

1.1.5 Consequence of slope failure 3

1.2 Statutory Provisions for Slope Stability in Opencast Mines 4

1.3 Slope Monitoring in Opencast Mines 5

1.4 Trigger Action Response Plan 5

1.5 Research Gap and Motivation 6

1.6 Problem Statement 6

1.7 Objectives 7

1.8 Research Methodology 7

1.9 Organization of Thesis 10

CHAPTER 2 13

2 **REVIEW OF LITERATURE** 13

2.1 Introduction 13

2.2 Slope Stability in Opencast Mines 13

2.3 Slope Failure and its Consequences in Opencast Mines 15

2.4 Factors Affecting Slope Stability 17

2.4.1 Geological structure 18

2.4.2 Geotechnical factors 20
2.4.3 Slope geometry 21
2.4.4 Other sources of slope disruption 22
2.5 Slope Monitoring in Opencast Mines 23
2.5.1 Visual inspection and tension crack monitoring 27
2.5.2 Inclinometer monitoring system 28
2.5.3 Monitoring with Extensometer 29
2.5.4 Monitoring with Piezometer 29
2.5.5 Micro seismic monitoring 30
2.5.6 Monitoring with Digital photogrammetry 31
2.5.7 Monitoring with Laser scanner 32
2.5.8 Monitoring with Total station 33
2.5.9 Time domain reflectometry monitoring system 34
2.5.10 Global positioning system 35
2.5.11 Slope stability radar system of monitoring 36
2.5.12 Light detection and ranging monitoring system 37
2.6 Slope Monitoring with Wireless Sensor Networks 38
2.6.1 Internet of Things in slope monitoring 40
2.6.2 Sensors in slope monitoring system 41
2.6.2.1 Soil moisture sensors 42
2.6.2.2 Vibration sensors 44
2.6.2.3 Displacement sensors 45
2.6.2.4 Microcontrollers 47
2.6.2.5 Wireless data communication 49
2.6.2.6 Cloud computing and real-time slope monitoring 52
2.7 Displacement Studies on Opencast Slopes 54
2.8 Slope Stability Prediction Using Numerical Modelling 56
2.9 Trigger Action Response Plan 61
2.10 Summary 66

CHAPTER 3

3	**INVESTIGATIONS**			67
	3.1	Sensors Calibration		67
		3.1.1	Calibration of FC-28 soil moisture sensor	68
		3.1.2	Calibration of SW420 sensor	70
		3.1.3	Calibration of displacement sensor	72
	3.2	Development of WSN and CCT Integrated Slope Monitoring System		73
		3.2.1	Sensing unit	75
		3.2.2	Data transmission unit	75
		3.2.3	Cloud data storage and analysis unit	77
	3.3	Performance Evaluation of Sensors and Advanced Slope Monitoring System		78
	3.4	Field Investigations		81
		3.4.1	Case study-1	82
			3.4.1.1 Slope monitoring using total station at Kakatiya Khani Opencast -2 project	84
			3.4.1.2 History of slope failure at KTK OC-2	85
			3.4.1.3 Selection of the site for investigations	87
			3.4.1.4 Investigations with WSN system for slope monitoring	87
		3.4.2	Case study-2	91
			3.4.2.1 Slope monitoring using total station at Khairagura opencast project	93
			3.4.2.2 History of slope failure at KHAOC	94
			3.4.2.3 Investigations with WSN system for slope monitoring	97
		3.4.3	Case study-3	99
			3.4.3.1 Slope monitoring using total station at Srirampur opencast -2 project	101
			3.4.3.2 History of slope failure at SRPOC2	102

3.4.3.3 Investigations with WSN system for slope monitoring 102
3.5 Laboratory Investigations for Properties of Rock Sample 106
3.6 Numerical Modelling Investigations with FLAC 2D Software 108
3.6.1 Details of numerical modelling based on field conditions 108
3.6.1.1 Numerical modelling for case study - I 108
3.6.1.2 Numerical modelling for case study - II 111
3.6.1.3 Numerical modelling for case study - III 113
3.6.2 Parametric study 115
3.6.2.1 Influence of density on slope displacement and FoS with respect to depth 116
3.6.2.2 Influence of cohesion on slope displacement and FoS with respect to depth 117
3.6.2.3 Influence of internal friction on slope displacement and FoS with respect to depth 118
3.6.2.4 Influence of young's modulus on slope displacement and FoS with respect to depth 119
3.7 Regression Analysis 120
3.8 Development of Trigger Action Response Plan 121
3.9 Summary 123
CHAPTER 4 125
4 **RESULTS AND ANALYSIS** 125
4.1 Analysis of Laboratory Experimentatal Results 125
4.1.1 Impact of moisture content and vibration on displacement 128
4.2 Field Investigations of Case Study Mines 130
4.2.1 Analysis of the sensor readings and numerical modelling results of KTK OC-2 case study 130
4.2.1.1 Soil moisture sensor observation 130
4.2.1.2 Displacement sensor observation 132

4.2.1.3 Vibration sensor observation 134
4.2.1.4 Impact of moisture content and vibration on rate of displacement 136
4.2.1.5 Numerical modelling based on site condition at case study-1 137
4.2.1.6 Comparison of field results with modelling results 139
4.2.2 Field investigations of case study- 2 140
4.2.2.1 Soil moisture sensor observation 140
4.2.2.2 Displacement sensor observation 142
4.2.2.3 Vibration sensor observation 144
4.2.2.4 Impact of moisture content and vibration on rate of displacement 146
4.2.2.5 Numerical modelling based on site condition 147
4.2.2.6 Comparison of field results with modelling results 149
4.2.3 Field investigations of case study-3 150
4.2.2.1 Soil moisture sensor observation 150
4.2.2.2 Displacement sensor observation 152
4.2.2.3 Vibration sensor observation 154
4.2.2.4 Impact of moisture content and vibration on rate of displacement 156
4.2.2.5 Numerical modelling based on site condition 157
4.2.2.6 Comparison of field results with modelling results 158
4.2.4 Summary of case study mine results based on WSN 159
4.3 Parametric Study Results 163
4.3.1 Influence of density on slope displacement and factor of safety with respect to depth 163

4.3.2 Influence of cohesion displacement and factor of safety with respect to depth 165
4.3.3 Influence of friction angle on slope displacement and factor of safety with respect to depth 167
4.3.4 Influence of elastic modulus on slope displacement and factor of safety 168
4.3.5 Relationship between slope displacement on FoS 170
4.3.6 Influence of various parameters on slope displacement and factor of safety 171
4.3.6 Development of ASMS software for slope monitoring using python software 173
4.4 Formulation of TARP Guidelines 176
4.5 Summary 179
CHAPTER 5 181
5 **CONCLUSIONS AND RECOMMENDATIONS** 181
5.1 Conclusions 181
5.1.1 Conclusions from development of advanced slope monitoring system 181
5.1.2 Conclusions from laboratory investigations 181
5.1.3 Conclusions from field investigations 182
5.1.4 Conclusions from numerical modelling study 183
5.1.5 Developing alert message system 184
5.1.6 Designing and developing advanced slope monitoring system embedded with alert message system and Trigger Action Response Plan (TARP) 185
5.2 Recommendations 186
5.3 Limitations of the Study 187
REFERENCES 189
APPENDICES (1-VI) 209
LIST OF PUBLICATIONS 259
BIO-DATA 261

LIST OF FIGURES

Figure No.	Title	Page. No.
1.1	Coal production in India for the last 10 years (OC vs UG)	2
1.2	Geometry of opencast mines	3
1.3	Schematic representation of the methodology	9
2.1	Different modes of slope failures	15
2.2	Slope Failure at Alxa League in Mongolia, China	16
2.3	Stone quarry slope failure at Maudarh, Mizoram, India	16
2.4	Slide at Mining site in Myanmar, India	17
2.5	Geological structures of a rock mass	19
2.6	Effect of groundwater with water-saturated sediment	20
2.7	Effect of groundwater with water Liquefaction	20
2.8	Relation between shear stress and normal stress	21
2.9	Schematic opencast diagram	22
2.10	Importance of Slope Monitoring	24
2.11	Classification of slope monitoring technique modified	26
2.12	Tension crack monitoring in surface mines	27
2.13	Slope inclinometer for monitoring	28
2.14	Wireline extensometer schematic figure	29
2.15	Monitoring with Piezometer	30
2.16	Micro Seismic monitoring using geophones	31
2.17	Monitoring with Digital photogrammetry	32
2.18	Laser Scanning-Quarryman Pro	33
2.19	Monitoring with Total Station	33
2.20	TDR monitoring system	35
2.21	The GPS displacement monitoring system	36
2.22	Slope Stability RADAR at mine site	37
2.23	Laser scanner data acquisition	37
2.24	Architecture of Wireless sensor network	39

Figure No.	Title	Page. No.
2.25	MEMS Sensors employed in Slope monitoring	42
2.26	FC-28 Soil Moisture Sensor	43
2.27	Vibration Sensor	45
2.28	Slider potentiometer	46
2.29	Arduino UNO and NodeMCU microcontroller with pinouts	48
2.30	XBee S2C and E32 LoRa RF Module pinout	50
2.31	XCTU ZigBee configuration software	51
2.32	EBYTE LoRa configuration software	52
2.33	ThingSpeak online data analytics platform	53
2.34	Various numerical analysis methods	59
2.35	Factors considered in TARP development at Bingham canyon	62
3.1	Finding of soil moisture% with FC-28 sensor for selected 15 samples	68
3.2	Regression analysis of soil moisture sensor values	69
3.3	Vibration sensor calibration	70
3.4	Regression analysis of vibration sensor	71
3.5	Calibration of displacement sensor	72
3.6	Regression analysis of displacement sensor values	72
3.7	Methodology of wireless sensor network and cloud computing integrated slope monitoring system	74
3.8	Preparatory models of the node	75
3.9	Circuit diagram of transmitter node with its components	76
3.10	Circuit diagram of receiver node with its components	77
3.11	Experimental setup of slope monitoring using soil moisture and vibration sensors	79
3.12	Laboratory arrangements of the displacement experiment	79

Figure No.	Title	Page. No.
3.13	Measurements of displacement sensor in ThingSpeak console	80
3.14	Early warning E-mail alerts triggered by the slope monitoring system	81
3.15	Coal Mining Areas of Godavari Valley Coalfield	82
3.16	KTK OC-II Project Key plan	83
3.17	Satellite view of the KTK OC- 2 project	83
3.18	Total station readings at KTKOC-2 mine	85
3.19	Part plan showing sliding areas of KTK OC-2 Project	85
3.20	Displacement of an existing slopes failure cases at KTK OC-2 project	86
3.21	Showing tension cracks developed and failed at RL870 & RL875 benches	86
3.22	Research study area of the KTK OC-2 Project	87
3.23	Location of nodes installation on the bench slope	88
3.24	Installation of sensor near bench toe at KTK OC-2 Project	88
3.25	Receiver node at KTK OC-2 mine slope monitoring station	89
3.26	ThingSpeak image of collected sensor data	90
3.27	Alert mail received at the monitoring station	90
3.28	Khairagura OC Project Key plan	91
3.29	Khairagura OC Project and Vattivagu reservoir satellite view	92
3.30	Seepage of water induced from Vattivagu reservoir	93
3.31	Total station readings at KHAOC mine	94
3.32	Recent Bench failure area of Khairagura OC Project	94
3.33	Displacement (mm) occurred before failure at RL930 benches	96

Figure No.	Title	Page. No.
3.34	Tension cracks developed at east side benches and failure taken place	96
3.35	Installation of Nodes at east side benches of Khairagura OC Project	97
3.36	ThingSpeak image of collecting sensor data	98
3.37	Alert emails received via python program	99
3.38	SRP OC-2 Project Key Plan	100
3.39	An Arial View of SRPOC- 2 Project	101
3.40	Total station readings at SRPOC-2 mine	101
3.41	Maximum displacement before failure at RL870&RL875 benches	102
3.42	Tension cracks and top three benches failed at SRP OC-II project	102
3.43	Location of nodes installation on the slopes of SRP OC 2 project	103
3.44	Installation of Nodes position at SRP OC – 2 Project	103
3.45	Sensors working results observations at monitoring station	104
3.46	Sensors data in the form graphs in the ThingSpeak platform	105
3.47	Alert mail received at the monitoring station	105
3.48	Direct Shear test methodology	106
3.49	Laboratory setup for tri-axial test	107
3.50	Cracks observed after the testing with Tri-axial test	107
3.51	Project slope model geometry in Flac 2D	109
3.52	Project slope model with different benches	110
3.53	Result of the analysis	111
3.54	Project slope model (FLAC 2D) in drained condition	112
3.55	Result of the analysis	113

Figure No.	Title	Page. No.
3.56	Project slope model (FLAC 2D) in drained condition	114
3.57	Result of the analysis	115
3.58	Slope displacement and FoS results from parametric study	116
3.59	Results of regression analysis based on numerical data in Minitab	121
4.1	Soil Moisture sensor observations	126
4.2	Vibration sensor observations	126
4.3	Displacement sensors observation on without the load condition	126
4.4	Displacement sensors observation on with load condition	127
4.5	Correlation of soil moisture content and slope displacement	128
4.6	Correlation of vibration and slope displacement	129
4.7	Soil moisture sensor readings at KTKOC2 using ThingSpeak platform	131
4.8	Soil moisture percentage variations from toe to crest	132
4.9	Displacement sensor reading from case study 1	133
4.10	Displacement variations from toe to crest	134
4.11	Vibration sensor reading from case study 1	134
4.12	Soil moisture percentage variations from toe to crest	135
4.13	Effect of soil moisture on rate of displacement	136
4.14	Effect of vibration on rate of displacement	137
4.15	Site condition numerical model results in the form of FoS and displacement	138
4.16	Site condition numerical modelling with resultant displacement	138
4.17	Displacement readings at sensors installation locations	139

Figure No.	Title	Page. No.
	in the project	
4.18	Comparison of displacement measured with Sensor, TS and NMM	139
4.19	Soil Moisture sensor reading from case study 2	141
4.20	Soil moisture percentage variations from toe to crest	142
4.21	Displacement sensor readings from case study 2	143
4.22	Displacement (mm) variations from toe to crest	144
4.23	Vibration sensor reading from case study 2	145
4.24	Vibrations variations from toe to crest	146
4.25	Effect of soil moisture on rate of displacement	146
4.26	Effect of Vibration on rate of displacement	147
4.27	Site condition numerical model FoS result	148
4.28	Site condition numerical model resultant displacement result	148
4.29	Displacement readings at sensors installation locations in the project	149
4.30	Comparison of displacement measured with Sensor, TS and NMM	149
4.31	Soil moisture sensor reading from case study 3	151
4.32	Soil moisture percentage variations from toe to crest	152
4.33	Displacement sensor reading from ThingSpeak of nodes 1,2,3 & 4	153
4.34	Displacement readings observed in the field by sensor nodes and Total station method of slope monitoring	154
4.35	Vibration sensor reading from case study 3	154
4.36	Vibration variations from toe to crest	155
4.37	Effect of soil moisture on rate of displacement	156
4.38	Effect of vibration on rate of displacement	156
4.39	Site condition numerical model results for of FoS and	157

Figure No.	Title	Page. No.
	displacement	
4.40	Site condition numerical model resultant displacement result	157
4.41	Displacement readings at sensors installation locations in the project	158
4.42	Comparison of displacement measured with Sensor, TS, and NMM	158
4.43	Comparison of increment of rate of displacement (mm/day) of KTK OC2, KHA OC & SRP OC2 case studies with respect to soil moisture (%)	161
4.44	Comparison of increment of rate of displacement (mm/day) of KTK OC2, KHA OC & SRP OC2 case studies with respect to vibration (Hz)	162
4.45	Displacement with varying depths at different densities	164
4.46	Factor of safety with varying depths at different densities	165
4.47	Displacement with varying depths at different cohesion	165
4.48	Factor of safety with varying depths at different cohesion	166
4.49	Displacement with varying depths at different internal friction angle	167
4.50	FoS with varying depths at different internal friction angle	168
4.51	Displacement with varying depth at different elastic modulus	169
4.52	Factor of safety with varying depth at different elastic modulus	170
4.53	Relationship between slope displacement and FoS	170
4.54	Percentage of impact of various parameters on slope	172

Figure No.	Title	Page. No.
	displacement	
4.55	Percentage of impact of various parameters on slope displacement	173
4.56	Login Page of software	175
4.57	Software interface of home page	175

LIST OF TABLES

Table No.	Title	Page. No.
2.1	Specifications of the soil moisture, vibration and displacement sensor	46
2.2	Displacement of Slopes in different failure states	54
2.3	Guidelines for Risk Classification of Slopes	55
2.4	Deformation values for Slope partition of Opencast over old Underground galleries	55
2.5	Classification of Pit Slope Velocities for Planning	56
2.6	Slope behaviour for different trigger action response plan levels	64
2.7	Trigger action response plan summary	65
2.8	Classification of Pit Slope Velocities for Planning	66
3.1	Soil moisture sensor output with predetermined samples	69
3.2	Geophone and Vibration sensor reading	71
3.3	Displacement sensor calibration experiment observation	73
3.4	Salient features of KTK OC- 2 project	84
3.5	Details of slides occurred in the mine	85
3.6	The maximum reading obtained from each sensor node	89
3.7	Salient features of KHA OC project	92
3.8	Displacement measured with Total station	95
3.9	The maximum readings obtained from each sensor node	98
3.10	Salient features of SRP OC- 2 project	100
3.11	Maximum readings obtained from each node sensor	104
3.12	KTK OC2 mine slope configuration	109
3.13	Rock properties of slopes used for field numerical modelling	110
3.14	KHA OC mine slope configuration	111
3.15	Rock mass properties of slope at Khairagura OC Project	112

Table No.	Title	Page. No.
3.16	SRP OC2 mine slope configuration	113
3.17	Rock mass properties of slope materials on rise side slope at SRP OC-2 Project	114
3.18	Displacement by varying the depth and densities	117
3.19	FoS by varying the depth and densities	117
3.20	Displacement (mm) by varying the cohesion	117
3.21	FoS by varying the depth and densities	118
3.22	Displacement by varying the internal friction angle	118
3.23	Shows the FoS by varying the internal friction angle	118
3.24	Displacement by varying the Youngs modulus	119
3.25	FoS by varying the Youngs modulus	119
3.26	Observations of slope displacement and rate of displacement from the existing slope failure cases at different mines	123
4.1	Maximum soil moisture sensor reading from case study 1	131
4.2	Maximum displacement sensor reading from case study 1	133
4.3	Vibrations sensor reading from case study 1	135
4.4	Comparison of maximum displacement in slope by different modes	140
4.5	Maximum Soil Moisture sensor reading from case study 2	141
4.6	Displacement sensor observation readings at KHA OC2 (case study 2)	143
4.7	Maximum vibration sensor reading from case study 2	145
4.8	Comparison of maximum displacement in slope by different nodes	150
4.9	Maximum soil moisture sensor readings form case study 3	151
4.10	Displacement sensor observation readings at SRP OC2	153
4.11	Displacement sensor observation readings at SRP OC2 (case study 3)	155

Table No.	Title	Page. No.
4.12	Comparison of maximum displacement observed in slope by different modes	159
4.13	Variance in average soil moisture and average displacement due to rain of each case study	160
4.14	Minimum, average and maximum sensor readings of soil moisture, displacement and vibration sensor recorded in each case study	160
4.15	Notation of the parameters utilized in the rate of displacement linear regression equation	162
4.16	Relationship between the slope stability influencing parameters against displacement and factor of safety	171
4.17	Order of influence of various parameters obtained from regression analysis on displacement	172
4.18	Order of influence of various parameters obtained from regression analysis on Factor of safety	173
4.19	Parameters and its units of the notation used in the equations	174
4.20	Range of displacement (mm) corresponding to the factor of safety	177
4.21	Derived Trigger Action Response Plan from the analysis conducted on three case studies	178

NOMENCLATURE

ADC	Analog to Digital Conversion
ANOVA	Analysis of Variance
ASTM	American Society for Testing and Materials
CIL	Coal India Limited
DST	Department of Science and Technology
FEM	Finite Element Method
FDM	Finite Difference Method
FOS	Factor of Safety
GUI	Graphical User Interface
GSM	Global System for Mobile
GPS	Global Positioning System
GPRS	General Packet Radio Service
GSI	Geological Survey of India
HEMM	Heavy Earth Moving Machinery
ICT	Information and Communication Technology IDE Integrated Development Environment
IEA	International Energy Agency
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IFTTT	If This Then That.
IoT	Internet of Things
ISM	Industrial Scientific and Medical radio
ISRM	International Society for Rock Mechanics
ISO	International Standardization Organization
KHA OC	Khairagura Opencast Project
KTK OC2	Kakatiya Khani Opencast-2 Project
LiDAR	Light Detection and Ranging
LVDT	Linear Variable Differential Transformer

MIL-STD	Military Standards
NABL	National Accreditation Board for Testing and Calibration Laboratories
NIST	National Institute of Standards and Technologies
ODM	Oven Drying Method
SCCL	The Singareni Collieries Company Limited
SRP OC2	Srirampur Opencast -2 Project
SSR	Slope Stability Radar
TDR	Time Domain Reflectometry
USB	Universal Serial Bus
USN	Ubiquitous Sensor Network
Wi-Fi	Wireless Fidelity
WSN	Wireless Sensor Networks

CHAPTER - 1

CHAPTER 1

1. INTRODUCTION

This chapter deals with a brief introduction about coal production, necessity of opencast mines, general problems associated with deeper opencast mines, slope stability issues in particular and stability monitoring. Importance of slope monitoring by wireless sensor networks, numerical modelling studies for displacement assessment and trigger action response plan, Research gap, problem statement of the current work, objectives of this project and organization of chapters are also given.

1.1 General

Mining of minerals and fuels is an important economic activity which is a major driving source to the country's economy. The mining industry also significantly contributes to the technological development of mankind being the base of the manufacturing sector. Coal will continue to be a major contributor to the energy sector.

The worldwide energy demand continues to grow rapidly due to per capita consumption and also increase in population. India's overall coal production has increased by 33.71% from 730.87 Mt in the year 2019-20 to 997.25 Mt in the year 2023-24 (Ministry of Coal, 2024a). Whereas consumption of coal in India during the year 2023-24 is about 1236.24 Mt, resulting in import of 238.99 Mt (Ministry of Coal, 2024a). India requires 1.3-1.9 Bt of coal by 2030 (Ministry of Coal, 2024b).

1.1.1 Importance of opencast mining

Coal production from opencast mining has seen unprecedented growth, whereas underground production showed a declining trend during the last few decades. Figure 1.1 indicates coal production for the last ten years in Opencast (OC) and Underground (UG) mines in India, it clearly shows that the coal production from OC has increased by 70.6%, and the production from UG has decreased by 27.8%. The opencast method of mining contributes majorly to coal production in India it is about 96%.

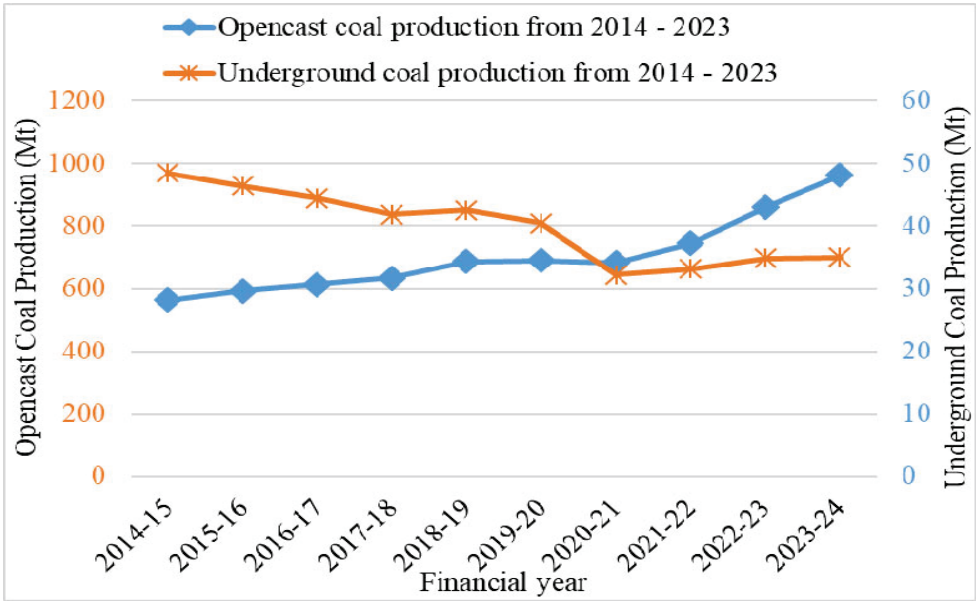


Figure 1.1 Coal Production in India for the last 10 years (OC Vs UG) (MoC, 2024a)

1.1.2 Necessity of deeper opencast coal mining

Opencast mines are operated over a larger area and they use modern, efficient, and large equipment. With the present day technology and size of the machines to extract original and residual coal are going deeper and deeper day by day, with stripping ratios up to 1:15, at depths beyond 300 m increases removal of very large quantities of overburden with high slope angles and higher bench heights become necessary.

1.1.3 Problems associated with deep opencast mines

As opencast coal projects become larger and deeper, parameters like planning, development, monitoring and control, etc., plays an important role to manage and to make the opencast projects successful. Deeper opencast mines have several significant challenges, like greater geological complexities, increased in-situ and induced stresses, various environmental issues like air pollution, water pollution, ground vibrations, land degradation noise etc., slope failures, and increased transportation and pumping costs.

1.1.4 Factors influencing slope stability

Slope stability plays an important role in the project's safety, economic, continuous operations. Slope stability depends on the uncontrollable parameters like geological formation and structure of deposit, rock type, geological features like joints, discontinuities, faults, folds etc., impacts of weather conditions including intensity of rainfall, rock properties and various strength properties like density, cohesion, angle of internal frictional, Young's modulus, etc. (Kumar and Kumar 2023). Controllable parameters such as overall slope angle, bench height, width, slope angle, orientation of faces, etc. Figure 1.2, shows the parameters influencing bench stability.

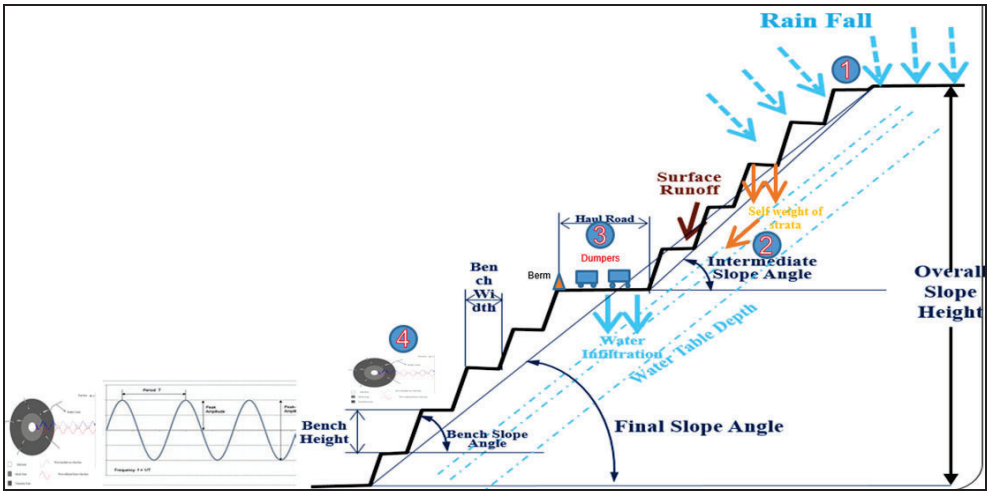


Figure 1.2 Geometry of Opencast Mine

1.1.5 Consequences of slope failures

One of the important problem associated with deep opencast mines is pit slope failures. Major impacts of slope failures are given below.

- Loss of life and equipment, which results in adverse effects to the project in terms of financial loss
- Production losses
- Cost of removal of the failed material and possible loss of reserves.
- Poor human relations due to slope failures.

1.2 Statutory Provisions for Slope Stability in Opencast Mines

Slope stability being a safety issue in OC mines, the Director General of Mines Safety (DGMS), made monitoring of slopes mandatory and also recommended development of Trigger Action Response Plan (TARP) for OC projects. Presently TARP is under designing stage in the coal industry.

The purpose of a slope monitoring system, which can provide a reliable warning of instability sufficiently in advance to facilitate stabilization of the particular slope bench failure or at least withdraw men and equipment to ensure safe operating practices. Displacement of vulnerable area must be continuously monitored to adopt suitable measures. In the early days, slope monitoring included monitoring the tension cracks in the slope for identifying and measuring displacement.

Mining companies have a moral and legal obligation to adhere to safety regulations to prevent accidents, especially those caused by slope failures, and to provide a safe working environment. This helps to protect the workforce and prevents financial losses in opencast mines. The use of monitoring instruments aids in hazard identification and helps to minimize workforce anxiety.

As per regulation number 106 (2) under Coal Mines Regulation (CMR) 2017 of India, it is mandatory for the owner, agent, manager of the mine to ensure the availability of scientific study report of that mine, which includes its method of working, ultimate pit slope, dump slope and monitoring of slopes for all mechanized opencast mines.

As per the Director General of Mines Safety DGMS (Tech), (2020a) circular No. 2, the manager of every mine shall establish a separate organizational set up including slope monitoring officer for slope monitoring for each opencast mine which works under the control of the Geotechnical-cell for a group of mines, to ensure that the activities of the Trigger Action Response Plan and procedure to be implemented accurately.

Circular No.3 of 2020, DGMS (Tech), (2020b), gave the guidelines for systematic monitoring of slopes and a detailed methodology to conduct the scientific study under regulation No.106 of CMR 2017 in opencast coal mines.

1.3 Slope Monitoring in Opencast Mines

In slope monitoring methods, the data is obtained and analyzed offline rather than real-time continuous monitoring. In conventional methods of slope monitoring, instruments like total station, extensometer, inclinometer, etc., this type of monitoring requires a human presence at the site, with the readout units physically connected to the base units. Additionally, monitoring can only be conducted during daylight hours. On the other hand, modern instruments such as SSR and LiDAR can effectively monitor slope movements. However, they rely on advanced technology, function only in daylight, and are quite expensive.

To predict slope failure due to displacement and to get early warning, sensors are being used apart from modern slope monitoring methods. As it is difficult to record and communicate the slope movements with conventional and modern instruments. Hence, WSN is an option to capture any minute indications of movement of the slopes in opencast mines. WSN are of low-cost, low-complexity and two-way communication network and implementation of WSN is a practical approach for the real-time monitoring of slope behaviour. It can also serve to issues advance warnings through an early warning system, ensuring continuous and safe operations while optimizing production in opencast mines.

In order to analyze the slope under different geo-mining conditions, numerical modelling is an efficient tool. Numerical simulation techniques also allow for the evaluation of the stability and safety of slopes under various loading and boundary conditions, which is critical for engineering design and risk assessment through reliable information on the displacement and failure mechanisms of slopes.

1.4 Trigger Action Response Plan

A Trigger Action Response Plan (TARP) provides a list of triggers, usually four or five observables at the operator level ranging from standard to extreme abnormal level of forces and displacements movements. TARP is a set of guidelines categorized into various levels that specify appropriate actions to be undertaken depending on prevailing slope stability conditions which is based on maximum displacement and rate of displacement.

1.5 Research Gap and Motivation

Slope monitoring systems, such as LiDAR, TDR, and SSR, are used in opencast mines. Despite their efficiency, these systems have drawbacks, including high cost, unsuitability for automation, lack of real-time data transfer, inability to detect displacement early due to higher least counts, late detection, etc.

Hence, utilization of technologies like wireless sensor networks along with Internet of Things (IoT) and cloud computing technology are being tried for slope monitoring. This technology is not fully established and utilized so far in mining industry.

TARP is recommended for slope monitoring in mines by DGMS, as it suggests actions to be taken in the event of symptoms of instability. It also emphasizes routine monitoring methods and maintenance of slope and helps to identify areas of concern that may require subsequent actions like stabilization if possible, warning and withdrawal of men and machinery.

Currently, there is no well-established method for developing a TARP with various trigger levels in slope management in opencast coal mines.

1.6 Problem Statement

The present research work is to conduct systematic research to develop an effective and reliable slope monitoring system in opencast coal mines using wireless sensors and communication networks with latest advancements in Information Technology (IT) like cloud computing technologies (CCT), and Internet of Things (IoT), and also developing a TARP for prediction of reliable potential slope failures using Wireless Sensor Network (WSN) based slope monitoring system and validate the same using existing total station system which is an established system. Similarly, the results of the WSN is validated with the results of numerical modelling.

1.7 Objectives

The following objectives are formulated to develop an advanced slope monitoring system to design a Trigger Action Response Plan.

1) To design WSN using IoT to monitor the slope displacement in opencast coal mine slopes.
2) To monitor the slope behavior by deploying the pre-designed WSN based slope monitoring system in opencast coal mines.
3) To develop an alert message system by processing the collected data using machine learning algorithms.
4) To design and develop an advanced slope monitoring system embedded with an alert system and Trigger Action Response Plan (TARP) for opencast coal mine slopes.

1.8 Research Methodology

Following is the methodology followed for achieving the above objectives of the research and a schematic diagram of the same is shown in Figure 1.3.

a) A literature review was conducted on conventional slope monitoring, wireless sensor networks, slope stability, and TARP.

b) Initially, suitable sensors were selected, calibrated, and tested in the laboratory. The slope monitoring system consists of wireless sensor networks are integrated with ThingSpeak to send an alert message, once the threshold limit crossed.

c) Once the laboratory scale system, is found to be reliable, field investigations were carried out in three selected opencast coal mines. Slope displacement was monitored using moisture, vibration and displacement sensors. Based on the initial data generated, the slope monitoring system is upgraded with more advanced tools like ThingSpeak cloud data analysis and Pythonanywhere platform to send alert messages.

d) Samples were collected from different locations/benches of the mines to determine the required rock properties in the laboratory. Data collected from sensors were validated against total station readings and numerical modeling studies. A numerical modeling parametric study was conducted, involving the

selection of variable parameters, simulation under different conditions, and interpretation of parameter influences.

e) Regression analysis was used to develop a user friendly slope stability and displacement prediction software, which can predict slope displacement, factor of safety, and rate of displacement. Finally, TARP guidelines were developed.

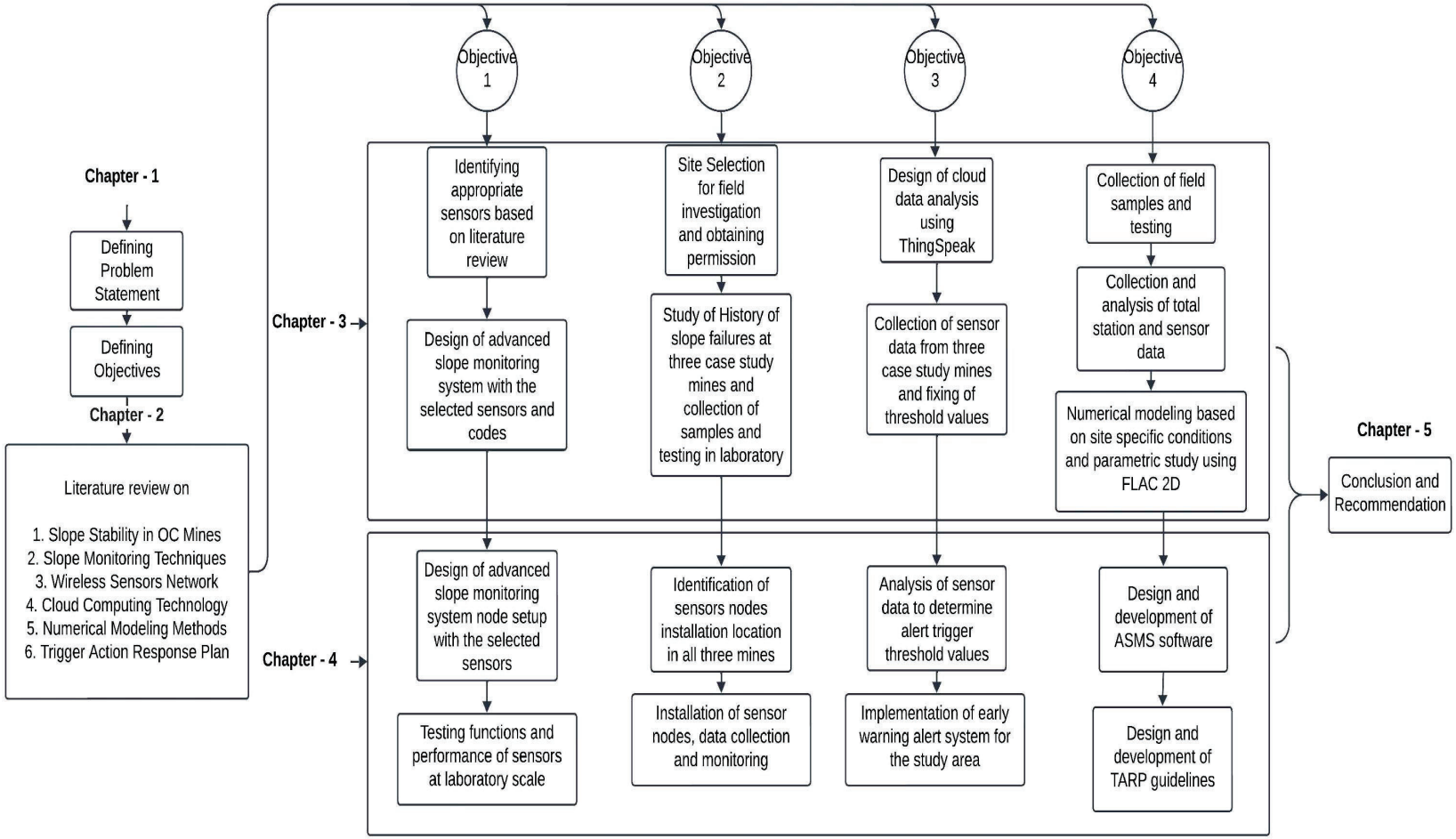


Figure 1.3 Schematic representation of the methodology

1.10 Organization of Thesis

This thesis is alienated into five major chapters.

Chapter – 1: Introduction

This chapter covers background information on the research topic. It includes the Indian coal mine production scenario and the importance of large and deep opencast coal mines, followed by the research gap, problem statement, a concise description of the research objectives and limitations of the study.

Chapter – 2: Literature Review

This chapter presents in detail review of literature on various topics associated with the current study, like slope stability, and conventional and modern slope monitoring techniques in large-scale opencast mines. Further, detailed literature is presented on the use of Internet of Things and wireless sensor networks for slope monitoring. Followed by the literature on fundamentals of numerical modelling and its applications to slope stability studies. The last section of the chapter describes the work carried out by other researchers on the basic elements of the TARP.

Chapter – 3: Investigations

This chapter covers the methodology adopted for field investigations. Experimentation regarding laboratory experimentation on the calibration of various sensors and performance of WSN based slope monitoring system. Following that salient features of the mine case studies along with the history of slope failure and details regarding the existing slope monitoring system are highlighted. Further, field investigations carried out with WSN based slope monitoring system are described. Subsequently, the procedure adopted for the rock samples collection and testing in the laboratory to obtain the rock properties are discussed. Similarly, the numerical modelling studies based on field conditions and parametric study leading to the development of advanced slope monitoring system software (ASMS) and design of TARP is elaborated.

Chapter – 4: Results and Analysis

This chapter presents a comprehensive discussion of the results and observations acquired from the WSN based slope monitoring system in the laboratory and in the field. Later, observations based on the effect of rainfall and vibrations on slope displacement is presented. Further, validated the WSN based slope monitoring results by comparing with total station based slope monitoring and field condition based numerical modelling and followed by the details of the parametric study conducted to develop a regression equation for displacement and factor of safety based on the numerical models are discussed along with effect of influence of various rock properties on slope displacement and factor of safety. Later, an advanced slope monitoring system (ASMS) software is developed. Formulated the Trigger Action Response Plan for opencast coal mines in this study are presented.

Chapter – 5: Conclusions and Recommendations

Conclusions were drawn based on the results of the investigations, recommendations and scope for the future study are presented in this chapter.

CHAPTER - 2

CHAPTER 2

REVIEW OF LITERATURE

2.1 Introduction

The literature review chapter of this thesis gives details of existing research on the topics of slope stability and different parameters that cause slope instability, slope stability analysis methods, current and emerging methods of slope monitoring, research studies on the effects of slope deformation and trigger action response plan for slopes. This chapter provides background information and context for the study and aims and a discussion of the main findings and conclusions of the existing research studies is covered. In addition to that, identifies gaps in current research areas. This chapter includes an overview of the back ground research conducted for this thesis, and on evaluation of the research methods used in the development of an advanced slope monitoring system and trigger action response plan for opencast coal mines, using the Internet of Things (IoT).

2.2 Slope Stability in Opencast Mines

Slope stability can be defined as a state at which slope is in equilibrium condition while withstanding internal and external forces without producing any significant displacement. Slope stability associated issues considerably affect all aspects of mining. Slope stability is determined by the local geological and geotechnical characteristics, as well as the prevailing groundwater circumstances of the rock mass forming the slope. The design of the opencast mine slopes is an important factor for the production and mine workers' safety, which controls the economics of the project. The ever-increasing pit depths and production demands of opencast mines compel design engineers and planners to balance stability and production constraints. Steepening the bench slope can enhance economic efficiency by reducing the volume of waste excavation. On the other hand, excessively steep slopes can result in slope collapse, leading to loss of human life and property damage. Slope failure occurs when the slope’s self-retaining ability deteriorates (Rusydy et al. 2016).

In recent years, slope failures in many opencast mines have resulted in significant production losses, additional stripping costs to remove landslide material, bench reformation, and haul road diversions etc. The mine economics can be severely benefited by scientifically designing an optimal slope which is stable in running high-walls of mechanized opencast mines.

Slopes must be engineered taking into account of various factors such as the depth of the pit, slope angle, geological conditions, rock strength, groundwater pressures, among others (Tripathy and Prakash 2010). Achieving optimal slope design involves a series of steps, including visual inspection of bench conditions, engineering assessments, rock sample testing, geo-mechanical classification, numerical analysis and stereo net analysis (Gundewar et al. 2014). In opencast mines, slope design optimization is crucial, particularly when geological structures distinctly characterize the rock mass. Proper orientation is essential to ensure stability and maximize efficiency.

Mode or type of slope failure is primarily controlled by rock mass properties, water content and foundational strength in natural settings (Wyllie and Mah 2005; Fleurisson 2012). Failures are classified into the following four types based on the occurrence and effect of failure and those are Plane Failure, Toppling Failure, Circular Failure, and Wedge Failure (Wyllie and Mah 1974) and (Wyllie and Mah 2005). Figure 2.1 depicts different types of slope failures observed in surface mines. In the mining areas, though the controls are different, the mechanism remains the same.

Simple plane failure represents one of the most straightforward types of rock slope failure to analyze. Plane failure is characterized by failure along a discontinuity, like a bedding plane, which runs parallel to the slope face and dips into the excavation at an angle surpassing the friction angle (Raghuvanshi 2017). Wedge failure happens when two joints, originating from different sets, intersect with a dip towards the slope. If these discontinuities strike obliquely across the slope face and their intersection line crosses the slope face, the rock wedge resting on these discontinuities can slide down along this line, particularly if its inclination is significantly greater than the angle of friction. The magnitude of the failure is influenced by the frequency of joints and

typically results in smaller failures compared to plane failure.

Circular failures typically happen in weak rock or soil slopes. While they don't always manifest as perfect circles, some form of curved failure surface is usually evident. Factors such as particle size and mechanical properties influence these failures, particularly in very weak soil slopes or heavily jointed or fractured rock masses, such as in waste rock dumps. Toppling failure, on the other hand, happens along a dominant and continuous set of joints dipping against the slope, with a strike nearly parallel to the slope face. Hammah et al. (2007) describe toppling failure as occurring when the weight of rock resting on an inclined plane slides outside the base of the block. Surface toppling can lead to rock falls, while dip toppling tends not to occur suddenly.

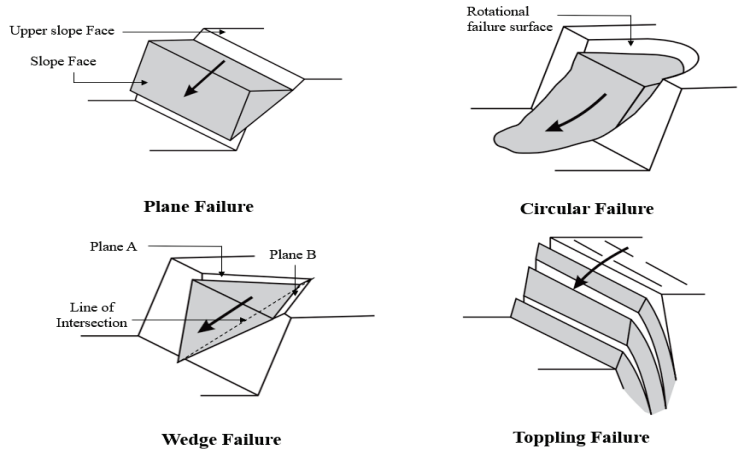


Figure 2.1 Different modes of slope failures (Wyllie and Mah 1974 and 2005)

2.2 Slope Failures and its Consequences in Opencast Mines

Slope instability is one of the leading causes for accidents due to the ground's unexpected movement. It has potentially endangered lives, demolished equipment, resulted in hampering day-to-day coal production and safety in real-time operations at opencast mines.

On February 22, 2023, a catastrophic incident occurred at Alxa League coal mine (Figure 2.2). A massive slope failure, reaching a height of 180 m, resulted in the collapse of the mine and the subsequent burial under an immense amount of debris. Tragically, this event claimed the lives of 6 individuals.



Figure 2.2 Slope Failure at Alxa League, Mongolia, China (Geo engineer 2023)

On November 14, 2022, a slope failure occurred at a stone quarry in Maudarh, located in the Indian state of Mizoram, resulting in the tragic loss of 12 lives (Figure 2.3). The landslide's initiation is believed to have occurred in residual soil located at an elevated position on the slope above the quarry (India Today 2022).



Figure 2.3 Stone quarry slope failure at Maudarh, Mizoram, India

On April 24, 2019, a devastating mudslide occurred at a mining site in Myanmar, resulting in loss of more than 50 lives. Myanmar, a Southeast Asian nation, is rich in natural resources such as jade, gold, and other minerals. The slide was primarily caused by the heavy rainfall in the region, which led to soil saturation and instability (Figure 2.4).



Figure 2.4 Slide at Mining site in Myanmar, India

In opencast mine mining operations, Slope collapse or failure is the primary issue with them. Consequently, there will be a significant volume of waste mining and dumping, which raises the possibility of high wall slope failures. Slope instability is a serious natural hazard that affects both natural slopes and coal mines.

2.4 Factors Affecting Slope Stability

Each incident of slope failure in a mine is expected to result in significant losses, not only due to the direct impact on in fracture and equipment but also because mining operations often need to cease temporarily during the investigations and restoration process (Harries et al. 2009). With the growing demand for minerals such as coal, surface mines have evolved to meet this need due to their numerous advantages. The challenges of slope stability become more pronounced as the height and width of benches were increased to accommodate large mining machinery and boost output. However, this also led to slope instability. Therefore, it become imperative to evaluate and comprehend the slope aspects that initiate slope collapses. Slope stability analysis and monitoring are effective tools to ensure safety. In the mid-1900s, during the initial stage of mechanized mines, Thornbury (1954), classifieds factors affecting slope stability. Water circulation and anthropogenic activities represent active factors influencing slope stability, while lithology, stratigraphy, topography, geological structure, and climate are passive factors.

According to Chaulya and Prasad (2016), geological structure, groundwater, lithology, mining methods, slope geometry and equipment, dynamic forces, cohesion and angle of internal friction are the different factors affecting slope stability. Kumar and Kumar (2022), classified the factors into four categories:

- Geological structures,
- Geotechnical factors,
- Slope geometry and
- Other sources of slope disruption.

Geological structures include incompetence of rock, tension cracks, joints and discontinuities, groundwater and lithology. Geotechnical factors include shear strength, internal angle of friction, and cohesion. Slope geometry includes slope angle, height and width of the slope and overall slope angle. Other sources of slope disruption include soil erosion, seismic effects, equipment and mining methods. The same parameters affecting slope stability have been mentioned by many other authors as well and each parameter is discussed in detail in the following section.

2.4.1 Geological structure

Slope monitoring systems, slope stability analysis, slope stabilization techniques, and other slope-related studies focus on the geological aspects of the slope. Empirical methods for stability evaluation often overlook the critical role of geological structure in influencing slope kinematics and stability (Fukuzono 1985). The geological structures of a slope play a significant role in determining the type or mode of failure. According to Saadoun et al. (2018), the most crucial geological structures affecting slope stability are the direction of dip, joints, discontinuities, faults, and intraformational shear zones, etc. Faults are viewed as planes of weakness where failure initiation can occur, and they also influence permeability, porosity, and water ingress into the rock. Hudson and Harrison (1997) illustrate the important geological structures of a rock mass in Figure 2.5.

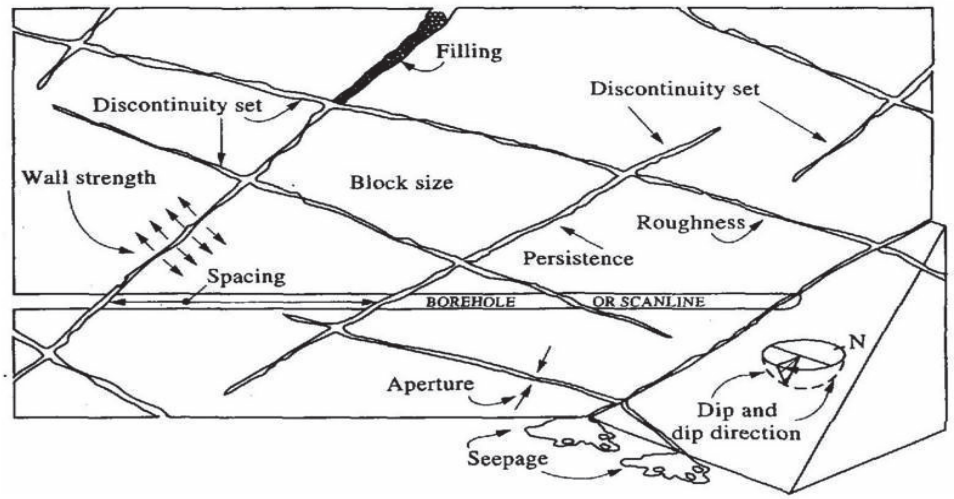


Figure 2.5 Geological structures of a rock mass (Hudson and Harrison 1997)

These cracks are susceptible to propagation, leading to the detachment of the rock face from the body. Moreover, they can exert a push force when filled with water, gravel, or soil. Joints, on the other hand, are fractures that occur at regular intervals within a rock mass. Individual joints and discontinuities play a significant role in the instability of a rock slope (Saadoun et al. 2018). According to Read and Stacey (2010), slope stability is highly influenced by the three-dimensional distribution of geological disturbance and slope configuration. When a discontinuity is present in intact rock, it tends to bear the entire sliding force, creating a plane of weakness that may eventually fail (Saadoun et al. 2017).

The compressive strength of rock is notably decreased by groundwater, which exerts physical and chemical effects on the pores within the rock. An abrupt alteration in water flow can rapidly mobilize a slope, accelerating the weathering process by infiltrating fractures (Chandarana et al. 2016). The images depicted in Figure 2.6 illustrate the effects of saturation on a slope. Figure 2.7 depicts the effect of groundwater liquefaction due to pore pressure. In such instances, water surrounds the grains, resulting in the elimination of contact between them and reducing friction.

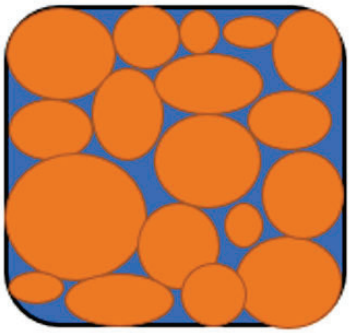


Figure 2.6 Effect of groundwater with water-saturated sediment

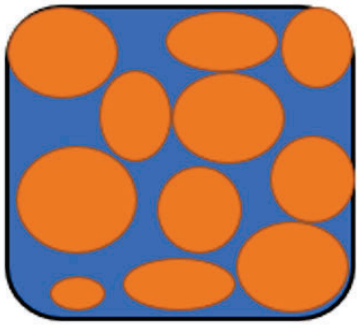


Figure 2.7 Effect of groundwater with water Liquefaction

2.4.2 Geotechnical factors

Geotechnical factors influencing slope stability include porosity, plastic limit, void ratio, plasticity index, liquid limit, in-situ water content, saturated unit weight, cohesion, angle of internal friction, and dry density (Yalcin 2007). Kim & Song (2015) and Bicocchi et al. (2019). As stated by Mali et al. (2021) the most relevant causal factors of slope failures are relative compaction, water content, porosity, slope angle, internal friction angle, in-situ, and saturated permeability.

The strength of rock on slopes varies widely. It depends on material properties, such as the rock type, which relates to the chemical properties of the rock (Skinner et al. 1995). The slope stability depends on the shear strength of the rock mass. Gravity constantly exerts a vertical downward force on the rock mass. This force can be divided into two components: the shear force, which pulls the rock mass along the slope downwards, and the normal force, which pushes the rock mass into the slope itself (Stephens et al., 1984). To cause the slope to slide from the slope, the shear force must exceed the shear strength of the rock mass. The shear strength of the material depends on factors such as joints and discontinuities, cohesion, friction, and density. However, shear strength can generally be considered a representation of slope stability. As the moisture content increases cohesion reduces (Verma et al. 2017). Figure 2.8 from Lambe and Whitman (1979), depicts the correlation between shear stress and normal stress, showcasing how friction and cohesion impact this relationship.

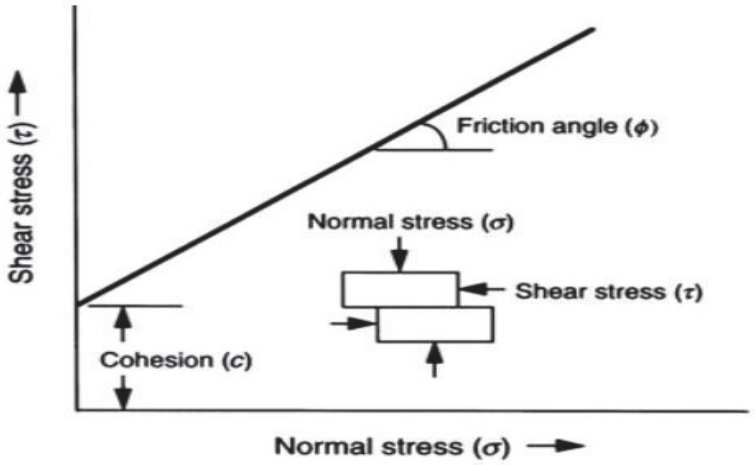


Figure 2.8 Relation between shear and normal stress (Lambe and Whitman 1979)

The friction angle represents the ability of a rock slope to withstand shear stress. A higher internal angle of friction leads to a higher factor of safety (Menglan et al. 2018). The coefficient of sliding friction typically measures a rock or soil's capacity to withstand shear stress. Factors such as particle roundness, size, and quartz content influence this coefficient. When rock is sheared at zero normal pressure, it produces a measurable resistance, which is quantified in pascals. This force of resistance per unit area is known as apparent cohesion (Blasio 2011). Indeed, a higher value of cohesion contributes to a higher factor of safety and reduces slope stress, strain, and deformation (Menglan et al. 2018). Cohesion is a fundamental property of rock or soil that gauges their resistance to deformation or fracture under various forces, including gravity.

2.4.3 Slope geometry

The primary objective of the slope design process is to achieve a design that is both safe and cost-effective for the mine bench, ramp, or overall slope (Saadoun et al. 2017). As mines deepen and expand, the slope design must inherently address higher risks associated with the potential size of failure and its consequences (Mohmmed 2021).

In geometric slope design, the three main parameters are height, overall slope angle, and failure area. As slope height increases, slope stability tends to decrease.

Furthermore, raising the overall slope angle can heighten the risk of failure occurring at the rear of crests, possibly resulting in localized ground deformation in the peripheral area of the mine. Figure 2.9 depicts key components of opencast mining.

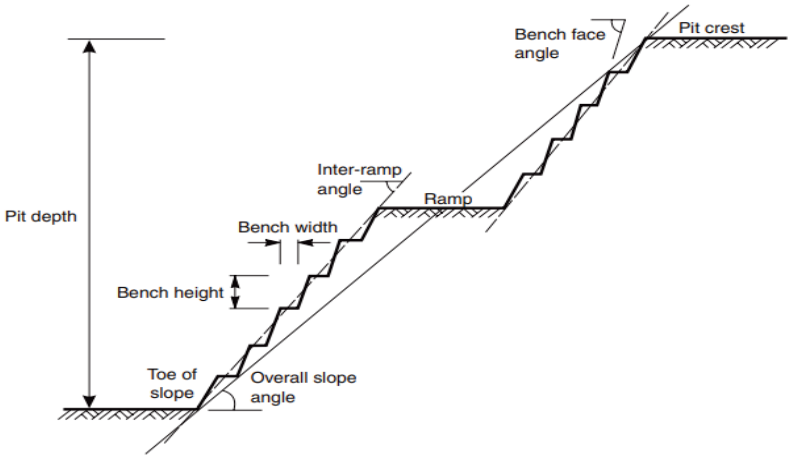


Figure 2.9 Schematic opencast diagram (Wyllie and Mah 2005)

Slope angle in indeed one to the most crucial factors influencing slope instability. The slope in various study areas can vary significantly based on their morphology. As noted by Chaulya (1993), the greater slope angle, the more unstable it tends to be. Given that steeper slopes pose a higher risk of landslides, it's logical to prioritize this factor in landslide risk assessment. Consequently, many studies utilize slope angle as a key parameter for landslide zoning due to its significant influence. Additionally, surfaces with angles of less than 10% typically do not experience slipping (Teshnizi et al. 2021).

2.4.4 Other sources of slope disruption

Other sources of slope disruption include soil erosion, seismic effects, equipment, and mining methods. Two aspects of erosion merit consideration. The first pertains to widespread erosion, such as river erosion at cliff bases. The second type is induced by groundwater or surface runoff. The method of mining and the type of mining equipment employed determine the duration of slope face exposure. Deeper and larger mine benches are expected to endure for years. Different surface mining methods utilize various approaches to address this issue, considering factors such a slope stability, deformation, and strain over time. In steeps seams, utilizing the opencast

mining technique allows greater slope height but also raises the risk of bulk mode failure. As mining equipment gathers on the benches of the pit, it adds weight, creating surcharge that exerts downward pressure on the slope, potentially inducing instability.

The difficulty in determining the optimum pit slope design stems from uncertainties associated with the stability of the slopes (Satyanarayana and Sinha 2018). As a result, no single standard principle can guarantee the correct solution with absolute certainty (Fleurisson 2012). In such cases, early prediction of slope failures with advanced slope monitoring allows for the implementation of preventive measures. There are numerous slope monitoring systems available, however, it is important to choose the most fitting approach to a specific site condition. To identify the optimal slope monitoring method of a specific site condition, it is crucial to have a comprehensive grasp of the parameters influencing slope failures and the potential modes of slope failures.

2.5 Slope Monitoring in Opencast Mines

The necessity of a slope monitoring system is to uphold safe operating practices for workers and equipment to provide warning of instability to minimize the impact of slope failure. Utilizing monitoring systems is crucial for evaluating design effectiveness, assessing the risk of failures, and aiding in risk mitigation. In the current context, mining firms bear both ethical and financial responsibilities to eradicate accident possibilities and legal obligations to ensure workforce safety. Legislation mandates that employers must exhaust all measures to guarantee a secure workplace. Failure to identify hazards and address associated risks may lead to legal penalties, including fines or imprisonment. Implementing monitoring instruments assists in identifying potential hazards and alleviating workforce concerns.

As per regulation number 106 (2) under coal mines regulation (CMR) 2017 of India, before starting any mechanized opencast mine, the owner and agent of the mine shall get scientific study done in the mine, which includes its method of working, ultimate pit slope, dump slope. As per the Director General of Mines Safety (DGMS) circular no. 2 of 2020 of India, the manager of every mine shall ensure that, maintaining a separate organization set up for slope monitoring system, including a slope

monitoring officer for each opencast mine under the control of the Geotechnical-cell for a group of mines, to ensure the activities of the Trigger Action Response Plan and procedures of the same have to be implemented accurately. Circular no.3 of 2020, DGMS, has circulated the guidelines for systematic monitoring of slopes and scientific study under regulation no.106 of CMR 2017 in opencast coal mines. In Figure 2.10, the importance and benefits of slope monitoring in a surface mine are listed.

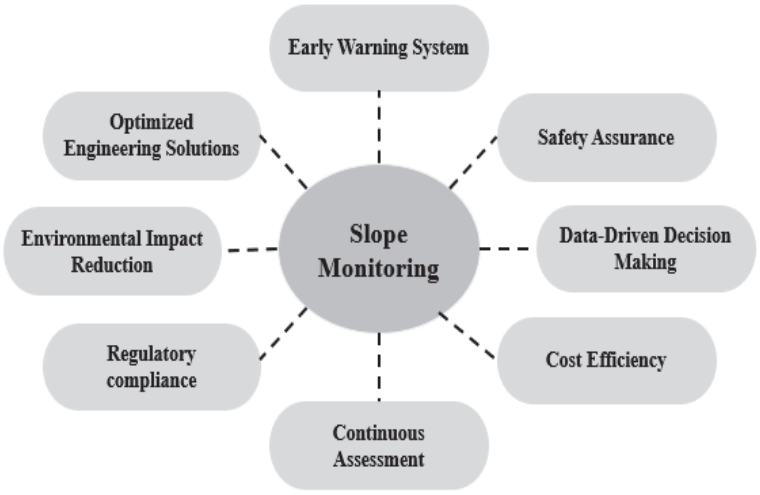


Figure 2.10 Importance of Slope Monitoring

According to Kayesa (2006), the reasons which make slope monitoring essential are

- To serve as a warning system,
- To measure the movement rate of the unstable zone,
- Requirement of risk management tool for slope stability,
- To update mine design and
- To assure the production and management officials with the technical data proof on the stability status and economic status of the mine.

The three primary objectives of slope monitoring given by Sjoberg (1996) are:

- To maintain safe operating practices
- To provide a prior warning or notice of instability and
- To provide geotechnical information on slope behaviour.

In the early days, slope monitoring included inspection of the tension crack along the slope face and mapping the readings of daily reports obtained from the manual inspection were the only mode of monitoring. These readings were analyzed regularly to observe the movement of the rock mass. Routine visual inspections involve monitoring slopes, pits, access ways, high walls, low walls, and crests in coal mines. (Osasan and Afeni 2010). Conventional geotechnical and survey instrumentation will remain relevant in slope monitoring efforts, and survey options also are used in slope monitoring, complementing the latest monitoring systems (Cawood and Stacey 2006). It is necessary to observe any minor changes in the condition of benches and faces due to cracks in faces, crest loss and changes in water flow. Slope monitoring instruments are more valuable for measuring slight movement and cracks that appear on a bench. Traditional methods for identifying significant failures include mapping and monitoring tension cracks formed along the slopes (Vinoth et al. 2016).

The rock slope movements exceeding the limit of control of rock strength create instability around the mining excavation (Kayesa 2006). General slope monitoring involves measuring the reference points periodically and automatically in or around the area under movement to determine the deformation (Osasan & Afeni 2010). Many mining companies give intense attention to slope monitoring since an unpredicted rock mass movement subsequently may result in an enormous slope failure, resulting in severe damage to the mining operations and posing a main safety issue or promoting significant financial losses for the companies (Girard 2001). Surface mines around the world utilize various methods of slope monitoring. It is crucial to select the most appropriate and advanced slope monitoring system concerning the site conditions. Figure 2.11 displays different slope mentoring techniques that are classified as conventional methods, and modern-day slope monitoring systems.

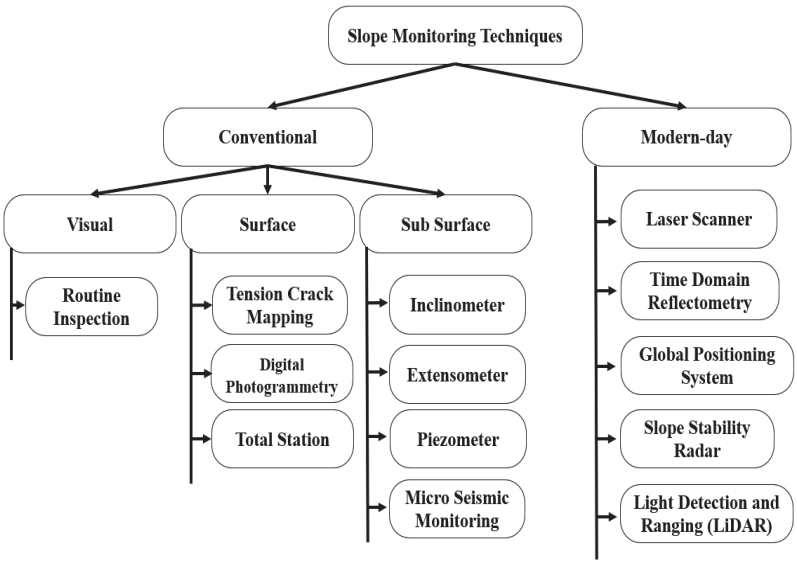


Figure 2.11 Slope monitoring technique (Vinoth et al. 2016; after Masood et al. 2022)

Further, the conventional methods can be classified as surface and sub-surface methods. Surface methods measure displacements at discrete points and over large slope areas using theodolites. Osasan et al. (2012) described the significant problems of the theodolite and total station using reflector prisms surveying system of slope monitoring, the errors due to dust and haze in the atmosphere, human errors, damages of a prism. Sub-surface methods rather detect rock movements that are impossible with surface methods. the instruments that are used in direct and indirect ways are wireline extensometer, Time Domain Reflectometry (TDR), Inclinometer, Borehole Extensometer, Settlement gauge, Tiltmeter, Groundwater table gauge, etc. These instruments are capable of measuring geometrical and physical parameters such as changes in distance between points, tilt angles, borehole profiles, stresses, and groundwater pressures (Nunoo et al. 2015). The technologies used to monitor the slope monitoring instruments above for continuous monitoring are Total Stations, LiDAR, SSR, GPS, and Digital Photogrammetry slope monitoring are used in opencast mines. A brief review of aforementioned methods is given in the following sections.

2.5.1 Visual inspection and tension crack monitoring

Regular visual slope monitoring inspections must be conducted by an engineer in close proximity to potentially hazardous working zones, encompassing the pit, access paths, high wall, and crests. When an area of slope fails to bend cracks are formed due to the tension developed (Yadav et al. 2019). Monitoring tension crack development can yield vital geotechnical insights into slope failure patterns, and direction of movement and potentially forecast the timing of failure (Ding and Qin 2000). Tension crack measurement involves a scale mounted across the sides of the crack, as the crack expands, the displacement distance can be calculated, as well as the displacement rate. Figure 2.12 depicts tension crack monitoring using the offset ruler.



Figure 2.12 Tension crack monitoring in surface mines (Jooste and Cawood 2006)

2.5.2 Inclinometer monitoring system

Slope inclinometers are utilized to ascertain various characteristics of landslide movement, including magnitude, rate, direction, depth, and type (Stark & Choi 2008). There are two types of inclinometers: Probe inclinometers and Fixed-in-place inclinometers (Laplante 1998). The grooves are precisely designed to accommodate the wheels of a probe-type inclinometer, and the angle of the probe is measured from the vertical axis using a pendulum. Deflections will be measured automatically from the known angular measurement and distance from the wheel, comparing old and new values will represent landslides (Cala et al. 2016). Figure 2.13 illustrates the visualization of an inclinometer installed within a borehole.

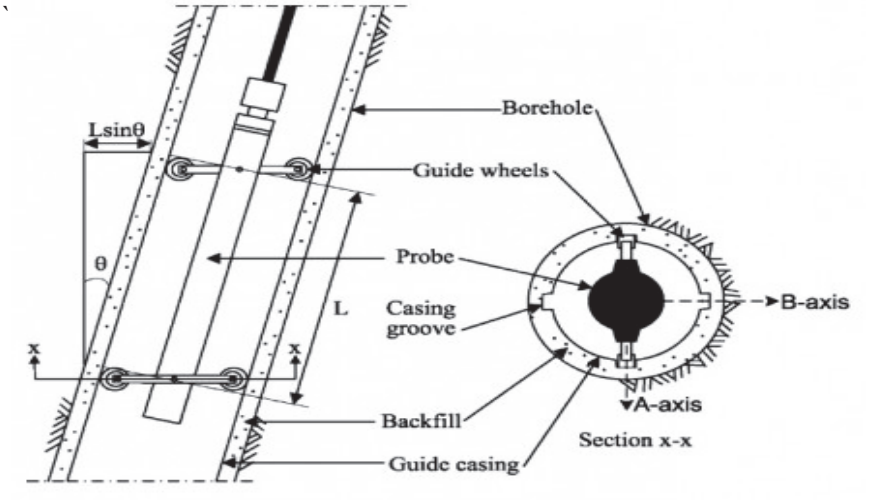


Figure 2.13 Slope inclinometer (Dunnicliff 1988 and Stark and Choi 2008)

2.5.3 Monitoring with Extensometer

Extensometers are effective and economical method of defining relative movement between points (Yang et al. 2017). Wireline Extensometer works from a stable section to monitor the unstable rock mass by mapping the movements along the crack. Extensometers usually use variable reluctance transducers, electrical resistance and mechanical micrometers (Ding and Qin 2000). A steel wire is attached to the unstable rock mass and the other end to the track-mounted weight, thus the mounted weight gives the displacement measurements and is recorded in the system. It measures the axial displacement between several reference points along the same axis and is installed on a sloped surface or within a borehole. Extensometers cover a wide range of measurements, spanning from just a few centimeters to approximately 180 meters (Ding and Qin 2000). Figure 2.14 displays a figure of the wireline extensometer.

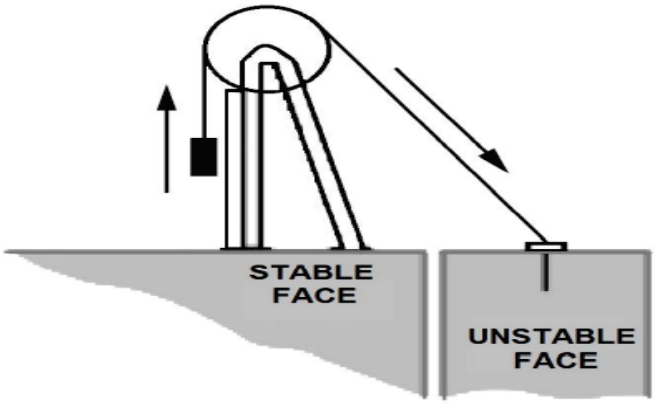


Figure 2.14 Wireline extensometer schematic figure (Girard and McHugh 2000)

Wireline Extensometers with digital measurements are available to measure the reading electronically and display the portable extensometers enable continuous surveillance even in bad climate conditions (Angeli et al. 2000). Girard and McHugh, (2000) claim that the distortion in the tension cable in the event of unexpected large deformation is the major disadvantage of this system. Measurement inaccuracies often arise from friction between anchors and linkages, sags triggered by temperature and wind, and imprecise measurements in areas of weakened ground crests due to loose soil (Dunnicliff et al. 2012).

2.5.4 Monitoring with Piezometer

Conventionally piezometers (Figure 2.15) are used to monitor the slope of groundwater problems. It is used to monitor the pore pressure within the rock (Girard 1998). Pore pressure in rock causes serious problems to the slope by reducing slope stability by reduction of shear strength, and development of seepage forces that lead to slope failure (Brawner, 1982). A piezometer operates by converting ground water pressure into a frequency signal using a diaphragm and a tensioned steel wire. Variations in pressure acting on the diaphragm cause changes in wire tension. When the wire is stimulated by a magnetic coil, it vibrates at its natural frequency. This vibration close to the magnetic coil generates a frequency signal that is transmitted to the readout device. Upon reception, the readout device processes the signal and displays a reading. Calibration factors are applied to establish the relationship

between the pressure exerted on the diaphragm and the frequency signal received by the readout device, enabling the conversion of Hertz readings into voltage.



Figure 2.15 Monitoring with Piezometer (Chaulya and Prasad, 2016)

2.5.5 Micro seismic monitoring

The working principle of micro seismic monitoring involves detecting and recording the micro-level seismic events in the subsurface, which indicate ground movements (Tarchi et al. 2003). This practice has been in use since 2002 to predict slope failure and associated problems (Farrington and Sargrand 2006). A set of data loggers are utilized to record the micro seismic events, transmitting them to the processing system (Vinoth and Kumar 2014). Subsequently, the system processes the received signals, identifying zones of weakness, rates of deformation, etc., This information proves valuable in recognizing potential excavation damage zones, and propagation of existing discontinuities within the monitoring zone (Cai et al. 2001; Liang et al. 2013; Xu et al. 2012; Little 2005). Furthermore, using the planes of weakness defined by seismic events aids in identifying previously unknown geologic structures (Lynch et al. 2005). Kumar et al. (2007) points out inaccuracy in predicting slope failure as its major disadvantage. Figure 2.16 shows a picture of micro seismic monitoring within a slope using geophones.

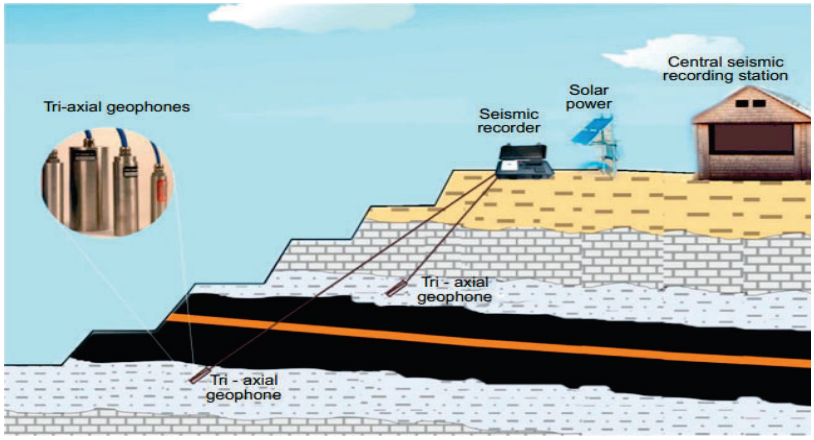


Figure 2.16 Micro Seismic monitoring using geophones (Kumar et al. 2007)

2.5.6 Monitoring with Digital photogrammetry

Digital photogrammetry stands out as the most prevalent and straightforward remote sensing method for detecting rock movements. Its primary goal is to discern the extensive displacement patterns of a target by comparing captured images through a digital camera (Ohnishi et al. 2006). When an object is photographed from two or more survey points with known relative positions and orientations, it becomes possible to ascertain the relative positions of identifiable points on the object (Figure 2.17). By employing digital photographs, it becomes feasible to estimate the geometric attributes of the object, including its shape and position. Furthermore, these images enable the assessment of the progression, extent, and underlying causes of slope deformation. (Ohnishi et al. 2006; Firpo et al. 2011). Aerial and terrestrial photogrammetry are extensively used in determining landslide movement studies. These instruments are used to monitor a large area, reduce fieldwork time, and be affected by atmospheric conditions like dust, haze, etc. (Patikova 2004).

Recent advancements in this approach now enable the creation of 3D models using terrestrial photographs (Sturzenegger and Stead 2009). Latest digital image processing techniques offer the potential to automatically gather information about discontinuities and related data, thereby reducing the possibility of human bias (Kemeny and Post 2003).

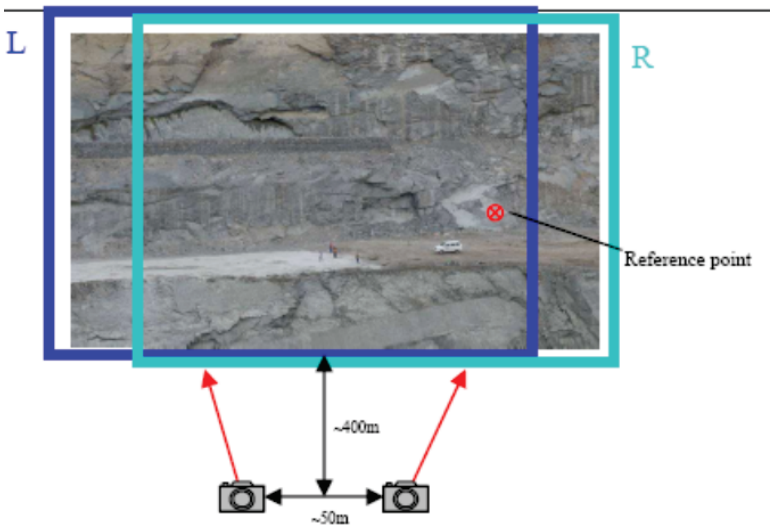


Figure 2.17 Monitoring with Digital photogrammetry (Little 2005)

In recent years, this approach has been widely applied to monitor large-scale structures like landslides and mountain slopes, achieving improved precision (Kaab 2002; Crescenzoa and Santo 2007). It possesses the capability to survey inaccessible areas and towering rock faces swiftly, serving as a remote characterization tool for professionals dealing with rock slopes. Consequently, it establishes a permanent record of slope conditions for future reference (Haneberg 2008; Sturzenegger and Stead 2009).

2.5.7 Monitoring with Laser scanner

This is a portable, user-controlled 3D scanner, illustrated in Figure 2.18, that operates independently without relying on any specific system or software. Encased in a single case designed as a tripod, it is lightweight and easily transportable. Typically, it functions in either a point-and-shoot mode or an automated laser scanning mode. With a rapid scanning rate of 250 points per second, it can capture millions of surface points and directly save them onto a USB drive without requiring any external devices. Subsequently, this data can be utilized to generate 3B models for editing, analysis, and processing via computer-aided design (CAD) software. Its durability allows it to endure challenging conditions while maintaining robust performance.



Figure 2.18 Laser Scanning-Quarryman Pro (Geotronics, 2021)

2.5.8 Monitoring with Total Station

A Total Station is an electronic tool utilized in surveying tasks. It integrates an electronic transit theodolite with Electronic Distance Measurement (EDM) technology. Ding et al. (1998) described EDM as suitable from 2.7 km to 4.3 km. Vertical and horizontal angles will be measured with the TS instrument. The measurement accuracy ranges from 5 mm to 10 mm per kilometer, while the angle measurement accuracy varies from 2 to 6 seconds. Factors influencing the accuracy of the total station include atmospheric disturbance such as fog and dust, human errors, damage to the prism, movement of the survey station, and setup errors of the instrument or reflector.



Figure 2.19 Monitoring with Total Station

Multiple prisms are strategically positioned along a slope at regular intervals to monitor its movements. Utilizing specialized software and a wireless communication network, this system facilitates comprehensive monitoring of slope movements in three movements into a total movement vector plot, the system generates valuable data. These data can be recorded either in real-time or processed afterwards. However, drawbacks entail the necessity for an unobstructed view of the sky; otherwise, insufficient tracked satellites can affect the system's performance. Additionally, interference from nearby machinery can disrupt the system's functionality.

2.5.9 Time domain reflectometry (TDR) monitoring system

Time domain reflectometry is a technique used to monitor slope movement, involving a coaxial cable and a cable tester. It detects discontinuities by examining the reflected electrical pulse passed through a conductor (Dowding et al. 1996). The basic principle of Time Domain Reflectometry (TDR) is similar to that of radar. It allows for the immediate and accurate determination of the deformation zone's relative magnitude, displacement rate, and location. Anderson and Welch (2000), describe the working of a coaxial cable placed and grouted in a borehole or trench (vertical, inclined, or horizontal). The cable detects slope movement by the stress applied on the cable due to elongation and contradiction of cable as a result of rock movement, and the exact point of deformation is determined using the TDR reader. The advantages of TDR are lower cost for installation, use in deeper holes, monitoring, and determination of displacement. So, it cannot give the direction of movement and the actual amount of movement (Kane et al. 1994). Figure 2.20 displays a picture of TDR monitoring.

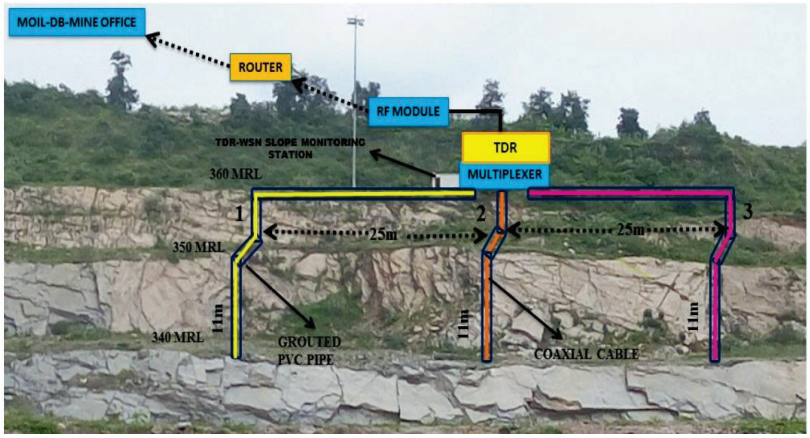


Figure 2.20 TDR monitoring system (Yadav et al. 2017)

2.5.10 Global Positioning System

The GPS is a satellite-based positioning technique extensively used in geophysical research, particularly for measuring active crustal defamation (Dixon 1991). GPS is a suitable and valuable tool for monitoring slopes due to its efficiency, affordability, adaptability, and versatility. It operates on the principle of determining relative positions with an accuracy of 1-2 mm in planimetry and 5-10 mm in altimetry. (Malet et al. 2002). An illustration of the basic GPS model is given in Figure 2.21, the antennas or sensors that are connected by cable to the computer unit, receive the data transmitted from the satellites then the computer unit collects and records the data and sends it to the server computer where it will be analyzed and displacement details are shown. This process repeats itself automatically to provide continuous monitoring services. Sometimes, the GPS signals could be inaccurate due to obstacles like buildings, and trees, and bad weather conditions like geomagnetic storms. Hence, the present accuracy of GPS may not be enough to assess critical slopes in mines (Bond et al. 2007).

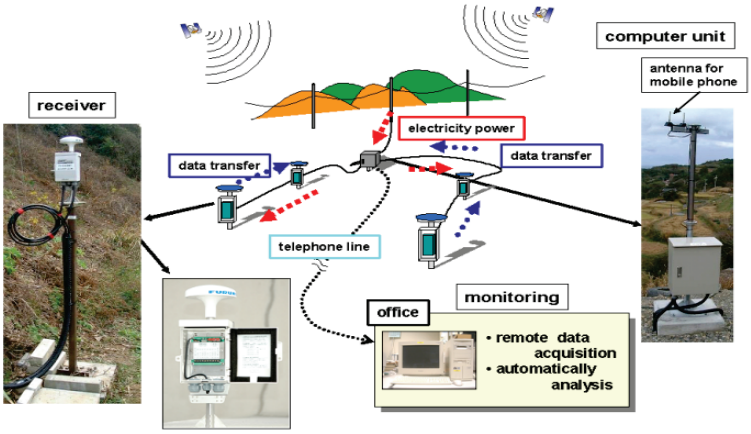


Figure 2.21 The GPS displacement monitoring system (Matsuda & Shimizu 2006)

2.5.11 Slope stability radar system of monitoring

Radio Detection and Ranging (RADAR) is a system designed to identify both stationary and moving targets, measuring their range, height, direction, and speed. Radar technology can utilize either spaceborne or ground-based sensors, depending on the coverage area required. (Tarchi et al. 2003). An image of the SSR working system is shown in Figure 2.22. Slope stability radar operates by emitting electromagnetic radiation and then detecting the echoes bouncing back from these targets. These echo signals provide crucial information about the targets (Skolnik 1990). The system calculates the range based on the time taken for the emitted energy to travel to the target and return. Additionally, a directional antenna measures the angle of arrival of the echo signal, allowing determination of the target's angle. It offers sub-millimeter precision and a huge coverage area of slope wall movements regardless of the surrounding environment and operates both day and night. The primary objective of SSR is to detect the location, altitude, direction, and rate of displacement of moving targets. Harries and Roberts (2007) mentioned that the ability of SSR to detect and alert movements of the strata with sub-millimeter precision as a major advantage of the system.

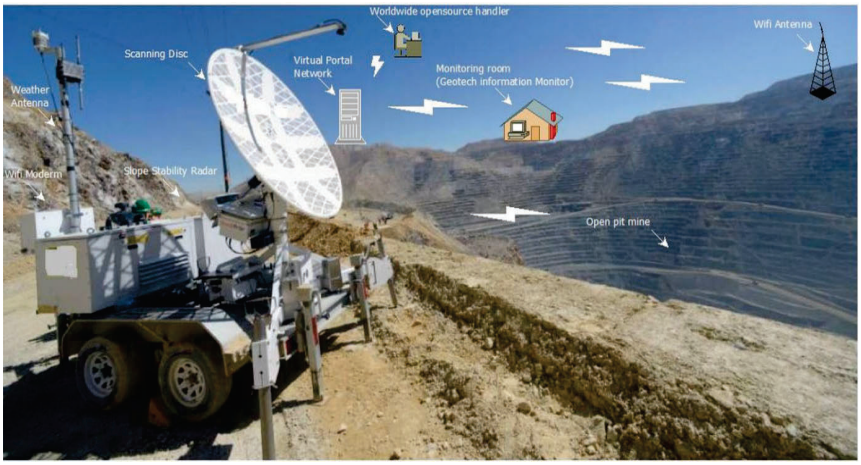


Figure 2.22 Slope Stability RADAR at mine site (Kumar and Rathee 2017)

2.5.12 Light detection and ranging monitoring system

Light Detection and Ranging (LiDAR) technology functions through Terrestrial Laser Scanning (TLS) and Airborne Laser Scanning (ALS) to map the topography of pit faces and monitor slopes. Laser scanning is similar to radar scanning due to the signal's wavelength and the repeatability of the measurements. Figure 2.23 shows the acquisition of 3D information on a slope at an extremely fast recording rate with LiDAR.

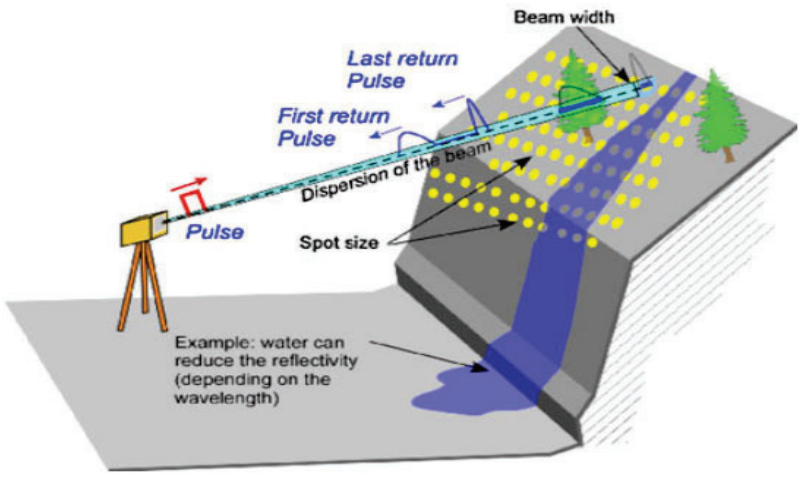


Figure 2.23 Laser scanner data acquisition (Jaboyedoff et al. 2012).

Longer-range scanners, capable of reaching up to 6 km, are also available. Additionally, LiDAR is useful for monitoring large waste dumps post-closure and natural landslides. The accuracy of the instrument gradually reduces in practical applications as a result of unfavorable conditions such as rough surfaces with poor reflecting ability, bad weather conditions like rain, hot wind and fog. (Jaboyedoff et al. 2012). With advancements in technology and increased accuracy, laser scanning is likely to see broader applications in slope monitoring (Read and Stacey 2010).

2.6 Slope Monitoring with Wireless Sensor Networks

As previously stated, slope monitoring in an opencast mine is crucial, and the techniques used to monitor the slope should be suitable and adaptable to the site's conditions for efficient utilization. Several factors contribute significantly to slope failure, and each of these factors should be individually monitored to prevent or predict such failures. The majority of monitoring systems mentioned in previous sections record or measure slope movements in various forms. For example, SSR doesn't consider the effects of pore water pressure or blast vibration. Furthermore, no research study confirms that slope failure can be predicted solely by observing slope movement. Thus, a slope monitoring system needs to incorporate multiple sensors that track various factors influencing slope movement. However, adopting multiple monitoring systems might not be economically viable and could increase the analysis latency.

Expensive slope monitoring systems too come with their own set of limitations and drawbacks. Mittapally and Marichamy (2023) quotes that despite the utilization of techniques like LiDAR, SSR and GPS for slope and landslide monitoring, they often encounter challenges such as inaccurate data collection, vulnerability to data loss, suboptimal transmission efficiency and delayed information distribution. For a slope monitoring system to operate at its highest efficiency, data analysis from the sensors and subsequent output must be generated in real-time. This is where Wireless Sensor Networks (WSN) comes into play to address these challenges. WSN allows the integration of multiple sensors in a unified system, facilitating real-time results through enabling the Internet of Things (IoT). Additionally, LiDAR operates at a low

cost by utilizing Micro Electro Mechanical System (MEMS) sensors. Wireless Sensor Networks (WSNs) also facilitate automated slope monitoring, essential for early warning functions. Current research efforts are aimed at enhancing real-time monitoring technology and reducing system costs. (Chang et al. 2013). The fundamental structure of WSN comprises of a network of sensor nodes connected to a communication gateway and ultimately to users (Figure 2.24).

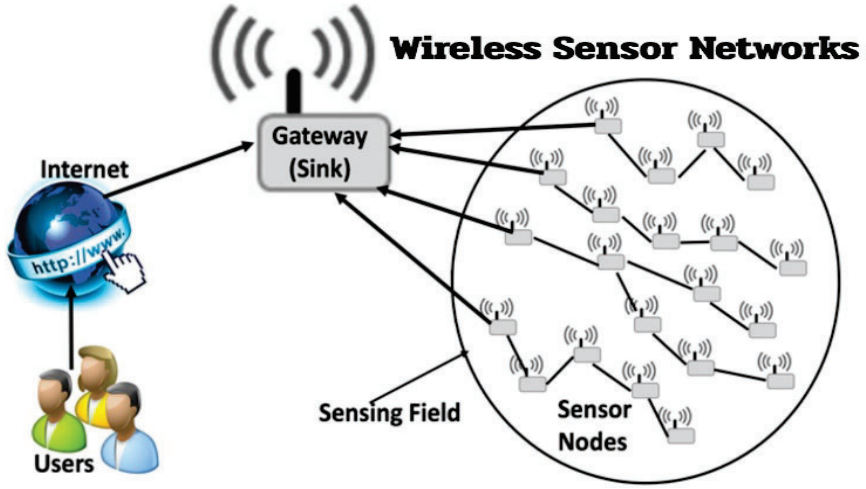


Figure 2.24 Wireless sensor network basic architecture (Akgul et al. 2018)

The WSN is defined as the collection of organized nodes into a cooperative network (Stankovic 2008). It comprises a group of sensors and actuators that operate autonomously using a wireless communication infrastructure to monitor and control physical and environmental conditions (Yang and Cao 2008; Yang 2014). It is a subset of wireless networking applications that gives the advantage of being a non-dependent wireless connection of sensors and actuators (Gutierrez et al. 2004). It includes MEMS (Micro Electro Mechanical Systems) apparatus such as sensor actuators, data fusion circuitry, signal processing engines and microcontrollers (Pottie 1998). The foremost benefit of WSN is its capability to measure and transmit information in a shorter time could act as a real-time monitoring system and as an early warning system (Mucchi et al. 2018; Koha and Takyama 2018; Jeong et al. 2019; Ciampalini et al. 2021). Slope monitoring with wireless sensor networks is a

modern technology combined with IoTs that brings the most efficiency out of it. In recent days there's been a pressing demand for a real-time monitoring system that facilitates seamless two-way data transmission, remains cost-effective, maintains simplicity, and operates on low power. Achieving this necessitates the integration of WSN, IoT and MEMS sensors.

2.6.1 Internet of things in slope monitoring

After the industrial revolution, the revolution of technologies commenced. The advantageous effect of this revolution was reflected in all industries, including the mining industry. Kevin Ashton introduced the term Internet of Things (IoT) in 1999, defined as the objects of a system in the physical world that could be connected to the Internet by sensors. It originated from the distributed sensor network (DSN), a Defence advanced research project agency (DARPA) program. The Internet of Things is a novel technology. The full potential of the Internet of Things (IoT) has yet to be fully realized or implemented. According to the Institute of Electrical and Electronics Engineering, an IoT system is defined as a network of entities comprising cyber-physical devices, information resources, and people. These entities interact with the physical world through sensing, information processing, and actuating functionalities (Ooi & Shirmohammadi 2020). The utilization of software in planning, numerical modelling methods, regression analysis, machine learning, robotics, and sensor applications has increased in all stages of mining, from exploration to reclamation, and are getting advanced with these technologies (Molaei et al. 2020). Applications of IoT in mining can be implied in all different areas of a mine in the various research studies by authors Molaei et al. 2020; Yinghua et al. 2012; Khan et al. 2012. Few authors such as Sun et al. (2012), Behr et al. (2016), Li Dong et al. (2017), Zhou et al. (2017) described the implementation of IoT and WSN for slope monitoring and other applications

Yadav et al. (2019b) conducted a critical analysis on slope monitoring systems with the aim of integrating WSN and IoT. They noted that existing geotechnical sensors such as inclinometers, vibrating wire piezometers, tiltmeters, borehole extensometers, and wireline extensometers are highly valuable instruments for detecting movements

in slope monitoring applications. Smarsly et al. 2012 presented an autonomous monitoring system for slope monitoring that merges WSN and web service, this research used an accelerometer as sensor nodes connected through a base node to detect any abnormal slope movements, trigger automation process like increasing sampling rates, signaling other sensor nodes to act and sending early warnings etc., is connected through a base station which gives access to Early Warning Information System (EWIS) to give information about the movement of the slope recorded by sensors with web service. Numerous researchers including Susha et al. (2014), Park et al. (2019), Towhata et al. (2015), and Yadav (2019) have incorporated WSN, IoT and MEMS sensors into their studies focused on slope monitoring.

2.6.2 Sensors in slope monitoring systems

Conventional slope monitoring techniques may not detect all the factors affecting slope instability simultaneously. In contrast, WSN combined with various MEMS sensors, which detect different parameters, enhance the efficiency of monitoring systems both technically and economically. Shaikh and Shitole (2012) explain that MEMS is a widely adopted miniaturization technology utilized by various industries, including the integrated circuit (IC) sector. It reduces the size of systems such as electrical, mechanical, optical, fluidic, and magnetic systems. This technology enables the development of a proactive computing world, facilitating automatic connectivity of computing nodes and the acquisition and utilization of real-time data from physical environments. In the mining industry, several researchers had employed MEMS sensors in their studies, particularly in the realm of slope monitoring. Dorthi et al. (2020) integrated Linear Variable Differential Transformers (LVDTs) and strain gauges into their Zigbee-based wireless data acquisition slope monitoring system. Meanwhile, Jawalkar et al. (2022) developed a low-cost and robust landslide detection and monitoring system that includes gyroscopic and soil moisture sensors. Susanto et al. (2019) evaluated the effectiveness of a landslide monitoring system incorporating humidity, vibration, and slope sensors. Mittapally and Karra (2023) proposed and assessed an advanced slope monitoring system that utilizes soil moisture and vibration sensors. A few MEMS sensors that are commonly utilized and researched in slope monitoring studies are shown in Figure 2.25, FC-28 Soil Moisture

Sensor, SW-420 Vibration Sensor, DHT11 Temperature Humidity Sensor, HC-SR04 Ultrasonic Sensor, 10k Slider Potentiometer sensor and BF 1000 Strain Gauge Sensor.

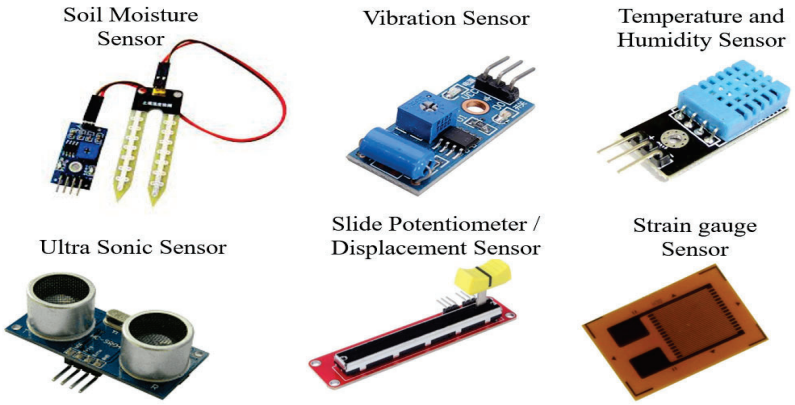


Figure 2.25 MEMS Sensors employed in Slope monitoring

As implied by their names, these sensors detect soil moisture, vibration, temperature and humidity, displacement and deformation or strain respectively. From the detailed examination of factors impacting slope stability, it is determined that multiple factors collectively lead to slope failure. However, among these factors, moisture and vibration emerge as significant contributors to slope failure. These factors are potentially detectable, and their effects on the slope can be studied.

2.6.2.1 Soil moisture sensor

The soil moisture content of a slope is a major factor contributing to slope instability, as it significantly reduces the strength of the slope (Abebe 2020). Rainfall is the primary contributor to the increase in the water table. According to Yuliza et al. (2016), as the duration and intensity of rainfall increase, water penetration into the soil rises, leading to an increase in soil weight and subsequent slope instability. Even a slight increase in moisture content can weaken slope strength and deformability (David 2002; Lamotte et al. 1997). While a rain gauge measures rainfall, it requires a predetermined threshold value for precipitation in the local area (Cahe & Kim 1986). Additionally, water penetration rates vary across different parts of the slope, highlighting the importance of soil moisture dimension in slope stability investigations (Bovolenta et al. 2020). Monitoring the moisture content of soil,

whether in dry or wet conditions, can be effectively achieved using a soil moisture sensor (Susanto et al. 2019)

Figure 2.26, shows a resistive type soil moisture sensor which is also called as two probe soil moisture sensor. The working principle of the soil moisture sensor is based on the change in resistance due to the presence of moisture in the soil around the two probes. It works as a variable resistor the resistance changes according to the soil moisture (Bhardwaj 2021). Moisture content in the probe gives better conductivity and as a result, increases the signal output. It determines soil resistivity and moisture content is directionally proportional to it, making it an ideal basis for a sensor (Zazueta and Xin 1994). This sensor works between 3.3 to 5v and the output value depends on the input voltage provided for the sensor.

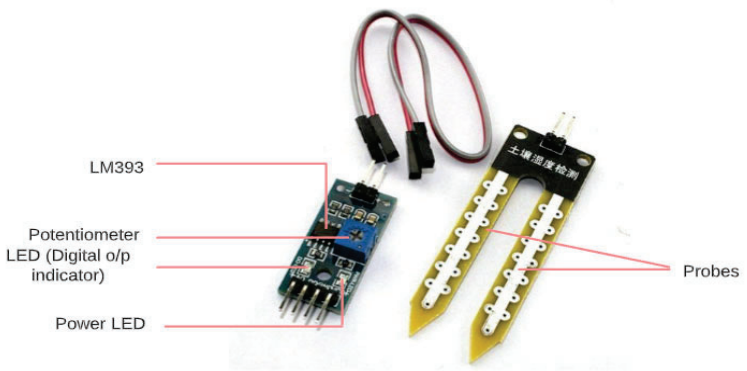


Figure 2.26 FC-28 Soil moisture sensor

The FC-28 Soil Moisture Sensor comprises two probes and three pins: VCC for power, GND for ground, and SIG for output. In this experiment, the analog output was employed. The ES98266/Node MCU microcontroller's 3V, GND, and A0 pins are connected to the sensor's VCC, GND, and SIG pins, respectively, as depicted in Figure 2.23. Power is sourced from the 3V pin of the microcontroller, ground from the GND pin, and the A0 pin is utilized for analog signal reading. In response to moisture content, the sensor generates an analog output ranging from 0V to 3.3V using an input voltage of 3.3V. The maximum output voltage 3.3v is mapped to the

maximum binary value is called the reference voltage of the analog to digital conversion.

The sensor uses a 10-bit ADC (Analog to Digital Converter), with 3.3v as the reference voltage, the highest possible 10-bit binary number (1111111111), 1024 in decimal system corresponds to 3.3v, and the lowest 10-bit binary number (0000000000) corresponds to 0v. The resolution of ADC of the measure of volts per bit in this binary conversion step up represents around 3.2mv. When sensors are powered up, they generate a flux between their probes. This flux remains uninterrupted when the observation point is dry. However, when moisture is present, it interrupts the flux, causing the SIG analog output to decrease. By mapping the analog output from 0 to 100%, the moisture content can be determined. A few important specifications of the sensor are listed is the Table 2.1.

2.6.2.2 Vibration sensors

Opencast bench slopes are highly sensitive to vibrations, and their effects can be unsettling. Ground vibrations that disturb slope stability can originate from various sources, including earthquakes, blasting, HEMM, or external factors. Therefore, monitoring vibrations becomes a crucial parameter. While instruments like geophones are commonly used to measure vibration magnitude, they may not always be ideal for real-time slope monitoring systems. As a solution, MEMS vibration sensors offer a low-cost and straightforward operation alternative.

The SW420 Vibration Sensor (Figure 2.27) exclusively produces digital output (either '0' or '1'), which can be converted to analog values within the Arduino IDE. A digital output of '1' indicates higher vibration levels. These sensors are equipped with onboard potentiometers for sensitivity adjustment. When connected to a power supply, power LEDs illuminate, while signal LEDs flash upon detecting vibrations. The LM393 comparator IC compares the reference voltage with the vibration signal input, generating binary states that are then transmitted to the digital output pin (Ghazali & Rahiman 2022).

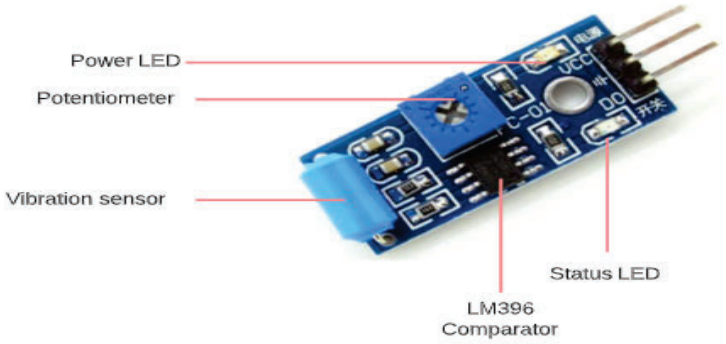


Figure 2.27 SW420 Vibration sensor

The vibration sensor circuit bears similarities to the soil moisture sensor, except for the SIG output pin, which connects to the microcontroller's D0 pin for digital signal reading. Within this sensor, a magnet is suspended freely and wiggles during vibration, altering the flux within the coil wrapped around it. Consequently, the coil's response to flux variations produces a digital signal '1'. In Arduino IDE, '1' represents 'HIGH', while '0' represents 'LOW'. The digital signal remains 'HIGH' until the magnet returns to its normal position. Table 2.1 presents several key specifications of the sensor.

2.6.2.3 Displacement sensor

Mining slopes typically exhibit gradual displacement and structural failures due to rock mass loading, excavation, and high porosity, e.g., cumulative damage, creep, dynamic load fatigue, and elastic mutation. Recording slope displacement gives insights into slope behaviour, Therefore, it is vital to have a displacement sensor in the slope monitoring system. In numerous slope displacement studies, various sensors like Linear Variable Differential Transformer (LVDT) (Dorthi et al. 2020) and Ultrasonic sensor are commonly used. However, the slider potentiometer displacement sensor stands out due to its versatility and cost-effectiveness, preceding these options in certain applications.

Slider Potentiometers (Figure 2.28) are resistive devices with three wires that produce a voltage divider signal proportional to the slider's position along the track.

Depending on the motion of the mechanical contact of the slider, the output resistance value of these potentiometers can be varied. The lever or the slider can be moved in order to generate a variable voltage, as the lever is shifted from one side to the other, the output voltage will vary between 0 V and 5 V. The length, width and height of the sensor are 90, 21 and 15 mm respectively, it is 15 gm in weight.

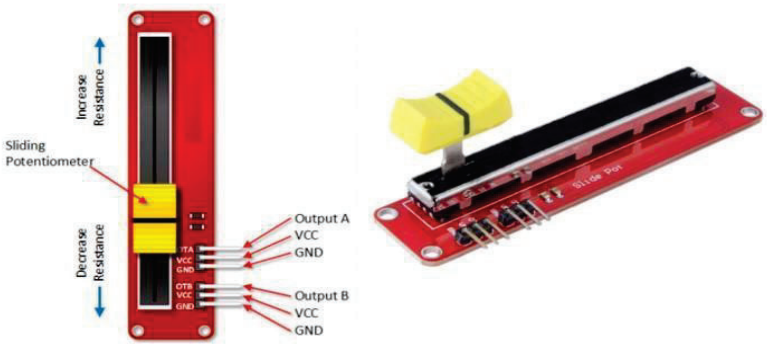


Figure 2.28 Slider potentiometer

Depending on the slider's position on the sensor, the slider potentiometer provides analogue values ranging from 0 to 1023 (depicting the resistivity offered by the sensor) as an analog output. Analog outputs of sensors can be scaled to meet specific measurement requirements. The slider displacement sensor has a measurement range of 60 mm (the length of the slider plane). A few important details of the sensors are listed in Table 2.1

Table 2.1 Specifications of the soil moisture, vibration and displacement sensor

Specifications		**Soil moisture sensor**	**Vibration sensor**	**Displacement sensor**
Input voltage		3.3v to 5v	3.3v to 5v	3.3v to 5v
Output voltage		0v to 4.2v	0v to 4.2v	0v to 4.2v
Input current		35mA	35mA	35mA
Output signal		Both analog and digital.	Digital	Analog
Pin outs	**VCC**	Power	Power	Power
	A0	Analog output	-	Analog output
	D0	Digital output	Digital output	-
	GND	Ground	Ground	Ground

2.6.2.3 Microcontrollers

The MEMS sensors are operated by a microcontroller/computer, such as an Arduino which converts the sensor's analog and digital signals to data form. Arduino UNO, Arduino Nano, and Arduino Mega have been widely used in both small and large-scale IoT projects. However, NodeMCU and Raspberry Pi are controllers enhanced and equipped with inbuilt Wi-Fi and Bluetooth capabilities. The picture in Figure 2.29 displays the Arduino UNO and NodeMCU microcomputers, along with their pinouts. Arduino UNO micro-computer's non-complex functions made it a popular choice among researchers and developers in slope monitoring, as evidenced by the works of Karthik et al. (2016), Susanto et al. (2019), Yadav et al. (2019), Taqwa et al. (2021), Azharudin and Daud (2022), Sudarmanto et al. (2023), and numerous others who have utilized it in their research and development. Arduino UNO has its microcontroller as the brain of the board, typically using Atmega328. It contains multiple components, including a power USB to feed codes and to power the board, a barrel Jack for alternative power, a voltage regulator for voltage control and stability, a crystal oscillator for timekeeping with the time issue, and a reset button to run the program from the beginning. In addition to that it has 6 Analog and 14 Digital input/output pins through which it receives sensor signal and passes instructions and TX-RX pins through which wireless data communication is possible. A LED indicator that indicates power source connection. Arduino UNO operates in the 3.3 to 5-volt and most of the components used with Arduino board work fine in this range. Arduino IDE is used to feed program codes on Arduino boards. Arduino IDE is renowned for its built-in libraries and examples that serve as useful guides for users in writing and uploading code to Arduino boards, making it one of the popular software options available for this purpose. Arduino microcontrollers are capable of connecting to different sensors and the collected data could be obtained on a software platform (Jha & Tukkaraja, 2020).

Due to its ability to support Wi-Fi, the NodeMCU has gained fame as a type of micro-computer in IoT projects.

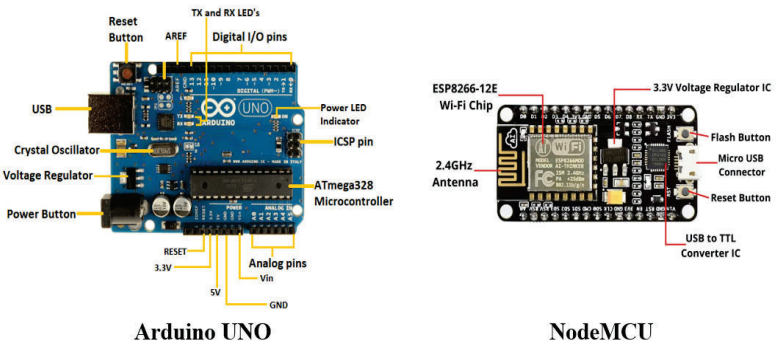


Figure 2.29 Arduino UNO and NodeMCU microcontroller with pinouts

In particular, researchers working on landslide and slope failure detection have used the NodeMCU in their work, including Jawalkar et al. (2022), Shetty et al. (2022), Idris et al. (2022), and others. The NodeMCU consists of components that are similar to those found in the Arduino UNO, albeit with some minor differences in Analog and Digital pins and the inclusion of a Wi-Fi chip and a 2.4GHz Antenna. It can transmit sensor data directly to the user through the internet provided that there is an active Wi-Fi connection in the area. In mining areas where connectivity is limited, the use of Wi-Fi chips in NodeMCU may not be feasible without a communication medium. Therefore, radio frequency modules such as Zigbee and LoRa devices are often employed as alternative communication solutions. Program code is written and uploaded using Arduino IDE just by changing the board settings to NodeMCU in the software.

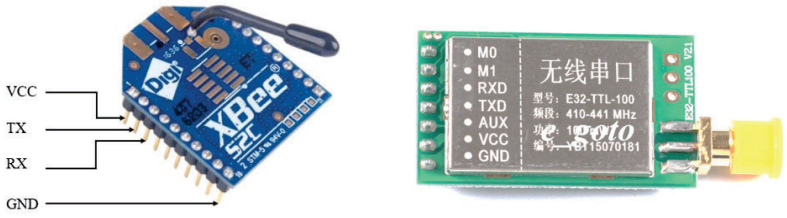
The device is capable of either hosting an application or offloading all Wi-Fi networking functions to another application processor. It comes pre-programmed with a set of AT commands (Sruthy et al., 2020). Programming and operation are simplified through a USB port using Arduino IDE software. The EN and RST buttons facilitate microcontroller reset and control. The AO analog pin measures signals ranging from 0 to 3.3V, while GPIO (General-purpose Input Output) pins handle input-output tasks. Serial Peripheral Interface (SPI) pins facilitate SPI communications or short-distance communications. Additionally, it features 4 MB flash memory, 128 KB RAM, and operates at a clock speed of 80MHz.

2.6.2.5 Wireless data communication

Wireless data communication or data transfer refers to the transmission of data as electromagnetic waves from a transmitting point to a receiving point. Electromagnetic waves are defined in the electromagnetic spectrum according to their frequency and wavelength, with long radio waves and FM radio waves having lower frequencies, followed by microwaves, infrared, ultraviolet, X-rays, and gamma rays with increasing frequencies. Cellular networks, such as 4G and 5G, as well as Wi-Fi and Bluetooth, all operate within the lower microwave spectrum. While they offer incredibly fast communication speeds, the lower microwave spectrum is not very reliable for long-range communication and consumes more power. Radio Frequency modules and others operate in long radio waves spectrum, supporting long-range communication with relatively lower speed and lesser power consumption.

The wireless communication technologies, ZigBee and LoRa which operate in long radio wave spectrum, are popularly used in industrial and domestic projects because of their ease of use in configuration and operation. The provided image in Figure 2.30 shows the XBee S2C ZigBee module alongside the E32 LoRa module. Researchers including Kim and Han (2008), Jayanthu and Karthik (2017), Nishikawa et al. (2018), and Dorthi and Chandar (2018) have utilized ZigBee transmission modules in their slope/landslide research. ZigBee is ideal for short-range data transmission, similar to Wi-Fi. According to Karthik et al. (2016), ZigBee can efficiently transmit data within a range of 400 m without any loss of data. One significant benefit of ZigBee is the XCTU ZigBee module configuration software that enables the assignment of unique roles and responsibilities such as Coordinator, Router and End device to each module. The Co-Ordinator radio's primary responsibility is to create a network that the other two radio types can join. There can only be one Co-Ordinator in a network, and it is also responsible for managing network security and assigning addresses. The Router radios are equipped to send, receive, and route information between two radios when they cannot communicate due to range constraints. A network can have multiple Router radios. The End device radios, on the other hand, can only send and receive information but cannot route it. LoRa technology is particularly useful in situations where long-range communication is required, as it offers a data transmission range of

15 km, as noted by Romdhane et al. (2017). LoRa operates within the ISM (Industrial, Scientific, and Medical) band, with a frequency range of 433 MHz, 868 MHz, or 915 MHz, depending on the region in which it is used, as stated by Augustin et al. (2016). The address and channel number settings of a LoRa module are crucial in facilitating communication between a transmitter and a receiver. The configuration process involves setting specific parameters to ensure the module functions correctly within a network, for this several software options are available, one of which is the EBYTE software.



XBee S2C Zigbee module **E32 – LoRa module**

Figure 2.30 XBee S2C and E32 LoRa RF Module pinout

XCTU application (Figure 2.31) offers a graphical network view for easy wireless network configuration and architecture, as well as an API frame builder as a simple development tool for quickly building XBee API frames. There are many parameter settings available in the XCTU, but only a few are necessary for networking, such as the “PAN ID” parameter, which enables the modules to join the respective network created by the coordinator with the same ID. The “Coordinator enable” option is used to designate a module as the coordinator. The “Node identifier” parameter assigns a name to the module that will be displayed in the devices list. The "Serial Number High" and "Serial Number Low" parameters provide the module's MAC address, and by assigning this address to the destination address of another module, data will be transferred to that module. XCTU also performs range testing between ZigBee modules using RSSI (Range Signal Strength indicator). The other way of configuring ZigBee modules is by AT commands, in that AT abbreviates for “Attention". Tools

such as the Trang multi-function program, Access port, and other software are commonly used to test data communication circuits. During data transmission, the module enters command mode when it receives '+++' and responds by sending 'OK'. It then pauses data transmission for 10 seconds from the last command. After this time, it exits command mode and resumes data transmission. Commands to configure the module begin with 'AT', followed by the category of the command, such as 'G' for general commands, 'N' for networking commands, 'S' for serial interface, 'I' for input/output control, and 'P' for power control. For example, to reset the module configuration that falls in the general command category, the command would be 'ATGRD' and to write it to the module 'ATGWR' command is used.

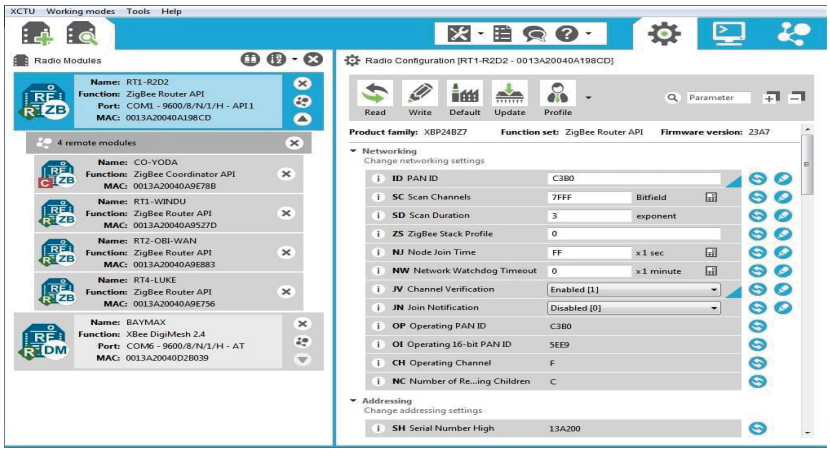


Figure 2.31. XCTU ZigBee configuration software

The EBYTE software (Figure 2.32) is a user-friendly tool that allows the configuration of LoRa modules. By connecting a LoRa module to a computer via USB, the EBYTE software can detect the module and provide an interface for configuring its settings. The software enables the selection of the desired LoRa frequency band, channel, and transmission power, as well as configuring the address and other relevant parameters. LoRa modules are transceivers that can both transmit and receive data simultaneously. Two types of transmissions are commonly used for LoRa networking: fixed transmission and broadcasting transmission. Fixed transmission is used when data must be sent to a specific receiver, with the receiver module's address and channel number set as the target address and channel number in the transmitter. Broadcasting transmission is used when data must be broadcasted to

all receiver modules under the same channel, with the target address fixed as "FFFF" in the transmitter and the channel number of receivers for which the data needs to be broadcasted set as the target channel number in the transmitter. Data transmission in this network works in both ways.

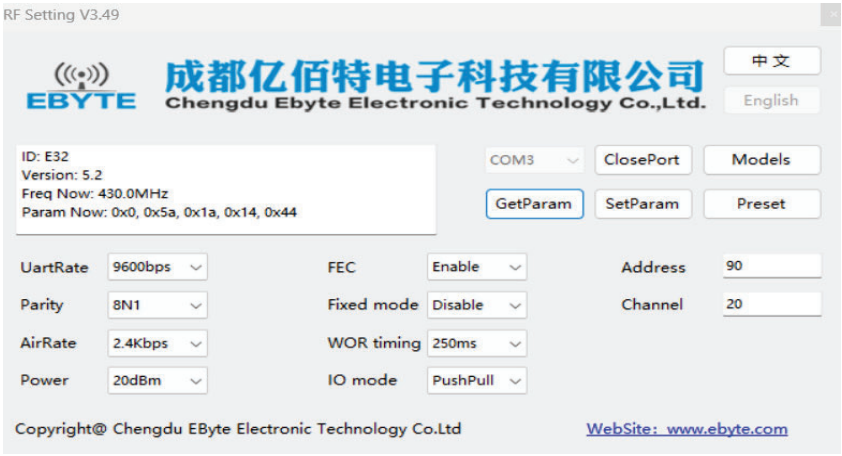


Figure 2.32 EBYTE LoRa configuration software

2.6.2.6 Cloud Computing and real-time slope monitoring

To determine the stability status of slopes, it is necessary to analyze the data obtained from sensors. Traditional techniques involve the use of a data logger to collect and store sensor data, which is then transported to the mining office for analysis. Similarly, total station slope displacement surveys using prisms entail taking the instrument to the observation site, recording the data in the total station, and later analyzing it in the office. AutoCAD software is commonly employed to transform the slope data into 2D and 3D visualizations. To establish a real-time slope monitoring and early warning alert system, it is crucial to collect data continuously and analyze it automatically round-the-clock. However, utilizing local computers for slope data analysis may result in inconsistent data analysis during system maintenance or repair. It is reliable to adopt cloud-based servers for data analysis to avoid such issues. There are numerous cloud data analytics services accessible online, but among them, ThingSpeak has gained the most popularity. ThingSpeak is an IoT analytics platform that operates on the cloud, allowing users to collect, display, and analyze real-time data streams. The platform supports the instant visualization of data sent by various

devices, including sensors and sensor nodes. Researchers, including Pitambar et al. (2019) and Taqwa et al. (2021), have used ThingSpeak to design landslide detection systems, by incorporating MEMS sensors and NodeMCU/RasberryPi microcomputers, they were able to develop reliable and effective monitoring systems that provided real-time data analysis and visualization. These studies highlight the potential of ThingSpeak as a cloud-based platform to enhance the real-time slope monitoring system. The display window of ThingSpeak is depicted in Figure 2.33.

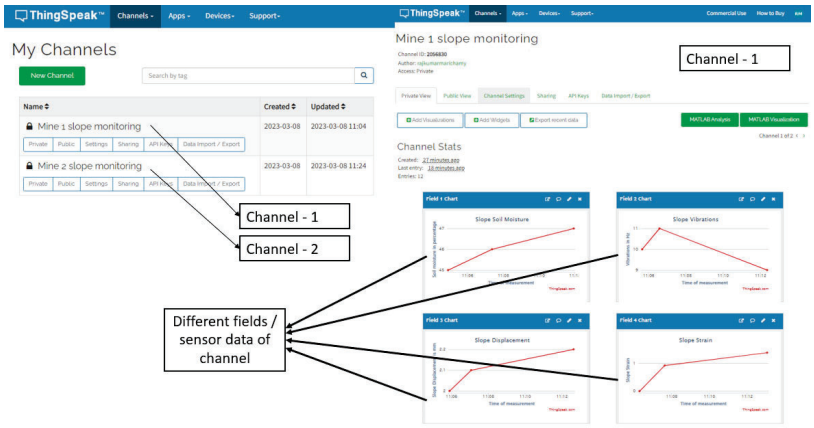


Figure 2.33 ThingSpeak online data analytics platform

In its free version, ThingSpeak allows users to create up to four channels, each with a maximum of eight fields. Each channel has a unique channel ID and Read and Write API keys that enable data updates. The eight fields correspond to eight distinct data inputs from different sensors that are updated every 15 seconds. It features a list of channels associated with the account on the left-hand side, while the right-hand side displays graphical representations of the collected sensor data for channel 1. The x-axis displays the time of data feed, while the y-axis shows the units of sensor data. The chart's title and other parameters can be modified using the chart options button provided on top of it, which includes the option to change the type of visualization. ThingSpeak provides an alert system through its React app, which requires MATLAB coding and allows alerts to be sent via Gmail and SMS. In addition, ThingSpeak supports external cloud computing via its Read API key, which allows data stored in ThingSpeak to be read by other cloud platforms for generating alerts via email and SMS when sensor readings reach a threshold. PythonAnywhere is an example of such

a platform that can be used to achieve this goal by utilizing simple Python code, along with IFTTT webhooks to activate notifications and alert users via email and SMS. In addition to ThingSpeak, other cloud-based data analysis platforms such as AWS (Amazon Web Services), Microsoft Azure, and Google Firebase can be utilized by incorporating HTML-CSS codes in Arduino programs. Alternatively, mobile apps such as BLYNK, which offer built-in graphical interfaces and human-machine interfaces tailored for IoT projects, can also be used. The Blynk app has been utilized in landslide detection monitoring systems by Jawalkar et al. (2022) and Sudarmanto et al. (2023), and their studies reported successful results in their respective models.

2.7 Displacement Studies on Opencast Slopes

Pit slope failures occur after several stages of slope movement. Abramson et al. (2002) state that the slopes that stood firm for a long time then start to fail when some geological parameters have surprise effects. According to Legg et al. (1982), the state of failure is classified according to the permanent displacement in centimeters, the effects or results or indication with respect to the failure state are displayed in Table 2.2 given below.

Table 2.2 Displacement of Slopes in different failure states (Legg et al. 1982)

Sl. No.	Failure state	Effects/ Result or indication	Permanent displacement (cm)
1	Light	Ground shaking is the only effect	D<0.5
2	Moderate	Small cracks likely to form	0.5<D<5
3	Heavy	Major ground failure slope displacement likely	5<D<50
4	Severe	Extreme ground failure large slope displacement	50<D500
5	Catastrophic	Total failure slope failures large distances	D>500

The Factor of Safety (FoS) is commonly known for the stability check of the opencast slope. Satyanarayana (2019), suggested the following guidelines given in Table 2.3, on the risk classification of slopes regarding slope behaviour, risk analysis is comprised based on various factors including Risk rating matrix for pit slope stability

associated with major risk, operational risk and historical risk, then total collective risk is framed by the sum of above three risk criteria provided in the risk rating matrix and that is classified and displayed in Table 2.3.

Table 2.3 Guidelines for Risk Classification of Slopes (Satyanarayana 2019)

Sl. No	Risk Classification	Total/Collective Risk	Factor of Safety
1	High Risk	More than or equal to 70	Less than 1.20
2	Medium Risk	In-between 30 and 70	1.20 to 1.50
3	Low Risk or Safe	Less than or equal to 30	More than 1.50

Dorthi et al., (2020), conducted a study of deformation of slopes of opencast mines upon the old underground mine and developed galleries using wireless monitoring sensors. In This study he measured the deformation using Wireless data actuation system WDAQ, data logger, and numerical modelling. As shown in Table 2.4, various deformation values were observed in different methods over-developed old underground galleries in opencast mine and given the guidelines to maintain suitable partition thickness for stable slopes.

Table 2.4 Deformation values for Slope partition of Opencast over old Underground galleries (Dorthi and Karra 2020)

Sl. No	Method of observation	Max deformation (mm)
1	Wireless data acquisition system (WDAQ)	2.41
2	Data logger	2.21
3	Numerical modelling approach	2.67

In Table 2.5 Sullivan (2007) classified the effects on the slope with respect to movement class described in that research study. The movement classes described by Sullivan (2007) are classified in a range of 1 to 6 representing Low creep (1), Significant creep (2), certain movement of slope associated to shear of displacement of structures (3), probable to fail sometime in future (4), high chance of failure (5), Pre-failure (6).

Table 2.5 Classification of Pit Slope Velocities for Planning (Sullivan 2007)

Movement class	Rate of displacement (mm/hr)	Rate of displacement (mm/day)	Displacement (mm/month)	Comment	effects
1	0.002	<0.05	<1.5	Possibly Stage 1 movements	Very low
2	0.002–0.004	0.05–0.1	1.5–3	Possibly Stage 1 movements	Low
3	0.004–0.01	0.1–0.25	3–7.5	Could stabilize if strain hardening	Medium
4	0.01–0.02	0.25–0.5	7.5–15	-	Medium to high
5	0.041	1	30	-	Medium to high
6	<0.041	>1.0	>30	-	High

2.8 Slope Stability Prediction Using Numerical Modelling

Numerical analysis is a good tool to calculate material deformation and failure by incorporating suitable failure criterion. In this technique the rock mass is divided into different zones and material properties are assigned to each zone. A numerical model's output may be safely extrapolated outside the data base, unlike empirical techniques where the failure is explicitly specified.

Numerical models, computer-based applications, aim to replicate the mechanical behavior of rock masses under defined initial conditions, including in situ stresses/strain, boundary conditions, and induced alterations like slope excavation. These models segment the rock mass into discrete zones, each assigned unique material models and properties. These material models represent idealized stress/strain relationships to describe the behavior of the rock material (Dick at el. 2013).

In slope stability analysis and slope monitoring numerical modelling takes the role of providing detailed understanding, knowledge and delicate information about a tiny part of the body of interest. Numerical modelling with the suitable material model of the surrounding takes input values of physical and mechanical properties of rock mass and gives the 3-dimensional view of stress and strain effects at present, past and future (over the time period) that helps in planning immediate action to avoid or protect failures occurrence. Wines et al. (2013), used numerical modelling to recreate the existing behavior of the moving wall and to predict future stability, and it was integrated into the overall risk management process by updating the model with observed slope behavior and the exposed rock mass conditions.

Numerical modeling offers valuable assistance to mining engineers in designing various types of excavations, including opencast and underground, as well as support systems. By leveraging extensive geotechnical data, these models enable comprehensive predictions of deformations, stability, and support loads.

There are different methods in numerical modelling, such as, Limit Equilibrium Method (LEM), Finite Element Method (FEM), Finite Difference Methods (FDM) etc. Based on the detailed review of different methods of numerical modelling and of FDM has the advantages compared to FEM such as its easier deployment and usually more efficient on simple geometries, both in terms of memory handling and computational speed. Hence, in this study FDM based Fast Lagrangian Analysis of Continua (FLAC) software was selected for slope stability analysis and studies.

Numerical modelling methods have been widely adopted in the study of slope stability in opencast mines. This extensive application is attributed to their capacity to accurately represent the irregular structure, as well as the non-linear, non-homogeneous, and anisotropic characteristics of rock formations. The strength reduction method (SRM) is utilized to analyze the stability of two-layered soil slopes. The aim is to quantitatively estimate the improvement in slope stability resulting from placing a stronger layer over a weaker layer. This analysis is conducted using software tools like SLIDE v6, ROCK SCIENCE PHASE v9, and Optum G2 (Sarkar and Chakraborty 2021).

To know the deformation on the partition slopes over the developed underground galleries due to movement of heavy earthmoving machinery (Dorthi et al. 2020) using ANSYS numerical modelling technique for stability analysis. Study on the analysis of stability evaluation of the pit slopes at Medapalli opencast project (MOCP), Telangana, India, by using Flacslope. The displacement trend has been shown for monitoring slopes within the mine (Satyanarayana et al. 2018). Parametric studies have been conducted by numerical modeling (Flac/Slope) for varying slope angles and depths of the typical mine condition to know the factor of safety (Kumar and Parkash 2015).

Slope stability concerns require increasingly thorough investigations. This particular study focuses on conducting 2D finite element simulations and analyses to address slope stability issues (Abbas 2015). Part of this study helps the researchers and professionals to evaluate all common issues that can be developed while studying slope stability issues. Applicability of software by using ADINA (Automatic Dynamic Incremental Nonlinear Analysis) software finite element method (FEM) and SWASE software limit equilibrium method (LEM) in the analysis of slope stability on the drained and undrained conditions was presented and compared between FEM and limit equilibrium method (Nuric et al. 2013).

Many engineering problems can be solved using numerical methods. There are various numerical analysis methods available (Figure 2.34) in which, the finite difference (or) element technique has become increasingly prominent in geotechnical engineering analysis as a result of recent advancements in computer technology. The finite element method (FEM) and the finite difference technique are two of the most widely used numerical approaches (Moudabel 2013).

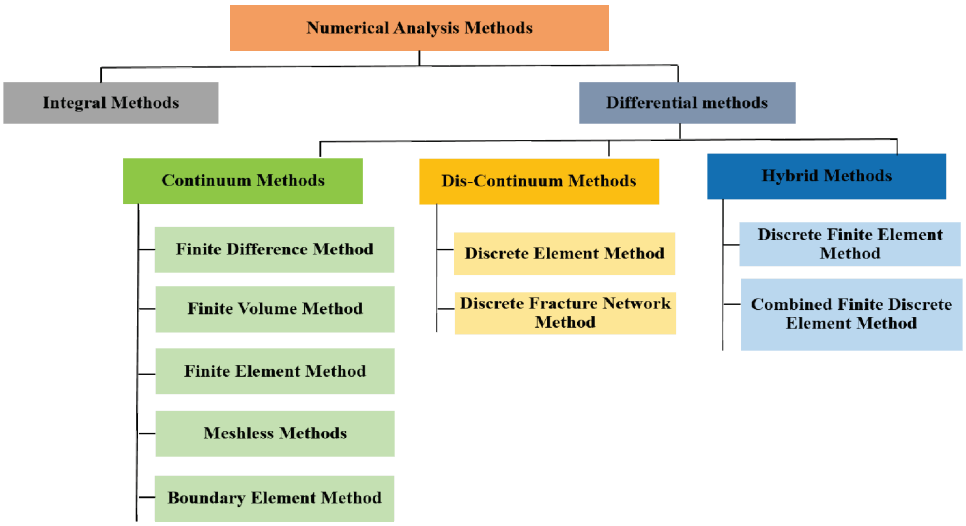


Figure 2.34 Various numerical analysis methods

Numerical simulation techniques also allow for the evaluation of the stability in the form of displacement measurement and the safety of slopes under various loading and boundary conditions, which is critical for engineering design and risk assessment. Numerical simulations can provide more comprehensive and reliable information on the deformation and failure mechanisms of slopes, which can help engineers identify potential failure modes and develop effective mitigation measures.

The numerical method has been extensively applied in studying the slope stability of opencast mines. This broad usage is attributed to its capability to model the irregular structure, as well as the non-linear, non-homogeneous, and anisotropic characteristics of rock strata. In summary, the introduction of numerical simulation techniques to measure the slope displacement along with the factor of safety is a relevant and genuine technique and has revolutionized the field of geotechnical engineering, providing a more accurate and realistic understanding of the behaviour of soil and rock masses under varying conditions. The increased use of these methods has significantly improved the safety and reliability of slope designs, reducing the risk of slope failures. In the numerical methods, various methods are available.

The (FDM) finite difference method is an approximation approach for resolving partial differential equations. It's been utilized to solve a broad range of issues. Linear and nonlinear as well as time-independent and dependent issues are commonly

encountered. This method can be used to address issues with various boundary conditions and for a region made up of various materials.

The derivation of the discretization equations and the building of the necessary programs need only elementary arithmetic, making FDM application straightforward. FDM emerged as the predominant numerical method for addressing practical problems. The advancement of high-speed computers with extensive storage capacities has led to the emergence of numerous numerical algorithms for solving partial differential equations. However, due to its ease of application, the finite difference approach remains a helpful method for dealing with these difficulties (Zhou 1993). The fundamental principle of FDM is to substitute unknown function derivate with their difference quotients. The shape of finite difference equations is determined by domain discretization. Flac 2D software to analyze the slope displacement and factor safety belongs to the FDM.

The square grid was designed to make life easier. Rectangular grids can be uniform (or non-uniform) depending on their application. For some figures, triangular grids are employed. For situations with circular boundaries, polar grids are used. Steps, also known as mesh lengths, represent the distances between grid lines, while nodes refer to the intersections of these grid lines. Upon subdividing the domain into grids, the continuous function is replaced by a large number of discretized values located at these nodes. (Zhou 1993).

Certainly, Finite Difference Methods (FDM) used for solving differential equations by approximating derivatives with finite differences. Here are some advantages of using FDM compared to other numerical methods like the FEM:

- FDM is usually simpler to implement.
- The implementation process is less time-consuming, making FDM an attractive choice for straightforward problems.
- For simple geometries, FDM can be more efficient than FEM
- When dealing with straightforward shapes, FDM often performs well.
- Some evidence suggests that FDM outperforms FEM for hyperbolic problems.

- Hyperbolic problems involve wave-like behaviour, and FDM can handle them effectively.
- FDM supports robust nonlinear methods for transport problems (e.g., ENO/WENO schemes).
- These FDM methods are useful for modelling phenomena like fluid flow and heat transfer.
- FDM can maintain accuracy even when dealing with irregularly shaped grids or varying aspect ratios.

2.9 Trigger Action Response Plan

The movement of a slope causing an accident in an opencast mine is a typical hazard, and it is vital to know how to avoid such an accident. So, summarizing an advanced slope monitoring system to frame the guidelines for a standard operating procedure in this type of case will help avoid such accidents and disasters. A Trigger Action Response Plan (TARP) provides a list of triggers, usually three or four observables at the operator level ranging from standard to extreme abnormal level of forces and displacements vertical and horizontal movements. Implementation of TARPs will be continued to develop suitable actions for any unanticipated or unidentified areas of slope deformation (Bakken et al. 2020). Especially, Slope-specific TARPs ought to be established as early as possible such that if/when displacement increases, there is a clear and well-defined plan defining trigger threshold for all teams to follow and avoid such type of slope failure. The slope movement, rate of displacement, and regular inspections are appropriate triggers for defining lower TARP levels.

Basically, a TARP is a set of guidelines categorized into various levels that specify appropriate actions to be undertaken based on prevailing slope stability conditions. These conditions are determined through ongoing continuous monitoring of the slope, facilitated by the slope monitoring system. The differentiation between TARP levels is determined by either cumulative displacement or the rate of displacement of the slope. This differentiation encompasses minimum displacement or its rate, which signifies the lower levels where normal operations on the bench can be allowed, while the maximum displacement or its rate signifies the point at which the slope

approaches a state closer to failure, representing the higher levels, and levels lower than that specifies some restriction to the workings. For each level within the TARP, a threshold displacement value will be established, drawing insights from the different previous slope failure case studies. Subsequently, when the slope monitoring system sends an alert indicating the specific level conditions, the corresponding action prescribed at that particular level will be implemented. Effective Trigger Action Response Plans (TARPs) must adhere to eight fundamental principles highlighted by Cliff (2009) and Belle & Cliff (2018).

- They must be robust and simple,
- Adequately resourced in terms of equipment and human resources,
- Be focused on prevention and control through early recognition,
- Complete knowledge of what in normal condition to set the trigger at abnormal condition,
- Regular review and update required in normal condition,
- High-quality monitoring systems,
- Should be based on best available advice,
- One hundred percent completion of action suggested by TARP.

Several factors are required to design a TARP. Figure 2.35, show the factors considered in TARP development at Bingham canyon by Bakken et al. (2020).

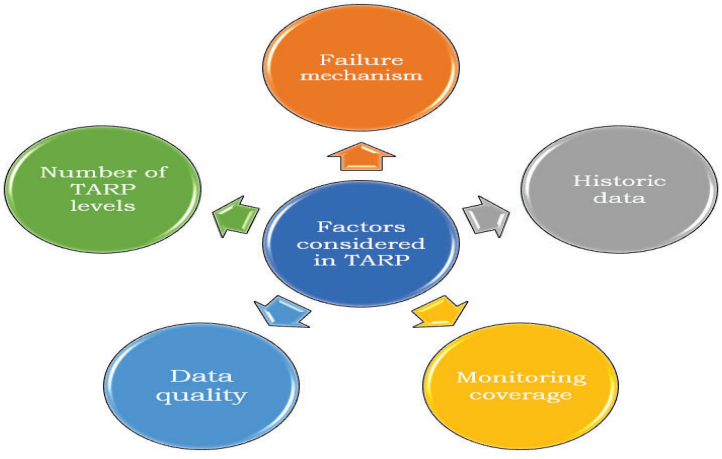


Figure 2.35 Factors considered in TARP at Bingham canyon (Bakken et al. 2020)

Five primary factors must be taken into account when designing a TARP, as follows:

(i) Historic Slope Failure Case Studies Information: This involves a thorough examination of information derived from case studies of historical slope failures

(ii) Monitoring Coverage of the Slope Monitoring System: Assessing the extent of coverage provided by the slope monitoring system employed in the mine is crucial.

(iii) Accuracy and Quality of Recorded Data: The precision and quality of data recorded by the monitoring system play a vital role in the effectiveness of the TARP.

(iv) Number of Alert Levels: Determining the appropriate number of alert levels is essential, considering various factors such as production activities and the nature of work taking place on the slope.

(v) Failure Mechanism of the Slope: Understanding the specific failure mechanism of the slope is critical for developing a TARP.

It is also important that the mine officials and personnel employed at the mine should be aware of the procedure to be followed in the event of a trigger alert. The general procedure of plan to be adopted is summarized in the following.

- Alert the slope monitoring team immediately.
- Conduct a visual inspection of the slope and surrounding areas.
- Conduct a risk assessment to determine potential hazards to people, infrastructure, or other assets in the area.
- If the risk assessment determines that there is a potential danger to people or assets in the area, immediately evacuate the area and notify emergency services.
- If monitoring indicates a potential slope failure, initiate a response plan that may include temporary or permanent slope stabilization measures.
- If necessary, engage the services of a slope stability expert or geotechnical engineer to assess the situation and provide recommendations for action.
- Monitor the slope continuously to detect any further movement or changes in conditions, and take appropriate action as necessary.

The crucial part of TARP is determining the trigger thresholds of each individual TARP levels. Most often the TARP levels are differentiated by a certain slope displacement rate. Coetsee et al. (2020) used the strain-based method of evaluating slope stability to define the threshold limit for stain values using displacement measurement. The basic idea was to compile TARP with the study stain criteria and separate the stain levels for the specific failure mode to make indicative displacement value into time-dependent displacement behaviour on which the alarm criteria can be based. The points considered while allocating derived revealing strain deformation thresholds for slope movement and instabilities are:

(i) Recommended strain thresholds for the different modes of slope failure for the poor to fair rock mass class taken from the case study presented by Brox & Newcomen (2003).
(ii) The strain at failure for the failure type for the rock mass class from RMR76 vs. high wall strain at failure for planar, toppling, wedge and rock mass failure by Newcomen & Dick (2016).
(iii) Pit slope movement and deformation in terms of slope movement stages
(iv) Classification on pit slope velocities provided with the average velocity in (mm/hr), (mm/day) and classification of slope velocities for the detection of acute velocities concerning different authors (Sullivan 2007).
(v) Utilizing a pre-defined strain values for the particular type of failure and converting this to a slope displacement value to be utilized as an alarm setting.

Archetypally, five TARP levels would exist as slope movement progresses from slight levels to the upper level, the general responses are shown in the Table 2.6.

Table 2.6 Slope behaviour and trigger action response plan levels (Bakken et al. 2020)

TARP levels	**failure progression**	**Mine responses**
1	No deformation	Routine operations
2	Gradual slope deformation at constant rate	Halt mining operations and expand radar coverage
3	Accelerated slope movement	Remove personnel and equipment
4	Expected failure	Ensure isolation
5	Unexpected failure	Removal of men and material

Table 2.7 shows, a Trigger Action Response plan summary developed by Bakken et al. 2020 at Bingham canyon mine. The Tigger level indicates the severity of slope conditions, with level one representing a safe condition and the highest level, as per the TARP, indicating an unforeseen slope failure. The trigger level description elucidates the present condition of the slope at a particular level, where triggers represent specific thresholds or limitations for each level. Responses provide detailed plans to be implemented immediately following a trigger. In case of huge mine area where different parts of opencast mine are prone to slide independently would not possess same triggers and summary. As the basic parameter that has its effects on slope stability alters the TRAP will be modified and updated accordingly.

Table 2.7 Trigger action response plan summary (Bakken et al. 2020)

TARP level description	**TARP level**	**TARP Triggers**	**Mine Response**
Excepted slope movement	1	<18 mm/day	Continue operation and enhance planning efforts
Observable deformation surpassing expected parameters	2	18 mm to 114mm/day	Compulsory radar coverage
Hastening of wall movement	3	>114mm/day and velocity ratio > 1.3	Secure laydown areas below the potential failure.
Possible failure progression	4	Inverse velocity predict failure within 36 hours	Evacuate all personnel from the lower pit area.
Unexpected failure	5	Unforeseen slope collapse	Incident command initiated

TARP levels are designed by the Coetsee, et al. (2020), based on classification of pit slope velocities and critical velocities (mm/hr, day, month) when imminent failure has taken place as given in Table 2.86, for slope monitoring in the form of classification of pit slope velocities.

Table 2.8 Classification of Pit Slope Velocities for Planning (Coetsee et al. 2020)

Sl. No	Movement class	Average velocity (mm/day)	Displacement (mm/month)	Comment	Sensitivity to environmental factors
1	Low creep	<0.05	<1.5	Stage 1 movements	Very low
2	Significant creep	0.05–0.1	1.5–3	Stage 1 movements	low
3	Definite movement of slope	0.1–0.25	3–7.5	Could stabilize if strain hardening	Medium
4	Likely to fail	0.25–0.5	7.5–15	-	Medium to high
5	High chance of Failure	1	30	-	Medium to high
6	Pre-failure collapse Movements	>1.0	>30	-	High

2.9 Summary

The summary of the literature was assembled using a comprehensive analysis of earlier studies on a range of slope stability issues, factors affecting the slopes and failures along with the conventional and modern slope monitoring systems, such as Time Domain Reflectometry (TDR), Light Detection and Ranging (LiDAR), and Slope Stability Radar (SSR), etc., come with their own set of problems, including high cost, low automation, challenges with real-time data transfer, erratic communication, delayed detection, and the inability to anticipate possible problems beforehand. Also given the research on various technologies like cloud computing, Internet of Things (IoT), and wireless sensor networks is becoming essential for slope monitoring, also added the work done by the various authors on communication systems. WSN-based slope monitoring systems. The use of different sensors to record displacement on slopes, as well as the many types of contemporary slope monitoring systems and their uses, have been the researchers' main areas of attention. Summary on various authors work on TARP and which is crucial for slope monitoring in opencast mines since it outlines what should be done in the event of triggers or symptoms of instability as instead by the Director General of Mine Safety (DGMS).

CHAPTER - 3

CHAPTER 3

INVESTIGATIONS

This chapter presents the investigations carried out to meet the objectives mentioned in the chapter-1. Firstly, details of the lab experimentation conducted to calibrate the sensors incorporated in the system is provided. Subsequently, the experimentation carried out to test the functions and performance of the proposed slope monitoring system using a laboratory model is discussed. Afterwards, the particulars regarding the development of advanced slope monitoring system and the investigations carried out in three case study mines (KTKOC2, KHAOC and SRPOC2) including the total station monitoring details are discussed. Then, numerical modeling study based on site conditions and parametric study to explore influence of the various parameters are given. Further, development of user friendly slope displacement and stability analysis software is developed. Finally, the procedure adopted to develop TARP is discussed.

3.1 Sensors Calibration

Micro Electro Mechanical Systems (MEMS) sensors used in this study to detect soil moisture content, ground vibrations and displacement. These sensors cannot be taken as a complete replacement for conventional/modern methods of slope monitoring unless they are calibrated at regular intervals and validated for their accuracy. American Society for Testing and Materials (ASTM) provides a standard methodology for laboratory determination of moisture content of soil (ASTM D2216-19) using Oven Drain Method (ODM). Seismometer and Linear Vernier calipers are universally proven tools to detect vibrations and measure displacements respectively. The following section explains the procedure adopted for calibration and validation of the MEMS sensor with the help of proven methods.

3.1.1 Calibration of FC-28 soil moisture sensor

The FC-28 soil moisture sensor provides output in the form of voltage which is then converted to bits by Analog-to-digital converter (ADC). The objective of this investigations is to calibrate the bits of sensor output to denote the relative moisture content. Oven drying method (ISO 17892-1:2014) is a robust and widely accepted procedure to analyze the water content in the soil that can be used to calibrate soil moisture sensor. The first step is to collect soil samples from the field. Total 15 soil samples weighing 200 g each were collected form the case study mines for this purpose. The collected samples were tested for moisture content with sensor, as shown in Figure 3.1, and then the moisture content of the samples were found using ODM method and they are presented in Table 3.1.

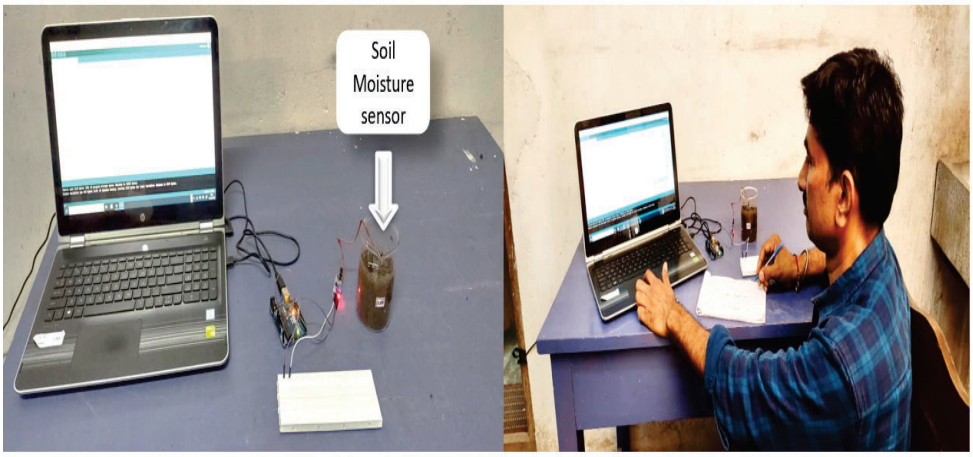


Figure 3.1 Determination of soil moisture content of selected samples using the FC-28 sensor

The linear regression equation obtained after plotted a graph with sensor readings and moisture content by ODM method is provided in the Figure 3.2. The derived linear regression equation is y = -0.0995 x + 98.96, where 'x' denotes the sensor output in bits and 'y' denotes the soil moisture percentage. When the sensors detect moisture, their output a value in bits, which is 'x' in this case. By applying this 'x' value to the equation, the corresponding soil moisture percentage 'y' is derived.

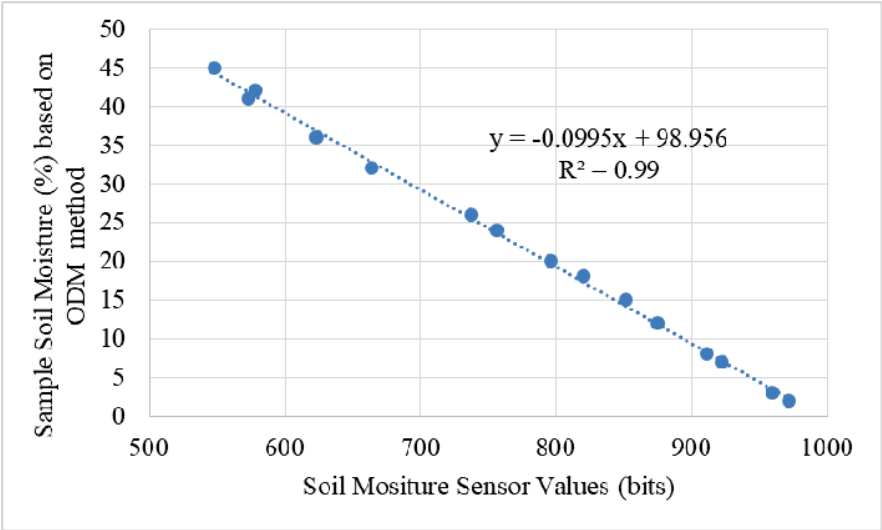


Figure 3.2 Regression analysis of soil moisture sensor values

Table 3.1 Soil moisture sensor output for selected samples

Sl. No	Moisture content in % (by ODM) method	Soil moisture sensor readings (bits)	Calibrated moisture content using regression equation	Difference between soil moisture sensor and ODM method (%)	Percentage of error between initial soil moisture readings and calibrated values
1	2	971.7	2.2	-0.2	-10.0
2	3	959.75	3.4	-0.4	-13.3
3	7	922.14	7.2	-0.2	-2.9
4	8	911.16	8.3	-0.3	-3.8
5	12	875.24	11.8	0.2	1.7
6	15	851.3	14.2	0.8	5.3
7	18	820.36	17.3	0.7	3.9
8	20	796.4	19.7	0.3	1.5
9	24	756.48	23.7	0.3	1.3
10	26	737.52	25.6	0.4	1.5
11	32	664.64	32.8	-0.8	-2.5
12	36	623.72	36.9	-0.9	-2.5
13	41	573.82	41.8	-0.8	-2.0
14	42	578.84	41.3	0.7	1.7
15	45	548.9	44.3	0.7	1.6

The maximum percentage of error between ODM method and the calibrated sensor values found to be 13.3%.

3.1.2 Calibration of SW420 vibration sensor

Geophones are universal tools to measure ground vibration. Thus, geophones are used to calibrate the SW420 vibration sensor. Geophone detects vibration in the form of frequency in Hertz (Hz), and peak particle velocity (ppv) in millimeters/second (mm/s), as per the coal mine regulations (2017), it's preferable to measure frequency to know the impact on the structures, hence measurement of frequency in Hertz (Hz) is considered in this study. The SW420 vibration sensor operates as a digital sensor, returning “0” when it detects no vibration and “1” when it detects vibration. Then the pulse is converted to frequency using this conversion formula 1 Hz is equal to 10,00,000 microseconds. Hz and microseconds are inversely proportional. Figure 3.3 depicts the vibration sensor calibration experimentation.

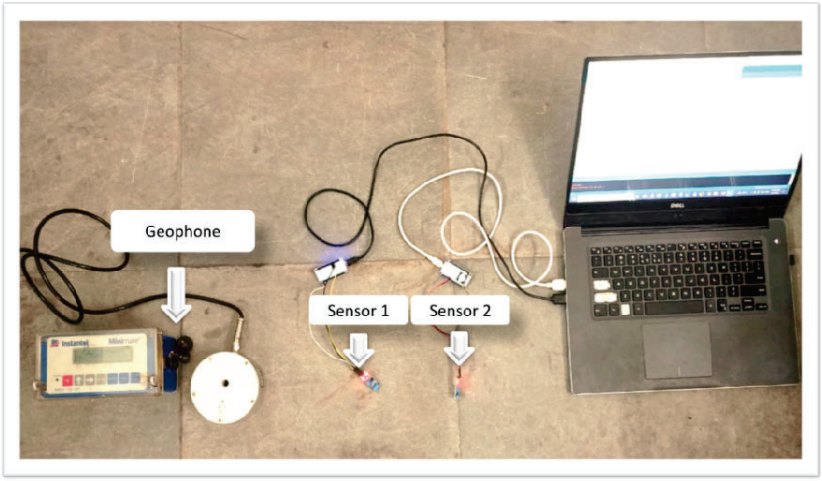


Figure 3.3. Vibration sensor calibration

In this case, two vibration sensors were utilized to evaluate their precision. The vibration sensor readings and Geophone readings were plotted against each other to develop a linear regression equation for calibration (Figure 3.4).

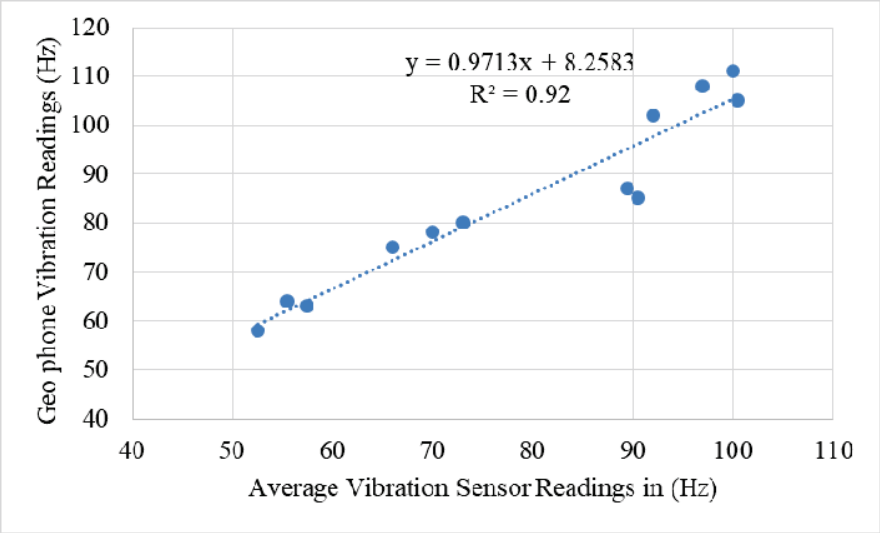


Figure 3.4 Regression analysis of displacement sensor values

Vibration in Hz were recorded using vibration sensor and Geophone, and the readings obtained and the calibrated values obtained through the regression equation are provided in the Table 3.2. The maximum percentage of error between calibrated values and geophone values is found to be 13.13%, which are acceptable.

Table 3.2 Geophone and Vibration sensor reading

Sl. No	Geo phone reading	Vibration sensor 1		Vibration sensor 2		Average vibration sensor reading (Hz)	Calibrated values (Hz)	Percentage of error b/w Geophone and calibrated values
	(Hz)	(µs)	(Hz)	(µs)	(Hz)			
1	105	10101	99	9804	102	100.5	105.87	-0.83
2	87	10989	91	11364	88	89.5	95.19	-9.41
3	85	11111	90	10989	91	90.5	96.16	-13.13
4	108	10101	99	10526	95	97	102.47	5.12
5	111	9709	103	10309	97	100	105.39	5.06
6	102	10753	93	10989	91	92	97.62	4.30
7	80	13888	72	13513	74	73	79.16	1.05
8	75	14492	69	15873	63	66	72.36	3.51
9	78	13333	75	15385	65	70	76.25	2.24
10	64	16949	59	19230	52	55.5	62.17	2.87
11	58	17857	56	20408	49	52.5	59.25	-2.16
12	63	18181	55	16666	60	57.5	64.11	-1.76

3.1.3 Calibration of displacement sensor

The displacement sensor is actually a sliding rheostat. The displacement sensor output will give in bits is similar to soil moisture sensor. So, in this case an Electronic Vernier caliper IS 3651-2 (1985), is used to calibrate displacement sensor. Arrangements and set-up of the calibration experiment are shown in Figure 3.5.

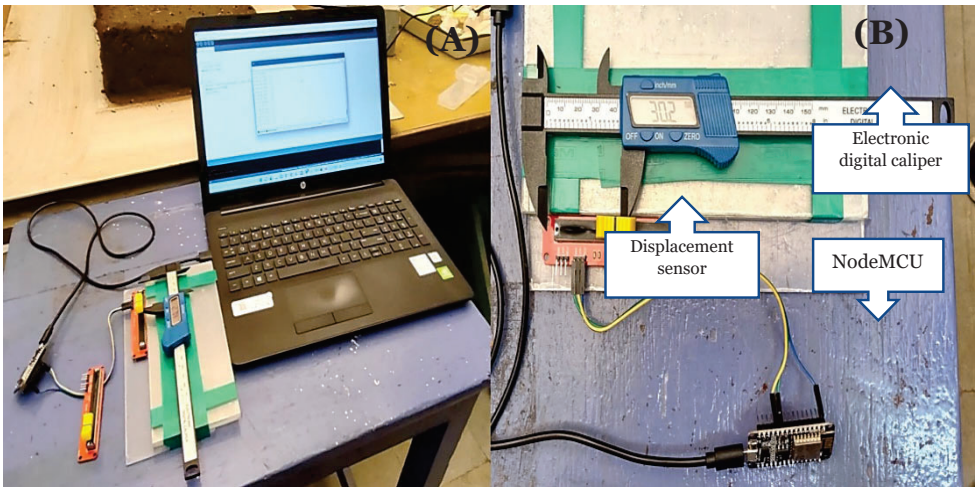


Figure 3.5 Calibration of displacement sensor (A-Serial monitor and B-Vernier Caliper)

Figure 3.6 show the scatter plot graph of displacement sensor and caliper readings plotted against each other with the obtained regression equation.

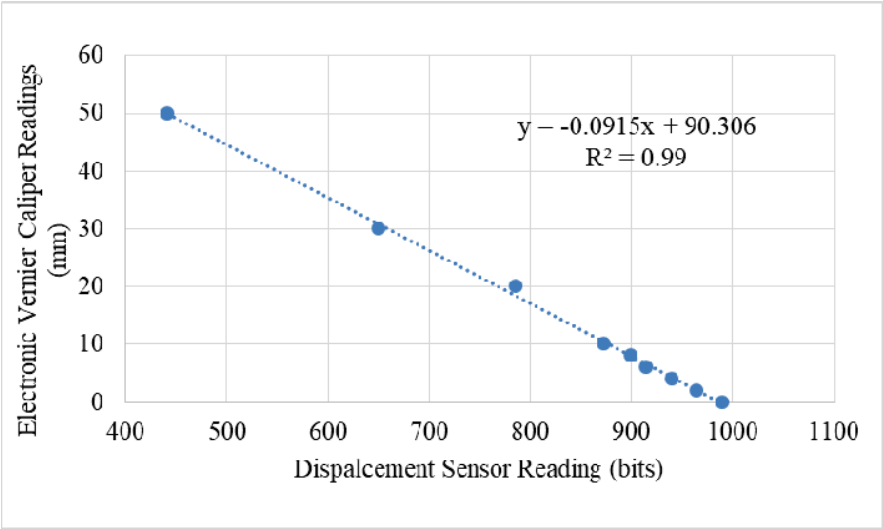


Figure 3.6 Regression analysis of displacement sensor values

Table 3.3 shows the displacement readings obtained through sensor and electronic digital caliper. The calibrated displacement values obtained from regression equation and the percentage of error between caliper and calibrated sensor readings are all included. From the below table, the maximum percentage of error between caliper and the calibrated sensor values found 10%, which is acceptable.

Table 3.3 Displacement sensor calibration experiment observation

SI. No.	Electronic digital calliper readings (mm)	Displacement sensor readings (bits)	Calibrated displacement values using regression equation	Difference between sensor values and calliper readings	Percentage of error between calliper and calibrated sensor readings
1	0	990	-0.28	0.279	0
2	2	965.04	2.00	-0.005	0
3	4	940.08	4.29	-0.3	7
4	6	915.12	6.57	-0.6	10
5	8	900.16	7.94	0.1	-1
6	10	873.2	10.41	-0.4	4
7	20	786.4	18.35	1.6	-8
8	30	650.6	30.78	-0.8	3
9	50	441	49.95	0.0	0

3.2 Development of WSN and CCT Integrated Slope Monitoring System

An effective slope monitoring system should enable automation as well as the collection and processing of data in real time, thereby resolving the issues mentioned in the problem description of the first chapter. Wireless sensors and cloud-based data analysis platforms integrated for the slope monitoring system to provide automated functionality and real-time data analysis. This study, realizes the advantages of both technologies, promotes the installation of a sophisticated slope monitoring system that combines WSN and CCT. The complete sequence is depicted in Figure 3.7, illustrating the entire process flow of the advanced slope monitoring system.

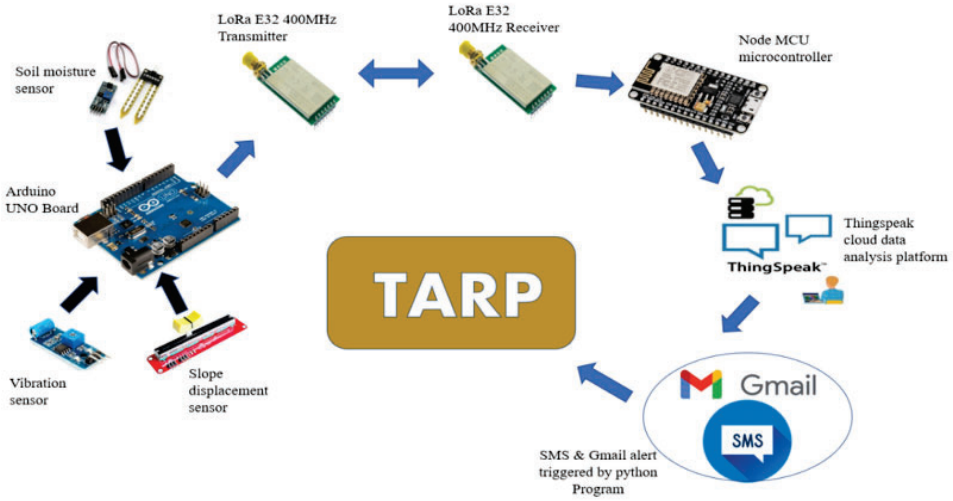


Figure 3.7 Methodology of wireless sensor network and cloud computing integrated slope monitoring system

To assess slope stability, measurements of soil moisture, vibrations, and displacement are required. For this purpose, a sensor node is assembled, consisting of FC-28 soil moisture, SW-420 vibration, and Slide potentiometer sensors, along with an Arduino UNO controller, a voltage regulator, LoRa transmitter module, and a 12V battery. The transmitter module sends the sensor data to the receiver located at the reception end. Detailed specification of the same are presented in the following sections.

The receiver module comprises a LoRa module connected to a NodeMCU controller, powered by a 12V battery, and regulated with a 7085-voltage regulator. The NodeMCU, equipped with an inbuilt Wi-Fi module, updates ThingSpeak with the received sensor data. ThingSpeak provides data storage and display capabilities. Additionally, PythonAnywhere is utilized to read the stored data and compare it with predetermined threshold values. If the predetermined threshold value of any sensor reading is reached, the system triggers email and SMS alerts. Guidelines specified in the TARP will be implemented by the mine official in response to the received alert from the system.

This system classified into distinct units, namely the sensing unit, data transmission unit, cloud data feed unit, cloud data storage & display unit, and cloud data analysis &

alert email dispatch unit. The following sections elaborate the functions of each unit individually.

3.2.1 Sensing unit

A sensing unit/node comprises of a collective setup of soil moisture, vibration, and displacement sensors, along with a microcontroller and LoRa module. A cuboid-shaped box was prepared using 6.0 mm thick acrylic sheet, which is found to be perfect for holding all the components and a battery to power them. The sensors and transceiver are positioned outside of the node box, while the battery and microcontroller are placed inside. A sample node model is shown in Figure 3.8

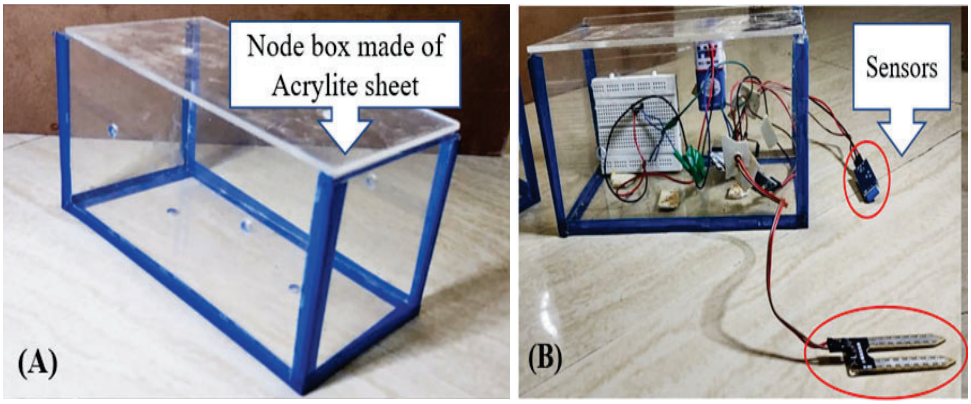


Figure 3.8 Preparatory model of the node (A- Acrylite sheets and B- Sensors and battery connections)

3.2.2 Data transmission unit

The data transmission units contain two modules, transmitter node and receiver node. The transmitter node utilizes an Arduino UNO microcontroller, which has six analog input/output pins, whereas the NodeMCU has only one. A transistor (7805) is used in the circuit to step down the 12V input by the battery to the operational voltage of 5V of Arduino. The output pins of the transistor are connected to the power input pins VCC (Voltage Common Collector) and GND (Ground) pins of Arduino for power supply. The sensors operate with a voltage range of 3.3V to 5V, thus they depend on the Arduino for power. To power the sensors, VCC and GND pins of the sensors are connected to the 3.3V and GND pins of the Arduino. Additionally, the analog signal

pins of the soil moisture sensor and displacement sensor are connected to the A0 and A1 pins of the Arduino, respectively, whereas the digital signal pin of the vibration sensor is connected to the ~7 pin of the Arduino. The circuit diagram of the transmitter node is provided in Figure 3.9, showing the serial connections between Arduino, sensors, and LoRa.

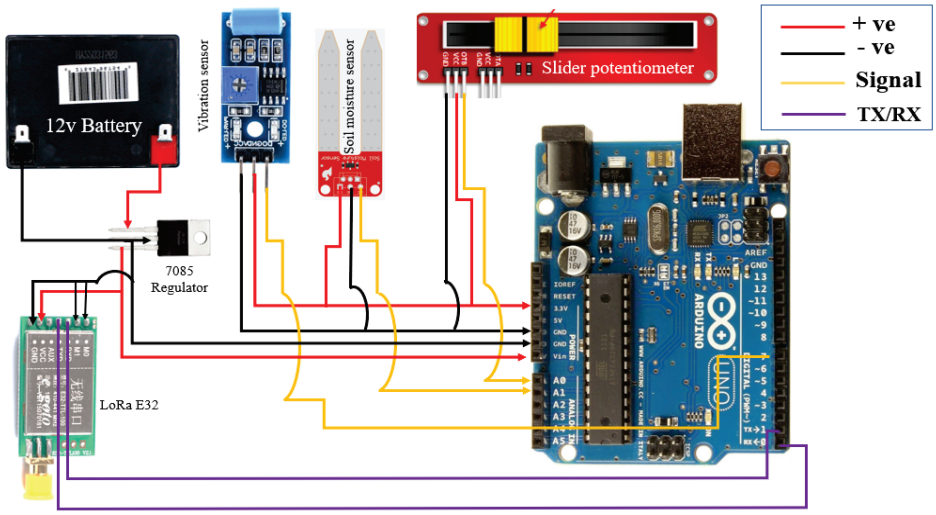


Figure 3.9 Circuit diagram of transmitter node with its components

The working voltage of the LoRa module is 5V. To avoid overloading the Arduino, the LoRa module's input power is taken from the battery through a transistor, even though the Arduino has a 5V output. The transmit (TX) pin and receive (RX) pins are used for Universal Asynchronous Receiver/Transmitter (UART) communication, which facilitates transmission and reception. Specifically, the TX of Arduino is connected to the RX of LoRa, and the RX of Arduino is connected to the TX of LoRa. The M0 and M1 pins of the LoRa module are responsible for setting the operational mode and must be set to "0". To achieve this, they are connected to the GND pin of the Arduino.

The receiver node serial connections are similar to the transmitter node. The 12V battery that powers the transmitter and receiver nodes. Additionally, an active Wi-Fi connection is provided to the NodeMCU to upload the data onto ThingSpeak. The circuit diagram of the receiver node is provided in Figure 3.10.

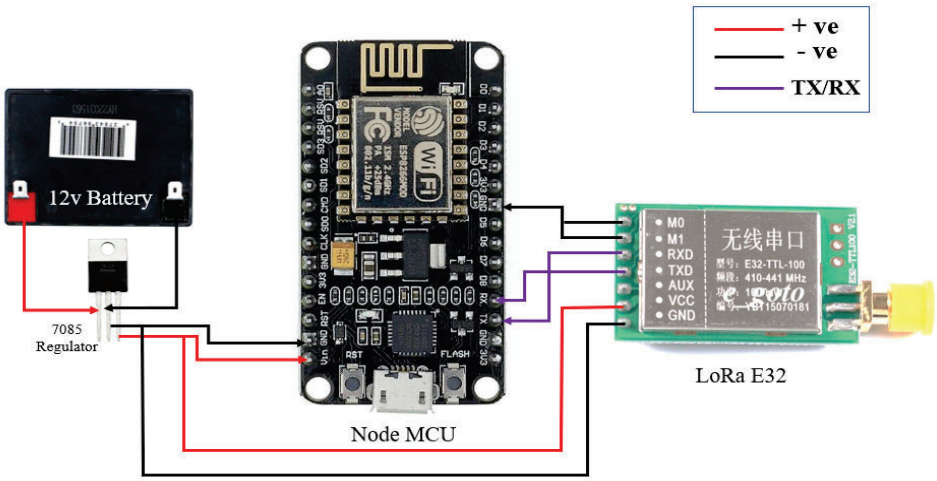


Figure 3.10 Circuit diagram of receiver node with its components

The transmitter and receiver node program (attached in Appendix-I) has been designed to collect sensor data. While multiple sensor transmitter nodes which are used with one receiver node each transmitted node is labeled with a specific 'id'. This enables the receiver node to identify the transmitter node from which it has received the data.

3.2.3 Cloud data storage and analysis unit

The code written on the NodeMCU can initiate a URL request, which includes the unique write API key provided by ThingSpeak. This API key specifies a particular channel, which can be considered as a representation of the sensor node. The fields within the channel represent each individual sensor of the node. By sending this URL request with the appropriate API key and data, the NodeMCU can update the corresponding channel on the ThingSpeak platform with the sensor readings. This process is repeated for each transmitter node within the network, with the data from each node being updated to their respective ThingSpeak channels using the corresponding API key of each channel. ThingSpeak provides a customizable graphical user interface that allows users to gain real-time insights into their feed data. Moreover, it provides a Read API key that grants access to the sensor data saved in ThingSpeak. This data can be utilized to activate early warnings and notifications upon meeting specific thresholds. The Python program (attached in Appendix - I),

hosted on a PythonAnywhere server, monitors the data stored in ThingSpeak using the Read API key and generates alerts accordingly.

3.3 Performance Evaluation of Sensors and Development of Advanced Slope Monitoring System

The performance evaluation of aforementioned calibrated sensors and the proposed slope monitoring system on a laboratory scale slope model is addressed in this section.

The laboratory slope bench model was prepared on the equivalent material slope model concept which is made up of the soil samples collected from the study area. The model built was a representation of an opencast mine slope with bench height of '0.5m' and bench width of '0.6m' with proportionality factor of '20' from actual mine conditions.

The objective of this experimentation is to evaluate the efficiency of the proposed design containing soil moisture, vibration, displacement sensors and Zigbee wireless module similar to LoRa. Zigbee is used as data transfer module in the laboratory experimentation study. The NodeMCU updates the sensor data from the receiver to the ThingSpeak. Python program hosted in PythonAnywhere triggers email alerts.

The experiment was conducted in two phases, the first phase with the soil moisture and vibration sensor and the second phase with only a displacement sensor. The moisture sensor and vibration sensor of each two are installed on the bench and the slope part of the model as shown in Figure 3.11, is connected to the transmitter side NodeMCU.

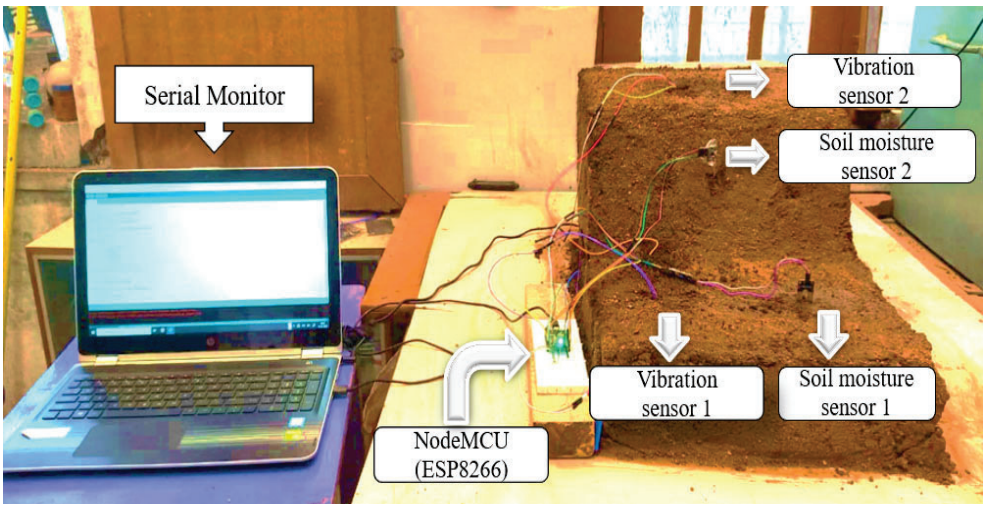


Figure 3.11 Experimental setup of slope monitoring using soil moisture and vibration sensors

The same circuit is used in the second phase also but the moisture and vibration sensors were replaced with displacement sensors as shown in Figure 3.12. Two different cases were examined in second phase, one with and one without load on the slope (Figure 3.12B & 3.10C).

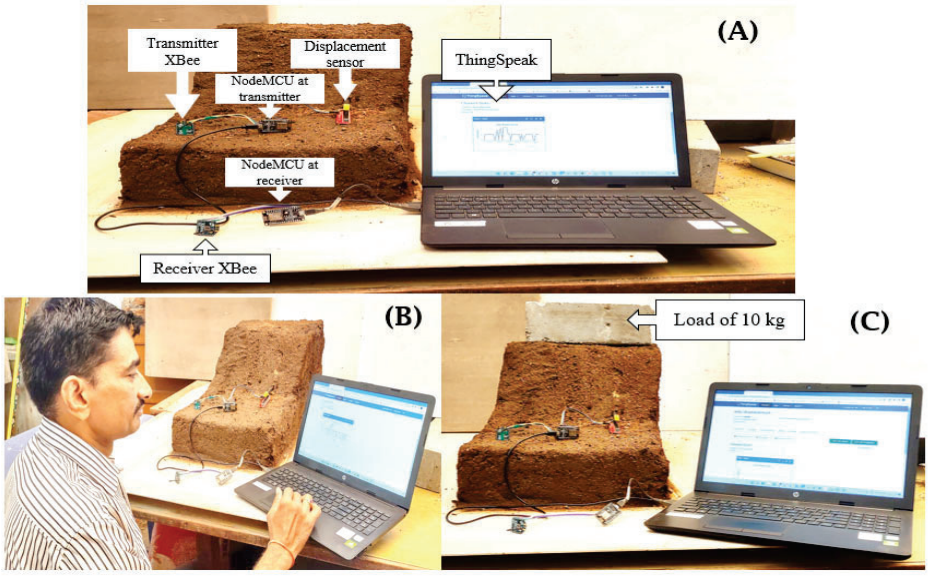


Figure 3.12. Laboratory arrangements of the displacement experiment

The sensor data captured in the ThingSpeak are displayed in Figure 3.13. Regarding the early warning alert system, the python program allows setting of certain thresholds for monitoring the parameters which are discussed in the previous section 3.2.3.

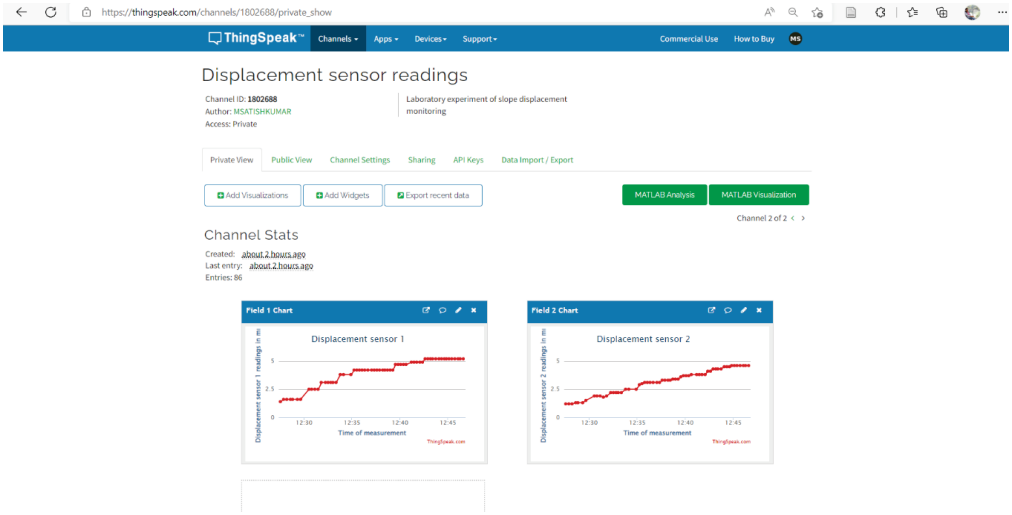


Figure 3.13 Measurements of displacement sensor in ThingSpeak console

In this program an email alert was generated using Simple Mail Transfer Protocol (SMTP) library, and the text alert can be sent using webhooks from a web service platform called 'If This Then That (IFTTT)' web service, which automates web-based tasks. However, it should be noted that while many apps support this feature, they are quite expensive. This Python code has the ability to assess sensor data according to time, and it can create multiple levels of alerts.

The data collected from the displacement sensor's, cloud data analysis was programmed to triggers emails in the following condition, the first email was triggered when the readings exceeded the pre-defined as threshold by 1 mm which is again on a trial basis, with the subject saying "Alert! Slope displacement exceeds the threshold", and the second email was triggered when the threshold was set as 1 mm for displacement based on the rate of displacement as shown in Figure 3.14. Threshold was set at 50%, for the moisture content. The system triggered an alert email right when it detects the values over the predefined threshold limits.

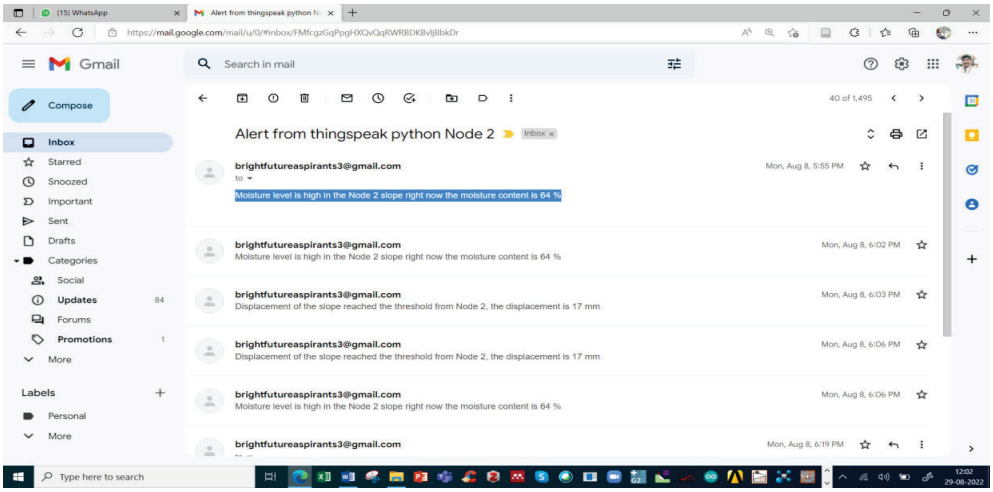


Figure 3.14 early warning E-mail alerts triggered by the slope monitoring system

Making use of calibrated sensors in the field to measure the moisture (%), vibration (Hz) and combined common effect causes displacement (mm) on the slopes of opencast mines, designed nodes has been deployed in the selected projects.

3.4 Field Investigations

Field investigations are carried out in the mines of The Singareni Collieries Company Limited (SCCL). SCCL has been exploiting coal for more than 110 years. Out of 470 Km long Pranahita and Godavari valley Coal field, the southern sector over 350 km length lying in the districts of Komram Bheem (Asifabad), Mancherial, Peddapalli, Jayashankar Bhupalpally, Bhadradri Kothagudem and Khammam of Telangana State is referred as Godavari Valley Coalfield (GVCF), major part of this sector is in the south Indian State of Telangana, mostly it includes from Dorli-Bellampally coal belt to Bhupalpally-Mulugu coal belt. In this study, three opencast projects namely, Kakatiya Khani Opencast - 2 Project (KTKOC-2), Khairagura Opencast Project (KHAOC), and Srirampur Opencast-2 Project (SRPOC-2) which covers the maximum length of the above mentioned sector. Location of these mines in the Godavari valley coalfield in shown in the Figure 3.15.

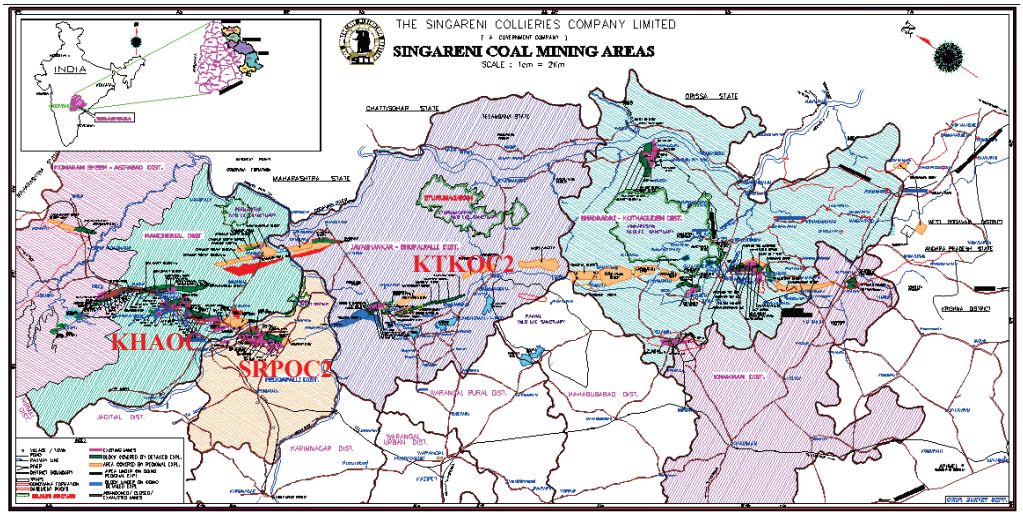


Figure 3.15 Coal Mining Areas of Godavari Valley Coalfield

These mines have slope instability problems and significant history of local slope failures making them ideal locations for studying the effectiveness of the proposed slope monitoring system. A total of 48 slope locations across all the above three stated opencast coal mines were monitored under the current field investigations and captured various parameters such as soil moisture levels, ground vibrations, and displacement. Observations of each individual case study is discussed in detail in the upcoming sections of this chapter.

3.4.1 Case Study-1

As case study -1, field investigations were carried out at KTK OC - 2 Project of The Singareni Collieries Company Limited, Bhupalpally in Jayashankar Bhupalpally District of Telangana State. KTK OC-2 Project is carved out of Kakatiyakhani-2 (KTK-2) Incline underground mine. The Project is located between North Latitudes 18° 26' 41" to 18° 28' 8" and East Longitudes 79° 50' 17" to 79° 52' 36" and falls in Survey of India Topo sheet No: 56 N/15. The nearest railhead to the project is Uppal railway station lying on the Balharshah-Kazipet section of South Central Railway, which is located at a distance of about 55 Km away. Figure 3.16 shows the Kakatiya Khani Opencast-2 Project key plan.

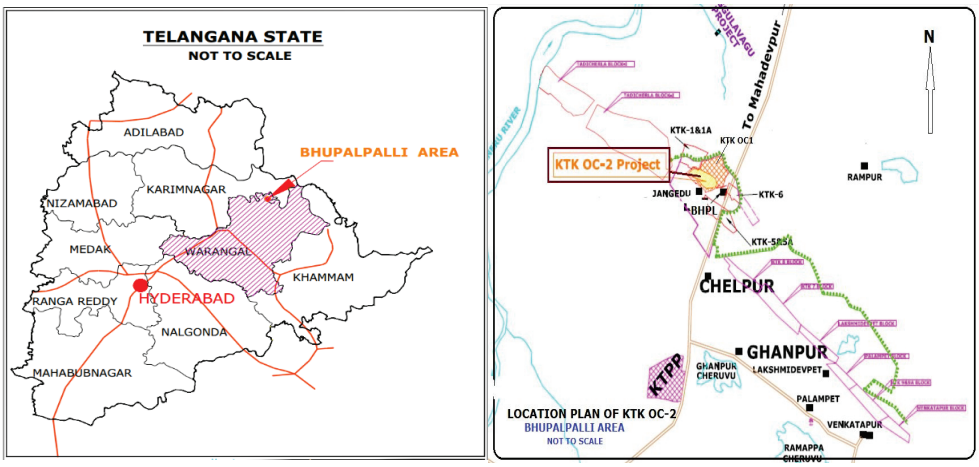


Figure 3.16 KTK OC-II Project Key plan

The satellite view of the KTK OC-2 Project indicating the mine boundary and topography is shown in Figure 3.17. Table 3.4 provide the salient features of KTK OC-2 project.



Figure 3.17 Satellite view of the KTK OC- 2 project

Table 3.4 Salient features of KTK OC- 2 project

Mining operations commenced during year	2017-2018
Mineable reserves	19.25 Mt
Total OB estimated to be handled	277.99 M Cu.m
Targeted production per year	1.25 Mt
Stripping Ratio (Coal in Te: OB in Cu.m)	1:13.41
Maximum depth of quarry	250 m
Average Gradient	1 in 3.0
Total life of mine	15 years
Mining Technology	Shovel –dumper combination

3.4.1.1 Slope monitoring using total station at KTK OC-2

At KTK OC-2 project, slopes are monitored using Total station with prisms put at regular intervals on the benches. The prism positions are monitored regularly, and the data is examined for any movement by comparing with previous readings. Permanent stations are established to use total station instrument in critical positions to monitor the prisms on a regular basis. The total station system of monitoring contains 21 prisms that are permanently fixed in low walls for monitoring, out of them 7 are on 1st bench, 6 on 2nd bench, 4 in the 3rd and 4th bench. Readings are taken from a fixed point by a total station at regular intervals.

Total station readings of the study area were collected from the mine to ascertain slope's behaviour. Figure 3.18 shows the total station readings in a line graph to observe the difference in displacement between individual stations. The highest displacement observed is 49.30 mm at RB309 prism station. During this observation, it was also noted that the slope benches currently under study show no indications of slope failure, such as tension cracks or significant acceleration in slope displacement.

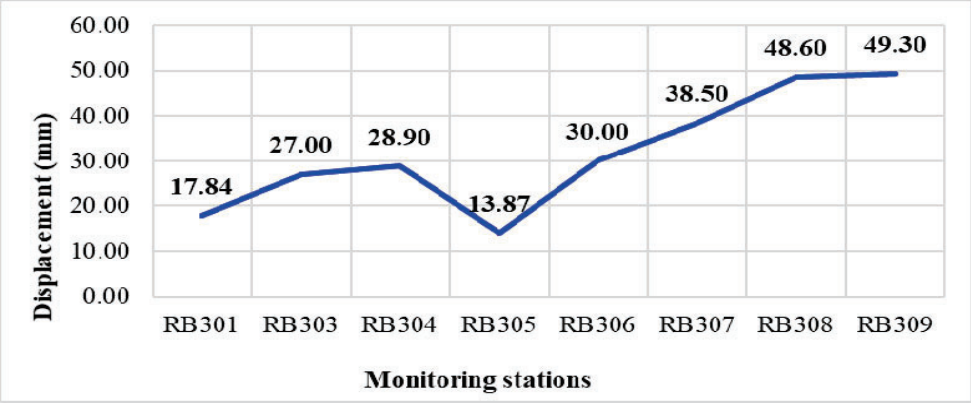


Figure 3.18 Total station readings at KTKOC-2 mine

3.4.1.2 History of slope failures at KTK OC-2

KTK OC-2 project has a history of small-scale slope failures occurred in 5 locations on the quarry's rise side. Table 3.5 contains the details of the slope failures and Figure 3.19 displays the locations of previous slope failures occurred in the mine.

Table 3.5 Details of slides occurred in the mine

S. No	Slide Area	Date of failure	Sections	RL's of slides	
				From	To
1	Slide 1	18.04.2018	8-10	870	836
2	Slide 2	20.09.2018	14-16	880	840
3	Slide 3	22.10.2019	17-18	886	860
4	Slide 4	18.06.2020	18-20	890	874
5	Slide 5	17.08.2020	9-12	870	865

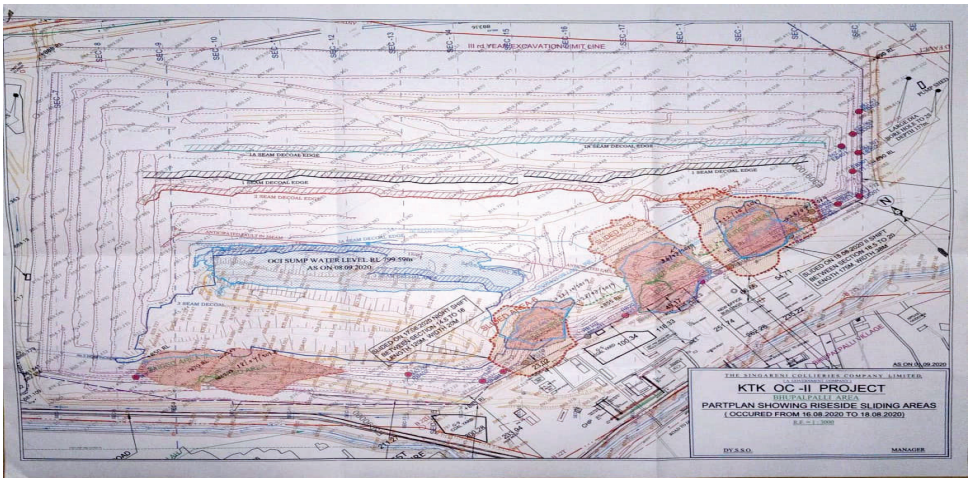


Figure 3.19 Part plan showing sliding areas of KTK OC-2 Project

Figure 3.20, shows the recorded displacements of slope failure cases at KTK OC-2 mine, the highest displacement recorded among the six stations is ranging from 93.20 mm to 122.01 mm, and also it is represented in a graphical way to understand easily the tendency of failure are occurred in this KTKOC-2 project after crossing the maximum displacement beyond the 122.01 mm.

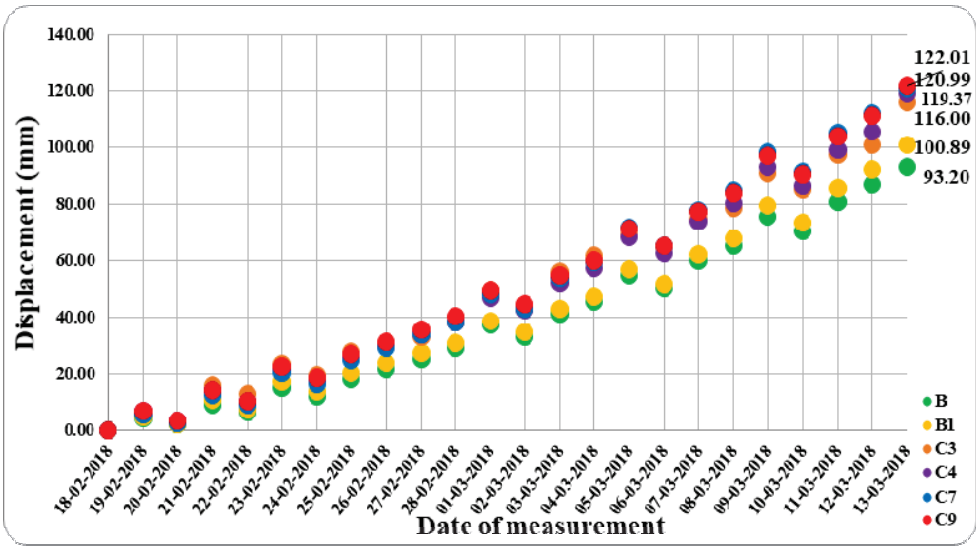


Figure 3.20 Displacement of slope failure cases at KTK OC-2 project

Cracks were observed at 870 RL and prisms were disturbed after readings recorded at a few locations (i.e., 870RL & 875RL) and failure occurred as shown in the Figure 3.21.



Figure 3.21 Tension cracks developed and slope failure (RL870 & RL875 benches)

The insights from the previous slope failures in the mine indicate that, tension cracks typically do not appear until 50 mm displacement is reached at the measuring point. A Maximum displacement of 122 mm was recorded before slope failure, indicating that the slope becomes unsafe once displacement crosses 100 mm.

3.4.1.3 Selection of the site for investigations

Field investigations were carried out with equipped nodes and set-up at KTK OC-2 Project. Based on the acquired information and discussions with mine authorities on previous slope failures in this mine. It is understood that the east side benches tend to slide often and are prone to be moist due to the nallah flowing near the site. Hence, the east side benches are selected for the present study. The transmitter sensor nodes were installed near to the RB303, RB304, RB308 and RB309 locations on the 4th bench, sensor nodes installed at present study area, are shown in Figure 3.22.

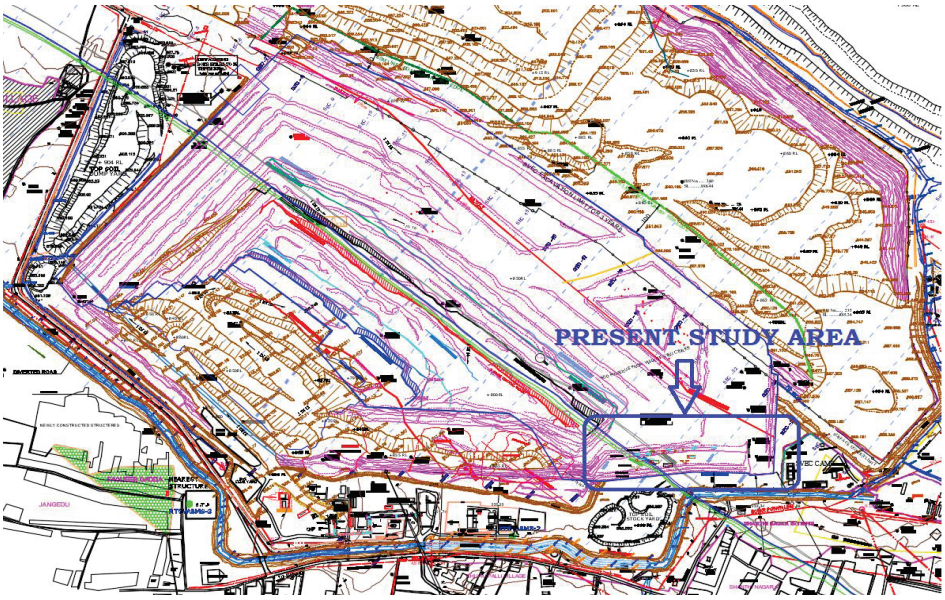


Figure 3.22 Research study area of the KTK OC-2 Project

3.4.1.4 Investigations with WSN system for slope monitoring

Figures 3.23 illustrate, the installation of sensor nodes as per the International Society of Rock Mechanics (ISRM) suggested methods at the bench toe and crest area at KTK OC-2 project.

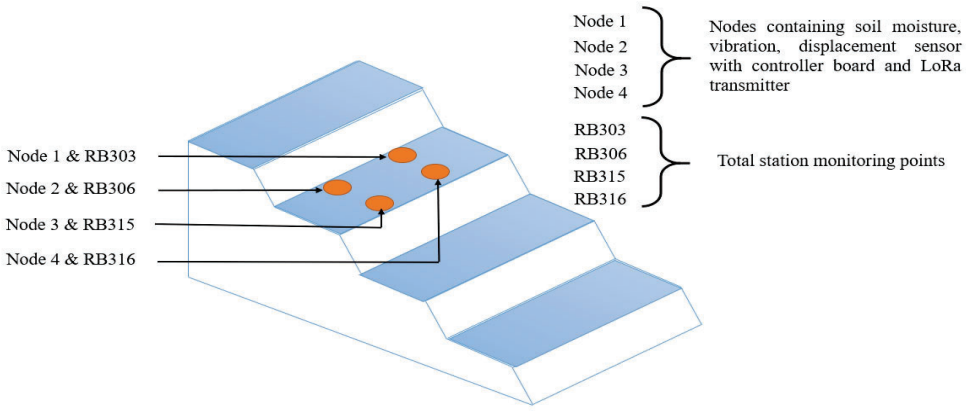


Figure 3.23 Location of nodes installation on the bench slope



Figure 3.24 Installation of sensor near bench toe at KTK OC-2 Project

Receiver nodes are mounted in the mine slope monitoring station where the sensor node readings are received and uploaded to the ThingSpeak (Figure 3.25). At KTK OC-2, it was the monsoon season during the study period. The soil moisture sensor observed an increase in the percentage of moisture in the slopes during the rainfall, and the displacement sensor captured the combined effect on slopes due to vehicle movement and other geotechnical effects in all three directions, i.e., x-direction, y-direction, and z-direction, and the vibration sensor was able to capture vibrations only during the blasting times. The effects of rainfall on soil moisture and slope displacement were clearly observed and thoroughly analyzed in the Chapter 4.

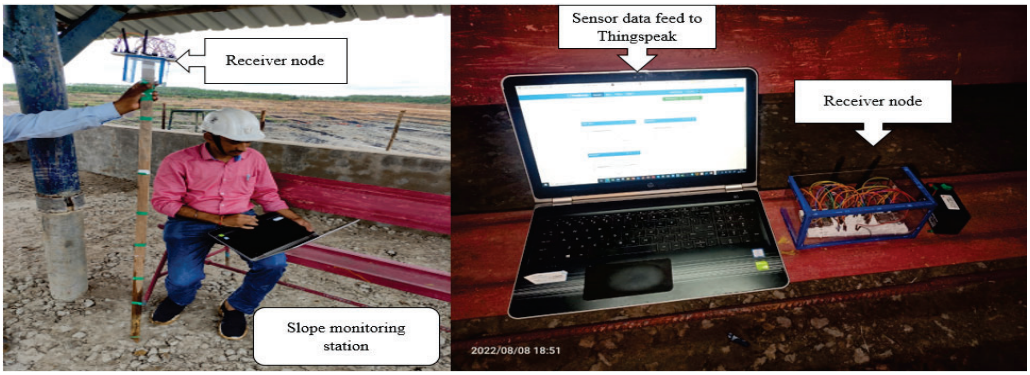


Figure 3.25 Receiver node at KTK OC-2 mine slope monitoring station

Throughout the investigations, a total of over ten thousand measurements were captured from three sensors of four nodes at the fixed locations on the benches. The maximum reading obtained from each sensor node is presented in the Table 3.6 for few days. Further, few of the readings collected from ThingSpeak cloud platform are attached at Annexure-II. Figure 3.26 shows an image from the ThingSpeak console, showcasing recorded data from individual sensors plotted against the time of measurement in a graph.

Table 3.6 The maximum reading obtained from each sensor node

SI. No	**Date**	**Nodes**											
		Moisture (%)				**Displacement (mm)**				**Vibration (Hz)**			
		1	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
1	8/8/2022	52	54	65	71	1.6	2.2	3.2	3.4	0	0	0	0
2	9/8/2022	54	59	63	65	2.2	2.3	4	3.8	0	0	0	0
3	10/8/2022	50	51	61	59	2.9	2.9	4.7	5.2	0	0	0	0
4	11/8/2022	33	29	45	43	1	1.4	1.7	2	31	33	29	28
5	12/8/2022	36	39	39	35	1.5	1.3	2.2	2.5	20	25	21	23
6	13/8/2022	33	35	40	43	1.5	1.7	2.2	2.7	19	19	17	14
7	14/8/2022	45	43	53	52	1.9	2.1	2.7	3	36	32	33	31
8	15/8/2022	56	53	68	65	3.5	3.3	4.7	4.6	0	0	0	0
9	16/8/2022	62	65	72	75	3	3.6	6.2	5.8	0	0	0	0
10	17/8/2022	39	34	45	42	1.3	1.5	2.4	2.9	31	28	29	27
11	18/8/2022	31	28	38	39	1.1	1	2.1	2.5	18	22	20	22
12	19/8/2022	28	30	40	37	0.8	1.6	1.6	1.9	17	19	14	15
13	20/8/2022	32	32	41	41	1.2	1.3	2.2	2.4	24	27	30	23
14	21/8/2022	25	28	37	32	1.1	1.5	2.3	2.1	31	32	28	36
15	22/8/2022	23	27	34	30	0.9	1	1.4	2	15	13	16	12
Total						**25.5**	**28.5**	**43.6**	**46.8**				

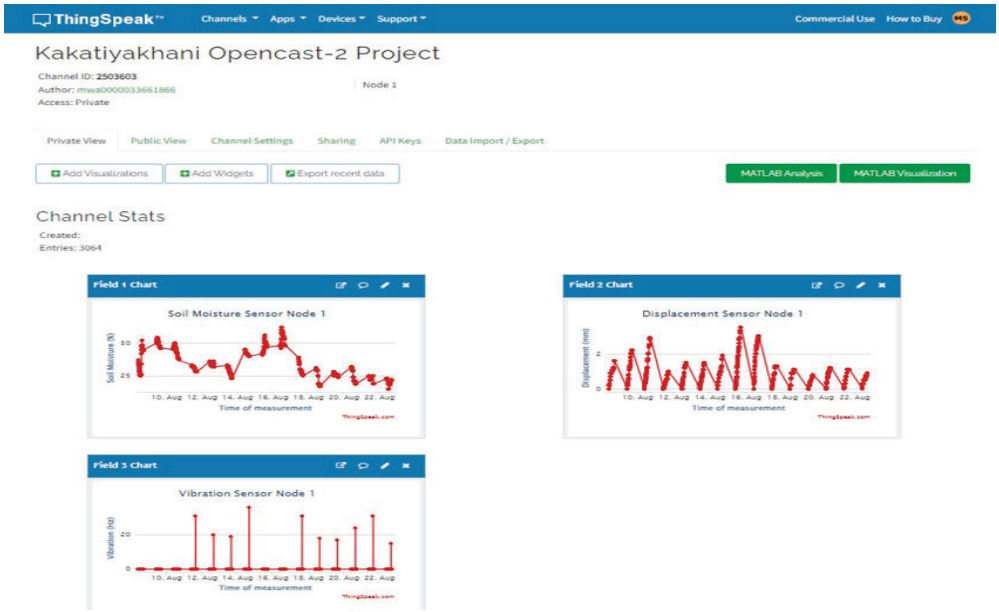


Figure 3.26 ThingSpeak image of collected sensor data

The Python software hosted in PythonAnywhere reads the sensor data from the ThingSpeak and sends alert emails when they surpass predefined limitations. During the experimentation, as depicted in Figure 3.27, alert SMS and emails were received for soil moisture percentage at node-1, registering at 52%, and for displacement at node-2, measuring 2.2 mm. No alert was generated for vibration as it remained below the threshold. A detailed analysis of the observed readings is provided in Chapter 4.

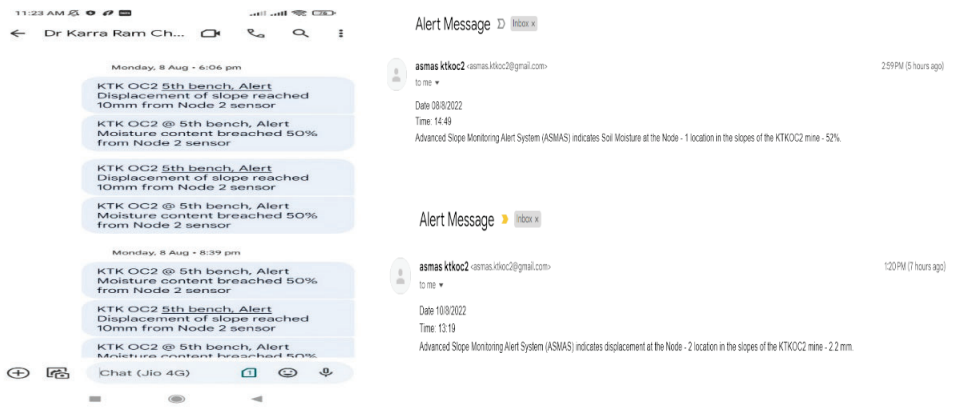


Figure 3.27 Alert mail received at the monitoring station

The same methodology was applied to the other two case studies, namely the Khairagura Opencast Project and the Srirampur Opencast -2 Project of The Singareni Collieries Company Limited. In both mines, tension cracks were observed once the total displacement exceeded 50 mm, and slope failures occurred after reaching 145 mm of displacement.

3.4.2 Case study-2

As case study -2, field investigations were carried out in Khairagura Opencast Project (KHAOC). This mine is situated at Bellampalli Area of SCCL in Kumrambheem Asifabad District of Telangana State in Godavari valley coal field. This mine covers a surface area of 8.8 Sq. Kms. The area is covered in Survey of India Topo Sheet No.56 M/3 and 56M/7&8 and is bounded by latitudes North 19^0 14' 10" to 19^0 15'20" and longitudes East 79^0 10'00" to 79^0 18' 15". Figure 3.28 shows the Khairagura OC Project Key plan.

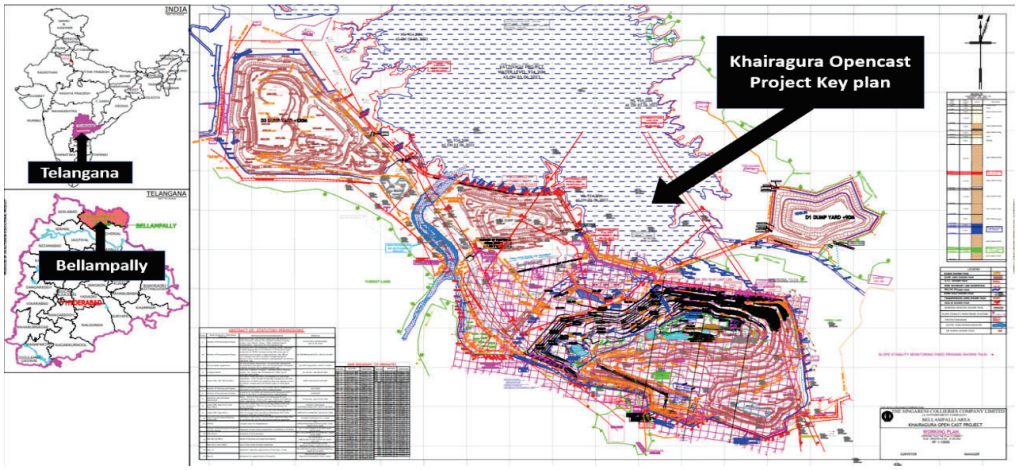


Figure 3.28 Khairagura OC Project Key plan

The Khairagura OC is an existing project, which is in operation since 2013-14 with a rated capacity of 2.5 Mtpa covering an excavation area of 5.42 sq.km. The salient features of the mine are provided in Table 3.7

Table 3.7 Salient features of KHA OC project

Mining operations commenced during year	2013-2014
Mineable reserves	66.87 Mt
Total OB estimated to be handled	584.77 M Cu.m
Targeted production per year	3.65 Mt
Stripping Ratio (Coal in Te: OB in Cu.m)	1:8.74
Maximum depth of quarry	222 m
Average Gradient	1 in 6.5
Total life of mine	14 years
Mining Technology	Shovel –dumper combination

The mine is situated in close proximity to the Vattivagu reservoir, merely 650m away from the mine boundary. This proximity has led to a consistent water seepage issue on the east side benches. This continuous water seepage renders the slope vulnerable to failure. Figure 3.29 shows the satellite view of Khairagura OC project and Vattivagu reservoir. Figure 3.30 illustrates the clear evidence of water seepage in the slope benches.

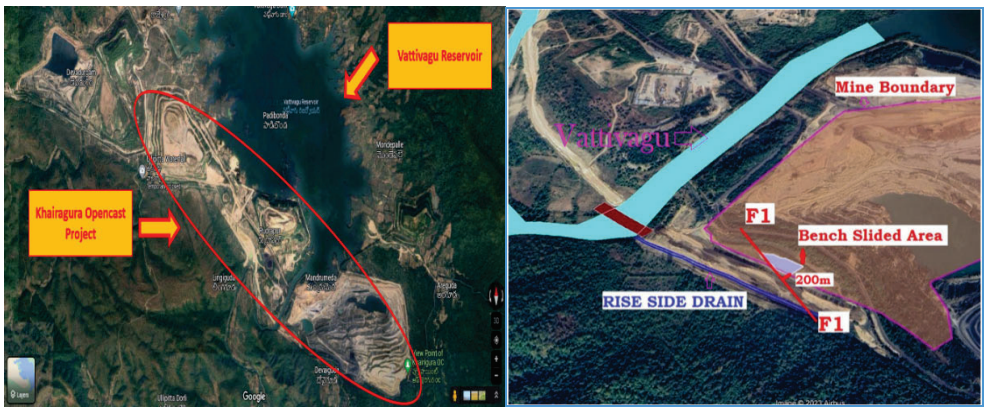


Figure 3.29 Khairagura OC Project and Vattivagu reservoir satellite view



Figure 3.30 Seepage of water induced from Vattivagu reservoir

3.4.2.1 Slope monitoring using total station at KHA OC project

At KHA OC project total station and prisms installed at regular intervals on the benches to monitor slope displacement. Prisms are installed on critical areas throughout the benches horizontally and vertically at regular spacing. The prism positions are measured regularly, and the data is reviewed for any displacement. The Total stations are kept on strategic points by permanent stations for monitoring the prisms on regular basis. As per the statuary requirement, management of every opencast mine engaging a separate crew of manpower to monitor the slopes of the mine on daily basis or weekly basis and as and when required.

At Khairagura opencast mine, a total of 08 prisms were permanently fixed on the rise side highwall of the mine at the 940 RL bench, which is the 3rd bench from the top, with the 4th bench serving as the internal haul road, where the current study lies using the proposed slope monitoring system. Additionally, 25 prisms were installed on the dip side. The prisms fixed on the benches were monitored regularly with Total station fixed at predefined stations. Readings are compared with initial reading & previous reading to know the slope movement, to calculate the slope movement based on the resultant displacement (mm). In the Figure 3.31, the total station readings are presented in line graph to follow the difference between individual stations. the highest displacement observed is 38.05 mm over a period of 51 days at 940/W7 prism station.

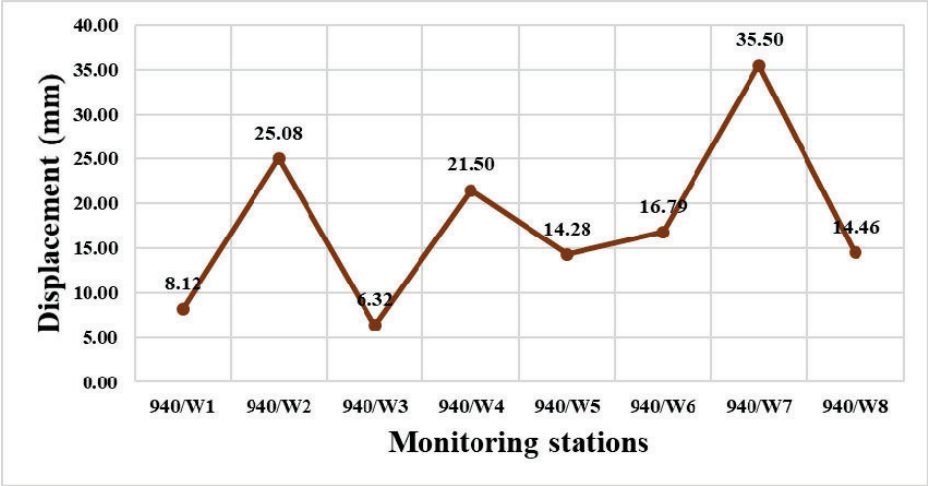


Figure 3.31 Total station readings at KHAOC mine

3.4.2.2 History of slope failures at KHA OC project

At KHA OC project, the South Western highwall benches at 940RL to 925RL (100m x 30m) were locally slide on 26.03.2023. In Figure 3.32 a recent slope failure at 930 RL of KHA OCP is shown. The major reason for the slope sliding on this region of the mine is the water seepage from the vattivagu reservoir.



Figure 3.32 Recent Bench failure area of Khairagura OC Project

The Total Station readings obtained from the slope is given in Table 3.8. After a few days of observation, the highest displacement recorded among the six stations ranging from 40.75 mm to 145.31 mm is represented in a plot (Figure 3.33).

Table 3.8 Displacement measured with Total station

Sl. No	Date of measurement	Displacement (mm) at different monitoring stations				
		930/W1	930/W2	930/W3	930/W4	930/W5
1	27-10-2022	0	0	0	0	0
2	28-10-2022	11	4	3	7	8
3	29-10-2022	7.75	10.25	14.27	11.13	7.64
4	30-10-2022	18.75	18.25	19.27	24.13	14.34
5	31-10-2022	13.75	19.25	17.27	24.13	13.38
6	01-11-2022	27.75	28.25	25.27	42.13	39.19
7	02-11-2022	14.75	25.25	20.27	29.13	35.37
8	03-11-2022	10.75	20.25	22.27	29.13	40.15
9	04-11-2022	17.75	24.25	32.27	41.13	69.78
10	05-11-2022	20.75	32.25	32.27	50.13	96.55
11	06-11-2022	20.75	20.25	29.27	32.13	64.05
12	07-11-2022	31.75	32.25	39.27	53.13	99.42
13	08-11-2022	34.75	39.25	39.27	48.13	100.38
14	09-11-2022	30.75	27.25	35.27	34.13	62.14
15	10-11-2022	32.75	38.25	49.27	54.13	92.73
16	11-11-2022	34.75	39.25	57.27	54.13	93.68
17	12-11-2022	16.75	32.25	43.27	37.13	70.74
18	13-11-2022	24.75	44.25	60.27	56.13	109.94
19	14-11-2022	34.75	49.25	61.27	61.13	107.07
20	15-11-2022	22.75	36.25	46.27	46.13	72.65
21	16-11-2022	33.75	53.25	65.27	67.13	109.94
22	17-11-2022	37.75	55.25	65.27	61.13	128.10
23	18-11-2022	24.75	39.25	49.27	43.13	90.82
24	19-11-2022	40.75	56.25	70.27	71.13	145.31

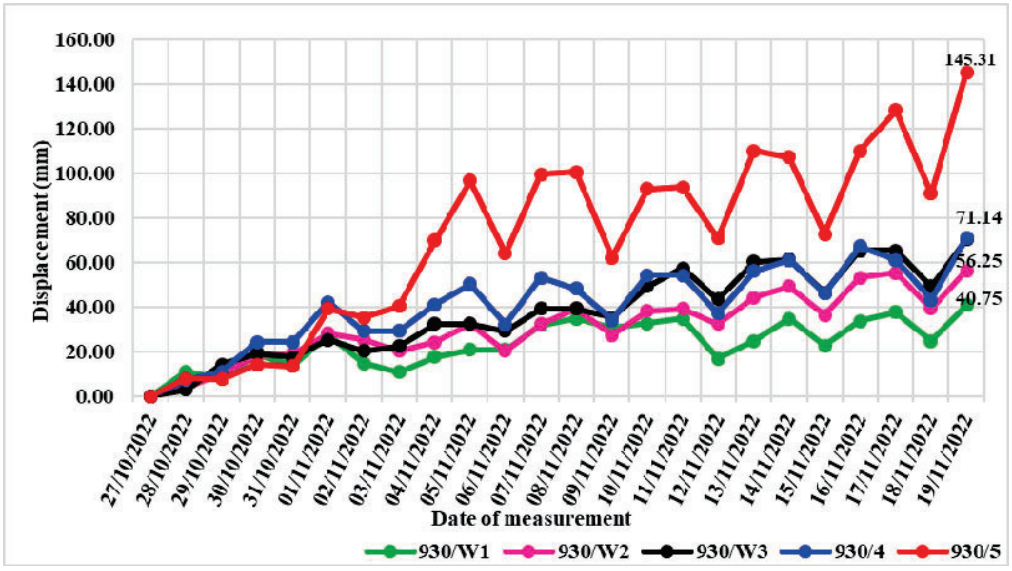


Figure 3.33 Displacement readings of slopes at KHAOC

As shown in Figure 3.34, the tension cracks were initially noticed at 930 RL location and its enlargement was observed by the mine authorities. Subsequently, a slope failure occurred after crossing the Total station reading of 145.31 mm and after observation of further elongation of the tension crack at the same location of the Khairagura OC Project.



Figure 3.34 Tension cracks developed at east side benches and slope failure

3.4.2.3 Investigations with WSN system for slope monitoring

As similar to the earlier case study, sensor nodes were prepared and installed in the slope benches. In this case study four sensor nodes were utilized and positioned in the slope benches (followed the same procedure as explained at case study-1). Two sensor nodes at the toe and two at the crest were installed near to the total station prisms for data capturing. Sensor nodes 1 and 2 are strategically placed at the bench toe, adjacent to P-5 and P-6 prism stations to monitor moisture levels, vibration, and displacement in the bench toe area. Similarly, Sensor nodes 3 and 4 are installed near P-10 and P-11 prism stations, located at the bench crest.

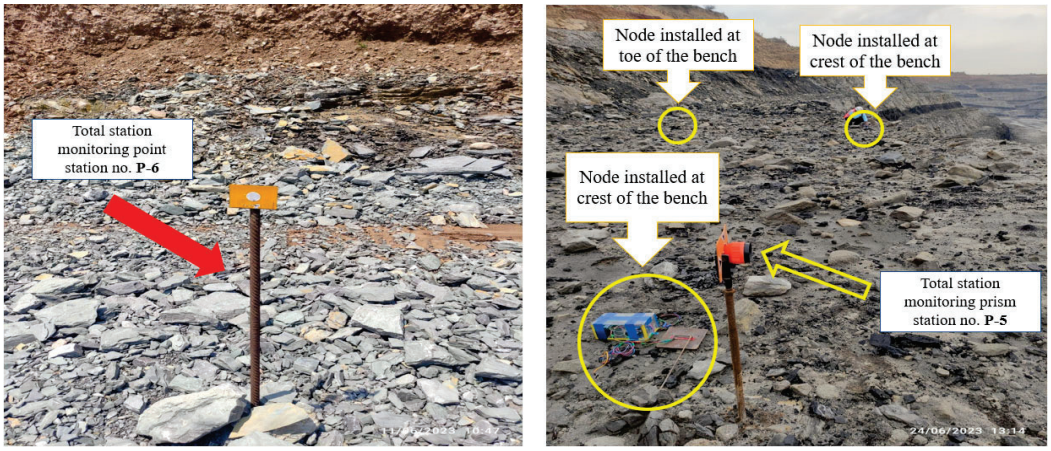


Figure 3.35. Installation of Nodes at east side benches of Khairagura OC Project

In this investigations, a total of over fifteen thousand measurements were collected from three sensors of four nodes at the different locations on the benches. The maximum reading obtained from each node sensors are presented in Table 3.9.

Table 3.9 The maximum readings obtained from each sensor node

SI. No	Date	Nodes											
		Moisture (%)				Displacement (mm)				Vibration (Hz)			
		1	2	3	4	1	2	3	4	1	2	3	4
1	10/6/2023	34	38	42	44	1.9	1.8	2.6	3	10	12	13	11
2	11/6/2023	65	68	72	76	3.2	3.5	4.1	3.9	0	0	0	0
3	12/6/2023	33	36	47	51	1.3	1.4	2.4	3	15	12	22	24
4	13/6/2023	37	43	51	47	1.6	1.7	1.9	2.2	20	23	26	25
5	14/6/2023	63	65	73	76	2.5	2.2	3.8	3.4	0	0	0	0
6	15/6/2023	36	36	45	44	1.2	1.1	1.4	1.8	12	11	18	20
7	16/6/2023	46	50	56	58	1.3	1.2	1.6	2	18	18	23	22
8	17/6/2023	65	61	76	78	2.1	2.2	2.7	3.7	0	0	0	0
9	18/6/2023	51	54	54	51	1.2	1.4	2.6	2.8	25	26	28	25
10	19/6/2023	25	28	35	34	1.6	1.8	1.2	1.6	20	18	26	25
11	20/6/2023	52	40	54	50	1.6	2.2	2.3	2.4	16	20	20	22
					Total	**19.5**	**20.5**	**26.6**	**29.8**				

Figure 3.36 displays the ThingSpeak visualization of sensor data and Figure 3.37 displays the alert emails received during the experimentation.

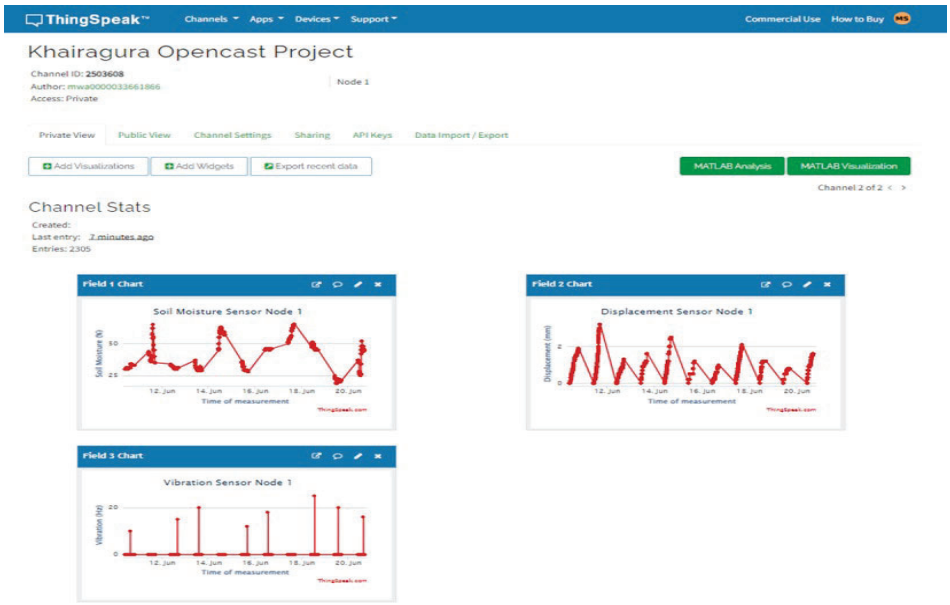


Figure 3.36 ThingSpeak image of collecting sensor data

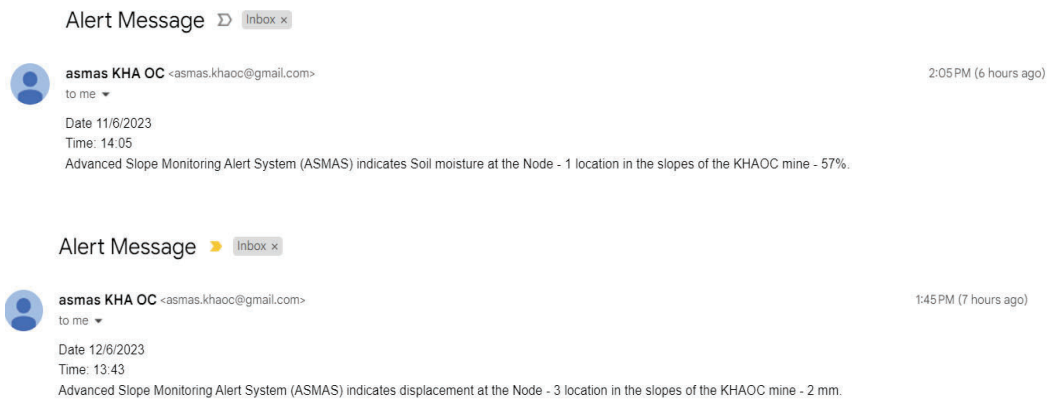


Figure 3.37 Alert emails received via python program

3.4.3 Case study-3

In case study -3, field investigations were carried out in SRP OC-2 Project of The Singareni Collieries Company Limited, Srirampur in Mancheriyal District of Telangana State. The SRP OC-2 Project is located in the southern part of the Somagudem –Indaram coal belt in the Godavari valley coal fields. The project is covered in survey of India Top sheet No. 56 N/5 and 56 N/9 and is bounded between the 18◦28’46’’ & 79◦31’44’’. The Project is connected to Chennur/Mancherial highway by 1.5 km. Srirampur town ship and Mancherial town are at a distance of 1.5 km and 7.5 km respectively. The Hyderabad and Nagpur high running in N-S direction in the east side of the project. The nearest railway station is Mancherial. which is at a distance of about 7.5 km on Kazipet- Balharshah section of south-central railway. Figure 3.38 shows the Srirampur Opencast-2 Project Key plan.

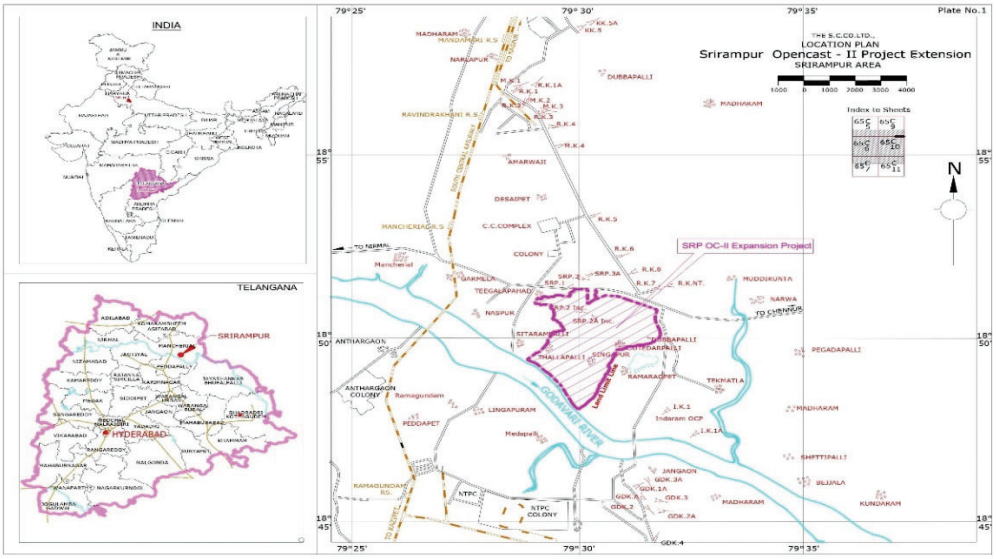


Figure 3.38 SRP OC-2 Project Key Plan

The salient features of the mine are given in Table 3.10. The satellite view of the SRP OC2 mine indicating the mine boundary is shown in the Figure 3.39.

Table 3.10 Salient features of SRP OC- 2 project

Mining operations commenced during year	2016-2017
Mineable reserves	74.15 Mt
Total OB estimated to be handled	739.71 M Cu.m
Targeted production per year	3.50 Mt
Stripping Ratio (Coal in Te: OB in Cu.m)	1:9.98
Maximum depth of quarry	350 m
Average Gradient	1 in 5.8
Total life of mine	22 years
Mining Technology	Shovel –dumper combination



Figure 3.39 An Arial View of SRPOC- 2 Project

3.4.3.1 Slope monitoring system using total station at SRP OC-2

Similar to other two mines, SRR OC2 also uses total station to monitor slopes. On the high wall side of the mine, 19 prisms were permanently fixed, 5 of them were installed on 1st bench, 4 on 2nd bench, 5 on 3rd bench and 5 on 4th bench. In Figure 3.40, the total station readings are plotted with a highest value is 51.34 mm in a line graph to follow the difference between individual stations.

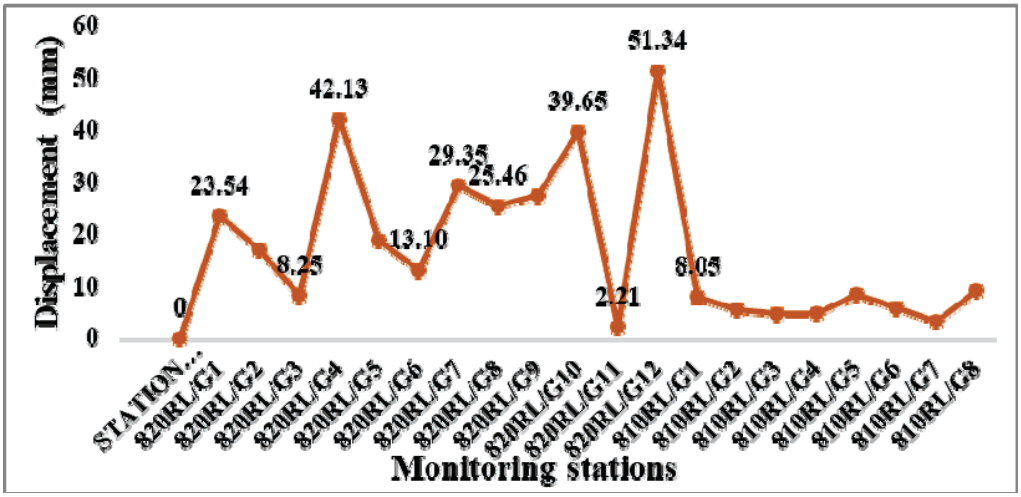


Figure 3.40 Total station readings at SRPOC-2 mine

3.4.3.2 History of slope failures at SRP OC-2

In the mine's history, failures of slope benches at RL 870 and 875, along with displacement and time are shown in Figure 3.41. The figure indicates that cracks appeared after a displacement of 50 mm, and the maximum displacement recorded was 167 mm. Figure 3.42 show the failure area.

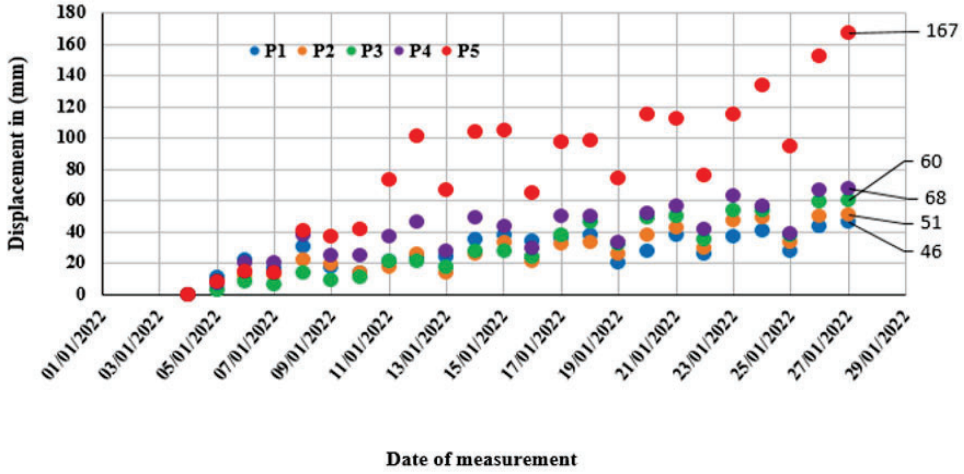


Figure 3.41 Maximum displacement before failure at RL870&RL875 benches



Figure 3.42 Tension cracks and top three benches failed at SRP OC- II project

3.4.3.4 Investigations with WSN system at SRP OC-2

A similar procedure was adopted as discussed in the previous case study in terms of sensor node preparation and site selection. The sensor nodes were installed on the slope benches as depicted in Figure 3.43, sensor nodes 1 and 3 were installed at the

bench toe in consecutive benches and nodes 2 and 4 were installed at the bench crest.

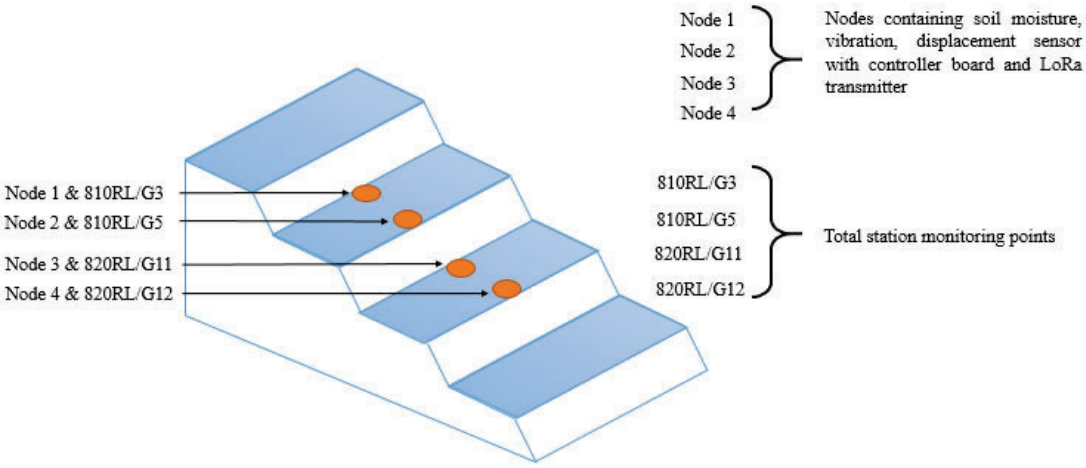


Figure 3.43 Location of nodes installation on the slopes of SRP OC 2 project

As shown in Figure 3.44, sensor nodes installed at the bench toe and crest area at SRP OC-2 mine. Receiver nodes are mounted in the mine slope monitoring station where the sensor node readings are received and uploaded to ThingSpeak as shown in Figure 3.45.



Figure 3.44 Installation of Nodes position at SRP OC – 2 Project



Figure 3.45 Sensors working results observations at monitoring station

Throughout the investigations, a total of over ten thousand measurements were captured from three sensors of four nodes at the fixed location on the benches. The maximum reading obtained from each node sensor is presented in Table 3.16.

Table 3.11 Maximum readings obtained from each node sensor

SI. No	Date	Nodes											
		Moisture (%)				Displacement (mm)				Vibration (Hz)			
		1	2	3	4	1	2	3	4	1	2	3	4
1	21/6/2023	30	31	44	46	0.8	0.6	1.8	1.7	15	18	10	12
2	22/6/2023	34	35	45	42	1.2	0.9	2.1	2.3	18	17	9	11
3	23/6/2023	28	30	42	37	0.8	1.1	2	2.45	22	24	18	19
4	24/6/2023	61	66	74	76	2.1	2.4	3.1	2.9	0	0	0	0
5	25/6/2023	65	68	73	70	2	2.2	2.9	3.1	0	0	0	0
6	26/6/2023	45	47	51	53	1.4	1.3	2.3	2.6	25	24	19	17
7	27/6/2023	40	38	52	56	1.5	1.7	2.5	3.1	9	13	7	6
8	28/6/2023	38	36	44	46	1.5	1.4	2.2	2.9	16	17	11	11
9	29/6/2023	25	28	30	36	0.5	0.8	2.2	2.2	19	22	19	15
10	30/6/2023	30	34	42	43	1	1.2	2.1	2.7	20	21	17	16
11	1/7/2023	36	33	39	40	1.2	1.2	1.9	2.0	28	30	25	28
12	2/7/2023	40	48	57	46	1.4	1.7	3.1	3.7	22	23	21	19
13	3/7/2023	69	65	78	82	2.7	3.2	3.5	2.9	0	0	0	0
14	4/7/2023	55	60	62	66	2	1.7	2.1	3.1	14	15	12	10
15	5/7/2023	43	40	47	48	1.6	1.5	2.2	2.5	17	12	8	11
Total						**21.70**	**22.90**	**35.99**	**40.15**				

Figure 3.46 shows an image from the ThingSpeak console with recorded data from individual sensors plotted against the time of measurement in a graph. Figure 3.47 depicts alert emails received with a displacement of 2 mm.

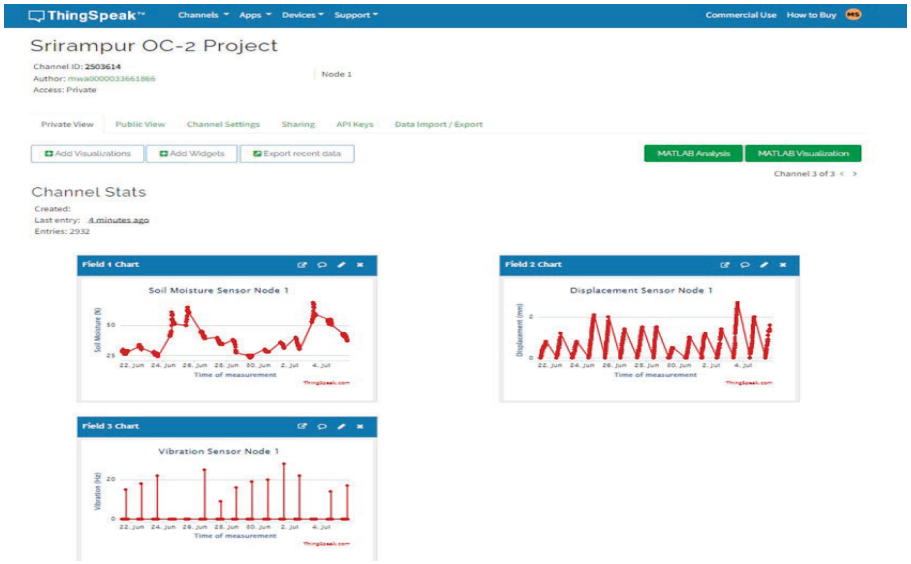


Figure 3.46 sensors data in the form graphs in the ThingSpeak platform

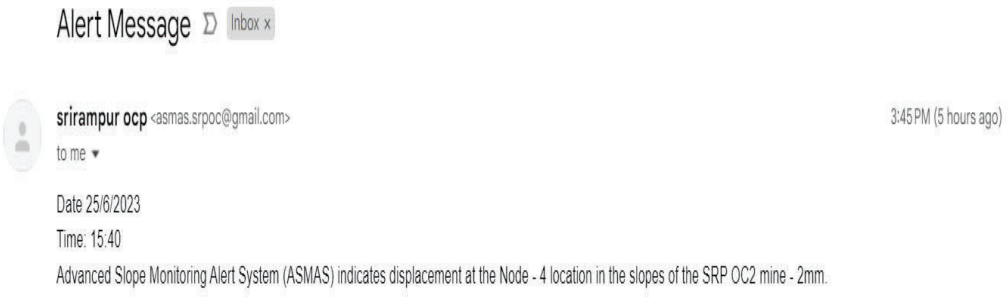


Figure 3.47 Alert mail received at the monitoring station

To facilitate numerical modeling, it becomes imperative to acquire a comprehensive understanding of the geo-mechanical properties specific to the study area. This necessitates the collection of samples from the study area, subjecting them to diverse tests in order to extract these properties. The following section provides detailed insight into the laboratory investigations conducted on soil and rock samples to determine material properties.

3.5 Laboratory Investigations for Rock Properties of Samples

This section deals with the laboratory investigations carried out on the soil and rock samples collected at the site to find their properties. The direct shear test (IS code 2720- part 13, 1986), carried out to determine the shear strength parameters such as cohesion and angle of internal friction for the soil. Further, rock samples were collected from the drill cores obtained from the mine exploration department. Tri-axial test as per ISRM suggested methods was conducted and determined the cohesion and internal friction angle for the rock samples.

Samples were collected from all three case studies (KTKOC2, KHAOC & SRPOC2). Figure 3.48, depicts the testing procedure of direct shear test on soil to determine the cohesion (c) and angle of internal friction (Φ) of the samples.



Figure 3.48 Direct Shear Test

Figure 3.49 shows the Tri-axial testing procedure of rock sample, the specimen is enclosed vertically by a thin "rubber" membrane and on both ends by rigid before it was mounted in the apparatus. Figure 3.50 shows the mode of failure of the tested samples.



Figure 3.49 Laboratory setup for tri-axial test



Figure 3.50 Cracks observed after the testing with Tri-axial test

Direct shear and tri-axial tests for soil and rock samples conducted separately by following accepted procedure on the samples to calculate the cohesion and internal friction angles. By analyzing the acquired data, the Mohr-Coulomb failure envelopes were plotted, resulting in an internal friction angle of 25.1, 28, and 29.5 degrees along with cohesion values of 277, 290, and 300 kPa for the KTKOC2, KHAOC & SRPOC2 case studies respectively. Other significant material properties such as density, elastic modulus and poisson's ratio were obtained from the Physico-Mechnical Properties (PMP) retrieved from the mine exploration department of SCCL for all three the case study mines.

The next section delves into numerical modelling investigations of all three case study mines using material properties as input data, along with parametric analysis to examine the influence of various parameters like density, cohesion, angle of internal friction, Young's modulus and slope geometry on the deformation and factor of safety by applying the Mohr's failure criterion.

3.6 Numerical Modelling Investigations with FLAC 2D software

FLAC 2D is a two-dimensional explicit Finite Difference Method (FDM) for engineering mechanics computation. Fast Lagrangian Analysis of Continua (FLAC) is a 2D/3D numerical modelling software for advanced geotechnical analysis, testing, and design of soil, rock, groundwater, and ground support by geotechnical, civil, and mining engineers. Though FLAC was originally developed for geotechnical and mining engineering applications, the program offers a wide range of capabilities to solve complex problems in mechanics. Several built-in constitutive models that permit the simulation of highly nonlinear, irreversible responses representative of geologic, or similar, materials are available. The methodology for conducting a numerical modelling analysis in FLAC 2D software is outlined in Appendix -III.

In this study, Numerical modelling investigations were carried out in two phases. The first phase involved numerical models of mine slopes representing the actual field condition of the three case studies, aiming to validate the results with WSN and total station monitoring systems. In the second phase, a parametric study was conducted to assess the influence of individual parameters and to formulate regression equations for resultant displacement and Factor of Safety (FoS).

3.6.1 Details of numerical modelling based on field conditions

To develop a slope model in FLAC 2D software, several mandatory parameters are necessary. These parameters include rock density, elastic modulus, cohesion and angle of internal friction in addition to the slope geometry. These material properties were derived from laboratory analysis of the mine samples and PMP data from the respective mines. Additionally, the details regarding slope geometry was gathered from mine survey department of each mine. The subsequent sections of this thesis provide concise details of the investigations for each individual case study. The detailed field modelling for all the three mines are presented in Appendix-IV.

3.6.1.1 Numerical modelling for case study -I

Field model for KTKOC-2 mine was developed based on mine slope configuration provided in the Table 3.12. The mine slope had an overall height of 110 m, consisting

of 12 benches with heights ranging from 5 to 10 m. The total width of the slope was approximately 220 m, with bench widths varying between 10 to 40 m. the final output of the slope model construction is illustrated in Figure 3.51.

Table 3.12 KTK OC2 mine slope configuration

Bench No.	Bench height (m)	Bench Width (m)	Slope angle (˚)
1	5	20	55
2	5	12	60
3	5	15	65
4	10	38	70
5	10	15	70
6	10	15	70
7	10	15	70
8	10	15	70
9	10	15	70
10	10	15	70
11	10	15	70
base	15	30	70

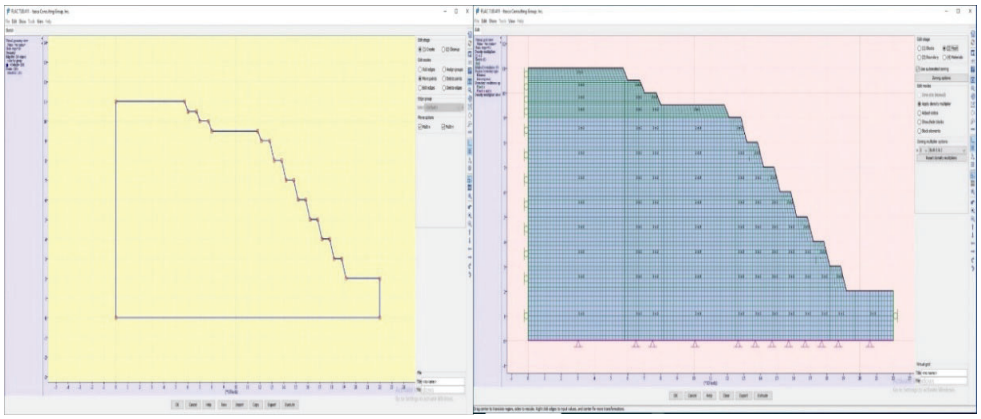


Figure 3.51 Project slope model geometry in Flac 2D

The physico-mechanical properties used for numerical modeling as input parameters on the East side (rise side) of the slopes of the KTKOC-2 mine are detailed in Table 3.13

Table 3.13. Rock properties of slopes used for field numerical modelling

Bench No.	Density (kg/m3)	Cohesion (kPa)	Friction angle (Degree)	Elastic modulus (GPa)	Poisson ratio
1 & 2	1525	60	23.10	1.00	0.25
3&4	1600	65	21.00	1.25	0.25
5	1650	70	21.30	1.50	0.28
6	2160	120	24.65	1.75	0.25
7	2340	135	26.25	2.00	0.28
8	2350	175	27.65	2.25	0.28
9	2390	215	28.00	2.50	0.30
10	2320	223	28.25	2.75	0.30
11	2329	235	25.00	2.50	0.25
12	2350	237	28.50	2.65	0.30

As depicted in Figure 3.52, different layers were considered based on the various benches available in the selected sections of the project. Bench-wise rock properties were provided to enhance the accuracy of the analysis.

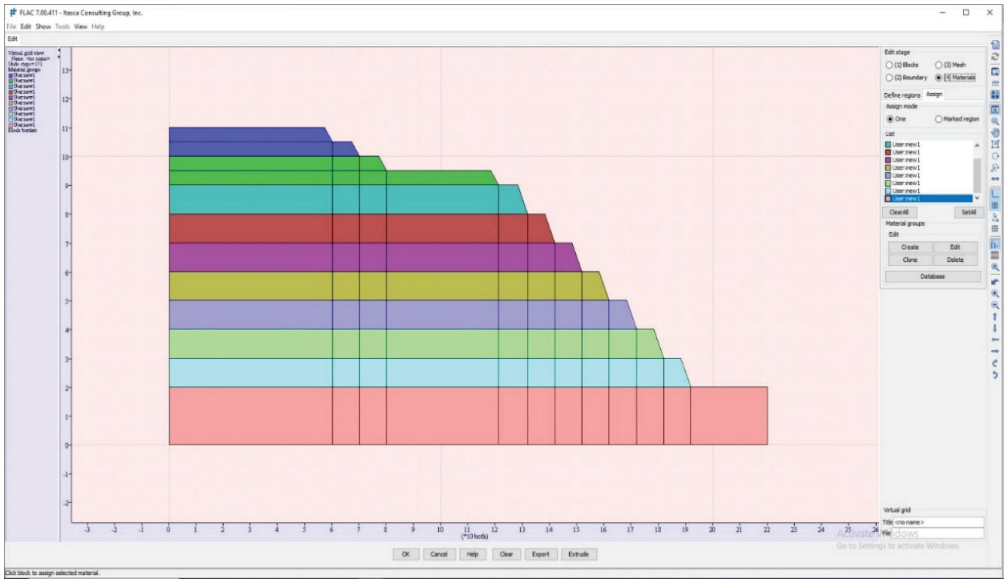


Figure 3.52 Project slope model with different benches

As illustrated in Figure 3.53, subsequent to executing the analysis program, results were obtained from the numerical modeling, presenting various forms such as factor of safety, displacement, and resultant displacement.

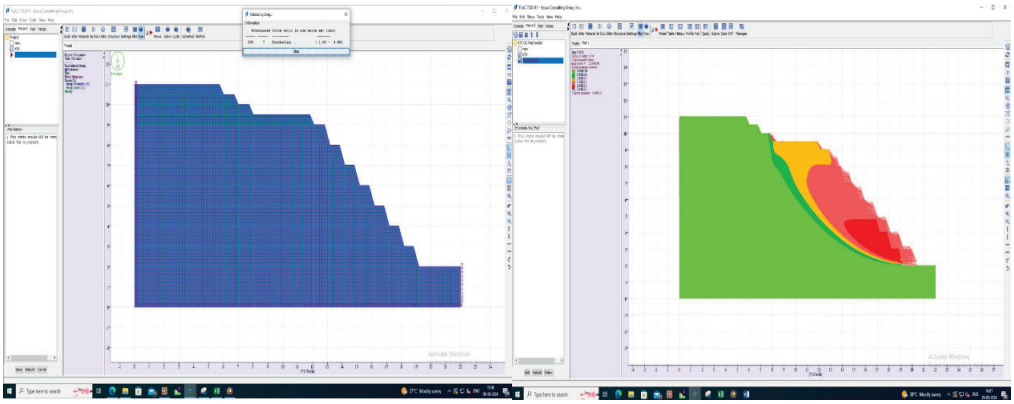


Figure 3.53 Result of the analysis

3.6.1.2 Numerical modelling for case study II

A field model for the KHA OC mine was constructed based on the mine slope configuration outlined in Table 3.14. The mine slope had a total height of around 140m, comprising 14 benches with heights varying from 5 to 10m. The overall width of the slope was approximately 235m, with bench widths ranging between 10 to 40m. The final outcome of the slope model construction is depicted in Figure 3.54.

Table 3.14 KHA OC mine slope configuration

Bench No.	Bench height (m)	Bench Width (m)	Slope angle (˚)
1	5	10	45
2	5	10	45
3	5	15	45
4	5	20	45
5	10	15	45
6	10	15	45
7	10	15	45
8	10	15	45
9	10	30	69
10	10	15	70
11	10	15	65
12	10	15	45
13	10	15	45
base	30	30	45

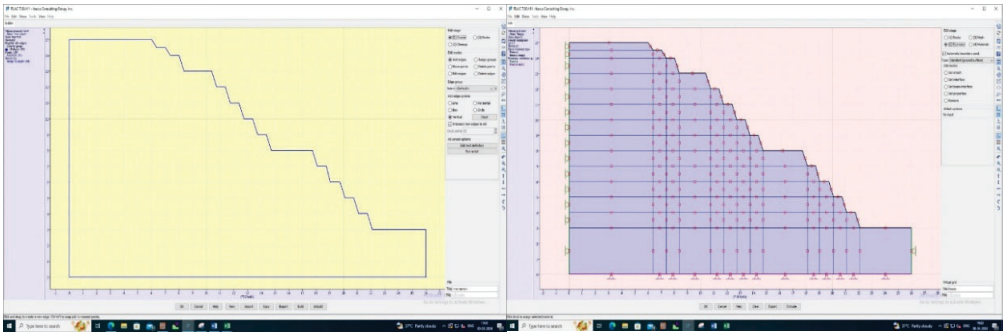


Figure 3.54 Project slope model (FLAC 2D) in drained condition

The physico-mechanical properties used as input parameters for numerical modelling on the dip side of the slopes of the KHA OC mine are outlined in Table 3.15.

Table 3.15 Rock mass properties of slope at Khairagura OC Project

Bench No.	Density (kg/m^3)	Cohesion (kPa)	Friction angle (Degree)	Elastic modulus (GPa)	Poisson ratio
1	1900	60	30.00	0.25	0.25
2	2010	80	24.00	1.25	0.25
3	2020	183	25.60	1.50	0.28
4	2160	311	26.30	1.75	0.25
5	2150	349	25.30	2.05	0.28
6	2160	380	25.20	2.25	0.28
7	2180	370	26.20	2.35	0.30
8	2200	450	27.60	3.05	0.30
9	2180	517	24.60	2.50	0.25
10	1960	525	22.00	4.00	0.30
11	2020	516	23.00	4.15	0.30
12	2000	480	23.50	4.25	0.28
13	2160	527	21.60	4.75	0.30
Base	2350	626	23.00	5.25	0.30

Resultant slope displacement and Factor of safety results of numerical model are displayed in Figure 3.55.

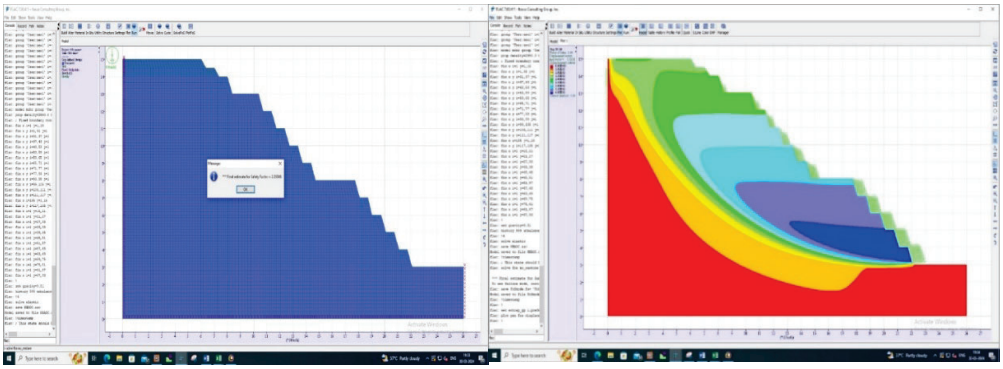


Figure 3.55 Result of the analysis

3.6.1.3 Numerical modelling of case study-III

During the site assessment at the SRP OC-2 project, information captured on coal seams along with discontinuities was taken into account for the development of the pit slope model. A simulation model with dimensions of 370 m in width and 150 m in height was considered, overall pit slope angle of 35.5°, as illustrated in Figure 3.56. The mine slope configuration utilized in this model are outlined in Table 3.12.

Table 3.16 SRP OC2 mine slope configuration

Bench No.	Bench height (m)	Bench Width (m)	Slope angle (˚)
1	5	10	70
2	5	15	70
3	10	15	70
4	10	15	70
5	10	15	70
6	10	15	70
7	10	15	70
8	10	15	70
9	10	40	70
10	10	15	70
11	10	15	70
12	10	15	70
13	10	15	70
14	10	15	70
15	10	100	70
base	10	40	70

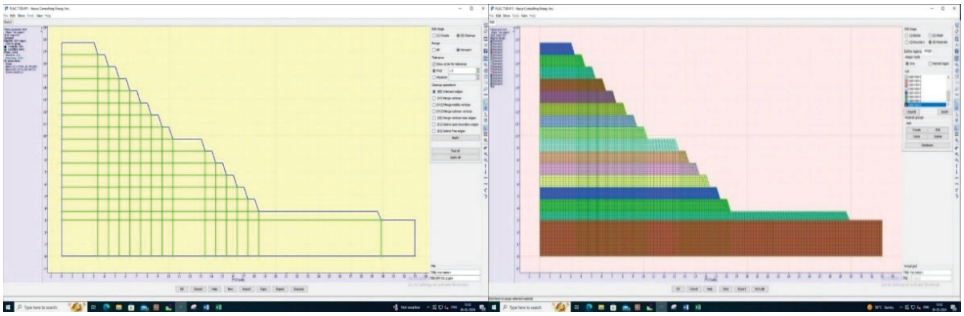


Figure 3.56 Project slope model (FLAC 2D) in drained condition

The rock properties, determined in the geotechnical laboratory and collected from the mine authorities, were utilized in the modeling study. The final values of these properties considered in the study are presented in Table 3.17.

Table 3.17 Rock properties of slope materials on rise side at SRP OC-2 Project

Bench No.	Density (kg/m^3)	Cohesion (kPa)	Friction angle (Degree)	Elastic modulus (GPa)	Poisson ratio
1	1860	84	24.00	0.25	0.25
2	1900	91	24.80	1.25	0.25
3	2000	161	25.00	1.50	0.28
4	1910	176	27.00	1.50	0.25
5	1990	236	26.25	2.05	0.28
6	2060	267	26.20	2.25	0.28
7	1990	283	27.00	2.35	0.30
8	1920	318	24.50	3.05	0.30
9	2020	337	25.20	3.00	0.25
10	1890	341	24.00	4.00	0.30
11	2000	358	24.20	4.00	0.28
12	2015	308	27.00	3.98	0.30
13	2005	373	29.00	4.20	0.28
14	2010	378	28.00	4.50	0.30
15	2020	359	28.30	5.00	0.30
Base	2050	339	28.50	5.00	0.30

Resultant slope displacement and Factor of safety results of numerical model are displayed in Figure 3.57.

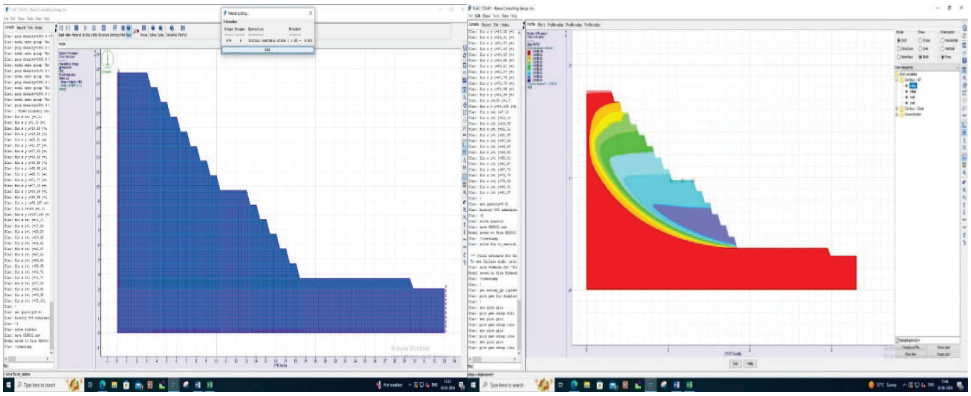


Figure 3.57 Result of the analysis

3.6.2 Parametric study

The second phase was dedicated to studying the influence of various parameters on slope displacement and factor of safety. A wide range of slope geometry and rock characteristics were taken into account in the following manner:

Depth of the slope was considered from 100 m to 300 m, Density was varied from 1500 kg/m^3 to 2500 kg/m^3, Cohesion ranged from 60 kPa to 600 kPa, Internal friction angle was considered from 22 degrees to 30 degrees, Elastic modulus was varied form 1 GPa to 5 GPa and Slope angles of 40 degrees and 70 degrees were considered.

Using Minitab software, 1220 models were selected. The models were then simulated to determine the displacement and FoS values. The sample result for resultant displacement and FoS from a parametric analysis utilizing a numerical modeling method is shown in Figure 3.58. Likewise, Appendix -V contains the results of the other slope models that were obtained.

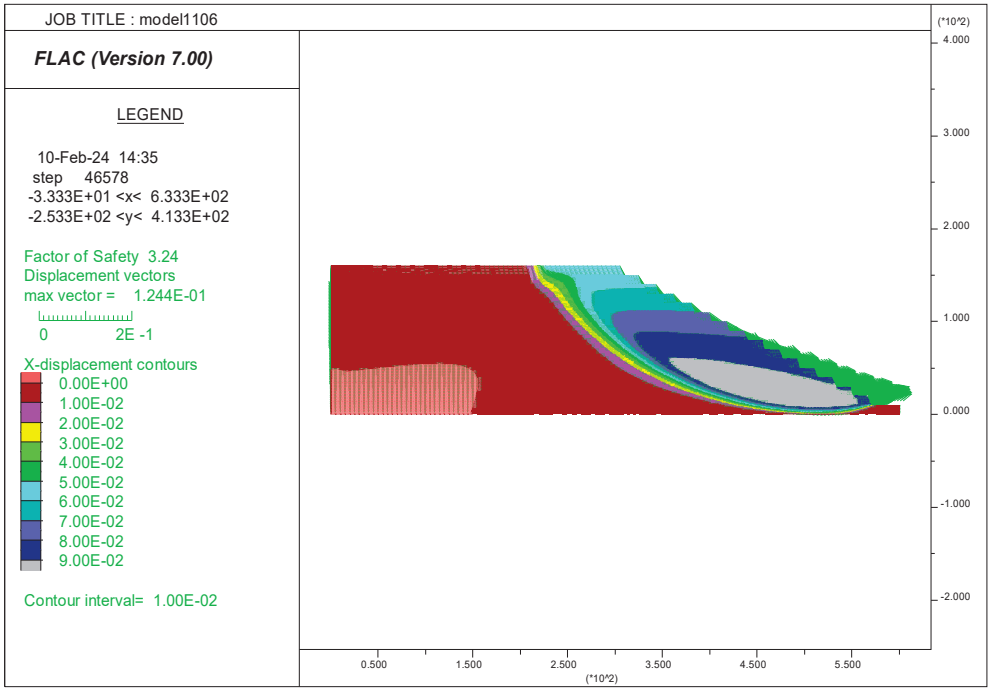


Figure 3.58 Slope displacement and FoS results from parametric study

Categorization of parametric study for understanding the influence of various parameters on displacement and Factor of Safety (FoS) with respect to depth was as follows, the following sections describes the particulars of this analysis in detail.

- Influence of Density on slope displacement and FoS
- Influence of Cohesion on slope displacement and FoS
- Influence of Internal Friction Angle on displacement and FoS
- Influence of Young's Modulus on slope displacement and FoS

3.6.2.1 Influence of density on slope displacement and FoS with respect to depth

The slope displacement and FoS obtained from the numerical models simulated with varying densities of 1500 kg/m^3, 1650 kg/m^3, 1800 kg/m^3, 1950 kg/m^3, 2100 kg/m^3, 2250 kg/m^3, 2400 kg/m^3 and 2500 kg/m^3 were examined with respect to the varying OCM depths of 100 m, 150 m, 200 m, 250 m and 300 m. Table 3.18 contains the obtained slope displacement under this condition while Table 3.19 contains the obtained FoS.

Table 3.18 Displacement by varying the depth and densities

Depth (m)	Densities (Kg/m^3)							
	1500	1650	1800	1950	2100	2250	2400	2500
	Displacement (mm)							
100	38.7	47.3	55.9	57.7	62.05	66.4	71.35	76.3
150	118	121	124.4	144	158	172	183.5	195
200	218	227	236	286	297	308	332.5	357
250	198	242	286	386	530.5	675	746	817
300	204.8	385.4	566	641	720.3	799.6	899.8	1000

Table 3.19 FoS by varying the depth and densities

Depth (m)	Densities (Kg/m^3)							
	1500	1650	1800	1950	2100	2250	2400	2500
	FoS							
100	4.44	4.24	4.04	3.74	3.62	3.50	3.40	3.30
150	3.53	3.39	3.24	3.02	2.94	2.85	2.78	2.71
200	3.03	2.92	2.80	2.63	2.56	2.49	2.44	2.38
250	2.71	2.62	2.52	2.38	2.33	2.27	2.22	2.17
300	2.50	2.41	2.31	2.22	2.17	2.11	2.07	2.03

3.6.2.2 Influence of cohesion on slope displacement and FoS with respect to depth

The slope displacement and FoS obtained from the numerical models stimulated with varying cohesion values of 60 kPa, 180 kPa, 300 kPa, 450 kPa and 600 kPa were examined with respect to the varying depths of 100 m, 150 m, 200 m, 250 m and 300 m. Table 3.20 contains the obtained slope displacement under this condition while Table 3.21 contains the obtained FoS.

Table 3.20 Displacement (mm) by varying the depth and cohesion

Depth (m)	Cohesion (kPa)				
	60	180	300	450	600
	Displacement (mm)				
100	84.7	73.98	63.04	80.98	57.72
150	730	104.2	377	157	172
200	346.7	480	971.5	280.3	357
250	1020	690.7	520.2	655	675.8
300	906	3166	1971	1085	951.9

Table 3.21 FoS by varying the depth and cohesion

Depth (m)	Cohesion (kPa)				
	60	180	300	450	600
	FoS				
100	1.44	1.95	2.39	2.86	3.30
150	1.35	1.71	2.03	2.38	2.71
200	1.29	1.62	1.845	2.12	2.38
250	1.25	1.50	1.71	1.96	2.17
300	1.21	1.45	1.63	1.83	2.02

3.6.2.3 Influence of Internal Friction on slope displacement and FoS with respect to depth

The slope displacement and FoS obtained from the numerical models simulated with varying friction angle of 22˚, 24˚, 26˚, 28˚ and 30˚ were analyzed with respect to the varying pit depths of 100 m, 150 m, 200 m, 250 m and 300 m. Table 3.22 contains the obtained slope displacement under this condition while Table 3.23 contains the obtained FoS values.

Table 3.22 Displacement by varying the depth and internal friction angle

Depth (m)	Internal Friction Angle (degrees)				
	22	24	26	28	30
	Displacement (mm)				
100	103.50	74.79	84.12	85.40	57.72
150	275	142.70	148.20	149.30	172.10
200	343.30	339.40	463.10	343	357.30
250	507.20	489.40	420.20	437	675.80
300	881.20	899	492.10	751.90	641

Table 3.23 FoS by varying the depth and internal friction angle

Depth (m)	Internal Friction Angle (degrees)				
	22	24	26	28	30
	FoS				
100	2.83	2.94	3.06	3.18	3.3
150	2.27	2.37	2.48	2.59	2.71
200	1.96	2.06	2.16	2.27	2.38
250	1.76	1.86	1.96	2.06	2.17
300	1.63	1.73	1.83	1.92	2.03

3.6.2.4 Influence of Youngs Modulus on slope displacement and FoS with respect to depth

The slope displacement and FoS obtained from the numerical models were simulated with varying Young's modulus of 1 GPa, 2 GPa, 3 GPa, 4 GPa and 5 GPa were analyzed concerning the varying depths of 100 m, 150 m, 200 m, 250 m and 300 m. Table 3.24 contains the obtained slope displacement under this condition while Table 3.25 contains the obtained FoS values.

Table 3.24 Displacement by varying the depth and Youngs modulus

Depth (m)	**Youngs Modulus (GPa)**				
	1	2	3	4	5
	Displacement (mm)				
100	339.50	143.80	109.50	91.77	57.72
150	859	429	288	217	172.1
200	2830	429	288	217	172
250	6400	3200	764	990	1520
300	8488	1205	1325	1443	1107

Table 3.25 FoS by varying the depth and Youngs modulus

Depth (m)	**Young's Modulus (GPa)**				
	1	2	3	4	5
	FoS				
100	3.30	3.30	3.30	3.30	3.30
150	2.71	2.71	2.71	2.71	2.71
200	2.38	2.38	2.38	2.38	2.38
250	2.18	2.18	2.17	2.17	2.18
300	2.03	2.04	2.04	2.02	2.03

Under the above mentioned conditions, the collected data plotted and a trend line was drawn at Chapter 4, to illustrate the relationship between slope displacement and the other influencing parameters namely density, cohesion, friction angle and Young's modulus. Further elaboration on the outcomes of this analysis is provided in the next Chapter. In addition, the parametric study results were subjected to a regression analysis aiming to develop a linear regression equation for slope displacement and FoS that enables to forecast slope displacement and FoS for any specific site condition associated with implementation of TARP.

3.7 Regression Analysis

Regression analysis is a statistical technique for estimating the relationship among variables. Data gathered from both field and numerical modeling studies were subjected to multiple regression analysis. This method is used when predicting a variable's value based on two or more other variables. In the present investigations, regression analysis was conducted using Minitab (version 17) software.

Slope displacement and FoS are influenced by numerous independent variables such as depth, slope angle, density, cohesion, and internal friction angle. These independent variables were subjected to parametric evaluation, considering the variation in input data.

The output from numerical modeling underwent regression analysis. Multiple regression is utilized to establish a relationship between the independent (predictor) variables and a dependent (criterion) variable in the study, represented by the following generalized equation:

$$Y = bl\ X1 + b2\ X2 + b3\ X3 + \ldots\ldots + bn\ Xn + c \qquad \ldots\ldots (3.2)$$

Where,

Y = dependent variable

Xn = Number of independent variables involved in the analysis.

bn = Regression coefficients

c = intercept value

In the above equation, the regression coefficients (‘b’) represent the independent contributions of each independent variable to the prediction of the dependent variable. The signs (plus or minus) of coefficients ‘b’ can interpret direction of the relationship between variables. If ‘b’ is positive, relationship of independent variable with dependent variable is positive otherwise the relationship is negative. Figure 3.59 displays the resultant regression equation obtained from Minitab software. The detailed procedure to derive linear regression equation in the Minitab software as a step by step process is enclosed in the Appendix -VI.

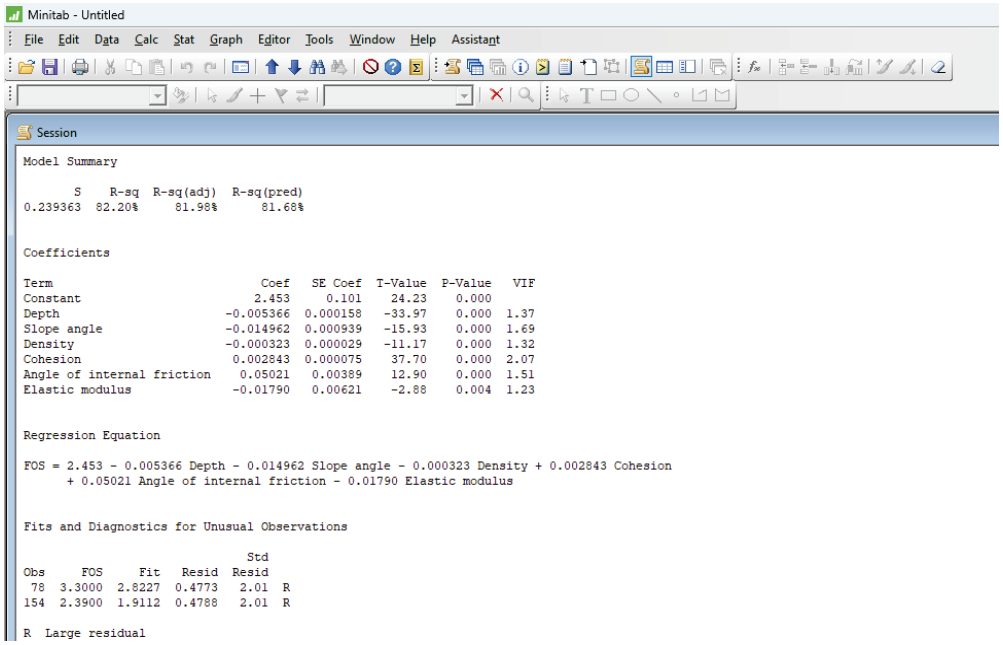


Figure 3.59 Results of regression analysis based on numerical data in Minitab

As a result of this regression analysis, distinct equations for slope displacement, FoS and rate of displacement were derived. Based on these equations, a user friendly software (Advanced Slope Monitoring System (ASMS) is developed in python language that indicates the status of the slope at different levels of TARP. The next and final section of this chapter discusses the development of TARP specific for these case study mines.

3.8 Development of Trigger Action Response Plan

A Trigger Action Response Plan (TARP) is a structured and pre-defined set of protocols designed to guide individuals or organizations through a series of steps in response to specific triggers or events and suggested actions to be initiated. TARP developed to ensure a swift and effective response to various situations, ranging from emergency incidents to operational disruptions. The goal of a TARP is to mitigate risks, minimize negative impacts, and facilitate a coordinated and organized response. As outlined in the literature review, the classification of various levels of TARP is based on the deformation and the rate of displacement. Based on the recommendations made by Coetsee et al. (2020), Bakken et al. (2020), and Park et al.

(2019), movement of slopes, measured in terms of rate of displacement (mm/day) and resultant displacement (mm) can be utilized to categorize TARP levels with instructions to be followed as action plans for specific triggers.

Various thresholds for different TARP levels were established for the specific site conditions, based on mine total station data on present slope behavior. By studying displacement measurements collected through Total Station across multiple instances of slope failures within the study area. Numerical modeling parametric study serves as a tool to determine this maximum displacement.

The literature study on TARP makes it obvious that analysis of slope displacement readings of earlier slope failure cases is crucial in formulation of TARP. Additionally, slope displacement readings from the total station of the slope under current study, collected until the period during to the observation through the WSN system, were collected to further investigate the slope's behavior. It is observed that, across all three case studies, tension cracks typically do not form until the resultant slope displacement reaches 50 mm. Thus, it can be reasonably concluded that the slope will remain safe until the resultant displacement reaches this certain value. This finding is also consistent with observations from previous slope failure cases. Furthermore, the numerical modelling analysis on site condition based models revealed maximum displacements before tension crack development similar to those recorded on total station for majority of slope failure cases specific to the respective mines. A comprehensive finding from the present slope monitoring and the earlier slope failure cases of each case study mines are included in Table 3.26.

The average of maximum rate of displacement (mm/day) and the average maximum resultant displacement (mm) before formation of tension crack and ultimate failure, from the earlier slope failure cases is likely to be followed by any slope failure that occurs in future. This conclusion is arrived based on the trend of the previous slope failures to the earlier ones, and the behavior of the slope that are currently under monitor.

Table 3.26 Observations of slope displacement and rate of displacement from the existing slope failure cases at different mines

Case Studies	Number of Slope failures	Before formation of tension crack		Before slope failure	
		Average of maximum rate of displacement (mm/day)	Average of maximum displacement (mm)	Average of maximum rate of displacement (mm/day)	Average of maximum displacement (mm)
KTK OC2	5	2.5	31	50	122
KHA OC	3	2.9	19	69	145
SRP OC2	7	3.0	22	62	167

The parametric study on the slope models revealed that the models with the highest displacement also had the lowest FoS, indicating an unstable slope condition. So, it is crucial to consider existing slope failure cases, readings of slope currently under study, numerical model estimations of displacement, and parametric study results into the design and development of TARP. The detailed exercise carried out for the formation of TARP specific for these case studies is discussed in this chapter, the conclusive design of the TARP after detailed review of other parameters such as WSN observation results and parametric study insights are disclosed in the next chapter.

3.9 Summary

In this chapter, a comprehensive discussion of methodologies and procedures adopted to design WSN based slope monitoring system was presented. The laboratory investigation procedures used to calibrate the sensors and to evaluate the functions and performance of the proposed system were explained. Following that, a step by step outline of field investigation procedures, implementing the proposed system in three case study mines were provided. Further, measures taken to develop TARP guidelines were described in detail. In the next chapter, the results and analysis of the same is provided.

CHAPTER - 4

CHAPTER 4

RESULTS AND ANALYSIS

This chapter presents the results and analysis of the investigations carried out. In the beginning of the chapter, analysis of the laboratory experimentation on functions of sensors and performance evaluation of WSN based slope monitoring system is discussed in detail including the effects of soil moisture and vibration on slope displacement. Following that, particulars about investigations on case study mines covering analysis of soil moisture, vibration, and displacement sensor readings, alongside effects of soil moisture and vibration on rate of slope displacement is also outlined. Additionally, the analysis results from numerical modelling are presented for each case study. The validation of displacement sensor data with total station and numerical model values is as emphasized. Later, the results from the parametric study are presented, discussing the impact of various parameters on slope displacement and factor of safety, along with their respective order of influence. Then, the development and working of the Advanced Slope Monitoring System (ASMS) software is discussed. Finally, the guidelines for the Trigger Action Response Plan (TARP) developed for these case study mines are finally revealed.

4.1 Analysis of the Laboratory Experimentation Results

This section deals with the results obtained from laboratory experimentation conducted to evaluate the functions of sensors and the performance of the Advanced Slope Monitoring System. The details regarding the installation of sensor on slope model were provided in the chapter 3. Figure 4.1 and 4.2 shows the moisture and vibration sensor measurements respectively.

In the case of the soil moisture sensor, at 11:14 AM, the observed moisture content is approximately 45% at soil moisture sensor 1, located on the bench part of the slope model, and 38% at sensor 2, positioned on the slope face. As time progresses, the model is also drying, and this is evidenced by declining trend of moisture content until 11:20 AM. After that, a tiny amount of water was sprayed on the model to observe the difference, and an exact replication was also observed in the values.

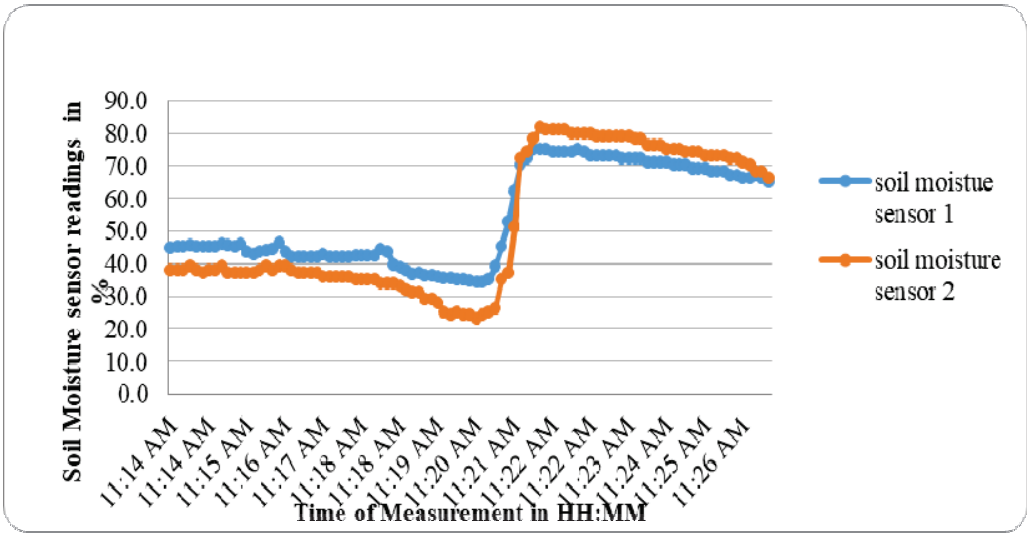


Figure 4.1 Soil Moisture sensor observations

In this experiment, the threshold for soil moisture was defined as 50%. Upon crossing this threshold, the ASMS will trigger an email alert. At 11:20 AM when the model is wet, the readings of both sensors spiked up above 50%, triggering an email alert. Initially, the vibration sensor recorded zeros until 11:14 AM. However, after that, both vibration sensors recorded a series of vibrations ranging from 20 to 80 Hz, as depicted in Figure 4.2.

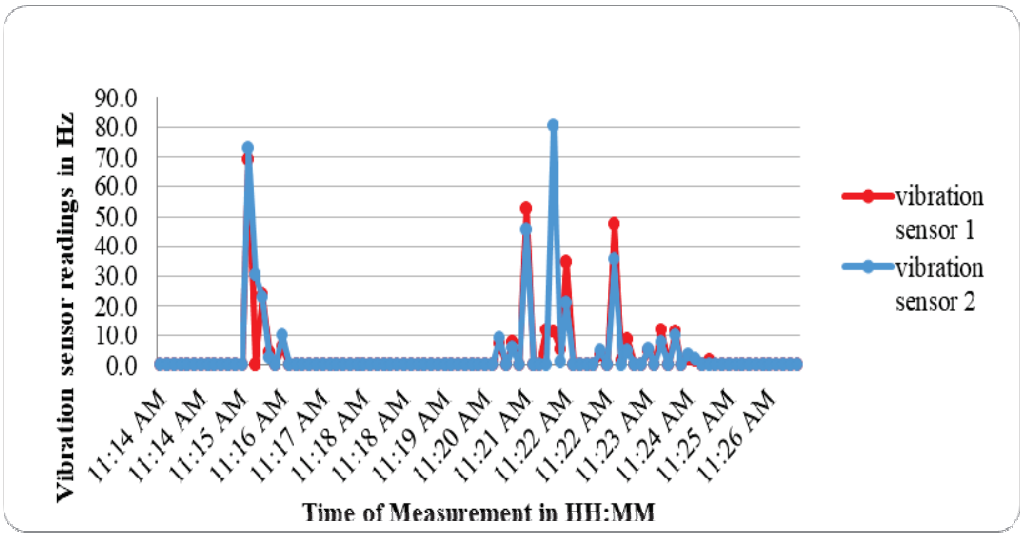


Figure 4.2 Vibration sensor observations

In Figure 4.3 presents observation of displacement sensors measuring the slope model's displacement under its self-weight. The vertical axis represents displacement (mm), and the horizontal axis represents the duration of the measurement. After almost 40 minutes of observation, both sensors picked up 0.25 mm displacement in the first ten minutes and remained constant thereafter.

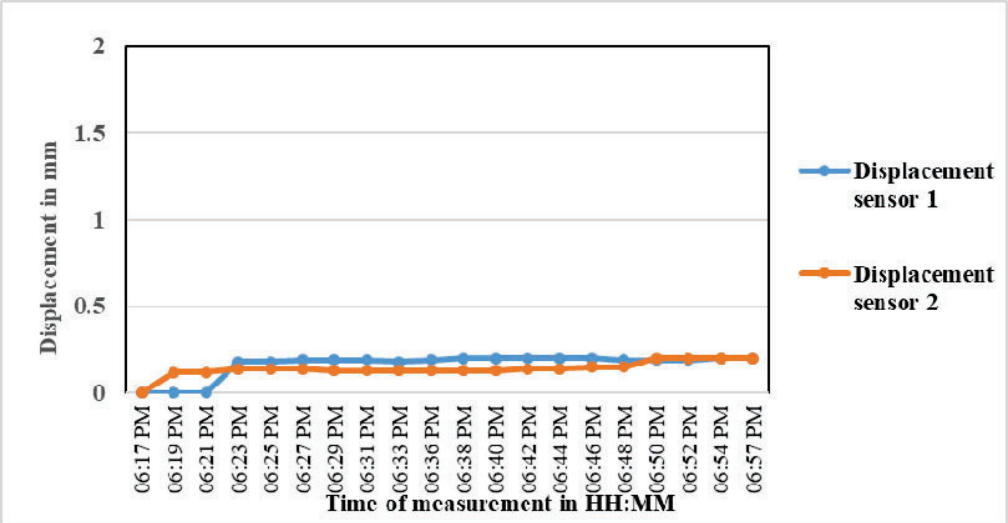


Figure 4.3 Displacement sensors observation without the load condition

In Figure 4.4 observation of displacement sensors measuring slope model's displacement due to the addition load placed upon it along with its self-weight, is presented. Based on the plots of sensor 1, the movement began at 12:18PM from 0.6 mm. The actual spike in the displacement of 2.5 mm was observed at 12:31PM, followed by a gradual increment. The slope movement froze once the displacement reached 5.3 mm at 12:42PM. From these observations, it is apparent that there is creepy behavior in slope model's movement. As the monitoring progressed, there was a gradual reduction in the difference between sensor 1 and 2, and at the end of the observation, it was 0.7 mm.

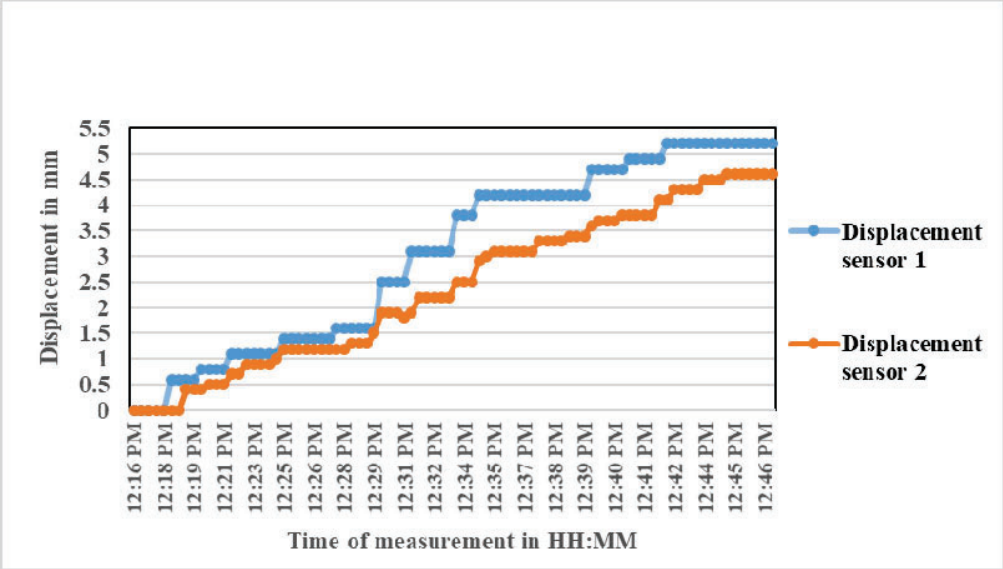


Figure 4.4 Displacement sensors observation on with load condition

The objective of this lab experimentation is to evaluate the functions and performance of the sensors and ASMS software. The result of this experimentation led to the following conclusions:

1. Soil moisture, vibration and displacement sensor detect changes in the slope model in real-time.
2. The wireless data transfer module communicates the sensor data to the receiver module flawlessly.
3. The sensor data were uploaded to cloud data analysis platform ThingSpeak within a delay of less than 15 seconds.
4. An email alert was received within 30 seconds of threshold breach.

These results serve as a conclusive evidence that, any significant changes in the opencast mine slope bench that could be recognized in real time, and alerts can be triggered immediately. This system is faster than any other slope monitoring systems that are currently being used in opencast mines.

4.1.1 Impact of moisture content and vibration on displacement

Based on the sensor readings presented in the previous section, it was intended to ascertain the effect of moisture and vibration on displacement of the model. This section explores the relationship of moisture content and vibration with displacement

of the model. Figure 4.5 depicts the correlation between moisture content and displacement. It is observed that the moisture content is directly proportional to the displacement. The slope model did not exhibit any movement until the moisture content attains 35%. Beyond this point, as moisture content increased, slope displacement increased steeply.

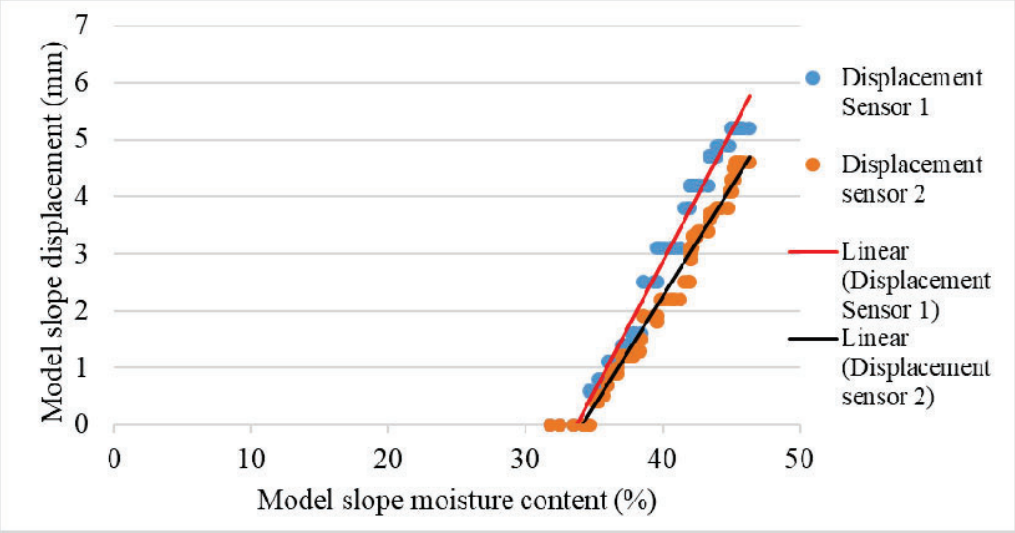


Figure 4.5 Correlation of soil moisture content with slope displacement

The correlation between vibration and slope displacement is illustrated in Figure 4.6. It indicates that the impact of vibration on slope displacement is also directly proportional. Slope displacement began when the vibration reached 15 Hz, and subsequently, as the vibration increased, the displacement increased gradually.

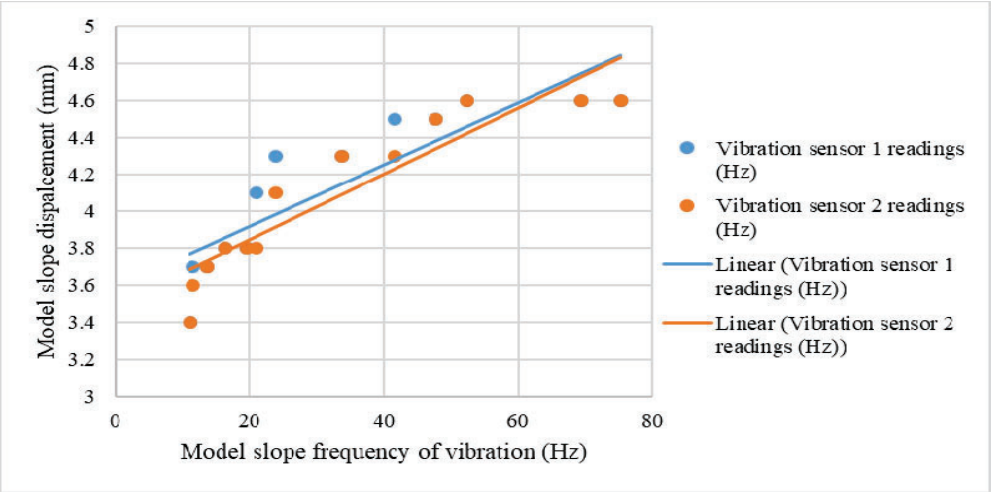


Figure 4.6 Correlation of vibration and slope displacement

From the above figures, it is observed that the linear trend of displacement increment with increase of moisture content is steeper than that of the vibration. Therefore, it is concluded that effect of moisture content on displacement is greater than the effect of vibration on displacement.

4.2 Field Investigations at Case Study Mines

This section focuses on the results obtained from field investigations conducted in the case study mines. Starting with the analysis of soil moisture, displacement and vibration sensors readings, followed by the analysis of results from numerical modelling investigations for the respective site conditions of the case study mines. Finally, a comparison among displacement sensor readings with total station readings and numerical model readings is analyzed.

4.2.1 Analysis of the sensor readings and numerical modelling results of KTK OC-2 case study

This section deals with the results obtained from field investigations using WSN based system at KTK OC -2 project. The details regarding the installation of sensor nodes and site are provided in the Chapter 3. Following the field experimentation, the uploaded data was extracted from Thingspeak platform. Subsequent analysis was conducted to comprehend the slope's response during different weather conditions, as well as the fluctuations in moisture content and displacement along the crest and toe sections of the slope.

4.2.1.1 Soil moisture sensor observations

Figure 4.7, shows the soil moisture content readings of sensor nodes retrieved from ThingSpeak and illustrate the nodes positioned at crest and toe alongside their corresponding date of measurement. The percentage of soil moisture is plotted against the date and time of measurement. The data indicates a correlation between the slope's soil moisture and weather conditions, with the highest moisture readings occurred on rainy days.

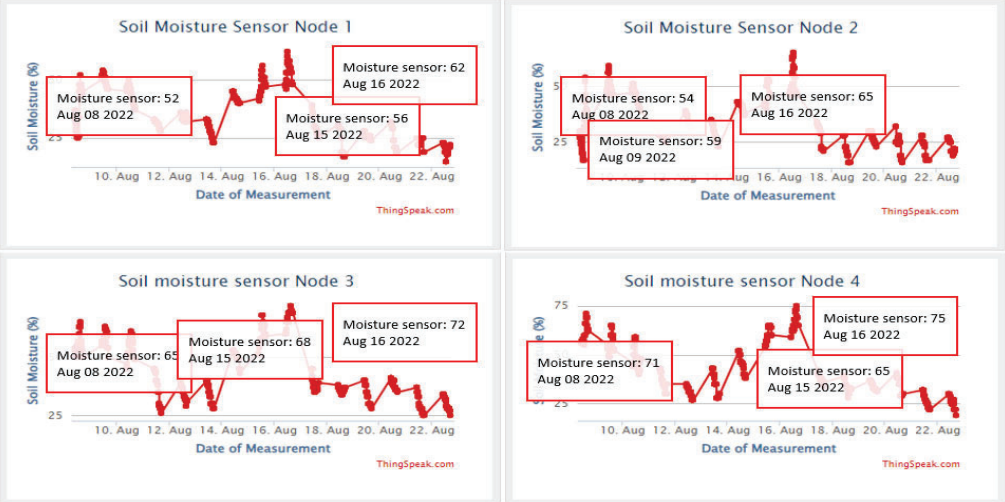


Figure 4.7 Soil moisture sensor readings at KTKOC2 using Thingspeak platform

Table 4.1 presents the maximum soil moisture readings recorded each day by sensor nodes. Nodes 1 and 2 were positioned at the bench toe, while nodes 3 and 4 were situated at the crest. A comparable trend in soil moisture readings is observed within toe and crest moisture content. However, a maximum difference of 41.94%, a minimum difference of 1.33%.

Table 4.1 Maximum soil moisture sensor reading from case study 1

SI. No	Date	Maximum Moisture content (%)				Difference in Moisture from toe to crest in (%)
		Toe		Crest		
		Node 1	Node 2	Node 3	Node 4	
1	08-08-2022	52	54	65	71	28.30%
2	09-08-2022	54	59	63	65	13.27%
3	10-08-2022	50	51	61	59	18.81%
4	11-08-2022	33	29	45	43	41.94%
5	12-08-2022	36	39	39	35	1.33%
6	13-08-2022	33	35	40	43	22.06%
7	14-08-2022	45	43	53	52	19.32%
8	15-08-2022	56	53	68	65	22.02%
9	16-08-2022	62	65	72	75	15.75%
10	17-08-2022	39	34	45	42	19.18%
11	18-08-2022	31	28	38	39	30.51%
12	19-08-2022	28	30	40	37	32.76%
13	20-08-2022	32	32	41	41	28.13%
14	21-08-2022	25	28	37	32	30.19%
15	22-08-2022	23	27	34	30	28.00%

Figure 4.8 shows the comparison of the percentage of soil moisture recorded at toe and crest of the slope. The data indicates that the soil moisture content at crest is consistently higher than that at toe.

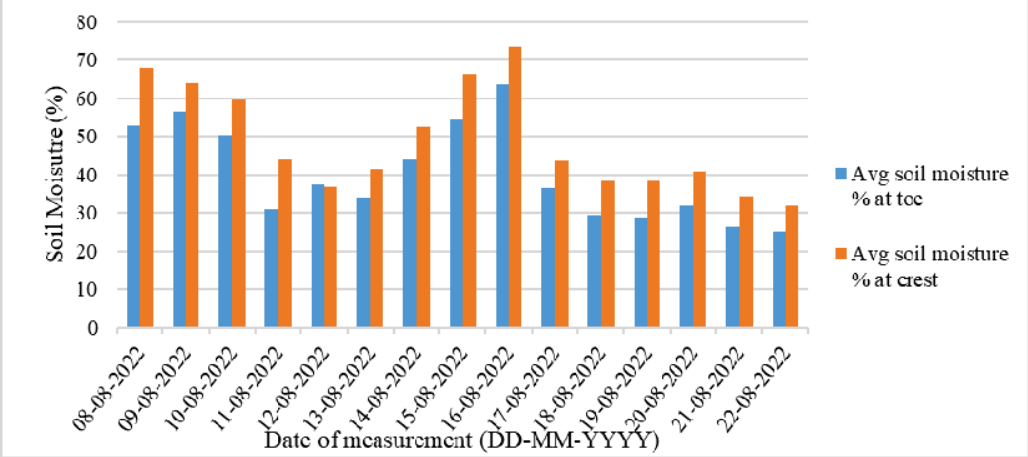


Figure 4.8 Soil moisture percentage variations from toe to crest

4.2.1.2 Displacement sensor observations

Figure 4.9, shows the displacement readings of sensor nodes through ThingSpeak, positioned at both the slope crest and toe. The slope displacement in mm is plotted against the date and time of measurement. Similar to what had been observed in the soil moisture sensor readings, analysis reveals a relationship between slope displacement and prevailing weather conditions, notably with peak displacement occurrences coinciding with rainy weather. Additionally, within the figure, highest displacement recordings are emphasized.

Table 4.2 provides an overview of the daily maximum displacement readings recorded by sensor nodes fixed at the predetermined locations as discussed in the prevision section. The difference in the readings observed from the nodes installed at toe part of the slope is minimal and negligible similar to the nodes installed at crest. It is determined that nodes located in the crest region of the slope exhibit a higher degree of displacement compared to those located in the toe region, regardless of weather conditions.

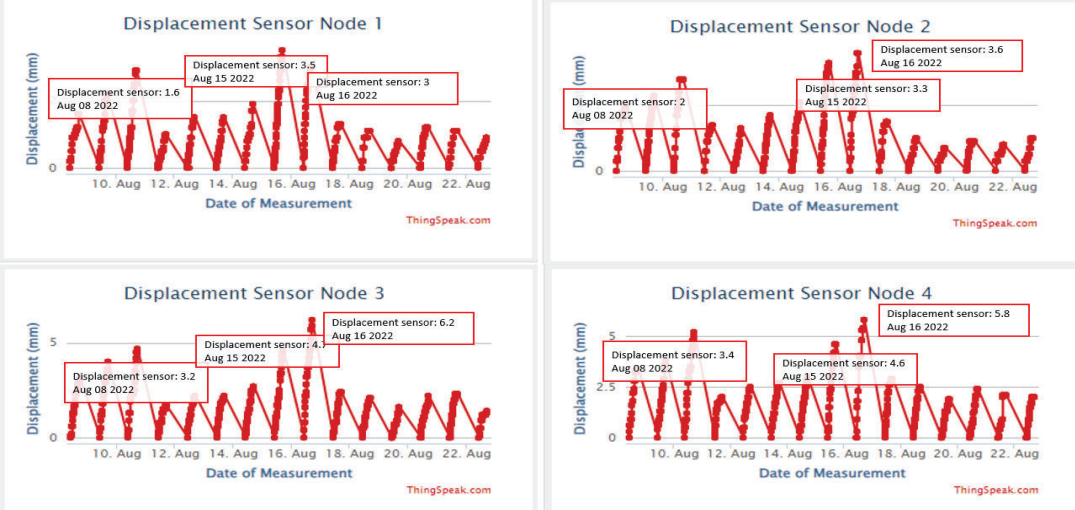


Figure 4.9 Displacement sensor reading from case study 1

However, difference within the displacement readings between toe and crest regions of bench varied significantly depending on moisture due to rain and other sources.

Table 4.2 Maximum displacement sensor reading from case study 1

SI. No	Date	Maximum Displacement (mm)				Difference in Displacement from toe to crest in (%)
		Toe		Crest		
		Node 1	Node 2	Node 3	Node 4	
1	08-08-2022	1.6	2	3.2	3.4	83.33%
2	09-08-2022	2.2	2.3	4	3.8	73.33%
3	10-08-2022	2.9	2.9	4.7	5.2	70.69%
4	11-08-2022	1	1.4	1.7	2	54.17%
5	12-08-2022	1.5	1.3	2.2	2.5	67.86%
6	13-08-2022	1.5	1.7	2.2	2.7	53.13%
7	14-08-2022	1.9	2.1	2.7	3	42.50%
8	15-08-2022	3.5	3.3	4.7	4.6	36.76%
9	16-08-2022	3	3.6	6.2	5.8	81.82%
10	17-08-2022	1.3	1.5	2.4	2.9	89.29%
11	18-08-2022	1.1	1	2.1	2.5	119.05%
12	19-08-2022	0.8	1.6	1.6	1.9	45.83%
13	20-08-2022	1.2	1.3	2.2	2.4	84.00%
14	21-08-2022	1.1	1.5	2.3	2.1	69.23%
15	22-08-2022	0.9	1	1.4	2	78.95%
Cumulative Displacement		**25.5**	**28.5**	**43.6**	**46.8**	

The average difference in displacement at the toe and crest is analyzed with displacement values obtained by sensors. The displacement recorded at toe is lesser

than at crest, as illustrated in Figure 4.10.

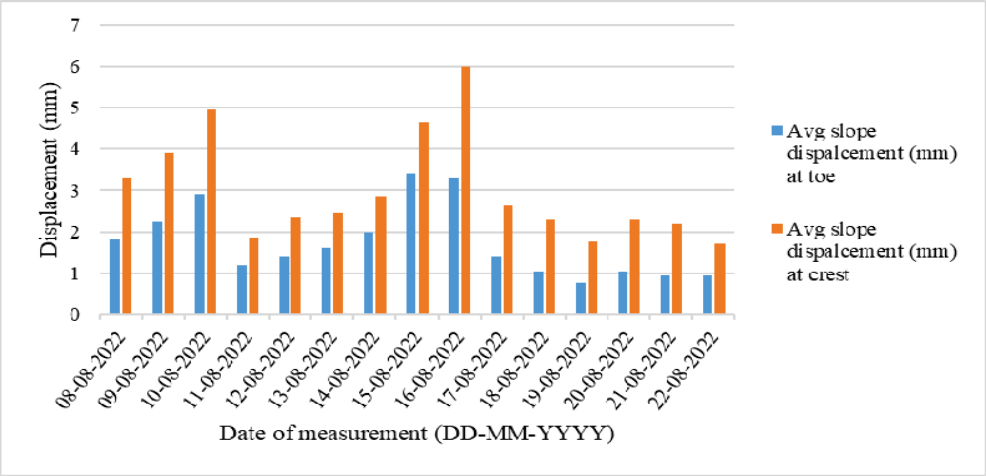


Figure 4.10 Displacement variations from toe to crest

4.2.1.3 Vibration sensor observations

Figure 4.11 illustrates the vibrations sensor readings measured in Hz plotted against the date and time of measurement, and Table 4.3 presents the observed maximum frequencies during the measurement. The variance in detected vibration values among the sensors is minimum is 0% and maximum difference is 19.44%. Additionally, blasting activities were abstained on rainy days and so, no vibration was detected, as indicated in Figure 4.11.

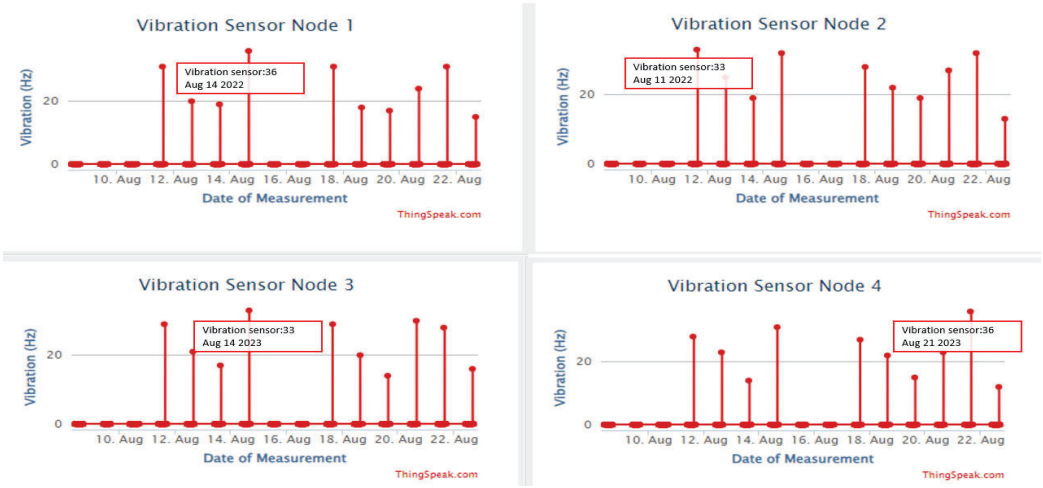


Figure 4.11 Vibration sensor reading from case study 1

Table 4.3 Vibrations sensor reading from case study 1

SI. No	Date	Maximum vibration (Hz)				Difference in Displacement from toe to crest in (%)
		Toe		Crest		
		Node 1	Node 2	Node 3	Node 4	
1	08-08-2022	0	0	0	0	-
2	09-08-2022	0	0	0	0	-
3	10-08-2022	0	0	0	0	-
4	11-08-2022	31	33	29	28	10.94%
5	12-08-2022	20	25	21	23	2.22%
6	13-08-2022	19	19	17	14	18.42%
7	14-08-2022	36	32	33	31	5.88%
8	15-08-2022	0	0	0	0	-
9	16-08-2022	0	0	0	0	-
10	17-08-2022	31	28	29	27	5.08%
11	18-08-2022	18	22	20	22	5.00%
12	19-08-2022	17	19	14	15	19.44%
13	20-08-2022	24	27	30	23	3.92%
14	21-08-2022	31	32	28	36	1.59%
15	22-08-2022	15	13	16	12	0.00%

An attempt to study the difference in the effect of blasting on toe and crest of bench showed that there is no substantial disparity. Comparison of vibrations observed at toe and crest are displayed in Figure 4.12.

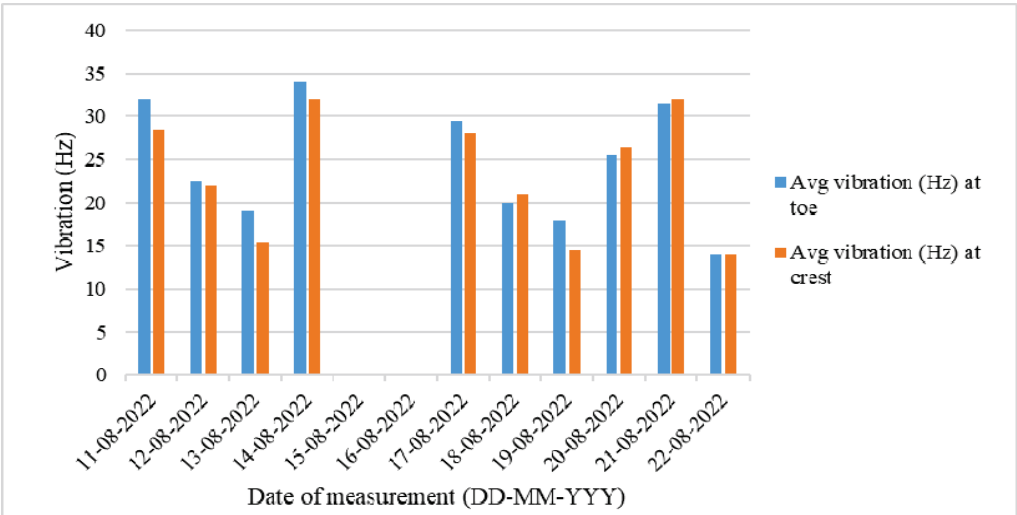


Figure 4.12 Vibration variations from toe to crest

4.2.1.4 Impact of moisture content and vibration on rate of displacement

The data plot of rate of displacement against moisture content is consistently fluctuating as illustrated in Figure 4.13, although the overall trend of rate of displacement in rising while the soil moisture content is rising. This comparison denotes that at 28% of soil moisture content the rate of displacement is 2.77, and for 30, 40, 50 and 60%, the rate displacement is found to be 3.07, 4.77, 6.47 and 8.17 respectively.

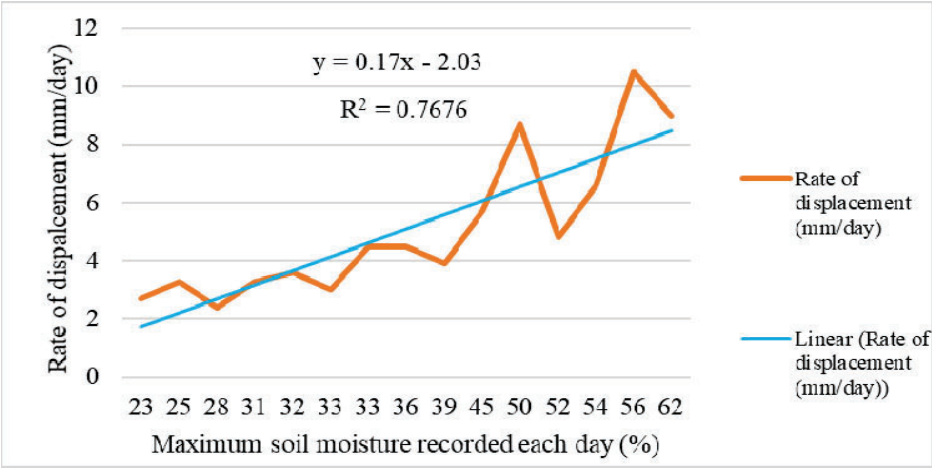


Figure 4.13 Effect of soil moisture on rate of displacement

A similar comparison with vibration values is made and the same is illustrated in Figure 4.14. The linear trend on increment of rate of displacement per day against vibration values shows a gradual rise. This comparison denotes that at 15 Hz of vibration the rate of displacement is 3.11, and for 20, 25, 30 and 35 Hz, the rate of displacement is found to be 3.43, 3.74, 4.05 and 4.36 respectively.

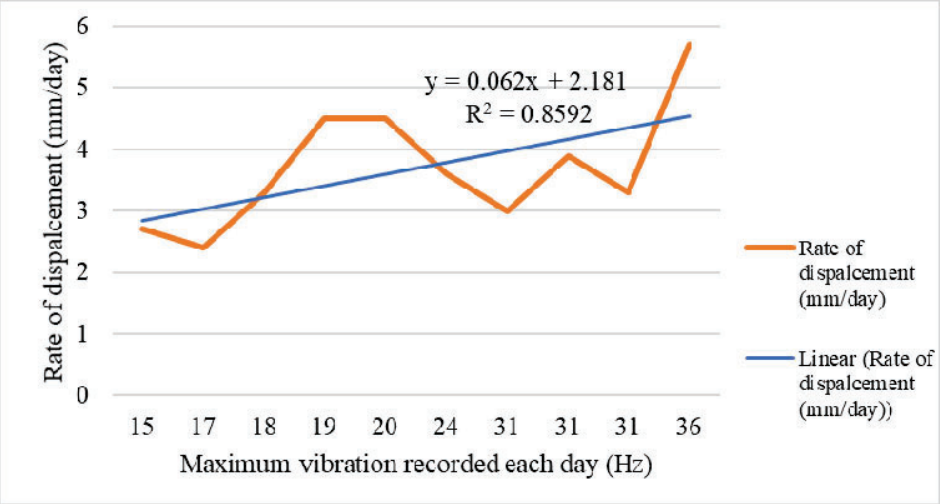


Figure 4.14 Effect of vibration on rate of displacement

The coefficient of soil moisture (slope of the linear trend line) obtained from the Figure 4.13 is '0.17', whereas in Figure 4.14 for vibration it is '0.062'. This comparison indicates that the impact of soil moisture on rate of displacement is higher than the effect of vibration.

4.2.1.5 Numerical modeling based on site condition at case study-1

This section discusses the outcomes of the numerical modelling study conducted to analyze slope displacements with respect to site-specific conditions of KTK OC -2 mine. Figure 4.15 depicts the FoS values obtained from the Flac 2D software.

Figure 4.16 shows the resultant displacement obtained from the Flac 2D software. The simulation results show a value of 43.32 mm as resultant displacement for the entire slope.

Falc 2D allows users to determine displacement at any specific point within the slope model. This function of Flac 2D is utilized to find the displacement that occurred at the locations where the sensor nodes and total station prisms were installed, enabling subsequent comparison and validation of the displacement readings obtained from the sensor.

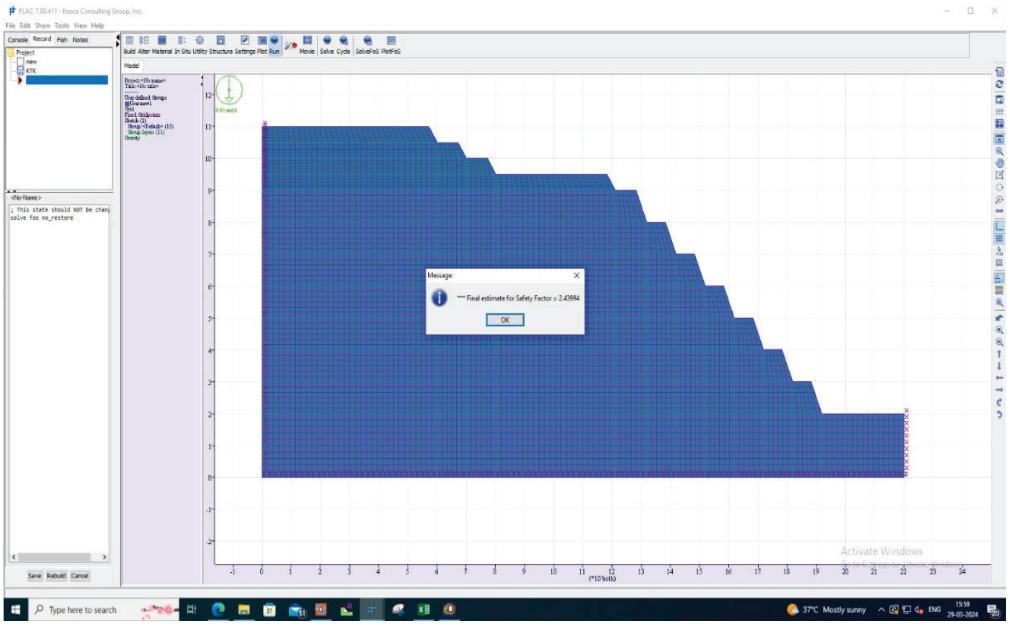


Figure 4.15 Site condition numerical model results in the form of FoS

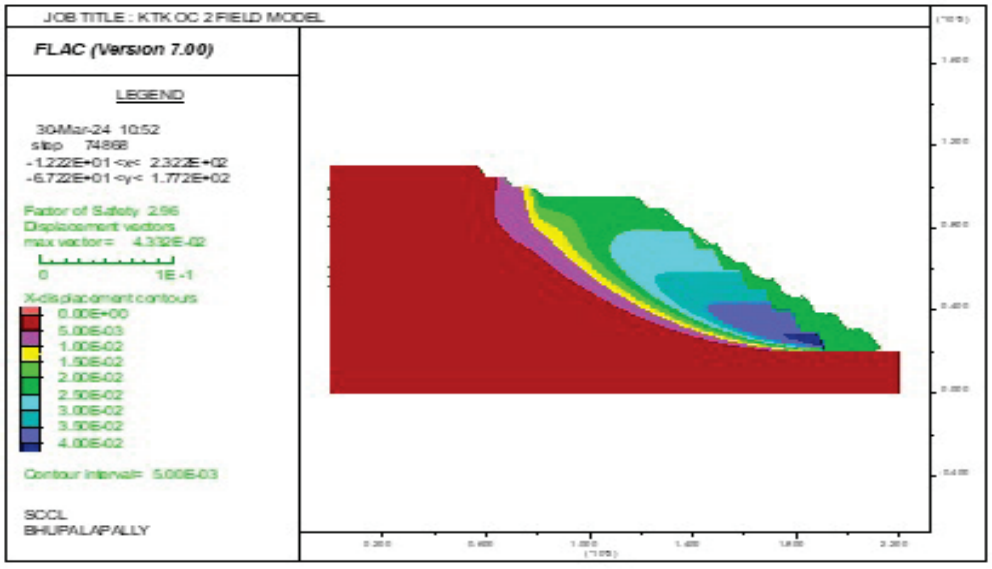


Figure 4.16 Site condition numerical modelling with resultant displacement

Figure 4.17, shows the displacement obtained at four locations where prisms and nodes were installed. The simulation results indicate, displacement of 29.77 mm, 33.18 mm, 38.98 mm, and 46.26 mm on the 4th bench at location of node 1, 2, 3 and 4 respectively.

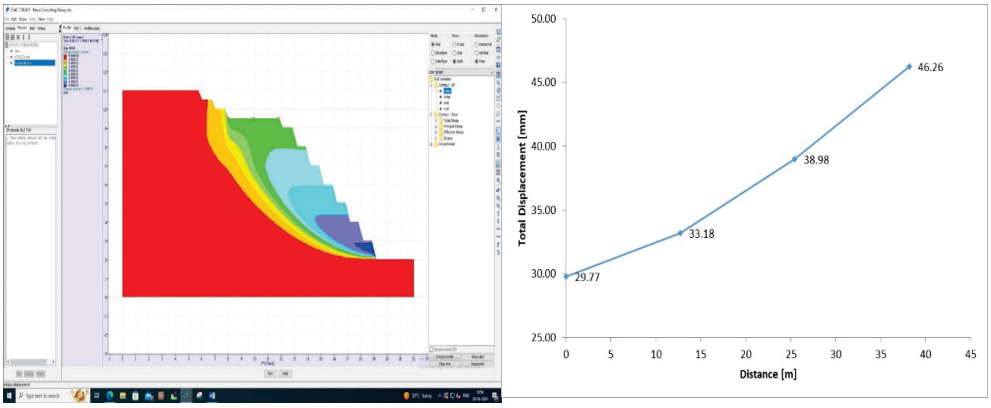


Figure 4.17 Displacement readings at sensors installation locations in the project

4.2.1.6 Comparison of Field Results with Modeling Results

Figure 4.18 provides a comparison of maximum displacement recorded by the sensor nodes with the readings observed by the total station and the readings derived from numerical model analysis. The analysis of the data presented in the figure indicates a notable similarity in the displacement values obtained from all three systems. However, it is noticed that the readings from the total station exhibit a slight elevation at node 3 and 4, corresponding to the crest of the slope.

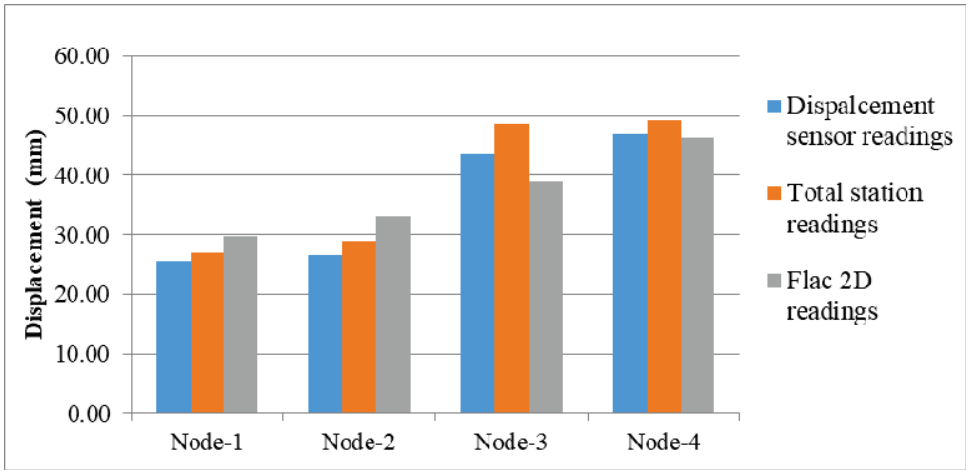


Figure 4.18 Comparison of displacement measured with Sensor, TS and NMM

Table 4.4 provides the respective displacement readings recorded by the sensor nodes, total station and from numerical model analysis along with the percentage difference in displacement between them.

Table 4.4 Comparison of maximum displacement in slope by different modes

Sl. No.	Installed Nodes	Readings observed with displacement sensor (mm)	Readings observed with total station (mm)	Readings observed with Flac 2D (mm)	Percentage of difference in displacement b/w Sensor readings and Total station readings	Percentage of difference in displacement b/w Sensor readings and Flac 2D readings
1	Node-1	25.50	27.00	29.77	5.88	16.75
2	Node-2	28.50	28.90	33.18	1.40	16.42
3	Node-3	43.60	48.60	38.98	11.47	-10.60
4	Node-4	46.80	49.30	46.26	5.34	-1.15

The variation between WSN and TS is around 5.34% to 11.47% and the variation between WSN and NMM is around -10.60% to 16.75%. However, the data obtained using WSN is in close to other two methods, indicating that WSN monitoring method is reliable from the findings of this case study mine.

4.2.2 Field investigations of case study- 2

In this section, field investigations result of case study 2 (KHA OC project) are given. The details regarding the installation of sensor nodes and site conditions has been provided in Chapter 3. Following the field experimentation, data extracted from the Thingspeak platform was subjected to subsequent analysis. This analysis aimed to understand the slope's response under various weather conditions and to assess fluctuations in moisture content and displacement along both the crest and toe sections of the slope.

4.2.2.1 Soil Moisture sensor observations

The data presented in Figure 4.19 provides a visualization of soil moisture readings obtained from sensor nodes located at both the slope crest and toe, following that in Table 4.5, maximum soil moisture values recorded by each node is provided. Analysis of retrieved data reveals a clear correlation between soil moisture levels and prevailing weather conditions, with the highest readings consistently recorded during rainy periods.

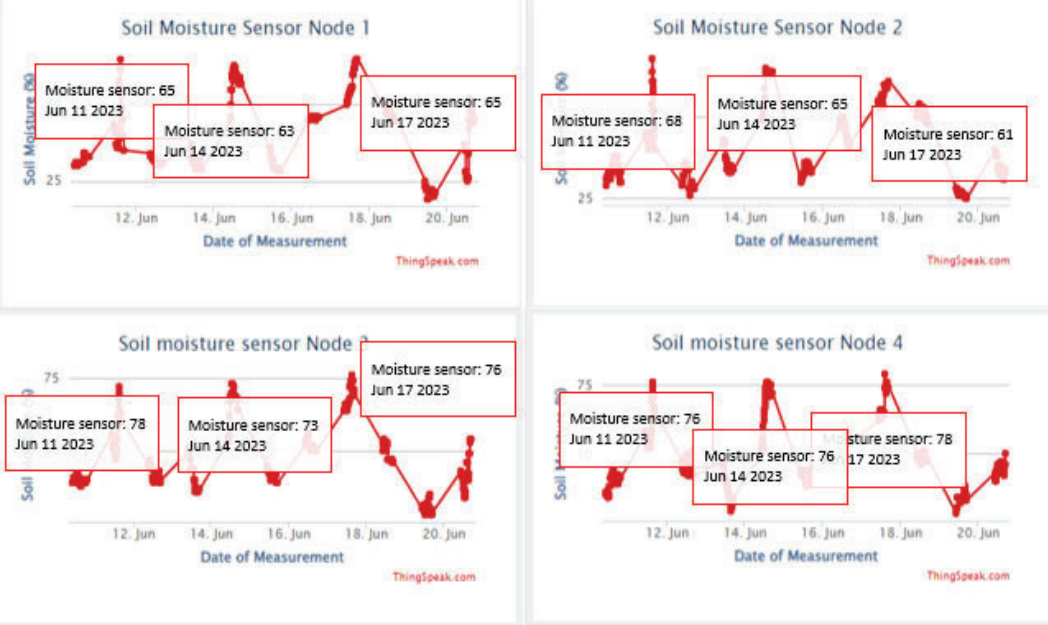


Figure 4.19. Soil Moisture sensor reading from case study 2

Table 4.5 Maximum Soil Moisture sensor reading from case study 2

SI. No	Day	Maximum Moisture content (%)				Difference in moisture from toe to crest in (%)
		Node 1 (Toe)	Node 2 (Toe)	Node 3 (Crest)	Node 4 (Crest)	
1	10/06/2023	34	38	42	44	4.86
2	11/06/2023	65	68	72	76	2.82
3	12/06/2023	33	36	47	51	10.51
4	13/06/2023	37	43	51	47	5.63
5	14/06/2023	63	65	73	76	4.1
6	15/06/2023	36	36	45	44	5.9
7	16/06/2023	46	50	56	58	4.69
8	17/06/2023	65	61	76	76	5.16
9	18/06/2023	51	54	54	51	0
10	19/06/2023	25	28	35	34	7.55
11	20/06/2023	52	40	54	50	3.26

From the values provided in Table 4.5, and as illustrated in Figure 4.20, it can be seen that the difference in moisture content at toe and crest on rainy and non-rainy day follows the same trend as the previous case study which is, the difference is lesser on rainy days and greater on non-rainy days. The difference in moisture content between toe and crest was calculated by taking average values of nodes 1 and 2 that were

installed at toe and nodes 3 and 4 from crest. On Average, the moisture content at crest of bench is 5% higher than toe, and a minimum of 0% and maximum of 10.51% moisture content is observed in this case study.

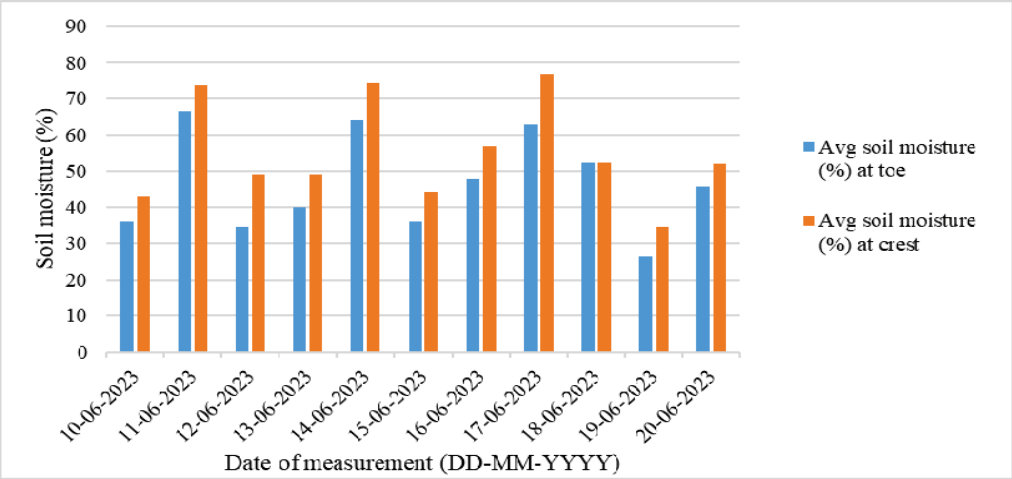


Figure 4.20 Soil moisture percentage variations from toe to crest

4.2.2.2 Displacement sensor observations

In Figure 4.21, the data collected from sensor nodes positioned at both the slope crest and toe are depicted. Upon analysis of the displacement data, a clear connection emerges between slope displacement and the weather conditions, particularly with peak displacements aligning with rainy weather patterns is consistent with the previous case study. Table 4.6. provides the maximum displacement measurements obtained from the sensor nodes.

Nodes situated in the crest of the slope exhibit greater displacement compared to those positioned in the toe region, irrespective of weather conditions. However, the variance in displacement readings between sensors installed at the toe and crest locations notably fluctuates based on rainy conditions.

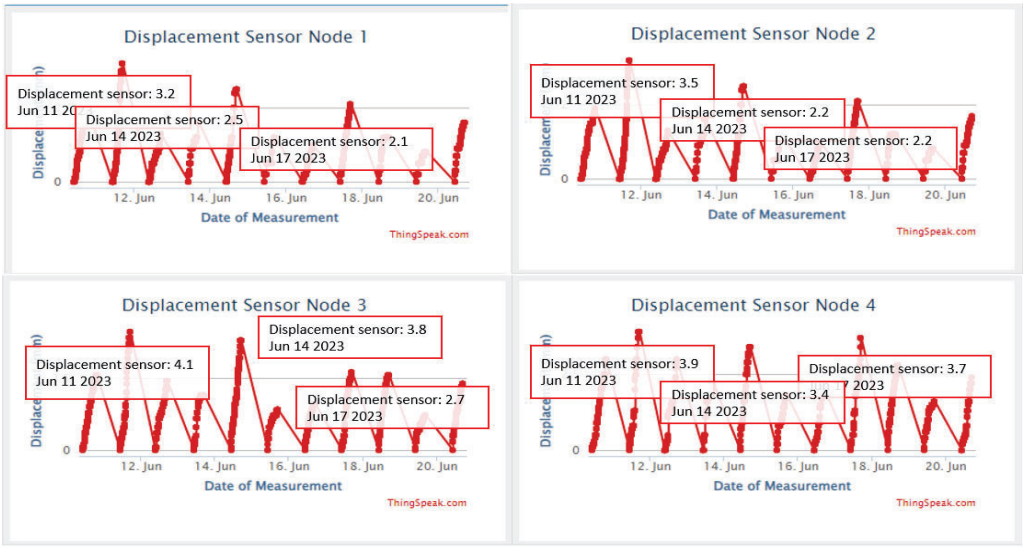


Figure 4.21 Displacement sensor readings from case study 2.

The comparison of toe and crest displacement values are presented in Figure 4.22. On Average, the displacement at crest of bench is 14% higher than toe, and a minimum of 4.85% and maximum of 25% moisture content is observed in this case study.

Table 4.6 Displacement sensor observation readings at KHA OC2 (case study 2)

SI. No	**Day**	**Maximum Displacement (mm)**				**Difference in displacement from toe to crest (%)**
		Node 1 (Toe)	**Node 2 (Toe)**	**Node 3 (Crest)**	**Node 4 (Crest)**	
1	10/06/2023	1.9	1.8	2.6	3	12.84%
2	11/06/2023	3.2	3.5	4.1	3.9	4.85%
3	12/06/2023	1.3	1.4	2.4	3	25.00%
4	13/06/2023	1.6	1.7	1.9	2.2	6.06%
5	14/06/2023	2.5	2.2	3.8	3.4	13.30%
6	15/06/2023	1.2	1.1	1.4	1.8	9.78%
7	16/06/2023	1.3	1.2	1.6	2	11.00%
8	17/06/2023	2.1	2.2	2.7	3.7	12.21%
9	18/06/2023	1.2	1.4	2.6	2.8	26.92%
10	19/06/2023	1.6	1.8	1.2	1.6	4.41%
11	20/06/2023	1.6	2.2	2.3	2.4	5.92%
Total Displacement		**19.5**	**20.5**	**26.6**	**29.8**	**10.25%**

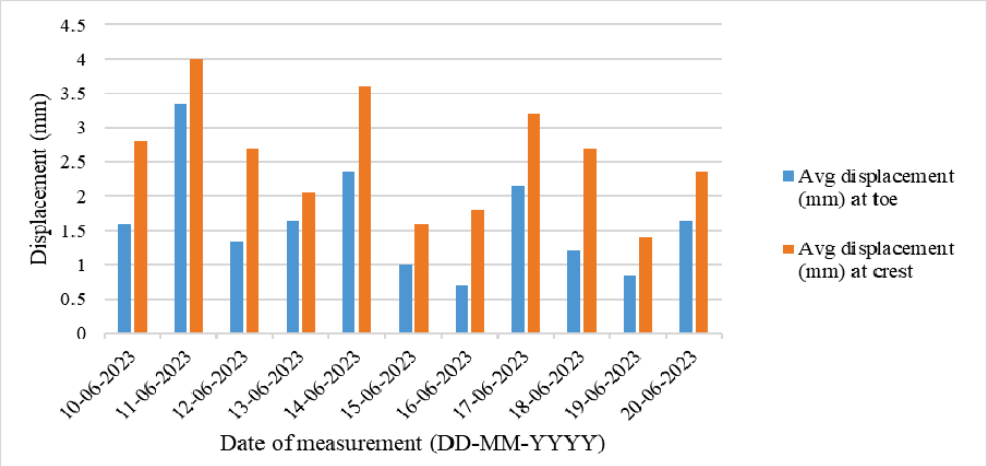


Figure 4.22 Displacement (mm) variations from toe to crest

4.2.2.3 Vibration sensor observations

Regarding the vibration sensor, as shown in Figure 4.23, there was no vibration detected during rainy days within the observation period. In Table 4.7 the maximum vibration frequencies measured during the study period alongside the difference in the values between nodes at toe and crest are given, and the same is illustrated in Figure 4.24. A Maximum of 17.59% difference is observed in between these nodes. From the figure, it is noted that the vibration recorded at crest is always greater than that of toe. It is significant to recall in previous case study that this comparison was inconsistent. The reason behind this behavior could be the geometry of the slope, the details regarding the slope geometry and material properties. Effects of these blast vibrations on slope displacement are discussed in next section.

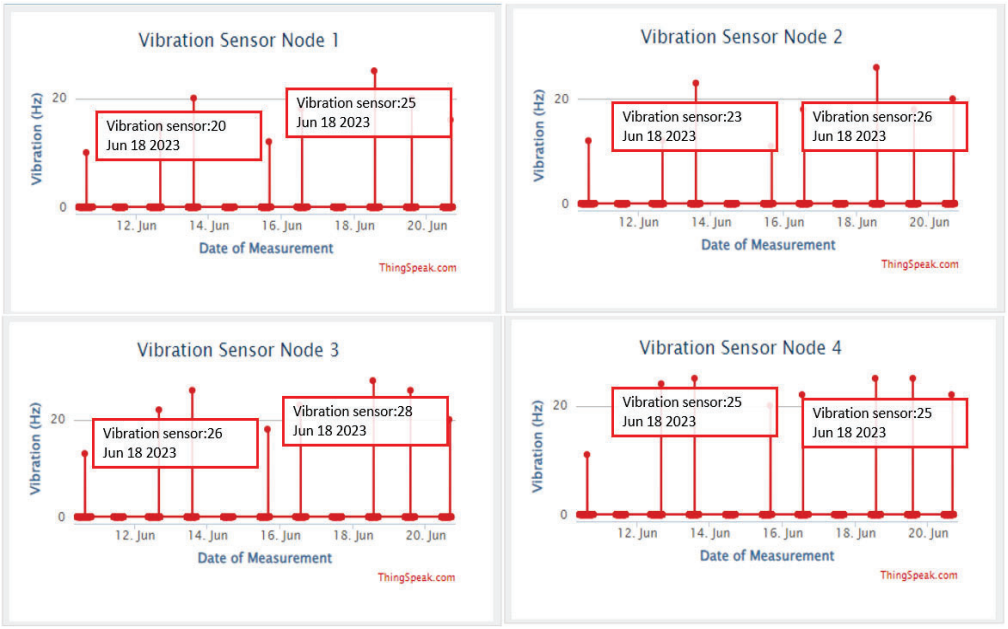


Figure 4.23 Vibration sensor reading from case study 2

Table 4.7 Maximum vibration sensor reading from case study 2

SI. No	Day	Maximum Vibration (Hz)				Difference in vibration from toe to crest (%)
		Node 1 (Toe)	Node 2 (Toe)	Node 3 (Crest)	Node 4 (Crest)	
1	10/06/2023	10	12	13	11	2.27
2	11/06/2023	NA	NA	NA	NA	NA
3	12/06/2023	15	12	22	24	17.59
4	13/06/2023	20	23	26	25	4.65
5	14/06/2023	NA	NA	NA	NA	NA
6	15/06/2023	12	11	18	20	16.3
7	16/06/2023	18	18	23	22	6.25
8	17/06/2023	NA	NA	NA	NA	NA
9	18/06/2023	25	26	28	25	0.98
10	19/06/2023	10	18	26	25	8.55
11	20/06/2023	16	20	20	22	4.17

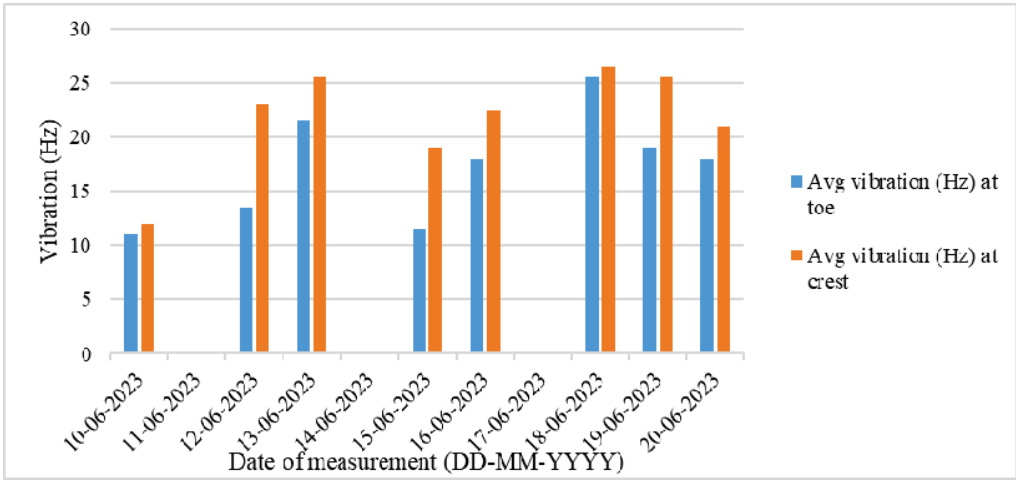


Figure 4.24 Vibrations variations from toe to crest

4.2.2.4 Impact of soil moisture and vibration on rate of displacement

Similar to the previous case study, a comparative analysis is conducted on the rate of displacement with soil moisture and vibration readings obtained from the field investigations. This aims to study the effect of moisture content and vibration on the rate of displacement. Figure 4.25 illustrates the comparison of moisture content and rate of displacement. According to the linear regression equation produced by this comparison, at 25% of soil moisture content the rate of displacement is 2.65, and for 30, 40, 50 and 60 %, the rate of displacement is found to be 3.2, 4.3, 5.4 and 6.5 respectively.

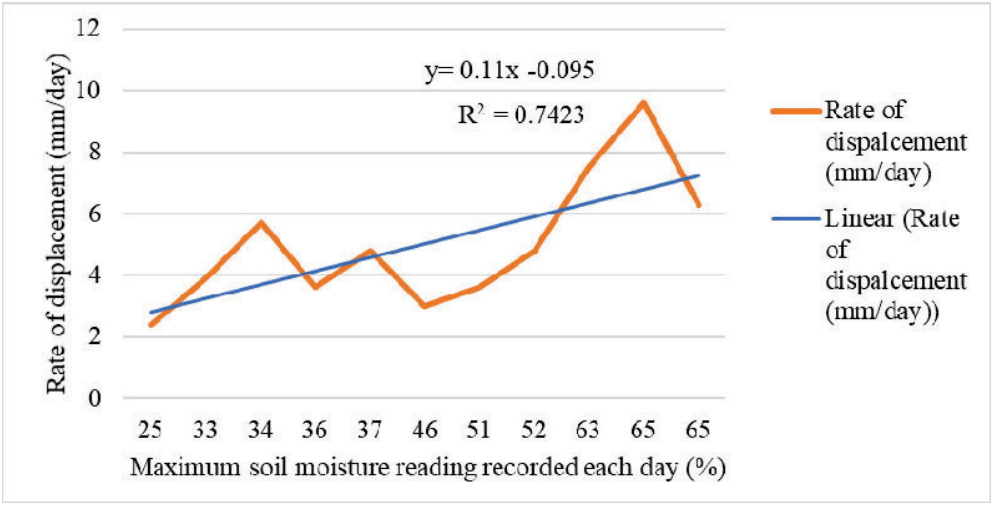


Figure 4.25 Effect of soil moisture on rate of displacement

As shown in Figure 4.26, effect of blast vibration on rate of displacement denotes a steeper trend where the input vibration readings ranges from 10 to 25 Hz. According to the linear regression equation produced by this comparison, for 10, 15, 20 and 25 Hz of vibration, the rate of displacement is found to be 2.42, 3.77, 5.12 and 6.46 respectively.

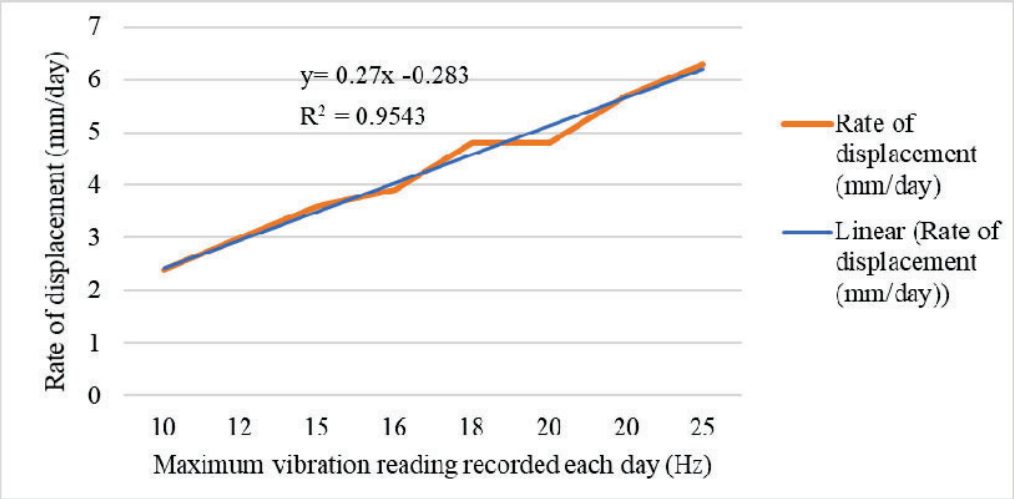


Figure 4.26 Effect of Vibration on rate of displacement

The coefficient of soil moisture (slope of the linear trend line) obtained from the Figure 4.25 is '0.11', whereas in Figure 4.26 for vibration it is '0.27'. This comparison indicates that the impact of soil moisture on rate of displacement is lesser than the effect of vibration.

4.2.2.5 Numerical modeling study based on site condition

This section discusses the outcomes of the numerical modelling study conducted to analyze the influence of site-specific conditions of case study 2 (KHA OCP). Figure 4.27 shows the FoS result obtained from the Flac 2D yielding a value of 2.83. Meanwhile, Figure 4.28 shows the result of resultant displacement with a value of 40.07 mm.

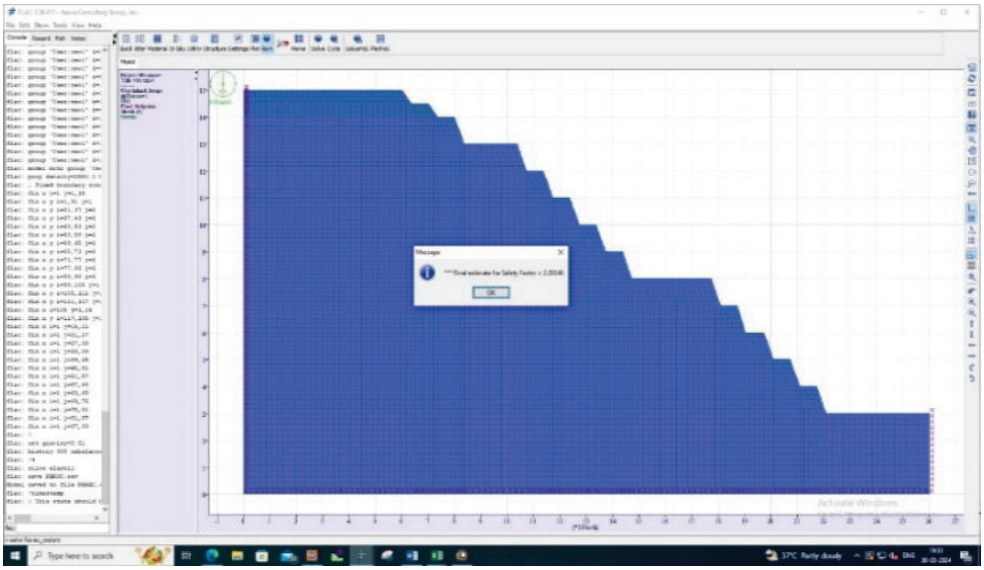


Figure 4.27 Site condition numerical model FoS result

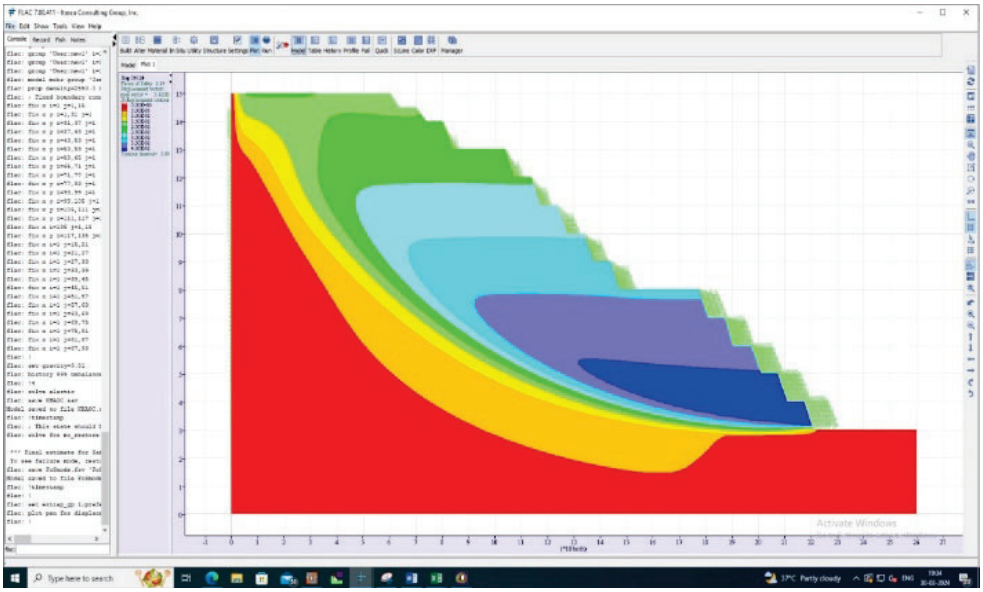


Figure 4.28 Site condition numerical model resultant displacement result

Figure 4.29, shows the displacement obtained at four locations where prisms and nodes were installed. The simulation results show displacement of 22.7 mm, 24.29 mm, 26.41 mm, and 28.71 mm on the 4th bench at node 1, 2, 3 and 4 locations respectively.

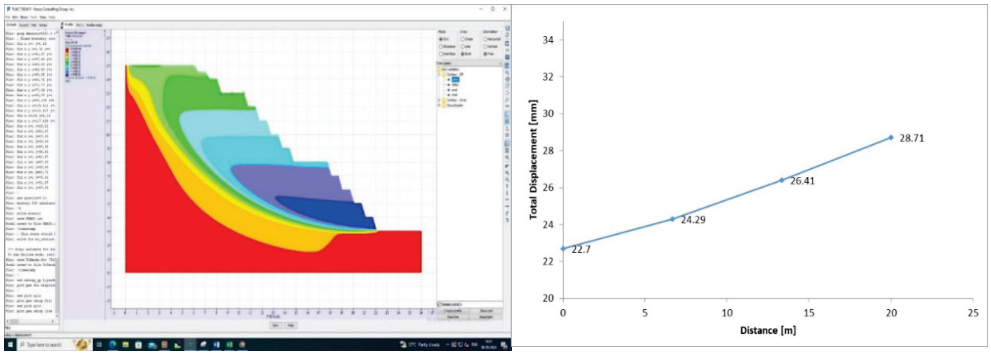


Figure 4.29 Displacement readings at sensors installation locations in the project

4.2.2.6 Comparison of field results with modeling results

Figure 4.30 provides a comparison of maximum displacement recorded by the sensor nodes with the readings observed by the total station and the readings derived from numerical model analysis. The analysis of the data presented in the figure indicates a notable similarity in the displacement values obtained from total station and sensors. While the numerical modelling readings closely align with the other two readings at crest node locations, it's notable that at the toe location, the displacement derived from the numerical model is notably higher than the other two measurements.

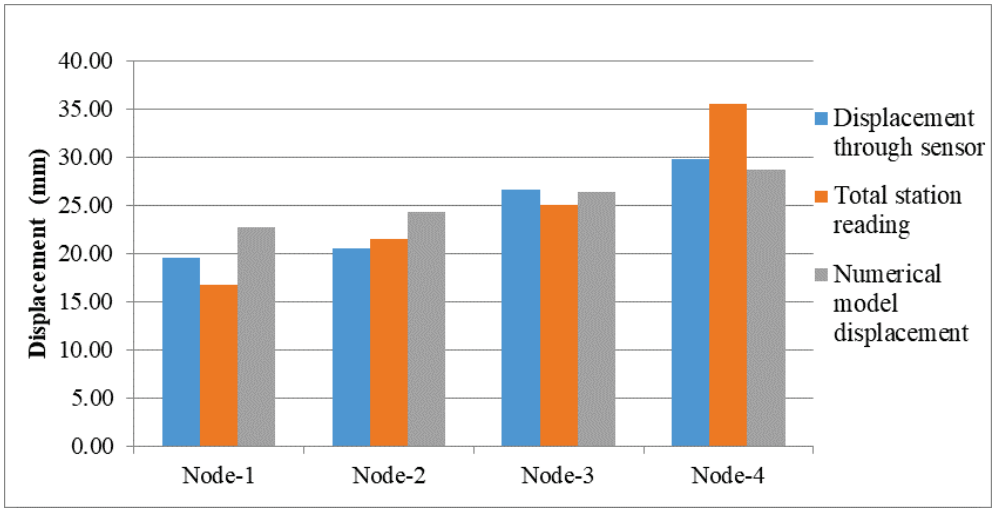


Figure 4.30 Comparison of displacement measured with Sensor, TS and NMM

Table 4.8 provides the respective displacement readings recorded by the sensor nodes, total station and from numerical model analysis along with the percentage difference in displacement between them.

Table 4.8 Comparison of maximum displacement in slope by different nodes

Sl. No.	Installed Nodes	Readings observed with displacement sensor (mm)	Readings observed with total station (mm)	Readings observed with Flac 2D (mm)	Percentage difference in displacement b/w Sensor readings and Total station readings	Percentage difference in displacement b/w Sensor readings and Flac 2D readings
1	Node-1	19.50	16.79	22.70	-13.90	16.41
2	Node-2	20.50	21.50	24.29	4.88	18.49
3	Node-3	26.60	25.08	26.41	-5.71	-0.71
4	Node-4	29.80	35.50	28.71	19.13	-3.66

The variation between WSN and TS is around -13.90% to 19.13%. The variation in between WSN and NMM is around -3.66% to 18.49%. However, the data obtained using WSN is in close to the other two methods, indicating WSN monitoring method is meaningful from the findings of this case study-2.

4.2.3 Field investigations of case study-3

The findings of the field investigations of Case Study 3 (SRP OC -2 Project) are provided in this section. Details regarding installations of node and data collection are furnished in Chapter 3.

4.2.3.1 Soil moisture sensor observations

Figure 4.31 shows the data from Nodes 1, 2, 3, and 4 of soil moisture sensors. Similar to previous cases studies, highest moisture values are observed on rainy days, and Nodes 2 and 4 installed in the crest of the slope indicated maximum moisture content than the other nodes. Table 4.9 presents the maximum moisture content measured during monitoring.

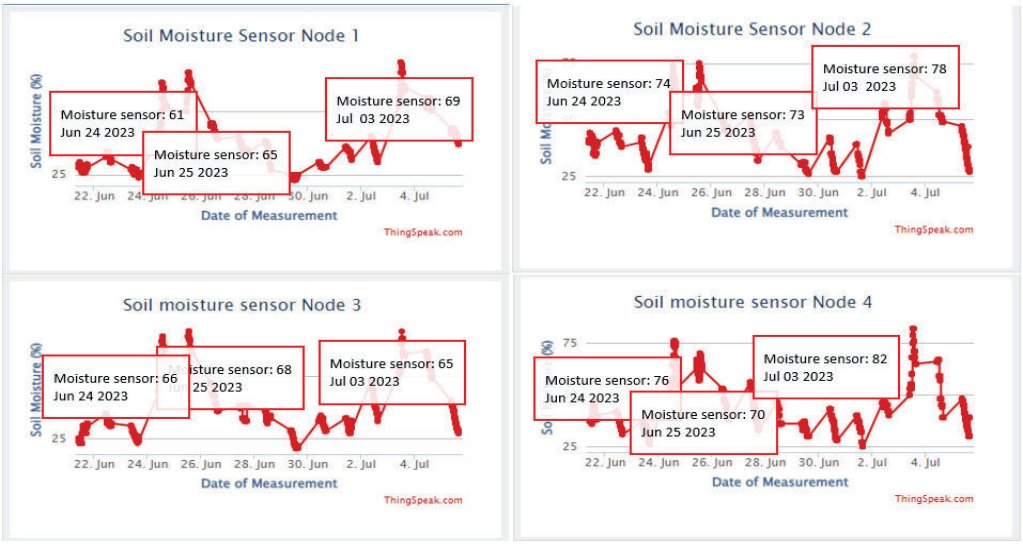


Figure 4.31 Soil moisture sensor reading from case study 3

Table 4.9 Maximum soil moisture sensor readings form case study 3

SI. No	Date of Measurement	Maximum Moisture Content (%)				Difference in Moisture from toe and crest in (%)
		Toe		Crest		
		Node 1	Node 3	Node 2	Node 4	
1	21-06-2023	30	31	44	46	11.89%
2	22-06-2023	34	35	45	42	6.52%
3	23-06-2023	28	30	42	37	9.05%
4	24-06-2023	61	66	74	76	4.53%
5	25-06-2023	65	68	73	70	1.88%
6	26-06-2023	45	47	51	53	3.26%
7	27-06-2023	40	38	52	56	9.62%
8	28-06-2023	38	36	44	46	5.41%
9	29-06-2023	25	28	30	36	6.13%
10	30-06-2023	30	34	42	43	8.20%
11	01-07-2023	36	33	39	40	3.62%
12	02-07-2023	40	48	57	46	4.26%
13	03-07-2023	69	65	78	82	4.85%
14	04-07-2023	55	60	62	66	2.83%
15	05-07-2023	43	40	47	48	3.61%

From the table, the difference between the moisture values at toe and crest is also in consistent with the other two case studies. A maximum of 11.89% and a minimum of 1.88% difference are observed between them during the observation. In consistent with previous case studies, difference in moisture content between toe and crest is

lesser in rainy days and more in non-rainy days. Interpretations from Figure 4.32 clearly state that the average moisture content at crest is greater that toe which also coincides with the previous case studies.

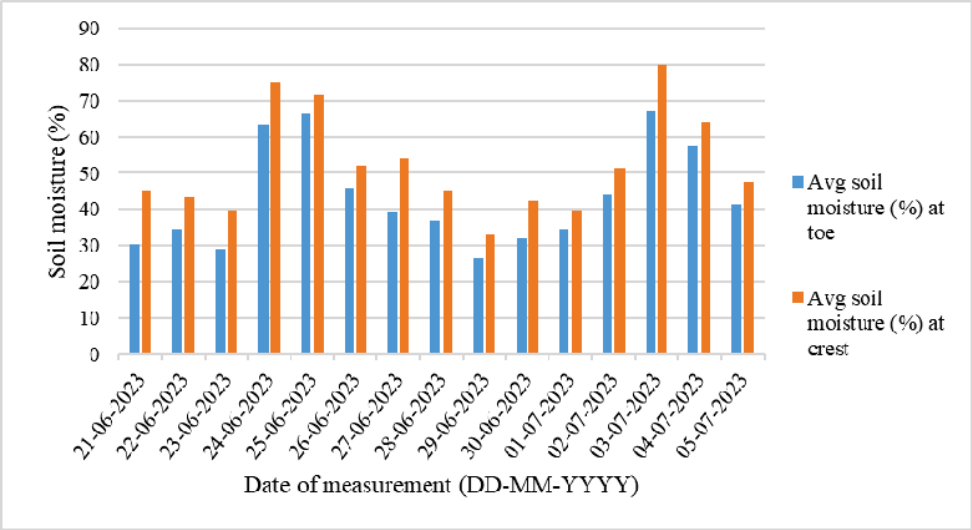


Figure 4.32 Soil moisture percentage variations from toe to crest

4.2.3.2 Displacement sensor observations

Figure 4.33 illustrates the displacement data collected by sensor nodes situated at both the slope crest and toe. Table 4.10 displays the maximum slope displacement recorded by the sensor nodes during the observation. In consistent with previous case studies, displacement at crest is greater than toe. During rainy days, displacement reading as high 5.3 mm and 3.2 mm is recorded by nodes at crest and toe respectively. It is important to note that, the difference in displacement between toe and crest is highest in this study among all three case studies, as depicted in Figure 4.34. A maximum displacement difference of 59.62% is recorded between toe and crest, and an average difference of 23.65% observed.

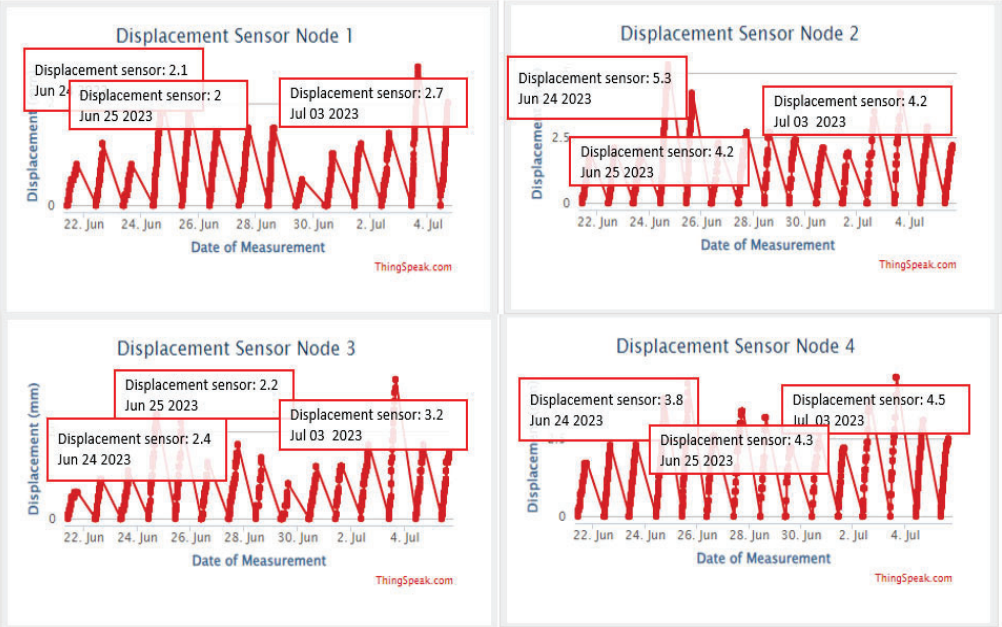


Figure 4.33 Displacement sensor reading from Thingspeak of nodes 1,2,3 & 4

Table 4.10 Displacement sensor readings at SRP OC2

SI. No	Date of Measurement	Maximum Displacement (mm)				Difference in Moisture from toe and crest in (%)
		Toe		Crest		
		Node 1	Node 3	Node 2	Node 4	
1	21-06-2023	0.8	0.6	1.8	1.7	37.50%
2	22-06-2023	1.2	0.9	2.1	2.3	27.38%
3	23-06-2023	0.8	1.1	2	2.45	33.55%
4	24-06-2023	2.1	2.4	3.1	2.7	7.22%
5	25-06-2023	2	2.2	2.9	3.1	10.71%
6	26-06-2023	1.4	1.3	2.3	2.6	20.37%
7	27-06-2023	1.5	1.7	2.5	2.6	14.84%
8	28-06-2023	1.5	1.4	2.2	2.4	14.66%
9	29-06-2023	0.5	0.8	2.2	2.2	59.62%
10	30-06-2023	1	1.2	2.1	2.3	25.00%
11	01-07-2023	1.2	1.2	1.9	2	15.63%
12	02-07-2023	1.4	1.7	3.1	5.3	42.74%
13	03-07-2023	2.7	3.2	3.5	2.9	2.12%
14	04-07-2023	2	1.7	2.1	3.1	10.14%
15	05-07-2023	1.6	1.5	2.2	2.5	12.90%
Total		**21.7**	**22.9**	**35.99**	**40.15**	**17.68%**

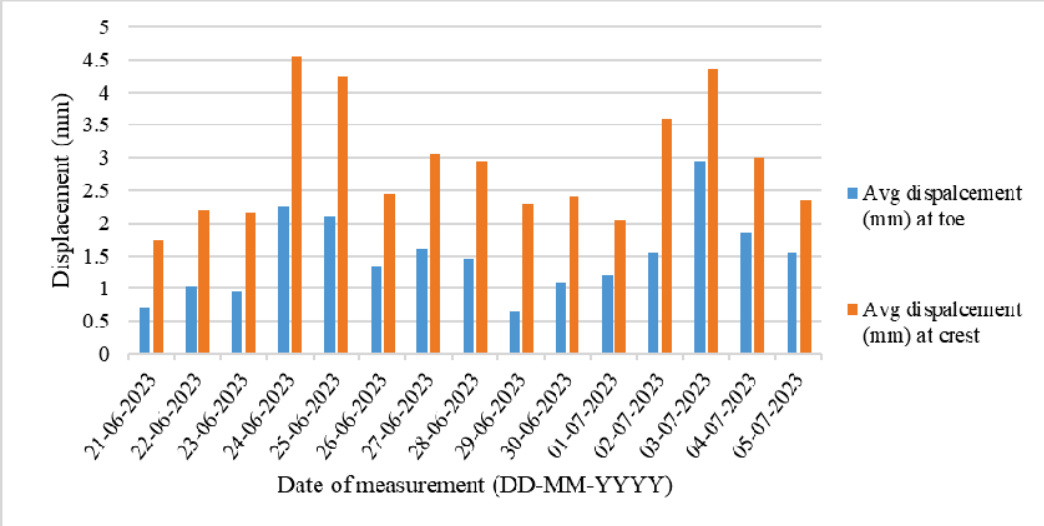


Table 4.34 Displacement readings variations from toe to crest

4.2.3.3 Vibration sensor observations

Vibration sensor readings measured in Hz against date and time of measurement is shown in Figure 4.35. In Table 4.11 shows the values of vibration readings retrieved from the Thingspeak. From the table, the maximum blast frequency recorded is 30 Hz from Node 3. It is observed that the sensors installed at the toe of the benches indicate higher values than that of the sensor in the crest region as indicated in Figure 4.36.

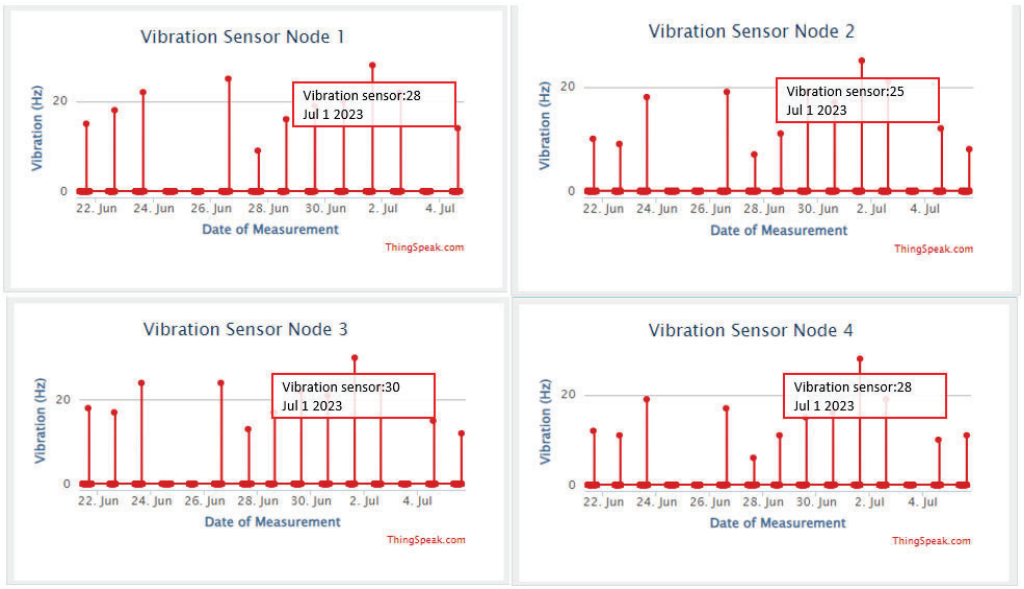


Figure 4.35. Vibration sensor reading from case study 3

Table 4.11 Vibration sensor readings at SRP OC2 (case study 3)

SI. No	Date of Measurement	Maximum Vibration (Hz)				Difference in vibration from toe and crest in (%)
		Toe		Crust		
		Node 1	Node 3	Node 2	Node 4	
1	21-06-2023	15	18	10	12	8.33%
2	22-06-2023	18	17	9	11	10.71%
3	23-06-2023	22	24	18	19	4.89%
4	24-06-2023	0	0	0	0	0
5	25-06-2023	0	0	0	0	0
6	26-06-2023	25	24	19	17	6.63%
7	27-06-2023	9	13	7	6	10.23%
8	28-06-2023	16	17	11	11	8.33%
9	29-06-2023	19	22	19	15	4.27%
10	30-06-2023	20	21	17	16	4.88%
11	01-07-2023	28	30	25	28	2.16%
12	02-07-2023	22	23	21	19	2.78%
13	03-07-2023	0	0	0	0	0
14	04-07-2023	14	15	12	10	6.03%
15	05-07-2023	17	12	8	11	8.62%

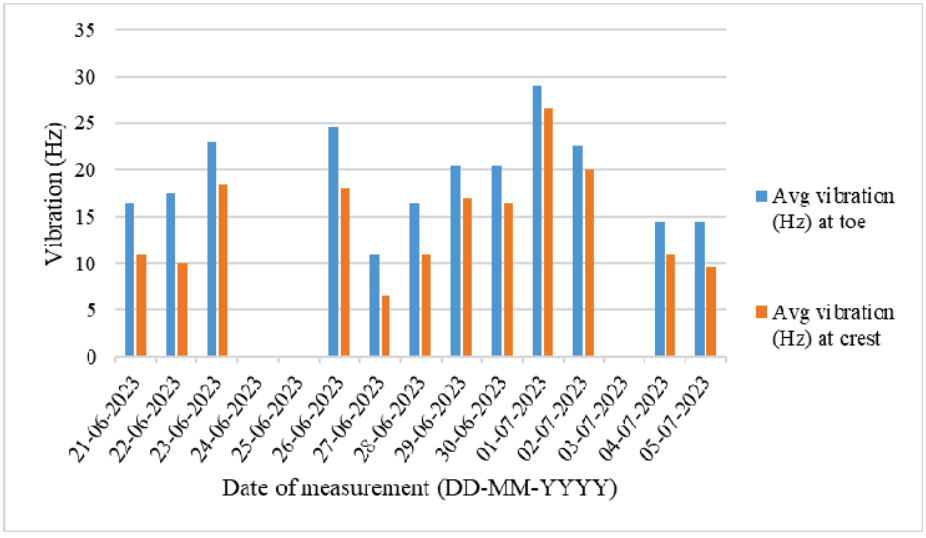


Figure 4.36 Vibration readings variations from toe to crest

4.2.3.4 Impact of moisture content and vibration on rate of displacement

Figure 4.37 illustrates the effect of moisture content on rate of displacement in a data plot. According to the linear regression equation produced by this comparison, at 25% of soil moisture content the rate of displacement is 2.22, and for 30, 40, 50 and 60 %, the rate displacement is found to be 2.8, 4.02, 5.2 and 6.42 respectively.

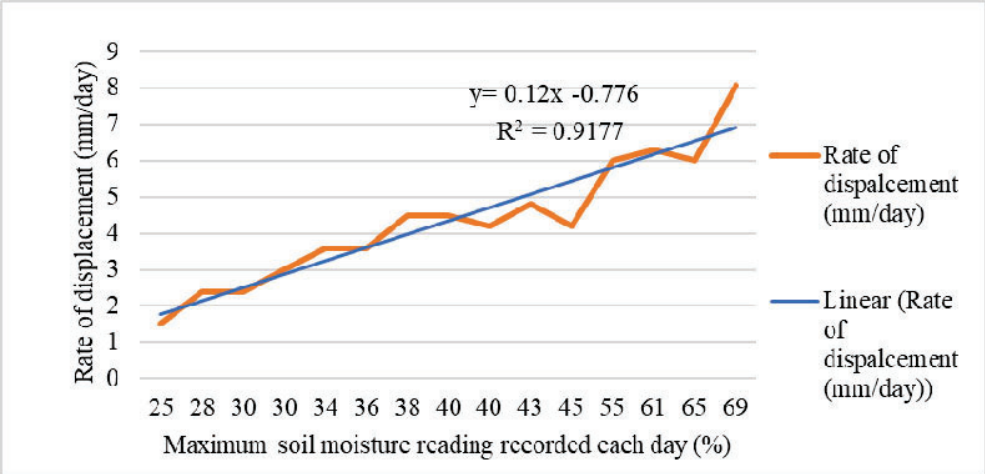


Figure 4.37 Effect of soil moisture on rate of displacement

As illustrated in Figure 4.38, The impact of blast vibration on the rate of displacement shows a sharper trend when the input vibration readings range from 9 to 28 Hz. According to the linear regression equation produced by this comparison, for 10, 15, 20 and 25 Hz of vibration, the rate displacement is found to be 1.96, 3.4, 4.85 and 6.3 respectively.

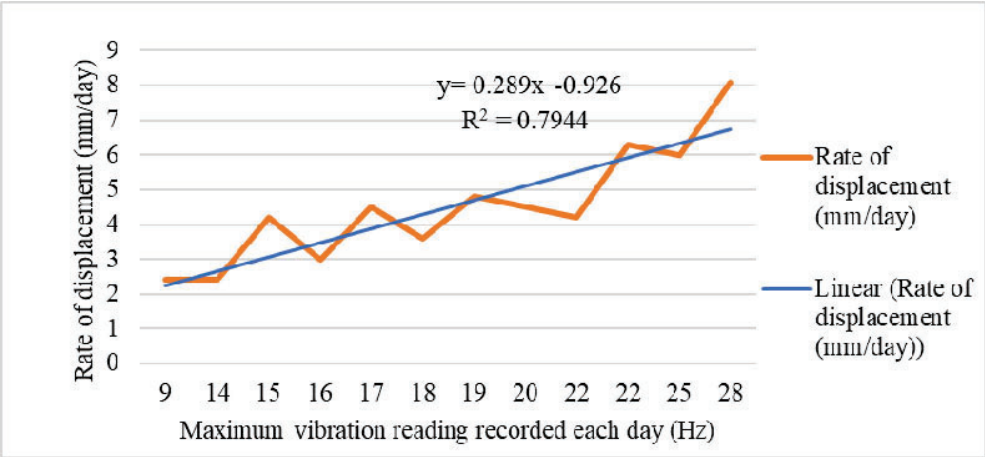


Figure 4.38 Effect of soil moisture on rate of displacement

The coefficient of soil moisture (a linear trend line) obtained from Figure 4.37 is '0.12', whereas in Figure 4.38 for vibration it is '0.30'. This comparison indicates that the impact of soil moisture on rate of displacement is lesser than the effect of vibration.

4.2.3.5 Numerical modeling study based on site condition

This section discusses the outcomes of the numerical modelling study conducted to analyze site-specific conditions of case study mine (SRP OC2). Figure 4.39 shows the FoS results obtained from Flac 2D yielding a value of 2.28. Meanwhile, Figure 4.40 shows the result of resultant displacement with a value of 54.70 mm.

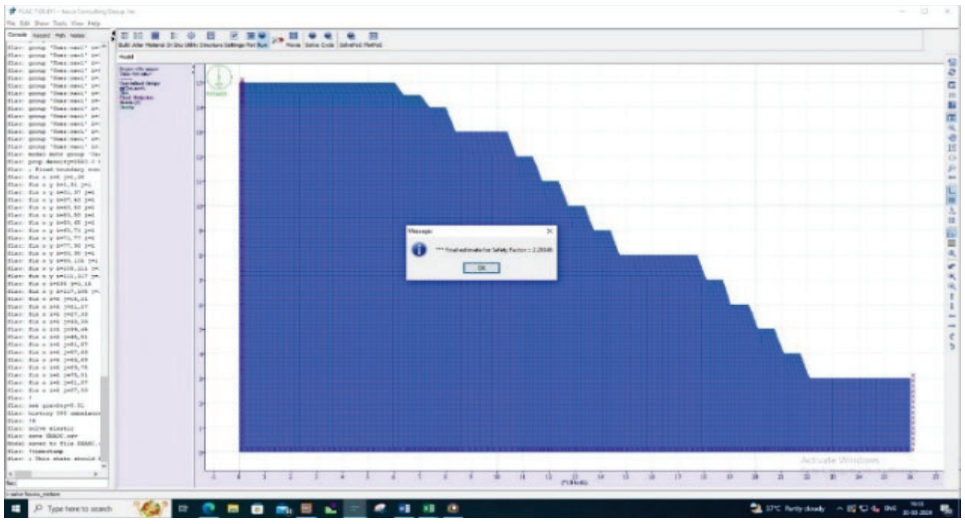


Figure 4.39 Site condition numerical model results for of FoS

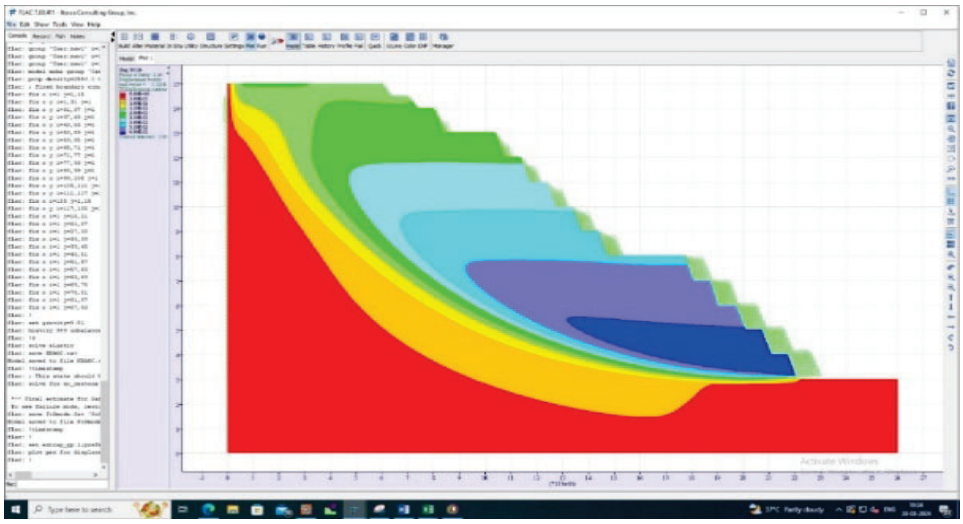


Figure 4.40 Site condition numerical model resultant displacement

Figure 4.41 shows the displacement at four locations where prisms and nodes were installed. The simulation results show displacement of 25.24 mm, 26.54 mm, 28.84 mm, and 32.26 mm on the 9th bench at node 1, 2, 3 and 4 locations respectively.

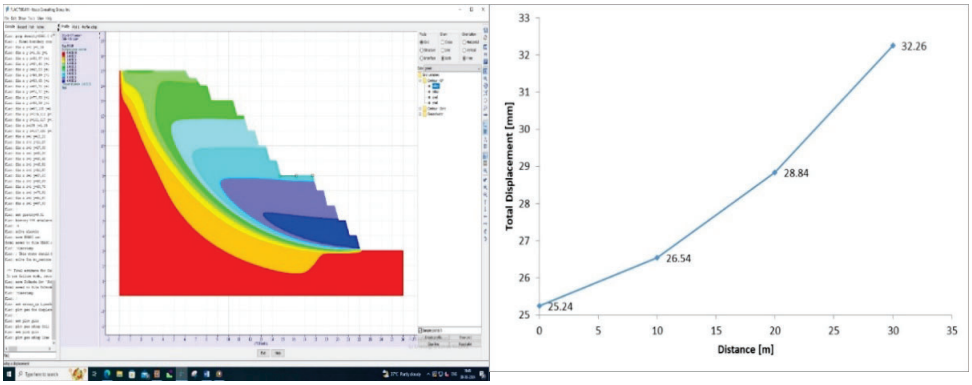


Figure 4.41 Displacement readings at sensors installation locations in the project

4.2.3.6 Comparison of field results with modeling results

Figure 4.42 provides a comparison of maximum displacement recorded by the sensor nodes with the readings observed by the total station and the readings derived from numerical model analysis. The x-axis represents the node locations and y-axis denotes slope displacement. The analysis of the data presented in the figure indicates a notable similarity in the displacement values obtained from all three systems. However, it is noteworthy that the readings from the numerical models exhibit a slight elevation at all node locations.

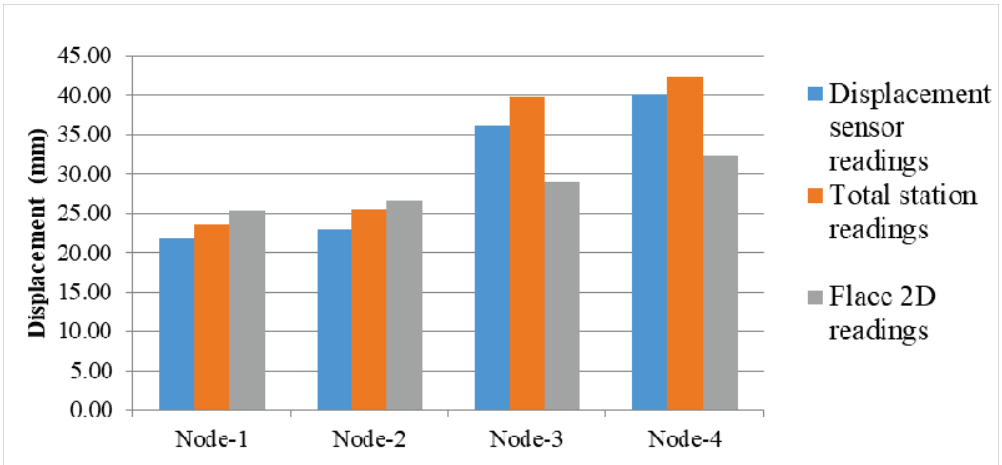


Figure 4.42 Comparison of displacement measured with Sensor, TS, and NMM

Table 4.12 provides the respective displacement readings recorded by the sensor nodes, total station and from numerical model analysis along with the percentage difference in displacement among them.

Table 4.12 Comparison of maximum displacement in slope by different modes

Sl. No.	Installed Nodes	Readings observed with displacement sensor (mm)	Readings observed with total station (mm)	Readings observed with Flac 2D (mm)	Difference in displacement b/w Sensor readings and Total station readings	Difference in displacement b/w Sensor readings and Flac 2D readings
1	Node-1	21.70	23.54	25.24	8.48	16.31
2	Node-2	22.90	25.46	26.54	11.18	15.90
3	Node-3	35.99	39.65	28.84	10.17	-19.87
4	Node-4	40.15	42.13	32.26	5.06	-19.55

The variation between WSN and TS is around 5.06% to 11.18%. The variation in between WSN and NMM is around -19.87% to 16.31%. However, the data obtained using WSN is in close to the other two methods, indicating WSN monitoring method is meaningful from the findings of this case study-3.

4.2.4 Summary of Case Study Mines Results Based on WSN

This section is dedicated to summarize the analysis of the sensor data obtained in field investigations. It is the most significant to understand the slope's behavior under site specific condition and other variable conditions such weather, blast vibration and external load on the bench. From the overall observation of the field data, it is obvious that the impact of soil moisture on the slope movement is higher than other parameters based on the analysis of rate of slope displacement and soil moisture content. It is also observed that effect of rain on the slope displacement is remarkable. Table 4.13 presents the variance due to the rain on average soil moisture and displacement of all three case studies. Nearly 60 to 70% more moisture content is recorded on rainy days. Regarding displacement, the variance ranges from 80 to 110%. An interpretation from the table defines that for case study (KTK OC2) has the highest sensitivity on slope displacement due to rain infiltration.

Table 4.13 Variance in average soil moisture and average displacement due to rain of each case study

Case studies	Average Soil Moisture (%)		Variance in soil moisture (%)	Average Displacement (mm)		Variance in displacement
	Dry day	Rainy day		Dry day	Rainy day	
KTK OC2	36.4	61	68	1.73	3.64	110%
KHA OC	43.81	69.8	59	1.71	3.1	81%
SRP OC2	42.04	70.5	68	1.88	3.4	81%

Table 4.14 shows the minimum, average and maximum sensor readings of soil moisture, displacement and vibration recorded during the measurement limited to the duration of measurement in each case study throughout the entire study period, and average rate of slope displacement per day is added in the last column in order to corelate the same. Case study KTK OC2 records the highest average rate of displacement per day of 7.12 mm/day, in correlation with least maximum soil moisture content of "75%" among all case studies. This is consistent with the previous findings of KTK OC2 mine being sensitive to rain infiltration on slope displacement. Case study KHA OC holds the record of highest average soil moisture content of "50%", with an average rate of displacement per day of "6.27 mm/day", which is also the least average rate of displacement as well. Case study SRP OC2 holds the record the highest soil moisture content measurement, with an average rate of displacement per day "6.57 mm/day". Regarding blast vibration although the highest vibration of "36Hz" is recorded in case study KTK OC2, the highest average vibration is found in case study KHA OC. Inference from the table shows that case study KHA OC has the least impact on slope displacement rate due to soil moisture and vibration when compared with other case studies.

Table 4.14 Minimum, average and maximum sensor readings of soil moisture, displacement and vibration sensor recorded in each case study

Case studies	Soil Moisture (%)			Displacement (mm)			Vibration (Hz)			Average rate of displacement per day
	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	
KTK OC2	23	44.6	75	0.7	2.73	6.2	0	16	36	7.12
KHA OC	25	50	78	0.8	2	4.1	0	19.5	28	6.27
SRP OC2	28	47.7	82	0.5	2.19	5.3	0	13.3	30	6.57

Subsequently, the next comparison highlights the effect of soil moisture and vibration on rate of slope displacement. In this analysis, the linear trend of increment of rate of displacement per day of each case is compared with each other. Figure 4.43 and 4.44 depicts the comparison of linear trend of rate of displacement (mm/day) of KTK OC2, KHA OC & SRP OC with respect to soil moisture and vibration respectively.

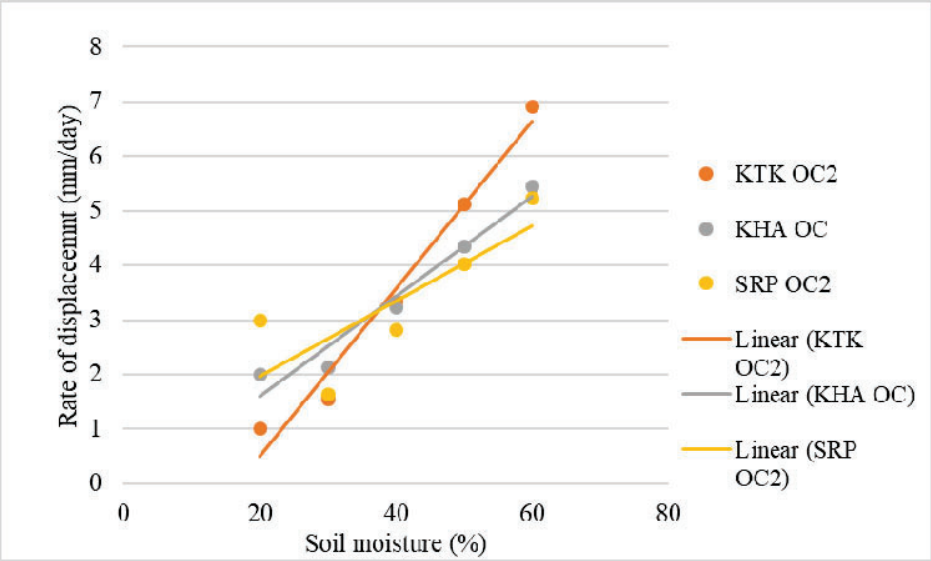


Figure 4.43 Comparison of increment of rate of displacement (mm/day) of KTK OC2, KHA OC & SRP OC2 case studies with respect to soil moisture (%)

Form the Figure 4.43, it can be noted that the linear trend of rate of increment of slope displacement (mm/day) is the steepest for the case study KTK OC2. A massive increment of 1 mm/day to 7 mm/day is observed while the soil moisture increased from 20 to 60%. At KHA OC, the increment is about 2 mm/day to 5.5 mm/day and for SRP OC it is 3 mm/day to 4.6mm/day recording the lowest increment in rate of displacement. Figure 4.44 displays the comparison of increment of rate of displacement (mm/day) of KTK OC2, KHA OC & SRP OC2 case studies with respect to vibration (Hz). Effect of increment of vibration has very low impact on rate of displacement (mm/day) at KTK OC2 case study, while the impact due to increment of soil moisture is high. Case study KHA OC and SRP OC2 shares same linear trend in rate of displacement (mm/day) against increment in vibration. Whereas, in these case studies the increment in rate of displacement is significant unlike case study KTK

OC2. Comparison of these linear trends of rate of displacement against soil moisture and vibration help to understand slope behavior. However, a linear regression analysis on the rate of displacement (mm/day) based on these comparison helps to predicts slope behavior on different conditions.

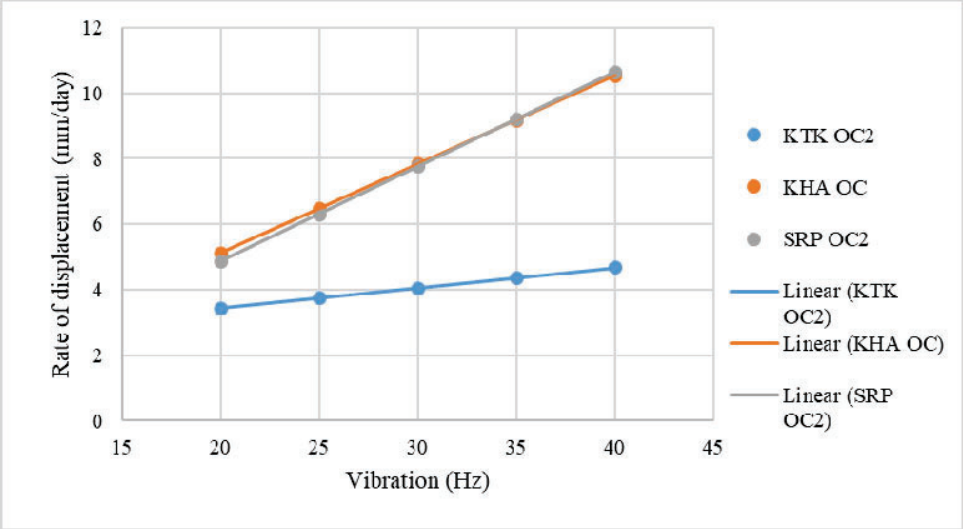


Figure 4.44 Comparison of increment of rate of displacement (mm/day) of KTK OC2, KHA OC & SRP OC2 case studies with respect to vibration (Hz)

Soil moisture and vibration sensor data obtained from the field investigations were subjected to linear regression analysis and a generalized linear regression equation is derived with an R^2 of 0.85. This equation helps to predict rate of displacement with respect to soil moisture and vibration values obtained at any certain instant. Table 4.15 outlines the notation of the parameters utilized in the equation. This segment of this section is directly related to the ultimate objective of development of TARP.

Rate of displacement (mm/day) = (0.0822 * **SM**) + (0.0946 * **VB**) – 0.97851

Table 4.15 Notation of the parameters utilized in the rate of displacement linear regression equation

SI. No	Notation	Parameter	Units
1	**SM**	Soil Moisture	Percentage
2	**VB**	Vibration	Hertz

4.3 Parametric Study Results

This section provides an in-depth discussion of the analysis conducted based on the results of parametric study. For parametric study analysis, depth of the opencast project considered is 100m, 150m, 200m, 250m and 300m, densities are 1500kg/m3, 1650 kg/m3, 1800 kg/m3, 1950 kg/m3, 2100 kg/m3, and 2250 kg/m3, 2400 kg/m3, and 2500 kg/m3, cohesion for the material is considered is 60kPa, 180kPa, 300kPa, 450kPa, and 600kPa, internal frictional angles are 22, 24, 26, 28, and 30 degrees, elastic modulus is 1, 2, 3, 4, and 5 GPa, and slope angles are 40, 45, 50, 55, 60,65 and 70 degrees, while conducting the analysis studies.

Results shows that even small variations in input parameters lead to considerable changes in the displacement and factor of safety values. The primary objective of this parametric study is to identify the most influencing factors that impact slope displacement and FOS, as well as to establish the relative significance of other parameters. To achieve this, the obtained results were analyzed in different ways. Each parameter was assessed one at a time to observe how a unit change in foresaid parameters affects slope displacement, with respect to mine depth and obtained inference are presented in the following sections.

4.3.1 Influence of density on slope displacement and factor of safety with respect to depth

Rock density plays a significant role in the strength properties of the rock mass, affecting factors such as cohesion and friction angle. Moreover, the density of the rock mass directly impacts the distribution of stress within the slope, with higher density rocks imposing greater self-load and consequently influencing slope stability. As the rock density increases, the self-load on the slope increases and resistive force decreases. densities increase displacement also increases at lowest and highest range of values rock properties and slope angles, while in case of factor of safety, density increases FoS shows a negative correlation with mine depth as shown in Figure 4.45.

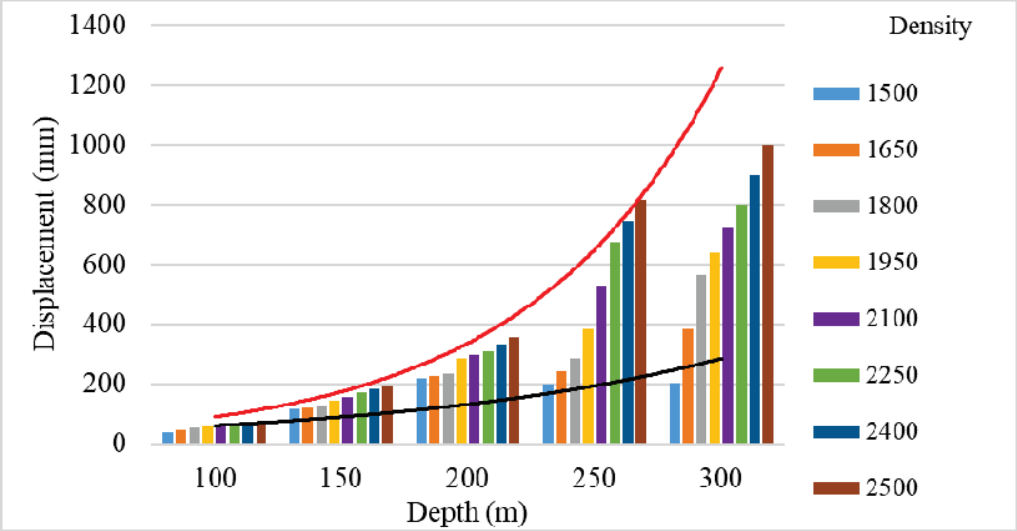


Figure 4.45 Displacement with varying depths at different densities

This analysis determines at a depth of 100m, the observed slope displacement ranges from 40 to 76 mm; while at 150 m, it spans from 118 to 195 mm; further at 200 m, the range extends from 218 to 357 mm, at 250 m, from 198 to 817 mm, and at 300 m, from 204 to 1000 mm. These observations suggest a positive correlation between mine depth and slope displacement. Moreover, a remarkable observation in the trend line plot, particularly when considering the lowest density value of 1500 kg/m^3 and the highest value of 2500 kg/m^3. It shows an exponential increase in slope displacement difference as mine depth increase within the highest and lowest rock densities. This observation explains a remarkable trend wherein mine slopes characterized by high-density rock formation exhibit an exponential increase in slope displacement with increasing mine depth. Figure 4.46, shows an inversely proportional relationship between mine depth and factor of safety.

Further, the comparison highlights factor of safety corresponding to rock density ranging from 1500 kg/m^3 to 2500 kg/m^3. At a depth of 100 m, the observed factor of safety ranges from 4.44 to 3.3; at 150 m; at 3.53 to 2.71; at 200 m, the range extends from 3.03 to 2.38, at 250 m; at 2.71 to 2.17, and at 300 m, from 2.5 to 2.03. These observations suggest a negative correlation between mine depth and factor of safety.

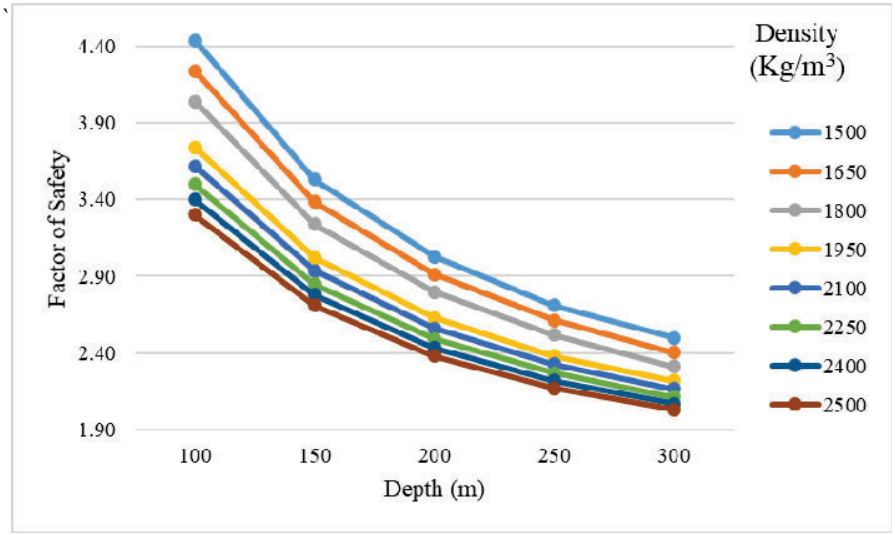


Figure 4.46 Factor of safety with varying depths at different densities

4.3.2 Influence of cohesion on slope displacement and factor of safety with respect to depth

Understanding the influence of rock cohesion is essential in slope stability analysis as it directly impacts the shear strength of the rock mass. Figure 4.47 shows, the influence of depth on slope displacement and FoS at varying cohesive strength. As cohesion increased, displacement shown a non-linear trend, cohesion increases, the resistive force of the slope also increases, leading to a higher factor of safety.

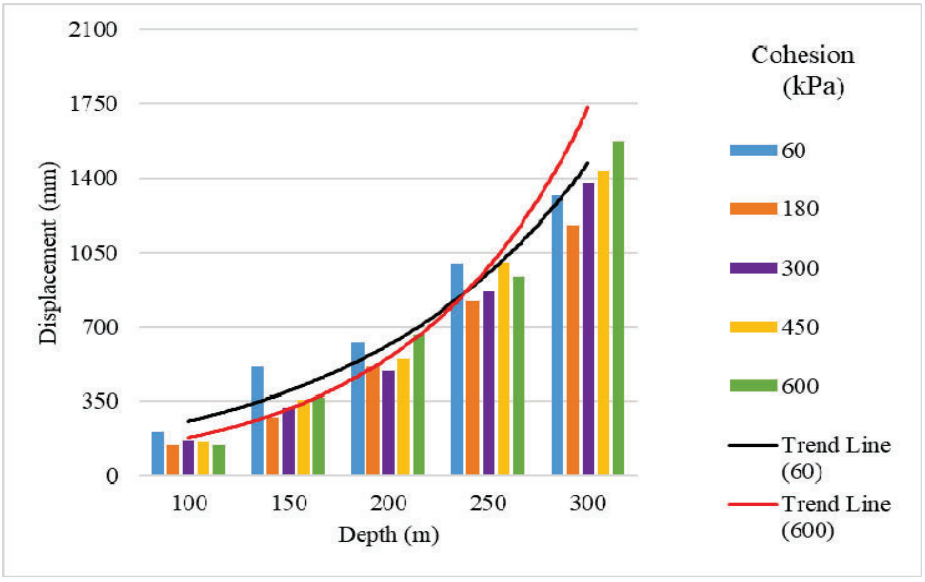


Figure 4.47 Displacement with varying depths at different cohesion

It is notable that slope displacement corresponding to varying cohesion values shows a minimal difference at lower mine depths, whereas at higher mine depths a remarkable difference is observed. at 100 m, the range is from 207 mm to 146 mm; at 150 m, it varies between 515 mm and 367 mm; at 200 m, it ranges from 629 mm to 666 mm; at 250 m, from 996 mm to 936 mm, and at 300 m, from 1318 mm to 1572 mm. From this analysis, it seems that the influence of cohesion on slope displacement is nonlinear. However, it is important to note that while cohesion may not play a significant role in slope displacement, it does strongly influence slope stability in the form of factor of safety, as discussed further below.

The results presented in Figure 4.48 provides a comparative analysis of influence of cohesion of FoS. This analysis attempts to understand the impact of the cohesive force of the mine slope on factor of safety.

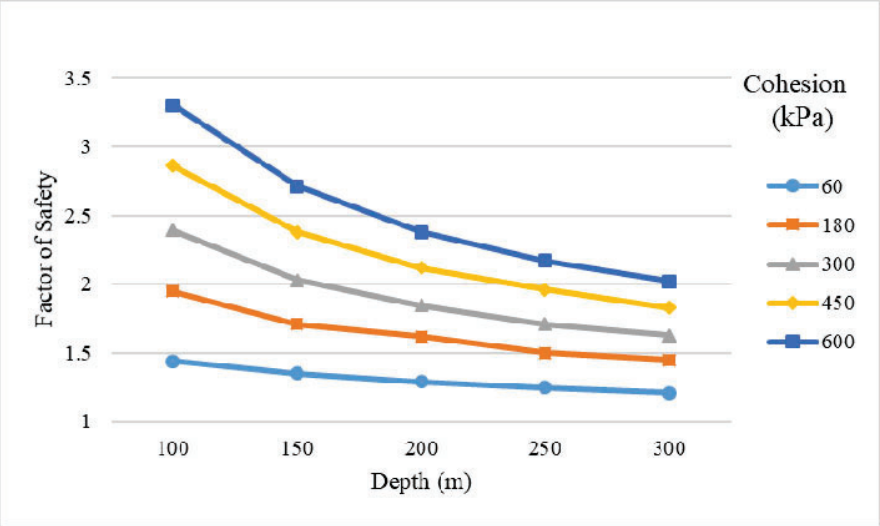


Figure 4.48 Factor of safety with varying depths at different cohesion

In consistent with previous findings, it is observed that FoS and mine depth exhibit an inverse relationship. Additionally, cohesion and FoS are likewise found to be inversely proportional. Higher cohesion values at lower depth exhibits higher FoS. At a depth of 100m, the observed factor of safety ranges from 1.44 to 3.3; at 150m; at 1.35 to 2.71; at 200m, the range extends from 1.29 to 2.38, at 250m; at 1.25 to 2.17, and at 300m, from 1.21 to 2.02.

4.3.3 Influence of friction angle on slope displacement and factor of safety with respect to depth

Slopes with higher internal angles of friction are less prone to failure. Figure 4.49 shows the trends in the displacement at different depths for various angle of internal friction. Similar to the influence of cohesion analysis, a non-linear trend in increment of slope displacement observed in this case.

According to Latha and Garaga (2010), a change in the shear strength indicates that a decrease in slope deformations is caused by an increase in the shear strength of the rock mass, with the fluctuation being extremely nonlinear. Shear strength of the low-quality rock mass will not be greatly reduced by an increase in shear strength.

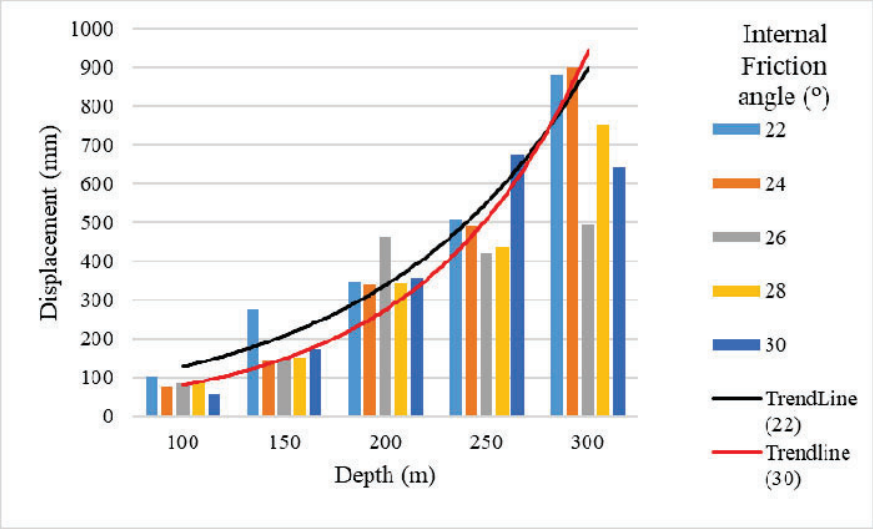


Figure 4.49 Displacement with varying depths at different internal friction angle

For instance, at a depth of 100 m, the observed slope displacement ranges from 103.5 mm to 57.75 mm, while at 150 m, it varies from 275 mm to 172.1 mm. At 200 m depth, the range extends from 343.3 mm to 357.3 mm, and at 250 m, from 507.2 mm to 675.8 mm. Finally, at 300 m, it ranges from 881.2 mm to 641 mm.

Figure 4.50 illustrates the analysis of influence of friction angle on FoS. It appears that there is an inverse relationship between the internal angle of friction and the FoS.

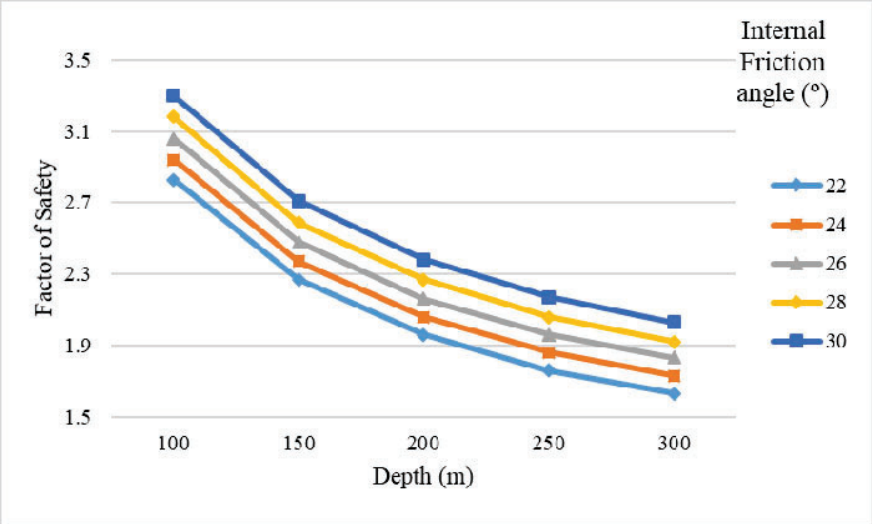


Figure 4.50 FoS with varying depths at different internal friction angle

Higher friction angle and lower depths correspond to higher FoS. At a depth of 100m, the observed factor of safety ranges from 1.44 to 3.3; at 150 m; at 1.35 to 2.71; at 200 m, the range extends from 1.29 to 2.38, at 250 m; at 1.25 to 2.17, and at 300 m, from 1.21 to 2.02.

4.3.4 Influence of elastic modulus on slope displacement and factor of safety with respect to depth

Elastic modulus or Young's modulus is a fundamental property of a rock. It refers to a measure of a rock's stiffness. Elastic modulus describes how a rock responds to the applied load. Figure 4.51 indicates, at lower elastic modulus values slope displacement is highest, especially at greater depths. It indicates an inverse relationship with the factor of safety.

While assessing the impact of rock density, cohesion, and friction angle, it was observed that slope displacement tends to decrease as resistive forces increase. However, in the case of elastic modulus, the trend appears to be in the opposite direction compared to previous conditions.

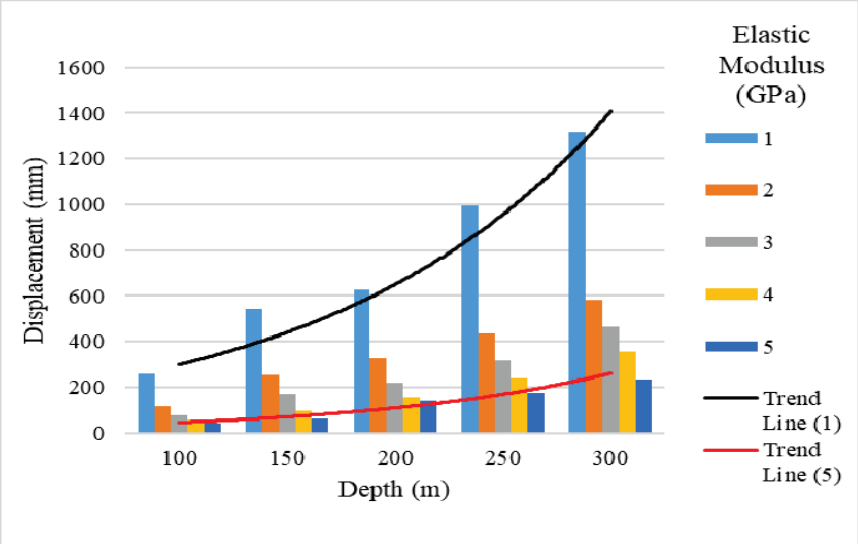


Figure 4.51 Displacement with varying depth at different elastic modulus

In Figure 4.51, the maximum displacement observed 1300 mm at 300 m depth with low elastic modulus, whereas. with high modulus observed less displacement. This indicates that at lower elastic modulus values, even with higher resistive forces, slope displacement is highest, especially at greater depths.

Figures 4.52 present the outcomes of an analysis conducted to assess the influence of the elastic modulus on the factor of safety of the slope. Observations from the graphs indicate an inverse relationship between the factor of safety and mine depth under both higher and lower elastic modulus conditions.

Additionally, it is evident that the elastic modulus has no discernible impact on the factor of safety in either condition. This can be attributed to the adoption of Mohr's Coulomb failure criteria in the numerical modeling parametric analysis of slope stability, where the elastic modulus is not considered as an influential parameter. However, in the context of slope displacement, the elastic modulus emerges as the most significant influencing factor based on observations.

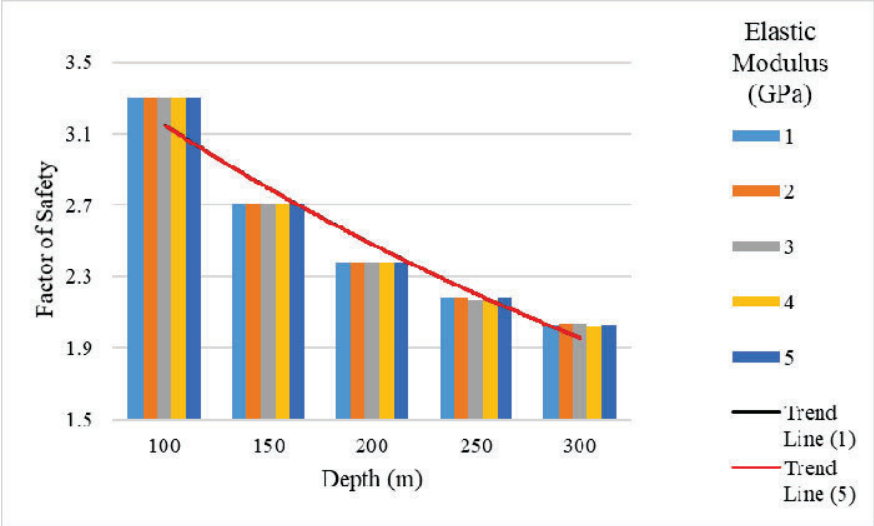


Figure 4.52 Factor of safety with varying depth at different elastic modulus

4.3.5 Relationship between slope displacement on factor of safety

The relationship between slope displacement and factor of safety, as determined by numerical modeling with multiple variable parameters influencing slope stability is shown in Figure 4.53.

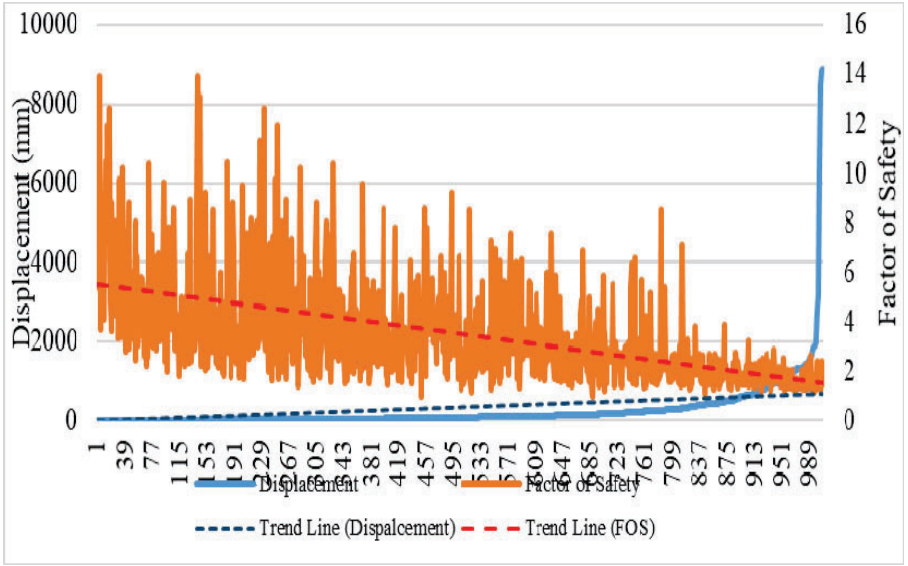


Figure 4.53 Relationship between slope displacement and factor of safety

Table 4.2 describes the relationship between the slope stability influencing parameters against displacement and factor of safety.

Table 4.16 Relationship between the slope stability influencing parameters against displacement and factor of safety

SI. No	Parameters		Displacement (mm)		Factor of safety	
1	Elastic modulus	↑	Inversely proportional	↓	No Impact	---
2	Internal angle of friction	↑	Non-linear	↓	Directly proportional	↑
3	Cohesion	↑	Non-linear	↓	Directly proportional	↑
4	Density	↑	Directly proportional	↑	Inversely proportional	↓
5	Slope angle	↑	Directly proportional	↑	Inversely proportional	↓
7	Mine Depth	↑	Directly proportional	↑	Inversely proportional	↓

4.3.6 Influence of various parameters on slope displacement and factor of safety

Regression analysis was used to determine the hierarchy of effects among the variable parameters used in the numerical modelling parametric study by calculating the standardized coefficients of each variable parameter on displacement and factor of safety. This analysis revealed that mine depth has the highest impact on slope displacement, followed by elastic modulus, density, cohesion, internal angle of friction and slope angle parameters. Regarding factor of safety, cohesion has the highest impact followed by mine depth, internal angle of friction, slope angle, density and elastic modulus. The obtained results from regression analysis on order of influence of slope displacement and factor of safety are presented in Table 4.17 and 4.18 respectively. These tables show the order of influence and the corresponding percentage of influence for each parameter derived from the regression analysis. Figures 4.54 and 4.55 shows the proportion of impact of these parameters on slope displacement and factor of safety respectively.

Table 4.17 Order of influence of various parameters obtained from regression analysis on displacement

SI. No	Parameter	Displacement (mm)			
		Un-Standardized Co-efficient	Standardized Co-efficient	Percentage of influence	Order of Influence
1	Mine Depth	3.50	0.94	63%	1
2	Elastic modulus	-30.60	0.24	16%	2
3	Density	0.04	0.16	11%	3
4	Cohesion	-0.25	0.07	5%	4
5	Angle of internal friction	-2.77	0.04	3%	5
6	Slope angle	0.72	0.04	2%	6

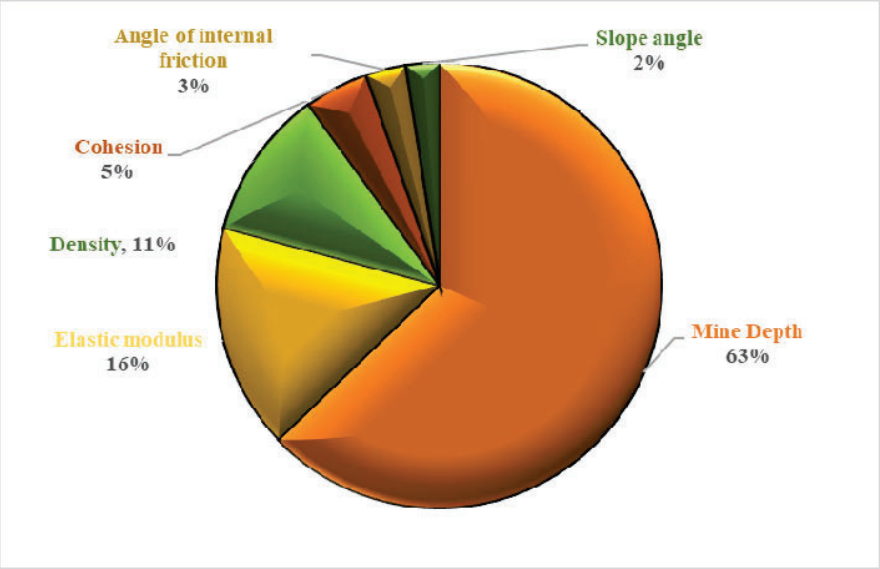


Figure 4.54 Percentage of impact of various parameters on slope displacement

Table 4.18 Order of influence of various parameters obtained from regression analysis on Factor of safety

SI. No	Parameter	Factor of Safety			
		Un-Standardized Co-efficient	Standardized Co-efficient	Percentage of influence	Order of Influence
1	Cohesion	0.0028	1.03	37.01%	1
2	Mine Depth	-0.0054	-0.76	27.15%	2
3	Angle of internal friction	-0.0150	-0.39	14.12%	3
4	Slope angle	0.0502	0.30	10.80%	4
5	Density	-0.0003	-0.24	8.75%	5
6	Elastic modulus	-0.0179	-0.06	2.18%	6

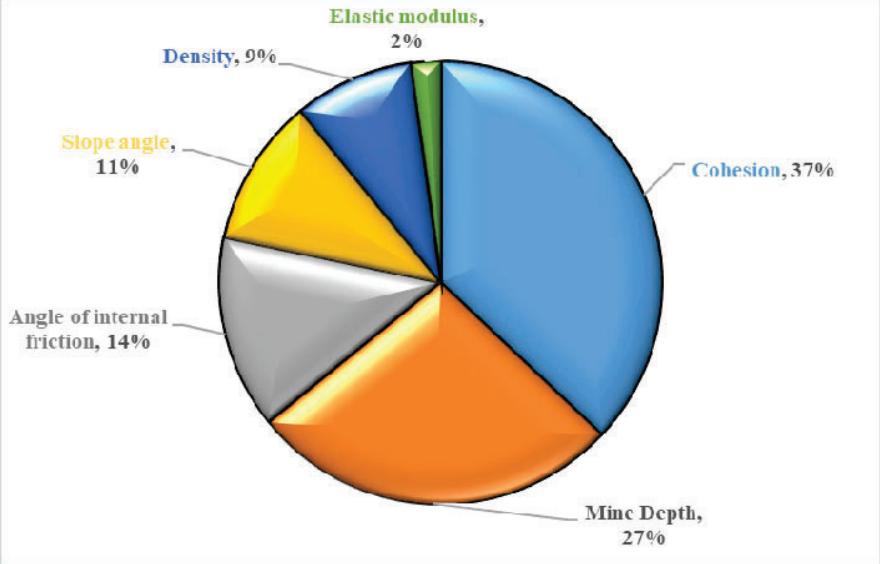


Figure 4.55 Percentage of impact of various parameters on factor of safety

4.3.7 Development of ASMS software for slope monitoring using python software

The regression analysis led to the formulation of relationships for slope displacement and factor of safety in relation to the mine depth, density, slope angle, friction angle, cohesion and elastic modulus, as expressed in the equations provided below. Table 4.19 outlines the parameters and its units of the notations used in the equation.

Displacement (mm) = (3.5*MD) + (-30.6* EM) +(0.04*D) + (-0.25*C) + (-2.77*F) + (0.72* SA) –16.32

Factor of Safety (FoS) = (0.0028 * C) + (-0.0054 * MD) +(-0.0150 * F) +(-0.0502 * SA) +(-0.0003 * D)+ (-0.0179*EM)+2.45

Rate of Displacement (mm/day) = (0.0822*SM)+(0.0946*VB)-0.97851

Table 4.19 Parameters and its units of the notation used in the equations

SI. No	Notation	Parameter	Units
1	MD	Mine Depth	Meters
2	SA	Slope Angle	Degree
3	D	Density	Kilogram per cubic meter
4	C	Cohesion	Kilo pascal
5	F	Internal Angle of Friction	Degree
6	EM	Elastic Modulus	Giga pascal
7	SM	Soil Moisture Sensor reading	Percentage
8	VB	Vibration Sensor reading	Hertz

These above equations are used to generate and analysis the trigger values or threshold values of TARP. It was delibrated to build a user-friendly software to forecast the expected slope displacement, FoS and rate of displacement based on the slope stiffness, strenght and design parameters. Figure 4.56 show the login page of the developed user-friendly software. Once the user has logged in using his credintials, the user is allowed to access the home page (Figure 4.57). At the home page, the user will be asked to entry the value of the input parameters. After the user has filled all the required fields, may click the “submit parameter” button provided right below the input lable. Then the expected rate of displaceemnt, slope total displacement and FoS will be displayed in the result lable.

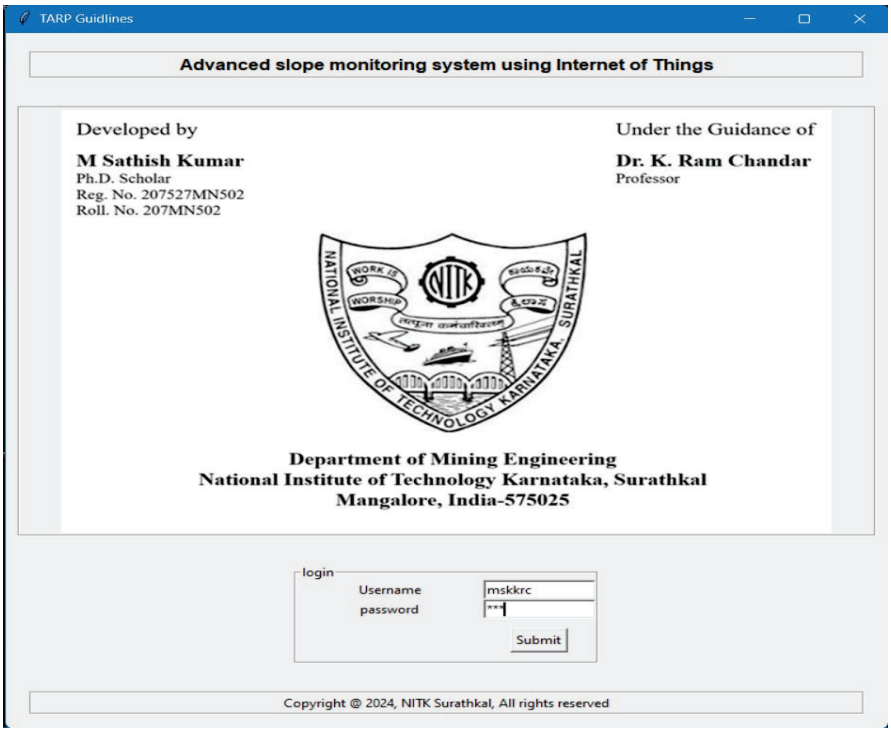


Figure 4.56 Login Page of software

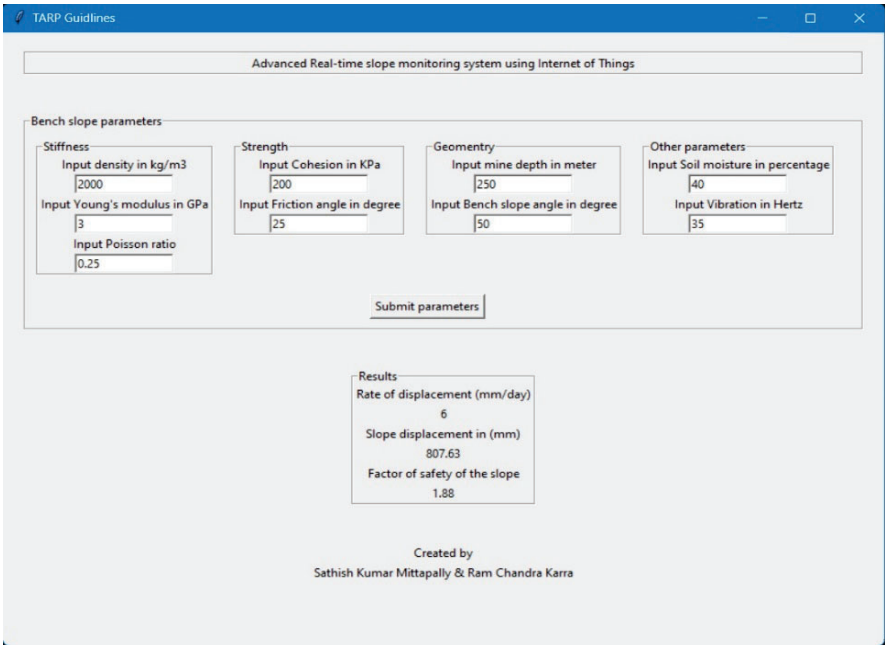


Figure 4.57 Software interface of home page

4.4 Formulation of TARP Guidelines

In opencast mining operations, TARP with varied levels are mandatory to implement the actions to be taken with regards to the slopes to safeguard the men and machinery. Different levels are suggested using rate of displacement, maximum displacement and factor of safety at the portion of the measurement based on the results of the investigations carried out in the different coal mines of SCCL in this study:

Wireless sensor networks linked with IoT and cloud computing technology, experimental studies were carried out in three case studies mine, and the results were presented as follows, at KTK OC2 recorded the highest average rate of displacement of 2.12 mm/day with a maximum displacement of 6.2 mm, in correlation with least maximum soil moisture content of "75%" among all case studies. Whereas at KHA OC holds the record of highest average soil moisture content of 50%, with an average rate of displacement of 3.27 mm/day with a maximum displacement of 4.1 mm, which is also the least average rate of displacement as well. At SRP OC2 holds the record of the highest maximum soil moisture content measured, with an average rate of displacement 3.57 mm/day with a maximum displacement of 5.3 mm.

Total station readings are instrumental in monitoring slopes and designing. The use of total station readings in this context involves the monitoring of displacement at various locations to detect potential slope instability at any location, allowing for timely action to prevent accidents or damage. Total station readings help in continuously comparing current conditions with the previous conditions. From the total station monitoring data and upon past slope failures histories, tension cracks are observed in all the case study mines once the displacement reaches 50 mm or more and failures have occurred after 100 mm, and moreover as per the total station monitoring system presently all the slopes at three mines are stable with below 50 mm cumulative readings as per the field investigations.

The following levels of various displacement ranges corresponding various range of factors of safety were observed (Table. 4.20), from the numerical modelling analysis, and were categorized based on actual field conditions on the current field scenarios

for all three case study mines, as well as based on the parametric study through numerical modelling:

Table. 4.20 Range of displacement (mm) corresponding to the factor of safety

Displacement (mm)	**Factor of Safety**
2.69 to 9.26	13.09 to 8.8.
10.33 to 47.31	6.75 to 5.65
60.08 to 95.04	1.96 to 1.34.
101.23 to 149.3	1.67 to 1.43.
156.2 to 234	1.35 to 1.01

The levels were fixed for various threshold values based on the experimental studies conducted with WSN, systematic monitoring with the total station, previous history of failures, and field condition based and parameters based numerical modelling studies in three mines in which studies have been carried out, so as to help the practicing engineer to take timely action to avoid accidents to persons and damage to the equipment.

With the help of the above investigations data related to the maximum displacement and factor of safety, Trigger Action Response Plan for SCCL mines of BPA, SRP and BHP area was formulated with 5 levels and indicated in the Table 4.20.

Table 4.21 Derived TARP Plan from the analysis conducted on three case studies

Rate of Slope movement (displacement - mm/day)	Total Slope movement (displacement-mm)	Levels of design	Suggested Monitoring Period	Suggested Monitoring Method	Action to be taken safe to continuous operations on the benches
< 0.3	< 10	Level 1	Weekly	Total Station	Routine operations
< 10	< 50	Level 2	Weekly	SSR & WSN based monitoring system	Indicates no failure & Routine operations can be continued
> 10 < 50	>50 <100	Level 3	Once in two days	SSR & WSN based monitoring system	Tension crack observed & Avoid movement of HEMM
>50 <100	>100 <150	Level 4	Daily	SSR & WSN based monitoring system	Indicates failure & Remove personnel and equipment
> 100	> 150	Level 5	Daily	SSR & WSN based monitoring system	Clear the vicinity & Adopt necessary reinforcement or remedial actions

Keeping safety in view, the highest of either the maximum of displacement or rate of displacement were considered for migration of a particular point from the present level to the subsequent level of danger i.e., if the maximum displacement crosses a prescribed threshold value the point will move to the subsequent higher level irrespective of rate of displacement reaches the threshold value or not. Similarly, the vice-versa is also considered i.e., if the maximum rate of displacement crosses the threshold value, move to higher level even though the maximum displacement doesn't, the point will move higher level.

4.5 Summary

In this chapter, the results and analysis of the laboratory investigations including the results of functions and performance evaluation of proposed system were provided. Following that, analysis of field investigations under each case study is presented, incorporating the analysis of total station readings from pervious slope failures and numerical models of the slope. Additionally, the parametric study results and evaluation of the influence of individual parameters were discussed. Finally, the development of ASMS software and guidelines for TARP were disclosed. In the next chapter, the conclusion derived based on the above results with recommendation for the future progress of the study is provided.

CHAPTER - 5

CHAPTER 5

5. CONCLUSIONS AND RECOMMENDATIONS

This chapter deals with conclusions drawn from the research studies, and recommendations made for future scope of work.

5.1 Conclusions

Based on the results obtained from the laboratory and field experiments and also through numerical modeling, the following conclusions are drawn.

5.1.1 Conclusions from development of advanced slope monitoring system

The study started with architecting a slope monitoring system that works on real-time basis using WSN, Cloud computing and IoT. Based on the literature review, it was absorbed that moisture content, vibration are the main reasons for slope displacement which is the most influential parameters that indicates slope behaviour. The best among the MEMS sensors available in the market were chosen to monitor the aforesaid parameters. Wireless modules ZigBee and LoRa were incorporated in the slope monitoring system design. Sensor data in real-time along with cloud computing technology was adopted to enable slope failure prediction and for giving early warning.

5.1.2 Conclusions from laboratory investigations

Calibration of the MEMS sensors with standard equipment following international standards was carried out. Linear regression equations were derived based on the sensors output to convert sensor values to moisture (%), vibration (Hz) and displacement (mm). Following that, laboratory experimentation were carried out to evaluate the applicability of the proposed advanced slope monitoring system design.

Results of the laboratory experimentation showed the reliability and versatility of the system to implement it in actual field investigations. The results from these exercises are listed below.

- For soil moisture sensor, the calibrated linear regression equation was y = -0.0995x+98.956, with R^2 of 0.99. For displacement and vibration sensors the results were, y = -0.0915x+90.306 and y = 0.9713x+8.2583 with R^2 of 0.99 and 0.92 respectively.
- In the laboratory experimentation, the soil moisture sensors recorded a maximum of 82% and minimum of 25%. Whereas the vibration sensor indicated minimum of 20 Hz and maximum of 80 Hz.
- In respect of displacement sensor, the maximum displacement without external load (i.e. gravity loading alone) was 0.25 mm, and with external load of 10 Kg, the maximum displacement recorded on the slope model was 5.3 mm.
- While evaluating the effect of soil moisture and vibration on the slope displacement, it was identified that the moisture content in the slope has more influence on slope displacement than vibrations.

5.1.3 Conclusions from field investigations

Field investigations were conducted in the Singareni Collieries Company Limited projects- Kakatiya Khani Opencast -2 Project (KTK OC-2), Khairagura Opencast Project (KHA OC), and Srirampur Opencast Project (SRP OC-2) in Telangana State, India. The Advanced slope monitoring system based on WSN was installed in the aforementioned case study mines and collected sensor data were subjected to different analysis while comparing the same with conventional total station readings being adopted in the mines and also numerical models generated representing the site conditions. These results were then articulated to formulate TARP, which ensure the safe working conditions. The key findings of the field investigations are listed below.

- Case study KTK OC2 recorded the maximum soil moisture content was 75%, the highest average rate of displacement 2.17 mm/day with a maximum displacement of 6.2 mm, and maximum vibration of 36 Hz.
- Case study KHA OC holds the highest maximum soil moisture content was 76%, the highest average rate of displacement 2.65 mm/day at

minimum soil moisture%, with a maximum displacement of 4.1 mm, and maximum vibration of 28 Hz.

- Case study SRP OC2 holds the highest maximum soil moisture content was 78%, the highest average rate of displacement 2.22 mm/day at minimum soil moisture%, with a maximum displacement of 5.3 mm, and maximum vibration of 28 Hz.
- In the analysis of rain water influence on slope behaviour, it was observed that nearly 70% moisture content was recorded on rainy days. As result, the slope displacement increased from 80 to 110% on rainy days.
- Since the sensor nodes were installed in the toe and crest regions of bench slope, a comparison is made to understand the slope behaviour in detail. It was found that, the difference in displacement in percentage between toe and crest ranged from 17 to 26% respectively, indicating that the crest exhibited greater displacement than the toe region for the same bench.
- Based on the total station monitoring upto a maximum of 50 mm displacement, slopes are stable, whereas between 50 mm to 100 mm cracks generated and from 100 mm to 150 mm potential failures were observed and when total displacement exceeding 150 mm failure have taken place.
- Comparisons of the results of Wireless Sensor Networks (WSN), Total Station (TS) and Numerical Modelling Methods (NMM) it was observed that WSN readings was significant with total station readings and reliable though used for TARP design.

5.1.4 Conclusions from numerical modelling parametric study

A wide range of factors, including rock density, elastic modulus, slope geometry, cohesion, and internal friction angle, impact the stability of a slope.

Numerical models were developed using Flac 2D software to simulate slope displacement and factor of safety for various conditions by varying density, cohesion, internal friction angle and Young's modulus. Total 1,220 models were developed by altering the above mentioned parameters. The crucial conclusions of numerical

modelling parametric study are given below.

- The relationship between slope displacement and factor of safety was found to be inversely proportional. Higher displacement values were observed at lower factor of safety and vice-versa.
- Influence of rock properties studies indicated that the density, slope angle, and mine depth were directly proportional, and elastic modulus was inversely proportional to the slope displacement. Cohesion and internal friction angle had non-linear impact on displacement.
- Internal friction angle and cohesion were directly proportional to FoS, while density, slope angle and mine depth were inversely proportional. Elastic modulus had no impact on factor of safety. The relationship between slope displacement and factor of safety is found to be inversely proportional.
- Influence of individual parameters in percentage on slope displacement is as follows, mine depth - 63% elastic modules - 16%, density – 11%, cohesion – 5%, friction – 3% and slope angle- 2%.
- Similarly, the relative influence on factor of safety were cohesion – 37%, mine depth – 27.15%, friction – 14.12%, slope angle - 10.8%, density – 8.75%, elastic modules – 2.18%.
- Regression analysis, developed an equation for displacement and FoS based on rock properties and slope geometry as input parameters. A generalized linear regression equation is derived with a R2 of 0.85.
- Using regression equations, the Advanced Slope Monitoring System (ASMS) software was developed to track the behaviour of slopes in opencast mines.

5.1.5 Developing alert message system

- During the field investigations, data on soil moisture percentage, vibrations, and displacement were recorded in the cloud-based platform Thingspeak. PhytonAnywhere software was then used to evaluate the data and produce the alarm messages.

- The advanced slope monitoring system was developed to send emails and SMS messages as soon as the soil moisture and displacement measurements exceeded 50% and 10 mm respectively or any other pre-fixed values.

5.1.6 Design and development of advanced slope monitoring system, embedded with alert messages and Trigger Action Response Plan (TARP)

Ultimately, results obtained from field investigations were put though linear regression analysis to derive a generalized regression equation that produces rate of displacement (mm/day), resultant displacement (mm) and factor of safety based on the real-time site condition of an open cast mine slope. A user-friendly offline software was developed incorporating the regression equations that calculates the afore mentioned results that correlates with predetermined levels in the developed TARP. The TARP developed in this study, based on the WSN and total station monitoring. Total station readings based on the data collected from slope failure history of case study mines. The author worked on the development of advanced slope monitoring system and provides email alerts on crucial conditions adopting user-friendly software that predicts rate of displacement (mm/day), resultant displacement (mm) and factor of safety in advance. TARP data sheet helps mine officials to predict slope behaviour much earlier and facilitate necessary action to avoid slope failure accidents.

TARP has been developed based on the field investigations of case study mines and different levels designed.

- Level 1, for displacement rates below 0.3 mm/day and total slope movement under 10 mm, recommends weekly monitoring.
- Level 2, rate of displacement below 10 mm/day and total displacement between 10 mm to 50 mm, suggests weekly monitoring with WSN-based system and slope indicates no tension crack.

- Level 3, for rate of displacement between 10 mm/day to 50 mm/day, and 50 mm to 100 mm total displacement, suggest monitoring every two days with WSN and slope indicates with tension crack.
- Level 4, rate of displacement between 50 mm/day to 100 mm/day, and total displacement between 100 mm to 150 mm recommends daily monitoring indicating potential failure.
- Level 5, rate of displacement exceeding 100 mm/day and total displacement exceeding 150 mm failure takes place and suggesting clearing the area.

5.2 Recommendations

The following suggestions are made for future research.

- In the present study, Zigbee/LoRa based MEMS sensors was used to measure the displacement and other parameters on the slope. In future work, it may be extended to usage of the large-scale industrial sensors for slope monitoring, offering increased accuracy, higher sensitivity, broader coverage, and robust construction.
- Slope stability and slope movement was monitored in this study by several parameters, indicating like moisture content and vibrations. In future studies, the monitoring of slopes can be enhanced by increasing the number of parameters.
- Currently, numerical modelling studies were exclusively conducted on the highwall side of the project, without accounting for naturally occurring geological disturbances, primarily due to constraints posed by the numerical modelling software utilized. Numerical modelling studies can be enhanced by including faults, joints, discontinuities, and heterogeneity within the study area, for more accurate results using appropriate software.

5.3 Limitations of the Study

The following limitations are present in this research study.

Currently, there are no established Trigger Action Response Plan (TARP) guidelines for slope monitoring in opencast mines for opencast coal mines. To address this gap, the scholar initiated research aimed at developing such guidelines for displacement monitoring of opencast slope of India, as other country guidelines couldn't be adopted as all are site specific.

Micro Electro Mechanical Systems (MEMS) sensors were chosen for this study due to their cost-effectiveness, and reliability of the results were verified with Total station readings. Whereas, MEMS sensors are not so robust and hence have been used for a period of research study under close supervision to ensure that they are not damaged during use. Industrial sensors are more robust and hence can be used for long duration in the field monitoring under adverse conditions.

Free platforms, with limited features, were utilized to generate alert messages regarding slope condition at constant intervals of time which can be varied. Whereas subscribed platforms have more features like varying the duration of intervals.

The parametric study, conducted through numerical modelling was focused on assessing the impact of rock properties and key strength parameters such as density, cohesion, internal friction angle, and Young's modulus. Additionally, controllable factors like overall slope angle, bench height, bench width, and slope angle were analyzed, as they were identified as critical contributors to slope instability. However, other variables, such as geological features (e.g., joints, discontinuities, faults, folds) and the influence of weather conditions, rainfall intensity, were not included in this study but are recommended for future research.

REFERENCES

REFERNCES

Abbas, J. M. (2015). “2D-FEM for assessment of slope stability.” Diyala J. Eng. Sci., 8(2), 84-98.

Abebe, D. G. (2020). “Determination of effect of moisture content and density on shear strength parameters and slope stability of highly plastic silt embackment soil (the case of Wozeka-Gidole Road).” Int. Res. J. Eng. Tech., 7(8), 2333-2346.

Abramson, L. W., Lee, T. S., Sharma, S. and Boyce, G. (2002). “Slope Stabilization and Stabilization Methods.” John Wiley & Sons, Inc. 2nd eds. Londan, UK.

Akgul, B. A., Hasoglu, M. F. and Haznedar, B. (2018). Inverstigation and Implementation Ultra-Low Power PIC-Based Sensor Node Network with Renewable Energy Source and Decision-Making Unit. “wireless sensor network”, 10(2): 41-58.

Anderson, N., and Welch, D. (2000). “Practical applications of time-domain reflectometry (TDR) to monitor and analyze soil and rock slopes.” *Geotec. Meas.,* 1(1), 65–79.

Angeli, D., Sontag, E. D. and Wang, Y. (2000). “A Characterization of Integral Input-to-State stability.” *IEEE Trans. Autom. Control*, 45(6), 1082–1097.

Augustin, A., Yi, J., Clausen, T. and Townsley, W. M. (2016). “A study of LoRa: Long Range and Low Power Networks for the Internet of Things”. *Sensors*, 16(9): 1466.

Azharudin M. A. A. and Daud, N. N. N. (2022). “Vibration effects on soil slope detected by using Arduino System.” *IOP conf. ser.: Earth Environ. Sci.,* The 9th AUN/SEED -Net regional conference on Natural Disaster, Vol 1091.

Bakken, K. M., Chapin, G.K. and Abrahams, M. G. (2020). “Trigger action response plan development and optimization at the Bingham Canyon Mine”.

Slope Stability 2020. *Proc., Int. Symp. on Slope Stability in Open pit Mining and Civil Eng*. Australian Centre for Geomechanics, Perth, Australia.

Behr, C. J., Kumar, A. and Hancke, G. P. (2016). "A smart helmet for air quality and hazardous event detection for the mining industry." *IEEE Int. Conf. Indus. Tech.* (ICIT). Orlando, FL, USA., 2026–2031.

Belle, B. and Cliff, D. (2018). "Improved TARP development based upon mine specific data." *Int. J. Mining Sci. Tech*., 28(3), 477–481.

Bhardwaj, R. B. (2021). "Landslide detection system: Based on IoT." *Int. J. Scientific Res. Development*, 9(1), 54 – 59.

Bicocchi, G., Tofani, V., Ambrosio, M. D'., Tacconi-stefanelli, C., Vannocci, P., Casagli, N., Lavorini, g., Trevisani, M. and Catani, F. (2019). "Geotechnical and hydrological characterization of hillslope deposits for regional landslide prediction modeling," *Bull. Eng. Geo. Environ.*, 78, 4875-4891.

Bond, J., Kim, D., Chrzanowski, A. and Szostak-Chrzanowski, A. (2007). "Development of a fully automated, GPS based monitoring system for disaster prevention and emergency preparedness: PPMS+RT." *Sens.*, 7(7) 1028–1046.

Bovolenta, R., Iacopino, A., Passalacqua, R. and Federici, B. (2020). "Field measurements of soil water content at shallow depths for landslide monitoring". *Geosci.,* 10, 409.

Brawner, C. O. (1982). "Control of Groundwater in Surface Mining." *Int. J. Mine Water*, 1(1), 1-16.

Brox, D. and Newcomen, W. (2003). "Utilizing strain criteria to predict highwall stability performance." *ISRM 2003- Tech. Roadmap for Rock Mech*., South Arican Insitute of Mining and Metallurgy. 1-4.

Cahe, B. G., and M.I. Kim. (1986). "Suggestion of a method for landslide early warning using the change in the volumetric water content gradient dye to rainfall infiltration." *Environmental earth sciences* 66:1973 – 1986.

Cai, M., Kaiser, P. K., and Martin, C. D. (2001). "Quantification of rock mass damage in underground excavations from microseismic event monitoring." *Int. J. Rock Mech. Min. Sci.*, 38(8), 1135–1145.

Cala, M., Jakobczyk, J. and Cyran, K. (2016). Inclinometer monitoring system for stability analysis: the western slope of the Belchatow field case study." *Studia Geotechnica et Mechanica*, 38(2), 3-13.

Cawood, F. T. and Stacey, T. R. (2006). "Survey and geotechnical slope monitoring considerations." *J. South African Inst. of Min. Metal.,* 106, 495-502.

Chandarana, U. P., Momayez, M. and Taylor, K. W. (2016). "Monitoring and predicating slope instability: A review of current practices from a mining perspective." *Int. J. Res. Eng. Tech*., 5(11), 139-151.

Chang, D. T. T., Tsai, Y. S. and Yang, K. C. (2013). "Study of real-time slope stability monitoring system using wireless sensor network." *Telkomnika*, 11(3), 1478-1488.

Chaulya, S. K. (1993). "Estimation of dump stability of an opencast mine dump," M. Tech. thesis, Department of Mining Engineering, Institute Technology, Banaras Hindu university, Varanasi, India.

Chaulya, S. K. and Prasad, G. M. (2016). "Slope failure mechanism and monitoring techniques" *Sensing and Monitoring Technologies for Mines and Hazardous Areas*, Elsevier Inc. Amsterdam.

Ciampalini, A., Farina, P., Lombardi, L., Nocentini, M., Taurino, V., Guidi, R., Pina, F. D. and Tavarini, D. (2021). "Integration of Satellite InSAR with a Wireless Network of Geotechnical Sensors for Slope Monitoring in Urban Areas: The Pariana Landslide Case (Massa, Italy)." Multitemporal Remote Sensing: Methods and Application for Geomorphology and Engineering Geology, *Remote Sensing*. 13(13), 2534–2535.

Cliff, D. (2009). “Trigger Action Response Plans (TARPs) in underground coal mines-tips, tricks and pitfalls.” *Proc. Queensland Mining Industry Health and Safety Conf*. Australia.

Coal Mine Regulation of India (2017).
https://www.dgms.net/Coal%20Mines%20Regulation%202017.pdf

Coetsee, S., Armstrong, R. and Terbrugge, P. (2020). “The use of strain threshold in slope stability trigger action response plans.” Slope Stability 2020. *Proc., Int. Symp. on Slope Stability in Open pit Mining and Civil Eng*. Australian Centre for Geomechanics, Perth, Australia. 339–352.

Crescenzoa, G. D. and Santo, A. (2007). “High-resolution mapping of rock fall instability through the integration of photogrammetric, geomorphological and engineering–geological surveys.” *Quaternary Int*., 171–172, 118–130.

David, F. (2002). “Essentials of soil mechanics and foundations: basic geotechnics.” 6th edition. Pearson College, Upper Sadiel River, New Jersey, USA.

De Blasio, F. V. (2011). “Introduction to the physics of landslide: lecture notes on the dynamics of mass wasting.” Chapter 2 Friction, Cohesion, and slope stability. *Springer Link*, Manhattan, New York. 23-52.

DGMS (Tech) (2020a). “Guidelines for Systematic Monitoring of slopes in Opencast Coal and metalliferous Mines.” Circular no. 2, Ministry of Labour and Employment. Government of India.
https://www.dgms.gov.in/writereaddata/UploadFile/DGMS%20(Tech)%20
(Aug.25. 2020).

DGMS (Tech) (2020b). “Guidelines for Scientific study under Regulation 106 of Coal Mines Regulation, 2017.” Circular no. 3, Ministry of Labour and Employment. Government of India.
https://www.dgms.gov.in/writereaddata/UploadFile/DGMS(Tech)%20.
(Aug.25. 2020).

Dick, G. J., Eberhardt, E., Cabrejo-Lievano, A. G., Stead, D. and Rose, N. D. (2013). "Development of an early-warning time-of-failure analysis methodology for open-pit mine slopes utilizing ground-based slope stability radar monitoring data." *Can. Geotech. J.,* 52(2013), 512-529

Ding, X. and Qin, H. (2000). "Geotechnical Instruments in Structural Monitoring." *J. Geospatial. Eng.*, 2(2), 45-56.

Ding, X., Montgomery, S. B., Tsakiri, M., Swindells, C. F. and Jewell, R. J. (1998). "Integrated monitoring systems for open pit wall deformation." Report No. 186. *Minerals and Energy Research Institute of Western Australia*, Perth, 1–186.

Dixon, T. H. (1991). "An Introduction to the Global Positioning system and some geological applications." *Rev. Geophy.*, 29(2), 249–276.

Dorthi, K and Chandar, K. R. (2018). "Slope stability monitoring in opencast coal mine based on wireless data acquisition system - a case study." *Int. J. Eng. Tech.,* 7(2.21), 24-28.

Dorthi, K., Bayyapu, N. and Chandar, K. R. (2020). "Zigbee Based Wireless Data Acquisition System for Monitoring of Partition Stability above old Underground Coal workings." *Arab. J. Geosci*. 13, 307.

Dowding, C. H., Nicholson, G. A., Taylor, P. A., Agoston, A. and Pierce, C. E. (1996). "Recent advancements in TDR monitoring of ground water levels and piezometric pressures." *Proc. 2nd North American Symp. Rock Mech. Tools and Techniq*., Montreal, Quebec, Canada.

Dunnicliff. J. (1988). "Geotechnical Instrumentation for Monitoring Field Performance." National Cooperative Highway Research Program. Transportation Research Board National Academy of Sciences 2101 Constitution Avenue, N.W. Washington, D.C. 20418.

Dunnicliff, J., John, B., Tim, C., Hilary, S. and Michael, B. (2012). “Chapter 95 Types of Geotechnical Instrumentation and Their Usage.” *ICE Manual Geotech.l Eng.*, ICE Publishing, 2, 1379-1403.

Engineering discoveries, (2024). Introduction to the total station. https://engineeringdiscoveries.com/total-station-advantages-disadvantages-and-precaution/ (15th September 2024)

Farrington, S. P. and Sargrand, S. M. (2006). “Advanced processing of Time Domain Reflectometry for improved slope stability monitoring.” *Geotech. Eng. Info. Tech. Age.*, Georgia, 1-8.

Firpo, G, Salvini, R, Francioni, M and Ranjith, P.G. (2011). “Use of Digital Terrestrial Photogrammetry in rocky slope stability analysis by Distinct Elements Numerical Methods.” *Int. J. Rock Mech. Min. Sci.,* 48(7), 1045–1054.

Fleurisson, J. A. (2012). “Slope design and Implementation in open pit mine: Geological and geomechanical approach.” *Procedia Eng*., 46(2012), 27-38.

Fukuzono, T. (1985). “A new method for predicting the failure time of a slope.” Proc. 4th Int. Conf. Field workshop on landslides, Tokyo. 145-150.

Geo engineer, (2023). “Open-pit coal mine collapse in china.” https://www.geoengineer.org/news/open-pit-coal-mine-collapse-in-china#:~:text=An%20open%2Dpit%20coal%20mine,and%2047%20more%20going%20missing (Mar. 5, 2023)

Ghazali, M. H. M. and Rahiman, W. (2022). “An Investigationof the Reliability of Different Types of Sensors in the Real-Time Vibration_Based Anomaly Inspection in Drone.” *Sensors*, 22(16), 6015.

Geotronics, 2021. Carlson Quarryman Pro. https://geotronics.com.pl/produkty-i-rozwiazania/skanowanie-laserowe-3d/carlson-quarryman-pro/ (15th September 2024).

Girard, J. M. (2001). “Assessing and monitoring open pit mine highwalls.” *Proc. 32nd Annu. Inst. Mining Health, Safety and Res.,* Roanoke.

Girard, J. M., Mayerle, R. T. and McHugh, E. L. (1998). “Advances in remote sensing techniques for monitoring rock falls and slope failures.” *Proc. 17th Int. Conf. Ground Control in Mining,* Washington, United States. 326-331.

Girard, J. and McHugh, E. (2000). “Detecting Problems With Mine Slope Stability.” Proceedings of Thirty-first Annual Institute on Mining Health, Safety and Research, Roanoke, Virgina. Bockosh GR, Karmis M, Langton J, McCarter MK, Rowe B, Eds. Blacksburg, VA: Virginia Polytechnic Institute of State Univeristy. 147-155.

Gundewar, C. S. (2014). “Application of rock mechanics in surface and underground mining.” *Indian Bureau of Mines*, Ministry of Mines, Government of India.

Gutierrez, J. A., Callaway, E. H. and Barrett, R. L. (2004). “Low-Rate Wireless Personal Area Networks Enabling Wireless Sensors with IEEE 802.15.4.” *Wiley-IEEE standards Association*. Piscataway.

Hammah, R. E., Yacoub, T. E., Corkum, B., Wibowo, F. and Curran, J. H. (2007). “Analysis of blocky rock slopes with finite element shear strength reduction analysis.” *Proc. 1st CanadaUS Rock Mech. Symp.,* Vancouver, Canada, 329-33.

Haneberg, W. C. (2008). “Using close range terrestrial digital photogrammetry for 3-D rock slope modeling and discontinuity mapping in the United States, *Bull. Eng. Geo. Environ*., 67, 457–469.

Harries, N. J. and Roberts, H. (2007). “The use of Slope Stability Radar (SSR) in managing slope instability hazards.” *Proc. 1st CanadaUS Rock Mech. Symp.,* Vancouver, Canada.

Harries, N. Noon, D. and Pritchett, H. (2009). “Slope stability radar for managing rock fall risks in open cut mines.” *Proc. 3rd CANUS Rock Mech. Symp.,* Toronto. 1-8.

Hudson, J. A. and Harrison, J. P. (1997). “Engineering Rock Mechanics: An introduction to the principles.” *Elsevier Science*, reprint, eds., Cambridge, Massachusetts, 444-445.

Idris, A., Hafez, M. A., Sidek, N., Zailani, W. W. A. and Baharuddin, N. A. Z. M. (2022). “Smart monitoring and warning landslide system using internet of things.” *Math. Statistician Eng. Appl.*, 71(4), 7226-7238.

India Today (2022). “8 labourers killed in stone quarry collapse in Mizoram.” https://www.indiatoday.in/india/story/mizoram-stone-quarry-collapse-labourers-killed-rescue-operation-underway-2297361-2022-11-15 (Mar. 5, 2023).

Jaboyedoff, M., Oppikofer, T., Abellan, A., Derron, M. -H., Loye, A., Metzger, R., and Pedrazzini, A. (2012). “Use of LIDAR in landslide investigations: a review.” *Nat Hazards*, 61(1), 5–28.

Jawalkar, M., Malviya, N., Hage, P., Chakule, S. and Pattewar, P. (2022). “IoT based landslide detection and monitoring system.” *Int. J. Res. Appl. Sci. Eng. Tech*., 10(5), 3396-3399.

Jayanthu. S. and Kathik, G. (2017). “Development of effective technology for online slope monitoring in opencast mines – R&D iniitative.” *Workshop on emerging mining technologies and low-carbon footprints with waste management*, Vigyan Bhawan, New Delhi, India.

Jeong, S., Junyoung Ko, and Kim, J. (2019). “The effectiveness of a wireless sensor network system for landslide monitoring.” IEEE Access, 8, 8073–8086.

Jha, A. and Tukkaraja, P. (2020). “Monitoring and assessment of underground climatic conditions using sensors and GIS tools.” *Int. J. Min. Sci. Tech*., 30(4), 495-499.

Jooste, M. A. and Cawood, F. T. (2006). "Survey slope stability monitoring: Lessons from Venetia diamond mine." *Int. Symp. Stab. Rock Slopes Open Pit Min. Civ. Eng.*, The South African Institute of Mining and Metallurgy. 361-374.

Kaab, A. (2002). "Monitoring high-mountain terrain deformation from repeated air- and space-borne optical data: examples using digital aerial imagery and ASTER data." *ISPRS J. Photo. Remote Sens*., 57(1-2), 39-52.

Kane, W. F., and Beck, T. J. (1994). "Development of a time-domain reflectometry system to monitor landslide activity." *Proc. 45th Highway Geo. Symp.,* Portland, Oregon.

Karthik, G., Jayanthu, S., Patil, B. N. and Prashanth, R. (2016). "Laboratory and field investigations on XBEE module and its effectiveness for transmission of slope monitoring data in mines." *Int. J. Elect. and Electron. Eng*., 8(2), 349-355.

Kayesa, G. (2006). "Prediction of slope failure at Letlhakane Mine with the Geomos Slope Monitoring System." *Proc. Int. Symp. Stab. Rock Slopes in Open Pit Mining and Civ. Eng.,* The South African Institute of Mining and Metallurgy. 605–622.

Kemeny, J and Post, R. (2003). "Estimating three-dimensional rock discontinuity orientation from digital images of fracture traces." Comp. Geosci., 29(1), 65–77.

Khan, R., Khan, S. U., Zaheer, R., & Khan, S. (2012). "Future Internet: The Internet of things architecture, possible applications, and key challenges." *Proc. 10th Int. Conf. Front. Inf. Tech.*, Queen's University, Belfast. 257–260.

Kim, K. S and Song, Y. S. (2015). "Geometrical and geotechnical characteristics of landslide in Korea under various geological conditions." *J. Mountain Sci*., 12, 1267-1280.

Kim, K. T. and Han J. G. (2008). "Design and implementation of a real-time slope monitoring system based on ubiquitous sensor network." *25th Int. Symp. Autom. Robotics Construction*, Lithuania. 330-336.

Koha, V. V. and Takayama, S. (2018). “Wireless sensor network in landslide monitoring system with remote data management.” *Meas*., 11(1), 214-229.

Kumar, A. and Rathee, R. (2017). “Monitoring and evaluating of slope stability for setting out of ctitical limit at slope stability radar.” *Int. J. Geo-Eng*., 8(18), 1-16.

Kumar, A., Raj, E. D., Renaldy, A. and Srinivasan, V (2007). Recent developments in openpit slope monitoring, ResearchGate.

Kumar, M. S. and Kumar M. R. (2022). “Factors Affecting Slope Stability of an opeencast Mine: A Bried Study.” *Int. J. Innov. Sci. Res. Tech.,* 7(4), 878-882.

Kumar, V. and Prakash, V. (2015). “A model study of slope stability in mines situated in south India.” *Adv. Appl. Sci. Res.,* 6(8), 82-90.

Lambe, W. T., and Whitman, R. V. (1979). “Soil Mechanics.” *John wiley and Sons,* New York.

Lamotte, M., A. Bruand, and G. Pedro (1997). “Towards the hardening of sandy soils: a natural evolution in semi-arid tropics.” *Earth and Planetary Science 325* (8): 577 – 584.

Laplante, J. P. (1998). “Instrumentation to monitor building damage from excavation induced ground movement.” Ph.D thesis, Massachusetts Inst. Tech., United States.

Latha, G.M. and Garaga, A. (2010). “Seismic Stability Analysis of a Himalayan Rock Slope.” *Rock Mech. and Rock Eng*, 43: 831-843.

Legg, M., Slosson, J., Eguchi, R. (1982). “Seismic hazard for lifelines vulnerability analysis.” *Proc. 3rd Int. conf. on Microzonation*, Seattle, Washington.

Li Dong, Mingyue, R., and Guoying, M. (2017). “Application of Internet of things technology on predictive maintenance system of coal equipment.” *Procedia Eng.,*174(2017), 885–889.

Liang, Z. Xu, N. Ma, K. Tang, S. and Tang, C. (2013). “Microseismic monitoring and numerical simulation of rock slope failure.” *Int. J. Distrib. Sens. Networks*, 9(11).

Little, M. J. (2005). “Slope monitoring strategy at Prust open pit operation.” *Proc. of Int. Symp. Stability of Rock Slopes*. The South African Institute of Mining and Metallurgy, 211-230.

Lynch, R. A., Wuite, R., Smith, B. S. and Cichowicz, A. (2005). “Microseismic monitoring of open pit slopes.” *Instrumentation and Modelling*, ISS International limited, South Africa. 581-592.

Malet, J. -P., Maquaire, O. and Calais, E. (2002). “The use of Global Positioning System for the continuous monitoring of landslides: application to the Super-Sauze earthflow (Alpes-de-Haute-Provence, France).” *Geomorphology*, 43(1-2), 33–54.

Mali, N., Dutt, V. and Uday, K. V. (2021). “Determining the geotechnical slope failure factors via ensemble and individual machine learning techniques: A case study in Mandi, India,” *Front. Earth Sci*. 9, 701837.

Masood, M. M., Raju, G. Y. and Verma, T. (2022). “Slope monitoirng and failure prediction techinques in mines: A review.” *J. Min., Met. Fules.,* 70(8), 171-181.

Matsuda, H. and Shimizu, N. (2006). “Assessment of rock slope stability based on the three-dimensional continuous displacement monitoring by global positioning system.” *Int. J. JCRM*, 2(1), 17–20.

Menglan, N., Xuesong, M. and Yueyue, W. (2018). “The influence of soil parameters on the stability of loose slope.” 3rd *Int. Conf. Adv. Materials, Mechatronics and Civ. Eng., Adv. Eng. Res.*, 162, 188-192.

Ministry of Coal (2024b). “Coal Vision 2030.” https:/coal.nic.in/en (May. 12, 2024).

Ministry of Coal. (2024a). “OC & UG coal production.” Government of India. https://coal.nic.in/en/major-statistics/production-and-supplies (Apr. 28, 2024).

Mittapally, S. K. and Karra, R. C. (2023). “Functions and performance of sensors for slope monitoring in opencast coal mines – laboratory experimentation.” *Petroleum Sci. Tech.*, Taylor & Francis Online, 41(6), 1-14.

Mittapally, S. K. and Marichamy, K. R. (2023). “Wireless Sensor Networks and Real-Time Sope Monitoring: A Bried Review.” *Proc. 2nd Int. Conf. Emerging Trends Eng.,* Atlantis press, 1307-1317.

Mohmmed, M. M. (2021). “A review on slope monitoring and application methods in open pit mining activities.” *Int. J. Scientific Tech. Res.,* 10(2), 181-186.

Molaei, F., Rahimi, E., Siavoshi, H., Ghaychi, A. and Tenorio, V. (2020). “A Comprehensive Review on Internet of things (IoT) and its Implications in the mining industry.” *American J. Eng. Appl. Sci*., Science Publications, 13(3), 499–515.

Moudabel, O. A. M. (2013). “Slope Stability Case Study By Limit Equilibrium and Numerical Methods.” M.Sc Thesis, College of Oklahoma State of University, Tripoli, Libya.

Mucchi, L., Jayousi, S., Martinelli, A., Caputo, S., Intrieri, E., Gigli, G., Gracchi, T., Mugnai, F., Favalli, M., Fornaciai, A. and Nannipieri, L. (2018). “A Flexible Wireless Sensor Network Based on Ultra-Wide Band Technology for Ground Instability Monitoring.” *Sensors*, 18(9), 2948.

Newcomen, W. and Dick, G. (2016). “An update to the strain-based approach to pit wall failure prediction, and a justification for slope monitoring.” *J. South. Africa. Inst. of Mining and Metall*., 116(5), 379-385.

Nishikawa, Y., Sasamura, T., Ishizuka, Y., Sugimoto, S., Iwasaki, S., Wang, H., Fujishima, T., Fujimoto, T., Yamashita, K., Suzuki, T. and Kurihara, K. (2018).

"Design of stable wireless sensor networks for slope monitoring." *IEEE Topical Conf. Wireless Sens. Sens. Networks*., Anaheim, CA, USA. 8-11.

Nunoo, S., Tannant, D. D. and Newcomen, H. W. (2015). "Slope monitoring practices at open pit porphyry mines in British Columbia, Canada." *Int. J. Mining, Reclamation and Environ.,* 30(2016), 245-256.

Nuric, A. Nuric, S., Kricak, L. and Husagic, R. (2013). "Numerical methods in analysis of slope stability." Int. J. Sci. eng. Investigations, 2(14), 41-48.

Ohnishi, Y, Nishiyama, S, Yano, T, Matsuyama, H and Amano, K. (2006). "A study of the application of digital photogrammetry to slope monitoring systems." *Int. J. Rock Mech. Min. Sci.*, 43(5), 756–766.

Ooi, B. Y. and Shirmohammadi, S, (2020). "The Potential of IoT for Instrumentation and Measurement." *IEEE Inst. Meas. Ma*g., 23(3), 21-26.

Osasan, K. S. (2012). "Open-casr mine slope deformation and failure mechanism interpreted from slope RADAR monitoring." Ph.D thesis, *Univerisity of Witwatersrand*, Johannesburg.

Osasan, K. S. and Afeni, T. B. (2010). "Review of surface mine slope monitoring techniques." J. Mining Sci., 4(2), 177–186.

Park, S., Lim, H., Tamang, B., Jin, J., Lee, S., Chang, S. and Kim, Y. (2019). "A Study on the Slope Failure Monitoring of a Model Slope by the Application of a Displacement Sensor." *J. Sens.,* 2019, 1–9.

Patikova, A. (2004). "Digital photogrammetry in the practice of open-pit mining." *Int. Arc. Photogram., Rem. Sens. Spatial Info. Sci.,* 34.

Pitambar, P., Akshay, P., Hardik, R., Ravi, H. and Shubhangi, K. (2019). IoT based landslide detection and monitoring." *Int. J. Res. Analytic. Rev*. 6(2), 52-59.

Pottie, G. J. (1998). "Wireless Sensor Networks." *1998 Info. Theory Workshop*., Killarney, Ireland, 139–140.

Raghuvanshi, T. K. (2017). “Plane failure in rock slope – A review on stability analysis techniques.” *J. King Saud Univ. Sci*., 31(1), 101-109.

Read, J. and Stacey, P. (2010). “Guidelines for open pit slope design.” *CSIRO Publishing*. Clayton, Australia.

Romdhane, R. F., Lami, Y., G-Catalot, D., Fourty, N., Lagreze, A., Jongmans, D. and Baillet, L. (2017). “Wireless sensor network for landslides prevention.” *IEEE Int. Conf. Comput. Intel. Virtual Environ. Sys. Appl*., Annecy, France, 222-227.

Rusydy, I,. Sugiyanto, D., Satrio, L., Zulfahriza, Rahman, A. Munandar, I. (2016). “ Geological aspect of slope failure and mitigation approach in Bireun - Takengon main road, Aceh provience, Indonesia,” Aceh Int. J. Sci. Technol., 5(1), 30-37.

Saadoun, A. Hafsaoui, A. and M. Fredj, M. (2017). “Landslide study of lands in quarrys. Case chouf amar – M’sila, Algeria,” *Int., Congress. Exhibition “Sustain. Civ. Infra.,* Sharm EL Shiekh, Egypt, 14-28.

Saadoun, A., Hafsaoui, A., Khadri, Y., Fredj, M., Boukarm, R. and Nakache, R. (2018). “Study effect of geological parameters of the slope stability by numerical modelling, case limestone carrer of Lafargem’sila, Algeria,” *IOP conf. ser.: Earth Environ. Sci*., World Multidisciplinary Earth Sciences Symposium (WMESS 2018), Prague, Czech Republic. 221.

Sarkar, S. and Chakraborty, M. (2021). “Stability analysis for two-layered slopes by using the strength reduction method.” *Int. J. Geo-Eng.,* (2021), 12-24.

Satyanarayana, I. (2019). “Risk Appraisal Approach of Open-pit Slope Design in Indian Mines.” *Model., Meas., and Control C*, 80(1), 16-21.

Satyanarayana, I. and Sinha, A. K. (2018). “A critical review of stability analysis and design of pit slopes in Indian opencast coal mines.” Chem. Eng., 66(2018), 1231-1236.

Satyanarayana, I., Budi, G., Sen, P. and Sinha, A. K. (2018). “Stability evaluation of highwall slope in an opencast coal mine-a case study.” *AMSE J. AMSE IIETA Pub.-2017 series: Modelling C*, 78(3), 253-273.

Shaikh, A. A. and Shitole, D. S. (2012). “Micro-Electromechanical System (MEMS) sensor.” *Int. J. Sci. Eng. Res*., 3(11), 1-8.

Shetty, R., Navi, S. S., Sindhu, Channappagoudar, S. R. and Moger, M. (2022). “Landslide detection and early warning system using wireless sensor network.” *Int. J. Innovative. Res. Tech*., 8(12),120-124.

Sjoberg, J. (1996). “Large Scale Stability in Open Pit Mining - A Review.” Technical Report, Division of Rock Mechanics, Lulea University of Technology, Lulea, Sweden.

Skinner, B. J. and Porter, S. C. (1995). “The dynamic earth: An introduction to physical geology,” John Wiley & Sons, Inc. 3rd eds. Londan, UK. 567.

Skolnik, M. (1990). “Radar Handbook.”, 2nd eds. *McGraw-Hill Inc*., New York.

Smarsly, K., Georgieva, K., Konig, M., and Law, K. H. (2012). “Monitoring of slope movements coupling autonomous wireless sensor networks and web services.” *1st Int. Conf. Performance-based life cycle Struct. Eng.,* Hong Kong, China.

Sruthy, M. R, Anjana, R., Archana, R., Dhanya, V., Hridya, A. H. (2020). “IoT-based landslide detection and monitoring system.” *International journal of research in engineering, science and management* 3(4): 596 – 599.

Stankovic, A. J. (2008). “Wireless Sensor Networks.” *Computer*, 41(10), 92-95.

Stark, T. D. and Choi, H. (2008). “Slope inclinometers for landslides.” *Landslides*, 5(3), 339-350.

Stephens, J. C., Allen, L. H., Jr. and Chen, E. (1984). “Organic soil subsidence.” *Man-Induced Land Subsidence*. Holzer, T. L., *Geological society of America reviews in engineering geology*, 3.

Sturzenegger, M. and Stead, D. (2009). “Close-range terrestrial digital photogrammetry and terrestrial laser scanning for discontinuity on rock cuts.” Eng. Geo., 106(3-4), 163 – 182.

Sudarmanto, A., Khalif, M. A. and Huda, A. K. (2023). “Detection of building slope and land subsidence using ultrasonic HC-SRO4 sensors-based Arduino UNO R3 and Blynk.” *AIP Conf. Proc*., 2540(1).

Sullivan, T. D. (2007). “Hydromechanical coupling and pit slope movements.” *Proc. Int. Symp. Rock Slope Stability in Open Pit Mining and Civ. Eng.,* Australian Centre for Geomechanics, Perth, 3–43.

Sun, E., Zhang, X., and Li, Z. (2012). “The internet of things (IoT) and cloud computing (CC) based tailings dam monitoring and pre-alarm system in mines.” *Safety Sci*., 50(4), 811–815.

Susanto, E., Budiman, F., Mukthar, D. P. H. and Latief, M. H. (2019). “Slope, Humidity and Vibration Sensors Performance for Landslide Monitoring System.” *IEEE Asia Pacific Conf. Wireless. Mobile*. Bali, Indonesia.

Susha, L. S. U., Singh, D. N., and Baghini, M. S. (2014). “A critical review of soil moisture measurement.” *Measurement*, 54(1), 92–105.

Taqwa, A., Fadhli, M., Soim, S., Handayani, A. S. and Suroso (2021). “Prototype design of landslide early detection system using LoRa and IoT.” Proc. 4th Forum Res. Sci. Tech., 7(1), 495-499.

Tarchi, D., Casagli, N., Fanti, R., Leva, D. D., Luzi, G., Pasuto, A., Pieraccini, M. and Silvano, S. (2003). “Landslide monitoring by using ground-based SAR interferometry: an example to the Tessina landslide in Italy.” *Eng. Geo.,* 68, 15-30.

Teshnizi, E. S., Golian, M., Sadeghi, S. and Rastegarnia, A. (2021). "Application of analytical hierarchy process (AHP) in landslide susceptibility mapping for Qazvin province, N Iran," Computer in earth and environmental sciences: artificial intelligence and advanced technologies in hazards and risk management, *Science direct*. 55-95.

The Hindu (2019). "Over 50 people dead in mudslide at mining site in Mynamar." https://www.thehindu.com/news/international/over-50-people-dead-in-mudslide-at-mining-site-in-myanmar/article26929553.ece (Mar. 5, 2023).

Thornbury, W. D. (1954). "Principle of geomorphology," *John willey and sons Inc*., New York.

Towhata, I., Uchimura, T., Seko, I., and Wang, L. (2015). "Monitoring of unstable slopes by MEMS tilting sensors and its application to the early warning." *Int. Symp. Geohaz. Geomech*. Warwick, UK. 26(1), 1-12.

Tripathy D. P. and Prakash B. B. (2010). "Numerical modeling for slope stability analysis in opencast mines." *The Mining Engineer's Journal*, April, 15-20

Verma, A. K., Deb, D. and Mukhopadhyay, S. K. (2017). "Stability analysis of a mine waste dump over an existing dump." *J. Mines, Metals & Fuels*. 65 (2), 41-48.

Vinoth, S. and Kumar, L, A. (2014). "Applying real time seismic monitoring technology for slope stability assessment - An Indian opencast coal mine perspective." *Int. J. Min. Sci. Tech.*, 24(1), 75–80.

Vinoth, S., Kumar, A. and Mishra, A. K. (2016). "Status and Developments of Slope Monitoring Techniques in Opencast Mines." *6th Indian Rock Conf.,* 2016, 767-781.

Wines, D. R., Hulls, I., Woods, E. and Creighton, A. (2013). The use of numerical modelling, slope monitoring and operational procedures to manage slope

deformations at the Ranger 3 pit." *Slope Stability 2013- P.M. Dight eds.,* Australian Center for Geomechanics, Brisbane, Australia.

Wyllie, D. C. and Mah, C. (2005). "Rock slope engineering," *Taylor and Francis*, New York.

Wyllie, D. C. and Mah, C. (2005). "Rock slope engineering," 3rd edition, *Taylor and Francis*, New York.

Wyllie, D. C. and Mah, C. (1974). "Rock slope engineering," 1st editoin, *Institute of Mining and Metallurgy,* Londan, England.

Xu, N., Tang, C-an. Li, H. Dai, F. Ma, K. Shao, J. –d. and Wu, J. (2012). "Excavation-induced microseismicity: microseismic monitoring and numerical simulation." *J. Zhejiang Univ. Sci. A*, 13(6), 445–460.

Yadav, D. K., Jayanthu, S., Das, S. K., Chinara, S., and Mishra, P. (2019). "Critical Review on Slope Monitoring Systems with a Vision of Unifying WSN and IoT." *IET Wireless Sensor Systems*, 9(4), 167–180.

Yadav, D. K., Karthik, G., Jayanthu, S. and Das, S. K. (2019b). "Design of Real-Time slope monitoring system using time-Domain Reflectometry with wireless sensor network." *IEEE Sensors letters*, 3(2), 1-4.

Yalcin, A. (2007) "The effects of clay on landslides: A case study." *Appl. Clay Sci.*, 38(1-2), 77-85.

Yang, B., Aminossadati, S. M., Chen, Z. and Kizil, M. S. (2017). "Fibre Optic Sensing Based Slope Crest Tension Crack Monitoring System for Surface Mines." *2nd Int. Conf. Fibre-optic Photonic Sens. Ind. Safety Appl.,* Brisbane, QLD, Australia, 27-32.

Yang, S. H. (2014). "Wireless Sensors Networks, Principles, Design and Applications." *Signals & Commun. Tech.,* Springer London Heidelberg NewYork.

Yang, S. H., and Cao, Y. (2008). “Networked control systems and wireless sensor networks: Theories and applications.” *Int. J. System Sci.,* 39(11), 1041–1044.

Yinghua, Z., Guanghua, F., Zhigang, Z., Zhian, H., Hongchen, L., and Jixing, Y. (2012). “Discussion on the application of IOT technology in coal mine safety supervision.” *Procedia Eng.,* 43, 233–237.

Yuliza, E., Habil. H., Munir, M. M., Irsyam, M., Abdullah, M. and Khairurrijal. (2016). “Study of soil moisture sensor for landslide early warning system: Experiment in laboratory scale.”J. Phys.: Conf. Ser., 1-6.

Zazueta, S. F. and Xin, J. (1994). “Soil Moisture Sensors.” *Bull. 292*, University of Florida, 1-12.

Zhou, C., Damiano, N., Whisner, B., and Reyes, M. (2017). Industrial Internet of Things: (IIoT) applications in underground coal mines. *Min. Eng.,* 69(12), 50.

Zhou, P. –B. (1993). “Finite difference method.” Numerical analysis of Electromagnitic Fields. *Springer link.* 63-94.

APPENDICES

(I - VI)

APPENDIX I

(WSN, Cloud data analysis and Advanced slope monitoring system software codes)

End Device code

```
char id='a'; // id = (node1 = a), (node2 = b), (node3 = c), (node4 = d)
long vibration(){
  long measurement=pulseIn (7, HIGH);  //wait for the pin to get HIGH and returns
measurement
  return measurement;}

void setup() {
  pinMode(A0, INPUT); // Moisture sensor
  pinMode(A1, INPUT); // displacement sensor
  pinMode(7, INPUT); // vibration sensor
  Serial.begin(9600);
}

void loop() {
    char ms = analogRead(A0);
    char dis = analogRead(A1);
    char vib =vibration();
    msc = -((ms - 996.17)/10.009); //calibration of moisture sensor
    disc = -((dis - 986.63)/10.908); //calibration of displacement sensor
    vibc = ((vib + 1.7038)/0.9793);  //calibration of displacement sensor
    Serial.print(id);
    Serial.print(msc);
    Serial.print(disc);
    Serial.print(vibc);
    delay(5000);
    }
```

Receiver code

```
#include <ESP8266WiFi.h>
#include <Wire.h>
String apiKey1 = "ZLIGAJYVTY01I2BJ"; // node1 channel APIkey
String apiKey2 = "I856W6GLE6S6F1KR"; // node2 channel APIkey
String apiKey3 = "KB46H3CG4P0DVV3M"; // node3 channel APIkey
String apiKey4 = "OZQMFOFOS656D219"; // node4 channel APIkey
const char* ssid = "Satish@act";
const char* password = "sai198211";
int moisture_content = 0;
int vibration = 0;
```

```
int displacement = 0;
char id = 0;
const char* server = "api.thingspeak.com";
WiFiClient client;
void setup() {
  Serial.begin(9600);
  delay(10);
  WiFi.begin(ssid, password);
  while (WiFi.status() != WL_CONNECTED) {
  delay(500);
    Serial.print(".");
  }
  Serial.println("");
  Serial.println("WiFi connected");
  delay(2000);
}

void loop() {
  while(!(Serial.available() > 0));
  id = Serial.read();
  if (id == 'a'){                          // node1 data collection
    id=0;
    while(!(Serial.available() > 0));
    moisture_content = Serial.read();
    while(!(Serial.available() > 0));
    displacement = Serial.read();
    while(!(Serial.available() > 0));
    vibration = Serial.read();
    if (client.connect(server,80))
       {
        String postStr = apiKey1;
            postStr +="&field1=";
            postStr += String(moisture_content);
            postStr +="&field2=";
            postStr += String(displacement);
            postStr +="&field3=";
            postStr += String(vibration);
            postStr += "\r\n\r\n";

       client.print("POST /update HTTP/1.1\n");
       client.print("Host: api.thingspeak.com\n");
       client.print("Connection: close\n");
       client.print("X-THINGSPEAKAPIKEY: "+apiKey1+"\n");
       client.print("Content-Type: application/x-www-form-urlencoded\n");
       client.print("Content-Length: ");
       client.print(postStr.length());
```

```
  client.print("\n\n");
  client.print(postStr);
  client.stop();
  }
  vibration = 0;
}
else if (id == 'b'){                    // node2 data collection
id=0;
while(!(Serial.available() > 0));
moisture_content = Serial.read();
while(!(Serial.available() > 0));
displacement = Serial.read();
while(!(Serial.available() > 0));
vibration = Serial.read();
if (client.connect(server,80))
  {
   String postStr = apiKey2;
       postStr +="&field1=";
       postStr += String(moisture_content);
       postStr +="&field2=";
       postStr += String(displacement);
       postStr +="&field3=";
       postStr += String(vibration);
       postStr += "\r\n\r\n";

  client.print("POST /update HTTP/1.1\n");
  client.print("Host: api.thingspeak.com\n");
  client.print("Connection: close\n");
  client.print("X-THINGSPEAKAPIKEY: "+apiKey2+"\n");
  client.print("Content-Type: application/x-www-form-urlencoded\n");
  client.print("Content-Length: ");
  client.print(postStr.length());
  client.print("\n\n");
  client.print(postStr);
  client.stop();
  }
  vibration = 0;
}
else if (id == 'c'){                    // node3 data collection
id=0;
while(!(Serial.available() > 0));
moisture_content = Serial.read();
while(!(Serial.available() > 0));
displacement = Serial.read();
while(!(Serial.available() > 0));
vibration = Serial.read();
```

```
if (client.connect(server,80))
   {
    String postStr = apiKey3;
        postStr +="&field1=";
        postStr += String(moisture_content);
        postStr +="&field2=";
        postStr += String(displacement);
        postStr +="&field3=";
        postStr += String(vibration);
        postStr += "\r\n\r\n";

   client.print("POST /update HTTP/1.1\n");
   client.print("Host: api.thingspeak.com\n");
   client.print("Connection: close\n");
   client.print("X-THINGSPEAKAPIKEY: "+apiKey3+"\n");
   client.print("Content-Type: application/x-www-form-urlencoded\n");
   client.print("Content-Length: ");
   client.print(postStr.length());
   client.print("\n\n");
   client.print(postStr);
   client.stop();
   }
   vibration = 0;
}
else if (id == 'd'){                        // node4 data collection
id=0;
while(!(Serial.available() > 0));
moisture_content = Serial.read();
while(!(Serial.available() > 0));
displacement = Serial.read();
while(!(Serial.available() > 0));
vibration = Serial.read();
if (client.connect(server,80))
   {
    String postStr = apiKey4;
        postStr +="&field1=";
        postStr += String(moisture_content);
        postStr +="&field2=";
        postStr += String(displacement);
        postStr +="&field3=";
        postStr += String(vibration);
        postStr += "\r\n\r\n";

   client.print("POST /update HTTP/1.1\n");
   client.print("Host: api.thingspeak.com\n");
   client.print("Connection: close\n");
```

```
    client.print("X-THINGSPEAKAPIKEY: "+apiKey4+"\n");
    client.print("Content-Type: application/x-www-form-urlencoded\n");
    client.print("Content-Length: ");
    client.print(postStr.length());
    client.print("\n\n");
    client.print(postStr);
    client.stop();
    }
    vibration = 0;
  }
 }
```

Cloud computing sensor data analysis code

```
import urllib.request
import requests
import json
import time
import smtplib
import datetime

def check_moisturecontent():
    read_url1 = 'https://api.thingspeak.com/channels/1798725/feeds.json?api_key='
    read_key1 = 'ZLIGAJYVTY01I2BJ'
    read_header1 = '&results=2'
    new_url1 = read_url1 + read_key1 + read_header1
    get_data1 = requests.get(new_url1).json()
    global moisture_percent
    try:
        moisture_percent = get_data1['feeds'][1][str('field1')]
    except IndexError:
        moisture_percent = "0"
    print("output value from the moisture sensor: ", moisture_percent)
    return moisture_percent

def check_displacement():
    read_url2 = 'https://api.thingspeak.com/channels/1798725/feeds.json?api_key='
    read_key2 = 'ZLIGAJYVTY01I2BJ'
    read_header2 = '&results=2'
    new_url2 = read_url2 + read_key2 + read_header2
    get_data2 = requests.get(new_url2).json()
    global displacement
    try:
        displacement = get_data2['feeds'][1][str('field2')]
    except IndexError:
        displacement = "0"
    print("output value from the displacement sensor: ", displacement)
```

```
    return displacement

def send_mail(subject, body, head):
    sender_email = "asmas.khoc@gmail.com"
    rec_email = "sathi.raa1980@gmail.com"
    password = "siksjxvjvpftrwop"
    with smtplib.SMTP_SSL('smtp.gmail.com', 465) as smtp:
        smtp.login(sender_email, password)
        msg = f'Subject: {subject}\n\n{body}'
        smtp.sendmail(sender_email, rec_email, msg)
    print(f'{head} email has been sent to', rec_email)

total = 0
Alert = False
Alert_d_l = False
Alert_d_h = False
while True:
    check_displacement()
    subjectd1= 'Alert from thingspeak python'
     bodyd1 = f'Displacement of the slope reached the threshold, the displacement is
{displacement} mm'
    subjectd2 = 'High Alert from thingspeak python'
       bodyd2 = f'Displacement of the slope reached the higher threshold, the
displacement is {displacement} mm'
    if int(displacement) >= 10:
        print("Alert displacement is more that 10mm")
        if not Alert_d_l:
            send_mail(subjectd1, bodyd1, "Alert displacement")
            Alert_d_l = True
    if int(displacement) >= 20:
        print("Alert displacement is more than 20mm")
        if not Alert_d_h:
            send_mail(subjectd2, bodyd2, "High Alert displacement")
            Alert_d_h = True
    check_moisturecontent()
    subject1 = 'Alert from thingspeak python'
     body1 = f'Moisture level is high in the slope right now the moisture content is
{moisture_percent} %'
    subject2 = 'Alert from thingspeak python'
     body2 = f'Moisture level is reduced in the slope right now the moisture content is
{moisture_percent} %'
    subject3 = 'High Alert from thingspeak python'
     body3 = f'Moisture level is been high for last one hour right now the moisture
content is {moisture_percent} %'
    if int(moisture_percent) >= 50:
        print("Alert moisture level is more than 50%")
        total = total + 25
```

```
        if not Alert:
            send_mail(subject1, body1, "Alert")
            Alert = True

urllib.request.urlopen('https://maker.ifttt.com/trigger/alertmoisturelevel/json/with/key/
cIbli6YWlFgARft-yXyWSP')
            print("Alert sent by text")
    elif int(moisture_percent) < 50:
        print("Alert moisture level is less than 50%")
        if Alert:
            send_mail(subject2, body2, "Alert retired")

urllib.request.urlopen('https://maker.ifttt.com/trigger/removealertmoisturelevel/json/w
ith/key/cIbli6YWlFgARft-yXyWSP')
            print("No Alert sent by text")
            Alert = False
            total = 0
    if total >= 3600:
        total = 0
        send_mail(subject3, body3, "High alert")

urllib.request.urlopen('https://maker.ifttt.com/trigger/removealertmoisturelevel/json/w
ith/key/cIbli6YWlFgARft-yXyWSP')
        print("High Alert sent by text")
    time.sleep(20)
```

Advanced slope monitoring system (ASMS) software code

```
from tkinter import *
from tkinter import messagebox
from PIL import ImageTk, Image

windows = Tk()
windows.geometry("750x750")
windows.title("TARP Guidlines")

def cal(D, Y, C, F, MD, BS, SM, VB):
    global DMM
    global FOS
    global ROD
    DMM = abs(round(3.5*MD-30.6*Y+0.04*D-0.25*C-2.77*F+0.72*BS-
    16.32, 2))
    FOS = abs(round(0.0028*C-0.0054*MD-0.0150*F -
                0.0502*BS-0.0003*D-0.0179*Y+2.45, 2))
    ROD = abs(round(0.0822*SM+0.0946*VB-0.97851))
    results_1_lable = Label(
    frame_results, text="Slope displacement in (mm)")
```

```
  results_1_lable.grid(row=3, column=0, sticky=NSEW)
  results_1_entry = Label(frame_results, text=DMM)
  results_1_entry.grid(row=4, column=0)

  results_2_lable = Label(
     frame_results, text="Factor of safety of the slope")
  results_2_lable.grid(row=5, column=0, sticky=NSEW)
  results_2_entry = Label(frame_results, text=FOS)
  results_2_entry.grid(row=6, column=0)

  results_3_lable = Label(
     frame_results, text="Rate of displacement (mm/day)")
  results_3_lable.grid(row=1, column=0, sticky=NSEW)
  results_3_entry = Label(frame_results, text=ROD)
  results_3_entry.grid(row=2, column=0)

def compute():
  # global results_1_lable
  # global results_1_entry
  # global results_2_lable
  # global results_2_entry
  global density
  global cohesion
  global friction
  global youngs
  global mdepth
  global bslopeangle
  global soilmoisture
  global vibration

  density = float(parameter_1_entry.get())
  youngs = float(parameter_2_entry.get())
  cohesion = float(parameter_4_entry.get())
  friction = float(parameter_5_entry.get())
  mdepth = float(parameter_6_entry.get())
  bslopeangle = float(parameter_8_entry.get())
  soilmoisture = float(parameter_9_entry.get())
  vibration = float(parameter_10_entry.get())

  results_1_lable.grid_forget()
  results_1_entry.grid_forget()
  results_2_lable.grid_forget()
  results_2_entry.grid_forget()
  results_3_lable.grid_forget()
  results_3_entry.grid_forget()

  cal(density, youngs, cohesion, friction, mdepth,
```

```
    bslopeangle, soilmoisture, vibration)

def sorcepage():
  global paramater_1_lable
  global paramater_2_lable
  global paramater_3_lable
  global paramater_4_lable
  global paramater_5_lable
  global paramater_6_lable
  global paramater_8_lable
  global parameter_1_entry
  global parameter_2_entry
  global parameter_3_entry
  global parameter_4_entry
  global parameter_5_entry
  global parameter_6_entry
  global parameter_8_entry
  global parameter_9_entry
  global parameter_10_entry
  global frame_body
  global frame_results
  global frame_body_Stiffness
  global frame_body_Strength
  global frame_body_Geomentry
  global frame_body_otherparameters
  global results_1_lable
  global results_2_lable
  global results_3_lable
  global results_1_entry
  global results_2_entry
  global results_3_entry
  global frame_foot
  global foot_label
  global foot_label2
  headframe.pack_forget()
  mainframe.pack_forget()
  footframe.pack_forget()
  copyright_frame.pack_forget()
  frame_head = LabelFrame(windows, text="", bd=2)
  frame_head.pack(padx=20, pady=20, fill="both", side=TOP)
  head_lable = Label(
  frame_head, text="Advanced Real-time slope monitoring system
   using Internet of Things")
  head_lable.pack()
  frame_body = LabelFrame(windows, text="Bench slope parameters",
  bd=2)
  frame_body.pack(padx=20, pady=20, fill="both", side=TOP)
```

```
frame_results = LabelFrame(windows, text="Results", bd=2)
frame_results.pack(padx=20, pady=20, side=TOP)
frame_body_Stiffness = LabelFrame(frame_body, text="Stiffness",
bd=2)
frame_body_Stiffness.grid(row=0, column=1, sticky=W, padx=10,
pady=10)

frame_body_Strength = LabelFrame(frame_body, text="Strength",
bd=2)
frame_body_Strength.grid(row=0, column=2, sticky=N, padx=10, pady=10)
frame_body_Geomentry = LabelFrame(frame_body, text="Geomentry", bd=2)
frame_body_Geomentry.grid(row=0, column=3, sticky=N, padx=10, pady=10)
frame_body_otherparameters = LabelFrame(
   frame_body, text="Other parameters", bd=2)
frame_body_otherparameters.grid(
   row=0, column=4, sticky=NE, padx=10, pady=10)

paramater_1_lable = Label(
   frame_body_Stiffness, text="Input density in kg/m3")
paramater_1_lable.pack()
parameter_1_entry = Entry(
   frame_body_Stiffness, width=15, borderwidth=2)
parameter_1_entry.pack()

paramater_2_lable = Label(
   frame_body_Stiffness, text="Input Young's modulus in GPa")
paramater_2_lable.pack()
parameter_2_entry = Entry(
   frame_body_Stiffness, width=15, borderwidth=2)
parameter_2_entry.pack()

paramater_3_lable = Label(
   frame_body_Stiffness, text="Input Poisson ratio")
paramater_3_lable.pack()
parameter_3_entry = Entry(
   frame_body_Stiffness, width=15, borderwidth=2)
parameter_3_entry.pack()

paramater_4_lable = Label(
   frame_body_Strength, text="Input Cohesion in KPa")
paramater_4_lable.pack()
parameter_4_entry = Entry(frame_body_Strength, width=15, borderwidth=2)
parameter_4_entry.pack()

paramater_5_lable = Label(
   frame_body_Strength, text="Input Friction angle in degree")
paramater_5_lable.pack()
```

```
parameter_5_entry = Entry(frame_body_Strength, width=15, borderwidth=2)
parameter_5_entry.pack()

paramater_6_lable = Label(
   frame_body_Geomentry, text="Input mine depth in meter")
paramater_6_lable.pack()
parameter_6_entry = Entry(
   frame_body_Geomentry, width=15, borderwidth=2)
parameter_6_entry.pack()

paramater_8_lable = Label(
   frame_body_Geomentry, text="Input Bench slope angle in degree")
paramater_8_lable.pack()
parameter_8_entry = Entry(
   frame_body_Geomentry, width=15, borderwidth=2)
parameter_8_entry.pack()

paramater_9_lable = Label(
   frame_body_otherparameters, text="Input Soil moisture in percentage")
paramater_9_lable.pack()
parameter_9_entry = Entry(
   frame_body_otherparameters, width=15, borderwidth=2)
parameter_9_entry.pack()

paramater_10_lable = Label(
   frame_body_otherparameters, text="Input Vibration in Hertz")
paramater_10_lable.pack()
parameter_10_entry = Entry(
   frame_body_otherparameters, width=15, borderwidth=2)
parameter_10_entry.pack()

results_1_lable = Label(
   frame_results, text="Slope displacement in (mm)")
results_1_lable.grid(row=3, column=0, sticky=NSEW)
results_1_entry = Label(frame_results, text='00')
results_1_entry.grid(row=4, column=0)

results_2_lable = Label(
   frame_results, text="Factor of safety of the slope")
results_2_lable.grid(row=5, column=0, sticky=NSEW)
results_2_entry = Label(frame_results, text='00')
results_2_entry.grid(row=6, column=0)

results_3_lable = Label(
   frame_results, text="Rate of displcement (mm/day)")
results_3_lable.grid(row=1, column=0, sticky=NSEW)
results_3_entry = Label(frame_results, text='00')
```

```
    results_3_entry.grid(row=2, column=0)

    submit_paramater_button = Button(
        frame_body, text="Submit parameters", command=lambda: compute(), bd=2)
    submit_paramater_button.grid(
        row=1, column=2, columnspan=2, padx=10, pady=10)

    frame_foot = LabelFrame(windows, text="", bd=0)
    frame_foot.pack(padx=20, pady=20, fill="both", side=TOP)
    foot_label = Label(
        frame_foot, text="Created by").pack()
    foot_label2 = Label(
        frame_foot, text="Sathish Kumar Mittapally & Ram Chandra Karra").pack()

def login():
    windows.geometry("850x650")
    global mainframe
    global foot_label

    username = username_Lable_entry.get()
    password = password_Lable_entry.get()

    # Validate the login credentials
    if username == "mskkrc" and password == "***":
        sorcepage()
        # Login successful

    else:
        # Login failed
        messagebox.showerror(
            "Login failed", "Invalid username or password. try again")

headframe = LabelFrame(windows, text="", bd=2)
mainframe = LabelFrame(windows, text="", bd=2)
footframe = LabelFrame(windows, text="login", bd=2)
copyright_frame = LabelFrame(windows, text="", bd=2)

headframe.pack(padx=20, pady=20, fill="both", side=TOP)
mainframe.pack(padx=10, pady=10, fill="both", side=TOP)
footframe.pack(padx=20, pady=20)
copyright_frame.pack(padx=20, pady=10, fill="both")

inviteimg = ImageTk.PhotoImage(Image.open("invitepicture.png"))
heading_Lable = Label(
    headframe, text="Advanced slope monitoring system using Internet of Things",
font=("Arial", 12, "bold"))
heading_Lable.pack()
```

```
invitepicture_lable = Label(mainframe, image=inviteimg)
invitepicture_lable.pack()

username_Lable = Label(footframe, text="Username")
username_Lable_entry = Entry(footframe, width=15, borderwidth=2)
password_Lable = Label(footframe, text="password")
password_Lable_entry = Entry(footframe, width=15, borderwidth=2)

username_Lable.grid(row=0, column=0, padx=50)
username_Lable_entry.grid(row=0, column=1)
password_Lable.grid(row=1, column=0, padx=50)
password_Lable_entry.grid(row=1, column=1)

copyright_lable = Label(
   copyright_frame, text="Copyright @ 2024, NITK Surathkal, All rights reserved")
copyright_lable.pack()

login_button = Button(
   footframe, text="Submit", command=lambda: login(), bd=2)
login_button.grid(row=2, column=1, columnspan=2, padx=10, pady=10)

windows.mainloop()
```

APPENDIX II

(Sensors data retrieved from Thingspeak cloud platform of all three case study mines) (few of the total collected data) KTK OC 2 Sensor data of nodes 1 to 4

Node 1					Node 2					Node 3					Node 4				
created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3
2022-08-08T10:15:03+05:30	1	37	0	0	2022-08-08T10:15:03+05:30	1	30	0	0	2022-08-08T10:15:03+05:30	1	53	0	0	2022-08-08T10:15:03+05:30	1	56	0	0
2022-08-08T10:24:03+05:30	5	37	0	0	2022-08-08T10:24:03+05:30	5	30	0	0	2022-08-08T10:24:03+05:30	5	53	0	0	2022-08-08T10:24:03+05:30	5	56	0	0
2022-08-08T10:25:33+05:30	6	35	0	0	2022-08-08T10:25:33+05:30	6	30	0	0	2022-08-08T10:25:33+05:30	6	53	0.1	0	2022-08-08T10:25:33+05:30	6	56	0	0
2022-08-08T10:27:03+05:30	7	35	0.2	0	2022-08-08T10:27:03+05:30	7	29	0	0	2022-08-08T10:27:03+05:30	7	53	0.1	0	2022-08-08T10:27:03+05:30	7	56	0.3	0
2022-08-08T10:28:33+05:30	8	35	0.2	0	2022-08-08T10:28:33+05:30	8	29	0	0	2022-08-08T10:28:33+05:30	8	53	0.1	0	2022-08-08T10:28:33+05:30	8	56	0.3	0
2022-08-08T10:30:03+05:30	9	35	0.2	0	2022-08-08T10:30:03+05:30	9	29	0	0	2022-08-08T10:30:03+05:30	9	53	0.1	0	2022-08-08T10:30:03+05:30	9	56	0.3	0
2022-08-08T10:31:28+05:30	10	35	0.2	0	2022-08-08T10:31:28+05:30	10	29	0.3	0	2022-08-08T10:31:28+05:30	10	53	0.1	0	2022-08-08T10:31:28+05:30	10	56	0.3	0
2022-08-08T10:32:53+05:30	11	35	0.2	0	2022-08-08T10:32:53+05:30	11	29	0.3	0	2022-08-08T10:32:53+05:30	11	54	0.1	0	2022-08-08T10:32:53+05:30	11	56	0.6	0
2022-08-08T10:34:18+05:30	12	35	0.2	0	2022-08-08T10:34:18+05:30	12	29	0.3	0	2022-08-08T10:34:18+05:30	12	54	0.1	0	2022-08-08T10:34:18+05:30	12	56	0.6	0
2022-08-08T10:36:33+05:30	13	33	0.2	0	2022-08-08T10:36:33+05:30	13	29	0.3	0	2022-08-08T10:36:33+05:30	13	54	0.1	0	2022-08-08T10:36:33+05:30	13	56	0.6	0
2022-08-08T10:38:48+05:30	14	33	0.2	0	2022-08-08T10:38:48+05:30	14	29	0.3	0	2022-08-08T10:38:48+05:30	14	54	0.1	0	2022-08-08T10:38:48+05:30	14	56	0.6	0
2022-08-08T10:41:03+05:30	15	33	0.2	0	2022-08-08T10:41:03+05:30	15	27	0.3	0	2022-08-08T10:41:03+05:30	15	54	0.1	0	2022-08-08T10:41:03+05:30	15	56	0.6	0
2022-08-08T10:43:18+05:30	16	33	0.2	0	2022-08-08T10:43:18+05:30	16	27	0.3	0	2022-08-08T10:43:18+05:30	16	54	0.1	0	2022-08-08T10:43:18+05:30	16	56	0.6	0
2022-08-08T10:45:33+05:30	17	33	0.2	0	2022-08-08T10:45:33+05:30	17	27	0.3	0	2022-08-08T10:45:33+05:30	17	54	0.1	0	2022-08-08T10:45:33+05:30	17	56	0.6	0
2022-08-08T10:48:13+05:30	18	33	0.2	0	2022-08-08T10:48:13+05:30	18	27	0.3	0	2022-08-08T10:48:13+05:30	18	54	0.2	0	2022-08-08T10:48:13+05:30	18	56	0.6	0
2022-08-08T10:50:53+05:30	19	32	0.2	0	2022-08-08T10:50:53+05:30	19	27	0.3	0	2022-08-08T10:50:53+05:30	19	54	0.2	0	2022-08-08T10:50:53+05:30	19	56	0.6	0
2022-08-08T10:53:33+05:30	20	32	0.2	0	2022-08-08T10:53:33+05:30	20	27	0.4	0	2022-08-08T10:53:33+05:30	20	54	0.2	0	2022-08-08T10:53:33+05:30	20	57	0.6	0
2022-08-08T10:56:13+05:30	21	32	0.2	0	2022-08-08T10:56:13+05:30	21	27	0.4	0	2022-08-08T10:56:13+05:30	21	54	0.2	0	2022-08-08T10:56:13+05:30	21	57	0.6	0
2022-08-08T10:58:53+05:30	22	32	0.2	0	2022-08-08T10:58:53+05:30	22	27	0.4	0	2022-08-08T10:58:53+05:30	22	50	0.2	0	2022-08-08T10:58:53+05:30	22	57	0.6	0
2022-08-08T11:03:08+05:30	23	31	0.2	0	2022-08-08T11:03:08+05:30	23	26	0.4	0	2022-08-08T11:03:08+05:30	23	50	0.2	0	2022-08-08T11:03:08+05:30	23	57	0.6	0
2022-08-08T11:07:23+05:30	24	31	0.3	0	2022-08-08T11:07:23+05:30	24	26	0.4	0	2022-08-08T11:07:23+05:30	24	50	0.2	0	2022-08-08T11:07:23+05:30	24	57	0.6	0
2022-08-08T11:11:38+05:30	25	31	0.3	0	2022-08-08T11:11:38+05:30	25	26	0.4	0	2022-08-08T11:11:38+05:30	25	50	0.2	0	2022-08-08T11:11:38+05:30	25	57	0.6	0
2022-08-08T11:15:53+05:30	26	31	0.3	0	2022-08-08T11:15:53+05:30	26	26	0.4	0	2022-08-08T11:15:53+05:30	26	50	0.2	0	2022-08-08T11:15:53+05:30	26	57	0.6	0
2022-08-08T11:20:08+05:30	27	29	0.3	0	2022-08-08T11:20:08+05:30	27	26	0.4	0	2022-08-08T11:20:08+05:30	27	50	0.2	0	2022-08-08T11:20:08+05:30	27	57	0.6	0
2022-08-08T11:24:23+05:30	28	29	0.3	0	2022-08-08T11:24:23+05:30	28	26	0.4	0	2022-08-08T11:24:23+05:30	28	50	0.2	0	2022-08-08T11:24:23+05:30	28	57	0.6	0
2022-08-08T11:25:58+05:30	29	29	0.3	0	2022-08-08T11:25:58+05:30	29	25	0.4	0	2022-08-08T11:25:58+05:30	29	50	0.6	0	2022-08-08T11:25:58+05:30	29	57	0.6	0
2022-08-08T11:27:33+05:30	30	29	0.3	0	2022-08-08T11:27:33+05:30	30	25	0.4	0	2022-08-08T11:27:33+05:30	30	50	0.6	0	2022-08-08T11:27:33+05:30	30	57	0.6	0
2022-08-08T11:29:08+05:30	31	29	0.3	0	2022-08-08T11:29:08+05:30	31	25	0.4	0	2022-08-08T11:29:08+05:30	31	50	0.6	0	2022-08-08T11:29:08+05:30	31	57	0.6	0
2022-08-08T11:30:43+05:30	32	29	0.3	0	2022-08-08T11:30:43+05:30	32	25	0.4	0	2022-08-08T11:30:43+05:30	32	50	0.6	0	2022-08-08T11:30:43+05:30	32	57	0.6	0
2022-08-08T11:32:18+05:30	33	29	0.3	0	2022-08-08T11:32:18+05:30	33	25	0.4	0	2022-08-08T11:32:18+05:30	33	50	0.6	0	2022-08-08T11:32:18+05:30	33	57	0.6	0
2022-08-08T11:34:33+05:30	34	28	0.3	0	2022-08-08T11:34:33+05:30	34	25	0.4	0	2022-08-08T11:34:33+05:30	34	50	0.6	0	2022-08-08T11:34:33+05:30	34	57	0.6	0
2022-08-08T11:36:48+05:30	35	28	0.3	0	2022-08-08T11:36:48+05:30	35	25	0.7	0	2022-08-08T11:36:48+05:30	35	52	0.6	0	2022-08-08T11:36:48+05:30	35	57	0.9	0
2022-08-08T11:39:03+05:30	36	28	0.5	0	2022-08-08T11:39:03+05:30	36	25	0.7	0	2022-08-08T11:39:03+05:30	36	52	0.6	0	2022-08-08T11:39:03+05:30	36	57	0.9	0
2022-08-08T11:41:18+05:30	37	28	0.5	0	2022-08-08T11:41:18+05:30	37	24	0.7	0	2022-08-08T11:41:18+05:30	37	52	0.6	0	2022-08-08T11:41:18+05:30	37	57	0.9	0
2022-08-08T11:43:33+05:30	38	28	0.5	0	2022-08-08T11:43:33+05:30	38	24	0.7	0	2022-08-08T11:43:33+05:30	38	52	0.6	0	2022-08-08T11:43:33+05:30	38	57	0.9	0
2022-08-08T11:45:48+05:30	39	28	0.5	0	2022-08-08T11:45:48+05:30	39	24	0.7	0	2022-08-08T11:45:48+05:30	39	52	0.6	0	2022-08-08T11:45:48+05:30	39	57	0.9	0
2022-08-08T11:47:23+05:30	40	28	0.5	0	2022-08-08T11:47:23+05:30	40	24	0.7	0	2022-08-08T11:47:23+05:30	40	52	0.6	0	2022-08-08T11:47:23+05:30	40	57	0.9	0
2022-08-08T11:48:58+05:30	41	28	0.5	0	2022-08-08T11:48:58+05:30	41	24	0.7	0	2022-08-08T11:48:58+05:30	41	52	0.9	0	2022-08-08T11:48:58+05:30	41	57	0.9	0
2022-08-08T11:50:33+05:30	42	28	0.5	0	2022-08-08T11:50:33+05:30	42	24	0.7	0	2022-08-08T11:50:33+05:30	42	52	0.9	0	2022-08-08T11:50:33+05:30	42	57	0.9	0
2022-08-08T14:10:58+05:30	109	42	0.9	0	2022-08-08T14:10:58+05:30	109	32	1.7	0	2022-08-08T14:10:58+05:30	109	60	2	0	2022-08-08T14:10:58+05:30	109	60	2.4	0
2022-08-08T14:13:13+05:30	110	42	1	0	2022-08-08T14:13:13+05:30	110	35	1.7	0	2022-08-08T14:13:13+05:30	110	60	2	0	2022-08-08T14:13:13+05:30	110	60	2.4	0
2022-08-08T14:15:28+05:30	111	45	1	0	2022-08-08T14:15:28+05:30	111	35	1.7	0	2022-08-08T14:15:28+05:30	111	60	2	0	2022-08-08T14:15:28+05:30	111	60	2.4	0
2022-08-08T14:17:43+05:30	112	45	1	0	2022-08-08T14:17:43+05:30	112	35	1.7	0	2022-08-08T14:17:43+05:30	112	60	2	0	2022-08-08T14:17:43+05:30	112	60	2.8	0
2022-08-08T14:19:58+05:30	113	45	1	0	2022-08-08T14:19:58+05:30	113	35	1.7	0	2022-08-08T14:19:58+05:30	113	60	2	0	2022-08-08T14:19:58+05:30	113	60	2.8	0
2022-08-08T14:22:13+05:30	114	45	1	0	2022-08-08T14:22:13+05:30	114	35	1.7	0	2022-08-08T14:22:13+05:30	114	60	2	0	2022-08-08T14:22:13+05:30	114	60	2.8	0
2022-08-08T14:24:28+05:30	115	45	1	0	2022-08-08T14:24:28+05:30	115	38	1.7	0	2022-08-08T14:24:28+05:30	115	60	2	0	2022-08-08T14:24:28+05:30	115	66	2.8	0
2022-08-08T14:26:43+05:30	116	45	1	0	2022-08-08T14:26:43+05:30	116	43	1.7	0	2022-08-08T14:26:43+05:30	116	60	2.3	0	2022-08-08T14:26:43+05:30	116	66	2.8	0
2022-08-08T14:28:58+05:30	117	45	1	0	2022-08-08T14:28:58+05:30	117	43	1.7	0	2022-08-08T14:28:58+05:30	117	63	2.3	0	2022-08-08T14:28:58+05:30	117	66	2.8	0
2022-08-08T14:31:13+05:30	118	45	1	0	2022-08-08T14:31:13+05:30	118	43	1.7	0	2022-08-08T14:31:13+05:30	118	63	2.3	0	2022-08-08T14:31:13+05:30	118	66	2.8	0
2022-08-08T14:33:28+05:30	119	45	1	0	2022-08-08T14:33:28+05:30	119	43	1.7	0	2022-08-08T14:33:28+05:30	119	63	2.3	0	2022-08-08T14:33:28+05:30	119	66	2.8	0
2022-08-08T14:35:43+05:30	120	48	1	0	2022-08-08T14:35:43+05:30	120	43	1.7	0	2022-08-08T14:35:43+05:30	120	63	2.3	0	2022-08-08T14:35:43+05:30	120	66	2.8	0
2022-08-08T14:37:58+05:30	121	48	1	0	2022-08-08T14:37:58+05:30	121	45	1.7	0	2022-08-08T14:37:58+05:30	121	63	2.3	0	2022-08-08T14:37:58+05:30	121	66	2.8	0
2022-08-08T14:40:13+05:30	122	48	1.1	0	2022-08-08T14:40:13+05:30	122	45	1.7	0	2022-08-08T14:40:13+05:30	122	63	2.3	0	2022-08-08T14:40:13+05:30	122	66	2.8	0
2022-08-08T14:42:28+05:30	123	48	1.1	0	2022-08-08T14:42:28+05:30	123	45	1.7	0	2022-08-08T14:42:28+05:30	123	63	2.3	0	2022-08-08T14:42:28+05:30	123	66	2.8	0
2022-08-08T14:44:43+05:30	124	48	1.1	0	2022-08-08T14:44:43+05:30	124	45	1.7	0	2022-08-08T14:44:43+05:30	124	63	2.3	0	2022-08-08T14:44:43+05:30	124	66	2.8	0
2022-08-08T14:46:58+05:30	125	48	1.1	0	2022-08-08T14:46:58+05:30	125	45	1.7	0	2022-08-08T14:46:58+05:30	125	63	2.3	0	2022-08-08T14:46:58+05:30	125	66	2.8	0
2022-08-08T14:49:13+05:30	126	52	1.1	0	2022-08-08T14:49:13+05:30	126	45	1.7	0	2022-08-08T14:49:13+05:30	126	63	2.3	0	2022-08-08T14:49:13+05:30	126	66	2.8	0
2022-08-08T14:51:28+05:30	127	52	1.1	0	2022-08-08T14:51:28+05:30	127	45	1.7	0	2022-08-08T14:51:28+05:30	127	63	2.3	0	2022-08-08T14:51:28+05:30	127	66	2.8	0
2022-08-08T14:53:43+05:30	128	52	1.1	0	2022-08-08T14:53:43+05:30	128	45	1.7	0	2022-08-08T14:53:43+05:30	128	63	2.3	0	2022-08-08T14:53:43+05:30	128	66	2.8	0
2022-08-08T14:55:58+05:30	129	52	1.1	0	2022-08-08T14:55:58+05:30	129	45	1.7	0	2022-08-08T14:55:58+05:30	129	63	2.3	0	2022-08-08T14:55:58+05:30	129	71	2.8	0
2022-08-08T14:58:13+05:30	130	48	1.1	0	2022-08-08T14:58:13+05:30	130	45	1.7	0	2022-08-08T14:58:13+05:30	130	65	2.3	0	2022-08-08T14:58:13+05:30	130	71	2.8	0
2022-08-08T15:00:28+05:30	131	48	1.1	0	2022-08-08T15:00:28+05:30	131	46	1.7	0	2022-08-08T15:00:28+05:30	131	65	2.3	0	2022-08-08T15:00:28+05:30	131	71	3.2	0
2022-08-08T15:02:43+05:30	132	48	1.1	0	2022-08-08T15:02:43+05:30	132	46	1.7	0	2022-08-08T15:02:43+05:30	132	65	2.3	0	2022-08-08T15:02:43+05:30	132	71	3.2	0
2022-08-08T15:04:58+05:30	133	48	1.1	0	2022-08-08T15:04:58+05:30	133	46	1.7	0	2022-08-08T15:04:58+05:30	133	65	2.3	0	2022-08-08T15:04:58+05:30	133	71	3.2	0
2022-08-08T15:18:28+05:30	139	47	1.1	0	2022-08-08T15:18:28+05:30	139	54	1.7	0	2022-08-08T15:18:28+05:30	139	65	2.3	0	2022-08-08T15:18:28+05:30	139	71	3.2	0
2022-08-08T15:20:43+05:30	140	47	1.1	0	2022-08-08T15:20:43+05:30	140	52	1.7	0	2022-08-08T15:20:43+05:30	140	65	2.3	0	2022-08-08T15:20:43+05:30	140	71	3.2	0
2022-08-08T15:22:58+05:30	141	47	1.1	0	2022-08-08T15:22:58+05:30	141	46	1.7	0	2022-08-08T15:22:58+05:30	141	65	2.3	0	2022-08-08T15:22:58+05:30	141	71	3.2	0
2022-08-08T15:25:13+05:30	142	47	1.1	0	2022-08-08T15:25:13+05:30	142	46	1.7	0	2022-08-08T15:25:13+05:30	142	65	2.3	0	2022-08-08T15:25:13+05:30	142	71	3.2	0
2022-08-08T15:27:28+05:30	143	47	1.1	0	2022-08-08T15:27:28+05:30	143	43	1.7	0	2022-08-08T15:27:28+05:30	143	65	2.3	0	2022-08-08T15:27:28+05:30	143	71	3.2	0
2022-08-08T15:29:43+05:30	144	47	1.1	0	2022-08-08T15:29:43+05:30	144	43	1.7	0	2022-08-08T15:29:43+05:30	144	65	2.3	0	2022-08-08T15:29:43+05:30	144	69	3.2	0
2022-08-08T15:31:58+05:30	145	47	1.1	0	2022-08-08T15:31:58+05:30	145	43	1.7	0	2022-08-08T15:31:58+05:30	145	65	2.5	0	2022-08-08T15:31:58+05:30	145	69	3.2	0
2022-08-08T15:34:13+05:30	146	47	1.1	0	2022-08-08T15:34:13+05:30	146	43	1.7	0	2022-08-08T15:34:13+05:30	146	65	2.5	0	2022-08-08T15:34:13+05:30	146	69	3.2	0
2022-08-08T15:36:28+05:30	147	47	1.1	0	2022-08-08T15:36:28+05:30	147	43	1.7	0	2022-08-08T15:36:28+05:30	147	57	2.5	0	2022-08-08T15:36:28+05:30	147	69	3.2	0
2022-08-08T15:38:43+05:30	148	47	1.1	0	2022-08-08T15:38:43+05:30	148	43	1.7	0	2022-08-08T15:38:43+05:30	148	57	2.5	0	2022-08-08T15:38:43+05:30	148	69	3.2	0
2022-08-09T11:23:48+05:30	235	52	0.4	0	2022-08-09T11:23:48+05:30	235	46	0.4	0	2022-08-09T11:23:48+05:30	235	56	0.9	0	2022-08-09T11:23:48+05:30	235	53	0.8	0
2022-08-09T11:25:17+05:30	236	52	0.4	0	2022-08-09T11:25:17+05:30	236	46	0.5	0	2022-08-09T11:25:17+05:30	236	55	0.9	0	2022-08-09T11:25:17+05:30	236	53	0.8	0
2022-08-09T11:47:21+05:30	248	54	0.5	0	2022-08-09T11:47:21+05:30	248	50	0.6	0	2022-08-09T11:47:21+05:30	248	56	1.2	0	2022-08-09T11:47:21+05:30	248	50	0.9	0
2022-08-09T11:49:54+05:30	249	54	0.5	0	2022-08-09T11:49:54+05:30	249	50	0.6	0	2022-08-09T11:49:54+05:30	249	56	1.2	0	2022-08-09T11:49:54+05:30	249	50	0.9	0
2022-08-09T11:52:27+05:30	250	54	0.5	0	2022-08-09T11:52:27+05:30	250	50	0.6	0	2022-08-09T11:52:27+05:30	250	56	1.2	0	2022-08-09T11:52:27+05:30	250	50	0.9	0
2022-08-09T11:55:00+05:30	251	54	0.5	0	2022-08-09T11:55:00+05:30	251	50	0.6	0	2022-08-09T11:55:00+05:30	251	56	1.2	0	2022-08-09T11:55:00+05:30	251	50	0.9	0
2022-08-09T11:57:33+05:30	252	54	0.6	0	2022-08-09T11:57:33+05:30	252	50	0.6	0	2022-08-09T11:57:33+05:30	252	56	1.2	0	2022-08-09T11:57:33+05:30	252	50	0.9	0
2022-08-09T12:00:06+05:30	253	54	0.6	0	2022-08-09T12:00:06+05:30	253	50	0.6	0	2022-08-09T12:00:06+05:30	253	56	1.2	0	2022-08-09T12:00:06+05:30	253	50	0.9	0
2022-08-09T12:02:39+05:30	254	54	0.6	0	2022-08-09T12:02:39+05:30	254	50	0.6	0	2022-08-09T12:02:39+05:30	254	56	1.2	0	2022-08-09T12:02:39+05:30	254	50	1	0
2022-08-09T12:05:12+05:30	255	54	0.6	0	2022-08-09T12:05:12+05:30	255	50	0.6	0	2022-08-09T12:05:12+05:30	255	56	1.2	0	2022-08-09T12:05:12+05:30	255	50	1	0
2022-08-09T12:07:45+05:30	256	54	0.6	0	2022-08-09T12:07:45+05:30	256	50	0.7	0	2022-08-09T12:07:45+05:30	256	56	1.2	0	2022-08-09T12:07:45+05:30	256	49	1	0
2022-08-09T12:09:47+05:30	257	54	0.6	0	2022-08-09T12:09:47+05:30	257	52	0.7	0	2022-08-09T12:09:47+05:30	257	56	1.4	0	2022-08-09T12:09:47+05:30	257	49	1	0
2022-08-09T12:11:49+05:30	258	54	0.6	0	2022-08-09T12:11:49+05:30	258	52	0.7	0	2022-08-09T12:11:49+05:30	258	56	1.4	0	2022-08-09T12:11:49+05:30	258	49	1	0
2022-08-09T12:13:51+05:30	259	53	0.6	0	2022-08-09T12:13:51+05:30	259	52	0.7	0	2022-08-09T12:13:51+05:30	259	56	1.4	0	2022-08-09T12:13:51+05:30	259	49	1	0
2022-08-09T12:15:53+05:30	260	53	0.6	0	2022-08-09T12:15:53+05:30	260	52	0.7	0	2022-08-09T12:15:53+05:30	260	56	1.4	0	2022-08-09T12:15:53+05:30	260	49	1	0
2022-08-09T12:17:55+05:30	261	53	0.6	0	2022-08-09T12:17:55+05:30	261	52	0.7	0	2022-08-09T12:17:55+05:30	261	56	1.4	0	2022-08-09T12:17:55+05:30	261	49	1	0
2022-08-09T12:19:57+05:30	262	53	0.6	0	2022-08-09T12:19:57+05:30	262	52	0.7	0	2022-08-09T12:19:57+05:30	262	55	1.4	0	2022-08-09T12:19:57+05:30	262	49	1	0
2022-08-09T12:21:59+05:30	263	53	0.6	0	2022-08-09T12:21:59+05:30	263	56	0.7	0	2022-08-09T12:21:59+05:30	263	55	1.4	0	2022-08-09T12:21:59+05:30	263	49	1	0
2022-08-09T12:24:01+05:30	264	53	0.6	0	2022-08-09T12:24:01+05:30	264	56	0.7	0	2022-08-09T12:24:01+05:30	264	55	1.4	0	2022-08-09T12:24:01+05:30	264	49	1	0
2022-08-09T12:25:49+05:30	265	53	0.6	0	2022-08-09T12:25:49+05:30	265	56	0.8	0	2022-08-09T12:25:49+05:30	265	55	1.4	0	2022-08-09T12:25:49+05:30	265	49	1.3	0
2022-08-09T12:27:37+05:30	266	53	0.6	0	2022-08-09T12:27:37+05:30	266	56	0.8	0	2022-08-09T12:27:37+05:30	266	55	1.4	0	2022-08-09T12:27:37+05:30	266	52	1.3	0
2022-08-09T12:29:25+05:30	267	53	0.8	0	2022-08-09T12:29:25+05:30	267	56	0.8	0	2022-08-09T12:29:25+05:30	267	55	1.4	0	2022-08-09T12:29:25+05:30	267	52	1.3	0
2022-08-09T12:31:13+05:30	268	53	0.8	0	2022-08-09T12:31:13+05:30	268	56	0.8	0	2022-08-09T12:31:13+05:30	268	55	1.4	0	2022-08-09T12:31:13+05:30	268	52	1.3	0
2022-08-09T12:33:01+05:30	269	53	0.8	0	2022-08-09T12:33:01+05:30	269	59	0.8	0	2022-08-09T12:33:01+05:30	269	55	1.4	0	2022-08-09T12:33:01+05:30	269	52	1.3	0
2022-08-09T12:34:49+05:30	270	53	0.8	0	2022-08-09T12:34:49+05:30	270	59	0.8	0	2022-08-09T12:34:49+05:30	270	55	1.4	0	2022-08-09T12:34:49+05:30	270	52	1.3	0
2022-08-09T12:36:05+05:30	271	53	0.8	0	2022-08-09T12:36:05+05:30	271	59	0.8	0	2022-08-09T12:36:05+05:30	271	55	1.4	0	2022-08-09T12:36:05+05:30	271	52	1.3	0
2022-08-09T12:48:02+05:30	282	52	1.1	0	2022-08-09T12:48:02+05:30	282	57	0.9	0	2022-08-09T12:48:02+05:30	282	57	1.8	0	2022-08-09T12:48:02+05:30	282	53	1.3	0
2022-08-09T12:49:01+05:30	283	52	1.1	0	2022-08-09T12:49:01+05:30	283	57	1.1	0	2022-08-09T12:49:01+05:30	283	57	1.8	0	2022-08-09T12:49:01+05:30	283	53	1.3	0
2022-08-09T12:51:30+05:30	284	52	1.1	0	2022-08-09T12:51:30+05:30	284	56	1.1	0	2022-08-09T12:51:30+05:30	284	57	1.8	0	2022-08-09T12:51:30+05:30	284	53	1.3	0
2022-08-09T12:53:59+05:30	285	52	1.1	0	2022-08-09T12:53:59+05:30	285	56	1.1	0	2022-08-09T12:53:59+05:30	285	57	1.8	0	2022-08-09T12:53:59+05:30	285	53	1.3	0
2022-08-09T12:56:28+05:30	286	51	1.1	0	2022-08-09T12:56:28+05:30	286	56	1.1	0	2022-08-09T12:56:28+05:30	286	57	1.8	0	2022-08-09T12:56:28+05:30	286	53	1.3	0
2022-08-09T12:58:57+05:30	287	51	1.1	0	2022-08-09T12:58:57+05:30	287	56	1.1	0	2022-08-09T

Node 1					Node 2					Node 3					Node 4				
created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3
2022-08-09T16:49:41+05:30	397	46	2.2	0	2022-08-09T16:49:41+05:30	397	46	2.5	0	2022-08-09T16:49:41+05:30	397	50	3.6	0	2022-08-09T16:49:41+05:30	397	52	3.8	0
2022-08-10T09:26:16+05:30	412	46	0.1	0	2022-08-10T09:26:16+05:30	412	47	0.1	0	2022-08-10T09:26:16+05:30	412	47	0.2	0	2022-08-10T09:26:16+05:30	412	46	0.3	0
2022-08-10T09:27:01+05:30	413	46	0.1	0	2022-08-10T09:27:01+05:30	413	47	0.1	0	2022-08-10T09:27:01+05:30	413	47	0.2	0	2022-08-10T09:27:01+05:30	413	46	0.5	0
2022-08-10T09:27:46+05:30	414	46	0.1	0	2022-08-10T09:27:46+05:30	414	47	0.1	0	2022-08-10T09:27:46+05:30	414	47	0.2	0	2022-08-10T09:27:46+05:30	414	45	0.5	0
2022-08-10T09:30:04+05:30	415	46	0.1	0	2022-08-10T09:30:04+05:30	415	47	0.1	0	2022-08-10T09:30:04+05:30	415	47	0.2	0	2022-08-10T09:30:04+05:30	415	45	0.5	0
2022-08-10T09:32:22+05:30	416	46	0.1	0	2022-08-10T09:32:22+05:30	416	47	0.1	0	2022-08-10T09:32:22+05:30	416	46	0.2	0	2022-08-10T09:32:22+05:30	416	45	0.5	0
2022-08-10T09:34:40+05:30	417	46	0.2	0	2022-08-10T09:34:40+05:30	417	47	0.1	0	2022-08-10T09:34:40+05:30	417	46	0.2	0	2022-08-10T09:34:40+05:30	417	45	0.5	0
2022-08-10T09:36:58+05:30	418	46	0.2	0	2022-08-10T09:36:58+05:30	418	47	0.1	0	2022-08-10T09:36:58+05:30	418	46	0.2	0	2022-08-10T09:36:58+05:30	418	45	0.5	0
2022-08-10T11:45:23+05:30	486	49	0.8	0	2022-08-10T11:45:23+05:30	486	48	1.7	0	2022-08-10T11:45:23+05:30	486	55	1.9	0	2022-08-10T11:45:23+05:30	486	58	2.7	0
2022-08-10T11:47:52+05:30	487	49	0.8	0	2022-08-10T11:47:52+05:30	487	48	1.7	0	2022-08-10T11:47:52+05:30	487	55	1.9	0	2022-08-10T11:47:52+05:30	487	58	2.7	0
2022-08-10T11:50:21+05:30	488	49	0.8	0	2022-08-10T11:50:21+05:30	488	48	1.7	0	2022-08-10T11:50:21+05:30	488	55	2.1	0	2022-08-10T11:50:21+05:30	488	58	2.7	0
2022-08-10T11:51:29+05:30	489	49	0.8	0	2022-08-10T11:51:29+05:30	489	48	1.7	0	2022-08-10T11:51:29+05:30	489	55	2.1	0	2022-08-10T11:51:29+05:30	489	58	2.7	0
2022-08-10T11:52:37+05:30	490	48	0.8	0	2022-08-10T11:52:37+05:30	490	48	1.7	0	2022-08-10T11:52:37+05:30	490	55	2.1	0	2022-08-10T11:52:37+05:30	490	58	2.7	0
2022-08-10T11:53:45+05:30	491	48	0.9	0	2022-08-10T11:53:45+05:30	491	48	1.7	0	2022-08-10T11:53:45+05:30	491	55	2.1	0	2022-08-10T11:53:45+05:30	491	58	2.7	0
2022-08-10T11:54:53+05:30	492	48	0.9	0	2022-08-10T11:54:53+05:30	492	48	1.7	0	2022-08-10T11:54:53+05:30	492	57	2.1	0	2022-08-10T11:54:53+05:30	492	58	2.7	0
2022-08-10T11:56:01+05:30	493	48	0.9	0	2022-08-10T11:56:01+05:30	493	48	1.7	0	2022-08-10T11:56:01+05:30	493	57	2.1	0	2022-08-10T11:56:01+05:30	493	58	2.7	0
2022-08-10T11:57:09+05:30	494	48	0.9	0	2022-08-10T11:57:09+05:30	494	48	1.7	0	2022-08-10T11:57:09+05:30	494	57	2.1	0	2022-08-10T11:57:09+05:30	494	59	2.7	0
2022-08-10T11:58:17+05:30	495	48	0.9	0	2022-08-10T11:58:17+05:30	495	48	1.7	0	2022-08-10T11:58:17+05:30	495	57	2.1	0	2022-08-10T11:58:17+05:30	495	59	2.7	0
2022-08-10T11:59:25+05:30	496	48	0.9	0	2022-08-10T11:59:25+05:30	496	48	1.7	0	2022-08-10T11:59:25+05:30	496	57	2.1	0	2022-08-10T11:59:25+05:30	496	59	2.7	0
2022-08-10T12:00:33+05:30	497	48	0.9	0	2022-08-10T12:00:33+05:30	497	48	1.7	0	2022-08-10T12:00:33+05:30	497	57	2.1	0	2022-08-10T12:00:33+05:30	497	59	2.7	0
2022-08-10T12:01:41+05:30	498	48	0.9	0	2022-08-10T12:01:41+05:30	498	48	1.7	0	2022-08-10T12:01:41+05:30	498	57	2.1	0	2022-08-10T12:01:41+05:30	498	59	2.7	0
2022-08-10T12:38:21+05:30	514	47	1.2	0	2022-08-10T12:38:21+05:30	514	47	1.9	0	2022-08-10T12:38:21+05:30	514	58	2.3	0	2022-08-10T12:38:21+05:30	514	57	2.9	0
2022-08-10T12:40:46+05:30	515	47	1.2	0	2022-08-10T12:40:46+05:30	515	47	1.9	0	2022-08-10T12:40:46+05:30	515	58	2.3	0	2022-08-10T12:40:46+05:30	515	57	2.9	0
2022-08-10T12:43:11+05:30	516	47	1.2	0	2022-08-10T12:43:11+05:30	516	47	1.9	0	2022-08-10T12:43:11+05:30	516	59	2.3	0	2022-08-10T12:43:11+05:30	516	57	2.9	0
2022-08-10T12:45:36+05:30	517	47	1.2	0	2022-08-10T12:45:36+05:30	517	47	1.9	0	2022-08-10T12:45:36+05:30	517	59	2.3	0	2022-08-10T12:45:36+05:30	517	49	3.2	0
2022-08-10T15:13:20+05:30	587	40	2.4	0	2022-08-10T15:13:20+05:30	587	44	2.8	0	2022-08-10T15:13:20+05:30	587	57	2.9	0	2022-08-10T15:13:20+05:30	587	42	4	0
2022-08-10T15:15:08+05:30	588	40	2.4	0	2022-08-10T15:15:08+05:30	588	44	2.8	0	2022-08-10T15:15:08+05:30	588	57	2.9	0	2022-08-10T15:15:08+05:30	588	42	4	0
2022-08-10T15:16:56+05:30	589	40	2.4	0	2022-08-10T15:16:56+05:30	589	44	2.8	0	2022-08-10T15:16:56+05:30	589	57	2.9	0	2022-08-10T15:16:56+05:30	589	42	4.3	0
2022-08-10T15:18:44+05:30	590	40	2.4	0	2022-08-10T15:18:44+05:30	590	44	2.8	0	2022-08-10T15:18:44+05:30	590	57	2.9	0	2022-08-10T15:18:44+05:30	590	42	4.3	0
2022-08-10T15:47:40+05:30	608	40	2.5	0	2022-08-10T15:47:40+05:30	608	42	2.8	0	2022-08-10T15:47:40+05:30	608	53	3.5	0	2022-08-10T15:47:40+05:30	608	40	4.5	0
2022-08-10T15:50:09+05:30	609	40	2.5	0	2022-08-10T15:50:09+05:30	609	42	2.8	0	2022-08-10T15:50:09+05:30	609	53	3.5	0	2022-08-10T15:50:09+05:30	609	40	4.5	0
2022-08-10T15:52:38+05:30	610	40	2.5	0	2022-08-10T15:52:38+05:30	610	42	2.8	0	2022-08-10T15:52:38+05:30	610	53	3.9	0	2022-08-10T15:52:38+05:30	610	40	4.5	0
2022-08-10T15:53:46+05:30	611	40	2.5	0	2022-08-10T15:53:46+05:30	611	42	2.8	0	2022-08-10T15:53:46+05:30	611	53	3.9	0	2022-08-10T15:53:46+05:30	611	42	4.5	0
2022-08-10T15:54:54+05:30	612	40	2.5	0	2022-08-10T15:54:54+05:30	612	42	2.8	0	2022-08-10T15:54:54+05:30	612	50	3.9	0	2022-08-10T15:54:54+05:30	612	42	4.5	0
2022-08-10T15:56:02+05:30	613	39	2.5	0	2022-08-10T15:56:02+05:30	613	42	2.8	0	2022-08-10T15:56:02+05:30	613	50	3.9	0	2022-08-10T15:56:02+05:30	613	42	4.5	0
2022-08-10T15:57:10+05:30	614	39	2.5	0	2022-08-10T15:57:10+05:30	614	42	2.8	0	2022-08-10T15:57:10+05:30	614	50	3.9	0	2022-08-10T15:57:10+05:30	614	42	4.5	0
2022-08-10T15:58:18+05:30	615	39	2.5	0	2022-08-10T15:58:18+05:30	615	42	2.8	0	2022-08-10T15:58:18+05:30	615	50	3.9	0	2022-08-10T15:58:18+05:30	615	42	4.5	0
2022-08-10T15:59:26+05:30	616	39	2.5	0	2022-08-10T15:59:26+05:30	616	42	2.8	0	2022-08-10T15:59:26+05:30	616	50	3.9	0	2022-08-10T15:59:26+05:30	616	42	4.5	0
2022-08-10T16:00:34+05:30	617	39	2.5	0	2022-08-10T16:00:34+05:30	617	42	2.8	0	2022-08-10T16:00:34+05:30	617	50	3.9	0	2022-08-10T16:00:34+05:30	617	42	4.5	0
2022-08-10T16:01:42+05:30	618	39	2.5	0	2022-08-10T16:01:42+05:30	618	42	2.8	0	2022-08-10T16:01:42+05:30	618	50	3.9	0	2022-08-10T16:01:42+05:30	618	42	4.5	0
2022-08-10T16:02:50+05:30	619	39	2.8	0	2022-08-10T16:02:50+05:30	619	42	2.8	0	2022-08-10T16:02:50+05:30	619	50	3.9	0	2022-08-10T16:02:50+05:30	619	42	4.5	0
2022-08-10T16:03:58+05:30	620	39	2.8	0	2022-08-10T16:03:58+05:30	620	42	2.8	0	2022-08-10T16:03:58+05:30	620	50	3.9	0	2022-08-10T16:03:58+05:30	620	42	4.5	0
2022-08-10T16:06:11+05:30	621	39	2.8	0	2022-08-10T16:06:11+05:30	621	42	2.8	0	2022-08-10T16:06:11+05:30	621	50	3.9	0	2022-08-10T16:06:11+05:30	621	42	4.8	0
2022-08-10T16:08:24+05:30	622	39	2.8	0	2022-08-10T16:08:24+05:30	622	42	2.8	0	2022-08-10T16:08:24+05:30	622	50	3.9	0	2022-08-10T16:08:24+05:30	622	42	4.8	0
2022-08-10T16:10:37+05:30	623	39	2.8	0	2022-08-10T16:10:37+05:30	623	42	2.8	0	2022-08-10T16:10:37+05:30	623	50	3.9	0	2022-08-10T16:10:37+05:30	623	42	4.8	0
2022-08-10T16:12:50+05:30	624	39	2.8	0	2022-08-10T16:12:50+05:30	624	42	2.8	0	2022-08-10T16:12:50+05:30	624	50	3.9	0	2022-08-10T16:12:50+05:30	624	42	4.8	0
2022-08-10T16:15:03+05:30	625	39	2.8	0	2022-08-10T16:15:03+05:30	625	40	2.8	0	2022-08-10T16:15:03+05:30	625	50	3.9	0	2022-08-10T16:15:03+05:30	625	42	4.8	0
2022-08-10T16:46:22+05:30	641	38	2.9	0	2022-08-10T16:46:22+05:30	641	40	2.8	0	2022-08-10T16:46:22+05:30	641	50	4.5	0	2022-08-10T16:46:22+05:30	641	46	5	0
2022-08-10T16:47:30+05:30	642	38	2.9	0	2022-08-10T16:47:30+05:30	642	40	2.8	0	2022-08-10T16:47:30+05:30	642	50	4.5	0	2022-08-10T16:47:30+05:30	642	46	5	0
2022-08-10T16:48:38+05:30	643	38	2.9	0	2022-08-10T16:48:38+05:30	643	40	2.8	0	2022-08-10T16:48:38+05:30	643	50	4.5	0	2022-08-10T16:48:38+05:30	643	46	5	0
2022-08-10T16:49:46+05:30	644	38	2.9	0	2022-08-10T16:49:46+05:30	644	40	2.8	0	2022-08-10T16:49:46+05:30	644	50	4.5	0	2022-08-10T16:49:46+05:30	644	48	5	0
2022-08-10T16:50:54+05:30	645	38	2.9	0	2022-08-10T16:50:54+05:30	645	40	2.8	0	2022-08-10T16:50:54+05:30	645	50	4.5	0	2022-08-10T16:50:54+05:30	645	48	5	0
2022-08-10T16:52:02+05:30	646	38	2.9	0	2022-08-10T16:52:02+05:30	646	40	2.8	0	2022-08-10T16:52:02+05:30	646	49	4.5	0	2022-08-10T16:52:02+05:30	646	48	5.2	0
2022-08-10T16:54:15+05:30	647	38	2.9	0	2022-08-10T16:54:15+05:30	647	40	2.8	0	2022-08-10T16:54:15+05:30	647	49	4.5	0	2022-08-10T16:54:15+05:30	647	48	5.2	0
2022-08-11T10:46:50+05:30	667	33	0	0	2022-08-11T10:46:50+05:30	667	29	0	0	2022-08-11T10:46:50+05:30	667	45	0.3	0	2022-08-11T10:46:50+05:30	667	43	0.2	0
2022-08-11T10:49:08+05:30	668	33	0	0	2022-08-11T10:49:08+05:30	668	29	0	0	2022-08-11T10:49:08+05:30	668	45	0.3	0	2022-08-11T10:49:08+05:30	668	43	0.2	0
2022-08-11T10:51:26+05:30	669	33	0	0	2022-08-11T10:51:26+05:30	669	29	0	0	2022-08-11T10:51:26+05:30	669	45	0.3	0	2022-08-11T10:51:26+05:30	669	43	0.2	0
2022-08-11T10:53:44+05:30	670	33	0	0	2022-08-11T10:53:44+05:30	670	29	0.3	0	2022-08-11T10:53:44+05:30	670	45	0.3	0	2022-08-11T10:53:44+05:30	670	42	0.4	0
2022-08-11T10:56:02+05:30	671	33	0	0	2022-08-11T10:56:02+05:30	671	29	0.3	0	2022-08-11T10:56:02+05:30	671	45	0.3	0	2022-08-11T10:56:02+05:30	671	42	0.4	0
2022-08-11T10:57:36+05:30	672	33	0	0	2022-08-11T10:57:36+05:30	672	29	0.3	0	2022-08-11T10:57:36+05:30	672	45	0.3	0	2022-08-11T10:57:36+05:30	672	42	0.4	0
2022-08-11T10:59:10+05:30	673	33	0.1	0	2022-08-11T10:59:10+05:30	673	29	0.3	0	2022-08-11T10:59:10+05:30	673	45	0.3	0	2022-08-11T10:59:10+05:30	673	42	0.4	0
2022-08-11T11:00:44+05:30	674	33	0.1	0	2022-08-11T11:00:44+05:30	674	29	0.3	0	2022-08-11T11:00:44+05:30	674	45	0.3	0	2022-08-11T11:00:44+05:30	674	42	0.4	0
2022-08-11T11:26:46+05:30	688	32	0.1	0	2022-08-11T11:26:46+05:30	688	28	0.3	0	2022-08-11T11:26:46+05:30	688	44	0.5	0	2022-08-11T11:26:46+05:30	688	42	0.9	0
2022-08-11T11:28:15+05:30	689	32	0.1	0	2022-08-11T11:28:15+05:30	689	28	0.6	0	2022-08-11T11:28:15+05:30	689	44	0.5	0	2022-08-11T11:28:15+05:30	689	41	0.9	0
2022-08-11T11:29:44+05:30	690	32	0.1	0	2022-08-11T11:29:44+05:30	690	28	0.6	0	2022-08-11T11:29:44+05:30	690	44	0.5	0	2022-08-11T11:29:44+05:30	690	41	0.9	0
2022-08-11T11:31:13+05:30	691	32	0	0	2022-08-11T11:31:13+05:30	691	28	0.6	0	2022-08-11T11:31:13+05:30	691	44	0.5	0	2022-08-11T11:31:13+05:30	691	41	0.9	0
2022-08-11T11:32:42+05:30	692	32	0.2	0	2022-08-11T11:32:42+05:30	692	28	0.6	0	2022-08-11T11:32:42+05:30	692	44	0.5	0	2022-08-11T11:32:42+05:30	692	41	0.9	0
2022-08-11T11:34:11+05:30	693	32	0.2	0	2022-08-11T11:34:11+05:30	693	28	0.6	0	2022-08-11T11:34:11+05:30	693	44	0.5	0	2022-08-11T11:34:11+05:30	693	41	0.9	0
2022-08-11T11:35:40+05:30	694	32	0.2	0	2022-08-11T11:35:40+05:30	694	28	0.6	0	2022-08-11T11:35:40+05:30	694	44	0.5	0	2022-08-11T11:35:40+05:30	694	41	0.9	0
2022-08-11T12:13:51+05:30	710	32	0.3	0	2022-08-11T12:13:51+05:30	710	28	0.9	0	2022-08-11T12:13:51+05:30	710	43	0.8	0	2022-08-11T12:13:51+05:30	710	38	1.2	0
2022-08-11T12:15:53+05:30	711	32	0.3	0	2022-08-11T12:15:53+05:30	711	28	0.9	0	2022-08-11T12:15:53+05:30	711	43	0.8	0	2022-08-11T12:15:53+05:30	711	38	1.4	0
2022-08-11T12:17:55+05:30	712	32	0.3	0	2022-08-11T12:17:55+05:30	712	28	0.9	0	2022-08-11T12:17:55+05:30	712	43	0.8	0	2022-08-11T12:17:55+05:30	712	38	1.4	0
2022-08-11T12:19:57+05:30	713	32	0.3	0	2022-08-11T12:19:57+05:30	713	28	0.9	0	2022-08-11T12:19:57+05:30	713	43	0.8	0	2022-08-11T12:19:57+05:30	713	38	1.4	0
2022-08-11T12:21:59+05:30	714	32	0.3	0	2022-08-11T12:21:59+05:30	714	28	0.9	0	2022-08-11T12:21:59+05:30	714	43	0.8	0	2022-08-11T12:21:59+05:30	714	38	1.4	0
2022-08-11T12:24:01+05:30	715	32	0.3	0	2022-08-11T12:24:01+05:30	715	28	0.9	0	2022-08-11T12:24:01+05:30	715	40	0.8	0	2022-08-11T12:24:01+05:30	715	38	1.4	0
2022-08-11T12:25:49+05:30	716	32	0.3	0	2022-08-11T12:25:49+05:30	716	28	0.9	0	2022-08-11T12:25:49+05:30	716	40	0.8	0	2022-08-11T12:25:49+05:30	716	38	1.4	0
2022-08-11T12:27:37+05:30	717	32	0.3	0	2022-08-11T12:27:37+05:30	717	28	0.9	0	2022-08-11T12:27:37+05:30	717	40	0.8	0	2022-08-11T12:27:37+05:30	717	38	1.4	0
2022-08-11T12:29:25+05:30	718	32	0.3	0	2022-08-11T12:29:25+05:30	718	28	0.9	0	2022-08-11T12:29:25+05:30	718	40	0.8	0	2022-08-11T12:29:25+05:30	718	38	1.4	0
2022-08-11T12:49:01+05:30	734	32	0.3	0	2022-08-11T12:49:01+05:30	734	28	0.9	0	2022-08-11T12:49:01+05:30	734	39	0.8	0	2022-08-11T12:49:01+05:30	734	37	1.5	0
2022-08-11T12:51:30+05:30	735	32	0.3	0	2022-08-11T12:51:30+05:30	735	28	0.9	0	2022-08-11T12:51:30+05:30	735	39	0.8	0	2022-08-11T12:51:30+05:30	735	37	1.5	0
2022-08-11T12:53:59+05:30	736	32	0.3	0	2022-08-11T12:53:59+05:30	736	28	0.9	0	2022-08-11T12:53:59+05:30	736	39	0.8	0	2022-08-11T12:53:59+05:30	736	37	1.5	0
2022-08-11T12:56:28+05:30	737	32	0.3	0	2022-08-11T12:56:28+05:30	737	28	0.9	0	2022-08-11T12:56:28+05:30	737	39	0.8	0	2022-08-11T12:56:28+05:30	737	36	1.5	0
2022-08-11T12:58:57+05:30	738	32	0.3	0	2022-08-11T12:58:57+05:30	738	28	0.9	0	2022-08-11T12:58:57+05:30	738	39	0.8	0	2022-08-11T12:58:57+05:30	738	36	1.5	0
2022-08-11T13:01:26+05:30	739	32	0.3	0	2022-08-11T13:01:26+05:30	739	28	0.9	0	2022-08-11T13:01:26+05:30	739	39	0.8	0	2022-08-11T13:01:26+05:30	739	36	1.5	0
2022-08-11T13:03:55+05:30	740	32	0.3	0	2022-08-11T13:03:55+05:30	740	28	0.9	0	2022-08-11T13:03:55+05:30	740	39	0.8	0	2022-08-11T13:03:55+05:30	740	36	1.5	0
2022-08-11T13:19:05+05:30	751	32	0.4	0	2022-08-11T13:19:05+05:30	751	28	0.9	0	2022-08-11T13:19:05+05:30	751	39	1	0	2022-08-11T13:19:05+05:30	751	36	1.7	0
2022-08-11T13:20:13+05:30	752	32	0.4	0	2022-08-11T13:20:13+05:30	752	28	0.9	0	2022-08-11T13:20:13+05:30	752	39	1	0	2022-08-11T13:20:13+05:30	752	36	1.7	0
2022-08-11T13:22:26+05:30	753	31	0.4	0	2022-08-11T13:22:26+05:30	753	28	0.9	0	2022-08-11T13:22:26+05:30	753	39	1	0	2022-08-11T13:22:26+05:30	753	36	1.7	0
2022-08-11T13:24:39+05:30	754	31	0.4	0	2022-08-11T13:24:39+05:30	754	28	0.9	0	2022-08-11T13:24:39+05:30	754	39	1	0	2022-08-11T13:24:39+05:30	754	35	1.7	0
2022-08-11T13:26:52+05:30	755	31	0.4	0	2022-08-11T13:26:52+05:30	755	28	0.9	0	2022-08-11T13:26:52+05:30	755	39	1	0	2022-08-11T13:26:52+05:30	755	35	1.7	0
2022-08-11T13:29:05+05:30	756	31	0.4	0	2022-08-11T13:29:05+05:30	756	28	0.9	0	2022-08-11T13:29:05+05:30	756	39	1	0	2022-08-11T13:29:05+05:30	756	35	1.7	0
2022-08-11T13:31:18+05:30	757	31	0.4	0	2022-08-11T13:31:18+05:30	757	28	0.9	0	2022-08-11T13:31:18+05:30	757	39	1	0	2022-08-11T13:31:18+05:30	757	35	1.7	0
2022-08-11T13:33:31+05:30	758	31	0.4	0	2022-08-11T13:33:31+05:30	758	28	0.9	0	2022-08-11T13:33:31+05:30	758	39	1	0	2022-08-11T13:33:31+05:30	758	35	1.7	0
2022-08-11T13:35:44+05:30	759	31	0.4	0	2022-08-11T13:35:44+05:30	759	28	0.9	0	2022-08-11T13:35:44+05:30	759	39	1	0	2022-08-11T13:35:44+05:30	759	35	1.7	0
2022-08-11T13:37:57+05:30	760	31	0.4	0	2022-08-11T13:37:57+05:30	760	28	0.9	0	2022-08-11T13:37:57+05:30	760	38	1	0	2022-08-11T13:37:57+05:30	760	35	1.7	0
2022-08-11T13:40:10+05:30	761	31	0.4	0	2022-08-11T13:40:10+05:30	761	28	0.9	0	2022-08-11T13:40:10+05:30	761	38	1	0	2022-08-11T13:40:10+05:30	761	35	1.7	0
2022-08-11T14:15:37+05:30	776	31	0.5	0	2022-08-11T14:15:37+05:30	776	28	1.1	0	2022-08-11T14:15:37+05:30	776	35	1.3	0	2022-08-11T14:15:37+05:30	776	34	1.7	0
2022-08-11T14:18:02+05:30	777	31	0.5	0	2022-08-11T14:18:02+05:30	777	28	1.1	0	2022-08-11T14:18:02+05:30	777	35	1.3	0	2022-08-11T14:18:02+05:30	777	34	1.7	0
2022-08-11T14:20:38+05:30	778	31	0.5	0	2022-08-11T14:20:38+05:30	778	28	1.1	0	2022-08-11T14:20:38+05:30	778	35	1.3	0	2022-08-11T14:20:38+05:30	778	34	1.7	0
2022-08-11T14:44:17+05:30	787	31	0.5	0	2022-08-11T14:44:17+05:30	787	28	1.1	0	2022-08-11T14:44:17+05:30	787	35	1.5	0	2022-08-11T14:44:17+05:30	787	34	1.8	0
2022-08-11T14:47:08+05:30	788	31	0.5	0	2022-08-11T14:47:08+05:30	788	28	1.1	0	2022-08-11T14:47:08+05:30	788	35	1.5	0	2022-08-11T14:47:08+05:30	788	34	1.8	0
2022-08-11T14:49:59+05:30	789	31	0.5	0	2022-08-11T14:49:59+05:30	789	28	1.1	0	2022-08-11T14:49:59+05:30	789	35	1.5	0	2022-08-11T14:49:59+05:30	789	34	1.8	0
2022-08-11T14:52:50+05:30	790	31	0.5	0	2022-08-11T14:52:50+05:30	790	26	1.2	0	2022-08-11T14:52:50+05:30	790	35	1.5	0	2022-08-11T14:52:50+05:30	790	34	1.8	0
2022-08-11T14:55:41+05:30	791	31	0.5	0	2022-08-11T14:55:41+05:30	791	26	1.2	0	2022-08-11T14:55:41+05:30	791	35	1.5	0	2022-08-11T14:55:41+05:30	791	34	1.8	0
2022-08-11T14:58:32+05:30	792	31	0.5	0	2022-08-11T14:58:32+05:30	792	26	1.2	0	2022-08-11T14:58:32+05:30	792	35	1.5	0	2022-08-11T14:58:32+05:30	792	34	1.8	0
2022-08-11T15:01:23+05:30	793	31	0.5	0	2022-08-11T15:01:23+05:30	793	26	1.2	0	2022-08-11T15:01:23+05:30	793	30	1.5	0	2022-08-11T15:01:

Node 1					Node 2					Node 3					Node 4				
created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3
2022-08-12T12:42:08+05:30	928	33	0.5	0	2022-08-12T12:42:08+05:30	928	36	0.3	0	2022-08-12T12:42:08+05:30	928	36	1	0	2022-08-12T12:42:08+05:30	928	33	1.3	0
2022-08-12T12:43:07+05:30	929	33	0.5	0	2022-08-12T12:43:07+05:30	929	36	0.3	0	2022-08-12T12:43:07+05:30	929	36	1	0	2022-08-12T12:43:07+05:30	929	31	1.3	0
2022-08-12T12:44:06+05:30	930	33	0.5	0	2022-08-12T12:44:06+05:30	930	36	0.3	0	2022-08-12T12:44:06+05:30	930	36	1.2	0	2022-08-12T12:44:06+05:30	930	31	1.3	0
2022-08-12T12:45:05+05:30	931	33	0.5	0	2022-08-12T12:45:05+05:30	931	36	0.3	0	2022-08-12T12:45:05+05:30	931	36	1.2	0	2022-08-12T12:45:05+05:30	931	31	1.3	0
2022-08-12T12:46:04+05:30	932	33	0.6	0	2022-08-12T12:46:04+05:30	932	36	0.3	0	2022-08-12T12:46:04+05:30	932	36	1.2	0	2022-08-12T12:46:04+05:30	932	31	1.3	0
2022-08-12T12:47:03+05:30	933	33	0.6	0	2022-08-12T12:47:03+05:30	933	36	0.3	0	2022-08-12T12:47:03+05:30	933	36	1.2	0	2022-08-12T12:47:03+05:30	933	31	1.3	0
2022-08-12T12:48:02+05:30	934	33	0.6	0	2022-08-12T12:48:02+05:30	934	35	0.3	0	2022-08-12T12:48:02+05:30	934	35	1.2	0	2022-08-12T12:48:02+05:30	934	31	1.3	0
2022-08-12T12:49:01+05:30	935	33	0.6	0	2022-08-12T12:49:01+05:30	935	35	0.3	0	2022-08-12T12:49:01+05:30	935	35	1.2	0	2022-08-12T12:49:01+05:30	935	31	1.3	0
2022-08-12T12:51:30+05:30	936	33	0.6	0	2022-08-12T12:51:30+05:30	936	35	0.3	0	2022-08-12T12:51:30+05:30	936	35	1.2	0	2022-08-12T12:51:30+05:30	936	31	1.3	0
2022-08-12T12:53:59+05:30	937	33	0.6	0	2022-08-12T12:53:59+05:30	937	35	0.3	0	2022-08-12T12:53:59+05:30	937	35	1.2	0	2022-08-12T12:53:59+05:30	937	31	1.3	0
2022-08-12T12:56:28+05:30	938	33	0.6	0	2022-08-12T12:56:28+05:30	938	35	0.4	0	2022-08-12T12:56:28+05:30	938	35	1.2	0	2022-08-12T12:56:28+05:30	938	31	1.3	0
2022-08-12T12:58:57+05:30	939	33	0.6	0	2022-08-12T12:58:57+05:30	939	35	0.4	0	2022-08-12T12:58:57+05:30	939	35	1.2	0	2022-08-12T12:58:57+05:30	939	31	1.3	0
2022-08-12T13:01:26+05:30	940	33	0.6	0	2022-08-12T13:01:26+05:30	940	35	0.4	0	2022-08-12T13:01:26+05:30	940	35	1.2	0	2022-08-12T13:01:26+05:30	940	31	1.3	0
2022-08-12T13:03:55+05:30	941	33	0.6	0	2022-08-12T13:03:55+05:30	941	35	0.4	0	2022-08-12T13:03:55+05:30	941	35	1.2	0	2022-08-12T13:03:55+05:30	941	31	1.3	0
2022-08-12T13:06:24+05:30	942	33	0.6	0	2022-08-12T13:06:24+05:30	942	35	0.4	0	2022-08-12T13:06:24+05:30	942	35	1.2	0	2022-08-12T13:06:24+05:30	942	31	1.3	0
2022-08-12T13:51:27+05:30	967	33	0.9	0	2022-08-12T13:51:27+05:30	967	33	0.6	0	2022-08-12T13:51:27+05:30	967	33	1.5	0	2022-08-12T13:51:27+05:30	967	31	1.7	0
2022-08-12T13:53:52+05:30	968	33	0.9	0	2022-08-12T13:53:52+05:30	968	33	0.6	0	2022-08-12T13:53:52+05:30	968	33	1.5	0	2022-08-12T13:53:52+05:30	968	31	1.7	0
2022-08-12T13:56:17+05:30	969	33	0.9	0	2022-08-12T13:56:17+05:30	969	33	0.6	0	2022-08-12T13:56:17+05:30	969	33	1.5	0	2022-08-12T13:56:17+05:30	969	31	1.7	0
2022-08-12T13:58:42+05:30	970	33	0.9	0	2022-08-12T13:58:42+05:30	970	33	0.6	0	2022-08-12T13:58:42+05:30	970	33	1.5	0	2022-08-12T13:58:42+05:30	970	31	1.7	0
2022-08-12T14:01:07+05:30	971	33	0.9	0	2022-08-12T14:01:07+05:30	971	33	0.6	0	2022-08-12T14:01:07+05:30	971	33	1.5	0	2022-08-12T14:01:07+05:30	971	31	1.7	0
2022-08-12T14:03:32+05:30	972	33	0.9	0	2022-08-12T14:03:32+05:30	972	33	0.6	0	2022-08-12T14:03:32+05:30	972	33	1.5	0	2022-08-12T14:03:32+05:30	972	31	1.7	0
2022-08-12T14:05:57+05:30	973	33	0.9	0	2022-08-12T14:05:57+05:30	973	33	0.6	0	2022-08-12T14:05:57+05:30	973	33	1.5	0	2022-08-12T14:05:57+05:30	973	31	1.7	0
2022-08-12T14:08:22+05:30	974	32	0.9	0	2022-08-12T14:08:22+05:30	974	33	0.6	0	2022-08-12T14:08:22+05:30	974	33	1.5	0	2022-08-12T14:08:22+05:30	974	31	1.7	0
2022-08-12T14:10:47+05:30	975	32	0.9	0	2022-08-12T14:10:47+05:30	975	33	0.6	0	2022-08-12T14:10:47+05:30	975	33	1.7	0	2022-08-12T14:10:47+05:30	975	31	1.7	0
2022-08-12T14:13:12+05:30	976	32	1.2	0	2022-08-12T14:13:12+05:30	976	33	0.6	0	2022-08-12T14:13:12+05:30	976	33	1.7	0	2022-08-12T14:13:12+05:30	976	31	1.7	0
2022-08-12T14:15:37+05:30	977	32	1.2	0	2022-08-12T14:15:37+05:30	977	33	0.6	0	2022-08-12T14:15:37+05:30	977	33	1.7	0	2022-08-12T14:15:37+05:30	977	31	1.7	0
2022-08-12T14:18:02+05:30	978	32	1.2	0	2022-08-12T14:18:02+05:30	978	33	0.6	0	2022-08-12T14:18:02+05:30	978	33	1.7	0	2022-08-12T14:18:02+05:30	978	31	1.7	0
2022-08-12T14:20:38+05:30	979	32	1.2	0	2022-08-12T14:20:38+05:30	979	33	0.7	0	2022-08-12T14:20:38+05:30	979	33	1.7	0	2022-08-12T14:20:38+05:30	979	31	1.8	0
2022-08-12T14:23:14+05:30	980	32	1.2	0	2022-08-12T14:23:14+05:30	980	33	0.7	0	2022-08-12T14:23:14+05:30	980	33	1.7	0	2022-08-12T14:23:14+05:30	980	31	1.8	0
2022-08-12T14:25:50+05:30	981	32	1.2	0	2022-08-12T14:25:50+05:30	981	33	0.7	0	2022-08-12T14:25:50+05:30	981	33	1.7	0	2022-08-12T14:25:50+05:30	981	31	1.8	0
2022-08-12T14:28:26+05:30	982	32	1.2	0	2022-08-12T14:28:26+05:30	982	33	0.7	0	2022-08-12T14:28:26+05:30	982	33	1.7	0	2022-08-12T14:28:26+05:30	982	31	1.8	0
2022-08-12T14:31:02+05:30	983	32	1.2	0	2022-08-12T14:31:02+05:30	983	33	0.7	0	2022-08-12T14:31:02+05:30	983	33	1.7	0	2022-08-12T14:31:02+05:30	983	31	1.8	0
2022-08-12T14:33:38+05:30	984	32	1.2	0	2022-08-12T14:33:38+05:30	984	33	0.7	0	2022-08-12T14:33:38+05:30	984	33	1.7	0	2022-08-12T14:33:38+05:30	984	31	1.8	0
2022-08-12T14:36:14+05:30	985	32	1.2	0	2022-08-12T14:36:14+05:30	985	32	0.7	0	2022-08-12T14:36:14+05:30	985	32	1.7	0	2022-08-12T14:36:14+05:30	985	31	1.8	0
2022-08-12T14:38:50+05:30	986	32	1.2	0	2022-08-12T14:38:50+05:30	986	32	0.7	0	2022-08-12T14:38:50+05:30	986	32	1.7	0	2022-08-12T14:38:50+05:30	986	31	1.8	0
2022-08-12T14:41:26+05:30	987	32	1.2	0	2022-08-12T14:41:26+05:30	987	32	0.7	0	2022-08-12T14:41:26+05:30	987	32	1.7	0	2022-08-12T14:41:26+05:30	987	31	1.8	0
2022-08-12T15:25:44+05:30	1013	36	1.3	0	2022-08-12T15:25:44+05:30	1013	31	0.9	0	2022-08-12T15:25:44+05:30	1013	31	1.8	0	2022-08-12T15:25:44+05:30	1013	29	2.3	0
2022-08-12T15:26:33+05:30	1014	36	1.3	0	2022-08-12T15:26:33+05:30	1014	31	0.9	0	2022-08-12T15:26:33+05:30	1014	31	1.8	0	2022-08-12T15:26:33+05:30	1014	29	2.3	0
2022-08-12T15:28:44+05:30	1015	36	1.4	0	2022-08-12T15:28:44+05:30	1015	31	0.9	0	2022-08-12T15:28:44+05:30	1015	31	1.8	0	2022-08-12T15:28:44+05:30	1015	29	2.3	0
2022-08-12T16:58:23+05:30	1052	32	1.5	0	2022-08-12T16:58:23+05:30	1052	31	1.3	0	2022-08-12T16:58:23+05:30	1052	31	2.2	0	2022-08-12T16:58:23+05:30	1052	27	2.5	0
2022-08-12T17:01:17+05:30	1053	32	1.5	0	2022-08-12T17:01:17+05:30	1053	31	1.3	0	2022-08-12T17:01:17+05:30	1053	31	2.2	0	2022-08-12T17:01:17+05:30	1053	27	2.5	0
2022-08-12T17:04:11+05:30	1054	32	1.5	0	2022-08-12T17:04:11+05:30	1054	31	1.3	0	2022-08-12T17:04:11+05:30	1054	31	2.2	0	2022-08-12T17:04:11+05:30	1054	27	2.5	0
2022-08-13T10:31:16+05:30	1055	33	0	0	2022-08-13T10:31:16+05:30	1055	35	0	0	2022-08-13T10:31:16+05:30	1055	40	0	0	2022-08-13T10:31:16+05:30	1055	43	0	0
2022-08-13T10:32:06+05:30	1056	33	0	0	2022-08-13T10:32:06+05:30	1056	35	0	0	2022-08-13T10:32:06+05:30	1056	40	0	0	2022-08-13T10:32:06+05:30	1056	43	0	0
2022-08-13T11:05:26+05:30	1079	32	0.2	0	2022-08-13T11:05:26+05:30	1079	34	0.1	0	2022-08-13T11:05:26+05:30	1079	40	0.3	0	2022-08-13T11:05:26+05:30	1079	43	0.5	0
2022-08-13T11:07:38+05:30	1080	32	0.2	0	2022-08-13T11:07:38+05:30	1080	34	0.1	0	2022-08-13T11:07:38+05:30	1080	40	0.3	0	2022-08-13T11:07:38+05:30	1080	40	0.5	0
2022-08-13T11:09:50+05:30	1081	32	0.2	0	2022-08-13T11:09:50+05:30	1081	34	0.1	0	2022-08-13T11:09:50+05:30	1081	40	0.3	0	2022-08-13T11:09:50+05:30	1081	40	0.5	0
2022-08-13T11:12:02+05:30	1082	32	0.2	0	2022-08-13T11:12:02+05:30	1082	34	0.1	0	2022-08-13T11:12:02+05:30	1082	40	0.5	0	2022-08-13T11:12:02+05:30	1082	40	0.5	0
2022-08-13T11:14:14+05:30	1083	32	0.2	0	2022-08-13T11:14:14+05:30	1083	34	0.1	0	2022-08-13T11:14:14+05:30	1083	40	0.5	0	2022-08-13T11:14:14+05:30	1083	40	0.5	0
2022-08-13T11:16:26+05:30	1084	32	0.2	0	2022-08-13T11:16:26+05:30	1084	34	0.1	0	2022-08-13T11:16:26+05:30	1084	40	0.5	0	2022-08-13T11:16:26+05:30	1084	40	0.5	0
2022-08-13T11:18:38+05:30	1085	32	0.2	0	2022-08-13T11:18:38+05:30	1085	34	0.1	0	2022-08-13T11:18:38+05:30	1085	38	0.5	0	2022-08-13T11:18:38+05:30	1085	40	0.5	0
2022-08-13T11:20:50+05:30	1086	32	0.2	0	2022-08-13T11:20:50+05:30	1086	34	0.1	0	2022-08-13T11:20:50+05:30	1086	38	0.5	0	2022-08-13T11:20:50+05:30	1086	40	0.5	0
2022-08-13T11:22:19+05:30	1087	32	0.2	0	2022-08-13T11:22:19+05:30	1087	34	0.1	0	2022-08-13T11:22:19+05:30	1087	38	0.5	0	2022-08-13T11:22:19+05:30	1087	40	0.6	0
2022-08-13T11:23:48+05:30	1088	32	0.2	0	2022-08-13T11:23:48+05:30	1088	33	0.2	0	2022-08-13T11:23:48+05:30	1088	38	0.5	0	2022-08-13T11:23:48+05:30	1088	40	0.6	0
2022-08-13T11:25:17+05:30	1089	32	0.2	0	2022-08-13T11:25:17+05:30	1089	33	0.2	0	2022-08-13T11:25:17+05:30	1089	38	0.5	0	2022-08-13T11:25:17+05:30	1089	40	0.6	0
2022-08-13T11:26:46+05:30	1090	32	0.2	0	2022-08-13T11:26:46+05:30	1090	33	0.2	0	2022-08-13T11:26:46+05:30	1090	38	0.6	0	2022-08-13T11:26:46+05:30	1090	40	0.6	0
2022-08-13T11:28:15+05:30	1091	32	0.2	0	2022-08-13T11:28:15+05:30	1091	33	0.2	0	2022-08-13T11:28:15+05:30	1091	38	0.6	0	2022-08-13T11:28:15+05:30	1091	40	0.6	0
2022-08-13T11:29:44+05:30	1092	32	0.2	0	2022-08-13T11:29:44+05:30	1092	33	0.2	0	2022-08-13T11:29:44+05:30	1092	38	0.6	0	2022-08-13T11:29:44+05:30	1092	40	0.6	0
2022-08-13T11:31:13+05:30	1093	32	0.2	0	2022-08-13T11:31:13+05:30	1093	33	0.2	0	2022-08-13T11:31:13+05:30	1093	38	0.6	0	2022-08-13T11:31:13+05:30	1093	40	0.6	0
2022-08-13T11:32:42+05:30	1094	31	0.3	0	2022-08-13T11:32:42+05:30	1094	33	0.2	0	2022-08-13T11:32:42+05:30	1094	38	0.6	0	2022-08-13T11:32:42+05:30	1094	40	0.6	0
2022-08-13T11:34:11+05:30	1095	31	0.3	0	2022-08-13T11:34:11+05:30	1095	33	0.2	0	2022-08-13T11:34:11+05:30	1095	38	0.6	0	2022-08-13T11:34:11+05:30	1095	40	0.6	0
2022-08-13T11:35:40+05:30	1096	31	0.3	0	2022-08-13T11:35:40+05:30	1096	33	0.2	0	2022-08-13T11:35:40+05:30	1096	38	0.6	0	2022-08-13T11:35:40+05:30	1096	40	0.6	0
2022-08-13T14:05:57+05:30	1174	28	0.8	0	2022-08-13T14:05:57+05:30	1174	28	1	0	2022-08-13T14:05:57+05:30	1174	33	1.8	0	2022-08-13T14:05:57+05:30	1174	28	1.9	0
2022-08-13T14:08:22+05:30	1175	28	0.8	0	2022-08-13T14:08:22+05:30	1175	28	1.1	0	2022-08-13T14:08:22+05:30	1175	33	1.8	0	2022-08-13T14:08:22+05:30	1175	28	1.9	0
2022-08-13T14:10:47+05:30	1176	28	0.8	0	2022-08-13T14:10:47+05:30	1176	28	1.1	0	2022-08-13T14:10:47+05:30	1176	33	1.8	0	2022-08-13T14:10:47+05:30	1176	28	1.9	0
2022-08-13T14:13:12+05:30	1177	28	0.8	0	2022-08-13T14:13:12+05:30	1177	28	1.1	0	2022-08-13T14:13:12+05:30	1177	33	1.8	0	2022-08-13T14:13:12+05:30	1177	28	1.9	0
2022-08-13T14:15:37+05:30	1178	28	0.8	0	2022-08-13T14:15:37+05:30	1178	28	1.1	0	2022-08-13T14:15:37+05:30	1178	33	1.8	0	2022-08-13T14:15:37+05:30	1178	28	1.9	0
2022-08-13T14:18:02+05:30	1179	28	0.8	0	2022-08-13T14:18:02+05:30	1179	28	1.1	0	2022-08-13T14:18:02+05:30	1179	33	1.8	0	2022-08-13T14:18:02+05:30	1179	28	1.9	0
2022-08-13T14:20:38+05:30	1180	28	0.8	0	2022-08-13T14:20:38+05:30	1180	28	1.1	0	2022-08-13T14:20:38+05:30	1180	33	1.8	0	2022-08-13T14:20:38+05:30	1180	28	1.9	0
2022-08-13T14:23:14+05:30	1181	28	0.8	0	2022-08-13T14:23:14+05:30	1181	28	1.1	0	2022-08-13T14:23:14+05:30	1181	30	1.8	0	2022-08-13T14:23:14+05:30	1181	28	1.9	0
2022-08-13T14:25:50+05:30	1182	28	0.8	0	2022-08-13T14:25:50+05:30	1182	28	1.1	0	2022-08-13T14:25:50+05:30	1182	30	1.8	0	2022-08-13T14:25:50+05:30	1182	28	1.9	0
2022-08-13T14:28:26+05:30	1183	28	0.8	0	2022-08-13T14:28:26+05:30	1183	28	1.2	0	2022-08-13T14:28:26+05:30	1183	30	1.8	0	2022-08-13T14:28:26+05:30	1183	28	2	0
2022-08-13T14:31:02+05:30	1184	27	0.8	0	2022-08-13T14:31:02+05:30	1184	28	1.2	0	2022-08-13T14:31:02+05:30	1184	30	1.8	0	2022-08-13T14:31:02+05:30	1184	28	2	0
2022-08-13T14:33:38+05:30	1185	27	0.8	0	2022-08-13T14:33:38+05:30	1185	28	1.2	0	2022-08-13T14:33:38+05:30	1185	30	1.8	0	2022-08-13T14:33:38+05:30	1185	28	2	0
2022-08-13T14:36:14+05:30	1186	27	0.8	0	2022-08-13T14:36:14+05:30	1186	27	1.2	0	2022-08-13T14:36:14+05:30	1186	30	1.8	0	2022-08-13T14:36:14+05:30	1186	28	2	0
2022-08-13T14:38:50+05:30	1187	27	0.9	0	2022-08-13T14:38:50+05:30	1187	27	1.2	0	2022-08-13T14:38:50+05:30	1187	30	1.8	0	2022-08-13T14:38:50+05:30	1187	28	2	0
2022-08-13T14:41:26+05:30	1188	27	0.9	0	2022-08-13T14:41:26+05:30	1188	27	1.2	0	2022-08-13T14:41:26+05:30	1188	30	1.8	0	2022-08-13T14:41:26+05:30	1188	28	2	0
2022-08-13T14:44:17+05:30	1189	27	0.9	0	2022-08-13T14:44:17+05:30	1189	27	1.2	0	2022-08-13T14:44:17+05:30	1189	30	1.8	0	2022-08-13T14:44:17+05:30	1189	28	2	0
2022-08-13T14:47:08+05:30	1190	27	0.9	0	2022-08-13T14:47:08+05:30	1190	27	1.3	0	2022-08-13T14:47:08+05:30	1190	30	1.8	0	2022-08-13T14:47:08+05:30	1190	28	2	0
2022-08-13T14:49:59+05:30	1191	27	0.9	0	2022-08-13T14:49:59+05:30	1191	27	1.3	0	2022-08-13T14:49:59+05:30	1191	30	1.8	0	2022-08-13T14:49:59+05:30	1191	28	2	0
2022-08-13T14:52:50+05:30	1192	27	0.9	0	2022-08-13T14:52:50+05:30	1192	27	1.3	0	2022-08-13T14:52:50+05:30	1192	30	1.8	0	2022-08-13T14:52:50+05:30	1192	28	2	0
2022-08-13T15:39:39+05:30	1221	25	1.1	0	2022-08-13T15:39:39+05:30	1221	25	1.5	0	2022-08-13T15:39:39+05:30	1221	30	2	0	2022-08-13T15:39:39+05:30	1221	28	2.4	0
2022-08-13T15:41:46+05:30	1222	25	1.1	0	2022-08-13T15:41:46+05:30	1222	25	1.5	0	2022-08-13T15:41:46+05:30	1222	30	2	0	2022-08-13T15:41:46+05:30	1222	28	2.4	0
2022-08-13T15:43:53+05:30	1223	25	1.1	0	2022-08-13T15:43:53+05:30	1223	25	1.5	0	2022-08-13T15:43:53+05:30	1223	30	2	0	2022-08-13T15:43:53+05:30	1223	28	2.6	0
2022-08-13T15:46:00+05:30	1224	25	1.1	0	2022-08-13T15:46:00+05:30	1224	25	1.5	0	2022-08-13T15:46:00+05:30	1224	30	2	0	2022-08-13T15:46:00+05:30	1224	28	2.6	0
2022-08-13T15:48:07+05:30	1225	25	1.1	0	2022-08-13T15:48:07+05:30	1225	25	1.5	0	2022-08-13T15:48:07+05:30	1225	30	2	0	2022-08-13T15:48:07+05:30	1225	28	2.6	0
2022-08-13T15:50:14+05:30	1226	25	1.3	0	2022-08-13T15:50:14+05:30	1226	25	1.5	0	2022-08-13T15:50:14+05:30	1226	30	2.1	0	2022-08-13T15:50:14+05:30	1226	28	2.6	0
2022-08-13T15:52:21+05:30	1227	25	1.1	0	2022-08-13T15:52:21+05:30	1227	25	1.5	0	2022-08-13T15:52:21+05:30	1227	30	2.1	0	2022-08-13T15:52:21+05:30	1227	28	2.6	0
2022-08-13T15:54:28+05:30	1228	25	1.1	0	2022-08-13T15:54:28+05:30	1228	25	1.6	0	2022-08-13T15:54:28+05:30	1228	30	2.1	0	2022-08-13T15:54:28+05:30	1228	28	2.6	0
2022-08-13T15:56:35+05:30	1229	24	1.1	0	2022-08-13T15:56:35+05:30	1229	25	1.6	0	2022-08-13T15:56:35+05:30	1229	30	2.1	0	2022-08-13T15:56:35+05:30	1229	28	2.6	0
2022-08-13T15:58:42+05:30	1230	24	1.1	0	2022-08-13T15:58:42+05:30	1230	25	1.6	0	2022-08-13T15:58:42+05:30	1230	30	2.1	0	2022-08-13T15:58:42+05:30	1230	28	2.6	0
2022-08-13T16:00:49+05:30	1231	24	1.1	0	2022-08-13T16:00:49+05:30	1231	24	1.6	0	2022-08-13T16:00:49+05:30	1231	30	2.1	0	2022-08-13T16:00:49+05:30	1231	28	2.6	0
2022-08-13T16:02:56+05:30	1232	24	1.1	0	2022-08-13T16:02:56+05:30	1232	24	1.6	0	2022-08-13T16:02:56+05:30	1232	30	2.1	0	2022-08-13T16:02:56+05:30	1232	28	2.6	0
2022-08-13T16:05:03+05:30	1233	24	1.1	0	2022-08-13T16:05:03+05:30	1233	24	1.6	0	2022-08-13T16:05:03+05:30	1233	30	2.1	0	2022-08-13T16:05:03+05:30	1233	28	2.6	0
2022-08-13T16:07:22+05:30	1234	24	1.1	0	2022-08-13T16:07:22+05:30	1234	24	1.6	0	2022-08-13T16:07:22+05:30	1234	30	2.1	0	2022-08-13T16:07:22+05:30	1234	28	2.6	0
2022-08-13T16:09:41+05:30	1235	24	1.1	0	2022-08-13T16:09:41+05:30	1235	24	1.6	0	2022-08-13T16:09:41+05:30	1235	30	2.1	0	2022-08-13T16:09:41+05:30	1235	28	2.6	0
2022-08-14T10:49:08+05:30	1271	45	0.2	0	2022-08-14T10:49:08+05:30	1271	43	0.1	0	2022-08-14T10:49:08+05:30	1271	53	0.4	0	2022-08-14T10:49:08+05:30	1271	52	0.3	0
2022-08-14T10:51:26+05:30	1272	45	0.2	0	2022-08-14T10:51:26+05:30	1272	43	0.1	0	2022-08-14T10:51:26+05:30	1272	53	0.4	0	2022-08-14T10:51:26+05:30	1272	52	0.3	0
2022-08-14T10:53:44+05:30	1273	45	0.2	0	2022-08-14T10:53:44+05:30	1273	43	0.1	0	2022-08-14T10:53:44+05:30	1273	53	0.4	0	2022-08-14T10:53:44+05:30	1273	52	0.5	0
2022-08-14T10:56:02+05:30	1274	44	0.2	0	2022-08-14T10:56:02+05:30	1274	43	0.1	0	2022-08-14T10:56:02+05:30	1274	53	0.4	0	2022-08-14T10:56:02+05:30	1274	52	0.5	0
2022-08-14T10:57:36+05:30	1275	44	0.2	0	2022-08-14T10:57:36+05:30	1275	43	0.1	0	2022-08-14T10:57:36+05:30	1275	53	0.4	0	2022-08-14T10:57:36+05:30	1275	52	0.5	0
2022-08-14T10:59:10+05:30	1276	44	0.2	0	2022-08-14T10:59:10+05:30	1276	43	0.1	0	2022-08-14T10:59:10+05:30	1276	53	0.6	0	2022-08-14T10:59:10+05:30	1276	52	0.5	0
2022-08-14T11:00:44+05:30	1277	44	0.2	0	2022-08-14T11:00:44+05:30	1277	42	0.1	0	2022-08-14T11:00:44+05:30	1277	53	0.6	0	2022-08-14T11:00:44+05:30	1277	50	0.5	0
2022-08-14T11:02:18+05:30	1278	44	0.2	0	2022-08-14T11:02:18+05:30	1278	42	0.1	0	2022-08-14T11:02:18+05:30	1278	53	0.6	0	2022-08-14T11:02:18+05:30	1278	50	0.5	0

Node 1					Node 2					Node 3					Node 4				
created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3
2022-08-14T11:57:33+05:30	1306	43	0.6	0	2022-08-14T11:57:33+05:30	1306	42	0.4	0	2022-08-14T11:57:33+05:30	1306	52	0.9	0	2022-08-14T11:57:33+05:30	1306	47	0.6	0
2022-08-14T12:00:06+05:30	1307	43	0.6	0	2022-08-14T12:00:06+05:30	1307	42	0.4	0	2022-08-14T12:00:06+05:30	1307	52	0.9	0	2022-08-14T12:00:06+05:30	1307	47	0.6	0
2022-08-14T12:02:39+05:30	1308	42	0.6	0	2022-08-14T12:02:39+05:30	1308	42	0.4	0	2022-08-14T12:02:39+05:30	1308	52	0.9	0	2022-08-14T12:02:39+05:30	1308	47	0.6	0
2022-08-14T12:05:12+05:30	1309	42	0.6	0	2022-08-14T12:05:12+05:30	1309	42	0.5	0	2022-08-14T12:05:12+05:30	1309	52	0.9	0	2022-08-14T12:05:12+05:30	1309	47	0.6	0
2022-08-14T12:07:45+05:30	1310	42	0.6	0	2022-08-14T12:07:45+05:30	1310	42	0.5	0	2022-08-14T12:07:45+05:30	1310	52	1.1	0	2022-08-14T12:07:45+05:30	1310	47	0.6	0
2022-08-14T12:09:47+05:30	1311	42	0.6	0	2022-08-14T12:09:47+05:30	1311	42	0.5	0	2022-08-14T12:09:47+05:30	1311	52	1.1	0	2022-08-14T12:09:47+05:30	1311	47	0.6	0
2022-08-14T12:11:49+05:30	1312	42	0.6	0	2022-08-14T12:11:49+05:30	1312	42	0.5	0	2022-08-14T12:11:49+05:30	1312	52	1.1	0	2022-08-14T12:11:49+05:30	1312	47	0.6	0
2022-08-14T14:25:50+05:30	1383	41	1	0	2022-08-14T14:25:50+05:30	1383	41	1.4	0	2022-08-14T14:25:50+05:30	1383	49	1.9	0	2022-08-14T14:25:50+05:30	1383	45	1.9	0
2022-08-14T14:28:26+05:30	1384	41	1	0	2022-08-14T14:28:26+05:30	1384	41	1.4	0	2022-08-14T14:28:26+05:30	1384	49	1.9	0	2022-08-14T14:28:26+05:30	1384	45	1.9	0
2022-08-14T14:31:02+05:30	1385	41	1	0	2022-08-14T14:31:02+05:30	1385	41	1.5	0	2022-08-14T14:31:02+05:30	1385	49	1.9	0	2022-08-14T14:31:02+05:30	1385	45	1.9	0
2022-08-14T14:33:38+05:30	1386	41	1	0	2022-08-14T14:33:38+05:30	1386	41	1.5	0	2022-08-14T14:33:38+05:30	1386	49	1.9	0	2022-08-14T14:33:38+05:30	1386	43	1.9	0
2022-08-14T14:36:14+05:30	1387	41	1	0	2022-08-14T14:36:14+05:30	1387	41	1.5	0	2022-08-14T14:36:14+05:30	1387	49	1.9	0	2022-08-14T14:36:14+05:30	1387	43	1.9	0
2022-08-14T14:38:50+05:30	1388	41	1	0	2022-08-14T14:38:50+05:30	1388	41	1.5	0	2022-08-14T14:38:50+05:30	1388	49	1.9	0	2022-08-14T14:38:50+05:30	1388	43	1.9	0
2022-08-14T14:41:26+05:30	1389	41	1	0	2022-08-14T14:41:26+05:30	1389	41	1.5	0	2022-08-14T14:41:26+05:30	1389	49	1.9	0	2022-08-14T14:41:26+05:30	1389	43	1.9	0
2022-08-14T14:44:17+05:30	1390	41	1	0	2022-08-14T14:44:17+05:30	1390	41	1.5	0	2022-08-14T14:44:17+05:30	1390	49	1.9	0	2022-08-14T14:44:17+05:30	1390	43	2	0
2022-08-14T14:47:08+05:30	1391	41	1	0	2022-08-14T14:47:08+05:30	1391	41	1.5	0	2022-08-14T14:47:08+05:30	1391	49	2	0	2022-08-14T14:47:08+05:30	1391	43	2	0
2022-08-14T14:49:59+05:30	1392	41	1	0	2022-08-14T14:49:59+05:30	1392	41	1.5	0	2022-08-14T14:49:59+05:30	1392	49	2	0	2022-08-14T14:49:59+05:30	1392	43	2	0
2022-08-14T14:52:50+05:30	1393	41	1	0	2022-08-14T14:52:50+05:30	1393	41	1.5	0	2022-08-14T14:52:50+05:30	1393	49	2	0	2022-08-14T14:52:50+05:30	1393	43	2	0
2022-08-14T14:55:41+05:30	1394	41	1	0	2022-08-14T14:55:41+05:30	1394	41	1.5	0	2022-08-14T14:55:41+05:30	1394	49	2	0	2022-08-14T14:55:41+05:30	1394	43	2	0
2022-08-14T14:58:32+05:30	1395	41	1	0	2022-08-14T14:58:32+05:30	1395	41	1.5	0	2022-08-14T14:58:32+05:30	1395	49	2	0	2022-08-14T14:58:32+05:30	1395	43	2	0
2022-08-14T15:01:23+05:30	1396	41	1.2	0	2022-08-14T15:01:23+05:30	1396	41	1.5	0	2022-08-14T15:01:23+05:30	1396	49	2	0	2022-08-14T15:01:23+05:30	1396	43	2	0
2022-08-14T15:56:35+05:30	1430	40	1.3	0	2022-08-14T15:56:35+05:30	1430	39	1.7	0	2022-08-14T15:56:35+05:30	1430	49	2.5	0	2022-08-14T15:56:35+05:30	1430	40	2.7	0
2022-08-14T15:58:42+05:30	1431	40	1.3	0	2022-08-14T15:58:42+05:30	1431	39	1.7	0	2022-08-14T15:58:42+05:30	1431	49	2.5	0	2022-08-14T15:58:42+05:30	1431	40	2.7	0
2022-08-14T16:00:49+05:30	1432	40	1.3	0	2022-08-14T16:00:49+05:30	1432	39	1.7	0	2022-08-14T16:00:49+05:30	1432	49	2.5	0	2022-08-14T16:00:49+05:30	1432	40	2.7	0
2022-08-14T16:02:56+05:30	1433	40	1.3	0	2022-08-14T16:02:56+05:30	1433	39	1.7	0	2022-08-14T16:02:56+05:30	1433	49	2.5	0	2022-08-14T16:02:56+05:30	1433	40	2.7	0
2022-08-14T16:05:03+05:30	1434	40	1.3	0	2022-08-14T16:05:03+05:30	1434	39	1.7	0	2022-08-14T16:05:03+05:30	1434	49	2.5	0	2022-08-14T16:05:03+05:30	1434	40	2.7	0
2022-08-14T16:07:22+05:30	1435	40	1.3	0	2022-08-14T16:07:22+05:30	1435	39	1.7	0	2022-08-14T16:07:22+05:30	1435	45	2.5	0	2022-08-14T16:07:22+05:30	1435	40	2.7	0
2022-08-14T16:09:41+05:30	1436	40	1.3	0	2022-08-14T16:09:41+05:30	1436	39	1.7	0	2022-08-14T16:09:41+05:30	1436	45	2.5	0	2022-08-14T16:09:41+05:30	1436	40	2.7	0
2022-08-14T16:12:00+05:30	1437	40	1.7	0	2022-08-14T16:12:00+05:30	1437	37	1.7	0	2022-08-14T16:12:00+05:30	1437	45	2.5	0	2022-08-14T16:12:00+05:30	1437	40	2.7	0
2022-08-14T16:14:19+05:30	1438	40	1.7	0	2022-08-14T16:14:19+05:30	1438	37	1.7	0	2022-08-14T16:14:19+05:30	1438	45	2.5	0	2022-08-14T16:14:19+05:30	1438	40	2.9	0
2022-08-14T16:16:38+05:30	1439	40	1.7	0	2022-08-14T16:16:38+05:30	1439	37	1.7	0	2022-08-14T16:16:38+05:30	1439	45	2.5	0	2022-08-14T16:16:38+05:30	1439	40	2.9	0
2022-08-14T16:18:57+05:30	1440	40	1.7	0	2022-08-14T16:18:57+05:30	1440	37	1.8	0	2022-08-14T16:18:57+05:30	1440	45	2.5	0	2022-08-14T16:18:57+05:30	1440	40	2.9	0
2022-08-14T16:21:16+05:30	1441	40	1.7	0	2022-08-14T16:21:16+05:30	1441	37	1.8	0	2022-08-14T16:21:16+05:30	1441	45	2.5	0	2022-08-14T16:21:16+05:30	1441	40	2.9	0
2022-08-14T16:23:35+05:30	1442	40	1.7	0	2022-08-14T16:23:35+05:30	1442	37	1.8	0	2022-08-14T16:23:35+05:30	1442	45	2.5	0	2022-08-14T16:23:35+05:30	1442	40	2.9	0
2022-08-14T16:26:29+05:30	1443	40	1.7	0	2022-08-14T16:26:29+05:30	1443	37	1.8	0	2022-08-14T16:26:29+05:30	1443	45	2.5	0	2022-08-14T16:26:29+05:30	1443	38	2.9	0
2022-08-14T16:29:23+05:30	1444	40	1.7	0	2022-08-14T16:29:23+05:30	1444	37	1.8	0	2022-08-14T16:29:23+05:30	1444	45	2.5	0	2022-08-14T16:29:23+05:30	1444	38	2.9	0
2022-08-14T16:32:17+05:30	1445	40	1.7	0	2022-08-14T16:32:17+05:30	1445	37	1.8	0	2022-08-14T16:32:17+05:30	1445	45	2.5	0	2022-08-14T16:32:17+05:30	1445	38	2.9	0
2022-08-14T16:35:11+05:30	1446	40	1.7	0	2022-08-14T16:35:11+05:30	1446	37	1.8	0	2022-08-14T16:35:11+05:30	1446	45	2.5	0	2022-08-14T16:35:11+05:30	1446	38	2.9	0
2022-08-14T16:38:05+05:30	1447	40	1.7	0	2022-08-14T16:38:05+05:30	1447	37	1.9	0	2022-08-14T16:38:05+05:30	1447	45	2.5	0	2022-08-14T16:38:05+05:30	1447	38	2.9	0
2022-08-15T10:51:26+05:30	1473	41	0.2	0	2022-08-15T10:51:26+05:30	1473	42	0.4	0	2022-08-15T10:51:26+05:30	1473	55	0.5	0	2022-08-15T10:51:26+05:30	1473	54	0.5	0
2022-08-15T10:53:44+05:30	1474	41	0.2	0	2022-08-15T10:53:44+05:30	1474	42	0.4	0	2022-08-15T10:53:44+05:30	1474	55	0.5	0	2022-08-15T10:53:44+05:30	1474	55	0.5	0
2022-08-15T10:56:02+05:30	1475	41	0.2	0	2022-08-15T10:56:02+05:30	1475	41	0.4	0	2022-08-15T10:56:02+05:30	1475	55	0.5	0	2022-08-15T10:56:02+05:30	1475	55	0.5	0
2022-08-15T10:57:36+05:30	1476	41	0.2	0	2022-08-15T10:57:36+05:30	1476	41	0.4	0	2022-08-15T10:57:36+05:30	1476	55	0.5	0	2022-08-15T10:57:36+05:30	1476	55	0.5	0
2022-08-15T10:59:10+05:30	1477	41	0.2	0	2022-08-15T10:59:10+05:30	1477	41	0.4	0	2022-08-15T10:59:10+05:30	1477	56	0.7	0	2022-08-15T10:59:10+05:30	1477	55	0.5	0
2022-08-15T11:00:44+05:30	1478	41	0.3	0	2022-08-15T11:00:44+05:30	1478	41	0.4	0	2022-08-15T11:00:44+05:30	1478	56	0.7	0	2022-08-15T11:00:44+05:30	1478	55	0.5	0
2022-08-15T11:02:18+05:30	1479	41	0.3	0	2022-08-15T11:02:18+05:30	1479	41	0.4	0	2022-08-15T11:02:18+05:30	1479	56	0.7	0	2022-08-15T11:02:18+05:30	1479	55	0.5	0
2022-08-15T11:03:52+05:30	1480	41	0.3	0	2022-08-15T11:03:52+05:30	1480	41	0.4	0	2022-08-15T11:03:52+05:30	1480	56	0.7	0	2022-08-15T11:03:52+05:30	1480	55	0.5	0
2022-08-15T11:05:26+05:30	1481	43	0.3	0	2022-08-15T11:05:26+05:30	1481	41	0.5	0	2022-08-15T11:05:26+05:30	1481	56	0.7	0	2022-08-15T11:05:26+05:30	1481	55	0.5	0
2022-08-15T11:07:38+05:30	1482	43	0.3	0	2022-08-15T11:07:38+05:30	1482	41	0.5	0	2022-08-15T11:07:38+05:30	1482	56	0.7	0	2022-08-15T11:07:38+05:30	1482	55	0.9	0
2022-08-15T11:09:50+05:30	1483	43	0.3	0	2022-08-15T11:09:50+05:30	1483	41	0.5	0	2022-08-15T11:09:50+05:30	1483	56	0.7	0	2022-08-15T11:09:50+05:30	1483	55	0.9	0
2022-08-15T11:12:02+05:30	1484	43	0.3	0	2022-08-15T11:12:02+05:30	1484	41	0.5	0	2022-08-15T11:12:02+05:30	1484	56	0.7	0	2022-08-15T11:12:02+05:30	1484	55	0.9	0
2022-08-15T11:14:14+05:30	1485	43	0.3	0	2022-08-15T11:14:14+05:30	1485	41	0.5	0	2022-08-15T11:14:14+05:30	1485	56	0.7	0	2022-08-15T11:14:14+05:30	1485	55	0.9	0
2022-08-15T11:16:26+05:30	1486	43	0.4	0	2022-08-15T11:16:26+05:30	1486	41	0.5	0	2022-08-15T11:16:26+05:30	1486	56	0.7	0	2022-08-15T11:16:26+05:30	1486	55	0.9	0
2022-08-15T11:18:38+05:30	1487	43	0.4	0	2022-08-15T11:18:38+05:30	1487	41	0.5	0	2022-08-15T11:18:38+05:30	1487	56	0.7	0	2022-08-15T11:18:38+05:30	1487	55	0.9	0
2022-08-15T11:20:50+05:30	1488	43	0.4	0	2022-08-15T11:20:50+05:30	1488	41	0.5	0	2022-08-15T11:20:50+05:30	1488	56	0.9	0	2022-08-15T11:20:50+05:30	1488	55	0.9	0
2022-08-15T11:22:19+05:30	1489	43	0.4	0	2022-08-15T11:22:19+05:30	1489	41	0.5	0	2022-08-15T11:22:19+05:30	1489	56	0.9	0	2022-08-15T11:22:19+05:30	1489	55	0.9	0
2022-08-15T11:23:48+05:30	1490	43	0.4	0	2022-08-15T11:23:48+05:30	1490	41	0.5	0	2022-08-15T11:23:48+05:30	1490	56	0.9	0	2022-08-15T11:23:48+05:30	1490	55	1.1	0
2022-08-15T11:25:17+05:30	1491	43	0.4	0	2022-08-15T11:25:17+05:30	1491	41	0.5	0	2022-08-15T11:25:17+05:30	1491	56	0.9	0	2022-08-15T11:25:17+05:30	1491	55	1.1	0
2022-08-15T11:26:46+05:30	1492	43	0.4	0	2022-08-15T11:26:46+05:30	1492	41	0.7	0	2022-08-15T11:26:46+05:30	1492	56	1.1	0	2022-08-15T11:26:46+05:30	1492	55	1.1	0
2022-08-15T11:28:15+05:30	1493	44	0.4	0	2022-08-15T11:28:15+05:30	1493	41	0.7	0	2022-08-15T11:28:15+05:30	1493	56	1.1	0	2022-08-15T11:28:15+05:30	1493	55	1.1	0
2022-08-15T11:29:44+05:30	1494	44	0.4	0	2022-08-15T11:29:44+05:30	1494	41	0.7	0	2022-08-15T11:29:44+05:30	1494	56	1.1	0	2022-08-15T11:29:44+05:30	1494	55	1.1	0
2022-08-15T11:31:13+05:30	1495	44	0.5	0	2022-08-15T11:31:13+05:30	1495	41	0.7	0	2022-08-15T11:31:13+05:30	1495	56	1.1	0	2022-08-15T11:31:13+05:30	1495	57	1.5	0
2022-08-15T11:32:42+05:30	1496	44	0.5	0	2022-08-15T11:32:42+05:30	1496	42	0.7	0	2022-08-15T11:32:42+05:30	1496	56	1.1	0	2022-08-15T11:32:42+05:30	1496	57	1.5	0
2022-08-15T11:34:11+05:30	1497	44	0.5	0	2022-08-15T11:34:11+05:30	1497	42	0.7	0	2022-08-15T11:34:11+05:30	1497	56	1.1	0	2022-08-15T11:34:11+05:30	1497	57	1.5	0
2022-08-15T12:37:21+05:30	1527	47	1.3	0	2022-08-15T12:37:21+05:30	1527	43	1.2	0	2022-08-15T12:37:21+05:30	1527	62	1.7	0	2022-08-15T12:37:21+05:30	1527	59	2.2	0
2022-08-15T12:38:37+05:30	1528	47	1.3	0	2022-08-15T12:38:37+05:30	1528	43	1.2	0	2022-08-15T12:38:37+05:30	1528	62	1.7	0	2022-08-15T12:38:37+05:30	1528	59	2.2	0
2022-08-15T12:39:53+05:30	1529	47	1.3	0	2022-08-15T12:39:53+05:30	1529	43	1.2	0	2022-08-15T12:39:53+05:30	1529	62	1.7	0	2022-08-15T12:39:53+05:30	1529	59	2.4	0
2022-08-15T12:41:09+05:30	1530	47	1.3	0	2022-08-15T12:41:09+05:30	1530	43	1.3	0	2022-08-15T12:41:09+05:30	1530	62	1.7	0	2022-08-15T12:41:09+05:30	1530	59	2.4	0
2022-08-15T12:42:08+05:30	1531	47	1.3	0	2022-08-15T12:42:08+05:30	1531	43	1.3	0	2022-08-15T12:42:08+05:30	1531	64	1.7	0	2022-08-15T12:42:08+05:30	1531	59	2.4	0
2022-08-15T12:43:07+05:30	1532	47	1.3	0	2022-08-15T12:43:07+05:30	1532	43	1.3	0	2022-08-15T12:43:07+05:30	1532	64	1.7	0	2022-08-15T12:43:07+05:30	1532	59	2.4	0
2022-08-15T12:44:06+05:30	1533	47	1.4	0	2022-08-15T12:44:06+05:30	1533	43	1.3	0	2022-08-15T12:44:06+05:30	1533	64	1.7	0	2022-08-15T12:44:06+05:30	1533	59	2.4	0
2022-08-15T12:45:05+05:30	1534	47	1.4	0	2022-08-15T12:45:05+05:30	1534	43	1.3	0	2022-08-15T12:45:05+05:30	1534	64	1.7	0	2022-08-15T12:45:05+05:30	1534	59	2.4	0
2022-08-15T12:46:04+05:30	1535	47	1.4	0	2022-08-15T12:46:04+05:30	1535	43	1.3	0	2022-08-15T12:46:04+05:30	1535	64	1.7	0	2022-08-15T12:46:04+05:30	1535	59	2.4	0
2022-08-15T12:47:03+05:30	1536	50	1.4	0	2022-08-15T12:47:03+05:30	1536	40	1.3	0	2022-08-15T12:47:03+05:30	1536	64	1.7	0	2022-08-15T12:47:03+05:30	1536	59	2.4	0
2022-08-15T16:23:35+05:30	1643	48	3.3	0	2022-08-15T16:23:35+05:30	1643	46	3.1	0	2022-08-15T16:23:35+05:30	1643	60	4.3	0	2022-08-15T16:23:35+05:30	1643	60	4.6	0
2022-08-15T16:26:29+05:30	1644	48	3.3	0	2022-08-15T16:26:29+05:30	1644	46	3.2	0	2022-08-15T16:26:29+05:30	1644	60	4.3	0	2022-08-15T16:26:29+05:30	1644	60	4.6	0
2022-08-15T16:29:23+05:30	1645	47	3.3	0	2022-08-15T16:29:23+05:30	1645	46	3.2	0	2022-08-15T16:29:23+05:30	1645	59	4.3	0	2022-08-15T16:29:23+05:30	1645	60	4.6	0
2022-08-15T16:32:17+05:30	1646	47	3.3	0	2022-08-15T16:32:17+05:30	1646	46	3.2	0	2022-08-15T16:32:17+05:30	1646	59	4.3	0	2022-08-15T16:32:17+05:30	1646	60	4.6	0
2022-08-15T16:35:11+05:30	1647	47	3.3	0	2022-08-15T16:35:11+05:30	1647	46	3.2	0	2022-08-15T16:35:11+05:30	1647	59	4.3	0	2022-08-15T16:35:11+05:30	1647	60	4.6	0
2022-08-15T16:38:05+05:30	1648	47	3.3	0	2022-08-15T16:38:05+05:30	1648	46	3.2	0	2022-08-15T16:38:05+05:30	1648	59	4.3	0	2022-08-15T16:38:05+05:30	1648	60	4.6	0
2022-08-15T16:40:59+05:30	1649	47	3.3	0	2022-08-15T16:40:59+05:30	1649	46	3.2	0	2022-08-15T16:40:59+05:30	1649	59	4.3	0	2022-08-15T16:40:59+05:30	1649	60	4.6	0
2022-08-15T16:43:53+05:30	1650	47	3.3	0	2022-08-15T16:43:53+05:30	1650	45	3.2	0	2022-08-15T16:43:53+05:30	1650	59	4.5	0	2022-08-15T16:43:53+05:30	1650	60	4.6	0
2022-08-15T16:46:47+05:30	1651	47	3.3	0	2022-08-15T16:46:47+05:30	1651	45	3.2	0	2022-08-15T16:46:47+05:30	1651	59	4.5	0	2022-08-15T16:46:47+05:30	1651	60	4.6	0
2022-08-15T16:49:41+05:30	1652	47	3.5	0	2022-08-15T16:49:41+05:30	1652	45	3.3	0	2022-08-15T16:49:41+05:30	1652	59	4.5	0	2022-08-15T16:49:41+05:30	1652	60	4.6	0
2022-08-15T16:52:35+05:30	1653	47	3.5	0	2022-08-15T16:52:35+05:30	1653	45	3.3	0	2022-08-15T16:52:35+05:30	1653	59	4.5	0	2022-08-15T16:52:35+05:30	1653	60	4.6	0
2022-08-15T16:55:29+05:30	1654	47	3.5	0	2022-08-15T16:55:29+05:30	1654	45	3.3	0	2022-08-15T16:55:29+05:30	1654	59	4.5	0	2022-08-15T16:55:29+05:30	1654	60	4.6	0
2022-08-15T16:58:23+05:30	1655	47	3.5	0	2022-08-15T16:58:23+05:30	1655	45	3.3	0	2022-08-15T16:58:23+05:30	1655	59	4.7	0	2022-08-15T16:58:23+05:30	1655	60	4.6	0
2022-08-16T12:00:06+05:30	1709	57	1.3	0	2022-08-16T12:00:06+05:30	1709	49	1.8	0	2022-08-16T12:00:06+05:30	1709	65	2.2	0	2022-08-16T12:00:06+05:30	1709	62	2.3	0
2022-08-16T12:02:39+05:30	1710	57	1.3	0	2022-08-16T12:02:39+05:30	1710	49	1.8	0	2022-08-16T12:02:39+05:30	1710	65	2.2	0	2022-08-16T12:02:39+05:30	1710	62	2.3	0
2022-08-16T12:05:12+05:30	1711	57	1.3	0	2022-08-16T12:05:12+05:30	1711	49	1.8	0	2022-08-16T12:05:12+05:30	1711	65	2.2	0	2022-08-16T12:05:12+05:30	1711	62	2.3	0
2022-08-16T12:07:45+05:30	1712	57	1.3	0	2022-08-16T12:07:45+05:30	1712	51	1.8	0	2022-08-16T12:07:45+05:30	1712	65	2.2	0	2022-08-16T12:07:45+05:30	1712	62	2.3	0
2022-08-16T12:09:47+05:30	1713	57	1.5	0	2022-08-16T12:09:47+05:30	1713	51	1.8	0	2022-08-16T12:09:47+05:30	1713	65	2.2	0	2022-08-16T12:09:47+05:30	1713	65	3.5	0
2022-08-16T12:11:49+05:30	1714	60	1.5	0	2022-08-16T12:11:49+05:30	1714	51	1.8	0	2022-08-16T12:11:49+05:30	1714	65	2.2	0	2022-08-16T12:11:49+05:30	1714	65	3.5	0
2022-08-16T12:13:51+05:30	1715	60	1.5	0	2022-08-16T12:13:51+05:30	1715	51	1.8	0	2022-08-16T12:13:51+05:30	1715	65	2.4	0	2022-08-16T12:13:51+05:30	1715	65	3.5	0
2022-08-16T12:15:53+05:30	1716	60	1.5	0	2022-08-16T12:15:53+05:30	1716	51	1.8	0	2022-08-16T12:15:53+05:30	1716	65	2.4	0	2022-08-16T12:15:53+05:30	1716	65	3.5	0
2022-08-16T12:17:55+05:30	1717	60	1.5	0	2022-08-16T12:17:55+05:30	1717	51	1.8	0	2022-08-16T12:17:55+05:30	1717	65	2.4	0	2022-08-16T12:17:55+05:30	1717	65	3.5	0
2022-08-16T12:19:57+05:30	1718	60	1.5	0	2022-08-16T12:19:57+05:30	1718	55	1.8	0	2022-08-16T12:19:57+05:30	1718	65	2.4	0	2022-08-16T12:19:57+05:30	1718	65	3.5	0
2022-08-16T12:21:59+05:30	1719	62	1.5	0	2022-08-16T12:21:59+05:30	1719	55	1.7	0	2022-08-16T12:21:59+05:30	1719	65	2.4	0	2022-08-16T12:21:59+05:30	1719	65	3.5	0
2022-08-16T12:24:01+05:30	1720	62	1.5	0	2022-08-16T12:24:01+05:30	1720	55	1.7	0	2022-08-16T12:24:01+05:30	1720	65	2.4	0	2022-08-16T12:24:01+05:30	1720	65	3.5	0
2022-08-16T12:25:49+05:30	1721	62	1.5	0	2022-08-16T12:25:49+05:30	1721	55	1.7	0	2022-08-16T12:25:49+05:30	1721	67	2.4	0	2022-08-16T12:25:49+05:30	1721	65	3.5	0
2022-08-16T12:27:37+05:30	1722	62	1.6	0	2022-08-16T12:27:37+05:30	1722	55	1.7	0	2022-08-16T12:27:37+05:30	1722	67	2.4	0	2022-08-16T12:27:37+05:30	1722	65	3.5	0
2022-08-16T12:29:25+05:30	1723	62	1.6	0	2022-08-16T12:29:25+05:30	1723	56	1.7	0	2022-08-16T12:29:25+05:30	1723	67	2.4	0	2022-08-16T12:29:25+05:30	1723	65	3.5	0
2022-08-16T12:31:13+05:30	1724	60	1.6	0	2022-08-16T12:31:13+05:30	1724	56	1.7	0	2022-08-16T12:31:13+05:30	1724	67	2.8	0	2022-08-16T12:31:13+05:30	1724	65	3.5	0
2022-08-16

Node 1					Node 2					Node 3					Node 4				
created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3
2022-08-17T12:37:21+05:30	1929	30	0.5	0	2022-08-17T12:37:21+05:30	1929	32	0.5	0	2022-08-17T12:37:21+05:30	1929	37	0.8	0	2022-08-17T12:37:21+05:30	1929	39	1.4	0
2022-08-17T12:38:37+05:30	1930	30	0.5	0	2022-08-17T12:38:37+05:30	1930	32	0.5	0	2022-08-17T12:38:37+05:30	1930	37	0.8	0	2022-08-17T12:38:37+05:30	1930	39	1.4	0
2022-08-17T12:39:53+05:30	1931	30	0.6	0	2022-08-17T12:39:53+05:30	1931	32	0.5	0	2022-08-17T12:39:53+05:30	1931	37	0.8	0	2022-08-17T12:39:53+05:30	1931	39	1.4	0
2022-08-17T12:41:09+05:30	1932	30	0.6	0	2022-08-17T12:41:09+05:30	1932	32	0.5	0	2022-08-17T12:41:09+05:30	1932	37	0.8	0	2022-08-17T12:41:09+05:30	1932	39	1.4	0
2022-08-17T12:42:08+05:30	1933	30	0.6	0	2022-08-17T12:42:08+05:30	1933	32	0.5	0	2022-08-17T12:42:08+05:30	1933	37	0.8	0	2022-08-17T12:42:08+05:30	1933	39	1.4	0
2022-08-17T12:43:07+05:30	1934	30	0.6	0	2022-08-17T12:43:07+05:30	1934	32	0.5	0	2022-08-17T12:43:07+05:30	1934	37	0.8	0	2022-08-17T12:43:07+05:30	1934	39	1.4	0
2022-08-17T12:44:06+05:30	1935	30	0.6	0	2022-08-17T12:44:06+05:30	1935	32	0.5	0	2022-08-17T12:44:06+05:30	1935	37	0.8	0	2022-08-17T12:44:06+05:30	1935	38	1.4	0
2022-08-17T12:45:05+05:30	1936	30	0.6	0	2022-08-17T12:45:05+05:30	1936	32	0.5	0	2022-08-17T12:45:05+05:30	1936	37	0.8	0	2022-08-17T12:45:05+05:30	1936	38	1.6	0
2022-08-17T12:46:04+05:30	1937	30	0.6	0	2022-08-17T12:46:04+05:30	1937	32	0.5	0	2022-08-17T12:46:04+05:30	1937	37	0.8	0	2022-08-17T12:46:04+05:30	1937	38	1.6	0
2022-08-17T12:47:03+05:30	1938	30	0.6	0	2022-08-17T12:47:03+05:30	1938	32	0.5	0	2022-08-17T12:47:03+05:30	1938	37	0.8	0	2022-08-17T12:47:03+05:30	1938	38	1.6	0
2022-08-17T12:48:02+05:30	1939	30	0.6	0	2022-08-17T12:48:02+05:30	1939	32	0.9	0	2022-08-17T12:48:02+05:30	1939	37	0.8	0	2022-08-17T12:48:02+05:30	1939	38	1.6	0
2022-08-17T12:49:01+05:30	1940	30	0.6	0	2022-08-17T12:49:01+05:30	1940	32	0.9	0	2022-08-17T12:49:01+05:30	1940	35	0.8	0	2022-08-17T12:49:01+05:30	1940	38	1.6	0
2022-08-17T12:51:30+05:30	1941	30	0.6	0	2022-08-17T12:51:30+05:30	1941	32	0.9	0	2022-08-17T12:51:30+05:30	1941	35	0.8	0	2022-08-17T12:51:30+05:30	1941	38	1.6	0
2022-08-17T14:55:41+05:30	1997	28	1.2	0	2022-08-17T14:55:41+05:30	1997	23	1.4	0	2022-08-17T14:55:41+05:30	1997	37	1.8	0	2022-08-17T14:55:41+05:30	1997	36	2.6	0
2022-08-17T14:58:32+05:30	1998	28	1.2	0	2022-08-17T14:58:32+05:30	1998	23	1.4	0	2022-08-17T14:58:32+05:30	1998	37	1.8	0	2022-08-17T14:58:32+05:30	1998	36	2.6	0
2022-08-17T15:01:23+05:30	1999	28	1.2	0	2022-08-17T15:01:23+05:30	1999	23	1.4	0	2022-08-17T15:01:23+05:30	1999	37	1.8	0	2022-08-17T15:01:23+05:30	1999	36	2.7	0
2022-08-17T15:04:14+05:30	2000	28	1.2	0	2022-08-17T15:04:14+05:30	2000	23	1.4	0	2022-08-17T15:04:14+05:30	2000	37	1.8	0	2022-08-17T15:04:14+05:30	2000	36	2.7	0
2022-08-17T15:07:05+05:30	2001	28	1.2	0	2022-08-17T15:07:05+05:30	2001	23	1.4	0	2022-08-17T15:07:05+05:30	2001	37	1.8	0	2022-08-17T15:07:05+05:30	2001	36	2.7	0
2022-08-17T15:08:20+05:30	2002	28	1.2	0	2022-08-17T15:08:20+05:30	2002	23	1.4	0	2022-08-17T15:08:20+05:30	2002	37	1.8	0	2022-08-17T15:08:20+05:30	2002	36	2.7	0
2022-08-17T15:09:35+05:30	2003	28	1.2	0	2022-08-17T15:09:35+05:30	2003	23	1.4	0	2022-08-17T15:09:35+05:30	2003	37	1.8	0	2022-08-17T15:09:35+05:30	2003	36	2.7	0
2022-08-17T15:10:50+05:30	2004	28	1.2	0	2022-08-17T15:10:50+05:30	2004	23	1.4	0	2022-08-17T15:10:50+05:30	2004	37	1.8	0	2022-08-17T15:10:50+05:30	2004	36	2.7	0
2022-08-17T15:12:05+05:30	2005	28	1.2	0	2022-08-17T15:12:05+05:30	2005	23	1.4	0	2022-08-17T15:12:05+05:30	2005	37	1.8	0	2022-08-17T15:12:05+05:30	2005	36	2.7	0
2022-08-17T15:13:20+05:30	2006	28	1.2	0	2022-08-17T15:13:20+05:30	2006	23	1.4	0	2022-08-17T15:13:20+05:30	2006	37	1.8	0	2022-08-17T15:13:20+05:30	2006	36	2.7	0
2022-08-17T15:14:35+05:30	2007	28	1.2	0	2022-08-17T15:14:35+05:30	2007	23	1.4	0	2022-08-17T15:14:35+05:30	2007	37	1.8	0	2022-08-17T15:14:35+05:30	2007	35	2.7	0
2022-08-17T15:15:50+05:30	2008	28	1.2	0	2022-08-17T15:15:50+05:30	2008	23	1.4	0	2022-08-17T15:15:50+05:30	2008	37	2	0	2022-08-17T15:15:50+05:30	2008	35	2.7	0
2022-08-17T15:17:05+05:30	2009	28	1.2	0	2022-08-17T15:17:05+05:30	2009	23	1.4	0	2022-08-17T15:17:05+05:30	2009	37	2	0	2022-08-17T15:17:05+05:30	2009	35	2.7	0
2022-08-17T15:18:20+05:30	2010	27	1.3	0	2022-08-17T15:18:20+05:30	2010	23	1.4	0	2022-08-17T15:18:20+05:30	2010	37	2	0	2022-08-17T15:18:20+05:30	2010	35	2.7	0
2022-08-17T15:19:35+05:30	2011	27	1.3	0	2022-08-17T15:19:35+05:30	2011	23	1.4	0	2022-08-17T15:19:35+05:30	2011	37	2	0	2022-08-17T15:19:35+05:30	2011	35	2.7	0
2022-08-17T16:26:29+05:30	2046	26	1.3	0	2022-08-17T16:26:29+05:30	2046	22	1.5	0	2022-08-17T16:26:29+05:30	2046	39	2.4	0	2022-08-17T16:26:29+05:30	2046	34	2.9	0
2022-08-17T16:29:23+05:30	2047	26	1.3	0	2022-08-17T16:29:23+05:30	2047	22	1.5	0	2022-08-17T16:29:23+05:30	2047	39	2.4	0	2022-08-17T16:29:23+05:30	2047	34	2.9	0
2022-08-17T16:32:17+05:30	2048	26	1.3	0	2022-08-17T16:32:17+05:30	2048	22	1.5	0	2022-08-17T16:32:17+05:30	2048	39	2.4	0	2022-08-17T16:32:17+05:30	2048	34	2.9	0
2022-08-17T16:35:11+05:30	2049	26	1.3	0	2022-08-17T16:35:11+05:30	2049	22	1.5	0	2022-08-17T16:35:11+05:30	2049	39	2.4	0	2022-08-17T16:35:11+05:30	2049	34	2.9	0
2022-08-17T16:38:05+05:30	2050	26	1.3	0	2022-08-17T16:38:05+05:30	2050	22	1.5	0	2022-08-17T16:38:05+05:30	2050	39	2.4	0	2022-08-17T16:38:05+05:30	2050	34	2.9	0
2022-08-18T10:51:26+05:30	2076	31	0	0	2022-08-18T10:51:26+05:30	2076	28	0	0	2022-08-18T10:51:26+05:30	2076	37	0.3	0	2022-08-18T10:51:26+05:30	2076	38	0.3	0
2022-08-18T10:53:44+05:30	2077	31	0.2	0	2022-08-18T10:53:44+05:30	2077	28	0	0	2022-08-18T10:53:44+05:30	2077	37	0.3	0	2022-08-18T10:53:44+05:30	2077	38	0.3	0
2022-08-18T10:56:02+05:30	2078	30	0.2	0	2022-08-18T10:56:02+05:30	2078	28	0.1	0	2022-08-18T10:56:02+05:30	2078	37	0.3	0	2022-08-18T10:56:02+05:30	2078	38	0.3	0
2022-08-18T10:57:36+05:30	2079	30	0.2	0	2022-08-18T10:57:36+05:30	2079	28	0.1	0	2022-08-18T10:57:36+05:30	2079	37	0.3	0	2022-08-18T10:57:36+05:30	2079	38	0.3	0
2022-08-18T10:59:10+05:30	2080	30	0.2	0	2022-08-18T10:59:10+05:30	2080	28	0.1	0	2022-08-18T10:59:10+05:30	2080	37	0.3	0	2022-08-18T10:59:10+05:30	2080	38	0.3	0
2022-08-18T12:36:05+05:30	2129	29	0.9	0	2022-08-18T12:36:05+05:30	2129	23	0.3	0	2022-08-18T12:36:05+05:30	2129	35	0.8	0	2022-08-18T12:36:05+05:30	2129	34	1.1	0
2022-08-18T12:37:21+05:30	2130	29	0.9	0	2022-08-18T12:37:21+05:30	2130	23	0.4	0	2022-08-18T12:37:21+05:30	2130	35	0.8	0	2022-08-18T12:37:21+05:30	2130	34	1.1	0
2022-08-18T12:38:37+05:30	2131	29	0.9	0	2022-08-18T12:38:37+05:30	2131	23	0.4	0	2022-08-18T12:38:37+05:30	2131	35	0.8	0	2022-08-18T12:38:37+05:30	2131	34	1.1	0
2022-08-18T12:39:53+05:30	2132	29	0.9	0	2022-08-18T12:39:53+05:30	2132	23	0.4	0	2022-08-18T12:39:53+05:30	2132	35	0.8	0	2022-08-18T12:39:53+05:30	2132	34	1.3	0
2022-08-18T12:41:09+05:30	2133	29	0.9	0	2022-08-18T12:41:09+05:30	2133	23	0.4	0	2022-08-18T12:41:09+05:30	2133	35	0.9	0	2022-08-18T12:41:09+05:30	2133	34	1.3	0
2022-08-18T12:42:08+05:30	2134	29	0.9	0	2022-08-18T12:42:08+05:30	2134	23	0.4	0	2022-08-18T12:42:08+05:30	2134	35	0.9	0	2022-08-18T12:42:08+05:30	2134	34	1.3	0
2022-08-18T12:43:07+05:30	2135	29	0.9	0	2022-08-18T12:43:07+05:30	2135	23	0.4	0	2022-08-18T12:43:07+05:30	2135	35	0.9	0	2022-08-18T12:43:07+05:30	2135	34	1.3	0
2022-08-18T12:44:06+05:30	2136	29	0.9	0	2022-08-18T12:44:06+05:30	2136	23	0.4	0	2022-08-18T12:44:06+05:30	2136	35	0.9	0	2022-08-18T12:44:06+05:30	2136	34	1.3	0
2022-08-18T12:45:05+05:30	2137	29	0.9	0	2022-08-18T12:45:05+05:30	2137	23	0.4	0	2022-08-18T12:45:05+05:30	2137	36	0.9	0	2022-08-18T12:45:05+05:30	2137	34	1.3	0
2022-08-18T12:46:04+05:30	2138	29	0.9	0	2022-08-18T12:46:04+05:30	2138	23	0.4	0	2022-08-18T12:46:04+05:30	2138	36	0.9	0	2022-08-18T12:46:04+05:30	2138	34	1.3	0
2022-08-18T12:47:03+05:30	2139	29	0.9	0	2022-08-18T12:47:03+05:30	2139	23	0.4	0	2022-08-18T12:47:03+05:30	2139	36	0.9	0	2022-08-18T12:47:03+05:30	2139	34	1.3	0
2022-08-18T12:48:02+05:30	2140	29	0.9	0	2022-08-18T12:48:02+05:30	2140	23	0.4	0	2022-08-18T12:48:02+05:30	2140	36	0.9	0	2022-08-18T12:48:02+05:30	2140	34	1.3	0
2022-08-18T13:33:31+05:30	2165	25	0.9	0	2022-08-18T13:33:31+05:30	2165	21	0.5	0	2022-08-18T13:33:31+05:30	2165	34	1.2	0	2022-08-18T13:33:31+05:30	2165	33	1.6	0
2022-08-18T13:35:44+05:30	2166	25	0.9	0	2022-08-18T13:35:44+05:30	2166	21	0.5	0	2022-08-18T13:35:44+05:30	2166	34	1.2	0	2022-08-18T13:35:44+05:30	2166	33	1.6	0
2022-08-18T13:37:57+05:30	2167	25	0.9	0	2022-08-18T13:37:57+05:30	2167	21	0.5	0	2022-08-18T13:37:57+05:30	2167	34	1.2	0	2022-08-18T13:37:57+05:30	2167	33	1.8	0
2022-08-18T13:40:10+05:30	2168	25	0.9	0	2022-08-18T13:40:10+05:30	2168	21	0.5	0	2022-08-18T13:40:10+05:30	2168	34	1.2	0	2022-08-18T13:40:10+05:30	2168	33	1.8	0
2022-08-18T13:42:23+05:30	2169	25	0.9	0	2022-08-18T13:42:23+05:30	2169	21	0.5	0	2022-08-18T13:42:23+05:30	2169	34	1.2	0	2022-08-18T13:42:23+05:30	2169	33	1.8	0
2022-08-18T13:44:36+05:30	2170	19	0.9	0	2022-08-18T13:44:36+05:30	2170	21	0.5	0	2022-08-18T13:44:36+05:30	2170	34	1.3	0	2022-08-18T13:44:36+05:30	2170	33	1.8	0
2022-08-18T14:33:38+05:30	2190	19	0.9	0	2022-08-18T14:33:38+05:30	2190	19	0.7	0	2022-08-18T14:33:38+05:30	2190	34	1.5	0	2022-08-18T14:33:38+05:30	2190	28	2	0
2022-08-18T14:36:14+05:30	2191	19	0.9	0	2022-08-18T14:36:14+05:30	2191	19	0.7	0	2022-08-18T14:36:14+05:30	2191	34	1.5	0	2022-08-18T14:36:14+05:30	2191	28	2	0
2022-08-18T14:38:50+05:30	2192	19	0.9	0	2022-08-18T14:38:50+05:30	2192	19	0.7	0	2022-08-18T14:38:50+05:30	2192	34	1.5	0	2022-08-18T14:38:50+05:30	2192	28	2	0
2022-08-19T11:37:09+05:30	2303	25	0.2	0	2022-08-19T11:37:09+05:30	2303	29	0.3	0	2022-08-19T11:37:09+05:30	2303	38	0.1	0	2022-08-19T11:37:09+05:30	2303	36	0.2	0
2022-08-19T11:39:42+05:30	2304	25	0.2	0	2022-08-19T11:39:42+05:30	2304	29	0.3	0	2022-08-19T11:39:42+05:30	2304	38	0.1	0	2022-08-19T11:39:42+05:30	2304	36	0.4	0
2022-08-19T11:42:15+05:30	2305	25	0.2	0	2022-08-19T11:42:15+05:30	2305	29	0.3	0	2022-08-19T11:42:15+05:30	2305	38	0.1	0	2022-08-19T11:42:15+05:30	2305	36	0.4	0
2022-08-19T11:44:48+05:30	2306	25	0.2	0	2022-08-19T11:44:48+05:30	2306	29	0.3	0	2022-08-19T11:44:48+05:30	2306	38	0.1	0	2022-08-19T11:44:48+05:30	2306	36	0.4	0
2022-08-19T12:37:21+05:30	2331	25	0.2	0	2022-08-19T12:37:21+05:30	2331	30	0.4	0	2022-08-19T12:37:21+05:30	2331	35	0.5	0	2022-08-19T12:37:21+05:30	2331	35	0.6	0
2022-08-19T12:38:37+05:30	2332	25	0.2	0	2022-08-19T12:38:37+05:30	2332	30	0.4	0	2022-08-19T12:38:37+05:30	2332	35	0.5	0	2022-08-19T12:38:37+05:30	2332	35	0.6	0
2022-08-19T12:39:53+05:30	2333	26	0.2	0	2022-08-19T12:39:53+05:30	2333	30	0.4	0	2022-08-19T12:39:53+05:30	2333	35	0.5	0	2022-08-19T12:39:53+05:30	2333	35	0.6	0
2022-08-19T12:41:09+05:30	2334	26	0.2	0	2022-08-19T12:41:09+05:30	2334	30	0.4	0	2022-08-19T12:41:09+05:30	2334	35	0.5	0	2022-08-19T12:41:09+05:30	2334	35	0.8	0
2022-08-19T12:42:08+05:30	2335	26	0.3	0	2022-08-19T12:42:08+05:30	2335	30	0.4	0	2022-08-19T12:42:08+05:30	2335	35	0.5	0	2022-08-19T12:42:08+05:30	2335	35	0.8	0
2022-08-19T12:43:07+05:30	2336	26	0.3	0	2022-08-19T12:43:07+05:30	2336	30	0.4	0	2022-08-19T12:43:07+05:30	2336	35	0.5	0	2022-08-19T12:43:07+05:30	2336	35	0.8	0
2022-08-19T12:44:06+05:30	2337	26	0.3	0	2022-08-19T12:44:06+05:30	2337	30	0.4	0	2022-08-19T12:44:06+05:30	2337	35	0.5	0	2022-08-19T12:44:06+05:30	2337	35	0.8	0
2022-08-19T12:45:05+05:30	2338	26	0.3	0	2022-08-19T12:45:05+05:30	2338	30	0.4	0	2022-08-19T12:45:05+05:30	2338	35	0.5	0	2022-08-19T12:45:05+05:30	2338	35	0.8	0
2022-08-19T12:46:04+05:30	2339	26	0.3	0	2022-08-19T12:46:04+05:30	2339	30	0.4	0	2022-08-19T12:46:04+05:30	2339	35	0.5	0	2022-08-19T12:46:04+05:30	2339	35	0.8	0
2022-08-19T12:47:03+05:30	2340	26	0.3	0	2022-08-19T12:47:03+05:30	2340	30	0.4	0	2022-08-19T12:47:03+05:30	2340	35	0.5	0	2022-08-19T12:47:03+05:30	2340	35	0.8	0
2022-08-19T12:48:02+05:30	2341	26	0.3	0	2022-08-19T12:48:02+05:30	2341	30	0.4	0	2022-08-19T12:48:02+05:30	2341	35	0.5	0	2022-08-19T12:48:02+05:30	2341	35	0.8	0
2022-08-19T12:49:01+05:30	2342	26	0.3	0	2022-08-19T12:49:01+05:30	2342	30	0.4	0	2022-08-19T12:49:01+05:30	2342	33	0.5	0	2022-08-19T12:49:01+05:30	2342	33	0.8	0
2022-08-19T12:51:30+05:30	2343	26	0.3	0	2022-08-19T12:51:30+05:30	2343	30	0.4	0	2022-08-19T12:51:30+05:30	2343	33	0.5	0	2022-08-19T12:51:30+05:30	2343	33	0.8	0
2022-08-19T12:53:59+05:30	2344	26	0.3	0	2022-08-19T12:53:59+05:30	2344	30	0.4	0	2022-08-19T12:53:59+05:30	2344	33	0.5	0	2022-08-19T12:53:59+05:30	2344	33	0.8	0
2022-08-19T12:56:28+05:30	2345	26	0.3	0	2022-08-19T12:56:28+05:30	2345	30	0.4	0	2022-08-19T12:56:28+05:30	2345	33	0.5	0	2022-08-19T12:56:28+05:30	2345	33	0.8	0
2022-08-19T12:58:57+05:30	2346	26	0.3	0	2022-08-19T12:58:57+05:30	2346	30	0.4	0	2022-08-19T12:58:57+05:30	2346	33	0.5	0	2022-08-19T12:58:57+05:30	2346	33	0.8	0
2022-08-19T13:01:26+05:30	2347	26	0.3	0	2022-08-19T13:01:26+05:30	2347	30	0.4	0	2022-08-19T13:01:26+05:30	2347	33	0.5	0	2022-08-19T13:01:26+05:30	2347	33	0.9	0
2022-08-19T13:03:55+05:30	2348	26	0.3	0	2022-08-19T13:03:55+05:30	2348	30	0.4	0	2022-08-19T13:03:55+05:30	2348	33	0.5	0	2022-08-19T13:03:55+05:30	2348	33	0.9	0
2022-08-19T13:06:24+05:30	2349	26	0.3	0	2022-08-19T13:06:24+05:30	2349	30	0.4	0	2022-08-19T13:06:24+05:30	2349	33	0.5	0	2022-08-19T13:06:24+05:30	2349	33	0.9	0
2022-08-19T13:08:53+05:30	2350	26	0.3	0	2022-08-19T13:08:53+05:30	2350	27	0.4	0	2022-08-19T13:08:53+05:30	2350	33	0.5	0	2022-08-19T13:08:53+05:30	2350	33	0.9	0
2022-08-19T13:10:01+05:30	2351	26	0.3	0	2022-08-19T13:10:01+05:30	2351	27	0.4	0	2022-08-19T13:10:01+05:30	2351	33	0.7	0	2022-08-19T13:10:01+05:30	2351	33	0.9	0
2022-08-19T13:11:09+05:30	2352	26	0.3	0	2022-08-19T13:11:09+05:30	2352	27	0.4	0	2022-08-19T13:11:09+05:30	2352	33	0.7	0	2022-08-19T13:11:09+05:30	2352	33	0.9	0
2022-08-19T13:12:17+05:30	2353	26	0.3	0	2022-08-19T13:12:17+05:30	2353	27	0.4	0	2022-08-19T13:12:17+05:30	2353	33	0.7	0	2022-08-19T13:12:17+05:30	2353	33	0.9	0
2022-08-19T13:13:25+05:30	2354	26	0.3	0	2022-08-19T13:13:25+05:30	2354	27	0.4	0	2022-08-19T13:13:25+05:30	2354	33	0.7	0	2022-08-19T13:13:25+05:30	2354	33	0.9	0
2022-08-19T13:56:17+05:30	2376	25	0.4	0	2022-08-19T13:56:17+05:30	2376	27	0.5	0	2022-08-19T13:56:17+05:30	2376	33	0.7	0	2022-08-19T13:56:17+05:30	2376	33	1.3	0
2022-08-19T13:58:42+05:30	2377	25	0.4	0	2022-08-19T13:58:42+05:30	2377	27	0.5	0	2022-08-19T13:58:42+05:30	2377	33	0.7	0	2022-08-19T13:58:42+05:30	2377	33	1.3	0
2022-08-19T14:01:07+05:30	2378	25	0.4	0	2022-08-19T14:01:07+05:30	2378	27	0.5	0	2022-08-19T14:01:07+05:30	2378	33	0.7	0	2022-08-19T14:01:07+05:30	2378	33	1.3	0
2022-08-20T10:31:16+05:30	2462	32	0	0	2022-08-20T10:31:16+05:30	2462	32	0	0	2022-08-20T10:31:16+05:30	2462	41	0	0	2022-08-20T10:31:16+05:30	2462	41	0	0
2022-08-20T10:32:06+05:30	2463	32	0	0	2022-08-20T10:32:06+05:30	2463	32	0	0	2022-08-20T10:32:06+05:30	2463	41	0	0	2022-08-20T10:32:06+05:30	2463	40	0	0
2022-08-20T10:32:56+05:30	2464	32	0	0	2022-08-20T10:32:56+05:30	2464	32	0	0	2022-08-20T10:32:56+05:30	2464	41	0	0	2022-08-20T10:32:56+05:30	2464	40	0	0
2022-08-20T10:33:46+05:30	2465	32	0	0	2022-08-20T10:33:46+05:30	2465	32	0.1	0	2022-08-20T10:33:46+05:30	2465	41	0	0	2022-08-20T10:33:46+05:30	2465	40	0	0
2022-08-20T10:34:36+05:30	2466	32	0	0	2022-08-20T10:34:36+05:30	2466	32	0.1	0	2022-08-20T10:34:36+05:30	2466	41	0	0	2022-08-20T10:34:36+05:30	2466	40	0	0
2022-08-20T10:35:26+05:30	2467	32	0	0	2022-08-20T10:35:26+05:30	2467	32	0.1	0	2022-08-20T10:35:26+05:30	2467	41	0	0	2022-08-20T10:35:26+05:30	2467	40	0	0
2022-08-20T10:36:11+05:30	2468	32	0	0	2022-08-20T10:36:11+05:30	2468	32	0.1	0	2022-08-20T10:36:11+05:30	2468	41	0	0	2022-08-20T10:36:11+05:30	2468	40	0	0
2022-08-20T10:36:56+05:30	2469	32	0	0	2022-08-20T10:36:56+05:30	2469	32	0.1	0	2022-08-20T10:36:56+05:30	2469	41	0	0	2022-08-20T10:36:56+05:30	2469	40	0	0
2022-08-20T10:37:41+05:30	2470	32	0	0	2022-08-20T10:37:41+05:30	2470	32	0.1	0	2022-08-20T10:37:41+05:30	2470	41	0	0	2022-08-20T10:37:41+05:30	2470	40	0	0
2022-08-20T10:38:26+05:30	2471	32	0	0	2022-08-20T10:38:26+05:30	2471	32	0.1	0	2022-08-20T10:38:26+05:30	2471	41	0	0	2022-08-20T10:38:26+05:30	2471	40	0	0
2022-08-20T10:39:11+05:30	2472	32	0.1	0	2022-08-20T10:39:11+05:30	2472	32	0.1	0	2022-08-20T10:39:11+05:30	2472	41	0	0	2022-08-20T10:39:11+05:30	2472	40	0	0
2022-08-20T10:39:56+05:30	2473	32	0.1	0	2022-08-20T10:39:56+05:30	2473	32	0.1	0	2022-08-20T10:39:56+05:30	2473	41	0	0	2022-08-20T10:39:56+05:30	2473	40	0	0
2022-08-20T10:42:14+05:30	2474	32	0.1	0	2022-08-20T10:42:14+05:30	2474	32	0.1	0	2022-08-20T10:42:14+05:30	2474	41	0	0	2022-08-20T10:42:14+05:30	2474	40	0	0
2022-08-20T10:44:32+05:30	2475	32	0.1	0	2022-08-20T10:44:32+05

Node 1					Node 2					Node 3					Node 4				
created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3
2022-08-20T13:31:18+05:30	2566	24	0.9	0	2022-08-20T13:31:18+05:30	2566	27	0.9	0	2022-08-20T13:31:18+05:30	2566	40	1.1	0	2022-08-20T13:31:18+05:30	2566	35	1.2	0
2022-08-20T13:33:31+05:30	2567	24	0.9	0	2022-08-20T13:33:31+05:30	2567	27	0.9	0	2022-08-20T13:33:31+05:30	2567	40	1.1	0	2022-08-20T13:33:31+05:30	2567	35	1.2	0
2022-08-20T13:35:44+05:30	2568	24	0.9	0	2022-08-20T13:35:44+05:30	2568	28	0.9	0	2022-08-20T13:35:44+05:30	2568	40	1.1	0	2022-08-20T13:35:44+05:30	2568	35	1.2	0
2022-08-20T14:20:38+05:30	2587	21	1	0	2022-08-20T14:20:38+05:30	2587	25	0.8	0	2022-08-20T14:20:38+05:30	2587	37	1.3	0	2022-08-20T14:20:38+05:30	2587	29	1.3	0
2022-08-20T14:23:14+05:30	2588	21	1	0	2022-08-20T14:23:14+05:30	2588	25	0.8	0	2022-08-20T14:23:14+05:30	2588	37	1.4	0	2022-08-20T14:23:14+05:30	2588	29	1.6	0
2022-08-20T14:25:50+05:30	2589	21	1	0	2022-08-20T14:25:50+05:30	2589	25	0.8	0	2022-08-20T14:25:50+05:30	2589	37	1.4	0	2022-08-20T14:25:50+05:30	2589	29	1.6	0
2022-08-20T14:28:26+05:30	2590	21	1	0	2022-08-20T14:28:26+05:30	2590	25	0.8	0	2022-08-20T14:28:26+05:30	2590	37	1.4	0	2022-08-20T14:28:26+05:30	2590	29	1.6	0
2022-08-20T14:31:02+05:30	2591	21	1	0	2022-08-20T14:31:02+05:30	2591	25	0.8	0	2022-08-20T14:31:02+05:30	2591	37	1.4	0	2022-08-20T14:31:02+05:30	2591	29	1.6	0
2022-08-20T14:33:38+05:30	2592	21	1	0	2022-08-20T14:33:38+05:30	2592	25	0.8	0	2022-08-20T14:33:38+05:30	2592	37	1.4	0	2022-08-20T14:33:38+05:30	2592	29	1.6	0
2022-08-20T14:36:14+05:30	2593	21	1	0	2022-08-20T14:36:14+05:30	2593	25	0.8	0	2022-08-20T14:36:14+05:30	2593	37	1.4	0	2022-08-20T14:36:14+05:30	2593	29	1.6	0
2022-08-20T14:38:50+05:30	2594	21	1	0	2022-08-20T14:38:50+05:30	2594	25	0.8	0	2022-08-20T14:38:50+05:30	2594	37	1.4	0	2022-08-20T14:38:50+05:30	2594	29	1.6	0
2022-08-20T14:41:26+05:30	2595	21	1.1	0	2022-08-20T14:41:26+05:30	2595	25	0.8	0	2022-08-20T14:41:26+05:30	2595	37	1.4	0	2022-08-20T14:41:26+05:30	2595	29	1.6	0
2022-08-20T14:44:17+05:30	2596	21	1.1	0	2022-08-20T14:44:17+05:30	2596	25	0.8	0	2022-08-20T14:44:17+05:30	2596	37	1.4	0	2022-08-20T14:44:17+05:30	2596	29	1.6	0
2022-08-20T14:47:08+05:30	2597	21	1.1	0	2022-08-20T14:47:08+05:30	2597	25	0.8	0	2022-08-20T14:47:08+05:30	2597	37	1.4	0	2022-08-20T14:47:08+05:30	2597	29	1.6	0
2022-08-20T14:49:59+05:30	2598	21	1.1	0	2022-08-20T14:49:59+05:30	2598	25	0.8	0	2022-08-20T14:49:59+05:30	2598	37	1.4	0	2022-08-20T14:49:59+05:30	2598	29	1.6	0
2022-08-20T14:52:50+05:30	2599	21	1.1	0	2022-08-20T14:52:50+05:30	2599	25	0.8	0	2022-08-20T14:52:50+05:30	2599	37	1.4	0	2022-08-20T14:52:50+05:30	2599	29	1.6	0
2022-08-20T14:55:41+05:30	2600	21	1.1	0	2022-08-20T14:55:41+05:30	2600	25	0.8	0	2022-08-20T14:55:41+05:30	2600	37	1.4	0	2022-08-20T14:55:41+05:30	2600	29	1.6	0
2022-08-20T14:58:32+05:30	2601	21	1.1	0	2022-08-20T14:58:32+05:30	2601	25	0.8	0	2022-08-20T14:58:32+05:30	2601	37	1.4	0	2022-08-20T14:58:32+05:30	2601	29	1.6	0
2022-08-20T15:01:23+05:30	2602	21	1.1	0	2022-08-20T15:01:23+05:30	2602	25	0.8	0	2022-08-20T15:01:23+05:30	2602	37	1.4	0	2022-08-20T15:01:23+05:30	2602	29	1.6	0
2022-08-20T15:04:14+05:30	2603	21	1.1	0	2022-08-20T15:04:14+05:30	2603	25	0.8	0	2022-08-20T15:04:14+05:30	2603	37	1.4	0	2022-08-20T15:04:14+05:30	2603	29	1.6	0
2022-08-20T15:07:05+05:30	2604	21	1.1	0	2022-08-20T15:07:05+05:30	2604	25	0.8	0	2022-08-20T15:07:05+05:30	2604	37	1.4	0	2022-08-20T15:07:05+05:30	2604	29	1.6	0
2022-08-20T15:08:20+05:30	2605	21	1.1	0	2022-08-20T15:08:20+05:30	2605	25	0.8	0	2022-08-20T15:08:20+05:30	2605	37	1.4	0	2022-08-20T15:08:20+05:30	2605	29	1.6	0
2022-08-20T15:33:06+05:30	2625	19	1.2	0	2022-08-20T15:33:06+05:30	2625	19	0.9	0	2022-08-20T15:33:06+05:30	2625	36	1.6	0	2022-08-20T15:33:06+05:30	2625	30	1.9	0
2022-08-20T15:35:17+05:30	2626	19	1.2	0	2022-08-20T15:35:17+05:30	2626	19	0.9	0	2022-08-20T15:35:17+05:30	2626	36	1.6	0	2022-08-20T15:35:17+05:30	2626	30	1.9	0
2022-08-20T15:37:28+05:30	2627	19	1.2	0	2022-08-20T15:37:28+05:30	2627	19	0.9	0	2022-08-20T15:37:28+05:30	2627	36	1.6	0	2022-08-20T15:37:28+05:30	2627	30	1.9	0
2022-08-20T15:39:39+05:30	2628	19	1.2	0	2022-08-20T15:39:39+05:30	2628	17	0.9	0	2022-08-20T15:39:39+05:30	2628	36	1.6	0	2022-08-20T15:39:39+05:30	2628	30	1.9	0
2022-08-20T15:41:46+05:30	2629	19	1.2	0	2022-08-20T15:41:46+05:30	2629	17	0.9	0	2022-08-20T15:41:46+05:30	2629	36	1.6	0	2022-08-20T15:41:46+05:30	2629	30	1.9	0
2022-08-20T15:43:53+05:30	2630	19	1.2	24	2022-08-20T15:43:53+05:30	2630	17	0.9	27	2022-08-20T15:43:53+05:30	2630	36	1.6	30	2022-08-20T15:43:53+05:30	2630	30	1.9	23
2022-08-20T15:46:00+05:30	2631	19	1.2	0	2022-08-20T15:46:00+05:30	2631	17	0.9	0	2022-08-20T15:46:00+05:30	2631	36	1.7	0	2022-08-20T15:46:00+05:30	2631	30	1.9	0
2022-08-20T15:48:07+05:30	2632	19	1.2	0	2022-08-20T15:48:07+05:30	2632	17	0.9	0	2022-08-20T15:48:07+05:30	2632	36	1.7	0	2022-08-20T15:48:07+05:30	2632	30	1.9	0
2022-08-20T15:50:14+05:30	2633	19	1.2	0	2022-08-20T15:50:14+05:30	2633	17	0.9	0	2022-08-20T15:50:14+05:30	2633	36	1.7	0	2022-08-20T15:50:14+05:30	2633	30	2.1	0
2022-08-20T15:52:21+05:30	2634	19	1.2	0	2022-08-20T15:52:21+05:30	2634	17	0.9	0	2022-08-20T15:52:21+05:30	2634	36	1.7	0	2022-08-20T15:52:21+05:30	2634	30	2.1	0
2022-08-20T16:52:35+05:30	2658	19	1.2	0	2022-08-20T16:52:35+05:30	2658	16	0.9	0	2022-08-20T16:52:35+05:30	2658	35	1.9	0	2022-08-20T16:52:35+05:30	2658	30	2.4	0
2022-08-20T16:55:29+05:30	2659	19	1.2	0	2022-08-20T16:55:29+05:30	2659	16	0.9	0	2022-08-20T16:55:29+05:30	2659	35	2.2	0	2022-08-20T16:55:29+05:30	2659	30	2.4	0
2022-08-20T16:58:23+05:30	2660	19	1.2	0	2022-08-20T16:58:23+05:30	2660	16	0.9	0	2022-08-20T16:58:23+05:30	2660	35	2.2	0	2022-08-20T16:58:23+05:30	2660	30	2.4	0
2022-08-20T17:01:17+05:30	2661	19	1.2	0	2022-08-20T17:01:17+05:30	2661	16	0.9	0	2022-08-20T17:01:17+05:30	2661	35	2.2	0	2022-08-20T17:01:17+05:30	2661	30	2.4	0
2022-08-20T17:04:11+05:30	2662	19	1.2	0	2022-08-20T17:04:11+05:30	2662	16	0.9	0	2022-08-20T17:04:11+05:30	2662	35	2.2	0	2022-08-20T17:04:11+05:30	2662	30	2.4	0
2022-08-21T10:31:16+05:30	2663	25	0	0	2022-08-21T10:31:16+05:30	2663	28	0	0	2022-08-21T10:31:16+05:30	2663	37	0	0	2022-08-21T10:31:16+05:30	2663	32	0	0
2022-08-21T10:32:06+05:30	2664	25	0	0	2022-08-21T10:32:06+05:30	2664	28	0	0	2022-08-21T10:32:06+05:30	2664	37	0	0	2022-08-21T10:32:06+05:30	2664	32	0	0
2022-08-21T10:32:56+05:30	2665	25	0	0	2022-08-21T10:32:56+05:30	2665	28	0	0	2022-08-21T10:32:56+05:30	2665	37	0	0	2022-08-21T10:32:56+05:30	2665	32	0	0
2022-08-21T10:33:46+05:30	2666	25	0.1	0	2022-08-21T10:33:46+05:30	2666	28	0.3	0	2022-08-21T10:33:46+05:30	2666	37	0	0	2022-08-21T10:33:46+05:30	2666	32	0	0
2022-08-21T10:34:36+05:30	2667	25	0.1	0	2022-08-21T10:34:36+05:30	2667	28	0.3	0	2022-08-21T10:34:36+05:30	2667	37	0	0	2022-08-21T10:34:36+05:30	2667	32	0	0
2022-08-21T14:01:07+05:30	2780	24	0.9	0	2022-08-21T14:01:07+05:30	2780	19	0.5	0	2022-08-21T14:01:07+05:30	2780	28	1.9	0	2022-08-21T14:01:07+05:30	2780	26	0.9	0
2022-08-21T14:03:32+05:30	2781	24	0.9	0	2022-08-21T14:03:32+05:30	2781	19	0.5	0	2022-08-21T14:03:32+05:30	2781	28	1.9	0	2022-08-21T14:03:32+05:30	2781	26	0.9	0
2022-08-21T14:05:57+05:30	2782	24	0.9	0	2022-08-21T14:05:57+05:30	2782	19	0.5	0	2022-08-21T14:05:57+05:30	2782	28	1.9	0	2022-08-21T14:05:57+05:30	2782	26	0.9	0
2022-08-21T14:08:22+05:30	2783	24	0.9	0	2022-08-21T14:08:22+05:30	2783	19	0.5	0	2022-08-21T14:08:22+05:30	2783	28	1.9	0	2022-08-21T14:08:22+05:30	2783	26	2	0
2022-08-21T15:01:23+05:30	2803	25	1.1	0	2022-08-21T15:01:23+05:30	2803	17	0.5	0	2022-08-21T15:01:23+05:30	2803	28	2	0	2022-08-21T15:01:23+05:30	2803	25	2.1	0
2022-08-21T15:04:14+05:30	2804	25	1.1	0	2022-08-21T15:04:14+05:30	2804	17	0.5	0	2022-08-21T15:04:14+05:30	2804	27	2	0	2022-08-21T15:04:14+05:30	2804	25	2.1	0
2022-08-21T15:07:05+05:30	2805	25	1.1	0	2022-08-21T15:07:05+05:30	2805	17	0.6	0	2022-08-21T15:07:05+05:30	2805	27	2.2	0	2022-08-21T15:07:05+05:30	2805	25	2.1	0
2022-08-21T15:08:20+05:30	2806	25	1.1	0	2022-08-21T15:08:20+05:30	2806	17	0.6	0	2022-08-21T15:08:20+05:30	2806	27	2.2	0	2022-08-21T15:08:20+05:30	2806	24	2.1	0
2022-08-21T15:09:35+05:30	2807	25	1.1	0	2022-08-21T15:09:35+05:30	2807	17	0.6	0	2022-08-21T15:09:35+05:30	2807	27	2.2	0	2022-08-21T15:09:35+05:30	2807	24	2.1	0
2022-08-21T15:10:50+05:30	2808	25	1.1	0	2022-08-21T15:10:50+05:30	2808	17	0.6	0	2022-08-21T15:10:50+05:30	2808	27	2.2	0	2022-08-21T15:10:50+05:30	2808	24	2.1	0
2022-08-21T15:33:06+05:30	2826	25	1.1	0	2022-08-21T15:33:06+05:30	2826	17	0.6	0	2022-08-21T15:33:06+05:30	2826	26	2.3	0	2022-08-21T15:33:06+05:30	2826	24	2.1	0
2022-08-21T15:35:17+05:30	2827	25	1.1	0	2022-08-21T15:35:17+05:30	2827	17	0.6	0	2022-08-21T15:35:17+05:30	2827	26	2.3	0	2022-08-21T15:35:17+05:30	2827	24	2.1	0
2022-08-21T16:21:16+05:30	2848	19	1.1	0	2022-08-21T16:21:16+05:30	2848	17	0.7	0	2022-08-21T16:21:16+05:30	2848	25	2.3	0	2022-08-21T16:21:16+05:30	2848	23	2.1	0
2022-08-21T16:23:35+05:30	2849	19	1.1	0	2022-08-21T16:23:35+05:30	2849	17	0.8	0	2022-08-21T16:23:35+05:30	2849	25	2.3	0	2022-08-21T16:23:35+05:30	2849	23	2.1	0
2022-08-21T16:26:29+05:30	2850	19	1.1	0	2022-08-21T16:26:29+05:30	2850	17	0.8	0	2022-08-21T16:26:29+05:30	2850	25	2.3	0	2022-08-21T16:26:29+05:30	2850	23	2.1	0
2022-08-21T16:29:23+05:30	2851	19	1.1	0	2022-08-21T16:29:23+05:30	2851	17	0.8	0	2022-08-21T16:29:23+05:30	2851	25	2.3	0	2022-08-21T16:29:23+05:30	2851	23	2.1	0
2022-08-21T16:32:17+05:30	2852	19	1.1	0	2022-08-21T16:32:17+05:30	2852	17	0.8	0	2022-08-21T16:32:17+05:30	2852	25	2.3	0	2022-08-21T16:32:17+05:30	2852	23	2.1	0
2022-08-21T16:35:11+05:30	2853	19	1.1	0	2022-08-21T16:35:11+05:30	2853	17	0.8	0	2022-08-21T16:35:11+05:30	2853	25	2.3	0	2022-08-21T16:35:11+05:30	2853	22	2.1	0
2022-08-22T10:39:11+05:30	2874	23	0.1	0	2022-08-22T10:39:11+05:30	2874	27	0.1	0	2022-08-22T10:39:11+05:30	2874	34	0	0	2022-08-22T10:39:11+05:30	2874	30	0.2	0
2022-08-22T10:39:56+05:30	2875	23	0.1	0	2022-08-22T10:39:56+05:30	2875	27	0.1	0	2022-08-22T10:39:56+05:30	2875	34	0	0	2022-08-22T10:39:56+05:30	2875	30	0.2	0
2022-08-22T10:42:14+05:30	2876	23	0.3	0	2022-08-22T10:42:14+05:30	2876	27	0.1	0	2022-08-22T10:42:14+05:30	2876	34	0	0	2022-08-22T10:42:14+05:30	2876	30	0.2	0
2022-08-22T10:44:32+05:30	2877	23	0.3	0	2022-08-22T10:44:32+05:30	2877	27	0.3	0	2022-08-22T10:44:32+05:30	2877	34	0	0	2022-08-22T10:44:32+05:30	2877	30	0.2	0
2022-08-22T10:46:50+05:30	2878	23	0.3	0	2022-08-22T10:46:50+05:30	2878	27	0.3	0	2022-08-22T10:46:50+05:30	2878	34	0	0	2022-08-22T10:46:50+05:30	2878	30	0.2	0
2022-08-22T10:49:08+05:30	2879	23	0.3	0	2022-08-22T10:49:08+05:30	2879	27	0.3	0	2022-08-22T10:49:08+05:30	2879	34	0	0	2022-08-22T10:49:08+05:30	2879	29	0.2	0
2022-08-22T10:51:26+05:30	2880	23	0.3	0	2022-08-22T10:51:26+05:30	2880	27	0.3	0	2022-08-22T10:51:26+05:30	2880	34	0.1	0	2022-08-22T10:51:26+05:30	2880	29	0.2	0
2022-08-22T10:53:44+05:30	2881	23	0.3	0	2022-08-22T10:53:44+05:30	2881	27	0.3	0	2022-08-22T10:53:44+05:30	2881	34	0.1	0	2022-08-22T10:53:44+05:30	2881	29	0.2	0
2022-08-22T10:56:02+05:30	2882	23	0.3	0	2022-08-22T10:56:02+05:30	2882	27	0.3	0	2022-08-22T10:56:02+05:30	2882	34	0.1	0	2022-08-22T10:56:02+05:30	2882	29	0.2	0
2022-08-22T10:57:36+05:30	2883	23	0.3	0	2022-08-22T10:57:36+05:30	2883	27	0.3	0	2022-08-22T10:57:36+05:30	2883	34	0.1	0	2022-08-22T10:57:36+05:30	2883	29	0.2	0
2022-08-22T10:59:10+05:30	2884	22	0.3	0	2022-08-22T10:59:10+05:30	2884	27	0.3	0	2022-08-22T10:59:10+05:30	2884	34	0.1	0	2022-08-22T10:59:10+05:30	2884	29	0.2	0
2022-08-22T11:00:44+05:30	2885	22	0.3	0	2022-08-22T11:00:44+05:30	2885	27	0.3	0	2022-08-22T11:00:44+05:30	2885	34	0.1	0	2022-08-22T11:00:44+05:30	2885	29	0.2	0
2022-08-22T11:02:18+05:30	2886	22	0.3	0	2022-08-22T11:02:18+05:30	2886	27	0.3	0	2022-08-22T11:02:18+05:30	2886	34	0.1	0	2022-08-22T11:02:18+05:30	2886	29	0.2	0
2022-08-22T11:03:52+05:30	2887	22	0.3	0	2022-08-22T11:03:52+05:30	2887	27	0.3	0	2022-08-22T11:03:52+05:30	2887	34	0.1	0	2022-08-22T11:03:52+05:30	2887	29	0.2	0
2022-08-22T11:05:26+05:30	2888	22	0.3	0	2022-08-22T11:05:26+05:30	2888	26	0.3	0	2022-08-22T11:05:26+05:30	2888	33	0.1	0	2022-08-22T11:05:26+05:30	2888	29	0.2	0
2022-08-22T11:07:38+05:30	2889	22	0.3	0	2022-08-22T11:07:38+05:30	2889	26	0.3	0	2022-08-22T11:07:38+05:30	2889	33	0.1	0	2022-08-22T11:07:38+05:30	2889	29	0.2	0
2022-08-22T11:09:50+05:30	2890	22	0.3	0	2022-08-22T11:09:50+05:30	2890	26	0.3	0	2022-08-22T11:09:50+05:30	2890	33	0.1	0	2022-08-22T11:09:50+05:30	2890	29	0.2	0
2022-08-22T11:12:02+05:30	2891	22	0.3	0	2022-08-22T11:12:02+05:30	2891	26	0.3	0	2022-08-22T11:12:02+05:30	2891	33	0.1	0	2022-08-22T11:12:02+05:30	2891	29	0.2	0
2022-08-22T11:14:14+05:30	2892	22	0.3	0	2022-08-22T11:14:14+05:30	2892	26	0.3	0	2022-08-22T11:14:14+05:30	2892	33	0.1	0	2022-08-22T11:14:14+05:30	2892	29	0.2	0
2022-08-22T11:16:26+05:30	2893	22	0.3	0	2022-08-22T11:16:26+05:30	2893	26	0.3	0	2022-08-22T11:16:26+05:30	2893	33	0.2	0	2022-08-22T11:16:26+05:30	2893	29	0.4	0
2022-08-22T11:18:38+05:30	2894	22	0.3	0	2022-08-22T11:18:38+05:30	2894	26	0.3	0	2022-08-22T11:18:38+05:30	2894	33	0.2	0	2022-08-22T11:18:38+05:30	2894	29	0.4	0
2022-08-22T11:20:50+05:30	2895	22	0.3	0	2022-08-22T11:20:50+05:30	2895	26	0.3	0	2022-08-22T11:20:50+05:30	2895	33	0.2	0	2022-08-22T11:20:50+05:30	2895	29	0.4	0
2022-08-22T11:22:19+05:30	2896	22	0.3	0	2022-08-22T11:22:19+05:30	2896	26	0.3	0	2022-08-22T11:22:19+05:30	2896	33	0.2	0	2022-08-22T11:22:19+05:30	2896	29	0.4	0
2022-08-22T11:23:48+05:30	2897	22	0.3	0	2022-08-22T11:23:48+05:30	2897	26	0.3	0	2022-08-22T11:23:48+05:30	2897	33	0.2	0	2022-08-22T11:23:48+05:30	2897	29	0.4	0
2022-08-22T11:25:17+05:30	2898	22	0.3	0	2022-08-22T11:25:17+05:30	2898	26	0.3	0	2022-08-22T11:25:17+05:30	2898	33	0.2	0	2022-08-22T11:25:17+05:30	2898	29	0.4	0
2022-08-22T11:26:46+05:30	2899	22	0.3	0	2022-08-22T11:26:46+05:30	2899	26	0.3	0	2022-08-22T11:26:46+05:30	2899	33	0.2	0	2022-08-22T11:26:46+05:30	2899	29	0.4	0
2022-08-22T11:28:15+05:30	2900	22	0.3	0	2022-08-22T11:28:15+05:30	2900	26	0.3	0	2022-08-22T11:28:15+05:30	2900	33	0.2	0	2022-08-22T11:28:15+05:30	2900	29	0.4	0
2022-08-22T11:29:44+05:30	2901	22	0.3	0	2022-08-22T11:29:44+05:30	2901	26	0.3	0	2022-08-22T11:29:44+05:30	2901	33	0.2	0	2022-08-22T11:29:44+05:30	2901	29	0.4	0
2022-08-22T14:03:32+05:30	2982	18	0.5	0	2022-08-22T14:03:32+05:30	2982	21	0.5	0	2022-08-22T14:03:32+05:30	2982	29	1.2	0	2022-08-22T14:03:32+05:30	2982	25	1.5	0
2022-08-22T14:05:57+05:30	2983	18	0.5	0	2022-08-22T14:05:57+05:30	2983	21	0.7	0	2022-08-22T14:05:57+05:30	2983	29	1.2	0	2022-08-22T14:05:57+05:30	2983	25	1.5	0
2022-08-22T14:08:22+05:30	2984	18	0.5	0	2022-08-22T14:08:22+05:30	2984	21	0.7	0	2022-08-22T14:08:22+05:30	2984	28	1.2	0	2022-08-22T14:08:22+05:30	2984	25	1.5	0
2022-08-22T14:10:47+05:30	2985	18	0.5	0	2022-08-22T14:10:47+05:30	2985	21	0.7	0	2022-08-22T14:10:47+05:30	2985	28	1.2	0	2022-08-22T14:10:47+05:30	2985	25	1.7	0
2022-08-22T14:13:12+05:30	2986	18	0.6	0	2022-08-22T14:13:12+05:30	2986	21	0.7	0	2022-08-22T14:13:12+05:30	2986	28	1.2	0	2022-08-22T14:13:12+05:30	2986	25	1.7	0
2022-08-22T14:15:37+05:30	2987	18	0.6	0	2022-08-22T14:15:37+05:30	2987	21	0.7	0	2022-08-22T14:15:37+05:30	2987	28	1.2	0	2022-08-22T14:15:37+05:30	2987	25	1.7	0
2022-08-22T14:18:02+05:30	2988	18	0.6	0	2022-08-22T14:18:02+05:30	2988	21	0.7	0	2022-08-22T14:18:02+05:30	2988	28	1.2	0	2022-08-22T14:18:02+05:30	2988	25	1.7	0
2022-08-22T14:20:38+05:30	2989	18	0.6	0	2022-08-22T14:20:38+05:30	2989	21	0.7	0	2022-08-22T14:20:38+05:30	2989	28	1.2	0	2022-08-22T14:20:38+05:30	2989	25	1.7	0
2022-08-22T14:23:14+05:30	2990	18	0.6	0	2022-08-22T14:23:14+05:30	2990	21	0.7	0	2022-08-22T14:23:14+05:30	2990	28	1.2	0	2022-08-22T14:23:14+05:30	2990	25	1.7	0
2022-08-22T14:25:50+05:30	2991	18	0.6	0	2022-08-22T14:25:50+05:30	2991	21	0.7	0	2022-08-22T14:25:50+05:30	2991	28	1.2	0	2022-08-22T14:25:50+05:30	2991	25	1.7	0
2022-08-22T14:28:26+05:30	2992	18	0.6	0	2022-08-22T14:28:26+05:30	2992	21	0.7	0	2022-08-22T14:28:26+05:30	2992	28	1.2	0	2022-08-22T14:28:26+05:30	2992	25	1.7	0
2022-08-22T14:31:02+05:30	2993	18	0.6	0	2022-08-22T14:31:02+05:30	2993	21	0.7	0	2022-08-22T14:31:02+05:30	2993	28	1.2	0	2022-08-22T14:31:02+05:30	2993	25	1.7	0
2022-08-22T14:33:38+05:30	2994	18	0.6	0	2022-08-22T14:33:38+05:30	2994	21	0.7	0	2022-08-22T14:33:38+05:30	2994	28	1.2	0	2022-08-22T14:33:38+05:30	2994	25	1.7	0
2022-08-22T14:36:14+05:30	2995	18	0.6	0	2022-08-22T14:36:14+05:30	2995	21	0.7	0	2022-08-22T14:36:14+05:30	2995	28	1.2	0	2022-08-22T14:36:14+05:30	2995	25	1.7	0
2022-08-22T14:38:50+05:30	2996	18	0.6	0	2022-08-22T14:38:50+05:30	2996	21	0.7	0	2022-08-22T14:38:50+05:30	2996	28	1.2	0	2022-08-22T14:38:50+05:30	2996	25	1.7	0
2022-08-22T14:41:26+05:30	2

KHA OC Sensor data of nodes 1 to 4

Node 1					Node 2					Node 3					Node 4				
created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3
2023-06-10T10:15:03+05:30	1	30	0	0	2023-06-10T10:15:03+05:30	1	29	0	0	2023-06-10T10:15:03+05:30	1	39	0	0	2023-06-10T10:15:03+05:30	1	35	0	0
2023-06-10T10:17:18+05:30	2	30	0	0	2023-06-10T10:17:18+05:30	2	29	0	0	2023-06-10T10:17:18+05:30	2	39	0	0	2023-06-10T10:17:18+05:30	2	35	0	0
2023-06-10T10:19:33+05:30	3	30	0	0	2023-06-10T10:19:33+05:30	3	29	0	0	2023-06-10T10:19:33+05:30	3	39	0	0	2023-06-10T10:19:33+05:30	3	35	0	0
2023-06-10T10:21:48+05:30	4	30	0	0	2023-06-10T10:21:48+05:30	4	29	0	0	2023-06-10T10:21:48+05:30	4	39	0.1	0	2023-06-10T10:21:48+05:30	4	35	0.1	0
2023-06-10T10:24:03+05:30	5	30	0	0	2023-06-10T10:24:03+05:30	5	29	0	0	2023-06-10T10:24:03+05:30	5	39	0.1	0	2023-06-10T10:24:03+05:30	5	35	0.1	0
2023-06-10T10:25:33+05:30	6	30	0	0	2023-06-10T10:25:33+05:30	6	29	0	0	2023-06-10T10:25:33+05:30	6	39	0.1	0	2023-06-10T10:25:33+05:30	6	35	0.1	0
2023-06-10T10:27:03+05:30	7	30	0	0	2023-06-10T10:27:03+05:30	7	29	0	0	2023-06-10T10:27:03+05:30	7	39	0.1	0	2023-06-10T10:27:03+05:30	7	35	0.1	0
2023-06-10T10:28:33+05:30	8	30	0	0	2023-06-10T10:28:33+05:30	8	29	0.1	0	2023-06-10T10:28:33+05:30	8	39	0.1	0	2023-06-10T10:28:33+05:30	8	35	0.1	0
2023-06-10T10:30:03+05:30	9	30	0	0	2023-06-10T10:30:03+05:30	9	29	0.1	0	2023-06-10T10:30:03+05:30	9	39	0.1	0	2023-06-10T10:30:03+05:30	9	35	0.1	0
2023-06-10T10:31:28+05:30	10	30	0	0	2023-06-10T10:31:28+05:30	10	29	0.1	0	2023-06-10T10:31:28+05:30	10	39	0.1	0	2023-06-10T10:31:28+05:30	10	35	0.1	0
2023-06-10T10:32:53+05:30	11	30	0	0	2023-06-10T10:32:53+05:30	11	31	0.1	0	2023-06-10T10:32:53+05:30	11	39	0.1	0	2023-06-10T10:32:53+05:30	11	35	0.1	0
2023-06-10T11:39:03+05:30	36	31	0.3	0	2023-06-10T11:39:03+05:30	36	33	0.2	0	2023-06-10T11:39:03+05:30	36	41	0.5	0	2023-06-10T11:39:03+05:30	36	35	0.2	0
2023-06-10T11:41:18+05:30	37	31	0.3	0	2023-06-10T11:41:18+05:30	37	33	0.2	0	2023-06-10T11:41:18+05:30	37	41	0.5	0	2023-06-10T11:41:18+05:30	37	35	0.2	0
2023-06-10T11:43:33+05:30	38	31	0.3	0	2023-06-10T11:43:33+05:30	38	33	0.2	0	2023-06-10T11:43:33+05:30	38	41	0.5	0	2023-06-10T11:43:33+05:30	38	34	0.2	0
2023-06-10T11:45:48+05:30	39	31	0.3	0	2023-06-10T11:45:48+05:30	39	33	0.2	0	2023-06-10T11:45:48+05:30	39	41	0.5	0	2023-06-10T11:45:48+05:30	39	34	0.2	0
2023-06-10T11:47:23+05:30	40	31	0.3	0	2023-06-10T11:47:23+05:30	40	33	0.2	0	2023-06-10T11:47:23+05:30	40	41	0.5	0	2023-06-10T11:47:23+05:30	40	34	0.3	0
2023-06-10T11:48:58+05:30	41	30	0.3	0	2023-06-10T11:48:58+05:30	41	33	0.2	0	2023-06-10T11:48:58+05:30	41	41	0.5	0	2023-06-10T11:48:58+05:30	41	34	0.3	0
2023-06-10T11:50:33+05:30	42	30	0.3	0	2023-06-10T11:50:33+05:30	42	33	0.2	0	2023-06-10T11:50:33+05:30	42	41	0.5	0	2023-06-10T11:50:33+05:30	42	34	0.3	0
2023-06-10T11:52:08+05:30	43	30	0.3	0	2023-06-10T11:52:08+05:30	43	33	0.2	0	2023-06-10T11:52:08+05:30	43	41	0.6	0	2023-06-10T11:52:08+05:30	43	34	0.3	0
2023-06-10T11:53:43+05:30	44	30	0.3	0	2023-06-10T11:53:43+05:30	44	33	0.3	0	2023-06-10T11:53:43+05:30	44	41	0.6	0	2023-06-10T11:53:43+05:30	44	34	0.3	0
2023-06-10T11:55:18+05:30	45	30	0.3	0	2023-06-10T11:55:18+05:30	45	33	0.3	0	2023-06-10T11:55:18+05:30	45	39	0.6	0	2023-06-10T11:55:18+05:30	45	34	0.3	0
2023-06-10T11:56:53+05:30	46	30	0.3	0	2023-06-10T11:56:53+05:30	46	33	0.3	0	2023-06-10T11:56:53+05:30	46	39	0.6	0	2023-06-10T11:56:53+05:30	46	34	0.3	0
2023-06-10T12:26:03+05:30	64	30	0.5	0	2023-06-10T12:26:03+05:30	64	31	0.4	0	2023-06-10T12:26:03+05:30	64	40	0.7	0	2023-06-10T12:26:03+05:30	64	35	0.4	0
2023-06-10T13:37:13+05:30	94	31	0.7	0	2023-06-10T13:37:13+05:30	94	34	0.5	0	2023-06-10T13:37:13+05:30	94	42	1.1	0	2023-06-10T13:37:13+05:30	94	42	0.9	0
2023-06-10T13:39:28+05:30	95	31	0.7	0	2023-06-10T13:39:28+05:30	95	34	0.5	0	2023-06-10T13:39:28+05:30	95	42	1.1	0	2023-06-10T13:39:28+05:30	95	42	0.9	0
2023-06-10T13:41:43+05:30	96	31	0.7	0	2023-06-10T13:41:43+05:30	96	34	0.5	0	2023-06-10T13:41:43+05:30	96	42	1.1	0	2023-06-10T13:41:43+05:30	96	42	1	0
2023-06-10T13:43:58+05:30	97	31	0.8	0	2023-06-10T13:43:58+05:30	97	34	0.5	0	2023-06-10T13:43:58+05:30	97	41	1.1	0	2023-06-10T13:43:58+05:30	97	42	1	0
2023-06-10T13:46:13+05:30	98	31	0.8	0	2023-06-10T13:46:13+05:30	98	34	0.5	0	2023-06-10T13:46:13+05:30	98	41	1.1	0	2023-06-10T13:46:13+05:30	98	42	1	0
2023-06-10T13:48:28+05:30	99	31	0.8	0	2023-06-10T13:48:28+05:30	99	34	0.5	0	2023-06-10T13:48:28+05:30	99	41	1.1	0	2023-06-10T13:48:28+05:30	99	42	1	0
2023-06-10T13:50:43+05:30	100	31	0.8	0	2023-06-10T13:50:43+05:30	100	34	0.5	0	2023-06-10T13:50:43+05:30	100	41	1.2	0	2023-06-10T13:50:43+05:30	100	42	1	0
2023-06-10T13:52:58+05:30	101	31	0.8	0	2023-06-10T13:52:58+05:30	101	34	0.5	0	2023-06-10T13:52:58+05:30	101	41	1.2	0	2023-06-10T13:52:58+05:30	101	42	1	0
2023-06-10T13:55:13+05:30	102	31	0.8	0	2023-06-10T13:55:13+05:30	102	34	0.5	0	2023-06-10T13:55:13+05:30	102	41	1.2	0	2023-06-10T13:55:13+05:30	102	42	1	0
2023-06-10T13:57:28+05:30	103	31	0.8	0	2023-06-10T13:57:28+05:30	103	34	0.5	0	2023-06-10T13:57:28+05:30	103	41	1.2	0	2023-06-10T13:57:28+05:30	103	42	1.1	0
2023-06-10T13:59:43+05:30	104	31	0.8	0	2023-06-10T13:59:43+05:30	104	35	0.5	0	2023-06-10T13:59:43+05:30	104	41	1.2	0	2023-06-10T13:59:43+05:30	104	42	1.1	0
2023-06-10T14:01:58+05:30	105	31	0.8	0	2023-06-10T14:01:58+05:30	105	35	0.5	0	2023-06-10T14:01:58+05:30	105	41	1.2	0	2023-06-10T14:01:58+05:30	105	42	1.1	0
2023-06-10T14:04:13+05:30	106	31	0.8	0	2023-06-10T14:04:13+05:30	106	35	0.5	0	2023-06-10T14:04:13+05:30	106	41	1.2	0	2023-06-10T14:04:13+05:30	106	42	1.1	0
2023-06-10T14:06:28+05:30	107	31	0.8	0	2023-06-10T14:06:28+05:30	107	35	0.5	0	2023-06-10T14:06:28+05:30	107	41	1.2	0	2023-06-10T14:06:28+05:30	107	42	1.1	0
2023-06-10T14:08:43+05:30	108	31	0.8	0	2023-06-10T14:08:43+05:30	108	35	0.6	0	2023-06-10T14:08:43+05:30	108	41	1.3	0	2023-06-10T14:08:43+05:30	108	42	1.1	0
2023-06-10T14:10:58+05:30	109	31	0.9	0	2023-06-10T14:10:58+05:30	109	35	0.6	0	2023-06-10T14:10:58+05:30	109	41	1.3	0	2023-06-10T14:10:58+05:30	109	42	1.1	0
2023-06-10T14:58:13+05:30	130	31	1.2	0	2023-06-10T14:58:13+05:30	130	38	0.8	0	2023-06-10T14:58:13+05:30	130	38	1.5	0	2023-06-10T14:58:13+05:30	130	44	1.5	0
2023-06-10T15:00:28+05:30	131	31	1.2	0	2023-06-10T15:00:28+05:30	131	38	0.8	0	2023-06-10T15:00:28+05:30	131	38	1.6	0	2023-06-10T15:00:28+05:30	131	44	1.6	0
2023-06-10T15:02:43+05:30	132	31	1.3	0	2023-06-10T15:02:43+05:30	132	38	0.8	0	2023-06-10T15:02:43+05:30	132	38	1.6	0	2023-06-10T15:02:43+05:30	132	44	1.6	0
2023-06-10T15:04:58+05:30	133	31	1.3	0	2023-06-10T15:04:58+05:30	133	38	0.8	0	2023-06-10T15:04:58+05:30	133	38	1.6	0	2023-06-10T15:04:58+05:30	133	44	1.6	0
2023-06-10T16:03:28+05:30	159	34	1.4	0	2023-06-10T16:03:28+05:30	159	35	1.1	0	2023-06-10T16:03:28+05:30	159	38	1.9	0	2023-06-10T16:03:28+05:30	159	40	1.8	0
2023-06-10T16:05:43+05:30	160	34	1.4	0	2023-06-10T16:05:43+05:30	160	36	1.1	0	2023-06-10T16:05:43+05:30	160	38	1.9	0	2023-06-10T16:05:43+05:30	160	40	1.8	0
2023-06-10T16:07:58+05:30	161	34	1.5	0	2023-06-10T16:07:58+05:30	161	36	1.1	0	2023-06-10T16:07:58+05:30	161	38	1.9	0	2023-06-10T16:07:58+05:30	161	40	2	0
2023-06-10T16:10:13+05:30	162	34	1.5	0	2023-06-10T16:10:13+05:30	162	36	1.1	0	2023-06-10T16:10:13+05:30	162	38	1.9	0	2023-06-10T16:10:13+05:30	162	40	2	0
2023-06-10T16:12:28+05:30	163	34	1.5	0	2023-06-10T16:12:28+05:30	163	36	1.1	0	2023-06-10T16:12:28+05:30	163	38	1.9	0	2023-06-10T16:12:28+05:30	163	40	2	0
2023-06-10T16:14:43+05:30	164	34	1.5	0	2023-06-10T16:14:43+05:30	164	36	1.1	0	2023-06-10T16:14:43+05:30	164	39	1.9	0	2023-06-10T16:14:43+05:30	164	40	2	0
2023-06-10T16:16:58+05:30	165	34	1.5	0	2023-06-10T16:16:58+05:30	165	36	1.1	0	2023-06-10T16:16:58+05:30	165	39	1.9	0	2023-06-10T16:16:58+05:30	165	40	2	0
2023-06-10T16:19:13+05:30	166	34	1.5	0	2023-06-10T16:19:13+05:30	166	36	1.1	0	2023-06-10T16:19:13+05:30	166	39	1.9	0	2023-06-10T16:19:13+05:30	166	40	2	0
2023-06-10T16:21:28+05:30	167	34	1.5	0	2023-06-10T16:21:28+05:30	167	36	1.2	0	2023-06-10T16:21:28+05:30	167	39	1.9	0	2023-06-10T16:21:28+05:30	167	40	2	0
2023-06-10T16:41:43+05:30	176	33	1.5	0	2023-06-10T16:41:43+05:30	176	36	1.2	0	2023-06-10T16:41:43+05:30	176	39	2	0	2023-06-10T16:41:43+05:30	176	39	2.1	0
2023-06-10T16:43:58+05:30	177	33	1.5	0	2023-06-10T16:43:58+05:30	177	36	1.2	0	2023-06-10T16:43:58+05:30	177	39	2	0	2023-06-10T16:43:58+05:30	177	39	2.1	0
2023-06-10T16:46:13+05:30	178	33	1.5	0	2023-06-10T16:46:13+05:30	178	36	1.2	0	2023-06-10T16:46:13+05:30	178	39	2	0	2023-06-10T16:46:13+05:30	178	39	2.1	0
2023-06-10T16:48:28+05:30	179	33	1.5	0	2023-06-10T16:48:28+05:30	179	36	1.2	0	2023-06-10T16:48:28+05:30	179	39	2	0	2023-06-10T16:48:28+05:30	179	39	2.1	0
2023-06-10T17:24:28+05:30	195	33	1.5	0	2023-06-10T17:24:28+05:30	195	35	1.2	0	2023-06-10T17:24:28+05:30	195	40	2.2	0	2023-06-10T17:24:28+05:30	195	39	2.2	0
2023-06-10T17:26:43+05:30	196	33	1.5	0	2023-06-10T17:26:43+05:30	196	35	1.2	0	2023-06-10T17:26:43+05:30	196	40	2.2	0	2023-06-10T17:26:43+05:30	196	39	2.2	0
2023-06-10T17:28:58+05:30	197	33	1.5	0	2023-06-10T17:28:58+05:30	197	38	1.2	0	2023-06-10T17:28:58+05:30	197	40	2.2	0	2023-06-10T17:28:58+05:30	197	39	2.2	0
2023-06-10T17:31:13+05:30	198	33	1.5	0	2023-06-10T17:31:13+05:30	198	38	1.2	0	2023-06-10T17:31:13+05:30	198	40	2.2	0	2023-06-10T17:31:13+05:30	198	39	2.2	0
2023-06-10T17:33:28+05:30	199	33	1.5	0	2023-06-10T17:33:28+05:30	199	38	1.2	0	2023-06-10T17:33:28+05:30	199	40	2.2	0	2023-06-10T17:33:28+05:30	199	39	2.3	0
2023-06-10T17:35:43+05:30	200	33	1.5	0	2023-06-10T17:35:43+05:30	200	38	1.2	0	2023-06-10T17:35:43+05:30	200	40	2.2	0	2023-06-10T17:35:43+05:30	200	39	2.3	0
2023-06-10T17:37:58+05:30	201	33	1.6	0	2023-06-10T17:37:58+05:30	201	38	1.2	0	2023-06-10T17:37:58+05:30	201	40	2.2	0	2023-06-10T17:37:58+05:30	201	39	2.3	0
2023-06-10T17:40:13+05:30	202	33	1.6	0	2023-06-10T17:40:13+05:30	202	38	1.2	0	2023-06-10T17:40:13+05:30	202	40	2.2	0	2023-06-10T17:40:13+05:30	202	39	2.3	0
2023-06-10T17:42:28+05:30	203	33	1.6	0	2023-06-10T17:42:28+05:30	203	38	1.2	0	2023-06-10T17:42:28+05:30	203	40	2.2	0	2023-06-10T17:42:28+05:30	203	39	2.3	0
2023-06-10T17:44:43+05:30	204	33	1.6	0	2023-06-10T17:44:43+05:30	204	35	1.2	0	2023-06-10T17:44:43+05:30	204	40	2.2	0	2023-06-10T17:44:43+05:30	204	39	2.3	0
2023-06-10T17:46:58+05:30	205	33	1.6	0	2023-06-10T17:46:58+05:30	205	35	1.2	0	2023-06-10T17:46:58+05:30	205	40	2.2	0	2023-06-10T17:46:58+05:30	205	39	2.3	0
2023-06-10T18:22:58+05:30	221	33	1.7	0	2023-06-10T18:22:58+05:30	221	32	1.3	0	2023-06-10T18:22:58+05:30	221	39	2.4	0	2023-06-10T18:22:58+05:30	221	42	2.5	0
2023-06-10T18:25:13+05:30	222	33	1.7	0	2023-06-10T18:25:13+05:30	222	32	1.3	0	2023-06-10T18:25:13+05:30	222	39	2.4	0	2023-06-10T18:25:13+05:30	222	42	2.5	0
2023-06-10T18:27:28+05:30	223	33	1.7	0	2023-06-10T18:27:28+05:30	223	32	1.3	0	2023-06-10T18:27:28+05:30	223	39	2.4	0	2023-06-10T18:27:28+05:30	223	42	2.5	0
2023-06-10T18:29:43+05:30	224	33	1.7	0	2023-06-10T18:29:43+05:30	224	32	1.3	0	2023-06-10T18:29:43+05:30	224	39	2.4	0	2023-06-10T18:29:43+05:30	224	42	2.5	0
2023-06-10T18:31:58+05:30	225	33	1.7	0	2023-06-10T18:31:58+05:30	225	32	1.3	0	2023-06-10T18:31:58+05:30	225	39	2.4	0	2023-06-10T18:31:58+05:30	225	42	2.5	0
2023-06-10T18:34:13+05:30	226	33	1.7	0	2023-06-10T18:34:13+05:30	226	32	1.3	0	2023-06-10T18:34:13+05:30	226	39	2.4	0	2023-06-10T18:34:13+05:30	226	42	2.5	0
2023-06-10T18:36:28+05:30	227	33	1.7	0	2023-06-10T18:36:28+05:30	227	32	1.3	0	2023-06-10T18:36:28+05:30	227	39	2.4	0	2023-06-10T18:36:28+05:30	227	42	2.5	0
2023-06-10T18:38:43+05:30	228	33	1.7	0	2023-06-10T18:38:43+05:30	228	32	1.3	0	2023-06-10T18:38:43+05:30	228	39	2.4	0	2023-06-10T18:38:43+05:30	228	42	2.9	0
2023-06-10T18:40:58+05:30	229	33	1.7	0	2023-06-10T18:40:58+05:30	229	32	1.3	0	2023-06-10T18:40:58+05:30	229	40	2.4	0	2023-06-10T18:40:58+05:30	229	42	2.9	0
2023-06-10T18:43:13+05:30	230	33	1.7	0	2023-06-10T18:43:13+05:30	230	30	1.3	0	2023-06-10T18:43:13+05:30	230	40	2.4	0	2023-06-10T18:43:13+05:30	230	42	2.9	0
2023-06-10T18:45:28+05:30	231	33	1.7	0	2023-06-10T18:45:28+05:30	231	30	1.3	0	2023-06-10T18:45:28+05:30	231	40	2.4	0	2023-06-10T18:45:28+05:30	231	42	2.9	0
2023-06-10T18:47:43+05:30	232	33	1.7	0	2023-06-10T18:47:43+05:30	232	30	1.3	0	2023-06-10T18:47:43+05:30	232	40	2.4	0	2023-06-10T18:47:43+05:30	232	41	2.9	0
2023-06-10T18:49:58+05:30	233	33	1.8	0	2023-06-10T18:49:58+05:30	233	30	1.3	0	2023-06-10T18:49:58+05:30	233	40	2.4	0	2023-06-10T18:49:58+05:30	233	41	2.9	0
2023-06-10T18:52:13+05:30	234	33	1.8	0	2023-06-10T18:52:13+05:30	234	30	1.3	0	2023-06-10T18:52:13+05:30	234	40	2.4	0	2023-06-10T18:52:13+05:30	234	41	2.9	0
2023-06-10T18:54:28+05:30	235	33	1.8	0	2023-06-10T18:54:28+05:30	235	30	1.3	0	2023-06-10T18:54:28+05:30	235	40	2.4	0	2023-06-10T18:54:28+05:30	235	41	2.9	0
2023-06-11T10:46:50+05:30	261	42	0	0	2023-06-11T10:46:50+05:30	261	45	0.1	0	2023-06-11T10:46:50+05:30	261	52	0.1	0	2023-06-11T10:46:50+05:30	261	58	0.2	0
2023-06-11T10:49:08+05:30	262	41	0	0	2023-06-11T10:49:08+05:30	262	45	0.1	0	2023-06-11T10:49:08+05:30	262	52	0.2	0	2023-06-11T10:49:08+05:30	262	58	0.2	0
2023-06-11T10:51:26+05:30	263	41	0	0	2023-06-11T10:51:26+05:30	263	45	0.1	0	2023-06-11T10:51:26+05:30	263	52	0.2	0	2023-06-11T10:51:26+05:30	263	58	0.2	0
2023-06-11T10:53:44+05:30	264	41	0	0	2023-06-11T10:53:44+05:30	264	45	0.1	0	2023-06-11T10:53:44+05:30	264	52	0.2	0	2023-06-11T10:53:44+05:30	264	58	0.2	0
2023-06-11T10:56:02+05:30	265	41	0	0	2023-06-11T10:56:02+05:30	265	45	0.1	0	2023-06-11T10:56:02+05:30	265	52	0.2	0	2023-06-11T10:56:02+05:30	265	57	0.2	0
2023-06-11T10:57:36+05:30	266	41	0	0	2023-06-11T10:57:36+05:30	266	45	0.1	0	2023-06-11T10:57:36+05:30	266	52	0.2	0	2023-06-11T10:57:36+05:30	266	57	0.2	0
2023-06-11T10:59:10+05:30	267	41	0	0	2023-06-11T10:59:10+05:30	267	45	0.1	0	2023-06-11T10:59:10+05:30	267	52	0.2	0	2023-06-11T10:59:10+05:30	267	57	0.2	0
2023-06-11T11:00:44+05:30	268	41	0	0	2023-06-11T11:00:44+05:30	268	45	0.1	0	2023-06-11T11:00:44+05:30	268	52	0.2	0	2023-06-11T11:00:44+05:30	268	57	0.2	0
2023-06-11T11:02:18+05:30	269	41	0	0	2023-06-11T11:02:18+05:30	269	45	0.2	0	2023-06-11T11:02:18+05:30	269	52	0.3	0	2023-06-11T11:02:18+05:30	269	57	0.2	0
2023-06-11T11:03:52+05:30	270	41	0	0	2023-06-11T11:03:52+05:30	270	45	0.2	0	2023-06-11T11:03:52+05:30	270	52	0.3	0	2023-06-11T11:03:52+05:30	270	57	0.2	0
2023-06-11T11:47:21+05:30	293	41	0.2	0	2023-06-11T11:47:21+05:30	293	45	0.3	0	2023-06-11T11:47:21+05:30	293	52	0.5	0	2023-06-11T11:47:21+05:30	293	54	0.5	0
2023-06-11T11:49:54+05:30	294	41	0.2	0	2023-06-11T11:49:54+05:30	294	45	0.3	0	2023-06-11T11:49:54+05:30	294	52	0.5	0	2023-06-11T11:49:54+05:30	294	52	0.5	0
2023-06-11T11:52:27+05:30	295	41	0.2	0	2023-06-11T11:52:27+05:30	295	45	0.4	0	2023-06-11T11:52:27+05:30	295	52	0.5	0	2023-06-11T11:52:27+05:30	295	52	0.5	0
2023-06-11T11:55:00+05:30	296	37	0.2	0	2023-06-11T11:55:00+05:30	296	45	0.4	0	2023-06-11T11:55:00+05:30	296	52	0.5	0	2023-06-11T11:55:00+05:30	296	52	0.5	0
2023-06-11T11:57:33+05:30	297	37	0.2	0	2023-06-11T11:57:33+05:30	297	45	0.4	0	2023-06-11T11:57:33+05:30	297	52	0.5	0	2023-06-11T11:57:33+05:30	297	52	0.5	0
2023-06-11T12:00:06+05:30	298	37	0.2	0	2023-06-11T12:00:06+05:30	298	45	0.4	0	2023-06-11T12:00:06+05:30	298	52	0.5	0	2023-06-11T12:00:06+05:30	298	52	0.5	0
2023-06-11T12:02:39+05:30	299	37	0.2	0	2023-06-11T12:02:39+05:30	299	45	0.4	0	2023-06-11T12:02:39+05:30	299	52	0.5	0	2023-06-11T12:02:39+05:30	299	52	0.5	0
2023-06-11T12:05:12+05:30	300	37	0.2	0	2023-06-11T12:05:12+05:30	300	45	0.4	0	2023-06-11T12:05:12+05:30	300	52	0.5	0	2023-06-11T12:05:12+05:30	300	52	0.5	0
2023-06-11T12:07:45+05:30	301	37	0.2	0	2023-06-11T12:07:45+05:30	301	42	0.4	0	2023-06-11T12:07:45+05:30	301	55	0.6	0	2023-06-11T12:07:45+05:30	301	56	0.5	0
2023-06-11T12:09:47+05:30	302	37	0.2	0	2023-06-11T12:09:47+05:30	302	42	0.4	0	2023-06-11T12:09:47+05:30	302	55	0.6	0	2023-06-11T12:09:47+05:30	302	56	0.6	0
2023-06-11T12:11:49+05:30	303	37	0.3	0	2023-06-11T12:11:49+05:30	303	42	0.4	0	2023-06-11T12:11:49+05:30	303	55	0.6	0	2023-06-11T12:11:49+05:30	303	56	0.6	0
2023-06-11T12:48:02+05:30	327	36	0.5	0	2023-06-11T12:48:02+05:30	327	40	0.7	0	2023-06-11T12:48:02+05:30	327	49	0.7	0	2023-06-11T12:48:02+05:30	327	58	0.8	0
2023-06-11T12:49:01+05:30	328	36	0.5	0	2023-06-11T12:49:01+05:30	328	40	0.7	0	2023-06-11T12:49:01+05:30	328	49	0.7	0	2023-06-11T12:49:01+05:30	328	58	0.8	0
2023-06-11T12:51:30+05:30	329	36	0.5	0	2023-06-11T12:51:30+05:30	329	40	0.7	0	2023-06-11T12:51:30+05:30	329	49	0.7	0	2023-06-11T12:51:30+05:30	329	58	0.8	0

Node 1					Node 2					Node 3					Node 4				
created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3
2023-06-11T14:52:50+05:30	384	54	1.5	0	2023-06-11T14:52:50+05:30	384	64	1.6	0	2023-06-11T14:52:50+05:30	384	68	2	0	2023-06-11T14:52:50+05:30	384	70	2.5	0
2023-06-11T14:55:41+05:30	385	54	1.5	0	2023-06-11T14:55:41+05:30	385	61	1.6	0	2023-06-11T14:55:41+05:30	385	68	2	0	2023-06-11T14:55:41+05:30	385	70	2.5	0
2023-06-11T14:58:32+05:30	386	55	1.5	0	2023-06-11T14:58:32+05:30	386	61	1.7	0	2023-06-11T14:58:32+05:30	386	68	2	0	2023-06-11T14:58:32+05:30	386	70	2.5	0
2023-06-11T15:01:23+05:30	387	55	1.6	0	2023-06-11T15:01:23+05:30	387	61	1.7	0	2023-06-11T15:01:23+05:30	387	68	2	0	2023-06-11T15:01:23+05:30	387	72	2.5	0
2023-06-11T15:04:14+05:30	388	55	1.6	0	2023-06-11T15:04:14+05:30	388	61	1.7	0	2023-06-11T15:04:14+05:30	388	68	2.3	0	2023-06-11T15:04:14+05:30	388	72	2.5	0
2023-06-11T15:07:05+05:30	389	55	1.6	0	2023-06-11T15:07:05+05:30	389	61	1.7	0	2023-06-11T15:07:05+05:30	389	68	2.3	0	2023-06-11T15:07:05+05:30	389	72	2.5	0
2023-06-11T15:08:20+05:30	390	55	1.6	0	2023-06-11T15:08:20+05:30	390	61	1.8	0	2023-06-11T15:08:20+05:30	390	70	2.5	0	2023-06-11T15:08:20+05:30	390	72	2.5	0
2023-06-11T15:09:35+05:30	391	55	1.7	0	2023-06-11T15:09:35+05:30	391	59	1.8	0	2023-06-11T15:09:35+05:30	391	70	2.7	0	2023-06-11T15:09:35+05:30	391	72	2.7	0
2023-06-11T15:10:50+05:30	392	55	1.7	0	2023-06-11T15:10:50+05:30	392	59	1.8	0	2023-06-11T15:10:50+05:30	392	70	2.7	0	2023-06-11T15:10:50+05:30	392	72	2.7	0
2023-06-11T15:12:05+05:30	393	55	1.7	0	2023-06-11T15:12:05+05:30	393	59	1.9	0	2023-06-11T15:12:05+05:30	393	70	2.7	0	2023-06-11T15:12:05+05:30	393	74	2.7	0
2023-06-11T15:43:53+05:30	415	45	2.6	0	2023-06-11T15:43:53+05:30	415	52	2.5	0	2023-06-11T15:43:53+05:30	415	63	3.4	0	2023-06-11T15:43:53+05:30	415	71	3.4	0
2023-06-11T15:46:00+05:30	416	45	2.6	0	2023-06-11T15:46:00+05:30	416	52	2.5	0	2023-06-11T15:46:00+05:30	416	63	3.4	0	2023-06-11T15:46:00+05:30	416	71	3.4	0
2023-06-11T15:48:07+05:30	417	45	2.7	0	2023-06-11T15:48:07+05:30	417	47	2.5	0	2023-06-11T15:48:07+05:30	417	63	3.4	0	2023-06-11T15:48:07+05:30	417	71	3.4	0
2023-06-11T15:50:14+05:30	418	45	2.7	0	2023-06-11T15:50:14+05:30	418	47	2.7	0	2023-06-11T15:50:14+05:30	418	63	3.4	0	2023-06-11T15:50:14+05:30	418	63	3.4	0
2023-06-11T15:52:21+05:30	419	45	2.8	0	2023-06-11T15:52:21+05:30	419	47	2.7	0	2023-06-11T15:52:21+05:30	419	63	3.4	0	2023-06-11T15:52:21+05:30	419	67	3.4	0
2023-06-11T15:54:28+05:30	420	45	2.8	0	2023-06-11T15:54:28+05:30	420	47	2.7	0	2023-06-11T15:54:28+05:30	420	63	3.4	0	2023-06-11T15:54:28+05:30	420	67	3.4	0
2023-06-11T15:56:35+05:30	421	40	2.8	0	2023-06-11T15:56:35+05:30	421	47	2.7	0	2023-06-11T15:56:35+05:30	421	63	3.4	0	2023-06-11T15:56:35+05:30	421	67	3.4	0
2023-06-11T15:58:42+05:30	422	40	2.8	0	2023-06-11T15:58:42+05:30	422	47	2.7	0	2023-06-11T15:58:42+05:30	422	63	3.4	0	2023-06-11T15:58:42+05:30	422	67	3.7	0
2023-06-11T16:00:49+05:30	423	40	2.8	0	2023-06-11T16:00:49+05:30	423	47	2.7	0	2023-06-11T16:00:49+05:30	423	63	3.5	0	2023-06-11T16:00:49+05:30	423	67	3.7	0
2023-06-11T16:02:56+05:30	424	40	2.8	0	2023-06-11T16:02:56+05:30	424	44	2.7	0	2023-06-11T16:02:56+05:30	424	63	3.5	0	2023-06-11T16:02:56+05:30	424	67	3.7	0
2023-06-11T16:05:03+05:30	425	40	2.8	0	2023-06-11T16:05:03+05:30	425	44	2.7	0	2023-06-11T16:05:03+05:30	425	63	3.5	0	2023-06-11T16:05:03+05:30	425	67	3.7	0
2023-06-11T16:07:22+05:30	426	40	2.8	0	2023-06-11T16:07:22+05:30	426	44	2.7	0	2023-06-11T16:07:22+05:30	426	63	3.5	0	2023-06-11T16:07:22+05:30	426	67	3.7	0
2023-06-11T16:09:41+05:30	427	40	2.9	0	2023-06-11T16:09:41+05:30	427	44	2.7	0	2023-06-11T16:09:41+05:30	427	63	3.5	0	2023-06-11T16:09:41+05:30	427	67	3.7	0
2023-06-12T09:27:46+05:30	459	33	0	0	2023-06-12T09:27:46+05:30	459	30	0.1	0	2023-06-12T09:27:46+05:30	459	45	0.1	0	2023-06-12T09:27:46+05:30	459	47	0	0
2023-06-12T09:30:04+05:30	460	33	0	0	2023-06-12T09:30:04+05:30	460	30	0.1	0	2023-06-12T09:30:04+05:30	460	45	0.1	0	2023-06-12T09:30:04+05:30	460	47	0	0
2023-06-12T09:32:22+05:30	461	33	0	0	2023-06-12T09:32:22+05:30	461	30	0.3	0	2023-06-12T09:32:22+05:30	461	45	0.1	0	2023-06-12T09:32:22+05:30	461	47	0	0
2023-06-12T09:34:40+05:30	462	33	0	0	2023-06-12T09:34:40+05:30	462	30	0.3	0	2023-06-12T09:34:40+05:30	462	45	0.1	0	2023-06-12T09:34:40+05:30	462	47	0	0
2023-06-12T09:36:58+05:30	463	33	0	0	2023-06-12T09:36:58+05:30	463	30	0.3	0	2023-06-12T09:36:58+05:30	463	45	0.1	0	2023-06-12T09:36:58+05:30	463	47	0	0
2023-06-12T10:23:08+05:30	489	32	0.1	0	2023-06-12T10:23:08+05:30	489	35	0.6	0	2023-06-12T10:23:08+05:30	489	47	0.4	0	2023-06-12T10:23:08+05:30	489	44	0.2	0
2023-06-12T10:25:41+05:30	490	32	0.1	0	2023-06-12T10:25:41+05:30	490	35	0.6	0	2023-06-12T10:25:41+05:30	490	47	0.4	0	2023-06-12T10:25:41+05:30	490	43	0.2	0
2023-06-12T10:28:14+05:30	491	32	0.1	0	2023-06-12T10:28:14+05:30	491	35	0.6	0	2023-06-12T10:28:14+05:30	491	47	0.4	0	2023-06-12T10:28:14+05:30	491	43	0.2	0
2023-06-12T10:30:47+05:30	492	32	0.1	0	2023-06-12T10:30:47+05:30	492	35	0.6	0	2023-06-12T10:30:47+05:30	492	47	0.6	0	2023-06-12T10:30:47+05:30	492	43	0.2	0
2023-06-12T10:33:20+05:30	493	32	0.1	0	2023-06-12T10:33:20+05:30	493	35	0.6	0	2023-06-12T10:33:20+05:30	493	47	0.6	0	2023-06-12T10:33:20+05:30	493	43	0.2	0
2023-06-12T10:35:53+05:30	494	32	0.1	0	2023-06-12T10:35:53+05:30	494	35	0.6	0	2023-06-12T10:35:53+05:30	494	47	0.6	0	2023-06-12T10:35:53+05:30	494	43	0.2	0
2023-06-12T10:38:26+05:30	495	32	0.1	0	2023-06-12T10:38:26+05:30	495	35	0.6	0	2023-06-12T10:38:26+05:30	495	47	0.6	0	2023-06-12T10:38:26+05:30	495	43	0.2	0
2023-06-12T10:40:59+05:30	496	32	0.1	0	2023-06-12T10:40:59+05:30	496	35	0.6	0	2023-06-12T10:40:59+05:30	496	47	0.6	0	2023-06-12T10:40:59+05:30	496	43	0.2	0
2023-06-12T10:43:32+05:30	497	32	0.2	0	2023-06-12T10:43:32+05:30	497	35	0.7	0	2023-06-12T10:43:32+05:30	497	45	0.6	0	2023-06-12T10:43:32+05:30	497	43	0.2	0
2023-06-12T10:46:05+05:30	498	32	0.2	0	2023-06-12T10:46:05+05:30	498	35	0.7	0	2023-06-12T10:46:05+05:30	498	45	0.6	0	2023-06-12T10:46:05+05:30	498	43	0.2	0
2023-06-12T10:48:38+05:30	499	32	0.2	0	2023-06-12T10:48:38+05:30	499	35	0.7	0	2023-06-12T10:48:38+05:30	499	45	0.6	0	2023-06-12T10:48:38+05:30	499	43	0.2	0
2023-06-12T10:51:11+05:30	500	32	0.2	0	2023-06-12T10:51:11+05:30	500	35	0.7	0	2023-06-12T10:51:11+05:30	500	45	0.6	0	2023-06-12T10:51:11+05:30	500	43	0.2	0
2023-06-12T10:53:13+05:30	501	32	0.2	0	2023-06-12T10:53:13+05:30	501	35	0.7	0	2023-06-12T10:53:13+05:30	501	45	0.6	0	2023-06-12T10:53:13+05:30	501	43	0.3	0
2023-06-12T10:55:15+05:30	502	32	0.2	0	2023-06-12T10:55:15+05:30	502	35	0.7	0	2023-06-12T10:55:15+05:30	502	45	0.6	0	2023-06-12T10:55:15+05:30	502	43	0.3	0
2023-06-12T10:57:17+05:30	503	32	0.2	0	2023-06-12T10:57:17+05:30	503	35	0.7	0	2023-06-12T10:57:17+05:30	503	45	0.6	0	2023-06-12T10:57:17+05:30	503	45	0.3	0
2023-06-12T11:37:56+05:30	528	32	0.4	0	2023-06-12T11:37:56+05:30	528	34	0.9	0	2023-06-12T11:37:56+05:30	528	41	0.9	0	2023-06-12T11:37:56+05:30	528	48	0.4	0
2023-06-12T11:40:25+05:30	529	32	0.4	0	2023-06-12T11:40:25+05:30	529	34	0.9	0	2023-06-12T11:40:25+05:30	529	41	0.9	0	2023-06-12T11:40:25+05:30	529	48	0.4	0
2023-06-12T11:42:54+05:30	530	32	0.4	0	2023-06-12T11:42:54+05:30	530	34	0.9	0	2023-06-12T11:42:54+05:30	530	41	0.9	0	2023-06-12T11:42:54+05:30	530	48	0.4	0
2023-06-12T11:45:23+05:30	531	32	0.4	0	2023-06-12T11:45:23+05:30	531	34	0.9	0	2023-06-12T11:45:23+05:30	531	41	0.9	0	2023-06-12T11:45:23+05:30	531	48	0.4	0
2023-06-12T11:47:52+05:30	532	32	0.5	0	2023-06-12T11:47:52+05:30	532	34	0.9	0	2023-06-12T11:47:52+05:30	532	41	0.9	0	2023-06-12T11:47:52+05:30	532	48	0.4	0
2023-06-12T11:50:21+05:30	533	32	0.5	0	2023-06-12T11:50:21+05:30	533	34	0.9	0	2023-06-12T11:50:21+05:30	533	41	0.9	0	2023-06-12T11:50:21+05:30	533	48	0.5	0
2023-06-12T16:10:37+05:30	668	31	0.9	0	2023-06-12T16:10:37+05:30	668	29	1.3	0	2023-06-12T16:10:37+05:30	668	41	1.9	0	2023-06-12T16:10:37+05:30	668	49	2.1	0
2023-06-12T17:05:20+05:30	697	31	1.3	0	2023-06-12T17:05:20+05:30	697	28	1.4	0	2023-06-12T17:05:20+05:30	697	40	2.4	0	2023-06-12T17:05:20+05:30	697	42	3	0
2023-06-13T10:31:16+05:30	698	37	0	0	2023-06-13T10:31:16+05:30	698	43	0	0	2023-06-13T10:31:16+05:30	698	50	0	0	2023-06-13T10:31:16+05:30	698	47	0	0
2023-06-13T10:32:06+05:30	699	37	0	0	2023-06-13T10:32:06+05:30	699	43	0	0	2023-06-13T10:32:06+05:30	699	51	0	0	2023-06-13T10:32:06+05:30	699	47	0	0
2023-06-13T10:35:26+05:30	703	35	0	0	2023-06-13T10:35:26+05:30	703	43	0	0	2023-06-13T10:35:26+05:30	703	51	0.1	0	2023-06-13T10:35:26+05:30	703	47	0	0
2023-06-13T10:36:11+05:30	704	35	0.2	0	2023-06-13T10:36:11+05:30	704	43	0	0	2023-06-13T10:36:11+05:30	704	51	0.1	0	2023-06-13T10:36:11+05:30	704	47	0	0
2023-06-13T10:36:56+05:30	705	35	0.2	0	2023-06-13T10:36:56+05:30	705	43	0	0	2023-06-13T10:36:56+05:30	705	51	0.1	0	2023-06-13T10:36:56+05:30	705	47	0	0
2023-06-13T10:37:41+05:30	706	35	0.2	0	2023-06-13T10:37:41+05:30	706	43	0	0	2023-06-13T10:37:41+05:30	706	51	0.1	0	2023-06-13T10:37:41+05:30	706	47	0	0
2023-06-13T11:28:15+05:30	734	31	0.5	0	2023-06-13T11:28:15+05:30	734	42	0.1	0	2023-06-13T11:28:15+05:30	734	47	0.4	0	2023-06-13T11:28:15+05:30	734	42	0.5	0
2023-06-13T11:29:44+05:30	735	31	0.5	0	2023-06-13T11:29:44+05:30	735	42	0.1	0	2023-06-13T11:29:44+05:30	735	44	0.4	0	2023-06-13T11:29:44+05:30	735	42	0.5	0
2023-06-13T11:31:13+05:30	736	31	0.5	0	2023-06-13T11:31:13+05:30	736	42	0.1	0	2023-06-13T11:31:13+05:30	736	44	0.4	0	2023-06-13T11:31:13+05:30	736	42	0.5	0
2023-06-13T11:32:42+05:30	737	31	0.5	0	2023-06-13T11:32:42+05:30	737	42	0.1	0	2023-06-13T11:32:42+05:30	737	44	0.4	0	2023-06-13T11:32:42+05:30	737	42	0.5	0
2023-06-13T11:34:11+05:30	738	31	0.5	0	2023-06-13T11:34:11+05:30	738	42	0.1	0	2023-06-13T11:34:11+05:30	738	44	0.4	0	2023-06-13T11:34:11+05:30	738	42	0.5	0
2023-06-13T11:35:40+05:30	739	31	0.5	0	2023-06-13T11:35:40+05:30	739	42	0.2	0	2023-06-13T11:35:40+05:30	739	44	0.5	0	2023-06-13T11:35:40+05:30	739	41	0.5	0
2023-06-13T11:37:09+05:30	740	31	0.5	0	2023-06-13T11:37:09+05:30	740	42	0.2	0	2023-06-13T11:37:09+05:30	740	44	0.5	0	2023-06-13T11:37:09+05:30	740	41	0.5	0
2023-06-13T11:39:42+05:30	741	31	0.5	0	2023-06-13T11:39:42+05:30	741	42	0.2	0	2023-06-13T11:39:42+05:30	741	44	0.5	0	2023-06-13T11:39:42+05:30	741	41	1.1	0
2023-06-13T11:42:15+05:30	742	31	0.5	0	2023-06-13T11:42:15+05:30	742	42	0.2	0	2023-06-13T11:42:15+05:30	742	44	0.5	0	2023-06-13T11:42:15+05:30	742	41	1.1	0
2023-06-13T11:44:48+05:30	743	31	0.7	0	2023-06-13T11:44:48+05:30	743	42	0.2	0	2023-06-13T11:44:48+05:30	743	44	0.5	0	2023-06-13T11:44:48+05:30	743	41	1.1	0
2023-06-13T11:47:21+05:30	744	31	0.7	0	2023-06-13T11:47:21+05:30	744	42	0.2	0	2023-06-13T11:47:21+05:30	744	44	0.5	0	2023-06-13T11:47:21+05:30	744	41	1.1	0
2023-06-13T11:49:54+05:30	745	31	0.7	0	2023-06-13T11:49:54+05:30	745	42	0.2	0	2023-06-13T11:49:54+05:30	745	44	0.5	0	2023-06-13T11:49:54+05:30	745	41	1.1	0
2023-06-13T11:52:27+05:30	746	31	0.7	0	2023-06-13T11:52:27+05:30	746	42	0.5	0	2023-06-13T11:52:27+05:30	746	44	0.5	0	2023-06-13T11:52:27+05:30	746	41	1.1	0
2023-06-13T12:41:09+05:30	771	30	0.9	0	2023-06-13T12:41:09+05:30	771	36	0.7	0	2023-06-13T12:41:09+05:30	771	44	1.3	0	2023-06-13T12:41:09+05:30	771	38	1.3	0
2023-06-13T12:42:08+05:30	772	30	0.9	0	2023-06-13T12:42:08+05:30	772	36	0.7	0	2023-06-13T12:42:08+05:30	772	44	1.3	0	2023-06-13T12:42:08+05:30	772	38	1.3	0
2023-06-13T12:43:07+05:30	773	30	0.9	0	2023-06-13T12:43:07+05:30	773	36	0.7	0	2023-06-13T12:43:07+05:30	773	44	1.3	0	2023-06-13T12:43:07+05:30	773	38	1.3	0
2023-06-13T12:44:06+05:30	774	29	0.9	0	2023-06-13T12:44:06+05:30	774	36	0.7	0	2023-06-13T12:44:06+05:30	774	44	1.3	0	2023-06-13T12:44:06+05:30	774	38	1.3	0
2023-06-14T10:53:44+05:30	916	50	0.2	0	2023-06-14T10:53:44+05:30	916	49	0	0	2023-06-14T10:53:44+05:30	916	55	0.5	0	2023-06-14T10:53:44+05:30	916	54	0.5	0
2023-06-14T10:56:02+05:30	917	50	0.2	0	2023-06-14T10:56:02+05:30	917	49	0	0	2023-06-14T10:56:02+05:30	917	55	0.5	0	2023-06-14T10:56:02+05:30	917	54	0.5	0
2023-06-14T10:57:36+05:30	918	50	0.2	0	2023-06-14T10:57:36+05:30	918	49	0	0	2023-06-14T10:57:36+05:30	918	55	0.5	0	2023-06-14T10:57:36+05:30	918	54	0.5	0
2023-06-14T11:35:40+05:30	940	60	0.4	0	2023-06-14T11:35:40+05:30	940	53	0.2	0	2023-06-14T11:35:40+05:30	940	62	0.8	0	2023-06-14T11:35:40+05:30	940	60	0.8	0
2023-06-14T11:37:09+05:30	941	60	0.4	0	2023-06-14T11:37:09+05:30	941	53	0.2	0	2023-06-14T11:37:09+05:30	941	62	0.8	0	2023-06-14T11:37:09+05:30	941	60	0.8	0
2023-06-14T11:39:42+05:30	942	60	0.4	0	2023-06-14T11:39:42+05:30	942	53	0.2	0	2023-06-14T11:39:42+05:30	942	67	0.8	0	2023-06-14T11:39:42+05:30	942	60	0.8	0
2023-06-14T11:42:15+05:30	943	60	0.4	0	2023-06-14T11:42:15+05:30	943	53	0.2	0	2023-06-14T11:42:15+05:30	943	67	0.8	0	2023-06-14T11:42:15+05:30	943	60	0.8	0
2023-06-14T11:44:48+05:30	944	60	0.4	0	2023-06-14T11:44:48+05:30	944	53	0.2	0	2023-06-14T11:44:48+05:30	944	67	0.8	0	2023-06-14T11:44:48+05:30	944	60	0.8	0
2023-06-14T11:47:21+05:30	945	59	0.4	0	2023-06-14T11:47:21+05:30	945	53	0.2	0	2023-06-14T11:47:21+05:30	945	67	0.8	0	2023-06-14T11:47:21+05:30	945	62	0.8	0
2023-06-14T11:49:54+05:30	946	59	0.4	0	2023-06-14T11:49:54+05:30	946	53	0.2	0	2023-06-14T11:49:54+05:30	946	67	0.9	0	2023-06-14T11:49:54+05:30	946	62	0.9	0
2023-06-14T11:52:27+05:30	947	59	0.4	0	2023-06-14T11:52:27+05:30	947	53	0.2	0	2023-06-14T11:52:27+05:30	947	67	0.9	0	2023-06-14T11:52:27+05:30	947	62	0.9	0
2023-06-14T12:34:49+05:30	967	62	0.6	0	2023-06-14T12:34:49+05:30	967	63	0.3	0	2023-06-14T12:34:49+05:30	967	69	1.1	0	2023-06-14T12:34:49+05:30	967	67	1.1	0
2023-06-14T12:36:05+05:30	968	62	0.7	0	2023-06-14T12:36:05+05:30	968	63	0.3	0	2023-06-14T12:36:05+05:30	968	69	1.1	0	2023-06-14T12:36:05+05:30	968	67	1.3	0
2023-06-14T12:37:21+05:30	969	62	0.7	0	2023-06-14T12:37:21+05:30	969	63	0.3	0	2023-06-14T12:37:21+05:30	969	70	1.1	0	2023-06-14T12:37:21+05:30	969	67	1.3	0
2023-06-14T12:38:37+05:30	970	62	0.7	0	2023-06-14T12:38:37+05:30	970	63	0.4	0	2023-06-14T12:38:37+05:30	970	70	1.2	0	2023-06-14T12:38:37+05:30	970	68	1.3	0
2023-06-14T12:39:53+05:30	971	63	0.7	0	2023-06-14T12:39:53+05:30	971	63	0.4	0	2023-06-14T12:39:53+05:30	971	70	1.2	0	2023-06-14T12:39:53+05:30	971	68	1.3	0
2023-06-14T12:41:09+05:30	972	63	0.7	0	2023-06-14T12:41:09+05:30	972	65	0.4	0	2023-06-14T12:41:09+05:30	972	70	1.2	0	2023-06-14T12:41:09+05:30	972	68	1.3	0
2023-06-14T12:42:08+05:30	973	63	0.7	0	2023-06-14T12:42:08+05:30	973	65	0.4	0	2023-06-14T12:42:08+05:30	973	70	1.2	0	2023-06-14T12:42:08+05:30	973	68	1.3	0
2023-06-14T12:43:07+05:30	974	63	0.7	0	2023-06-14T12:43:07+05:30	974	65	0.4	0	2023-06-14T12:43:07+05:30	974	70	1.2	0	2023-06-14T12:43:07+05:30	974	69	1.3	0
2023-06-14T12:44:06+05:30	975	63	0.7	0	2023-06-14T12:44:06+05:30	975	65	0.4	0	2023-06-14T12:44:06+05:30	975	70	1.2	0	2023-06-14T12:44:06+05:30	975	69	1.3	0
2023-06-14T12:45:05+05:30	976	63	0.7	0	2023-06-14T12:45:05+05:30	976	65	0.4	0	2023-06-14T12:45:05+05:30	976	70	1.3	0	2023-06-14T12:45:05+05:30	976	69	1.3	0
2023-06-14T13:03:55+05:30	986	62	0.8	0	2023-06-14T13:03:55+05:30	986	64	0.5	0	2023-06-14T13:03:55+05:30	986	73	1.4	0	2023-06-14T13:03:55+05:30	986	72	1.6	0
2023-06-14T13:06:24+05:30	987	62	0.9	0	2023-06-14T13:06:24+05:30	987	64	0.5	0	2023-06-14T13:06:24+05:30	987	73	1.4	0	2023-06-14T13:06:24+05:30	987	74	1.6	0
2023-06-14T13:08:53+05:30	988	62	0.9	0	2023-06-14T13:08:53+05:30	988	64	0.5	0	2023-06-14T13:08:53+05:30	988	73	1.4	0	2023-06-14T13:08:53+05:30	988	74	1.6	0
2023-06-14T13:10:01+05:30	989	62	0.9	0	2023-06-14T13:10:01+05:30	989	64	0.5	0	2023-06-14T13:10:01+05:30	989	73	1.5	0	2023-06-14T13:10:01+05:30	989	74	1.6	0
2023-06-14T13:11:09+05:30	990	62	0.9	0	2023-06-14T13:11:09+05:30	990	64	0.5	0	2023-06-14T13:11:09+05:30	990	73	1.5	0	2023-06-14T13:11:09+05:30	990	74	1.6	0
2023-06-14T13:12:17+05:30	991	62	0.9	0	2023-06-14T13:12:17+05:30	991	64	0.5	0	2023-06-14T13:12:17+05:30	991	73	1.5	0	2023-06-14T13:12:17+05:30	991	74	1.6	0
2023-06-14T13:13:25+05:30	992	62	0.9	0	2023-06-14T13:13:25+05:30	992	64	0.5	0	2023-06-14T13:13:25+05:30	992	73	1.5	0	2023-06-14T13:13:25+05:30	992	75	1.6	0
2023-06-14T13:14:33+05:30	993	62	0.9	0	2023-06-14T13:14:33+05:30	993	64	0.5	0	2023-06-14T13:14:33+05:30	993	73	1.5	0	2023-06-14T13:14:33+05:30	993	75	1.6	0
2023-06-14T13:15:41+05:30	994	62	0.9	0	2023-06-14T13:15:41+05:30	994	64	0.5	0	2023-06-14T13:15:41+05:30	994	73	1.5	0	2023-06-14T13:15:41+05:30	994	75	1.6	0
2023-06-14T14:03:32+05:30	1017	59	1.2	0	2023-06-14T14:03:32+05:30	1017	63	0.9	0	2023-06-14T14:03:32+05:30	1017	72	1.8	0	2023-06-14T14:03:32+05:30	1017	76	1.9	0
2023-06-14T14:05:57+05:30	1018	59	1.2	0	2023-06-14T14:05:57+05:30	1018	63	0.9	0	2023-06-14T14:05:57+05:30	1018	72	1.8	0	2023-06-14T14:05:57+05:30

Node 1					Node 2					Node 3					Node 4				
created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3
2023-06-14T15:54:28+05:30	1072	59	2	0	2023-06-14T15:54:28+05:30	1072	64	1.8	0	2023-06-14T15:54:28+05:30	1072	68	3.1	0	2023-06-14T15:54:28+05:30	1072	75	3.1	0
2023-06-14T15:56:35+05:30	1073	59	2	0	2023-06-14T15:56:35+05:30	1073	64	1.8	0	2023-06-14T15:56:35+05:30	1073	68	3.1	0	2023-06-14T15:56:35+05:30	1073	75	3.1	0
2023-06-14T15:58:42+05:30	1074	59	2.4	0	2023-06-14T15:58:42+05:30	1074	64	2	0	2023-06-14T15:58:42+05:30	1074	68	3.1	0	2023-06-14T15:58:42+05:30	1074	75	3.1	0
2023-06-14T16:00:49+05:30	1075	59	2.4	0	2023-06-14T16:00:49+05:30	1075	64	2	0	2023-06-14T16:00:49+05:30	1075	68	3.1	0	2023-06-14T16:00:49+05:30	1075	75	3.1	0
2023-06-14T16:02:56+05:30	1076	59	2.4	0	2023-06-14T16:02:56+05:30	1076	64	2	0	2023-06-14T16:02:56+05:30	1076	68	3.1	0	2023-06-14T16:02:56+05:30	1076	75	3.1	0
2023-06-14T16:05:03+05:30	1077	59	2.4	0	2023-06-14T16:05:03+05:30	1077	64	2	0	2023-06-14T16:05:03+05:30	1077	68	3.1	0	2023-06-14T16:05:03+05:30	1077	75	3.1	0
2023-06-14T16:07:22+05:30	1078	59	2.4	0	2023-06-14T16:07:22+05:30	1078	64	2	0	2023-06-14T16:07:22+05:30	1078	68	3.2	0	2023-06-14T16:07:22+05:30	1078	75	3.2	0
2023-06-14T16:09:41+05:30	1079	59	2.4	0	2023-06-14T16:09:41+05:30	1079	64	2	0	2023-06-14T16:09:41+05:30	1079	68	3.2	0	2023-06-14T16:09:41+05:30	1079	75	3.2	0
2023-06-15T10:35:26+05:30	1105	36	0.2	0	2023-06-15T10:35:26+05:30	1105	30	0	0	2023-06-15T10:35:26+05:30	1105	45	0.4	0	2023-06-15T10:35:26+05:30	1105	43	0.2	0
2023-06-15T10:36:11+05:30	1106	36	0.2	0	2023-06-15T10:36:11+05:30	1106	30	0	0	2023-06-15T10:36:11+05:30	1106	45	0.4	0	2023-06-15T10:36:11+05:30	1106	43	0.2	0
2023-06-15T11:25:17+05:30	1134	34	0.2	0	2023-06-15T11:25:17+05:30	1134	31	0.2	0	2023-06-15T11:25:17+05:30	1134	44	0.6	0	2023-06-15T11:25:17+05:30	1134	44	0.4	0
2023-06-15T11:26:46+05:30	1135	34	0.2	0	2023-06-15T11:26:46+05:30	1135	31	0.2	0	2023-06-15T11:26:46+05:30	1135	43	0.6	0	2023-06-15T11:26:46+05:30	1135	44	0.6	0
2023-06-15T11:28:15+05:30	1136	34	0.2	0	2023-06-15T11:28:15+05:30	1136	31	0.2	0	2023-06-15T11:28:15+05:30	1136	43	0.6	0	2023-06-15T11:28:15+05:30	1136	44	0.6	0
2023-06-15T11:29:44+05:30	1137	34	0.2	0	2023-06-15T11:29:44+05:30	1137	31	0.2	0	2023-06-15T11:29:44+05:30	1137	43	0.8	0	2023-06-15T11:29:44+05:30	1137	44	0.8	0
2023-06-15T11:31:13+05:30	1138	34	0.2	0	2023-06-15T11:31:13+05:30	1138	31	0.2	0	2023-06-15T11:31:13+05:30	1138	43	0.8	0	2023-06-15T11:31:13+05:30	1138	44	0.8	0
2023-06-15T11:32:42+05:30	1139	34	0.2	0	2023-06-15T11:32:42+05:30	1139	31	0.2	0	2023-06-15T11:32:42+05:30	1139	43	0.8	0	2023-06-15T11:32:42+05:30	1139	44	0.8	0
2023-06-15T12:27:37+05:30	1164	32	0.5	0	2023-06-15T12:27:37+05:30	1164	33	0.4	0	2023-06-15T12:27:37+05:30	1164	42	0.9	0	2023-06-15T12:27:37+05:30	1164	44	0.8	0
2023-06-15T12:29:25+05:30	1165	32	0.5	0	2023-06-15T12:29:25+05:30	1165	33	0.4	0	2023-06-15T12:29:25+05:30	1165	42	0.9	0	2023-06-15T12:29:25+05:30	1165	44	0.8	0
2023-06-15T12:31:13+05:30	1166	32	0.5	0	2023-06-15T12:31:13+05:30	1166	33	0.4	0	2023-06-15T12:31:13+05:30	1166	42	0.9	0	2023-06-15T12:31:13+05:30	1166	44	0.8	0
2023-06-15T12:33:01+05:30	1167	32	0.5	0	2023-06-15T12:33:01+05:30	1167	33	0.4	0	2023-06-15T12:33:01+05:30	1167	42	0.9	0	2023-06-15T12:33:01+05:30	1167	44	0.8	0
2023-06-15T12:34:49+05:30	1168	32	0.5	0	2023-06-15T12:34:49+05:30	1168	33	0.4	0	2023-06-15T12:34:49+05:30	1168	42	0.9	0	2023-06-15T12:34:49+05:30	1168	44	0.8	0
2023-06-15T12:36:05+05:30	1169	32	0.5	0	2023-06-15T12:36:05+05:30	1169	33	0.4	0	2023-06-15T12:36:05+05:30	1169	42	0.9	0	2023-06-15T12:36:05+05:30	1169	44	0.8	0
2023-06-15T12:37:21+05:30	1170	32	0.5	0	2023-06-15T12:37:21+05:30	1170	33	0.4	0	2023-06-15T12:37:21+05:30	1170	43	0.9	0	2023-06-15T12:37:21+05:30	1170	44	0.8	0
2023-06-16T10:36:11+05:30	1307	45	0.1	0	2023-06-16T10:36:11+05:30	1307	47	0.1	0	2023-06-16T10:36:11+05:30	1307	52	0.1	0	2023-06-16T10:36:11+05:30	1307	54	0	0
2023-06-16T10:36:56+05:30	1308	45	0.1	0	2023-06-16T10:36:56+05:30	1308	47	0.1	0	2023-06-16T10:36:56+05:30	1308	52	0.1	0	2023-06-16T10:36:56+05:30	1308	54	0	0
2023-06-16T10:37:41+05:30	1309	45	0.1	0	2023-06-16T10:37:41+05:30	1309	47	0.1	0	2023-06-16T10:37:41+05:30	1309	52	0.1	0	2023-06-16T10:37:41+05:30	1309	54	0	0
2023-06-16T10:38:26+05:30	1310	45	0.1	0	2023-06-16T10:38:26+05:30	1310	47	0.1	0	2023-06-16T10:38:26+05:30	1310	52	0.1	0	2023-06-16T10:38:26+05:30	1310	54	0	0
2023-06-16T11:32:42+05:30	1340	46	0.2	0	2023-06-16T11:32:42+05:30	1340	49	0.1	0	2023-06-16T11:32:42+05:30	1340	54	0.4	0	2023-06-16T11:32:42+05:30	1340	52	0.2	0
2023-06-16T11:34:11+05:30	1341	46	0.2	0	2023-06-16T11:34:11+05:30	1341	50	0.1	0	2023-06-16T11:34:11+05:30	1341	54	0.4	0	2023-06-16T11:34:11+05:30	1341	52	0.3	0
2023-06-16T12:25:49+05:30	1364	46	0.2	0	2023-06-16T12:25:49+05:30	1364	49	0.1	0	2023-06-16T12:25:49+05:30	1364	56	0.6	0	2023-06-16T12:25:49+05:30	1364	54	0.4	0
2023-06-16T12:27:37+05:30	1365	46	0.2	0	2023-06-16T12:27:37+05:30	1365	49	0.1	0	2023-06-16T12:27:37+05:30	1365	56	0.6	0	2023-06-16T12:27:37+05:30	1365	54	0.4	0
2023-06-16T12:29:25+05:30	1366	46	0.2	0	2023-06-16T12:29:25+05:30	1366	49	0.1	0	2023-06-16T12:29:25+05:30	1366	56	0.7	0	2023-06-16T12:29:25+05:30	1366	54	0.4	0
2023-06-16T12:31:13+05:30	1367	46	0.2	0	2023-06-16T12:31:13+05:30	1367	49	0.1	0	2023-06-16T12:31:13+05:30	1367	56	0.7	0	2023-06-16T12:31:13+05:30	1367	55	0.4	0
2023-06-16T12:33:01+05:30	1368	46	0.2	0	2023-06-16T12:33:01+05:30	1368	49	0.1	0	2023-06-16T12:33:01+05:30	1368	56	0.7	0	2023-06-16T12:33:01+05:30	1368	55	0.4	0
2023-06-16T12:34:49+05:30	1369	46	0.2	0	2023-06-16T12:34:49+05:30	1369	49	0.1	0	2023-06-16T12:34:49+05:30	1369	56	0.7	0	2023-06-16T12:34:49+05:30	1369	55	0.4	0
2023-06-16T12:36:05+05:30	1370	46	0.2	0	2023-06-16T12:36:05+05:30	1370	49	0.1	0	2023-06-16T12:36:05+05:30	1370	56	0.7	0	2023-06-16T12:36:05+05:30	1370	55	0.4	0
2023-06-16T12:37:21+05:30	1371	46	0.2	0	2023-06-16T12:37:21+05:30	1371	49	0.1	0	2023-06-16T12:37:21+05:30	1371	56	0.7	0	2023-06-16T12:37:21+05:30	1371	55	0.4	0
2023-06-16T12:38:37+05:30	1372	46	0.2	0	2023-06-16T12:38:37+05:30	1372	50	0.1	0	2023-06-16T12:38:37+05:30	1372	56	0.7	0	2023-06-16T12:38:37+05:30	1372	55	0.4	0
2023-06-16T12:39:53+05:30	1373	46	0.2	0	2023-06-16T12:39:53+05:30	1373	50	0.1	0	2023-06-16T12:39:53+05:30	1373	52	0.7	0	2023-06-16T12:39:53+05:30	1373	55	0.4	0
2023-06-16T12:41:09+05:30	1374	46	0.2	0	2023-06-16T12:41:09+05:30	1374	50	0.1	0	2023-06-16T12:41:09+05:30	1374	52	0.7	0	2023-06-16T12:41:09+05:30	1374	55	0.4	0
2023-06-16T12:42:08+05:30	1375	46	0.2	0	2023-06-16T12:42:08+05:30	1375	50	0.1	0	2023-06-16T12:42:08+05:30	1375	52	0.7	0	2023-06-16T12:42:08+05:30	1375	54	0.4	0
2023-06-16T13:08:53+05:30	1390	46	0.3	0	2023-06-16T13:08:53+05:30	1390	49	0.2	0	2023-06-16T13:08:53+05:30	1390	52	0.9	0	2023-06-16T13:08:53+05:30	1390	55	0.6	0
2023-06-16T13:10:01+05:30	1391	46	0.3	0	2023-06-16T13:10:01+05:30	1391	49	0.2	0	2023-06-16T13:10:01+05:30	1391	52	0.9	0	2023-06-16T13:10:01+05:30	1391	55	0.6	0
2023-06-16T13:11:09+05:30	1392	46	0.3	0	2023-06-16T13:11:09+05:30	1392	49	0.2	0	2023-06-16T13:11:09+05:30	1392	52	0.9	0	2023-06-16T13:11:09+05:30	1392	55	0.6	0
2023-06-16T13:12:17+05:30	1393	46	0.3	0	2023-06-16T13:12:17+05:30	1393	49	0.2	0	2023-06-16T13:12:17+05:30	1393	52	0.9	0	2023-06-16T13:12:17+05:30	1393	55	0.6	0
2023-06-16T13:13:25+05:30	1394	46	0.3	0	2023-06-16T13:13:25+05:30	1394	49	0.2	0	2023-06-16T13:13:25+05:30	1394	52	0.9	0	2023-06-16T13:13:25+05:30	1394	55	0.6	0
2023-06-16T13:14:33+05:30	1395	46	0.3	0	2023-06-16T13:14:33+05:30	1395	49	0.2	0	2023-06-16T13:14:33+05:30	1395	51	1	0	2023-06-16T13:14:33+05:30	1395	55	0.6	0
2023-06-16T13:15:41+05:30	1396	46	0.3	0	2023-06-16T13:15:41+05:30	1396	48	0.2	0	2023-06-16T13:15:41+05:30	1396	51	1	0	2023-06-16T13:15:41+05:30	1396	55	0.6	0
2023-06-17T10:36:11+05:30	1508	51	0.2	0	2023-06-17T10:36:11+05:30	1508	55	0.2	0	2023-06-17T10:36:11+05:30	1508	64	0.1	0	2023-06-17T10:36:11+05:30	1508	62	0.2	0
2023-06-17T10:36:56+05:30	1509	51	0.2	0	2023-06-17T10:36:56+05:30	1509	55	0.2	0	2023-06-17T10:36:56+05:30	1509	64	0.1	0	2023-06-17T10:36:56+05:30	1509	62	0.2	0
2023-06-17T10:37:41+05:30	1510	51	0.2	0	2023-06-17T10:37:41+05:30	1510	55	0.2	0	2023-06-17T10:37:41+05:30	1510	64	0.1	0	2023-06-17T10:37:41+05:30	1510	62	0.2	0
2023-06-17T11:23:48+05:30	1535	53	0.4	0	2023-06-17T11:23:48+05:30	1535	53	0.3	0	2023-06-17T11:23:48+05:30	1535	66	0.3	0	2023-06-17T11:23:48+05:30	1535	64	0.3	0
2023-06-17T11:25:17+05:30	1536	53	0.4	0	2023-06-17T11:25:17+05:30	1536	53	0.3	0	2023-06-17T11:25:17+05:30	1536	66	0.3	0	2023-06-17T11:25:17+05:30	1536	64	0.3	0
2023-06-17T11:26:46+05:30	1537	53	0.4	0	2023-06-17T11:26:46+05:30	1537	53	0.4	0	2023-06-17T11:26:46+05:30	1537	66	0.3	0	2023-06-17T11:26:46+05:30	1537	64	0.5	0
2023-06-17T11:28:15+05:30	1538	53	0.4	0	2023-06-17T11:28:15+05:30	1538	53	0.4	0	2023-06-17T11:28:15+05:30	1538	66	0.3	0	2023-06-17T11:28:15+05:30	1538	64	0.5	0
2023-06-17T11:29:44+05:30	1539	53	0.4	0	2023-06-17T11:29:44+05:30	1539	53	0.4	0	2023-06-17T11:29:44+05:30	1539	66	0.3	0	2023-06-17T11:29:44+05:30	1539	64	0.5	0
2023-06-17T11:31:13+05:30	1540	53	0.4	0	2023-06-17T11:31:13+05:30	1540	55	0.4	0	2023-06-17T11:31:13+05:30	1540	66	0.3	0	2023-06-17T11:31:13+05:30	1540	64	0.5	0
2023-06-17T11:32:42+05:30	1541	53	0.4	0	2023-06-17T11:32:42+05:30	1541	55	0.4	0	2023-06-17T11:32:42+05:30	1541	66	0.3	0	2023-06-17T11:32:42+05:30	1541	64	0.5	0
2023-06-17T11:34:11+05:30	1542	53	0.4	0	2023-06-17T11:34:11+05:30	1542	55	0.4	0	2023-06-17T11:34:11+05:30	1542	66	0.3	0	2023-06-17T11:34:11+05:30	1542	66	0.5	0
2023-06-17T11:35:40+05:30	1543	53	0.4	0	2023-06-17T11:35:40+05:30	1543	55	0.4	0	2023-06-17T11:35:40+05:30	1543	66	0.5	0	2023-06-17T11:35:40+05:30	1543	66	0.5	0
2023-06-17T11:37:09+05:30	1544	53	0.4	0	2023-06-17T11:37:09+05:30	1544	55	0.4	0	2023-06-17T11:37:09+05:30	1544	66	0.5	0	2023-06-17T11:37:09+05:30	1544	66	0.5	0
2023-06-17T12:31:13+05:30	1568	55	0.7	0	2023-06-17T12:31:13+05:30	1568	57	1.1	0	2023-06-17T12:31:13+05:30	1568	65	0.7	0	2023-06-17T12:31:13+05:30	1568	65	0.8	0
2023-06-17T12:33:01+05:30	1569	55	0.7	0	2023-06-17T12:33:01+05:30	1569	57	1.1	0	2023-06-17T12:33:01+05:30	1569	65	0.7	0	2023-06-17T12:33:01+05:30	1569	65	0.8	0
2023-06-17T12:34:49+05:30	1570	55	0.7	0	2023-06-17T12:34:49+05:30	1570	57	1.1	0	2023-06-17T12:34:49+05:30	1570	65	0.7	0	2023-06-17T12:34:49+05:30	1570	65	0.8	0
2023-06-17T12:36:05+05:30	1571	55	0.7	0	2023-06-17T12:36:05+05:30	1571	57	1.1	0	2023-06-17T12:36:05+05:30	1571	65	0.8	0	2023-06-17T12:36:05+05:30	1571	65	0.8	0
2023-06-17T12:37:21+05:30	1572	55	0.7	0	2023-06-17T12:37:21+05:30	1572	57	1.1	0	2023-06-17T12:37:21+05:30	1572	65	0.8	0	2023-06-17T12:37:21+05:30	1572	64	0.8	0
2023-06-17T12:38:37+05:30	1573	55	0.7	0	2023-06-17T12:38:37+05:30	1573	57	1.1	0	2023-06-17T12:38:37+05:30	1573	65	0.8	0	2023-06-17T12:38:37+05:30	1573	64	0.8	0
2023-06-17T12:39:53+05:30	1574	55	0.7	0	2023-06-17T12:39:53+05:30	1574	57	1.1	0	2023-06-17T12:39:53+05:30	1574	65	0.8	0	2023-06-17T12:39:53+05:30	1574	64	0.8	0
2023-06-17T12:41:09+05:30	1575	55	0.7	0	2023-06-17T12:41:09+05:30	1575	56	1.1	0	2023-06-17T12:41:09+05:30	1575	65	0.8	0	2023-06-17T12:41:09+05:30	1575	64	0.8	0
2023-06-17T12:42:08+05:30	1576	55	0.7	0	2023-06-17T12:42:08+05:30	1576	56	1.1	0	2023-06-17T12:42:08+05:30	1576	65	0.9	0	2023-06-17T12:42:08+05:30	1576	64	0.9	0
2023-06-17T12:43:07+05:30	1577	55	0.7	0	2023-06-17T12:43:07+05:30	1577	56	1.1	0	2023-06-17T12:43:07+05:30	1577	64	0.9	0	2023-06-17T12:43:07+05:30	1577	64	0.9	0
2023-06-17T13:26:52+05:30	1604	56	1.1	0	2023-06-17T13:26:52+05:30	1604	54	1.5	0	2023-06-17T13:26:52+05:30	1604	67	1.5	0	2023-06-17T13:26:52+05:30	1604	65	1.8	0
2023-06-17T13:29:05+05:30	1605	56	1.1	0	2023-06-17T13:29:05+05:30	1605	53	1.5	0	2023-06-17T13:29:05+05:30	1605	67	1.5	0	2023-06-17T13:29:05+05:30	1605	65	1.8	0
2023-06-17T13:31:18+05:30	1606	56	1.1	0	2023-06-17T13:31:18+05:30	1606	53	1.5	0	2023-06-17T13:31:18+05:30	1606	67	1.5	0	2023-06-17T13:31:18+05:30	1606	65	1.8	0
2023-06-17T13:33:31+05:30	1607	56	1.1	0	2023-06-17T13:33:31+05:30	1607	53	1.5	0	2023-06-17T13:33:31+05:30	1607	67	1.5	0	2023-06-17T13:33:31+05:30	1607	65	1.8	0
2023-06-17T13:35:44+05:30	1608	56	1.1	0	2023-06-17T13:35:44+05:30	1608	53	1.5	0	2023-06-17T13:35:44+05:30	1608	67	1.5	0	2023-06-17T13:35:44+05:30	1608	65	1.8	0
2023-06-17T13:37:57+05:30	1609	56	1.1	0	2023-06-17T13:37:57+05:30	1609	53	1.5	0	2023-06-17T13:37:57+05:30	1609	68	1.5	0	2023-06-17T13:37:57+05:30	1609	65	1.8	0
2023-06-17T13:40:10+05:30	1610	60	1.1	0	2023-06-17T13:40:10+05:30	1610	53	1.5	0	2023-06-17T13:40:10+05:30	1610	68	1.8	0	2023-06-17T13:40:10+05:30	1610	65	1.8	0
2023-06-17T13:42:23+05:30	1611	60	1.2	0	2023-06-17T13:42:23+05:30	1611	53	1.5	0	2023-06-17T13:42:23+05:30	1611	68	1.8	0	2023-06-17T13:42:23+05:30	1611	65	1.8	0
2023-06-17T13:44:36+05:30	1612	60	1.2	0	2023-06-17T13:44:36+05:30	1612	53	1.7	0	2023-06-17T13:44:36+05:30	1612	68	1.8	0	2023-06-17T13:44:36+05:30	1612	65	1.8	0
2023-06-17T13:46:49+05:30	1613	60	1.2	0	2023-06-17T13:46:49+05:30	1613	53	1.7	0	2023-06-17T13:46:49+05:30	1613	68	1.8	0	2023-06-17T13:46:49+05:30	1613	65	1.8	0
2023-06-17T15:07:05+05:30	1644	62	1.5	0	2023-06-17T15:07:05+05:30	1644	59	1.8	0	2023-06-17T15:07:05+05:30	1644	75	2.1	0	2023-06-17T15:07:05+05:30	1644	73	2.1	0
2023-06-17T15:08:20+05:30	1645	62	1.5	0	2023-06-17T15:08:20+05:30	1645	59	1.8	0	2023-06-17T15:08:20+05:30	1645	75	2.1	0	2023-06-17T15:08:20+05:30	1645	73	2.1	0
2023-06-17T15:09:35+05:30	1646	64	1.5	0	2023-06-17T15:09:35+05:30	1646	59	1.8	0	2023-06-17T15:09:35+05:30	1646	75	2.1	0	2023-06-17T15:09:35+05:30	1646	73	2.1	0
2023-06-17T15:10:50+05:30	1647	64	1.5	0	2023-06-17T15:10:50+05:30	1647	59	1.8	0	2023-06-17T15:10:50+05:30	1647	75	2.1	0	2023-06-17T15:10:50+05:30	1647	73	2.3	0
2023-06-17T15:12:05+05:30	1648	64	1.5	0	2023-06-17T15:12:05+05:30	1648	59	1.8	0	2023-06-17T15:12:05+05:30	1648	75	2.1	0	2023-06-17T15:12:05+05:30	1648	73	2.3	0
2023-06-17T16:02:56+05:30	1679	64	1.8	0	2023-06-17T16:02:56+05:30	1679	60	2.1	0	2023-06-17T16:02:56+05:30	1679	70	2.5	0	2023-06-17T16:02:56+05:30	1679	75	2.5	0
2023-06-17T16:05:03+05:30	1680	65	1.8	0	2023-06-17T16:05:03+05:30	1680	60	2.1	0	2023-06-17T16:05:03+05:30	1680	70	2.5	0	2023-06-17T16:05:03+05:30	1680	75	2.5	0
2023-06-17T16:07:22+05:30	1681	65	1.8	0	2023-06-17T16:07:22+05:30	1681	60	2.1	0	2023-06-17T16:07:22+05:30	1681	70	2.5	0	2023-06-17T16:07:22+05:30	1681	75	2.5	0
2023-06-17T16:09:41+05:30	1682	65	1.9	0	2023-06-17T16:09:41+05:30	1682	60	2.1	0	2023-06-17T16:09:41+05:30	1682	70	2.5	0	2023-06-17T16:09:41+05:30	1682	75	2.5	0
2023-06-17T16:12:00+05:30	1683	65	1.9	0	2023-06-17T16:12:00+05:30	1683	60	2.1	0	2023-06-17T16:12:00+05:30	1683	70	2.5	0	2023-06-17T16:12:00+05:30	1683	74	2.5	0
2023-06-17T16:14:19+05:30	1684	65	1.9	0	2023-06-17T16:14:19+05:30	1684	60	2.1	0	2023-06-17T16:14:19+05:30	1684	70	2.5	0	2023-06-17T16:14:19+05:30	1684	74	2.5	0
2023-06-17T16:16:38+05:30	1685	65	1.9	0	2023-06-17T16:16:38+05:30	1685	60	2.1	0	2023-06-17T16:16:38+05:30	1685	70	2.5	0	2023-06-17T16:16:38+05:30	1685	74	2.5	0
2023-06-17T16:18:57+05:30	1686	65	1.9	0	2023-06-17T16:18:57+05:30	1686	60	2.1	0	2023-06-17T16:18:57+05:30	1686	70	2.5	0	2023-06-17T16:18:57+05:30	1686	74	2.8	0
2023-06-17T16:21:16+05:30	1687	65	1.9	0	2023-06-17T16:21:16+05:30	1687	60	2.1	0	2023-06-17T16:21:16+05:30	1687	70	2.5	0	2023-06-17T16:21:16+05:30	1687	74	2.8	0
2023-06-18T10:46:50+05:30	1717	49	0.2	0	2023-06-18T10:46:50+05:30	1717	52	0	0	2023-06-18T10:46:50+05:30	1717	53	0.4	0	2023-06-18T10:46:50+05:30	1717	49	0.4	0
2023-06-18T10:49:08+05:30	1718	49	0.2	0	2023-06-18T10:49:08+05:30	1718	52	0	0	2023-06-18T10:49:08+05:30	1718	53	0.4	0	2023-06-18T10:49:08+05:30	1718	49	0.5	0
2023-06-18T10:51:26+05:30	1719	49	0.2	0	2023-06-18T10:51:26+05:30	1719	52	0.1	0	2023-06-18T10:51:26+05:30	1719	53	0.4	0	2023-06-18T10:51:26+05:30	1719	49	0.5	0
2023-06-18T10:53:44+05:30	1720	49	0.2	0	2023-06-18T10:53:44+05:30	1720	52	0.1	0	2023-06-18T10:53:44+05:30	1720	53	0.4	0	2023-06-18T10:53:44+05:30	1720	49	0.5	0
2023-06-18T10:56:02+05:30	1721	49	0.2	0	2023-06-18T10:56:02+05:30	1721	52	0.1	0	2023-06-18T10:56:02+05:30	1721	53	0.4	0	2023-06-18T10:56:02+05:30	1721	50	0.5	0
2023-06-18T10:57:36+05:30	1722	49	0.2	0	2023-06-18T10:57:36+05:30	1722	52	0.1	0	2023-06-18T10:57:36+05:30	1722	53	0.4	0	2023-06-18T10:57:36+05:30	1722	50	0.5	0
2023-06-18T10:59:10+05:30	1723	49	0.3	0	2023-06-18T10:59:10+05:30	1723	52	0.1	0	2023-06-18T10:59:10+05:30	1723	53	0.5	0	2023-06-18T10:59:10+05:30	1723	50	0.5	0
2023-06-18T11:52:27+05:30	1751	51	0.4	0	2023-06-18T11:52:27+05:30	1751	54	0.3	0	2023-06-18T11:52:27+05:30	1751	52	0.9	0	2023-06-18T11:52:27+05:30	1751	48	0.

Node 1					Node 2					Node 3					Node 4				
created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3
2023-06-18T12:29:25+05:30	1768	49	0.8	0	2023-06-18T12:29:25+05:30	1768	53	0.3	0	2023-06-18T12:29:25+05:30	1768	53	1.2	0	2023-06-18T12:29:25+05:30	1768	46	1.2	0
2023-06-18T12:31:13+05:30	1769	49	0.8	0	2023-06-18T12:31:13+05:30	1769	53	0.4	0	2023-06-18T12:31:13+05:30	1769	53	1.2	0	2023-06-18T12:31:13+05:30	1769	46	1.2	0
2023-06-18T12:33:01+05:30	1770	49	0.8	0	2023-06-18T12:33:01+05:30	1770	53	0.4	0	2023-06-18T12:33:01+05:30	1770	53	1.2	0	2023-06-18T12:33:01+05:30	1770	46	1.2	0
2023-06-18T12:34:49+05:30	1771	49	0.8	0	2023-06-18T12:34:49+05:30	1771	53	0.4	0	2023-06-18T12:34:49+05:30	1771	53	1.2	0	2023-06-18T12:34:49+05:30	1771	46	1.2	0
2023-06-18T12:36:05+05:30	1772	49	0.8	0	2023-06-18T12:36:05+05:30	1772	53	0.4	0	2023-06-18T12:36:05+05:30	1772	53	1.2	0	2023-06-18T12:36:05+05:30	1772	46	1.2	0
2023-06-18T12:37:21+05:30	1773	49	0.8	0	2023-06-18T12:37:21+05:30	1773	52	0.4	0	2023-06-18T12:37:21+05:30	1773	53	1.2	0	2023-06-18T12:37:21+05:30	1773	46	1.3	0
2023-06-18T12:38:37+05:30	1774	49	0.9	0	2023-06-18T12:38:37+05:30	1774	52	0.4	0	2023-06-18T12:38:37+05:30	1774	53	1.2	0	2023-06-18T12:38:37+05:30	1774	46	1.3	0
2023-06-18T12:39:53+05:30	1775	49	0.9	0	2023-06-18T12:39:53+05:30	1775	52	0.4	0	2023-06-18T12:39:53+05:30	1775	53	1.2	0	2023-06-18T12:39:53+05:30	1775	47	1.3	0
2023-06-18T12:41:09+05:30	1776	49	0.9	0	2023-06-18T12:41:09+05:30	1776	52	0.4	0	2023-06-18T12:41:09+05:30	1776	53	1.2	0	2023-06-18T12:41:09+05:30	1776	47	1.3	0
2023-06-18T12:42:08+05:30	1777	49	0.9	0	2023-06-18T12:42:08+05:30	1777	52	0.4	0	2023-06-18T12:42:08+05:30	1777	53	1.3	0	2023-06-18T12:42:08+05:30	1777	47	1.3	0
2023-06-18T12:43:07+05:30	1778	49	0.9	0	2023-06-18T12:43:07+05:30	1778	52	0.4	0	2023-06-18T12:43:07+05:30	1778	53	1.3	0	2023-06-18T12:43:07+05:30	1778	47	1.3	0
2023-06-18T13:37:57+05:30	1810	46	1.1	0	2023-06-18T13:37:57+05:30	1810	52	0.8	0	2023-06-18T13:37:57+05:30	1810	47	1.6	0	2023-06-18T13:37:57+05:30	1810	48	1.7	0
2023-06-18T13:40:10+05:30	1811	46	1.1	0	2023-06-18T13:40:10+05:30	1811	52	0.8	0	2023-06-18T13:40:10+05:30	1811	47	1.6	0	2023-06-18T13:40:10+05:30	1811	49	1.7	0
2023-06-18T13:42:23+05:30	1812	46	1.1	0	2023-06-18T13:42:23+05:30	1812	52	0.8	0	2023-06-18T13:42:23+05:30	1812	47	1.6	0	2023-06-18T13:42:23+05:30	1812	49	1.7	0
2023-06-18T13:44:36+05:30	1813	46	1.1	0	2023-06-18T13:44:36+05:30	1813	52	0.8	0	2023-06-18T13:44:36+05:30	1813	47	1.7	0	2023-06-18T13:44:36+05:30	1813	49	1.7	0
2023-06-18T13:46:49+05:30	1814	46	1.1	0	2023-06-18T13:46:49+05:30	1814	52	0.8	0	2023-06-18T13:46:49+05:30	1814	47	1.7	0	2023-06-18T13:46:49+05:30	1814	47	1.7	0
2023-06-18T13:49:02+05:30	1815	46	1.1	0	2023-06-18T13:49:02+05:30	1815	52	0.8	0	2023-06-18T13:49:02+05:30	1815	47	1.7	0	2023-06-18T13:49:02+05:30	1815	47	1.7	0
2023-06-18T13:51:27+05:30	1816	46	1.2	0	2023-06-18T13:51:27+05:30	1816	52	0.8	0	2023-06-18T13:51:27+05:30	1816	47	1.7	0	2023-06-18T13:51:27+05:30	1816	47	1.8	0
2023-06-18T13:53:52+05:30	1817	46	1.2	0	2023-06-18T13:53:52+05:30	1817	52	0.8	0	2023-06-18T13:53:52+05:30	1817	47	1.7	0	2023-06-18T13:53:52+05:30	1817	47	1.8	0
2023-06-18T13:56:17+05:30	1818	45	1.2	0	2023-06-18T13:56:17+05:30	1818	52	0.8	0	2023-06-18T13:56:17+05:30	1818	47	1.7	0	2023-06-18T13:56:17+05:30	1818	47	1.8	0
2023-06-18T13:58:42+05:30	1819	45	1.2	0	2023-06-18T13:58:42+05:30	1819	52	0.9	0	2023-06-18T13:58:42+05:30	1819	47	1.7	0	2023-06-18T13:58:42+05:30	1819	47	1.8	0
2023-06-18T14:01:07+05:30	1820	45	1.2	0	2023-06-18T14:01:07+05:30	1820	53	0.9	0	2023-06-18T14:01:07+05:30	1820	47	1.7	0	2023-06-18T14:01:07+05:30	1820	49	1.8	0
2023-06-18T14:03:32+05:30	1821	45	1.2	0	2023-06-18T14:03:32+05:30	1821	53	0.9	0	2023-06-18T14:03:32+05:30	1821	47	1.8	0	2023-06-18T14:03:32+05:30	1821	49	1.8	0
2023-06-18T14:05:57+05:30	1822	45	1.2	0	2023-06-18T14:05:57+05:30	1822	53	0.9	0	2023-06-18T14:05:57+05:30	1822	47	1.8	0	2023-06-18T14:05:57+05:30	1822	49	1.8	0
2023-06-18T14:08:22+05:30	1823	45	1.2	0	2023-06-18T14:08:22+05:30	1823	53	0.9	0	2023-06-18T14:08:22+05:30	1823	47	1.8	0	2023-06-18T14:08:22+05:30	1823	49	1.8	0
2023-06-18T15:17:05+05:30	1853	46	1.2	0	2023-06-18T15:17:05+05:30	1853	50	1.1	0	2023-06-18T15:17:05+05:30	1853	47	2.2	0	2023-06-18T15:17:05+05:30	1853	49	2.2	0
2023-06-18T15:18:20+05:30	1854	46	1.2	0	2023-06-18T15:18:20+05:30	1854	50	1.1	0	2023-06-18T15:18:20+05:30	1854	47	2.2	0	2023-06-18T15:18:20+05:30	1854	49	2.2	0
2023-06-18T15:19:35+05:30	1855	46	1.2	0	2023-06-18T15:19:35+05:30	1855	50	1.1	0	2023-06-18T15:19:35+05:30	1855	47	2.3	0	2023-06-18T15:19:35+05:30	1855	49	2.3	0
2023-06-18T15:20:50+05:30	1856	46	1.2	0	2023-06-18T15:20:50+05:30	1856	50	1.1	0	2023-06-18T15:20:50+05:30	1856	47	2.3	0	2023-06-18T15:20:50+05:30	1856	48	2.3	0
2023-06-18T15:21:39+05:30	1857	46	1.2	0	2023-06-18T15:21:39+05:30	1857	50	1.1	0	2023-06-18T15:21:39+05:30	1857	47	2.3	0	2023-06-18T15:21:39+05:30	1857	48	2.3	0
2023-06-18T15:22:28+05:30	1858	46	1.2	0	2023-06-18T15:22:28+05:30	1858	49	1.1	0	2023-06-18T15:22:28+05:30	1858	47	2.3	0	2023-06-18T15:22:28+05:30	1858	48	2.4	0
2023-06-18T15:23:17+05:30	1859	46	1.2	0	2023-06-18T15:23:17+05:30	1859	49	1.1	0	2023-06-18T15:23:17+05:30	1859	47	2.3	0	2023-06-18T15:23:17+05:30	1859	48	2.4	0
2023-06-18T16:43:53+05:30	1896	45	1.2	0	2023-06-18T16:43:53+05:30	1896	50	1.1	0	2023-06-18T16:43:53+05:30	1896	46	2.6	0	2023-06-18T16:43:53+05:30	1896	47	2.8	0
2023-06-18T16:46:47+05:30	1897	45	1.2	0	2023-06-18T16:46:47+05:30	1897	50	1.1	0	2023-06-18T16:46:47+05:30	1897	46	2.6	0	2023-06-18T16:46:47+05:30	1897	47	2.8	0
2023-06-19T11:03:52+05:30	1927	23	0.2	0	2023-06-19T11:03:52+05:30	1927	28	0.1	0	2023-06-19T11:03:52+05:30	1927	31	0.5	0	2023-06-19T11:03:52+05:30	1927	30	0.6	0
2023-06-19T11:05:26+05:30	1928	23	0.2	0	2023-06-19T11:05:26+05:30	1928	28	0.1	0	2023-06-19T11:05:26+05:30	1928	31	0.5	0	2023-06-19T11:05:26+05:30	1928	30	0.6	0
2023-06-19T11:07:38+05:30	1929	23	0.2	0	2023-06-19T11:07:38+05:30	1929	28	0.1	0	2023-06-19T11:07:38+05:30	1929	30	0.5	0	2023-06-19T11:07:38+05:30	1929	30	0.6	0
2023-06-19T11:09:50+05:30	1930	23	0.2	0	2023-06-19T11:09:50+05:30	1930	28	0.1	0	2023-06-19T11:09:50+05:30	1930	30	0.5	0	2023-06-19T11:09:50+05:30	1930	30	0.6	0
2023-06-19T11:12:02+05:30	1931	23	0.2	0	2023-06-19T11:12:02+05:30	1931	28	0.1	0	2023-06-19T11:12:02+05:30	1931	30	0.5	0	2023-06-19T11:12:02+05:30	1931	30	0.6	0
2023-06-19T11:14:14+05:30	1932	23	0.2	0	2023-06-19T11:14:14+05:30	1932	28	0.1	0	2023-06-19T11:14:14+05:30	1932	30	0.5	0	2023-06-19T11:14:14+05:30	1932	30	0.6	0
2023-06-19T11:16:26+05:30	1933	23	0.2	0	2023-06-19T11:16:26+05:30	1933	28	0.1	0	2023-06-19T11:16:26+05:30	1933	30	0.5	0	2023-06-19T11:16:26+05:30	1933	30	0.6	0
2023-06-19T11:18:38+05:30	1934	23	0.2	0	2023-06-19T11:18:38+05:30	1934	28	0.1	0	2023-06-19T11:18:38+05:30	1934	30	0.6	0	2023-06-19T11:18:38+05:30	1934	30	0.6	0
2023-06-19T11:20:50+05:30	1935	23	0.2	0	2023-06-19T11:20:50+05:30	1935	28	0.1	0	2023-06-19T11:20:50+05:30	1935	30	0.6	0	2023-06-19T11:20:50+05:30	1935	30	0.6	0
2023-06-19T11:22:19+05:30	1936	23	0.2	0	2023-06-19T11:22:19+05:30	1936	28	0.1	0	2023-06-19T11:22:19+05:30	1936	30	0.6	0	2023-06-19T11:22:19+05:30	1936	30	0.6	0
2023-06-19T11:23:48+05:30	1937	23	0.2	0	2023-06-19T11:23:48+05:30	1937	28	0.1	0	2023-06-19T11:23:48+05:30	1937	30	0.6	0	2023-06-19T11:23:48+05:30	1937	30	0.6	0
2023-06-19T11:25:17+05:30	1938	23	0.2	0	2023-06-19T11:25:17+05:30	1938	27	0.1	0	2023-06-19T11:25:17+05:30	1938	30	0.6	0	2023-06-19T11:25:17+05:30	1938	34	0.6	0
2023-06-19T11:26:46+05:30	1939	23	0.2	0	2023-06-19T11:26:46+05:30	1939	27	0.1	0	2023-06-19T11:26:46+05:30	1939	30	0.6	0	2023-06-19T11:26:46+05:30	1939	34	0.6	0
2023-06-19T11:28:15+05:30	1940	23	0.2	0	2023-06-19T11:28:15+05:30	1940	27	0.1	0	2023-06-19T11:28:15+05:30	1940	30	0.6	0	2023-06-19T11:28:15+05:30	1940	34	0.6	0
2023-06-19T11:29:44+05:30	1941	23	0.2	0	2023-06-19T11:29:44+05:30	1941	27	0.1	0	2023-06-19T11:29:44+05:30	1941	30	0.6	0	2023-06-19T11:29:44+05:30	1941	34	0.7	0
2023-06-19T12:42:08+05:30	1978	20	0.5	0	2023-06-19T12:42:08+05:30	1978	26	0.4	0	2023-06-19T12:42:08+05:30	1978	29	0.7	0	2023-06-19T12:42:08+05:30	1978	33	0.9	0
2023-06-19T12:43:07+05:30	1979	20	0.5	0	2023-06-19T12:43:07+05:30	1979	26	0.4	0	2023-06-19T12:43:07+05:30	1979	29	0.7	0	2023-06-19T12:43:07+05:30	1979	33	0.9	0
2023-06-19T12:44:06+05:30	1980	20	0.5	0	2023-06-19T12:44:06+05:30	1980	26	0.5	0	2023-06-19T12:44:06+05:30	1980	29	0.7	0	2023-06-19T12:44:06+05:30	1980	33	1	0
2023-06-19T12:45:05+05:30	1981	20	0.5	0	2023-06-19T12:45:05+05:30	1981	26	0.5	0	2023-06-19T12:45:05+05:30	1981	29	0.7	0	2023-06-19T12:45:05+05:30	1981	33	1	0
2023-06-19T12:46:04+05:30	1982	20	0.5	0	2023-06-19T12:46:04+05:30	1982	26	0.5	0	2023-06-19T12:46:04+05:30	1982	29	0.7	0	2023-06-19T12:46:04+05:30	1982	33	1	0
2023-06-19T14:08:22+05:30	2024	22	0.7	0	2023-06-19T14:08:22+05:30	2024	27	0.5	0	2023-06-19T14:08:22+05:30	2024	30	0.9	0	2023-06-19T14:08:22+05:30	2024	33	1.4	0
2023-06-19T14:18:02+05:30	2028	22	0.7	0	2023-06-19T14:18:02+05:30	2028	27	0.5	0	2023-06-19T14:18:02+05:30	2028	31	0.9	0	2023-06-19T14:18:02+05:30	2028	33	1.4	0
2023-06-19T14:20:38+05:30	2029	22	0.7	0	2023-06-19T14:20:38+05:30	2029	27	0.5	0	2023-06-19T14:20:38+05:30	2029	31	0.9	0	2023-06-19T14:20:38+05:30	2029	33	1.4	0
2023-06-19T14:23:14+05:30	2030	22	0.7	0	2023-06-19T14:23:14+05:30	2030	27	0.5	0	2023-06-19T14:23:14+05:30	2030	31	0.9	0	2023-06-19T14:23:14+05:30	2030	33	1.4	0
2023-06-19T14:25:50+05:30	2031	22	0.7	0	2023-06-19T14:25:50+05:30	2031	26	0.5	0	2023-06-19T14:25:50+05:30	2031	31	1	0	2023-06-19T14:25:50+05:30	2031	33	1.4	0
2023-06-19T14:28:26+05:30	2032	22	0.7	0	2023-06-19T14:28:26+05:30	2032	26	0.5	0	2023-06-19T14:28:26+05:30	2032	31	1	0	2023-06-19T14:28:26+05:30	2032	33	1.4	0
2023-06-19T14:31:02+05:30	2033	22	0.7	0	2023-06-19T14:31:02+05:30	2033	26	0.5	0	2023-06-19T14:31:02+05:30	2033	31	1	0	2023-06-19T14:31:02+05:30	2033	33	1.4	0
2023-06-19T14:33:38+05:30	2034	22	0.7	0	2023-06-19T14:33:38+05:30	2034	26	0.5	0	2023-06-19T14:33:38+05:30	2034	31	1	0	2023-06-19T14:33:38+05:30	2034	33	1.4	0
2023-06-19T15:58:42+05:30	2079	20	0.8	0	2023-06-19T15:58:42+05:30	2079	26	0.8	0	2023-06-19T15:58:42+05:30	2079	30	1.1	0	2023-06-19T15:58:42+05:30	2079	37	1.5	0
2023-06-19T16:00:49+05:30	2080	20	0.8	0	2023-06-19T16:00:49+05:30	2080	26	0.8	0	2023-06-19T16:00:49+05:30	2080	30	1.1	0	2023-06-19T16:00:49+05:30	2080	38	1.5	0
2023-06-19T16:02:56+05:30	2081	20	0.8	0	2023-06-19T16:02:56+05:30	2081	26	0.8	0	2023-06-19T16:02:56+05:30	2081	30	1.1	0	2023-06-19T16:02:56+05:30	2081	38	1.5	0
2023-06-19T16:05:03+05:30	2082	20	0.8	0	2023-06-19T16:05:03+05:30	2082	26	0.8	0	2023-06-19T16:05:03+05:30	2082	30	1.1	0	2023-06-19T16:05:03+05:30	2082	38	1.5	0
2023-06-19T16:07:22+05:30	2083	20	0.8	0	2023-06-19T16:07:22+05:30	2083	26	0.8	0	2023-06-19T16:07:22+05:30	2083	28	1.1	0	2023-06-19T16:07:22+05:30	2083	38	1.5	0
2023-06-19T16:09:41+05:30	2084	20	0.8	0	2023-06-19T16:09:41+05:30	2084	26	0.8	0	2023-06-19T16:09:41+05:30	2084	28	1.1	0	2023-06-19T16:09:41+05:30	2084	38	1.5	0
2023-06-19T16:12:00+05:30	2085	20	0.8	0	2023-06-19T16:12:00+05:30	2085	26	0.8	0	2023-06-19T16:12:00+05:30	2085	28	1.1	0	2023-06-19T16:12:00+05:30	2085	38	1.5	0
2023-06-19T16:14:19+05:30	2086	20	0.8	0	2023-06-19T16:14:19+05:30	2086	26	0.8	0	2023-06-19T16:14:19+05:30	2086	28	1.1	0	2023-06-19T16:14:19+05:30	2086	38	1.5	0
2023-06-19T16:16:38+05:30	2087	21	0.8	0	2023-06-19T16:16:38+05:30	2087	26	0.8	0	2023-06-19T16:16:38+05:30	2087	28	1.1	0	2023-06-19T16:16:38+05:30	2087	38	1.5	0
2023-06-20T11:16:26+05:30	2134	35	0.3	0	2023-06-20T11:16:26+05:30	2134	38	0.3	0	2023-06-20T11:16:26+05:30	2134	42	0.6	0	2023-06-20T11:16:26+05:30	2134	42	0.2	0
2023-06-20T11:18:38+05:30	2135	35	0.3	0	2023-06-20T11:18:38+05:30	2135	38	0.3	0	2023-06-20T11:18:38+05:30	2135	42	0.6	0	2023-06-20T11:18:38+05:30	2135	42	0.2	0
2023-06-20T11:20:50+05:30	2136	35	0.3	0	2023-06-20T11:20:50+05:30	2136	38	0.3	0	2023-06-20T11:20:50+05:30	2136	42	0.6	0	2023-06-20T11:20:50+05:30	2136	42	0.2	0
2023-06-20T11:22:19+05:30	2137	35	0.3	0	2023-06-20T11:22:19+05:30	2137	38	0.3	0	2023-06-20T11:22:19+05:30	2137	42	0.6	0	2023-06-20T11:22:19+05:30	2137	42	0.2	0
2023-06-20T11:23:48+05:30	2138	35	0.3	0	2023-06-20T11:23:48+05:30	2138	38	0.3	0	2023-06-20T11:23:48+05:30	2138	42	0.6	0	2023-06-20T11:23:48+05:30	2138	42	0.3	0
2023-06-20T11:25:17+05:30	2139	28	0.3	0	2023-06-20T11:25:17+05:30	2139	38	0.3	0	2023-06-20T11:25:17+05:30	2139	42	0.7	0	2023-06-20T11:25:17+05:30	2139	42	0.3	0
2023-06-20T11:26:46+05:30	2140	28	0.5	0	2023-06-20T11:26:46+05:30	2140	38	0.3	0	2023-06-20T11:26:46+05:30	2140	41	0.7	0	2023-06-20T11:26:46+05:30	2140	42	0.3	0
2023-06-20T11:28:15+05:30	2141	28	0.5	0	2023-06-20T11:28:15+05:30	2141	38	0.4	0	2023-06-20T11:28:15+05:30	2141	41	0.7	0	2023-06-20T11:28:15+05:30	2141	42	0.3	0
2023-06-20T11:29:44+05:30	2142	28	0.5	0	2023-06-20T11:29:44+05:30	2142	38	0.4	0	2023-06-20T11:29:44+05:30	2142	41	0.7	0	2023-06-20T11:29:44+05:30	2142	42	0.3	0
2023-06-20T12:42:08+05:30	2179	25	0.9	0	2023-06-20T12:42:08+05:30	2179	33	0.5	0	2023-06-20T12:42:08+05:30	2179	36	1.1	0	2023-06-20T12:42:08+05:30	2179	43	0.5	0
2023-06-20T12:43:07+05:30	2180	25	0.9	0	2023-06-20T12:43:07+05:30	2180	33	0.5	0	2023-06-20T12:43:07+05:30	2180	36	1.1	0	2023-06-20T12:43:07+05:30	2180	43	0.5	0
2023-06-20T12:44:06+05:30	2181	25	0.9	0	2023-06-20T12:44:06+05:30	2181	33	0.5	0	2023-06-20T12:44:06+05:30	2181	36	1.1	0	2023-06-20T12:44:06+05:30	2181	43	0.5	0
2023-06-20T12:45:05+05:30	2182	25	0.9	0	2023-06-20T12:45:05+05:30	2182	33	0.5	0	2023-06-20T12:45:05+05:30	2182	36	1.2	0	2023-06-20T12:45:05+05:30	2182	43	0.5	0
2023-06-20T12:46:04+05:30	2183	25	0.9	0	2023-06-20T12:46:04+05:30	2183	33	0.5	0	2023-06-20T12:46:04+05:30	2183	36	1.2	0	2023-06-20T12:46:04+05:30	2183	43	0.5	0
2023-06-20T12:47:03+05:30	2184	25	0.9	0	2023-06-20T12:47:03+05:30	2184	33	0.5	0	2023-06-20T12:47:03+05:30	2184	36	1.2	0	2023-06-20T12:47:03+05:30	2184	43	0.5	0
2023-06-20T12:48:02+05:30	2185	25	0.9	0	2023-06-20T12:48:02+05:30	2185	33	0.5	0	2023-06-20T12:48:02+05:30	2185	36	1.2	0	2023-06-20T12:48:02+05:30	2185	43	0.5	0
2023-06-20T12:49:01+05:30	2186	25	0.9	0	2023-06-20T12:49:01+05:30	2186	33	0.7	0	2023-06-20T12:49:01+05:30	2186	34	1.2	0	2023-06-20T12:49:01+05:30	2186	43	0.5	0
2023-06-20T13:53:52+05:30	2219	45	1	0	2023-06-20T13:53:52+05:30	2219	35	1.1	0	2023-06-20T13:53:52+05:30	2219	42	1.5	0	2023-06-20T13:53:52+05:30	2219	44	0.8	0
2023-06-20T13:56:17+05:30	2220	45	1	0	2023-06-20T13:56:17+05:30	2220	35	1.1	0	2023-06-20T13:56:17+05:30	2220	42	1.5	0	2023-06-20T13:56:17+05:30	2220	44	0.8	0
2023-06-20T13:58:42+05:30	2221	45	1	0	2023-06-20T13:58:42+05:30	2221	35	1.1	0	2023-06-20T13:58:42+05:30	2221	42	1.5	0	2023-06-20T13:58:42+05:30	2221	44	0.8	0
2023-06-20T14:01:07+05:30	2222	45	1	0	2023-06-20T14:01:07+05:30	2222	35	1.1	0	2023-06-20T14:01:07+05:30	2222	42	1.5	0	2023-06-20T14:01:07+05:30	2222	44	0.8	0
2023-06-20T14:03:32+05:30	2223	45	1	0	2023-06-20T14:03:32+05:30	2223	35	1.2	0	2023-06-20T14:03:32+05:30	2223	42	1.5	0	2023-06-20T14:03:32+05:30	2223	45	1.1	0
2023-06-20T14:05:57+05:30	2224	48	1	0	2023-06-20T14:05:57+05:30	2224	35	1.2	0	2023-06-20T14:05:57+05:30	2224	42	1.5	0	2023-06-20T14:05:57+05:30	2224	45	1.1	0
2023-06-20T14:08:22+05:30	2225	48	1	0	2023-06-20T14:08:22+05:30	2225	35	1.2	0	2023-06-20T14:08:22+05:30	2225	42	1.5	0	2023-06-20T14:08:22+05:30	2225	45	1.1	0
2023-06-20T14:10:47+05:30	2226	48	1.1	0	2023-06-20T14:10:47+05:30	2226	35	1.2	0	2023-06-20T14:10:47+05:30	2226	42	1.5	0	2023-06-20T14:10:47+05:30	2226	45	1.1	0
2023-06-20T14:13:12+05:30	2227	48	1.1	0	2023-06-20T14:13:12+05:30	2227	34	1.2	0	2023-06-20T14:13:12+05:30	2227	46	1.5	0	2023-06-20T14:13:12+05:30	2227	45	1.1	0
2023-06-20T14:15:37+05:30	2228	48	1.1	0	2023-06-20T14:15:37+05:30	2228	34	1.2	0	2023-06-20T14:15:37+05:30	2228	46	1.6	0	2023-06-20T14:15:37+05:30	2228	45	1.3	0
2023-06-20T14:18:02+05:30	2229	48	1.1	0	2023-06-20T14:18:02+05:30	2229	34	1.2	0	2023-06-20T14:18:02+05:30	2229	46	1.6	0	2023-06-20T14:18:02+05:30	2229	45	1.3	0
2023-06-20T14:20:38+05:30	2230	52	1.1	0	2023-06-20T14:20:38+05:30	2230	34	1.2	0	2023-06-20T14:20:38+05:30	2230	46	1.6	0	2023-06-20T14:20:38+05:30	2230	45	1.3	0
2023-06-20T14:23:14+05:30	2231	52	1.1	0	2023-06-20T14:23:14+05:30	2231	34	1.2	0	2023-06-20T14:23:14+05:30	2231	46	1.6	0	2023-06-20T14:23:14+05:30	2231	47	1.3	0
2023-06-20T15:01:23+05:30	2245	47	1.3	0	2023-06-20T15:01:23+05:30	2245	34	1.4	0	2023-06-20T15:01:23+05:30	2245	40	1.6	0	2023-06-20T15:01:23+05:30	2245	47	1.5	0
2023-06-20T15:04:14+05:30	2246	47	1.3	0	2023-06-20T15:04:14+05:30	2246	34	1.4	0	2023-06-20T15:04:14+05:30	2246	40	1.6	0	2023-06-20T15:04:14+05:30	2246

SRP OC 2 Sensor data of nodes 1 to 4

Node 1					Node 2					Node 3					Node 4				
created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3
2023-06-21T11:50:33+05:30	42	27	0.1	0	2023-06-21T11:50:33+05:30	42	43	0.4	0	2023-06-21T11:50:33+05:30	42	25	0.2	0	2023-06-21T11:50:33+05:30	42	36	0.4	0
2023-06-21T11:52:08+05:30	43	27	0.1	0	2023-06-21T11:52:08+05:30	43	43	0.4	0	2023-06-21T11:52:08+05:30	43	25	0.2	0	2023-06-21T11:52:08+05:30	43	36	0.4	0
2023-06-21T11:53:43+05:30	44	27	0.1	0	2023-06-21T11:53:43+05:30	44	43	0.4	0	2023-06-21T11:53:43+05:30	44	25	0.2	0	2023-06-21T11:53:43+05:30	44	36	0.4	0
2023-06-21T11:55:18+05:30	45	27	0.1	0	2023-06-21T11:55:18+05:30	45	43	0.4	0	2023-06-21T11:55:18+05:30	45	25	0.2	0	2023-06-21T11:55:18+05:30	45	36	0.4	0
2023-06-21T11:56:53+05:30	46	27	0.1	0	2023-06-21T11:56:53+05:30	46	43	0.4	0	2023-06-21T11:56:53+05:30	46	25	0.2	0	2023-06-21T11:56:53+05:30	46	36	0.4	0
2023-06-21T11:58:28+05:30	47	27	0.2	0	2023-06-21T11:58:28+05:30	47	43	0.4	0	2023-06-21T11:58:28+05:30	47	25	0.2	0	2023-06-21T11:58:28+05:30	47	36	0.4	0
2023-06-21T12:00:03+05:30	48	27	0.2	0	2023-06-21T12:00:03+05:30	48	43	0.4	0	2023-06-21T12:00:03+05:30	48	25	0.2	0	2023-06-21T12:00:03+05:30	48	38	0.4	0
2023-06-21T12:01:38+05:30	49	27	0.2	0	2023-06-21T12:01:38+05:30	49	42	0.4	0	2023-06-21T12:01:38+05:30	49	25	0.2	0	2023-06-21T12:01:38+05:30	49	38	0.4	0
2023-06-21T13:25:58+05:30	89	27	0.4	0	2023-06-21T13:25:58+05:30	89	42	0.8	0	2023-06-21T13:25:58+05:30	89	27	0.4	0	2023-06-21T13:25:58+05:30	89	44	0.8	0
2023-06-21T13:28:13+05:30	90	27	0.4	0	2023-06-21T13:28:13+05:30	90	42	0.8	0	2023-06-21T13:28:13+05:30	90	27	0.4	0	2023-06-21T13:28:13+05:30	90	44	0.8	0
2023-06-21T13:30:28+05:30	91	27	0.4	0	2023-06-21T13:30:28+05:30	91	42	0.8	0	2023-06-21T13:30:28+05:30	91	27	0.4	0	2023-06-21T13:30:28+05:30	91	44	0.8	0
2023-06-21T13:32:43+05:30	92	27	0.4	0	2023-06-21T13:32:43+05:30	92	42	0.8	0	2023-06-21T13:32:43+05:30	92	27	0.5	0	2023-06-21T13:32:43+05:30	92	44	0.8	0
2023-06-21T13:34:58+05:30	93	26	0.4	0	2023-06-21T13:34:58+05:30	93	42	0.8	0	2023-06-21T13:34:58+05:30	93	27	0.5	0	2023-06-21T13:34:58+05:30	93	44	0.8	0
2023-06-21T13:37:13+05:30	94	26	0.4	0	2023-06-21T13:37:13+05:30	94	42	0.8	0	2023-06-21T13:37:13+05:30	94	27	0.5	0	2023-06-21T13:37:13+05:30	94	44	0.8	0
2023-06-21T13:39:28+05:30	95	26	0.4	0	2023-06-21T13:39:28+05:30	95	42	0.8	0	2023-06-21T13:39:28+05:30	95	27	0.5	0	2023-06-21T13:39:28+05:30	95	44	0.8	0
2023-06-21T13:41:43+05:30	96	26	0.4	0	2023-06-21T13:41:43+05:30	96	42	0.8	0	2023-06-21T13:41:43+05:30	96	27	0.5	0	2023-06-21T13:41:43+05:30	96	45	0.8	0
2023-06-21T13:43:58+05:30	97	26	0.4	0	2023-06-21T13:43:58+05:30	97	42	0.8	0	2023-06-21T13:43:58+05:30	97	27	0.5	0	2023-06-21T13:43:58+05:30	97	45	0.8	0
2023-06-21T13:46:13+05:30	98	26	0.5	0	2023-06-21T13:46:13+05:30	98	39	0.8	0	2023-06-21T13:46:13+05:30	98	27	0.5	0	2023-06-21T13:46:13+05:30	98	45	0.8	0
2023-06-21T13:48:28+05:30	99	26	0.5	0	2023-06-21T13:48:28+05:30	99	39	0.8	0	2023-06-21T13:48:28+05:30	99	27	0.5	0	2023-06-21T13:48:28+05:30	99	45	0.8	0
2023-06-21T15:36:28+05:30	147	26	0.5	15	2023-06-21T15:36:28+05:30	147	35	1.3	10	2023-06-21T15:36:28+05:30	147	29	0.5	18	2023-06-21T15:36:28+05:30	147	40	1.3	12
2023-06-21T15:38:43+05:30	148	26	0.5	0	2023-06-21T15:38:43+05:30	148	35	1.3	0	2023-06-21T15:38:43+05:30	148	28	0.5	0	2023-06-21T15:38:43+05:30	148	40	1.3	0
2023-06-21T15:40:58+05:30	149	26	0.5	0	2023-06-21T15:40:58+05:30	149	35	1.3	0	2023-06-21T15:40:58+05:30	149	28	0.5	0	2023-06-21T15:40:58+05:30	149	40	1.3	0
2023-06-21T15:43:13+05:30	150	26	0.5	0	2023-06-21T15:43:13+05:30	150	35	1.3	0	2023-06-21T15:43:13+05:30	150	28	0.5	0	2023-06-21T15:43:13+05:30	150	40	1.3	0
2023-06-21T15:45:28+05:30	151	26	0.5	0	2023-06-21T15:45:28+05:30	151	35	1.3	0	2023-06-21T15:45:28+05:30	151	28	0.5	0	2023-06-21T15:45:28+05:30	151	40	1.3	0
2023-06-21T15:47:43+05:30	152	26	0.5	0	2023-06-21T15:47:43+05:30	152	34	1.4	0	2023-06-21T15:47:43+05:30	152	28	0.5	0	2023-06-21T15:47:43+05:30	152	40	1.4	0
2023-06-21T15:49:58+05:30	153	26	0.5	0	2023-06-21T15:49:58+05:30	153	34	1.4	0	2023-06-21T15:49:58+05:30	153	28	0.5	0	2023-06-21T15:49:58+05:30	153	40	1.4	0
2023-06-21T15:52:13+05:30	154	26	0.5	0	2023-06-21T15:52:13+05:30	154	34	1.4	0	2023-06-21T15:52:13+05:30	154	28	0.5	0	2023-06-21T15:52:13+05:30	154	40	1.4	0
2023-06-21T15:54:28+05:30	155	26	0.5	0	2023-06-21T15:54:28+05:30	155	34	1.4	0	2023-06-21T15:54:28+05:30	155	28	0.5	0	2023-06-21T15:54:28+05:30	155	39	1.4	0
2023-06-21T15:56:43+05:30	156	26	0.5	0	2023-06-21T15:56:43+05:30	156	34	1.4	0	2023-06-21T15:56:43+05:30	156	28	0.5	0	2023-06-21T15:56:43+05:30	156	39	1.4	0
2023-06-21T15:58:58+05:30	157	26	0.5	0	2023-06-21T15:58:58+05:30	157	34	1.4	0	2023-06-21T15:58:58+05:30	157	28	0.5	0	2023-06-21T15:58:58+05:30	157	39	1.4	0
2023-06-21T16:01:13+05:30	158	27	0.5	0	2023-06-21T16:01:13+05:30	158	34	1.5	0	2023-06-21T16:01:13+05:30	158	28	0.5	0	2023-06-21T16:01:13+05:30	158	39	1.5	0
2023-06-21T16:12:28+05:30	163	27	0.6	0	2023-06-21T16:12:28+05:30	163	34	1.6	0	2023-06-21T16:12:28+05:30	163	27	0.6	0	2023-06-21T16:12:28+05:30	163	38	1.6	0
2023-06-21T17:31:13+05:30	198	29	0.6	0	2023-06-21T17:31:13+05:30	198	39	1.8	0	2023-06-21T17:31:13+05:30	198	30	0.6	0	2023-06-21T17:31:13+05:30	198	40	1.7	0
2023-06-21T17:33:28+05:30	199	29	0.6	0	2023-06-21T17:33:28+05:30	199	39	1.8	0	2023-06-21T17:33:28+05:30	199	30	0.6	0	2023-06-21T17:33:28+05:30	199	40	1.7	0
2023-06-21T17:35:43+05:30	200	29	0.6	0	2023-06-21T17:35:43+05:30	200	39	1.8	0	2023-06-21T17:35:43+05:30	200	30	0.6	0	2023-06-21T17:35:43+05:30	200	40	1.7	0
2023-06-21T17:37:58+05:30	201	29	0.6	0	2023-06-21T17:37:58+05:30	201	39	1.8	0	2023-06-21T17:37:58+05:30	201	30	0.6	0	2023-06-21T17:37:58+05:30	201	40	1.7	0
2023-06-21T17:40:13+05:30	202	29	0.7	0	2023-06-21T17:40:13+05:30	202	39	1.8	0	2023-06-21T17:40:13+05:30	202	30	0.6	0	2023-06-21T17:40:13+05:30	202	40	1.7	0
2023-06-21T17:42:28+05:30	203	29	0.7	0	2023-06-21T17:42:28+05:30	203	39	1.8	0	2023-06-21T17:42:28+05:30	203	30	0.6	0	2023-06-21T17:42:28+05:30	203	40	1.7	0
2023-06-21T17:44:43+05:30	204	29	0.7	0	2023-06-21T17:44:43+05:30	204	39	1.8	0	2023-06-21T17:44:43+05:30	204	30	0.6	0	2023-06-21T17:44:43+05:30	204	40	1.7	0
2023-06-22T10:37:41+05:30	233	32	0	0	2023-06-22T10:37:41+05:30	233	45	0.1	0	2023-06-22T10:37:41+05:30	233	35	0	0	2023-06-22T10:37:41+05:30	233	42	0	0
2023-06-22T10:38:26+05:30	234	32	0	0	2023-06-22T10:38:26+05:30	234	45	0.1	0	2023-06-22T10:38:26+05:30	234	35	0	0	2023-06-22T10:38:26+05:30	234	42	0	0
2023-06-22T10:39:11+05:30	235	32	0	0	2023-06-22T10:39:11+05:30	235	45	0.1	0	2023-06-22T10:39:11+05:30	235	35	0	0	2023-06-22T10:39:11+05:30	235	42	0	0
2023-06-22T10:39:56+05:30	236	32	0	0	2023-06-22T10:39:56+05:30	236	45	0.1	0	2023-06-22T10:39:56+05:30	236	35	0	0	2023-06-22T10:39:56+05:30	236	42	0	0
2023-06-22T10:42:14+05:30	237	32	0	0	2023-06-22T10:42:14+05:30	237	45	0.1	0	2023-06-22T10:42:14+05:30	237	35	0	0	2023-06-22T10:42:14+05:30	237	42	0	0
2023-06-22T10:44:32+05:30	238	32	0	0	2023-06-22T10:44:32+05:30	238	45	0.1	0	2023-06-22T10:44:32+05:30	238	35	0	0	2023-06-22T10:44:32+05:30	238	42	0	0
2023-06-22T10:57:36+05:30	244	32	0.1	0	2023-06-22T10:57:36+05:30	244	44	0.2	0	2023-06-22T10:57:36+05:30	244	35	0	0	2023-06-22T10:57:36+05:30	244	41	0.1	0
2023-06-22T10:59:10+05:30	245	32	0.1	0	2023-06-22T10:59:10+05:30	245	44	0.2	0	2023-06-22T10:59:10+05:30	245	35	0	0	2023-06-22T10:59:10+05:30	245	41	0.1	0
2023-06-22T11:00:44+05:30	246	32	0.1	0	2023-06-22T11:00:44+05:30	246	44	0.2	0	2023-06-22T11:00:44+05:30	246	34	0	0	2023-06-22T11:00:44+05:30	246	41	0.2	0
2023-06-22T11:02:18+05:30	247	32	0.1	0	2023-06-22T11:02:18+05:30	247	44	0.2	0	2023-06-22T11:02:18+05:30	247	34	0	0	2023-06-22T11:02:18+05:30	247	41	0.2	0
2023-06-22T11:03:52+05:30	248	32	0.1	0	2023-06-22T11:03:52+05:30	248	44	0.2	0	2023-06-22T11:03:52+05:30	248	34	0	0	2023-06-22T11:03:52+05:30	248	41	0.2	0
2023-06-22T11:05:26+05:30	249	33	0.1	0	2023-06-22T11:05:26+05:30	249	44	0.2	0	2023-06-22T11:05:26+05:30	249	34	0	0	2023-06-22T11:05:26+05:30	249	41	0.2	0
2023-06-22T11:07:38+05:30	250	33	0.1	0	2023-06-22T11:07:38+05:30	250	44	0.2	0	2023-06-22T11:07:38+05:30	250	34	0	0	2023-06-22T11:07:38+05:30	250	41	0.2	0
2023-06-22T11:32:42+05:30	264	33	0.2	0	2023-06-22T11:32:42+05:30	264	43	0.2	0	2023-06-22T11:32:42+05:30	264	32	0.1	0	2023-06-22T11:32:42+05:30	264	40	0.4	0
2023-06-22T11:34:11+05:30	265	33	0.2	0	2023-06-22T11:34:11+05:30	265	43	0.2	0	2023-06-22T11:34:11+05:30	265	32	0.1	0	2023-06-22T11:34:11+05:30	265	40	0.4	0
2023-06-22T11:35:40+05:30	266	33	0.2	0	2023-06-22T11:35:40+05:30	266	43	0.2	0	2023-06-22T11:35:40+05:30	266	32	0.1	0	2023-06-22T11:35:40+05:30	266	40	0.4	0
2023-06-22T11:37:09+05:30	267	33	0.2	0	2023-06-22T11:37:09+05:30	267	43	0.3	0	2023-06-22T11:37:09+05:30	267	32	0.1	0	2023-06-22T11:37:09+05:30	267	40	0.4	0
2023-06-22T11:39:42+05:30	268	33	0.2	0	2023-06-22T11:39:42+05:30	268	43	0.3	0	2023-06-22T11:39:42+05:30	268	32	0.1	0	2023-06-22T11:39:42+05:30	268	40	0.5	0
2023-06-22T11:42:15+05:30	269	33	0.2	0	2023-06-22T11:42:15+05:30	269	43	0.3	0	2023-06-22T11:42:15+05:30	269	32	0.1	0	2023-06-22T11:42:15+05:30	269	40	0.5	0
2023-06-22T11:44:48+05:30	270	33	0.2	0	2023-06-22T11:44:48+05:30	270	43	0.3	0	2023-06-22T11:44:48+05:30	270	32	0.1	0	2023-06-22T11:44:48+05:30	270	40	0.5	0
2023-06-22T11:47:21+05:30	271	33	0.2	0	2023-06-22T11:47:21+05:30	271	43	0.3	0	2023-06-22T11:47:21+05:30	271	32	0.1	0	2023-06-22T11:47:21+05:30	271	39	0.5	0
2023-06-22T11:49:54+05:30	272	34	0.2	0	2023-06-22T11:49:54+05:30	272	43	0.3	0	2023-06-22T11:49:54+05:30	272	32	0.1	0	2023-06-22T11:49:54+05:30	272	39	0.5	0
2023-06-22T11:52:27+05:30	273	34	0.2	0	2023-06-22T11:52:27+05:30	273	43	0.3	0	2023-06-22T11:52:27+05:30	273	32	0.1	0	2023-06-22T11:52:27+05:30	273	39	0.5	0
2023-06-22T11:55:00+05:30	274	34	0.2	0	2023-06-22T11:55:00+05:30	274	43	0.3	0	2023-06-22T11:55:00+05:30	274	31	0.2	0	2023-06-22T11:55:00+05:30	274	39	0.5	0
2023-06-22T11:57:33+05:30	275	34	0.2	0	2023-06-22T11:57:33+05:30	275	43	0.3	0	2023-06-22T11:57:33+05:30	275	31	0.2	0	2023-06-22T11:57:33+05:30	275	39	0.6	0
2023-06-22T12:00:06+05:30	276	34	0.2	0	2023-06-22T12:00:06+05:30	276	43	0.3	0	2023-06-22T12:00:06+05:30	276	31	0.3	0	2023-06-22T12:00:06+05:30	276	39	0.6	0
2023-06-22T13:10:01+05:30	315	32	0.4	0	2023-06-22T13:10:01+05:30	315	43	0.8	0	2023-06-22T13:10:01+05:30	315	33	0.5	0	2023-06-22T13:10:01+05:30	315	37	1	0
2023-06-22T13:11:09+05:30	316	32	0.4	0	2023-06-22T13:11:09+05:30	316	43	0.9	0	2023-06-22T13:11:09+05:30	316	33	0.5	0	2023-06-22T13:11:09+05:30	316	37	1	0
2023-06-22T13:12:17+05:30	317	32	0.4	0	2023-06-22T13:12:17+05:30	317	43	0.9	0	2023-06-22T13:12:17+05:30	317	33	0.5	0	2023-06-22T13:12:17+05:30	317	37	1	0
2023-06-22T13:13:25+05:30	318	32	0.4	0	2023-06-22T13:13:25+05:30	318	43	0.9	0	2023-06-22T13:13:25+05:30	318	33	0.5	0	2023-06-22T13:13:25+05:30	318	37	1	0
2023-06-22T13:14:33+05:30	319	32	0.5	0	2023-06-22T13:14:33+05:30	319	43	0.9	0	2023-06-22T13:14:33+05:30	319	33	0.5	0	2023-06-22T13:14:33+05:30	319	37	1.1	0
2023-06-22T13:15:41+05:30	320	32	0.5	0	2023-06-22T13:15:41+05:30	320	43	0.9	0	2023-06-22T13:15:41+05:30	320	33	0.5	0	2023-06-22T13:15:41+05:30	320	37	1.1	0
2023-06-22T13:16:49+05:30	321	32	0.5	0	2023-06-22T13:16:49+05:30	321	43	0.9	0	2023-06-22T13:16:49+05:30	321	33	0.5	0	2023-06-22T13:16:49+05:30	321	37	1.1	0
2023-06-22T13:17:57+05:30	322	32	0.5	0	2023-06-22T13:17:57+05:30	322	43	1	0	2023-06-22T13:17:57+05:30	322	31	0.5	0	2023-06-22T13:17:57+05:30	322	37	1.1	0
2023-06-22T13:19:05+05:30	323	32	0.5	0	2023-06-22T13:19:05+05:30	323	43	1	0	2023-06-22T13:19:05+05:30	323	31	0.5	0	2023-06-22T13:19:05+05:30	323	37	1.1	0
2023-06-22T14:28:26+05:30	353	32	0.7	0	2023-06-22T14:28:26+05:30	353	40	1.4	0	2023-06-22T14:28:26+05:30	353	30	0.7	0	2023-06-22T14:28:26+05:30	353	34	1.5	0
2023-06-22T14:31:02+05:30	354	32	0.7	0	2023-06-22T14:31:02+05:30	354	40	1.4	0	2023-06-22T14:31:02+05:30	354	30	0.7	0	2023-06-22T14:31:02+05:30	354	34	1.5	0
2023-06-22T14:33:38+05:30	355	32	0.7	0	2023-06-22T14:33:38+05:30	355	40	1.4	0	2023-06-22T14:33:38+05:30	355	30	0.7	0	2023-06-22T14:33:38+05:30	355	34	1.6	0
2023-06-22T14:36:14+05:30	356	32	0.7	0	2023-06-22T14:36:14+05:30	356	40	1.4	0	2023-06-22T14:36:14+05:30	356	30	0.7	0	2023-06-22T14:36:14+05:30	356	34	1.6	0
2023-06-22T14:38:50+05:30	357	32	0.7	0	2023-06-22T14:38:50+05:30	357	40	1.4	0	2023-06-22T14:38:50+05:30	357	30	0.7	0	2023-06-22T14:38:50+05:30	357	34	1.6	0
2023-06-22T14:41:26+05:30	358	30	0.7	0	2023-06-22T14:41:26+05:30	358	40	1.5	0	2023-06-22T14:41:26+05:30	358	30	0.7	0	2023-06-22T14:41:26+05:30	358	34	1.6	0
2023-06-22T15:28:44+05:30	386	30	0.9	0	2023-06-22T15:28:44+05:30	386	38	1.9	0	2023-06-22T15:28:44+05:30	386	31	0.9	0	2023-06-22T15:28:44+05:30	386	32	2	0
2023-06-22T15:30:55+05:30	387	30	0.9	0	2023-06-22T15:30:55+05:30	387	38	2	0	2023-06-22T15:30:55+05:30	387	31	0.9	0	2023-06-22T15:30:55+05:30	387	32	2	0
2023-06-22T15:33:06+05:30	388	30	0.9	0	2023-06-22T15:33:06+05:30	388	38	2	0	2023-06-22T15:33:06+05:30	388	31	0.9	0	2023-06-22T15:33:06+05:30	388	32	2.1	0
2023-06-22T15:35:17+05:30	389	30	1	0	2023-06-22T15:35:17+05:30	389	38	2	0	2023-06-22T15:35:17+05:30	389	31	0.9	0	2023-06-22T15:35:17+05:30	389	32	2.1	0
2023-06-22T15:37:28+05:30	390	30	1	0	2023-06-22T15:37:28+05:30	390	38	2	0	2023-06-22T15:37:28+05:30	390	31	0.9	0	2023-06-22T15:37:28+05:30	390	32	2.1	0
2023-06-22T15:39:39+05:30	391	30	1	0	2023-06-22T15:39:39+05:30	391	38	2	0	2023-06-22T15:39:39+05:30	391	31	0.9	0	2023-06-22T15:39:39+05:30	391	32	2.1	0
2023-06-22T15:41:46+05:30	392	30	1.2	0	2023-06-22T15:41:46+05:30	392	38	2	0	2023-06-22T15:41:46+05:30	392	31	0.9	0	2023-06-22T15:41:46+05:30	392	32	2.1	0
2023-06-22T15:43:53+05:30	393	30	1.2	0	2023-06-22T15:43:53+05:30	393	38	2.1	0	2023-06-22T15:43:53+05:30	393	31	0.9	0	2023-06-22T15:43:53+05:30	393	32	2.2	0
2023-06-22T15:46:00+05:30	394	31	1.2	0	2023-06-22T15:46:00+05:30	394	38	2.1	0	2023-06-22T15:46:00+05:30	394	31	0.9	0	2023-06-22T15:46:00+05:30	394	31	2.2	0
2023-06-23T09:47:00+05:30	421	27	0	0	2023-06-23T09:47:00+05:30	421	42	0.2	0	2023-06-23T09:47:00+05:30	421	30	0	0	2023-06-23T09:47:00+05:30	421	36	0.2	0
2023-06-23T09:48:34+05:30	422	27	0	0	2023-06-23T09:48:34+05:30	422	42	0.2	0	2023-06-23T09:48:34+05:30	422	30	0	0	2023-06-23T09:48:34+05:30	422	36	0.2	0
2023-06-23T09:50:08+05:30	423	27	0	0	2023-06-23T09:50:08+05:30	423	42	0.2	0	2023-06-23T09:50:08+05:30	423	30	0	0	2023-06-23T09:50:08+05:30	423	36	0.2	0
2023-06-23T09:51:42+05:30	424	27	0	0	2023-06-23T09:51:42+05:30	424	42	0.2	0	2023-06-23T09:51:42+05:30	424	30	0	0	2023-06-23T09:51:42+05:30	424	36	0.2	0
2023-06-23T09:53:16+05:30	425	27	0	0	2023-06-23T09:53:16+05:30	425	42	0.2	0	2023-06-23T09:53:16+05:30	425	30	0	0	2023-06-23T09:53:16+05:30	425	36	0.3	0
2023-06-23T09:55:28+05:30	426	27	0	0	2023-06-23T09:55:28+05:30	426	42	0.2	0	2023-06-23T09:55:28+05:30	426	30	0	0	2023-06-23T09:55:28+05:30	426	36	0.3	0
2023-06-23T09:57:40+05:30	427	27	0	0	2023-06-23T09:57:40+05:30	427	42	0.2	0	2023-06-23T09:57:40+05:30	427	29	0	0	2023-06-23T09:57:40+05:30	427	36	0.3	0
2023-06-23T09:59:52+05:30	428	28	0	0	2023-06-23T09:59:52+05:30	428	39	0.3	0	2023-06-23T09:59:52+05:30	428	29	0	0	2023-06-23T09:59:52+05:30	428	36	0.3	0
2023-06-23T10:02:04+05:30	429	28	0	0	2023-06-23T10:02:04+05:30	429	39	0.3	0	2023-06-23T10:02:04+05:30	429	29	0	0	2023-06-23T10:02:04+05:30	429	36	0.3	0
2023-06-23T10:04:16+05:30	430	28	0	0	2023-06-23T10:04:16+05:30	430	39	0.3	0	2023-06-23T10:04:16+05:30	430	29	0	0	2023-06-23T10:04:16+05:30	430	36	0.3	0
2023-06-23T10:05:45+05:30	431	28	0.1	0	2023-06-23T10:05:45+05:30	431	39	0.3	0	2023-06-23T10:05:45+05:30	431	29	0.1	0	2023-06-23T10:05:45+05:30	431	36	0.3	0
2023-06-23T13:03:37+05:30	522	26	0.3	0	2023-06-23T13:03:37+05:30	522	32	1	0	2023-06-23T13:03:37+05:30	522	26	0.4	0	2023-06-23T13:03:37+05:30	522	35	1.3	0
2023-06-23T13:06:13+05:30	523	26	0.3	0	2023-06-23T13:06:13+05:30	523	32	1	0	2023-06-23T13:06:13+05:30	523	26	0.4	0	2023-06-23T13:06:13+05:30	523	35	1.3	0
2023-06-23T13:08:49+05:30	524	26	0.3	0	2023-06-23T13:08:49+05:30	524	32	1	0	2023-06-23T13:08:49+05:30	524	26	0.4	0	2023-06-23T13:08:49+05:30	524	35	1.3	0
2023-06-23T13:11:25+05:30	525	26	0.3	0	2023-06-23T13:11:25+05:30	525	32	1	0	2023-06-23T13:11:25+05:30	525	26	0.4	0	2023-06-23T13:11:25+05:30	525	35	1.3	0
2023-06-23T13:14:16+05:30	526	26	0.3	0	2023-06-23T13:14:16+05:30	526	32	1	0	2023-06-23T13:14:16+05:30	526	26	0.4	0	2023-06-23T13:14:16+05:30	526	35	1.4	0
2023-06-23T13:17:07+05:30	527	26	0.3	0	2023-06-23T13:17:07+05:30	527	32	1	0	2023-06-23T13:17:07+05:30	527	26	0.4	0	2023-06-23T13:17:07+05:30	527	35	1.4	0
2023-06-23T13:19:58+05:30	528	26

Node 1					Node 2					Node 3					Node 4				
created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3
2023-06-23T14:53:28+05:30	575	26	0.6	0	2023-06-23T14:53:28+05:30	575	32	1.5	0	2023-06-23T14:53:28+05:30	575	24	0.6	0	2023-06-23T14:53:28+05:30	575	30	1.9	0
2023-06-23T14:55:30+05:30	576	26	0.6	0	2023-06-23T14:55:30+05:30	576	32	1.5	0	2023-06-23T14:55:30+05:30	576	24	0.6	0	2023-06-23T14:55:30+05:30	576	30	1.9	0
2023-06-23T14:57:32+05:30	577	26	0.6	0	2023-06-23T14:57:32+05:30	577	32	1.5	0	2023-06-23T14:57:32+05:30	577	24	0.6	0	2023-06-23T14:57:32+05:30	577	30	1.9	0
2023-06-23T14:59:34+05:30	578	26	0.6	0	2023-06-23T14:59:34+05:30	578	32	1.5	0	2023-06-23T14:59:34+05:30	578	24	0.6	0	2023-06-23T14:59:34+05:30	578	29	1.9	0
2023-06-23T15:01:36+05:30	579	26	0.6	0	2023-06-23T15:01:36+05:30	579	31	1.5	0	2023-06-23T15:01:36+05:30	579	24	0.6	0	2023-06-23T15:01:36+05:30	579	29	2	0
2023-06-23T15:03:38+05:30	580	26	0.6	0	2023-06-23T15:03:38+05:30	580	31	1.5	0	2023-06-23T15:03:38+05:30	580	24	0.7	0	2023-06-23T15:03:38+05:30	580	29	2	0
2023-06-23T15:05:40+05:30	581	26	0.6	0	2023-06-23T15:05:40+05:30	581	31	1.5	0	2023-06-23T15:05:40+05:30	581	24	0.7	0	2023-06-23T15:05:40+05:30	581	29	2	0
2023-06-23T15:52:38+05:30	608	25	0.7	0	2023-06-23T15:52:38+05:30	608	28	1.8	0	2023-06-23T15:52:38+05:30	608	25	0.8	0	2023-06-23T15:52:38+05:30	608	26	2.3	0
2023-06-23T15:53:46+05:30	609	25	0.7	0	2023-06-23T15:53:46+05:30	609	30	1.8	0	2023-06-23T15:53:46+05:30	609	25	0.8	0	2023-06-23T15:53:46+05:30	609	26	2.3	0
2023-06-23T15:54:54+05:30	610	25	0.7	0	2023-06-23T15:54:54+05:30	610	30	1.8	0	2023-06-23T15:54:54+05:30	610	25	0.8	0	2023-06-23T15:54:54+05:30	610	26	2.3	0
2023-06-23T15:56:02+05:30	611	25	0.7	0	2023-06-23T15:56:02+05:30	611	30	1.8	0	2023-06-23T15:56:02+05:30	611	25	0.8	0	2023-06-23T15:56:02+05:30	611	26	2.3	0
2023-06-23T15:57:10+05:30	612	25	0.8	0	2023-06-23T15:57:10+05:30	612	30	1.8	0	2023-06-23T15:57:10+05:30	612	25	0.9	0	2023-06-23T15:57:10+05:30	612	26	2.3	0
2023-06-23T15:58:18+05:30	613	24	0.8	0	2023-06-23T15:58:18+05:30	613	30	2	0	2023-06-23T15:58:18+05:30	613	24	1	0	2023-06-23T15:58:18+05:30	613	26	2.3	0
2023-06-23T15:59:26+05:30	614	24	0.8	0	2023-06-23T15:59:26+05:30	614	30	2	0	2023-06-23T15:59:26+05:30	614	24	1.1	0	2023-06-23T15:59:26+05:30	614	26	2.3	0
2023-06-23T16:00:34+05:30	615	24	0.8	0	2023-06-23T16:00:34+05:30	615	30	2	0	2023-06-23T16:00:34+05:30	615	24	1.1	0	2023-06-23T16:00:34+05:30	615	26	2.3	0
2023-06-23T16:01:42+05:30	616	24	0.8	0	2023-06-23T16:01:42+05:30	616	30	2	0	2023-06-23T16:01:42+05:30	616	24	1.1	0	2023-06-23T16:01:42+05:30	616	26	2.3	0
2023-06-23T16:02:50+05:30	617	24	0.8	0	2023-06-23T16:02:50+05:30	617	30	2	0	2023-06-23T16:02:50+05:30	617	24	1.1	0	2023-06-23T16:02:50+05:30	617	26	2.3	0
2023-06-23T16:03:58+05:30	618	24	0.8	0	2023-06-23T16:03:58+05:30	618	30	2	0	2023-06-23T16:03:58+05:30	618	24	1.1	0	2023-06-23T16:03:58+05:30	618	26	2.3	0
2023-06-24T10:15:03+05:30	619	41	0	0	2023-06-24T10:15:03+05:30	619	53	0	0	2023-06-24T10:15:03+05:30	619	44	0	0	2023-06-24T10:15:03+05:30	619	55	0	0
2023-06-24T10:17:18+05:30	620	41	0	0	2023-06-24T10:17:18+05:30	620	53	0	0	2023-06-24T10:17:18+05:30	620	44	0	0	2023-06-24T10:17:18+05:30	620	56	0	0
2023-06-24T10:19:33+05:30	621	41	0	0	2023-06-24T10:19:33+05:30	621	53	0	0	2023-06-24T10:19:33+05:30	621	44	0	0	2023-06-24T10:19:33+05:30	621	56	0	0
2023-06-24T10:21:48+05:30	622	41	0	0	2023-06-24T10:21:48+05:30	622	53	0	0	2023-06-24T10:21:48+05:30	622	44	0	0	2023-06-24T10:21:48+05:30	622	56	0	0
2023-06-24T10:24:03+05:30	623	41	0	0	2023-06-24T10:24:03+05:30	623	53	0	0	2023-06-24T10:24:03+05:30	623	44	0	0	2023-06-24T10:24:03+05:30	623	56	0	0
2023-06-24T10:25:33+05:30	624	41	0	0	2023-06-24T10:25:33+05:30	624	53	0	0	2023-06-24T10:25:33+05:30	624	44	0	0	2023-06-24T10:25:33+05:30	624	56	0	0
2023-06-24T11:30:43+05:30	650	43	0.2	0	2023-06-24T11:30:43+05:30	650	52	0.6	0	2023-06-24T11:30:43+05:30	650	45	0.3	0	2023-06-24T11:30:43+05:30	650	54	0.4	0
2023-06-24T11:41:18+05:30	655	43	0.3	0	2023-06-24T11:41:18+05:30	655	53	0.7	0	2023-06-24T11:41:18+05:30	655	46	0.3	0	2023-06-24T11:41:18+05:30	655	53	0.5	0
2023-06-24T11:43:33+05:30	656	43	0.3	0	2023-06-24T11:43:33+05:30	656	53	0.7	0	2023-06-24T11:43:33+05:30	656	46	0.3	0	2023-06-24T11:43:33+05:30	656	53	0.5	0
2023-06-24T11:45:48+05:30	657	43	0.4	0	2023-06-24T11:45:48+05:30	657	53	0.8	0	2023-06-24T11:45:48+05:30	657	46	0.3	0	2023-06-24T11:45:48+05:30	657	53	0.5	0
2023-06-24T12:19:38+05:30	675	44	0.6	0	2023-06-24T12:19:38+05:30	675	52	1.2	0	2023-06-24T12:19:38+05:30	675	47	0.6	0	2023-06-24T12:19:38+05:30	675	54	0.7	0
2023-06-24T12:20:33+05:30	676	44	0.6	0	2023-06-24T12:20:33+05:30	676	50	1.2	0	2023-06-24T12:20:33+05:30	676	47	0.6	0	2023-06-24T12:20:33+05:30	676	54	0.7	0
2023-06-24T12:21:28+05:30	677	44	0.6	0	2023-06-24T12:21:28+05:30	677	50	1.3	0	2023-06-24T12:21:28+05:30	677	48	0.6	0	2023-06-24T12:21:28+05:30	677	54	0.9	0
2023-06-24T12:22:23+05:30	678	44	0.6	0	2023-06-24T12:22:23+05:30	678	50	1.3	0	2023-06-24T12:22:23+05:30	678	48	0.7	0	2023-06-24T12:22:23+05:30	678	54	0.9	0
2023-06-24T12:23:18+05:30	679	44	0.6	0	2023-06-24T12:23:18+05:30	679	50	1.4	0	2023-06-24T12:23:18+05:30	679	48	0.7	0	2023-06-24T12:23:18+05:30	679	54	0.9	0
2023-06-24T12:24:13+05:30	680	44	0.6	0	2023-06-24T12:24:13+05:30	680	50	1.4	0	2023-06-24T12:24:13+05:30	680	48	0.7	0	2023-06-24T12:24:13+05:30	680	56	0.9	0
2023-06-24T12:25:08+05:30	681	45	0.6	0	2023-06-24T12:25:08+05:30	681	50	1.4	0	2023-06-24T12:25:08+05:30	681	48	0.7	0	2023-06-24T12:25:08+05:30	681	56	0.9	0
2023-06-24T12:26:03+05:30	682	45	0.6	0	2023-06-24T12:26:03+05:30	682	50	1.5	0	2023-06-24T12:26:03+05:30	682	48	0.7	0	2023-06-24T12:26:03+05:30	682	56	0.9	0
2023-06-24T12:26:58+05:30	683	45	0.6	0	2023-06-24T12:26:58+05:30	683	50	1.5	0	2023-06-24T12:26:58+05:30	683	48	0.7	0	2023-06-24T12:26:58+05:30	683	56	0.9	0
2023-06-24T12:29:13+05:30	684	45	0.6	0	2023-06-24T12:29:13+05:30	684	49	1.5	0	2023-06-24T12:29:13+05:30	684	48	0.7	0	2023-06-24T12:29:13+05:30	684	56	0.9	0
2023-06-24T12:31:28+05:30	685	45	0.6	0	2023-06-24T12:31:28+05:30	685	49	1.5	0	2023-06-24T12:31:28+05:30	685	48	0.7	0	2023-06-24T12:31:28+05:30	685	57	1.1	0
2023-06-24T12:33:43+05:30	686	45	0.6	0	2023-06-24T12:33:43+05:30	686	49	1.5	0	2023-06-24T12:33:43+05:30	686	48	0.7	0	2023-06-24T12:33:43+05:30	686	57	1.1	0
2023-06-24T12:35:58+05:30	687	45	0.6	0	2023-06-24T12:35:58+05:30	687	49	1.6	0	2023-06-24T12:35:58+05:30	687	48	0.7	0	2023-06-24T12:35:58+05:30	687	57	1.1	0
2023-06-24T12:38:13+05:30	688	45	0.6	0	2023-06-24T12:38:13+05:30	688	49	1.6	0	2023-06-24T12:38:13+05:30	688	48	0.7	0	2023-06-24T12:38:13+05:30	688	57	1.1	0
2023-06-24T12:40:28+05:30	689	45	0.6	0	2023-06-24T12:40:28+05:30	689	49	1.6	0	2023-06-24T12:40:28+05:30	689	48	0.7	0	2023-06-24T12:40:28+05:30	689	57	1.1	0
2023-06-24T12:42:43+05:30	690	45	0.7	0	2023-06-24T12:42:43+05:30	690	49	1.6	0	2023-06-24T12:42:43+05:30	690	48	0.7	0	2023-06-24T12:42:43+05:30	690	57	1.1	0
2023-06-24T12:44:58+05:30	691	45	0.7	0	2023-06-24T12:44:58+05:30	691	49	1.7	0	2023-06-24T12:44:58+05:30	691	48	0.8	0	2023-06-24T12:44:58+05:30	691	58	1.1	0
2023-06-24T14:24:28+05:30	733	58	1.2	0	2023-06-24T14:24:28+05:30	733	70	3	0	2023-06-24T14:24:28+05:30	733	62	1.3	0	2023-06-24T14:24:28+05:30	733	76	1.6	0
2023-06-24T14:33:28+05:30	737	59	1.2	0	2023-06-24T14:33:28+05:30	737	69	3.2	0	2023-06-24T14:33:28+05:30	737	62	1.4	0	2023-06-24T14:33:28+05:30	737	76	1.7	0
2023-06-24T14:35:43+05:30	738	59	1.2	0	2023-06-24T14:35:43+05:30	738	69	3.2	0	2023-06-24T14:35:43+05:30	738	62	1.4	0	2023-06-24T14:35:43+05:30	738	76	1.7	0
2023-06-24T14:37:58+05:30	739	59	1.2	0	2023-06-24T14:37:58+05:30	739	68	3.2	0	2023-06-24T14:37:58+05:30	739	62	1.4	0	2023-06-24T14:37:58+05:30	739	74	1.7	0
2023-06-24T14:40:13+05:30	740	55	1.3	0	2023-06-24T14:40:13+05:30	740	68	3.2	0	2023-06-24T14:40:13+05:30	740	62	1.4	0	2023-06-24T14:40:13+05:30	740	74	1.7	0
2023-06-24T14:42:28+05:30	741	55	1.3	0	2023-06-24T14:42:28+05:30	741	68	3.3	0	2023-06-24T14:42:28+05:30	741	62	1.4	0	2023-06-24T14:42:28+05:30	741	74	1.7	0
2023-06-24T14:44:43+05:30	742	55	1.3	0	2023-06-24T14:44:43+05:30	742	68	3.3	0	2023-06-24T14:44:43+05:30	742	62	1.4	0	2023-06-24T14:44:43+05:30	742	74	1.7	0
2023-06-24T14:46:58+05:30	743	55	1.3	0	2023-06-24T14:46:58+05:30	743	68	3.3	0	2023-06-24T14:46:58+05:30	743	62	1.4	0	2023-06-24T14:46:58+05:30	743	74	1.7	0
2023-06-24T14:49:13+05:30	744	55	1.3	0	2023-06-24T14:49:13+05:30	744	68	3.4	0	2023-06-24T14:49:13+05:30	744	62	1.4	0	2023-06-24T14:49:13+05:30	744	74	1.8	0
2023-06-24T14:51:28+05:30	745	55	1.3	0	2023-06-24T14:51:28+05:30	745	68	3.4	0	2023-06-24T14:51:28+05:30	745	62	1.4	0	2023-06-24T14:51:28+05:30	745	75	1.8	0
2023-06-24T14:53:43+05:30	746	55	1.3	0	2023-06-24T14:53:43+05:30	746	65	3.4	0	2023-06-24T14:53:43+05:30	746	62	1.4	0	2023-06-24T14:53:43+05:30	746	75	1.8	0
2023-06-24T14:55:58+05:30	747	55	1.3	0	2023-06-24T14:55:58+05:30	747	65	3.5	0	2023-06-24T14:55:58+05:30	747	62	1.5	0	2023-06-24T14:55:58+05:30	747	75	1.8	0
2023-06-24T14:58:13+05:30	748	55	1.4	0	2023-06-24T14:58:13+05:30	748	65	3.5	0	2023-06-24T14:58:13+05:30	748	62	1.5	0	2023-06-24T14:58:13+05:30	748	75	1.8	0
2023-06-24T16:14:43+05:30	782	52	1.6	0	2023-06-24T16:14:43+05:30	782	64	4.5	0	2023-06-24T16:14:43+05:30	782	57	2	0	2023-06-24T16:14:43+05:30	782	65	2.7	0
2023-06-24T16:16:58+05:30	783	52	1.6	0	2023-06-24T16:16:58+05:30	783	64	4.5	0	2023-06-24T16:16:58+05:30	783	57	2	0	2023-06-24T16:16:58+05:30	783	64	2.7	0
2023-06-24T16:19:13+05:30	784	52	1.6	0	2023-06-24T16:19:13+05:30	784	64	4.5	0	2023-06-24T16:19:13+05:30	784	57	2	0	2023-06-24T16:19:13+05:30	784	64	2.7	0
2023-06-24T16:21:28+05:30	785	52	1.7	0	2023-06-24T16:21:28+05:30	785	63	4.5	0	2023-06-24T16:21:28+05:30	785	57	2.1	0	2023-06-24T16:21:28+05:30	785	64	2.7	0
2023-06-24T16:23:43+05:30	786	52	1.7	0	2023-06-24T16:23:43+05:30	786	63	4.5	0	2023-06-24T16:23:43+05:30	786	56	2.1	0	2023-06-24T16:23:43+05:30	786	64	2.7	0
2023-06-24T16:25:58+05:30	787	52	1.7	0	2023-06-24T16:25:58+05:30	787	63	4.5	0	2023-06-24T16:25:58+05:30	787	56	2.1	0	2023-06-24T16:25:58+05:30	787	64	2.7	0
2023-06-24T16:28:13+05:30	788	52	1.7	0	2023-06-24T16:28:13+05:30	788	63	4.6	0	2023-06-24T16:28:13+05:30	788	56	2.1	0	2023-06-24T16:28:13+05:30	788	64	2.7	0
2023-06-24T16:30:28+05:30	789	52	1.7	0	2023-06-24T16:30:28+05:30	789	63	4.6	0	2023-06-24T16:30:28+05:30	789	56	2.1	0	2023-06-24T16:30:28+05:30	789	64	2.8	0
2023-06-24T16:32:43+05:30	790	52	1.7	0	2023-06-24T16:32:43+05:30	790	63	4.6	0	2023-06-24T16:32:43+05:30	790	56	2.1	0	2023-06-24T16:32:43+05:30	790	64	2.8	0
2023-06-24T16:34:58+05:30	791	52	1.7	0	2023-06-24T16:34:58+05:30	791	63	4.6	0	2023-06-24T16:34:58+05:30	791	56	2.1	0	2023-06-24T16:34:58+05:30	791	64	2.8	0
2023-06-24T16:37:13+05:30	792	52	1.7	0	2023-06-24T16:37:13+05:30	792	63	4.6	0	2023-06-24T16:37:13+05:30	792	56	2.1	0	2023-06-24T16:37:13+05:30	792	64	2.8	0
2023-06-24T16:39:28+05:30	793	52	1.7	0	2023-06-24T16:39:28+05:30	793	63	4.6	0	2023-06-24T16:39:28+05:30	793	56	2.1	0	2023-06-24T16:39:28+05:30	793	64	2.8	0
2023-06-24T16:41:43+05:30	794	52	1.8	0	2023-06-24T16:41:43+05:30	794	62	4.7	0	2023-06-24T16:41:43+05:30	794	56	2.1	0	2023-06-24T16:41:43+05:30	794	64	2.8	0
2023-06-24T16:43:58+05:30	795	52	1.8	0	2023-06-24T16:43:58+05:30	795	62	4.7	0	2023-06-24T16:43:58+05:30	795	56	2.1	0	2023-06-24T16:43:58+05:30	795	63	2.9	0
2023-06-24T17:53:43+05:30	826	51	2.1	0	2023-06-24T17:53:43+05:30	826	60	5.3	0	2023-06-24T17:53:43+05:30	826	54	2.4	0	2023-06-24T17:53:43+05:30	826	54	3.8	0
2023-06-24T17:55:58+05:30	827	51	2.1	0	2023-06-24T17:55:58+05:30	827	60	5.3	0	2023-06-24T17:55:58+05:30	827	54	2.4	0	2023-06-24T17:55:58+05:30	827	54	3.8	0
2023-06-25T10:31:16+05:30	828	50	0	0	2023-06-25T10:31:16+05:30	828	62	0	0	2023-06-25T10:31:16+05:30	828	55	0	0	2023-06-25T10:31:16+05:30	828	63	0	0
2023-06-25T10:32:06+05:30	829	50	0	0	2023-06-25T10:32:06+05:30	829	62	0	0	2023-06-25T10:32:06+05:30	829	55	0	0	2023-06-25T10:32:06+05:30	829	63	0	0
2023-06-25T10:32:56+05:30	830	50	0	0	2023-06-25T10:32:56+05:30	830	62	0	0	2023-06-25T10:32:56+05:30	830	55	0	0	2023-06-25T10:32:56+05:30	830	63	0	0
2023-06-25T10:33:46+05:30	831	50	0	0	2023-06-25T10:33:46+05:30	831	62	0	0	2023-06-25T10:33:46+05:30	831	55	0	0	2023-06-25T10:33:46+05:30	831	63	0	0
2023-06-25T10:34:36+05:30	832	50	0	0	2023-06-25T10:34:36+05:30	832	62	0	0	2023-06-25T10:34:36+05:30	832	55	0	0	2023-06-25T10:34:36+05:30	832	63	0	0
2023-06-25T10:35:26+05:30	833	50	0	0	2023-06-25T10:35:26+05:30	833	62	0	0	2023-06-25T10:35:26+05:30	833	55	0	0	2023-06-25T10:35:26+05:30	833	63	0	0
2023-06-25T11:26:46+05:30	863	50	0.3	0	2023-06-25T11:26:46+05:30	863	62	0.7	0	2023-06-25T11:26:46+05:30	863	53	0.3	0	2023-06-25T11:26:46+05:30	863	63	1	0
2023-06-25T11:28:15+05:30	864	50	0.3	0	2023-06-25T11:28:15+05:30	864	62	0.7	0	2023-06-25T11:28:15+05:30	864	53	0.3	0	2023-06-25T11:28:15+05:30	864	63	1	0
2023-06-25T11:29:44+05:30	865	50	0.3	0	2023-06-25T11:29:44+05:30	865	62	0.8	0	2023-06-25T11:29:44+05:30	865	53	0.3	0	2023-06-25T11:29:44+05:30	865	63	1	0
2023-06-25T11:31:13+05:30	866	50	0.3	0	2023-06-25T11:31:13+05:30	866	58	0.8	0	2023-06-25T11:31:13+05:30	866	53	0.5	0	2023-06-25T11:31:13+05:30	866	63	1	0
2023-06-25T11:32:42+05:30	867	53	0.3	0	2023-06-25T11:32:42+05:30	867	58	0.8	0	2023-06-25T11:32:42+05:30	867	53	0.5	0	2023-06-25T11:32:42+05:30	867	63	1	0
2023-06-25T11:34:11+05:30	868	53	0.4	0	2023-06-25T11:34:11+05:30	868	58	0.8	0	2023-06-25T11:34:11+05:30	868	52	0.5	0	2023-06-25T11:34:11+05:30	868	63	1.1	0
2023-06-25T11:35:40+05:30	869	53	0.4	0	2023-06-25T11:35:40+05:30	869	58	0.9	0	2023-06-25T11:35:40+05:30	869	52	0.5	0	2023-06-25T11:35:40+05:30	869	63	1.1	0
2023-06-25T11:37:09+05:30	870	53	0.4	0	2023-06-25T11:37:09+05:30	870	58	0.9	0	2023-06-25T11:37:09+05:30	870	52	0.5	0	2023-06-25T11:37:09+05:30	870	62	1.1	0
2023-06-25T12:34:49+05:30	896	57	0.6	0	2023-06-25T12:34:49+05:30	896	63	1.7	0	2023-06-25T12:34:49+05:30	896	56	0.6	0	2023-06-25T12:34:49+05:30	896	60	1.6	0
2023-06-25T12:36:05+05:30	897	57	0.6	0	2023-06-25T12:36:05+05:30	897	63	1.7	0	2023-06-25T12:36:05+05:30	897	56	0.6	0	2023-06-25T12:36:05+05:30	897	60	1.6	0
2023-06-25T12:37:21+05:30	898	57	0.6	0	2023-06-25T12:37:21+05:30	898	63	1.8	0	2023-06-25T12:37:21+05:30	898	56	0.6	0	2023-06-25T12:37:21+05:30	898	60	1.6	0
2023-06-25T12:38:37+05:30	899	57	0.7	0	2023-06-25T12:38:37+05:30	899	63	1.8	0	2023-06-25T12:38:37+05:30	899	58	0.7	0	2023-06-25T12:38:37+05:30	899	60	1.6	0
2023-06-25T12:39:53+05:30	900	57	0.7	0	2023-06-25T12:39:53+05:30	900	63	1.8	0	2023-06-25T12:39:53+05:30	900	58	0.7	0	2023-06-25T12:39:53+05:30	900	59	1.6	0
2023-06-25T12:41:09+05:30	901	57	0.7	0	2023-06-25T12:41:09+05:30	901	63	1.8	0	2023-06-25T12:41:09+05:30	901	58	0.7	0	2023-06-25T12:41:09+05:30	901	59	1.7	0
2023-06-25T12:42:08+05:30	902	58	0.7	0	2023-06-25T12:42:08+05:30	902	63	1.8	0	2023-06-25T12:42:08+05:30	902	58	0.7	0	2023-06-25T12:42:08+05:30	902	59	1.7	0
2023-06-25T12:43:07+05:30	903	58	0.7	0	2023-06-25T12:43:07+05:30	903	62	1.8	0	2023-06-25T12:43:07+05:30	903	58	0.7	0	2023-06-25T12:43:07+05:30	903	59	1.7	0
2023-06-25T13:26:52+05:30	930	63	0.9	0	2023-06-25T13:26:52+05:30	930	69	2.5	0	2023-06-25T13:26:52+05:30	930	65	1	0	2023-06-25T13:26:52+05:30	930	63	2.3	0
2023-06-25T13:29:05+05:30	931	63	0.9	0	2023-06-25T13:29:05+05:30	931	69	2.5	0	2023-06-25T13:29:05+05:30	931	65	1	0	2023-06-25T13:29:05+05:30	931	64	2.3	0
2023-06-25T13:31:18+05:30	932	63	0.9	0	2023-06-25T13:31:18+05:30	932	69	2.5	0	2023-06-25T13:31:18+05:30	932	65	1	0	2023-06-25T13:31:18+05:30	932	64	2.3	0
2023-06-25T13:33:31+05:30	933	63	1	0	2023-06-25T13:33:31+05:30	933	69	2.5	0	2023-06-25T13:33:31+05:30	933	65	1	0	2023-06-25T13:33:31+05:30	933	64	2.4	0
2023-06-25T13:35:44+05:30	934	63	1	0	2023-06-25T13:35:44+05:30	934	70	2.5	0	2023-06-25T13:35:44+05:30	934	65	1.2	0	2023-06-25T13:35:44+05:30	934	64	2.4	0
2023-06-25T13:37:57+05:30	935	63	1	0	2023-06-25T13:37:57+05:30	935	70	2.7	0	2023-06-25T13:37:57+05:30	935	65	1.2	0	2023-06-25T13:37:57+05:30	935	68	2.4	0
2023-06-25T13:40:10+05:30	936	63	1	0	2023-06-25T13:40:10+05:30	936	70	2.7	0	2023-06-25T13:40:10+05:30	936	65	1.2	0	2023-06-25T13:40:10+05:30	936	68	2.4	0
2023-06-25T13:42:23+05:30	937	63	1	0	2023-06-25T13:42:23+05:30	937	70	2.7	0	2023-06-25T13:42:23+05:30	937	65	1.2	0	2023-06-25T13:42:23+05:30	937	68	2.4	0
2023-06-25T14:49:59+05:30	964	61	1.3	0	2023-06-25T14:49:59+05:30	964	69	3.2	0	2023-06-25T14:49:59+05:30	964	61	1.4	0	2023-06-25T14:49:59+05:30	964	65	3	0
2023-06-25T14:52:50+05:30	965	61	1.3	0	2023-06-25T14:52:50+05:30	965	69	3.2	0	2023-06-25T14:52:50+05:30	965	61	1.4	0	2023-06-25T14:52:50+05:30	965	65	3	0
2023-06-25T14:55:41+05:30	966	61	1.3	0	2023-06-25T14:55:41+05:30	966	69	3.3	0

Node 1					Node 2					Node 3					Node 4				
created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3
2023-06-26T09:25:31+05:30	1008	45	0	0	2023-06-26T09:25:31+05:30	1008	51	0	0	2023-06-26T09:25:31+05:30	1008	47	0	0	2023-06-26T09:25:31+05:30	1008	53	0	0
2023-06-26T09:26:16+05:30	1009	45	0	0	2023-06-26T09:26:16+05:30	1009	51	0	0	2023-06-26T09:26:16+05:30	1009	47	0	0	2023-06-26T09:26:16+05:30	1009	53	0	0
2023-06-26T09:27:01+05:30	1010	45	0	0	2023-06-26T09:27:01+05:30	1010	51	0	0	2023-06-26T09:27:01+05:30	1010	47	0	0	2023-06-26T09:27:01+05:30	1010	53	0	0
2023-06-26T09:27:46+05:30	1011	45	0	0	2023-06-26T09:27:46+05:30	1011	51	0	0	2023-06-26T09:27:46+05:30	1011	47	0	0	2023-06-26T09:27:46+05:30	1011	53	0	0
2023-06-26T09:30:04+05:30	1012	45	0	0	2023-06-26T09:30:04+05:30	1012	51	0	0	2023-06-26T09:30:04+05:30	1012	47	0	0	2023-06-26T09:30:04+05:30	1012	53	0	0
2023-06-26T10:13:10+05:30	1035	45	0.2	0	2023-06-26T10:13:10+05:30	1035	52	0.2	0	2023-06-26T10:13:10+05:30	1035	43	0	0	2023-06-26T10:13:10+05:30	1035	52	0.4	0
2023-06-26T10:14:39+05:30	1036	45	0.2	0	2023-06-26T10:14:39+05:30	1036	52	0.2	0	2023-06-26T10:14:39+05:30	1036	43	0	0	2023-06-26T10:14:39+05:30	1036	52	0.4	0
2023-06-26T10:16:08+05:30	1037	45	0.2	0	2023-06-26T10:16:08+05:30	1037	52	0.2	0	2023-06-26T10:16:08+05:30	1037	43	0	0	2023-06-26T10:16:08+05:30	1037	52	0.4	0
2023-06-26T10:17:37+05:30	1038	45	0.2	0	2023-06-26T10:17:37+05:30	1038	51	0.2	0	2023-06-26T10:17:37+05:30	1038	43	0.1	0	2023-06-26T10:17:37+05:30	1038	52	0.4	0
2023-06-26T10:19:06+05:30	1039	45	0.2	0	2023-06-26T10:19:06+05:30	1039	51	0.2	0	2023-06-26T10:19:06+05:30	1039	43	0.1	0	2023-06-26T10:19:06+05:30	1039	52	0.4	0
2023-06-26T10:20:35+05:30	1040	45	0.2	0	2023-06-26T10:20:35+05:30	1040	51	0.2	0	2023-06-26T10:20:35+05:30	1040	43	0.1	0	2023-06-26T10:20:35+05:30	1040	52	0.4	0
2023-06-26T10:23:08+05:30	1041	45	0.2	0	2023-06-26T10:23:08+05:30	1041	51	0.3	0	2023-06-26T10:23:08+05:30	1041	43	0.1	0	2023-06-26T10:23:08+05:30	1041	52	0.4	0
2023-06-26T10:25:41+05:30	1042	45	0.2	0	2023-06-26T10:25:41+05:30	1042	51	0.3	0	2023-06-26T10:25:41+05:30	1042	43	0.1	0	2023-06-26T10:25:41+05:30	1042	52	0.4	0
2023-06-26T10:28:14+05:30	1043	45	0.2	0	2023-06-26T10:28:14+05:30	1043	51	0.3	0	2023-06-26T10:28:14+05:30	1043	43	0.1	0	2023-06-26T10:28:14+05:30	1043	52	0.4	0
2023-06-26T10:30:47+05:30	1044	45	0.2	0	2023-06-26T10:30:47+05:30	1044	51	0.3	0	2023-06-26T10:30:47+05:30	1044	43	0.1	0	2023-06-26T10:30:47+05:30	1044	52	0.4	0
2023-06-26T10:33:20+05:30	1045	45	0.2	0	2023-06-26T10:33:20+05:30	1045	51	0.3	0	2023-06-26T10:33:20+05:30	1045	43	0.1	0	2023-06-26T10:33:20+05:30	1045	52	0.4	0
2023-06-26T10:35:53+05:30	1046	45	0.2	0	2023-06-26T10:35:53+05:30	1046	51	0.3	0	2023-06-26T10:35:53+05:30	1046	43	0.1	0	2023-06-26T10:35:53+05:30	1046	52	0.5	0
2023-06-26T10:38:26+05:30	1047	45	0.2	0	2023-06-26T10:38:26+05:30	1047	51	0.3	0	2023-06-26T10:38:26+05:30	1047	43	0.1	0	2023-06-26T10:38:26+05:30	1047	52	0.5	0
2023-06-26T10:40:59+05:30	1048	45	0.2	0	2023-06-26T10:40:59+05:30	1048	51	0.3	0	2023-06-26T10:40:59+05:30	1048	43	0.1	0	2023-06-26T10:40:59+05:30	1048	52	0.5	0
2023-06-26T10:43:32+05:30	1049	45	0.3	0	2023-06-26T10:43:32+05:30	1049	51	0.3	0	2023-06-26T10:43:32+05:30	1049	43	0.1	0	2023-06-26T10:43:32+05:30	1049	52	0.5	0
2023-06-26T10:46:05+05:30	1050	45	0.3	0	2023-06-26T10:46:05+05:30	1050	51	0.4	0	2023-06-26T10:46:05+05:30	1050	43	0.1	0	2023-06-26T10:46:05+05:30	1050	52	0.5	0
2023-06-26T10:48:38+05:30	1051	45	0.3	0	2023-06-26T10:48:38+05:30	1051	51	0.4	0	2023-06-26T10:48:38+05:30	1051	43	0.1	0	2023-06-26T10:48:38+05:30	1051	52	0.5	0
2023-06-26T10:51:11+05:30	1052	45	0.3	0	2023-06-26T10:51:11+05:30	1052	50	0.4	0	2023-06-26T10:51:11+05:30	1052	43	0.1	0	2023-06-26T10:51:11+05:30	1052	52	0.5	0
2023-06-26T10:53:13+05:30	1053	45	0.3	0	2023-06-26T10:53:13+05:30	1053	50	0.4	0	2023-06-26T10:53:13+05:30	1053	43	0.1	0	2023-06-26T10:53:13+05:30	1053	48	0.8	0
2023-06-26T10:55:15+05:30	1054	45	0.3	0	2023-06-26T10:55:15+05:30	1054	50	0.4	0	2023-06-26T10:55:15+05:30	1054	43	0.1	0	2023-06-26T10:55:15+05:30	1054	48	0.8	0
2023-06-26T10:57:17+05:30	1055	45	0.3	0	2023-06-26T10:57:17+05:30	1055	50	0.4	0	2023-06-26T10:57:17+05:30	1055	43	0.1	0	2023-06-26T10:57:17+05:30	1055	48	0.8	0
2023-06-26T10:59:19+05:30	1056	45	0.3	0	2023-06-26T10:59:19+05:30	1056	50	0.4	0	2023-06-26T10:59:19+05:30	1056	43	0.1	0	2023-06-26T10:59:19+05:30	1056	48	0.8	0
2023-06-26T11:47:52+05:30	1084	44	0.5	0	2023-06-26T11:47:52+05:30	1084	47	0.5	0	2023-06-26T11:47:52+05:30	1084	42	0.3	0	2023-06-26T11:47:52+05:30	1084	47	1.2	0
2023-06-26T11:50:21+05:30	1085	44	0.5	0	2023-06-26T11:50:21+05:30	1085	47	0.5	0	2023-06-26T11:50:21+05:30	1085	42	0.3	0	2023-06-26T11:50:21+05:30	1085	47	1.2	0
2023-06-26T11:51:29+05:30	1086	44	0.6	0	2023-06-26T11:51:29+05:30	1086	47	0.5	0	2023-06-26T11:51:29+05:30	1086	42	0.3	0	2023-06-26T11:51:29+05:30	1086	47	1.2	0
2023-06-26T11:52:37+05:30	1087	44	0.6	0	2023-06-26T11:52:37+05:30	1087	47	0.5	0	2023-06-26T11:52:37+05:30	1087	42	0.3	0	2023-06-26T11:52:37+05:30	1087	47	1.2	0
2023-06-26T11:53:45+05:30	1088	44	0.6	0	2023-06-26T11:53:45+05:30	1088	47	0.5	0	2023-06-26T11:53:45+05:30	1088	42	0.3	0	2023-06-26T11:53:45+05:30	1088	47	1.2	0
2023-06-26T11:54:53+05:30	1089	44	0.6	0	2023-06-26T11:54:53+05:30	1089	47	0.5	0	2023-06-26T11:54:53+05:30	1089	42	0.3	0	2023-06-26T11:54:53+05:30	1089	47	1.2	0
2023-06-26T11:56:01+05:30	1090	44	0.6	0	2023-06-26T11:56:01+05:30	1090	47	0.5	0	2023-06-26T11:56:01+05:30	1090	42	0.3	0	2023-06-26T11:56:01+05:30	1090	47	1.2	0
2023-06-26T11:57:09+05:30	1091	44	0.6	0	2023-06-26T11:57:09+05:30	1091	47	0.5	0	2023-06-26T11:57:09+05:30	1091	42	0.3	0	2023-06-26T11:57:09+05:30	1091	47	1.2	0
2023-06-26T11:58:17+05:30	1092	44	0.6	0	2023-06-26T11:58:17+05:30	1092	47	0.5	0	2023-06-26T11:58:17+05:30	1092	42	0.3	0	2023-06-26T11:58:17+05:30	1092	47	1.2	0
2023-06-26T11:59:25+05:30	1093	44	0.6	0	2023-06-26T11:59:25+05:30	1093	47	0.5	0	2023-06-26T11:59:25+05:30	1093	42	0.4	0	2023-06-26T11:59:25+05:30	1093	47	1.4	0
2023-06-26T13:08:49+05:30	1123	42	0.8	0	2023-06-26T13:08:49+05:30	1123	45	0.8	0	2023-06-26T13:08:49+05:30	1123	39	0.6	0	2023-06-26T13:08:49+05:30	1123	45	1.9	0
2023-06-26T13:11:25+05:30	1124	42	0.9	0	2023-06-26T13:11:25+05:30	1124	45	0.8	0	2023-06-26T13:11:25+05:30	1124	39	0.6	0	2023-06-26T13:11:25+05:30	1124	45	1.9	0
2023-06-26T13:14:16+05:30	1125	42	0.9	0	2023-06-26T13:14:16+05:30	1125	45	0.8	0	2023-06-26T13:14:16+05:30	1125	39	0.6	0	2023-06-26T13:14:16+05:30	1125	45	1.9	0
2023-06-26T13:17:07+05:30	1126	42	0.9	0	2023-06-26T13:17:07+05:30	1126	45	0.8	0	2023-06-26T13:17:07+05:30	1126	39	0.6	0	2023-06-26T13:17:07+05:30	1126	45	1.9	0
2023-06-26T13:19:58+05:30	1127	42	0.9	0	2023-06-26T13:19:58+05:30	1127	46	0.8	0	2023-06-26T13:19:58+05:30	1127	39	0.7	0	2023-06-26T13:19:58+05:30	1127	45	1.9	0
2023-06-26T13:22:49+05:30	1128	42	0.9	0	2023-06-26T13:22:49+05:30	1128	46	0.8	0	2023-06-26T13:22:49+05:30	1128	39	0.7	0	2023-06-26T13:22:49+05:30	1128	44	1.9	0
2023-06-26T13:25:40+05:30	1129	41	0.9	0	2023-06-26T13:25:40+05:30	1129	46	0.8	0	2023-06-26T13:25:40+05:30	1129	39	0.7	0	2023-06-26T13:25:40+05:30	1129	44	1.9	0
2023-06-26T13:28:31+05:30	1130	41	0.9	0	2023-06-26T13:28:31+05:30	1130	46	0.8	0	2023-06-26T13:28:31+05:30	1130	39	0.7	0	2023-06-26T13:28:31+05:30	1130	44	1.9	0
2023-06-26T13:29:46+05:30	1131	41	0.9	0	2023-06-26T13:29:46+05:30	1131	46	0.8	0	2023-06-26T13:29:46+05:30	1131	39	0.7	0	2023-06-26T13:29:46+05:30	1131	44	1.9	0
2023-06-26T13:31:01+05:30	1132	41	0.9	0	2023-06-26T13:31:01+05:30	1132	46	0.8	0	2023-06-26T13:31:01+05:30	1132	39	0.7	0	2023-06-26T13:31:01+05:30	1132	44	1.9	0
2023-06-26T13:32:16+05:30	1133	41	0.9	0	2023-06-26T13:32:16+05:30	1133	46	0.8	0	2023-06-26T13:32:16+05:30	1133	39	0.7	0	2023-06-26T13:32:16+05:30	1133	44	1.9	0
2023-06-26T14:22:44+05:30	1163	41	1.1	0	2023-06-26T14:22:44+05:30	1163	47	1.2	0	2023-06-26T14:22:44+05:30	1163	37	0.9	0	2023-06-26T14:22:44+05:30	1163	41	2.3	0
2023-06-26T15:25:36+05:30	1192	39	1.4	0	2023-06-26T15:25:36+05:30	1192	45	1.8	0	2023-06-26T15:25:36+05:30	1192	36	1	0	2023-06-26T15:25:36+05:30	1192	38	2.4	0
2023-06-26T15:26:52+05:30	1193	39	1.4	0	2023-06-26T15:26:52+05:30	1193	45	1.8	0	2023-06-26T15:26:52+05:30	1193	36	1	0	2023-06-26T15:26:52+05:30	1193	38	2.4	0
2023-06-26T15:27:51+05:30	1194	39	1.4	0	2023-06-26T15:27:51+05:30	1194	45	1.8	0	2023-06-26T15:27:51+05:30	1194	36	1	0	2023-06-26T15:27:51+05:30	1194	38	2.4	0
2023-06-26T15:28:50+05:30	1195	39	1.4	0	2023-06-26T15:28:50+05:30	1195	45	1.8	0	2023-06-26T15:28:50+05:30	1195	36	1.2	0	2023-06-26T15:28:50+05:30	1195	38	2.4	0
2023-06-26T15:29:49+05:30	1196	39	1.4	0	2023-06-26T15:29:49+05:30	1196	45	2.2	0	2023-06-26T15:29:49+05:30	1196	36	1.2	0	2023-06-26T15:29:49+05:30	1196	38	2.4	0
2023-06-26T15:30:48+05:30	1197	39	1.4	0	2023-06-26T15:30:48+05:30	1197	45	2.2	0	2023-06-26T15:30:48+05:30	1197	36	1.2	0	2023-06-26T15:30:48+05:30	1197	38	2.4	0
2023-06-26T15:31:47+05:30	1198	39	1.4	0	2023-06-26T15:31:47+05:30	1198	45	2.2	0	2023-06-26T15:31:47+05:30	1198	36	1.2	0	2023-06-26T15:31:47+05:30	1198	38	2.4	0
2023-06-26T15:32:46+05:30	1199	39	1.4	0	2023-06-26T15:32:46+05:30	1199	45	2.2	0	2023-06-26T15:32:46+05:30	1199	36	1.2	0	2023-06-26T15:32:46+05:30	1199	38	2.6	0
2023-06-26T15:35:15+05:30	1200	39	1.4	0	2023-06-26T15:35:15+05:30	1200	44	2.2	0	2023-06-26T15:35:15+05:30	1200	36	1.2	0	2023-06-26T15:35:15+05:30	1200	38	2.6	0
2023-06-26T15:37:44+05:30	1201	39	1.4	0	2023-06-26T15:37:44+05:30	1201	44	2.2	0	2023-06-26T15:37:44+05:30	1201	36	1.2	0	2023-06-26T15:37:44+05:30	1201	38	2.6	0
2023-06-26T15:40:13+05:30	1202	39	1.4	0	2023-06-26T15:40:13+05:30	1202	44	2.2	0	2023-06-26T15:40:13+05:30	1202	36	1.2	0	2023-06-26T15:40:13+05:30	1202	38	2.6	0
2023-06-26T15:42:42+05:30	1203	39	1.4	0	2023-06-26T15:42:42+05:30	1203	44	2.2	0	2023-06-26T15:42:42+05:30	1203	36	1.2	0	2023-06-26T15:42:42+05:30	1203	38	2.6	0
2023-06-27T10:56:13+05:30	1230	39	0.1	0	2023-06-27T10:56:13+05:30	1230	52	0.3	0	2023-06-27T10:56:13+05:30	1230	38	0.1	0	2023-06-27T10:56:13+05:30	1230	55	0.5	0
2023-06-27T10:58:53+05:30	1231	39	0.1	0	2023-06-27T10:58:53+05:30	1231	52	0.3	0	2023-06-27T10:58:53+05:30	1231	38	0.1	0	2023-06-27T10:58:53+05:30	1231	55	0.5	0
2023-06-27T11:03:08+05:30	1232	39	0.1	0	2023-06-27T11:03:08+05:30	1232	52	0.3	0	2023-06-27T11:03:08+05:30	1232	38	0.1	0	2023-06-27T11:03:08+05:30	1232	55	0.5	0
2023-06-27T12:19:38+05:30	1266	38	0.3	0	2023-06-27T12:19:38+05:30	1266	47	0.9	0	2023-06-27T12:19:38+05:30	1266	37	0.4	0	2023-06-27T12:19:38+05:30	1266	52	1.4	0
2023-06-27T12:20:33+05:30	1267	38	0.3	0	2023-06-27T12:20:33+05:30	1267	47	0.9	0	2023-06-27T12:20:33+05:30	1267	37	0.4	0	2023-06-27T12:20:33+05:30	1267	52	1.4	0
2023-06-27T12:21:28+05:30	1268	38	0.3	0	2023-06-27T12:21:28+05:30	1268	47	0.9	0	2023-06-27T12:21:28+05:30	1268	37	0.4	0	2023-06-27T12:21:28+05:30	1268	52	1.4	0
2023-06-27T12:22:23+05:30	1269	38	0.3	0	2023-06-27T12:22:23+05:30	1269	47	1.1	0	2023-06-27T12:22:23+05:30	1269	37	0.4	0	2023-06-27T12:22:23+05:30	1269	52	1.4	0
2023-06-27T12:23:18+05:30	1270	38	0.3	0	2023-06-27T12:23:18+05:30	1270	47	1.1	0	2023-06-27T12:23:18+05:30	1270	37	0.4	0	2023-06-27T12:23:18+05:30	1270	52	1.4	0
2023-06-27T12:24:13+05:30	1271	38	0.3	0	2023-06-27T12:24:13+05:30	1271	47	1.1	0	2023-06-27T12:24:13+05:30	1271	37	0.4	0	2023-06-27T12:24:13+05:30	1271	52	1.4	0
2023-06-27T12:25:08+05:30	1272	37	0.3	0	2023-06-27T12:25:08+05:30	1272	47	1.1	0	2023-06-27T12:25:08+05:30	1272	37	0.4	0	2023-06-27T12:25:08+05:30	1272	52	1.4	0
2023-06-27T12:26:03+05:30	1273	37	0.3	0	2023-06-27T12:26:03+05:30	1273	46	1.1	0	2023-06-27T12:26:03+05:30	1273	37	0.4	0	2023-06-27T12:26:03+05:30	1273	52	1.4	0
2023-06-27T13:39:28+05:30	1304	36	0.5	0	2023-06-27T13:39:28+05:30	1304	43	1.4	0	2023-06-27T13:39:28+05:30	1304	33	0.6	0	2023-06-27T13:39:28+05:30	1304	47	2.1	0
2023-06-27T13:41:43+05:30	1305	36	0.5	0	2023-06-27T13:41:43+05:30	1305	43	1.4	0	2023-06-27T13:41:43+05:30	1305	33	0.6	0	2023-06-27T13:41:43+05:30	1305	47	2.1	0
2023-06-27T13:43:58+05:30	1306	36	0.5	0	2023-06-27T13:43:58+05:30	1306	43	1.4	0	2023-06-27T13:43:58+05:30	1306	33	0.6	0	2023-06-27T13:43:58+05:30	1306	45	2.1	0
2023-06-27T13:46:13+05:30	1307	36	0.5	0	2023-06-27T13:46:13+05:30	1307	42	1.4	0	2023-06-27T13:46:13+05:30	1307	33	0.6	0	2023-06-27T13:46:13+05:30	1307	45	2.1	0
2023-06-27T13:48:28+05:30	1308	36	0.5	0	2023-06-27T13:48:28+05:30	1308	42	1.4	0	2023-06-27T13:48:28+05:30	1308	33	0.6	0	2023-06-27T13:48:28+05:30	1308	45	2.1	0
2023-06-27T13:50:43+05:30	1309	36	0.5	0	2023-06-27T13:50:43+05:30	1309	42	1.4	0	2023-06-27T13:50:43+05:30	1309	33	0.6	0	2023-06-27T13:50:43+05:30	1309	45	2.1	0
2023-06-27T13:52:58+05:30	1310	36	0.5	0	2023-06-27T13:52:58+05:30	1310	42	1.6	0	2023-06-27T13:52:58+05:30	1310	33	0.6	0	2023-06-27T13:52:58+05:30	1310	45	2.1	0
2023-06-27T13:55:13+05:30	1311	35	0.5	0	2023-06-27T13:55:13+05:30	1311	42	1.6	0	2023-06-27T13:55:13+05:30	1311	33	0.6	0	2023-06-27T13:55:13+05:30	1311	45	2.1	0
2023-06-27T13:57:28+05:30	1312	35	0.5	0	2023-06-27T13:57:28+05:30	1312	42	1.6	0	2023-06-27T13:57:28+05:30	1312	33	0.7	0	2023-06-27T13:57:28+05:30	1312	45	2.3	0
2023-06-27T13:59:43+05:30	1313	35	0.5	0	2023-06-27T13:59:43+05:30	1313	42	1.6	0	2023-06-27T13:59:43+05:30	1313	33	0.7	0	2023-06-27T13:59:43+05:30	1313	45	2.3	0
2023-06-27T14:01:58+05:30	1314	35	0.5	0	2023-06-27T14:01:58+05:30	1314	42	1.6	0	2023-06-27T14:01:58+05:30	1314	33	0.7	0	2023-06-27T14:01:58+05:30	1314	45	2.3	0
2023-06-27T14:04:13+05:30	1315	35	0.5	0	2023-06-27T14:04:13+05:30	1315	42	1.6	0	2023-06-27T14:04:13+05:30	1315	33	0.7	0	2023-06-27T14:04:13+05:30	1315	45	2.3	0
2023-06-27T14:06:28+05:30	1316	35	0.6	0	2023-06-27T14:06:28+05:30	1316	42	1.6	0	2023-06-27T14:06:28+05:30	1316	33	0.7	0	2023-06-27T14:06:28+05:30	1316	45	2.3	0
2023-06-27T15:27:28+05:30	1352	34	0.9	0	2023-06-27T15:27:28+05:30	1352	39	1.8	0	2023-06-27T15:27:28+05:30	1352	33	0.9	0	2023-06-27T15:27:28+05:30	1352	42	2.7	0
2023-06-27T15:29:43+05:30	1353	34	0.9	0	2023-06-27T15:29:43+05:30	1353	39	1.8	0	2023-06-27T15:29:43+05:30	1353	33	0.9	0	2023-06-27T15:29:43+05:30	1353	42	2.7	0
2023-06-27T15:38:43+05:30	1357	34	1	0	2023-06-27T15:38:43+05:30	1357	37	1.8	0	2023-06-27T15:38:43+05:30	1357	33	0.9	0	2023-06-27T15:38:43+05:30	1357	42	2.9	0
2023-06-27T15:40:58+05:30	1358	34	1	0	2023-06-27T15:40:58+05:30	1358	37	1.8	0	2023-06-27T15:40:58+05:30	1358	33	0.9	0	2023-06-27T15:40:58+05:30	1358	42	2.9	0
2023-06-27T15:43:13+05:30	1359	34	1	0	2023-06-27T15:43:13+05:30	1359	37	1.8	0	2023-06-27T15:43:13+05:30	1359	33	0.9	0	2023-06-27T15:43:13+05:30	1359	42	2.9	0
2023-06-27T15:45:28+05:30	1360	34	1	0	2023-06-27T15:45:28+05:30	1360	37	1.8	0	2023-06-27T15:45:28+05:30	1360	33	0.9	0	2023-06-27T15:45:28+05:30	1360	42	2.9	0
2023-06-27T15:47:43+05:30	1361	34	1	0	2023-06-27T15:47:43+05:30	1361	37	1.8	0	2023-06-27T15:47:43+05:30	1361	33	0.9	0	2023-06-27T15:47:43+05:30	1361	39	2.9	0
2023-06-27T15:49:58+05:30	1362	34	1	0	2023-06-27T15:49:58+05:30	1362	37	1.8	0	2023-06-27T15:49:58+05:30	1362	33	0.9	0	2023-06-27T15:49:58+05:30	1362	39	2.9	0
2023-06-27T15:52:13+05:30	1363	34	1	0	2023-06-27T15:52:13+05:30	1363	37	1.8	0	2023-06-27T15:52:13+05:30	1363	33	0.9	0	2023-06-27T15:52:13+05:30	1363	39	2.9	0
2023-06-27T15:54:28+05:30	1364	34	1	0	2023-06-27T15:54:28+05:30	1364	37	1.8	0	2023-06-27T15:54:28+05:30	1364	33	0.9	0	2023-06-27T15:54:28+05:30	1364	39	2.9	0
2023-06-27T15:56:43+05:30	1365	34	1.1	9	2023-06-27T15:56:43+05:30	1365	37	2	7	2023-06-27T15:56:43+05:30	1365	32	0.9	13	2023-06-27T15:56:43+05:30	1365	39	2.9	6
2023-06-27T17:06:28+05:30	1396	35	1.3	0	2023-06-27T17:06:28+05:30	1396	36	2.3	0	2023-06-27T17:06:28+05:30	1396	32	1.3	0	2023-06-27T17:06:28+05:30	1396	36	3.3	0
2023-06-27T17:08:43+05:30	1397	35	1.3	0	2023-06-27T17:08:43+05:30	1397	36	2.3	0	2023-06-27T17:08:43+05:30	1397	32	1.3	0	2023-06-27T17:08:43+05:30	1397	36	3.3	0
2023-06-27T17:10:58+05:30	1398	35	1.3	0	2023-06-27T17:10:58+05:30	1398	36	2.3	0	2023-06-27T17:10:58+05:30	1398	32	1.3	0	2023-06-27T17:10:58+05:30	1398	36	3.3	0
2023-06-27T17:13:13+05:30	1399	35	1.3	0	2023-06-27T17:13:13+05:30	1399	36	2.5	0	2023-06-27T17:13:13+05:30	1399	32	1.3	0	2023-06-27T17:13:13+05:30	1399	36	3.3	0
2023-06-27T17:15:28+05:30	1400	35	1.3	0	2023-06-27T17:15:28+05:30	1400	36	2.5	0	2023-06-27T17:15:28+05:30	1400	32	1.3	0	2023-06-27T17:15:28+05:30	1400	36	3.3	0
2023-06-27T17:17:43+05:30	1401	35	1.3	0	2023-06-27T17:17:43+05:30	1401	36	2.5	0	2023-06-27T17:17:43+05:30	1401	32	1.3	0	2023-06-27T17:17:43+05:30	1401	36	3.3	0
2023-06-27T17:19:58+05:30	1402	35	1.3	0	2023-06-27T17:19:58+05:30	1402	36	2.5	0	2023-06-27T17:19:58+05:30	1402	32	1.3	0	2023-06-27T17:19:58+05:30	1402	36	3.3	0
2023-06-27T17:22:13+05:30	1403

Node 1					Node 2					Node 3					Node 4				
created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3
2023-06-28T11:16:26+05:30	1459	37	0.2	0	2023-06-28T11:16:26+05:30	1459	44	0.6	0	2023-06-28T11:16:26+05:30	1459	35	0.2	0	2023-06-28T11:16:26+05:30	1459	46	0.6	0
2023-06-28T11:18:38+05:30	1460	37	0.2	0	2023-06-28T11:18:38+05:30	1460	44	0.6	0	2023-06-28T11:18:38+05:30	1460	34	0.3	0	2023-06-28T11:18:38+05:30	1460	46	0.6	0
2023-06-28T11:20:50+05:30	1461	37	0.2	0	2023-06-28T11:20:50+05:30	1461	44	0.6	0	2023-06-28T11:20:50+05:30	1461	34	0.3	0	2023-06-28T11:20:50+05:30	1461	46	0.6	0
2023-06-28T11:22:19+05:30	1462	37	0.2	0	2023-06-28T11:22:19+05:30	1462	44	0.6	0	2023-06-28T11:22:19+05:30	1462	34	0.3	0	2023-06-28T11:22:19+05:30	1462	46	0.6	0
2023-06-28T11:23:48+05:30	1463	37	0.2	0	2023-06-28T11:23:48+05:30	1463	44	0.6	0	2023-06-28T11:23:48+05:30	1463	34	0.3	0	2023-06-28T11:23:48+05:30	1463	46	0.6	0
2023-06-28T11:25:17+05:30	1464	37	0.2	0	2023-06-28T11:25:17+05:30	1464	44	0.6	0	2023-06-28T11:25:17+05:30	1464	34	0.3	0	2023-06-28T11:25:17+05:30	1464	46	0.6	0
2023-06-28T12:33:01+05:30	1497	36	0.6	0	2023-06-28T12:33:01+05:30	1497	40	1.1	0	2023-06-28T12:33:01+05:30	1497	33	0.3	0	2023-06-28T12:33:01+05:30	1497	43	1.2	0
2023-06-28T12:34:49+05:30	1498	36	0.6	0	2023-06-28T12:34:49+05:30	1498	40	1.1	0	2023-06-28T12:34:49+05:30	1498	33	0.3	0	2023-06-28T12:34:49+05:30	1498	43	1.2	0
2023-06-28T12:36:05+05:30	1499	36	0.6	0	2023-06-28T12:36:05+05:30	1499	40	1.1	0	2023-06-28T12:36:05+05:30	1499	33	0.3	0	2023-06-28T12:36:05+05:30	1499	43	1.2	0
2023-06-28T12:37:21+05:30	1500	36	0.6	0	2023-06-28T12:37:21+05:30	1500	40	1.1	0	2023-06-28T12:37:21+05:30	1500	33	0.3	0	2023-06-28T12:37:21+05:30	1500	43	1.2	0
2023-06-28T12:38:37+05:30	1501	36	0.6	0	2023-06-28T12:38:37+05:30	1501	40	1.5	0	2023-06-28T12:38:37+05:30	1501	33	0.3	0	2023-06-28T12:38:37+05:30	1501	43	1.2	0
2023-06-28T12:39:53+05:30	1502	36	0.6	0	2023-06-28T12:39:53+05:30	1502	40	1.5	0	2023-06-28T12:39:53+05:30	1502	33	0.3	0	2023-06-28T12:39:53+05:30	1502	43	1.2	0
2023-06-28T12:41:09+05:30	1503	36	0.7	0	2023-06-28T12:41:09+05:30	1503	40	1.5	0	2023-06-28T12:41:09+05:30	1503	33	0.3	0	2023-06-28T12:41:09+05:30	1503	43	1.2	0
2023-06-28T12:42:08+05:30	1504	36	0.7	0	2023-06-28T12:42:08+05:30	1504	40	1.5	0	2023-06-28T12:42:08+05:30	1504	33	0.3	0	2023-06-28T12:42:08+05:30	1504	43	1.2	0
2023-06-28T12:43:07+05:30	1505	36	0.7	0	2023-06-28T12:43:07+05:30	1505	40	1.5	0	2023-06-28T12:43:07+05:30	1505	33	0.3	0	2023-06-28T12:43:07+05:30	1505	43	1.2	0
2023-06-28T12:44:06+05:30	1506	36	0.7	0	2023-06-28T12:44:06+05:30	1506	40	1.5	0	2023-06-28T12:44:06+05:30	1506	33	0.3	0	2023-06-28T12:44:06+05:30	1506	43	1.2	0
2023-06-28T13:33:31+05:30	1535	34	1	0	2023-06-28T13:33:31+05:30	1535	40	1.9	0	2023-06-28T13:33:31+05:30	1535	33	0.5	0	2023-06-28T13:33:31+05:30	1535	36	1.7	0
2023-06-28T13:35:44+05:30	1536	34	1	0	2023-06-28T13:35:44+05:30	1536	40	1.9	0	2023-06-28T13:35:44+05:30	1536	33	0.5	0	2023-06-28T13:35:44+05:30	1536	36	1.7	0
2023-06-28T13:37:57+05:30	1537	34	1	0	2023-06-28T13:37:57+05:30	1537	40	1.9	0	2023-06-28T13:37:57+05:30	1537	33	0.5	0	2023-06-28T13:37:57+05:30	1537	36	1.7	0
2023-06-28T13:46:49+05:30	1541	34	1.1	0	2023-06-28T13:46:49+05:30	1541	40	2	0	2023-06-28T13:46:49+05:30	1541	33	0.6	0	2023-06-28T13:46:49+05:30	1541	36	1.7	0
2023-06-28T13:49:02+05:30	1542	34	1.1	0	2023-06-28T13:49:02+05:30	1542	40	2	0	2023-06-28T13:49:02+05:30	1542	33	0.6	0	2023-06-28T13:49:02+05:30	1542	36	1.7	0
2023-06-28T13:51:27+05:30	1543	32	1.1	0	2023-06-28T13:51:27+05:30	1543	40	2	0	2023-06-28T13:51:27+05:30	1543	33	0.6	0	2023-06-28T13:51:27+05:30	1543	36	1.7	0
2023-06-28T13:53:52+05:30	1544	32	1.1	0	2023-06-28T13:53:52+05:30	1544	40	2	0	2023-06-28T13:53:52+05:30	1544	33	0.6	0	2023-06-28T13:53:52+05:30	1544	36	1.7	0
2023-06-28T13:56:17+05:30	1545	32	1.1	0	2023-06-28T13:56:17+05:30	1545	40	2	0	2023-06-28T13:56:17+05:30	1545	33	0.6	0	2023-06-28T13:56:17+05:30	1545	36	1.9	0
2023-06-28T13:58:42+05:30	1546	32	1.2	0	2023-06-28T13:58:42+05:30	1546	40	2	0	2023-06-28T13:58:42+05:30	1546	33	0.6	0	2023-06-28T13:58:42+05:30	1546	36	1.9	0
2023-06-28T14:01:07+05:30	1547	32	1.2	0	2023-06-28T14:01:07+05:30	1547	40	2	0	2023-06-28T14:01:07+05:30	1547	33	0.6	0	2023-06-28T14:01:07+05:30	1547	36	1.9	0
2023-06-28T15:17:05+05:30	1580	27	1.5	0	2023-06-28T15:17:05+05:30	1580	38	2.7	0	2023-06-28T15:17:05+05:30	1580	33	1.3	0	2023-06-28T15:17:05+05:30	1580	36	3.2	0
2023-06-28T15:18:20+05:30	1581	27	1.5	0	2023-06-28T15:18:20+05:30	1581	38	2.7	0	2023-06-28T15:18:20+05:30	1581	33	1.3	0	2023-06-28T15:18:20+05:30	1581	36	3.2	0
2023-06-28T15:19:35+05:30	1582	27	1.5	0	2023-06-28T15:19:35+05:30	1582	38	2.7	0	2023-06-28T15:19:35+05:30	1582	33	1.4	0	2023-06-28T15:19:35+05:30	1582	36	3.2	0
2023-06-28T15:20:50+05:30	1583	27	1.5	0	2023-06-28T15:20:50+05:30	1583	38	2.7	0	2023-06-28T15:20:50+05:30	1583	33	1.4	0	2023-06-28T15:20:50+05:30	1583	36	3.2	0
2023-06-28T15:21:39+05:30	1584	27	1.5	0	2023-06-28T15:21:39+05:30	1584	38	2.7	0	2023-06-28T15:21:39+05:30	1584	33	1.4	0	2023-06-28T15:21:39+05:30	1584	36	3.2	0
2023-06-28T15:22:28+05:30	1585	27	1.5	0	2023-06-28T15:22:28+05:30	1585	38	2.7	0	2023-06-28T15:22:28+05:30	1585	33	1.4	0	2023-06-28T15:22:28+05:30	1585	36	3.2	0
2023-06-29T09:23:16+05:30	1591	25	0	0	2023-06-29T09:23:16+05:30	1591	30	0	0	2023-06-29T09:23:16+05:30	1591	28	0	0	2023-06-29T09:23:16+05:30	1591	36	0	0
2023-06-29T09:24:01+05:30	1592	25	0	0	2023-06-29T09:24:01+05:30	1592	30	0	0	2023-06-29T09:24:01+05:30	1592	28	0	0	2023-06-29T09:24:01+05:30	1592	36	0	0
2023-06-29T10:16:08+05:30	1623	25	0	0	2023-06-29T10:16:08+05:30	1623	31	0.6	0	2023-06-29T10:16:08+05:30	1623	27	0	0	2023-06-29T10:16:08+05:30	1623	33	0.5	0
2023-06-29T10:17:37+05:30	1624	25	0	0	2023-06-29T10:17:37+05:30	1624	31	0.6	0	2023-06-29T10:17:37+05:30	1624	27	0	0	2023-06-29T10:17:37+05:30	1624	33	0.5	0
2023-06-29T10:19:06+05:30	1625	25	0	0	2023-06-29T10:19:06+05:30	1625	31	0.6	0	2023-06-29T10:19:06+05:30	1625	27	0	0	2023-06-29T10:19:06+05:30	1625	33	0.5	0
2023-06-29T10:20:35+05:30	1626	25	0	0	2023-06-29T10:20:35+05:30	1626	31	0.6	0	2023-06-29T10:20:35+05:30	1626	27	0	0	2023-06-29T10:20:35+05:30	1626	33	0.5	0
2023-06-29T10:23:08+05:30	1627	25	0	0	2023-06-29T10:23:08+05:30	1627	31	0.6	0	2023-06-29T10:23:08+05:30	1627	27	0	0	2023-06-29T10:23:08+05:30	1627	33	0.5	0
2023-06-29T10:25:41+05:30	1628	25	0	0	2023-06-29T10:25:41+05:30	1628	31	0.6	0	2023-06-29T10:25:41+05:30	1628	27	0	0	2023-06-29T10:25:41+05:30	1628	33	0.5	0
2023-06-29T10:28:14+05:30	1629	25	0	0	2023-06-29T10:28:14+05:30	1629	31	0.6	0	2023-06-29T10:28:14+05:30	1629	27	0	0	2023-06-29T10:28:14+05:30	1629	33	0.5	0
2023-06-29T11:25:34+05:30	1658	24	0.1	0	2023-06-29T11:25:34+05:30	1658	31	1.3	0	2023-06-29T11:25:34+05:30	1658	25	0.1	0	2023-06-29T11:25:34+05:30	1658	37	1.3	0
2023-06-29T11:26:33+05:30	1659	24	0.1	0	2023-06-29T11:26:33+05:30	1659	31	1.3	0	2023-06-29T11:26:33+05:30	1659	25	0.1	0	2023-06-29T11:26:33+05:30	1659	37	1.3	0
2023-06-29T11:27:32+05:30	1660	24	0.1	0	2023-06-29T11:27:32+05:30	1660	31	1.3	0	2023-06-29T11:27:32+05:30	1660	25	0.1	0	2023-06-29T11:27:32+05:30	1660	37	1.3	0
2023-06-29T11:28:31+05:30	1661	24	0.1	0	2023-06-29T11:28:31+05:30	1661	31	1.3	0	2023-06-29T11:28:31+05:30	1661	25	0.1	0	2023-06-29T11:28:31+05:30	1661	37	1.3	0
2023-06-29T11:29:30+05:30	1662	24	0.1	0	2023-06-29T11:29:30+05:30	1662	31	1.3	0	2023-06-29T11:29:30+05:30	1662	25	0.1	0	2023-06-29T11:29:30+05:30	1662	37	1.3	0
2023-06-29T11:30:29+05:30	1663	24	0.1	0	2023-06-29T11:30:29+05:30	1663	31	1.3	0	2023-06-29T11:30:29+05:30	1663	25	0.1	0	2023-06-29T11:30:29+05:30	1663	37	1.3	0
2023-06-29T11:32:58+05:30	1664	24	0.1	0	2023-06-29T11:32:58+05:30	1664	31	1.3	0	2023-06-29T11:32:58+05:30	1664	25	0.1	0	2023-06-29T11:32:58+05:30	1664	37	1.3	0
2023-06-29T11:35:27+05:30	1665	24	0.1	0	2023-06-29T11:35:27+05:30	1665	31	1.3	0	2023-06-29T11:35:27+05:30	1665	25	0.1	0	2023-06-29T11:35:27+05:30	1665	34	1.3	0
2023-06-29T11:37:56+05:30	1666	24	0.1	0	2023-06-29T11:37:56+05:30	1666	31	1.5	0	2023-06-29T11:37:56+05:30	1666	25	0.1	0	2023-06-29T11:37:56+05:30	1666	36	1.3	0
2023-06-29T11:40:25+05:30	1667	24	0.1	0	2023-06-29T11:40:25+05:30	1667	31	1.5	0	2023-06-29T11:40:25+05:30	1667	25	0.1	0	2023-06-29T11:40:25+05:30	1667	36	1.5	0
2023-06-29T11:42:54+05:30	1668	24	0.1	0	2023-06-29T11:42:54+05:30	1668	31	1.5	0	2023-06-29T11:42:54+05:30	1668	25	0.1	0	2023-06-29T11:42:54+05:30	1668	36	1.5	0
2023-06-29T11:45:23+05:30	1669	24	0.1	0	2023-06-29T11:45:23+05:30	1669	31	1.5	0	2023-06-29T11:45:23+05:30	1669	25	0.1	0	2023-06-29T11:45:23+05:30	1669	36	1.5	0
2023-06-29T12:33:31+05:30	1695	23	0.2	0	2023-06-29T12:33:31+05:30	1695	31	1.8	0	2023-06-29T12:33:31+05:30	1695	23	0.1	0	2023-06-29T12:33:31+05:30	1695	34	1.6	0
2023-06-29T12:35:56+05:30	1696	23	0.2	0	2023-06-29T12:35:56+05:30	1696	31	1.8	0	2023-06-29T12:35:56+05:30	1696	23	0.1	0	2023-06-29T12:35:56+05:30	1696	34	1.9	0
2023-06-29T12:38:21+05:30	1697	23	0.2	0	2023-06-29T12:38:21+05:30	1697	28	1.8	0	2023-06-29T12:38:21+05:30	1697	23	0.1	0	2023-06-29T12:38:21+05:30	1697	34	1.9	0
2023-06-29T12:40:46+05:30	1698	23	0.2	0	2023-06-29T12:40:46+05:30	1698	28	1.8	0	2023-06-29T12:40:46+05:30	1698	23	0.1	0	2023-06-29T12:40:46+05:30	1698	34	1.9	0
2023-06-29T12:43:11+05:30	1699	23	0.2	0	2023-06-29T12:43:11+05:30	1699	28	1.8	0	2023-06-29T12:43:11+05:30	1699	23	0.1	0	2023-06-29T12:43:11+05:30	1699	33	1.9	0
2023-06-29T12:45:36+05:30	1700	23	0.2	0	2023-06-29T12:45:36+05:30	1700	28	1.9	0	2023-06-29T12:45:36+05:30	1700	23	0.1	0	2023-06-29T12:45:36+05:30	1700	33	1.9	0
2023-06-29T12:48:01+05:30	1701	23	0.3	0	2023-06-29T12:48:01+05:30	1701	28	1.9	0	2023-06-29T12:48:01+05:30	1701	23	0.1	0	2023-06-29T12:48:01+05:30	1701	33	1.9	0
2023-06-29T12:50:37+05:30	1702	23	0.3	0	2023-06-29T12:50:37+05:30	1702	28	1.9	0	2023-06-29T12:50:37+05:30	1702	22	0.3	0	2023-06-29T12:50:37+05:30	1702	33	1.9	0
2023-06-29T12:53:13+05:30	1703	23	0.3	0	2023-06-29T12:53:13+05:30	1703	28	1.9	0	2023-06-29T12:53:13+05:30	1703	22	0.3	0	2023-06-29T12:53:13+05:30	1703	33	1.9	0
2023-06-29T12:55:49+05:30	1704	23	0.3	0	2023-06-29T12:55:49+05:30	1704	28	1.9	0	2023-06-29T12:55:49+05:30	1704	22	0.3	0	2023-06-29T12:55:49+05:30	1704	33	1.9	0
2023-06-29T13:38:31+05:30	1724	24	0.4	0	2023-06-29T13:38:31+05:30	1724	28	2.2	0	2023-06-29T13:38:31+05:30	1724	21	0.3	0	2023-06-29T13:38:31+05:30	1724	30	2	0
2023-06-29T13:39:46+05:30	1725	24	0.4	0	2023-06-29T13:39:46+05:30	1725	28	2.2	0	2023-06-29T13:39:46+05:30	1725	21	0.3	0	2023-06-29T13:39:46+05:30	1725	30	2.2	0
2023-06-29T13:40:35+05:30	1726	24	0.4	0	2023-06-29T13:40:35+05:30	1726	28	2.2	0	2023-06-29T13:40:35+05:30	1726	21	0.3	0	2023-06-29T13:40:35+05:30	1726	30	2.2	0
2023-06-29T13:41:24+05:30	1727	24	0.4	0	2023-06-29T13:41:24+05:30	1727	28	2.2	0	2023-06-29T13:41:24+05:30	1727	21	0.3	0	2023-06-29T13:41:24+05:30	1727	30	2.2	0
2023-06-29T13:42:13+05:30	1728	24	0.4	0	2023-06-29T13:42:13+05:30	1728	28	2.2	0	2023-06-29T13:42:13+05:30	1728	21	0.3	0	2023-06-29T13:42:13+05:30	1728	30	2.2	0
2023-06-29T13:43:02+05:30	1729	24	0.4	0	2023-06-29T13:43:02+05:30	1729	28	2.2	0	2023-06-29T13:43:02+05:30	1729	21	0.3	0	2023-06-29T13:43:02+05:30	1729	30	2.2	0
2023-06-29T13:43:51+05:30	1730	24	0.4	0	2023-06-29T13:43:51+05:30	1730	28	2.2	0	2023-06-29T13:43:51+05:30	1730	22	0.3	0	2023-06-29T13:43:51+05:30	1730	30	2.2	0
2023-06-29T13:44:40+05:30	1731	24	0.4	0	2023-06-29T13:44:40+05:30	1731	28	2.2	0	2023-06-29T13:44:40+05:30	1731	22	0.3	0	2023-06-29T13:44:40+05:30	1731	30	2.2	0
2023-06-29T13:45:29+05:30	1732	24	0.4	0	2023-06-29T13:45:29+05:30	1732	28	2.3	0	2023-06-29T13:45:29+05:30	1732	22	0.3	0	2023-06-29T13:45:29+05:30	1732	30	2.2	0
2023-06-29T13:47:40+05:30	1733	24	0.4	0	2023-06-29T13:47:40+05:30	1733	27	2.3	0	2023-06-29T13:47:40+05:30	1733	22	0.3	0	2023-06-29T13:47:40+05:30	1733	30	2.2	0
2023-06-29T14:38:58+05:30	1755	24	0.4	0	2023-06-29T14:38:58+05:30	1755	27	2.4	0	2023-06-29T14:38:58+05:30	1755	22	0.3	0	2023-06-29T14:38:58+05:30	1755	30	2.2	0
2023-06-29T14:41:52+05:30	1756	24	0.4	0	2023-06-29T14:41:52+05:30	1756	27	2.4	0	2023-06-29T14:41:52+05:30	1756	22	0.3	0	2023-06-29T14:41:52+05:30	1756	30	2.2	0
2023-06-29T14:44:46+05:30	1757	24	0.4	0	2023-06-29T14:44:46+05:30	1757	27	2.4	0	2023-06-29T14:44:46+05:30	1757	22	0.4	0	2023-06-29T14:44:46+05:30	1757	30	2.2	0
2023-06-29T14:47:40+05:30	1758	24	0.4	0	2023-06-29T14:47:40+05:30	1758	27	2.4	0	2023-06-29T14:47:40+05:30	1758	22	0.4	0	2023-06-29T14:47:40+05:30	1758	30	2.2	0
2023-06-29T14:50:34+05:30	1759	25	0.4	0	2023-06-29T14:50:34+05:30	1759	27	2.4	0	2023-06-29T14:50:34+05:30	1759	22	0.4	0	2023-06-29T14:50:34+05:30	1759	30	2.2	0
2023-06-29T14:53:28+05:30	1760	25	0.5	0	2023-06-29T14:53:28+05:30	1760	27	2.4	0	2023-06-29T14:53:28+05:30	1760	22	0.5	0	2023-06-29T14:53:28+05:30	1760	30	2.2	0
2023-06-29T14:55:30+05:30	1761	25	0.5	0	2023-06-29T14:55:30+05:30	1761	27	2.4	0	2023-06-29T14:55:30+05:30	1761	22	0.5	0	2023-06-29T14:55:30+05:30	1761	30	2.2	0
2023-06-29T14:57:32+05:30	1762	25	0.5	0	2023-06-29T14:57:32+05:30	1762	27	2.4	0	2023-06-29T14:57:32+05:30	1762	22	0.5	0	2023-06-29T14:57:32+05:30	1762	30	2.2	0
2023-06-29T14:59:34+05:30	1763	25	0.5	0	2023-06-29T14:59:34+05:30	1763	27	2.4	0	2023-06-29T14:59:34+05:30	1763	21	0.5	0	2023-06-29T14:59:34+05:30	1763	30	2.2	0
2023-06-29T15:01:36+05:30	1764	25	0.5	0	2023-06-29T15:01:36+05:30	1764	27	2.4	0	2023-06-29T15:01:36+05:30	1764	21	0.5	0	2023-06-29T15:01:36+05:30	1764	30	2.2	0
2023-06-30T10:28:33+05:30	1784	30	0	0	2023-06-30T10:28:33+05:30	1784	42	0	0	2023-06-30T10:28:33+05:30	1784	32	0	0	2023-06-30T10:28:33+05:30	1784	43	0	0
2023-06-30T10:30:03+05:30	1785	30	0	0	2023-06-30T10:30:03+05:30	1785	42	0	0	2023-06-30T10:30:03+05:30	1785	32	0	0	2023-06-30T10:30:03+05:30	1785	43	0	0
2023-06-30T10:31:28+05:30	1786	30	0	0	2023-06-30T10:31:28+05:30	1786	42	0	0	2023-06-30T10:31:28+05:30	1786	32	0	0	2023-06-30T10:31:28+05:30	1786	43	0	0
2023-06-30T10:32:53+05:30	1787	30	0	0	2023-06-30T10:32:53+05:30	1787	42	0	0	2023-06-30T10:32:53+05:30	1787	32	0	0	2023-06-30T10:32:53+05:30	1787	43	0	0
2023-06-30T10:34:18+05:30	1788	30	0	0	2023-06-30T10:34:18+05:30	1788	42	0	0	2023-06-30T10:34:18+05:30	1788	32	0	0	2023-06-30T10:34:18+05:30	1788	43	0	0
2023-06-30T10:36:33+05:30	1789	30	0	0	2023-06-30T10:36:33+05:30	1789	42	0	0	2023-06-30T10:36:33+05:30	1789	32	0	0	2023-06-30T10:36:33+05:30	1789	43	0	0
2023-06-30T10:38:48+05:30	1790	30	0	0	2023-06-30T10:38:48+05:30	1790	42	0	0	2023-06-30T10:38:48+05:30	1790	32	0	0	2023-06-30T10:38:48+05:30	1790	43	0	0
2023-06-30T10:41:03+05:30	1791	30	0	0	2023-06-30T10:41:03+05:30	1791	42	0	0	2023-06-30T10:41:03+05:30	1791	32	0	0	2023-06-30T10:41:03+05:30	1791	43	0	0
2023-06-30T10:43:18+05:30	1792	30	0	0	2023-06-30T10:43:18+05:30	1792	42	0	0	2023-06-30T10:43:18+05:30	1792	32	0	0	2023-06-30T10:43:18+05:30	1792	43	0	0
2023-06-30T10:45:33+05:30	1793	30	0	0	2023-06-30T10:45:33+05:30	1793	42	0	0	2023-06-30T10:45:33+05:30	1793	32	0	0	2023-06-30T10:45:33+05:30	1793	43	0	0
2023-06-30T10:48:13+05:30	1794	30	0	0	2023-06-30T10:48:13+05:30	1794	42	0	0	2023-06-30T10:48:13+05:30	1794	32	0	0	2023-06-30T10:48:13+05:30	1794	43	0.4	0
2023-06-30T10:50:53+05:30	1795	30	0	0	2023-06-30T10:50:53+05:30	1795	42	0	0	2023-06-30T10:50:53+05:30	1795	32	0	0	2023-06-30T10:50:53+05:30	1795	43	0.4	0
2023-06-30T10:53:33+05:30	1796	30	0	0	2023-06-30T10:53:33+05:30	1796	42	0.3	0	2023-06-30T10:53:33+05:30	1796	32	0	0	2023-06-30T10:53:33+05:30	1796	43	0.4	0
2023-06-30T10:56:13+05:30	1797	30	0	0	2023-06-30T10:56:13+05:30	1797	42	0.3	0	2023-06-30T10:56:13+05:30	1797	32	0	0	2023-06-30T10:56:13+05:30	1797	43	0.4	0
2023-06-30T10:58:53+05:30	1798	30	0	0	2023-06-30T10:58:53+05:30	1798	42	0.3	0	2023-06-30T10:58:53+05:30	1798	32	0	0	2023-06-30T10:58:53+05:30	1798	43	0.4	0
2023-06-30T11:03:08+05:30	1799	30	0	0	2023-06-30T11:03:08+05:30	1799	40	0.3	0	2023-06-30T11:03:08+05:30	1799	32	0	0	2023-06-30T11:03:08+05:30	1799	43	0.4	0
2023-06-30T11:07:23+05:30	1800	30	0	0	2023-06-30T11:07:23+05:30	1800	40	0.3	0	2023-06-30T11:07:23+05:30	1800	32	0	0	2023-06-30T11:07:23+05:30	1800	43	0.4	0
2023-06-30T11:11:38+05:30	1801	30	0	0	2023-06-30T11:11:38+05:30	1801	40	0.3	0	2023-06-30T11:11:38+05:30	1801	33	0	0	2023-06-30T11:11:38+05:30	1801	43	0.4	0
2023-06-30T11:15:53+05:30	1802	29	0	0	2023-06-30T11:15:53+05:30	1802	40	0.3	0	2023-06-30T11:15:53+05:30	1802	33	0.1	0	2023-06-30T11:15:53+05:30	1802	43	0.4	0
2023-06-30T12:29:13+05:30	1842	29	0.1	0	2023-06-30T12:29:13+05:30	1842	35	0.9	0	2023-06-30T12:29:13+05:30	1842	32	0.3	0	2023-06-30T12:29:13+05:30	1842	40	1.2	0
2023-06-30T12:31:28+05:30	1843	29	0.1	0	2023-06-30T12:31:28+05:30	1843	35	1.1	0	2023-06-30T12:31:28+05:30	1843	32	0.3	0	2023-06-30T12:31:28+05:30	1843

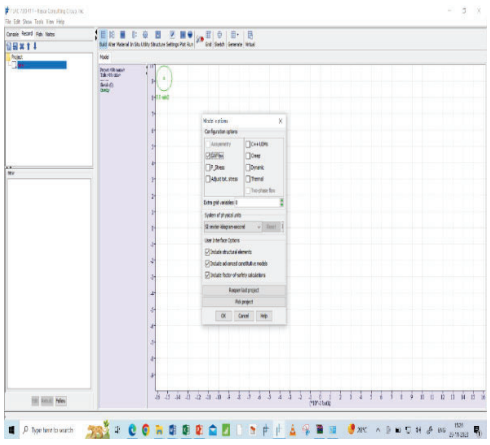
Node 1					Node 2					Node 3					Node 4				
created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3
2023-06-30T14:19:58+05:30	1889	28	0.4	0	2023-06-30T14:19:58+05:30	1889	30	1.5	0	2023-06-30T14:19:58+05:30	1889	31	0.6	0	2023-06-30T14:19:58+05:30	1889	35	1.8	0
2023-06-30T14:22:13+05:30	1890	28	0.5	0	2023-06-30T14:22:13+05:30	1890	30	1.5	0	2023-06-30T14:22:13+05:30	1890	31	0.6	0	2023-06-30T14:22:13+05:30	1890	35	1.8	0
2023-06-30T14:24:28+05:30	1891	28	0.5	0	2023-06-30T14:24:28+05:30	1891	30	1.5	0	2023-06-30T14:24:28+05:30	1891	31	0.6	0	2023-06-30T14:24:28+05:30	1891	35	1.8	0
2023-06-30T14:26:43+05:30	1892	28	0.5	0	2023-06-30T14:26:43+05:30	1892	30	1.5	0	2023-06-30T14:26:43+05:30	1892	31	0.6	0	2023-06-30T14:26:43+05:30	1892	35	1.8	0
2023-06-30T15:38:43+05:30	1924	28	0.7	0	2023-06-30T15:38:43+05:30	1924	28	1.9	0	2023-06-30T15:38:43+05:30	1924	30	0.8	0	2023-06-30T15:38:43+05:30	1924	31	2.2	0
2023-06-30T15:40:58+05:30	1925	28	0.7	0	2023-06-30T15:40:58+05:30	1925	28	1.9	0	2023-06-30T15:40:58+05:30	1925	29	0.8	0	2023-06-30T15:40:58+05:30	1925	31	2.2	0
2023-06-30T15:43:13+05:30	1926	28	0.8	0	2023-06-30T15:43:13+05:30	1926	28	1.9	0	2023-06-30T15:43:13+05:30	1926	29	0.8	0	2023-06-30T15:43:13+05:30	1926	29	2.2	0
2023-06-30T15:45:28+05:30	1927	28	0.8	0	2023-06-30T15:45:28+05:30	1927	28	1.9	0	2023-06-30T15:45:28+05:30	1927	29	0.8	0	2023-06-30T15:45:28+05:30	1927	29	2.2	0
2023-06-30T15:47:43+05:30	1928	28	0.8	0	2023-06-30T15:47:43+05:30	1928	27	2	0	2023-06-30T15:47:43+05:30	1928	29	0.8	0	2023-06-30T15:47:43+05:30	1928	29	2.2	0
2023-06-30T15:49:58+05:30	1929	28	0.8	0	2023-06-30T15:49:58+05:30	1929	27	2	0	2023-06-30T15:49:58+05:30	1929	29	0.8	0	2023-06-30T15:49:58+05:30	1929	29	2.2	0
2023-06-30T15:52:13+05:30	1930	28	0.8	0	2023-06-30T15:52:13+05:30	1930	27	2	0	2023-06-30T15:52:13+05:30	1930	29	0.8	0	2023-06-30T15:52:13+05:30	1930	29	2.2	0
2023-06-30T15:54:28+05:30	1931	28	0.8	0	2023-06-30T15:54:28+05:30	1931	27	2	0	2023-06-30T15:54:28+05:30	1931	29	0.8	0	2023-06-30T15:54:28+05:30	1931	29	2.4	0
2023-06-30T15:56:43+05:30	1932	28	0.8	0	2023-06-30T15:56:43+05:30	1932	27	2	0	2023-06-30T15:56:43+05:30	1932	29	0.8	0	2023-06-30T15:56:43+05:30	1932	29	2.4	0
2023-06-30T15:58:58+05:30	1933	28	0.8	0	2023-06-30T15:58:58+05:30	1933	27	2	0	2023-06-30T15:58:58+05:30	1933	29	0.8	0	2023-06-30T15:58:58+05:30	1933	29	2.4	0
2023-06-30T16:01:13+05:30	1934	28	0.8	0	2023-06-30T16:01:13+05:30	1934	27	2	0	2023-06-30T16:01:13+05:30	1934	29	0.8	0	2023-06-30T16:01:13+05:30	1934	29	2.4	0
2023-07-01T10:33:46+05:30	1961	36	0	0	2023-07-01T10:33:46+05:30	1961	39	0	0	2023-07-01T10:33:46+05:30	1961	33	0	0	2023-07-01T10:33:46+05:30	1961	40	0	0
2023-07-01T10:34:36+05:30	1962	36	0	0	2023-07-01T10:34:36+05:30	1962	39	0	0	2023-07-01T10:34:36+05:30	1962	33	0	0	2023-07-01T10:34:36+05:30	1962	40	0	0
2023-07-01T10:35:26+05:30	1963	36	0	0	2023-07-01T10:35:26+05:30	1963	39	0	0	2023-07-01T10:35:26+05:30	1963	33	0	0	2023-07-01T10:35:26+05:30	1963	40	0	0
2023-07-01T10:36:11+05:30	1964	36	0	0	2023-07-01T10:36:11+05:30	1964	39	0	0	2023-07-01T10:36:11+05:30	1964	33	0	0	2023-07-01T10:36:11+05:30	1964	40	0	0
2023-07-01T10:36:56+05:30	1965	36	0	0	2023-07-01T10:36:56+05:30	1965	39	0	0	2023-07-01T10:36:56+05:30	1965	33	0	0	2023-07-01T10:36:56+05:30	1965	40	0	0
2023-07-01T10:37:41+05:30	1966	36	0	0	2023-07-01T10:37:41+05:30	1966	39	0	0	2023-07-01T10:37:41+05:30	1966	33	0	0	2023-07-01T10:37:41+05:30	1966	40	0	0
2023-07-01T10:38:26+05:30	1967	36	0	0	2023-07-01T10:38:26+05:30	1967	39	0	0	2023-07-01T10:38:26+05:30	1967	33	0.1	0	2023-07-01T10:38:26+05:30	1967	40	0	0
2023-07-01T11:35:40+05:30	1999	35	0.4	0	2023-07-01T11:35:40+05:30	1999	35	0.4	0	2023-07-01T11:35:40+05:30	1999	32	0.4	0	2023-07-01T11:35:40+05:30	1999	37	0.7	0
2023-07-01T11:37:09+05:30	2000	35	0.4	0	2023-07-01T11:37:09+05:30	2000	35	0.4	0	2023-07-01T11:37:09+05:30	2000	32	0.4	0	2023-07-01T11:37:09+05:30	2000	37	0.7	0
2023-07-01T11:39:42+05:30	2001	35	0.4	0	2023-07-01T11:39:42+05:30	2001	35	0.4	0	2023-07-01T11:39:42+05:30	2001	32	0.4	0	2023-07-01T11:39:42+05:30	2001	37	0.7	0
2023-07-01T11:42:15+05:30	2002	35	0.4	0	2023-07-01T11:42:15+05:30	2002	35	0.4	0	2023-07-01T11:42:15+05:30	2002	32	0.4	0	2023-07-01T11:42:15+05:30	2002	38	0.7	0
2023-07-01T11:44:48+05:30	2003	35	0.4	0	2023-07-01T11:44:48+05:30	2003	35	0.4	0	2023-07-01T11:44:48+05:30	2003	32	0.4	0	2023-07-01T11:44:48+05:30	2003	38	0.7	0
2023-07-01T11:47:21+05:30	2004	35	0.4	0	2023-07-01T11:47:21+05:30	2004	35	0.4	0	2023-07-01T11:47:21+05:30	2004	32	0.4	0	2023-07-01T11:47:21+05:30	2004	38	0.7	0
2023-07-01T11:49:54+05:30	2005	35	0.4	0	2023-07-01T11:49:54+05:30	2005	35	0.4	0	2023-07-01T11:49:54+05:30	2005	32	0.4	0	2023-07-01T11:49:54+05:30	2005	38	0.8	0
2023-07-01T11:52:27+05:30	2006	35	0.4	0	2023-07-01T11:52:27+05:30	2006	35	0.4	0	2023-07-01T11:52:27+05:30	2006	32	0.4	0	2023-07-01T11:52:27+05:30	2006	38	0.8	0
2023-07-01T11:55:00+05:30	2007	35	0.4	0	2023-07-01T11:55:00+05:30	2007	35	0.4	0	2023-07-01T11:55:00+05:30	2007	32	0.4	0	2023-07-01T11:55:00+05:30	2007	38	0.8	0
2023-07-01T11:57:33+05:30	2008	35	0.4	0	2023-07-01T11:57:33+05:30	2008	35	0.4	0	2023-07-01T11:57:33+05:30	2008	32	0.4	0	2023-07-01T11:57:33+05:30	2008	38	0.8	0
2023-07-01T13:03:55+05:30	2045	35	0.7	0	2023-07-01T13:03:55+05:30	2045	33	1.1	0	2023-07-01T13:03:55+05:30	2045	31	0.9	0	2023-07-01T13:03:55+05:30	2045	35	1.5	0
2023-07-01T13:06:24+05:30	2046	35	0.7	0	2023-07-01T13:06:24+05:30	2046	33	1.1	0	2023-07-01T13:06:24+05:30	2046	31	0.9	0	2023-07-01T13:06:24+05:30	2046	35	1.5	0
2023-07-01T13:08:53+05:30	2047	35	0.7	0	2023-07-01T13:08:53+05:30	2047	33	1.3	0	2023-07-01T13:08:53+05:30	2047	29	0.9	0	2023-07-01T13:08:53+05:30	2047	35	1.5	0
2023-07-01T13:10:01+05:30	2048	35	0.7	0	2023-07-01T13:10:01+05:30	2048	32	1.3	0	2023-07-01T13:10:01+05:30	2048	29	0.9	0	2023-07-01T13:10:01+05:30	2048	35	1.5	0
2023-07-01T13:11:09+05:30	2049	35	0.7	0	2023-07-01T13:11:09+05:30	2049	32	1.3	0	2023-07-01T13:11:09+05:30	2049	29	0.9	0	2023-07-01T13:11:09+05:30	2049	35	1.5	0
2023-07-01T13:12:17+05:30	2050	35	0.7	0	2023-07-01T13:12:17+05:30	2050	32	1.3	0	2023-07-01T13:12:17+05:30	2050	29	0.9	0	2023-07-01T13:12:17+05:30	2050	35	1.5	0
2023-07-01T13:13:25+05:30	2051	35	0.7	0	2023-07-01T13:13:25+05:30	2051	32	1.3	0	2023-07-01T13:13:25+05:30	2051	29	0.9	0	2023-07-01T13:13:25+05:30	2051	35	1.5	0
2023-07-01T13:14:33+05:30	2052	35	0.8	0	2023-07-01T13:14:33+05:30	2052	32	1.3	0	2023-07-01T13:14:33+05:30	2052	29	0.9	0	2023-07-01T13:14:33+05:30	2052	35	1.6	0
2023-07-01T13:15:41+05:30	2053	35	0.8	0	2023-07-01T13:15:41+05:30	2053	32	1.3	0	2023-07-01T13:15:41+05:30	2053	29	0.9	0	2023-07-01T13:15:41+05:30	2053	35	1.6	0
2023-07-01T13:16:49+05:30	2054	35	0.8	0	2023-07-01T13:16:49+05:30	2054	32	1.3	0	2023-07-01T13:16:49+05:30	2054	29	0.9	0	2023-07-01T13:16:49+05:30	2054	35	1.6	0
2023-07-01T13:17:57+05:30	2055	35	0.8	0	2023-07-01T13:17:57+05:30	2055	32	1.3	0	2023-07-01T13:17:57+05:30	2055	29	0.9	0	2023-07-01T13:17:57+05:30	2055	34	1.6	0
2023-07-01T13:19:05+05:30	2056	35	0.8	0	2023-07-01T13:19:05+05:30	2056	32	1.3	0	2023-07-01T13:19:05+05:30	2056	29	0.9	0	2023-07-01T13:19:05+05:30	2056	34	1.6	0
2023-07-01T13:20:13+05:30	2057	35	0.8	0	2023-07-01T13:20:13+05:30	2057	32	1.3	0	2023-07-01T13:20:13+05:30	2057	29	0.9	0	2023-07-01T13:20:13+05:30	2057	34	1.6	0
2023-07-01T13:22:26+05:30	2058	35	0.8	0	2023-07-01T13:22:26+05:30	2058	32	1.3	0	2023-07-01T13:22:26+05:30	2058	29	0.9	0	2023-07-01T13:22:26+05:30	2058	34	1.6	0
2023-07-01T13:24:39+05:30	2059	35	0.8	0	2023-07-01T13:24:39+05:30	2059	32	1.3	0	2023-07-01T13:24:39+05:30	2059	28	0.9	0	2023-07-01T13:24:39+05:30	2059	34	1.6	0
2023-07-01T13:26:52+05:30	2060	34	0.8	0	2023-07-01T13:26:52+05:30	2060	32	1.3	0	2023-07-01T13:26:52+05:30	2060	28	0.9	0	2023-07-01T13:26:52+05:30	2060	34	1.6	0
2023-07-01T14:36:14+05:30	2089	34	1	0	2023-07-01T14:36:14+05:30	2089	27	1.8	0	2023-07-01T14:36:14+05:30	2089	30	1.1	0	2023-07-01T14:36:14+05:30	2089	32	2.1	0
2023-07-01T14:38:50+05:30	2090	34	1	0	2023-07-01T14:38:50+05:30	2090	27	1.8	0	2023-07-01T14:38:50+05:30	2090	30	1.1	0	2023-07-01T14:38:50+05:30	2090	32	2.1	0
2023-07-01T14:41:26+05:30	2091	34	1	0	2023-07-01T14:41:26+05:30	2091	27	1.8	0	2023-07-01T14:41:26+05:30	2091	30	1.1	0	2023-07-01T14:41:26+05:30	2091	32	2.1	0
2023-07-01T14:44:17+05:30	2092	34	1.1	0	2023-07-01T14:44:17+05:30	2092	27	1.8	0	2023-07-01T14:44:17+05:30	2092	30	1.1	0	2023-07-01T14:44:17+05:30	2092	32	2.1	0
2023-07-01T14:58:32+05:30	2097	34	1.1	0	2023-07-01T14:58:32+05:30	2097	27	1.8	0	2023-07-01T14:58:32+05:30	2097	30	1.1	0	2023-07-01T14:58:32+05:30	2097	32	2.1	0
2023-07-01T15:01:23+05:30	2098	34	1.1	0	2023-07-01T15:01:23+05:30	2098	27	1.8	0	2023-07-01T15:01:23+05:30	2098	30	1.1	0	2023-07-01T15:01:23+05:30	2098	32	2.1	0
2023-07-01T15:04:14+05:30	2099	34	1.1	0	2023-07-01T15:04:14+05:30	2099	27	1.8	0	2023-07-01T15:04:14+05:30	2099	30	1.1	0	2023-07-01T15:04:14+05:30	2099	32	2.1	0
2023-07-01T15:07:05+05:30	2100	34	1.1	0	2023-07-01T15:07:05+05:30	2100	27	1.8	0	2023-07-01T15:07:05+05:30	2100	30	1.1	0	2023-07-01T15:07:05+05:30	2100	32	2.1	0
2023-07-01T15:12:05+05:30	2104	33	1.1	0	2023-07-01T15:12:05+05:30	2104	25	1.8	0	2023-07-01T15:12:05+05:30	2104	32	1.1	0	2023-07-01T15:12:05+05:30	2104	27	2.1	0
2023-07-01T15:13:20+05:30	2105	33	1.1	0	2023-07-01T15:13:20+05:30	2105	25	1.8	0	2023-07-01T15:13:20+05:30	2105	32	1.1	0	2023-07-01T15:13:20+05:30	2105	27	2.1	0
2023-07-01T15:48:07+05:30	2128	31	1.1	0	2023-07-01T15:48:07+05:30	2128	25	1.9	0	2023-07-01T15:48:07+05:30	2128	29	1.2	0	2023-07-01T15:48:07+05:30	2128	25	2.2	0
2023-07-01T15:50:14+05:30	2129	31	1.1	0	2023-07-01T15:50:14+05:30	2129	25	1.9	0	2023-07-01T15:50:14+05:30	2129	29	1.2	0	2023-07-01T15:50:14+05:30	2129	25	2.2	0
2023-07-01T15:58:42+05:30	2133	31	1.2	0	2023-07-01T15:58:42+05:30	2133	25	1.9	0	2023-07-01T15:58:42+05:30	2133	29	1.2	0	2023-07-01T15:58:42+05:30	2133	25	2.2	0
2023-07-02T09:30:04+05:30	2147	40	0	0	2023-07-02T09:30:04+05:30	2147	51	0	0	2023-07-02T09:30:04+05:30	2147	48	0.2	0	2023-07-02T09:30:04+05:30	2147	46	0.2	0
2023-07-02T09:32:22+05:30	2148	40	0	0	2023-07-02T09:32:22+05:30	2148	51	0	0	2023-07-02T09:32:22+05:30	2148	48	0.2	0	2023-07-02T09:32:22+05:30	2148	46	0.2	0
2023-07-02T09:34:40+05:30	2149	40	0	0	2023-07-02T09:34:40+05:30	2149	51	0	0	2023-07-02T09:34:40+05:30	2149	48	0.2	0	2023-07-02T09:34:40+05:30	2149	46	0.2	0
2023-07-02T10:20:35+05:30	2175	39	0.1	0	2023-07-02T10:20:35+05:30	2175	53	0.8	0	2023-07-02T10:20:35+05:30	2175	46	0.4	0	2023-07-02T10:20:35+05:30	2175	44	0.9	0
2023-07-02T10:23:08+05:30	2176	39	0.1	0	2023-07-02T10:23:08+05:30	2176	53	0.8	0	2023-07-02T10:23:08+05:30	2176	46	0.4	0	2023-07-02T10:23:08+05:30	2176	44	0.9	0
2023-07-02T10:25:41+05:30	2177	39	0.1	0	2023-07-02T10:25:41+05:30	2177	53	0.8	0	2023-07-02T10:25:41+05:30	2177	46	0.4	0	2023-07-02T10:25:41+05:30	2177	44	0.9	0
2023-07-02T10:28:14+05:30	2178	39	0.1	0	2023-07-02T10:28:14+05:30	2178	53	0.8	0	2023-07-02T10:28:14+05:30	2178	46	0.4	0	2023-07-02T10:28:14+05:30	2178	44	0.9	0
2023-07-02T10:30:47+05:30	2179	39	0.1	0	2023-07-02T10:30:47+05:30	2179	53	0.8	0	2023-07-02T10:30:47+05:30	2179	45	0.4	0	2023-07-02T10:30:47+05:30	2179	44	0.9	0
2023-07-02T10:33:20+05:30	2180	39	0.2	0	2023-07-02T10:33:20+05:30	2180	53	0.8	0	2023-07-02T10:33:20+05:30	2180	45	0.4	0	2023-07-02T10:33:20+05:30	2180	44	1.2	0
2023-07-02T11:24:35+05:30	2206	38	0.3	0	2023-07-02T11:24:35+05:30	2206	54	1.5	0	2023-07-02T11:24:35+05:30	2206	44	0.6	0	2023-07-02T11:24:35+05:30	2206	44	1.5	0
2023-07-02T11:25:34+05:30	2207	38	0.3	0	2023-07-02T11:25:34+05:30	2207	54	1.5	0	2023-07-02T11:25:34+05:30	2207	43	0.6	0	2023-07-02T11:25:34+05:30	2207	44	1.5	0
2023-07-02T11:26:33+05:30	2208	38	0.3	0	2023-07-02T11:26:33+05:30	2208	54	1.5	0	2023-07-02T11:26:33+05:30	2208	43	0.6	0	2023-07-02T11:26:33+05:30	2208	47	1.5	0
2023-07-02T11:27:32+05:30	2209	37	0.3	0	2023-07-02T11:27:32+05:30	2209	54	1.5	0	2023-07-02T11:27:32+05:30	2209	43	0.6	0	2023-07-02T11:27:32+05:30	2209	47	1.5	0
2023-07-02T11:28:31+05:30	2210	37	0.3	0	2023-07-02T11:28:31+05:30	2210	54	1.5	0	2023-07-02T11:28:31+05:30	2210	43	0.8	0	2023-07-02T11:28:31+05:30	2210	47	1.5	0
2023-07-02T11:29:30+05:30	2211	37	0.4	0	2023-07-02T11:29:30+05:30	2211	54	1.5	0	2023-07-02T11:29:30+05:30	2211	43	0.8	0	2023-07-02T11:29:30+05:30	2211	47	1.5	0
2023-07-02T11:30:29+05:30	2212	37	0.4	0	2023-07-02T11:30:29+05:30	2212	54	1.5	0	2023-07-02T11:30:29+05:30	2212	43	0.8	0	2023-07-02T11:30:29+05:30	2212	47	1.5	0
2023-07-02T12:28:41+05:30	2242	35	0.5	0	2023-07-02T12:28:41+05:30	2242	56	1.8	0	2023-07-02T12:28:41+05:30	2242	39	1	0	2023-07-02T12:28:41+05:30	2242	46	1.9	0
2023-07-02T12:31:06+05:30	2243	35	0.5	0	2023-07-02T12:31:06+05:30	2243	56	1.8	0	2023-07-02T12:31:06+05:30	2243	39	1	0	2023-07-02T12:31:06+05:30	2243	46	1.9	0
2023-07-02T12:33:31+05:30	2244	35	0.5	0	2023-07-02T12:33:31+05:30	2244	56	1.8	0	2023-07-02T12:33:31+05:30	2244	39	1	0	2023-07-02T12:33:31+05:30	2244	46	1.9	0
2023-07-02T12:35:56+05:30	2245	34	0.5	0	2023-07-02T12:35:56+05:30	2245	56	1.8	0	2023-07-02T12:35:56+05:30	2245	39	1	0	2023-07-02T12:35:56+05:30	2245	46	1.9	0
2023-07-02T12:38:21+05:30	2246	34	0.5	0	2023-07-02T12:38:21+05:30	2246	56	1.8	0	2023-07-02T12:38:21+05:30	2246	39	1	0	2023-07-02T12:38:21+05:30	2246	46	1.9	0
2023-07-02T12:40:46+05:30	2247	34	0.5	0	2023-07-02T12:40:46+05:30	2247	56	1.8	0	2023-07-02T12:40:46+05:30	2247	39	1	0	2023-07-02T12:40:46+05:30	2247	46	2.2	0
2023-07-02T12:43:11+05:30	2248	34	0.5	0	2023-07-02T12:43:11+05:30	2248	56	1.8	0	2023-07-02T12:43:11+05:30	2248	39	1	0	2023-07-02T12:43:11+05:30	2248	46	2.2	0
2023-07-02T12:45:36+05:30	2249	34	0.5	0	2023-07-02T12:45:36+05:30	2249	56	1.8	0	2023-07-02T12:45:36+05:30	2249	39	1	0	2023-07-02T12:45:36+05:30	2249	46	2.2	0
2023-07-02T13:40:35+05:30	2275	33	0.7	0	2023-07-02T13:40:35+05:30	2275	49	1.9	0	2023-07-02T13:40:35+05:30	2275	37	1.1	0	2023-07-02T13:40:35+05:30	2275	45	2.4	0
2023-07-02T13:41:24+05:30	2276	33	0.7	0	2023-07-02T13:41:24+05:30	2276	49	1.9	0	2023-07-02T13:41:24+05:30	2276	37	1.1	0	2023-07-02T13:41:24+05:30	2276	45	2.8	0
2023-07-02T13:42:13+05:30	2277	33	0.7	0	2023-07-02T13:42:13+05:30	2277	49	2.4	0	2023-07-02T13:42:13+05:30	2277	37	1.1	0	2023-07-02T13:42:13+05:30	2277	45	2.8	0
2023-07-02T13:43:02+05:30	2278	33	0.7	0	2023-07-02T13:43:02+05:30	2278	49	2.4	0	2023-07-02T13:43:02+05:30	2278	37	1.1	0	2023-07-02T13:43:02+05:30	2278	45	2.8	0
2023-07-02T13:43:51+05:30	2279	33	0.7	0	2023-07-02T13:43:51+05:30	2279	49	2.4	0	2023-07-02T13:43:51+05:30	2279	37	1.1	0	2023-07-02T13:43:51+05:30	2279	45	2.8	0
2023-07-02T13:44:40+05:30	2280	33	0.7	0	2023-07-02T13:44:40+05:30	2280	49	2.4	0	2023-07-02T13:44:40+05:30	2280	37	1.1	0	2023-07-02T13:44:40+05:30	2280	45	2.8	0
2023-07-02T15:01:36+05:30	2313	31	1.1	0	2023-07-02T15:01:36+05:30	2313	45	3	0	2023-07-02T15:01:36+05:30	2313	35	1.3	0	2023-07-02T15:01:36+05:30	2313	42	3.4	0
2023-07-02T15:03:38+05:30	2314	31	1.1	0	2023-07-02T15:03:38+05:30	2314	45	3	0	2023-07-02T15:03:38+05:30	2314	35	1.3	0	2023-07-02T15:03:38+05:30	2314	42	3.4	0
2023-07-02T15:05:40+05:30	2315	31	1.1	22	2023-07-02T15:05:40+05:30	2315	45	3	21	2023-07-02T15:05:40+05:30	2315	35	1.3	23	2023-07-02T15:05:40+05:30	2315	42	3.4	19
2023-07-02T15:07:42+05:30	2316	31	1.1	0	2023-07-02T15:07:42+05:30	2316	45	3	0	2023-07-02T15:07:42+05:30	2316	35	1.3	0	2023-07-02T15:07:42+05:30	2316	42	3.4	0
2023-07-02T15:09:44+05:30	2317	31	1.1	0	2023-07-02T15:09:44+05:30	2317	45	3	0	2023-07-02T15:09:44+05:30	2317	34	1.4	0	2023-07-02T15:09:44+05:30	2317	42	3.4	0
2023-07-02T15:11:32+05:30	2318	31	1.1	0	2023-07-02T15:11:32+05:30	2318	45	3	0	2023-07-02T15:11:32+05:30	2318	34	1.4	0	2023-07-02T15:11:32+05:30	2318	42	3.6	0
2023-07-02T15:54:54+05:30	2344	30	1.4	0	2023-07-02T15:54:54+05:30	2344	44	3.5	0	2023-07-02T15:54:54+05:30	2344	32	1.7	0	2023-07-02T15:54:54+05:30	2344	40	3.7	0
2023-07-02T15:56:02+05:30	2345	30	1.4	0	2023-07-02T15:56:02+05:30	2345	44	3.5	0	2023-07-02T15:56:02+05:30	2345	32	1.7	0	2023-07-02T15:56:02+05:30	2345	40	5.3	0
2023-07-02T15:57:10+05:30	2346	30	1.4	0	2023-07-02T15:57:10+05:30	2346	44	3.5	0	2023-07-02T15:57:10+05:30	2346	32	1.7	0	2023-07-02T15:57:10+05:30	2346	40	3.7	0
2023-07-03T10:15:03+05:30	2347	52	0	0	2023-07-03T10:15:03+05:30	2347	50	0	0	2023-07-03T10:15:03+05:30	2347	52	0	0	2023-07-03T10:15:03+05:30	2347	50	0	0
2023-07-03T10:17:18+05:30	2348	53	0	0	2023-07-03T10:17:18+05:30	2348	50	0	0	2023-07-03T10:17:18+05:30	2348	52	0	0	2023-07-03T10:17:18+05:30	2348	50	0	0
2023-07-03T10:19:33+05:30	2349	53	0	0	2023-07-03T10:19:33+05:30	2349	50	0	0	2023-07-03T10:19:33+05:30	2349	52	0	0	2023-07-03T10:19:33+05:30	2349	50	0	0
2023-07-03T10:21:48+05:30	2350	53	0	0	2023-07-03T10:21:48+05:30	2350	50	0	0	2023-07-03T10:21:48+05:30	2

Node 1					Node 2					Node 3					Node 4				
created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3	created_at	entry_id	field1	field2	field3
2023-07-03T12:03:53+05:30	2396	57	0.6	0	2023-07-03T12:03:53+05:30	2396	62	1.5	0	2023-07-03T12:03:53+05:30	2396	53	0.5	0	2023-07-03T12:03:53+05:30	2396	55	1.4	0
2023-07-03T12:06:08+05:30	2397	57	0.6	0	2023-07-03T12:06:08+05:30	2397	62	1.5	0	2023-07-03T12:06:08+05:30	2397	53	0.5	0	2023-07-03T12:06:08+05:30	2397	55	1.4	0
2023-07-03T12:08:23+05:30	2398	57	0.6	0	2023-07-03T12:08:23+05:30	2398	62	1.5	0	2023-07-03T12:08:23+05:30	2398	53	0.5	0	2023-07-03T12:08:23+05:30	2398	55	1.4	0
2023-07-03T12:10:38+05:30	2399	57	0.6	0	2023-07-03T12:10:38+05:30	2399	62	1.5	0	2023-07-03T12:10:38+05:30	2399	53	0.5	0	2023-07-03T12:10:38+05:30	2399	55	1.4	0
2023-07-03T13:10:23+05:30	2429	68	1.4	0	2023-07-03T13:10:23+05:30	2429	69	2.3	0	2023-07-03T13:10:23+05:30	2429	65	1.6	0	2023-07-03T13:10:23+05:30	2429	79	2.1	0
2023-07-03T13:13:03+05:30	2430	67	1.4	0	2023-07-03T13:13:03+05:30	2430	69	2.3	0	2023-07-03T13:13:03+05:30	2430	65	1.6	0	2023-07-03T13:13:03+05:30	2430	79	2.4	0
2023-07-03T13:15:43+05:30	2431	67	1.4	0	2023-07-03T13:15:43+05:30	2431	69	2.3	0	2023-07-03T13:15:43+05:30	2431	65	1.6	0	2023-07-03T13:15:43+05:30	2431	79	2.4	0
2023-07-03T13:18:23+05:30	2432	67	1.4	0	2023-07-03T13:18:23+05:30	2432	69	2.3	0	2023-07-03T13:18:23+05:30	2432	65	1.6	0	2023-07-03T13:18:23+05:30	2432	79	2.4	0
2023-07-03T13:21:03+05:30	2433	67	1.5	0	2023-07-03T13:21:03+05:30	2433	69	2.3	0	2023-07-03T13:21:03+05:30	2433	65	1.6	0	2023-07-03T13:21:03+05:30	2433	79	2.4	0
2023-07-03T13:23:43+05:30	2434	67	1.5	0	2023-07-03T13:23:43+05:30	2434	69	2.3	0	2023-07-03T13:23:43+05:30	2434	65	1.8	0	2023-07-03T13:23:43+05:30	2434	82	2.4	0
2023-07-03T13:25:58+05:30	2435	67	1.5	0	2023-07-03T13:25:58+05:30	2435	69	2.3	0	2023-07-03T13:25:58+05:30	2435	65	1.8	0	2023-07-03T13:25:58+05:30	2435	82	2.4	0
2023-07-03T13:28:13+05:30	2436	67	1.5	0	2023-07-03T13:28:13+05:30	2436	70	2.3	0	2023-07-03T13:28:13+05:30	2436	65	1.8	0	2023-07-03T13:28:13+05:30	2436	82	2.4	0
2023-07-03T13:37:13+05:30	2440	65	1.6	0	2023-07-03T13:37:13+05:30	2440	70	2.5	0	2023-07-03T13:37:13+05:30	2440	65	1.8	0	2023-07-03T13:37:13+05:30	2440	82	2.4	0
2023-07-03T14:42:28+05:30	2469	59	2.1	0	2023-07-03T14:42:28+05:30	2469	78	2.9	0	2023-07-03T14:42:28+05:30	2469	59	2.5	0	2023-07-03T14:42:28+05:30	2469	71	2.8	0
2023-07-03T14:44:43+05:30	2470	59	2.1	0	2023-07-03T14:44:43+05:30	2470	78	2.9	0	2023-07-03T14:44:43+05:30	2470	59	2.5	0	2023-07-03T14:44:43+05:30	2470	71	2.8	0
2023-07-03T14:46:58+05:30	2471	59	2.1	0	2023-07-03T14:46:58+05:30	2471	78	2.9	0	2023-07-03T14:46:58+05:30	2471	59	2.5	0	2023-07-03T14:46:58+05:30	2471	71	2.8	0
2023-07-03T14:49:13+05:30	2472	59	2.1	0	2023-07-03T14:49:13+05:30	2472	78	3.2	0	2023-07-03T14:49:13+05:30	2472	59	2.5	0	2023-07-03T14:49:13+05:30	2472	71	2.8	0
2023-07-03T14:51:28+05:30	2473	59	2.1	0	2023-07-03T14:51:28+05:30	2473	78	3.2	0	2023-07-03T14:51:28+05:30	2473	59	2.5	0	2023-07-03T14:51:28+05:30	2473	71	2.8	0
2023-07-03T14:53:43+05:30	2474	59	2.1	0	2023-07-03T14:53:43+05:30	2474	78	3.2	0	2023-07-03T14:53:43+05:30	2474	59	2.5	0	2023-07-03T14:53:43+05:30	2474	68	2.8	0
2023-07-03T15:02:43+05:30	2478	59	2.2	0	2023-07-03T15:02:43+05:30	2478	78	3.2	0	2023-07-03T15:02:43+05:30	2478	59	2.7	0	2023-07-03T15:02:43+05:30	2478	68	3.2	0
2023-07-03T15:04:58+05:30	2479	59	2.2	0	2023-07-03T15:04:58+05:30	2479	78	3.2	0	2023-07-03T15:04:58+05:30	2479	59	2.7	0	2023-07-03T15:04:58+05:30	2479	68	3.2	0
2023-07-03T15:07:13+05:30	2480	59	2.3	0	2023-07-03T15:07:13+05:30	2480	78	3.2	0	2023-07-03T15:07:13+05:30	2480	59	2.7	0	2023-07-03T15:07:13+05:30	2480	68	3.2	0
2023-07-03T15:56:43+05:30	2502	59	2.6	0	2023-07-03T15:56:43+05:30	2502	69	4.2	0	2023-07-03T15:56:43+05:30	2502	59	3.2	0	2023-07-03T15:56:43+05:30	2502	65	4.5	0
2023-07-03T15:58:58+05:30	2503	59	2.6	0	2023-07-03T15:58:58+05:30	2503	69	4.2	0	2023-07-03T15:58:58+05:30	2503	59	3.2	0	2023-07-03T15:58:58+05:30	2503	65	4.5	0
2023-07-03T16:01:13+05:30	2504	59	2.7	0	2023-07-03T16:01:13+05:30	2504	69	4.2	0	2023-07-03T16:01:13+05:30	2504	59	3.2	0	2023-07-03T16:01:13+05:30	2504	65	4.5	0
2023-07-03T16:03:28+05:30	2505	59	2.7	0	2023-07-03T16:03:28+05:30	2505	69	4.2	0	2023-07-03T16:03:28+05:30	2505	59	3.2	0	2023-07-03T16:03:28+05:30	2505	65	4.5	0
2023-07-03T16:05:43+05:30	2506	59	2.7	0	2023-07-03T16:05:43+05:30	2506	69	4.2	0	2023-07-03T16:05:43+05:30	2506	59	3.2	0	2023-07-03T16:05:43+05:30	2506	65	4.5	0
2023-07-03T16:07:58+05:30	2507	59	2.7	0	2023-07-03T16:07:58+05:30	2507	69	4.2	0	2023-07-03T16:07:58+05:30	2507	59	3.2	0	2023-07-03T16:07:58+05:30	2507	65	4.5	0
2023-07-03T16:10:13+05:30	2508	59	2.7	0	2023-07-03T16:10:13+05:30	2508	69	4.2	0	2023-07-03T16:10:13+05:30	2508	59	3.2	0	2023-07-03T16:10:13+05:30	2508	65	4.5	0
2023-07-04T10:31:16+05:30	2509	55	0	0	2023-07-04T10:31:16+05:30	2509	62	0	0	2023-07-04T10:31:16+05:30	2509	60	0	0	2023-07-04T10:31:16+05:30	2509	66	0	0
2023-07-04T10:32:06+05:30	2510	54	0	0	2023-07-04T10:32:06+05:30	2510	62	0	0	2023-07-04T10:32:06+05:30	2510	60	0	0	2023-07-04T10:32:06+05:30	2510	66	0	0
2023-07-04T10:38:26+05:30	2518	54	0	0	2023-07-04T10:38:26+05:30	2518	62	0.1	0	2023-07-04T10:38:26+05:30	2518	60	0.1	0	2023-07-04T10:38:26+05:30	2518	66	0.1	0
2023-07-04T10:39:11+05:30	2519	54	0	0	2023-07-04T10:39:11+05:30	2519	62	0.1	0	2023-07-04T10:39:11+05:30	2519	60	0.1	0	2023-07-04T10:39:11+05:30	2519	66	0.2	0
2023-07-04T10:39:56+05:30	2520	54	0	0	2023-07-04T10:39:56+05:30	2520	62	0.1	0	2023-07-04T10:39:56+05:30	2520	60	0.1	0	2023-07-04T10:39:56+05:30	2520	66	0.2	0
2023-07-04T10:42:14+05:30	2521	54	0	0	2023-07-04T10:42:14+05:30	2521	62	0.1	0	2023-07-04T10:42:14+05:30	2521	60	0.1	0	2023-07-04T10:42:14+05:30	2521	66	0.2	0
2023-07-04T10:44:32+05:30	2522	54	0	0	2023-07-04T10:44:32+05:30	2522	62	0.1	0	2023-07-04T10:44:32+05:30	2522	60	0.1	0	2023-07-04T10:44:32+05:30	2522	66	0.2	0
2023-07-04T12:00:06+05:30	2560	52	0.3	0	2023-07-04T12:00:06+05:30	2560	59	0.6	0	2023-07-04T12:00:06+05:30	2560	58	0.4	0	2023-07-04T12:00:06+05:30	2560	66	0.9	0
2023-07-04T12:02:39+05:30	2561	52	0.3	0	2023-07-04T12:02:39+05:30	2561	59	0.7	0	2023-07-04T12:02:39+05:30	2561	58	0.4	0	2023-07-04T12:02:39+05:30	2561	66	0.9	0
2023-07-04T12:05:12+05:30	2562	52	0.3	0	2023-07-04T12:05:12+05:30	2562	59	0.7	0	2023-07-04T12:05:12+05:30	2562	58	0.4	0	2023-07-04T12:05:12+05:30	2562	66	0.9	0
2023-07-04T13:11:09+05:30	2600	52	0.5	0	2023-07-04T13:11:09+05:30	2600	52	1.2	0	2023-07-04T13:11:09+05:30	2600	55	0.6	0	2023-07-04T13:11:09+05:30	2600	59	1.5	0
2023-07-04T13:12:17+05:30	2601	52	0.5	0	2023-07-04T13:12:17+05:30	2601	52	1.2	0	2023-07-04T13:12:17+05:30	2601	55	0.6	0	2023-07-04T13:12:17+05:30	2601	59	1.5	0
2023-07-04T13:13:25+05:30	2602	52	0.6	0	2023-07-04T13:13:25+05:30	2602	52	1.2	0	2023-07-04T13:13:25+05:30	2602	55	0.6	0	2023-07-04T13:13:25+05:30	2602	59	1.6	0
2023-07-04T13:14:33+05:30	2603	52	0.6	0	2023-07-04T13:14:33+05:30	2603	52	1.3	0	2023-07-04T13:14:33+05:30	2603	55	0.6	0	2023-07-04T13:14:33+05:30	2603	59	1.6	0
2023-07-04T13:15:41+05:30	2604	52	0.6	0	2023-07-04T13:15:41+05:30	2604	52	1.3	0	2023-07-04T13:15:41+05:30	2604	55	0.6	0	2023-07-04T13:15:41+05:30	2604	59	1.6	0
2023-07-04T13:16:49+05:30	2605	52	0.6	0	2023-07-04T13:16:49+05:30	2605	52	1.3	0	2023-07-04T13:16:49+05:30	2605	55	0.6	0	2023-07-04T13:16:49+05:30	2605	59	1.6	0
2023-07-04T13:17:57+05:30	2606	52	0.6	0	2023-07-04T13:17:57+05:30	2606	52	1.3	0	2023-07-04T13:17:57+05:30	2606	55	0.6	0	2023-07-04T13:17:57+05:30	2606	59	1.7	0
2023-07-04T13:19:05+05:30	2607	52	0.6	0	2023-07-04T13:19:05+05:30	2607	52	1.3	0	2023-07-04T13:19:05+05:30	2607	55	0.6	0	2023-07-04T13:19:05+05:30	2607	59	1.7	0
2023-07-04T14:44:17+05:30	2643	55	1.1	0	2023-07-04T14:44:17+05:30	2643	51	1.8	0	2023-07-04T14:44:17+05:30	2643	55	1.1	0	2023-07-04T14:44:17+05:30	2643	48	2.1	0
2023-07-04T14:58:32+05:30	2648	55	1.2	0	2023-07-04T14:58:32+05:30	2648	51	1.8	0	2023-07-04T14:58:32+05:30	2648	55	1.1	0	2023-07-04T14:58:32+05:30	2648	48	2.2	0
2023-07-04T15:01:23+05:30	2649	55	1.2	0	2023-07-04T15:01:23+05:30	2649	51	1.8	0	2023-07-04T15:01:23+05:30	2649	55	1.1	0	2023-07-04T15:01:23+05:30	2649	48	2.3	0
2023-07-04T15:04:14+05:30	2650	55	1.3	0	2023-07-04T15:04:14+05:30	2650	51	1.9	0	2023-07-04T15:04:14+05:30	2650	55	1.1	0	2023-07-04T15:04:14+05:30	2650	48	2.3	0
2023-07-04T15:07:05+05:30	2651	55	1.3	0	2023-07-04T15:07:05+05:30	2651	51	1.9	0	2023-07-04T15:07:05+05:30	2651	55	1.1	0	2023-07-04T15:07:05+05:30	2651	45	2.3	0
2023-07-04T15:08:20+05:30	2652	55	1.3	0	2023-07-04T15:08:20+05:30	2652	51	1.9	0	2023-07-04T15:08:20+05:30	2652	55	1.1	0	2023-07-04T15:08:20+05:30	2652	45	2.3	0
2023-07-04T15:09:35+05:30	2653	54	1.3	14	2023-07-04T15:09:35+05:30	2653	51	1.9	12	2023-07-04T15:09:35+05:30	2653	55	1.1	15	2023-07-04T15:09:35+05:30	2653	45	2.3	10
2023-07-04T15:10:50+05:30	2654	54	1.3	0	2023-07-04T15:10:50+05:30	2654	51	1.9	0	2023-07-04T15:10:50+05:30	2654	53	1.1	0	2023-07-04T15:10:50+05:30	2654	45	2.3	0
2023-07-04T15:12:05+05:30	2655	54	1.4	0	2023-07-04T15:12:05+05:30	2655	51	1.9	0	2023-07-04T15:12:05+05:30	2655	53	1.1	0	2023-07-04T15:12:05+05:30	2655	45	2.4	0
2023-07-04T15:13:20+05:30	2656	54	1.4	0	2023-07-04T15:13:20+05:30	2656	51	1.9	0	2023-07-04T15:13:20+05:30	2656	53	1.1	0	2023-07-04T15:13:20+05:30	2656	45	2.4	0
2023-07-04T15:14:35+05:30	2657	54	1.4	0	2023-07-04T15:14:35+05:30	2657	51	1.9	0	2023-07-04T15:14:35+05:30	2657	53	1.1	0	2023-07-04T15:14:35+05:30	2657	45	2.4	0
2023-07-04T15:15:50+05:30	2658	54	1.4	0	2023-07-04T15:15:50+05:30	2658	51	1.9	0	2023-07-04T15:15:50+05:30	2658	53	1.1	0	2023-07-04T15:15:50+05:30	2658	45	2.4	0
2023-07-04T15:17:05+05:30	2659	54	1.4	0	2023-07-04T15:17:05+05:30	2659	51	1.9	0	2023-07-04T15:17:05+05:30	2659	53	1.1	0	2023-07-04T15:17:05+05:30	2659	45	2.4	0
2023-07-04T15:18:20+05:30	2660	54	1.5	0	2023-07-04T15:18:20+05:30	2660	51	1.9	0	2023-07-04T15:18:20+05:30	2660	53	1.1	0	2023-07-04T15:18:20+05:30	2660	45	2.4	0
2023-07-04T15:19:35+05:30	2661	54	1.5	0	2023-07-04T15:19:35+05:30	2661	51	1.9	0	2023-07-04T15:19:35+05:30	2661	53	1.1	0	2023-07-04T15:19:35+05:30	2661	45	2.4	0
2023-07-04T16:02:56+05:30	2686	52	1.7	0	2023-07-04T16:02:56+05:30	2686	49	2.3	0	2023-07-04T16:02:56+05:30	2686	50	1.4	0	2023-07-04T16:02:56+05:30	2686	39	2.8	0
2023-07-04T16:05:03+05:30	2687	52	1.7	0	2023-07-04T16:05:03+05:30	2687	49	2.3	0	2023-07-04T16:05:03+05:30	2687	50	1.4	0	2023-07-04T16:05:03+05:30	2687	39	2.8	0
2023-07-04T16:18:57+05:30	2693	52	1.8	0	2023-07-04T16:18:57+05:30	2693	49	2.5	0	2023-07-04T16:18:57+05:30	2693	50	1.4	0	2023-07-04T16:18:57+05:30	2693	39	2.9	0
2023-07-04T16:21:16+05:30	2694	52	1.8	0	2023-07-04T16:21:16+05:30	2694	49	2.5	0	2023-07-04T16:21:16+05:30	2694	50	1.5	0	2023-07-04T16:21:16+05:30	2694	39	2.9	0
2023-07-04T16:23:35+05:30	2695	52	1.8	0	2023-07-04T16:23:35+05:30	2695	49	2.5	0	2023-07-04T16:23:35+05:30	2695	50	1.5	0	2023-07-04T16:23:35+05:30	2695	39	2.9	0
2023-07-04T16:26:29+05:30	2696	51	1.8	0	2023-07-04T16:26:29+05:30	2696	49	2.5	0	2023-07-04T16:26:29+05:30	2696	49	1.5	0	2023-07-04T16:26:29+05:30	2696	39	3	0
2023-07-04T16:29:23+05:30	2697	51	1.9	0	2023-07-04T16:29:23+05:30	2697	49	2.7	0	2023-07-04T16:29:23+05:30	2697	49	1.5	0	2023-07-04T16:29:23+05:30	2697	39	3	0
2023-07-04T16:32:17+05:30	2698	51	1.9	0	2023-07-04T16:32:17+05:30	2698	49	2.7	0	2023-07-04T16:32:17+05:30	2698	49	1.5	0	2023-07-04T16:32:17+05:30	2698	39	3	0
2023-07-04T16:35:11+05:30	2699	51	1.9	0	2023-07-04T16:35:11+05:30	2699	49	2.7	0	2023-07-04T16:35:11+05:30	2699	49	1.5	0	2023-07-04T16:35:11+05:30	2699	39	3	0
2023-07-05T09:43:52+05:30	2728	42	0.1	0	2023-07-05T09:43:52+05:30	2728	45	0.2	0	2023-07-05T09:43:52+05:30	2728	40	0.1	0	2023-07-05T09:43:52+05:30	2728	47	0.3	0
2023-07-05T09:45:26+05:30	2729	42	0.1	0	2023-07-05T09:45:26+05:30	2729	45	0.2	0	2023-07-05T09:45:26+05:30	2729	40	0.1	0	2023-07-05T09:45:26+05:30	2729	47	0.3	0
2023-07-05T09:47:00+05:30	2730	42	0.1	0	2023-07-05T09:47:00+05:30	2730	45	0.2	0	2023-07-05T09:47:00+05:30	2730	40	0.1	0	2023-07-05T09:47:00+05:30	2730	47	0.3	0
2023-07-05T09:48:34+05:30	2731	42	0.1	0	2023-07-05T09:48:34+05:30	2731	45	0.2	0	2023-07-05T09:48:34+05:30	2731	40	0.1	0	2023-07-05T09:48:34+05:30	2731	47	0.3	0
2023-07-05T09:50:08+05:30	2732	42	0.1	0	2023-07-05T09:50:08+05:30	2732	45	0.3	0	2023-07-05T09:50:08+05:30	2732	39	0.1	0	2023-07-05T09:50:08+05:30	2732	47	0.3	0
2023-07-05T10:57:17+05:30	2765	42	0.3	0	2023-07-05T10:57:17+05:30	2765	42	0.7	0	2023-07-05T10:57:17+05:30	2765	38	0.3	0	2023-07-05T10:57:17+05:30	2765	44	0.9	0
2023-07-05T10:59:19+05:30	2766	42	0.3	0	2023-07-05T10:59:19+05:30	2766	42	0.7	0	2023-07-05T10:59:19+05:30	2766	38	0.3	0	2023-07-05T10:59:19+05:30	2766	44	0.9	0
2023-07-05T11:01:21+05:30	2767	42	0.3	0	2023-07-05T11:01:21+05:30	2767	42	0.7	0	2023-07-05T11:01:21+05:30	2767	38	0.4	0	2023-07-05T11:01:21+05:30	2767	44	0.9	0
2023-07-05T11:03:23+05:30	2768	42	0.3	0	2023-07-05T11:03:23+05:30	2768	42	0.7	0	2023-07-05T11:03:23+05:30	2768	38	0.4	0	2023-07-05T11:03:23+05:30	2768	44	0.9	0
2023-07-05T11:05:25+05:30	2769	43	0.3	0	2023-07-05T11:05:25+05:30	2769	42	0.7	0	2023-07-05T11:05:25+05:30	2769	38	0.4	0	2023-07-05T11:05:25+05:30	2769	44	0.9	0
2023-07-05T11:07:27+05:30	2770	43	0.4	0	2023-07-05T11:07:27+05:30	2770	42	0.7	0	2023-07-05T11:07:27+05:30	2770	37	0.4	0	2023-07-05T11:07:27+05:30	2770	44	0.9	0
2023-07-05T11:09:15+05:30	2771	43	0.4	0	2023-07-05T11:09:15+05:30	2771	42	0.7	0	2023-07-05T11:09:15+05:30	2771	37	0.4	0	2023-07-05T11:09:15+05:30	2771	44	0.9	0
2023-07-05T11:11:03+05:30	2772	43	0.4	0	2023-07-05T11:11:03+05:30	2772	42	0.7	0	2023-07-05T11:11:03+05:30	2772	37	0.4	0	2023-07-05T11:11:03+05:30	2772	44	1	0
2023-07-05T11:12:51+05:30	2773	43	0.4	0	2023-07-05T11:12:51+05:30	2773	42	0.7	0	2023-07-05T11:12:51+05:30	2773	37	0.4	0	2023-07-05T11:12:51+05:30	2773	44	1	0
2023-07-05T12:03:54+05:30	2806	42	0.7	0	2023-07-05T12:03:54+05:30	2806	39	1	0	2023-07-05T12:03:54+05:30	2806	35	0.7	0	2023-07-05T12:03:54+05:30	2806	40	1.4	0
2023-07-05T12:06:07+05:30	2807	42	0.7	0	2023-07-05T12:06:07+05:30	2807	39	1	0	2023-07-05T12:06:07+05:30	2807	35	0.7	0	2023-07-05T12:06:07+05:30	2807	40	1.4	0
2023-07-05T12:08:20+05:30	2808	42	0.7	0	2023-07-05T12:08:20+05:30	2808	39	1	0	2023-07-05T12:08:20+05:30	2808	35	0.7	0	2023-07-05T12:08:20+05:30	2808	40	1.4	0
2023-07-05T12:10:33+05:30	2809	42	0.7	0	2023-07-05T12:10:33+05:30	2809	39	1.1	0	2023-07-05T12:10:33+05:30	2809	35	0.7	0	2023-07-05T12:10:33+05:30	2809	40	1.5	0
2023-07-05T12:12:46+05:30	2810	42	0.7	0	2023-07-05T12:12:46+05:30	2810	39	1.1	0	2023-07-05T12:12:46+05:30	2810	34	0.7	0	2023-07-05T12:12:46+05:30	2810	40	1.5	0
2023-07-05T12:14:59+05:30	2811	42	0.7	0	2023-07-05T12:14:59+05:30	2811	39	1.1	0	2023-07-05T12:14:59+05:30	2811	34	0.7	0	2023-07-05T12:14:59+05:30	2811	39	1.5	0
2023-07-05T12:17:12+05:30	2812	42	0.7	0	2023-07-05T12:17:12+05:30	2812	38	1.1	0	2023-07-05T12:17:12+05:30	2812	34	0.7	0	2023-07-05T12:17:12+05:30	2812	39	1.5	0
2023-07-05T12:19:25+05:30	2813	42	0.7	0	2023-07-05T12:19:25+05:30	2813	38	1.1	0	2023-07-05T12:19:25+05:30	2813	34	0.7	0	2023-07-05T12:19:25+05:30	2813	39	1.5	0
2023-07-05T12:21:38+05:30	2814	42	0.7	0	2023-07-05T12:21:38+05:30	2814	38	1.1	0	2023-07-05T12:21:38+05:30	2814	34	0.7	0	2023-07-05T12:21:38+05:30	2814	39	1.5	0
2023-07-05T12:23:51+05:30	2815	42	0.7	0	2023-07-05T12:23:51+05:30	2815	38	1.1	0	2023-07-05T12:23:51+05:30	2815	34	0.7	0	2023-07-05T12:23:51+05:30	2815	39	1.5	0
2023-07-05T12:26:16+05:30	2816	41	0.7	0	2023-07-05T12:26:16+05:30	2816	38	1.1	0	2023-07-05T12:26:16+05:30	2816	34	0.7	0	2023-07-05T12:26:16+05:30	2816	39	1.5	0
2023-07-05T12:28:41+05:30	2817	41	0.7	0	2023-07-05T12:28:41+05:30	2817	38	1.1	0	2023-07-05T12:28:41+05:30	2817	34	0.7	0	2023-07-05T12:28:41+05:30	2817	39	1.6	0
2023-07-05T12:31:06+05:30	2818	41	0.7	0	2023-07-05T12:31:06+05:30	2818	38	1.1	0	2023-07-05T12:31:06+05:30	2818	34	0.7	0	2023-07-05T12:31:06+05:30	2818	38	1.6	0
2023-07-05T12:33:31+05:30	2819	41	0.8	0	2023-07-05T12:33:31+05:30	2819	38	1.2	0	2023-07-05T12:33:31+05:30	2819	34	0.8	0	2023-07-05T12:33:31+05:30	2819	38	1.6	0
2023-07-05T12:35:56+05:30	2820	41	0.8	0	2023-07-05T12:35:56+05:30	2820	38	1.2	0	2023-07-05T12:35:56+05:30	2820	34	0.8	0	2023-07-05T12:35:56+05:30	2820	38	1.6	0
2023-07-05T12:38:21+05:30	2821	41	0.8	0	2023-07-05T12:38:21+05:30	2821	37	1.2	0	2023-07-05T12:38:21+05:30	2821	34	0.8	0	2023-07-05T12:38:21+05:30	2821	38	1.6	0
2023-07-05T12:40:46+05:30	2822	41	0.8	0	2023-07-05T12:40:46+05:30	2822	37	1.2	0	2023-07-05T12:40:46+05:30	2822	34	0.8	0	2023-07-05T12:40:46+05:30	2822	38	1.6	0
2023-07-05T12:43:11+05:30	2823	41	0.8	0	2023-07-05T12:43:11+05:30	2823	37	1.2	0	2023-07-05T12:43:11+05:30	2823	34	0.8	0	2023-07-05T12:43:11+05:30	2823	38	1.6	0

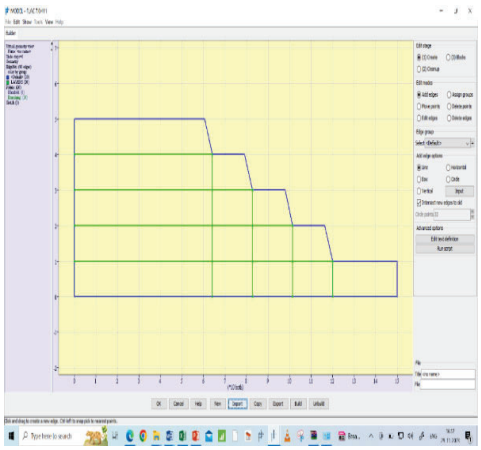
APPENDIX III
(Methodology followed in Numerical modelling)

Methodology adopted for numerical modelling (Flac 2D) software:

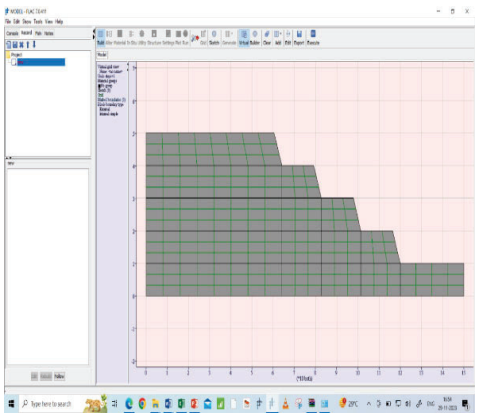
Step-1 Initial Screen in Flac2D:



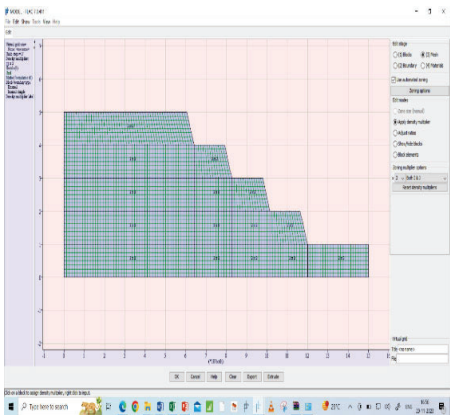
Step-2 Define the Geometry:



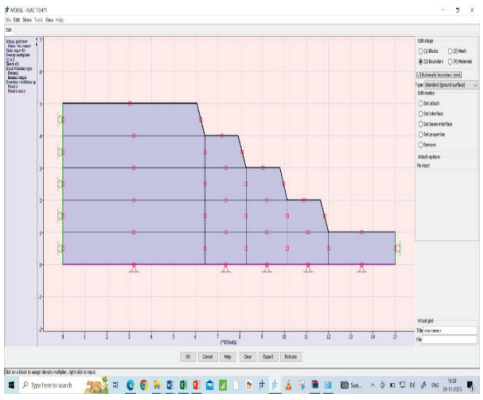
Step-3 Building of model:



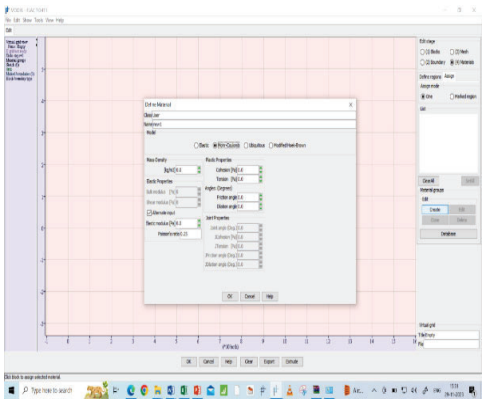
Step-4 Mesh Generation:



Step-5 Boundary Conditions:



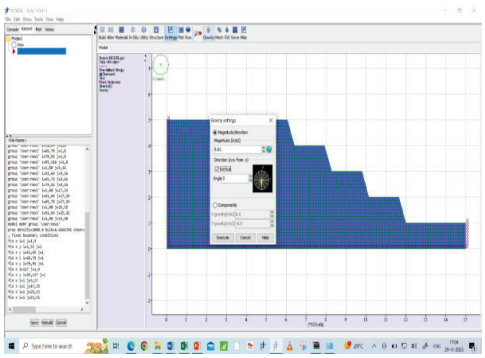
Step-6 Material Properties:



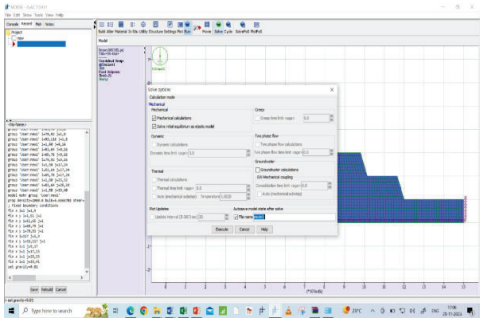
Step-7 Initial Conditions:



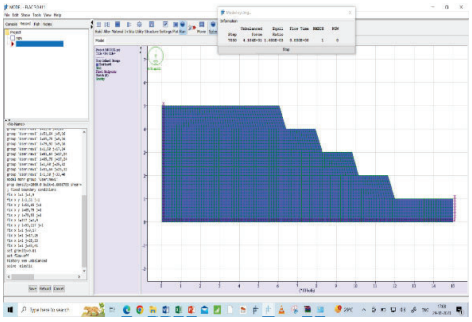
Step-8 Model settings with gravity:



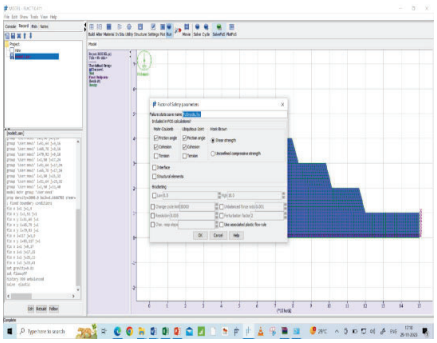
Step-9 Begin the Analysis:

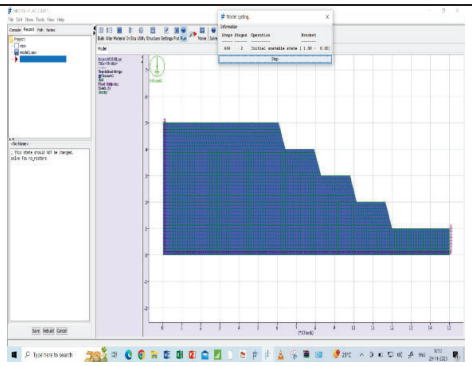


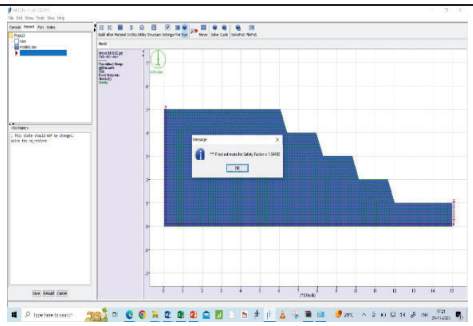
Step-10 Running the analysis:

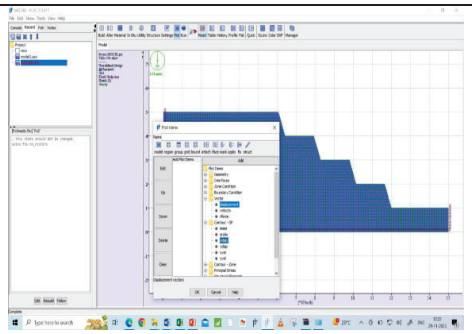


Step-11 Solve for FoS:

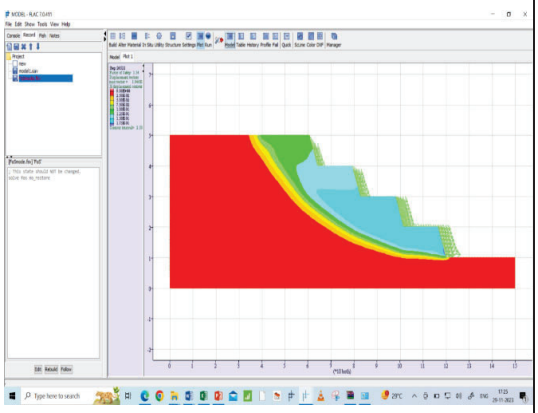




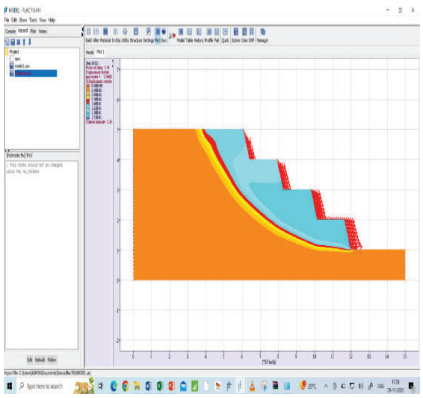




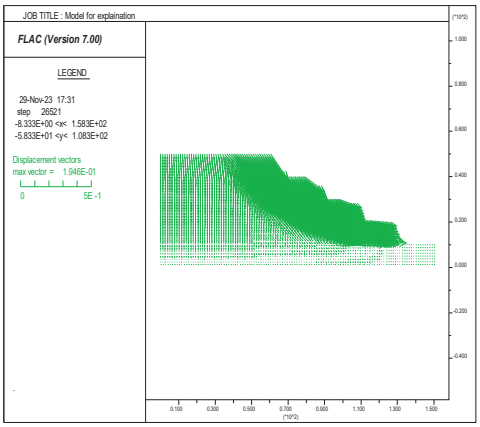
Displacement results

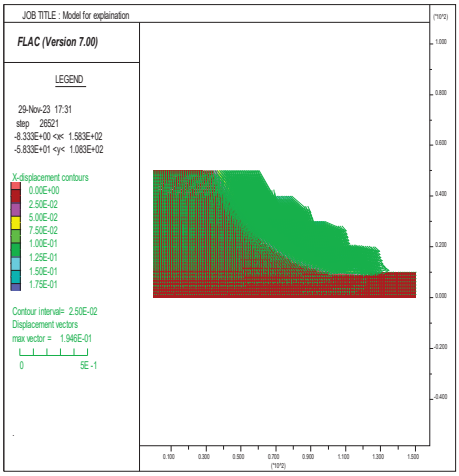


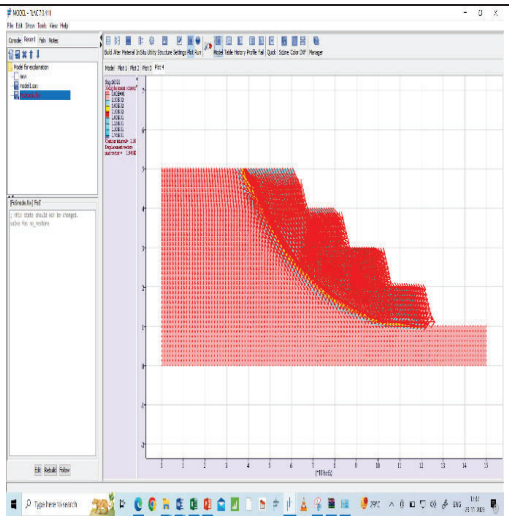
x-direction displacement



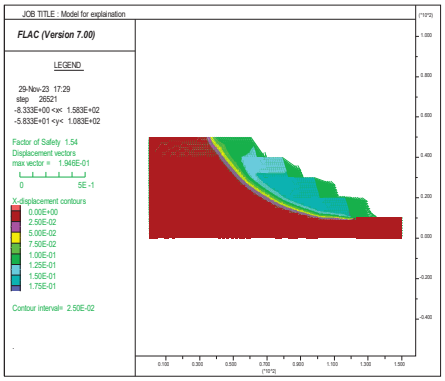
Total displacement







Final FoS, resultant displacement, and vector displacement



APPENDIX IV

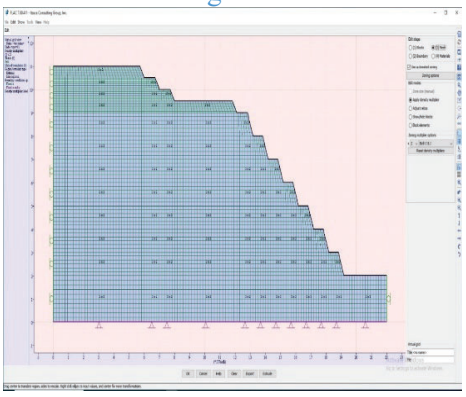
(Numerical modelling based on site conditions for all three case study mines)

Numerical modelling of case study-I

East side benches with grid pattern in Flac2D.



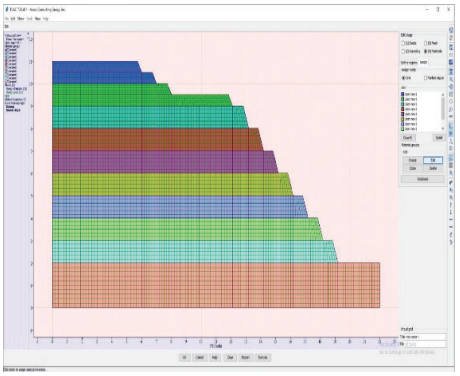
Meshing the model



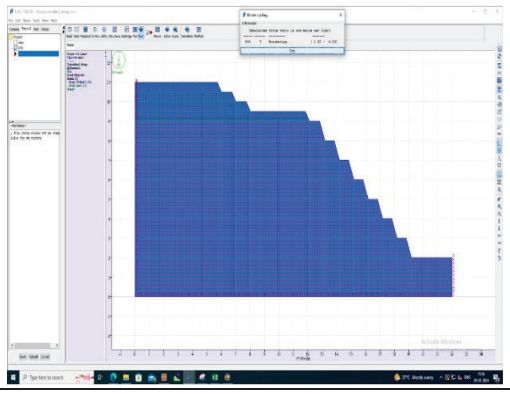
Assigning material properties



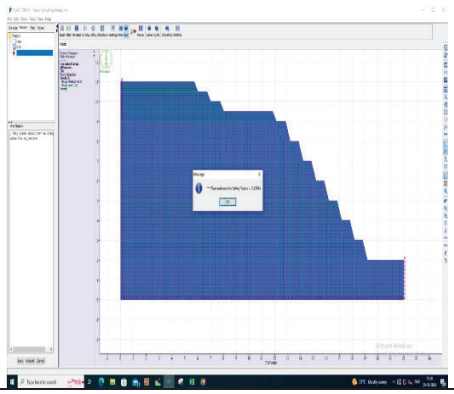
After assigning material properties



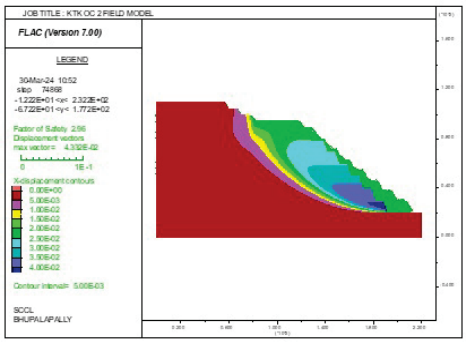
Running the model



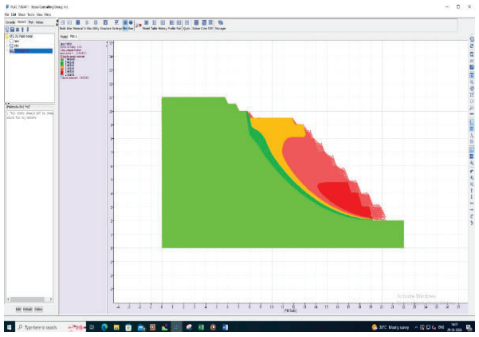
FoS as a result



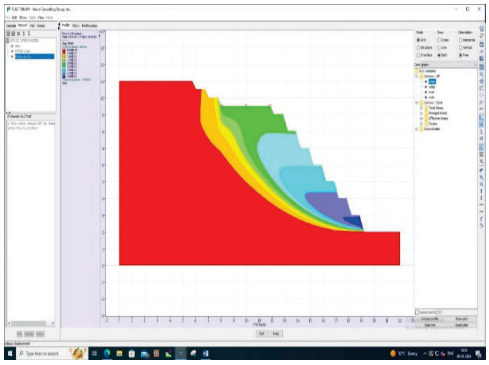
Results of the KTKOC-2 model

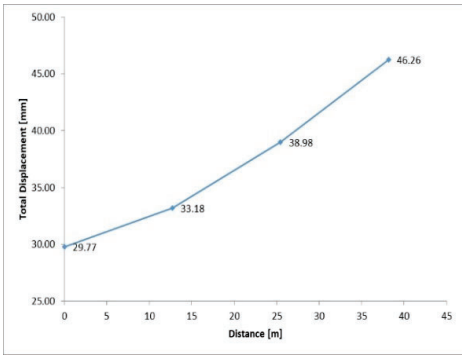


Stress distribution within the slope



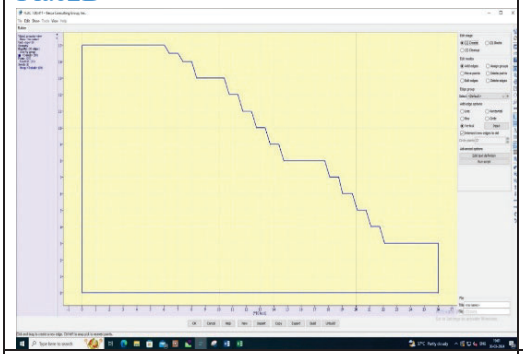
Slope displacement at nodes installed location



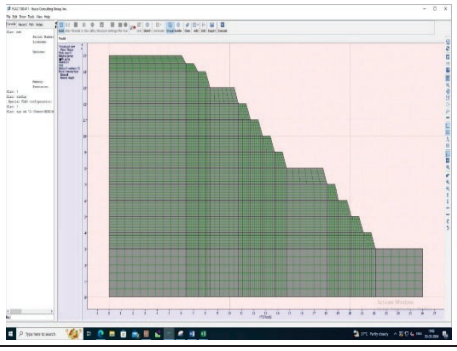


Numerical modelling of case study II

Mine benches with grid pattern in Flac2D

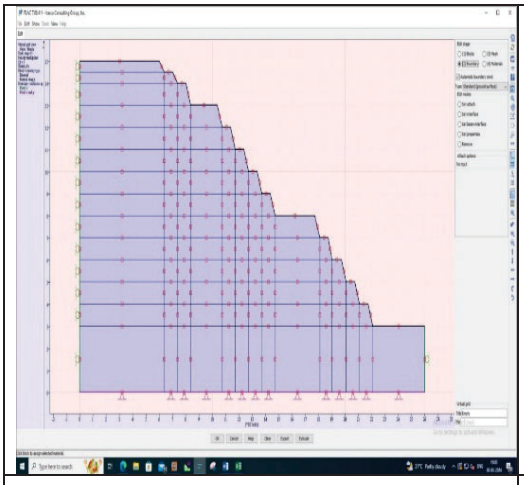


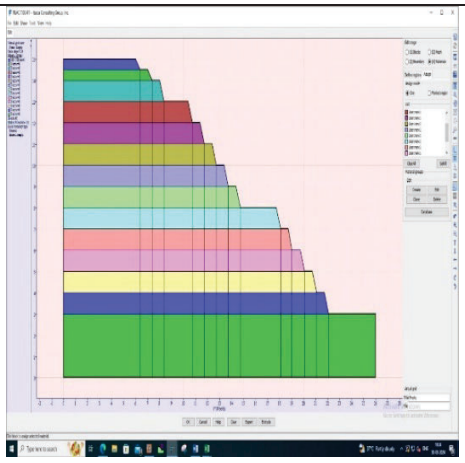
Meshing the model



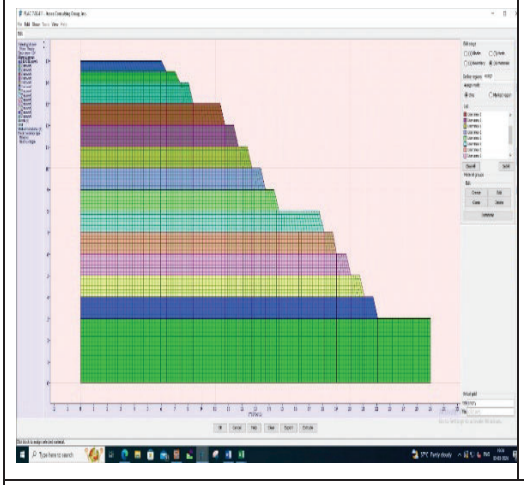
Applying boundary conditions

Assigning material properties

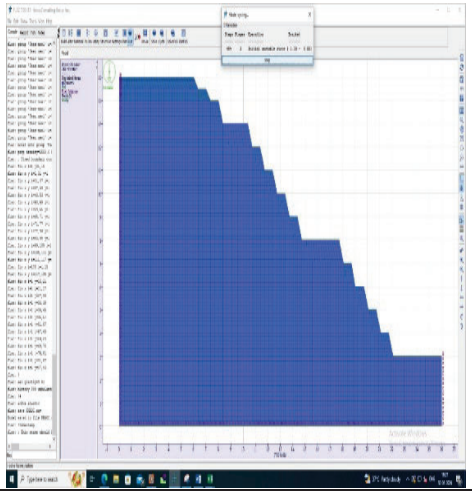




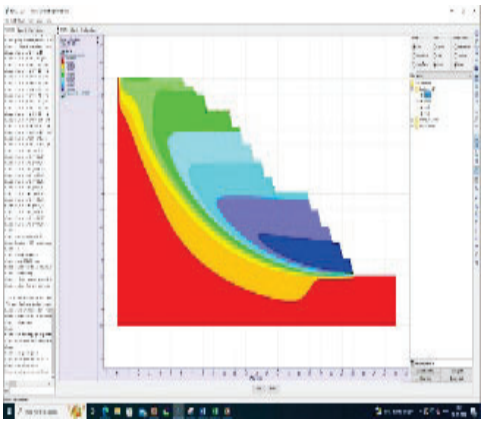
Assigning material properties

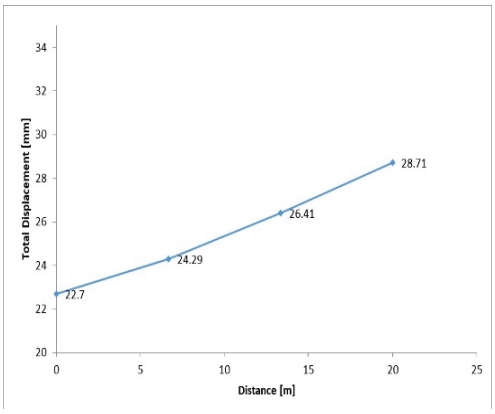


Running the model



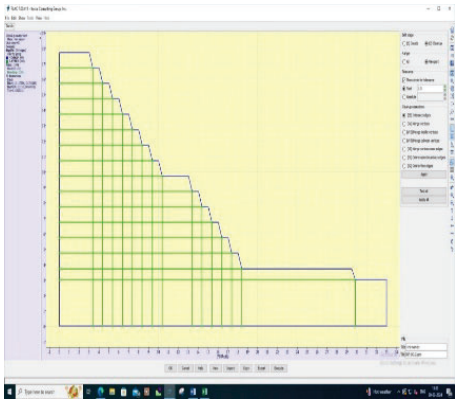
Slope displacement at nodes installed location



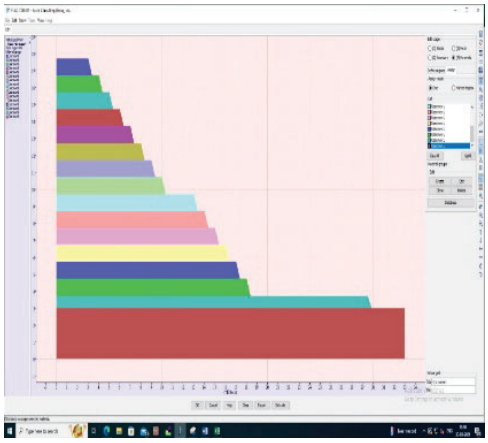


Numerical modelling of case study-III

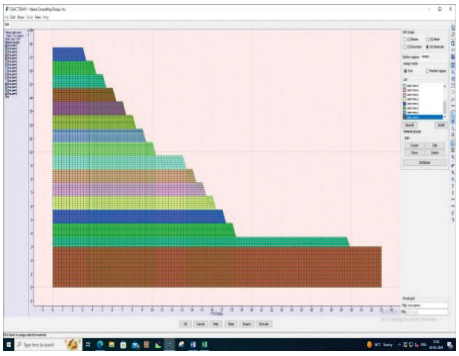
Geometry drawing with grid pattern in Flac2D



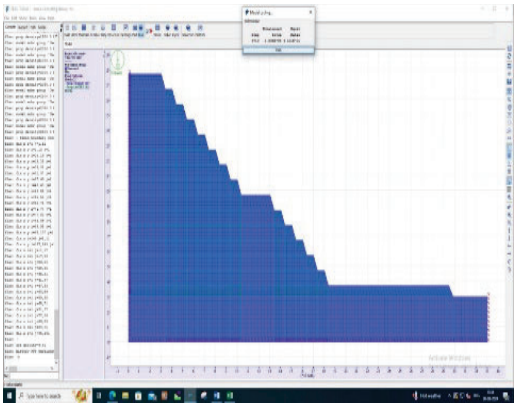
Material assignment for individual benches



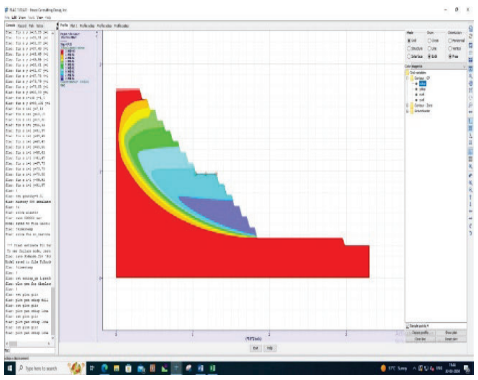
View after material assignment for individual benches

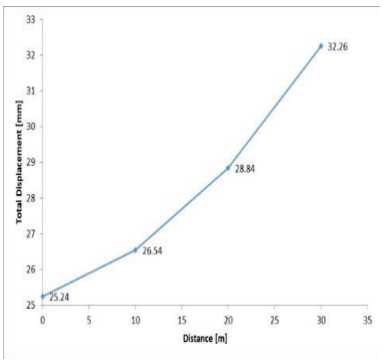


Model execution



Slope displacement at nodes installed location

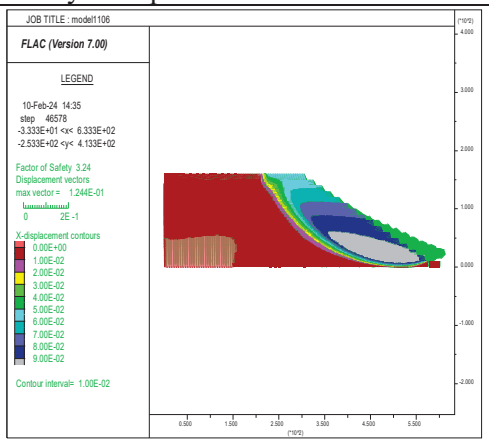




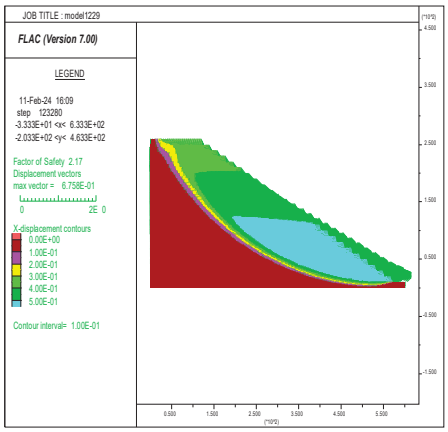
APPENDIX V

(Numerical modelling based on parametric study for all three case study mines)

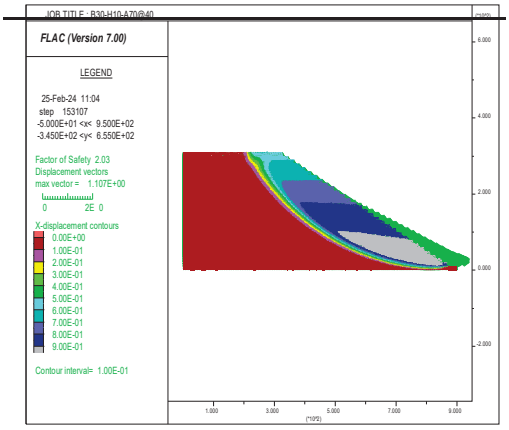
Density vs depth



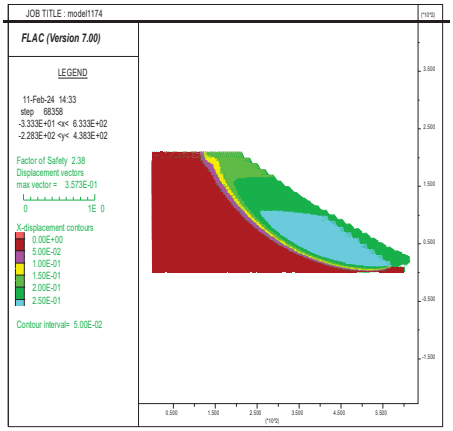
DEPTH 150, SA70, D1800, C600, AF30, YM5



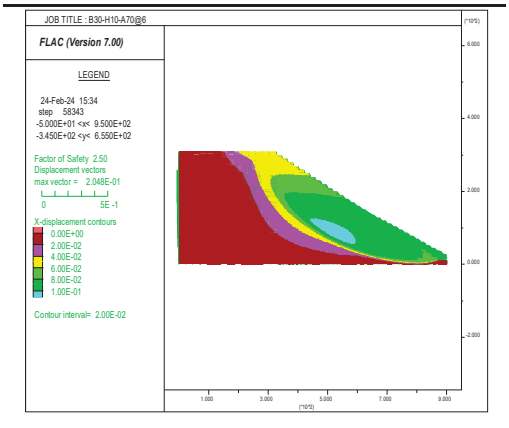
DEPTH 250, SA70, D2250, C600, AF30, YM5



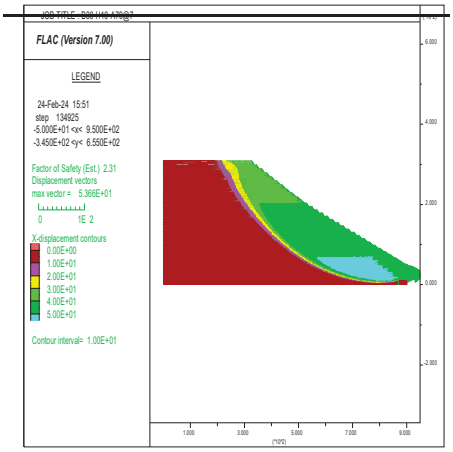
DEPTH 300, SA70, D2500, C600, AF30, YM5



DEPTH 200, SA70, D2500, C600, AF30, YM5

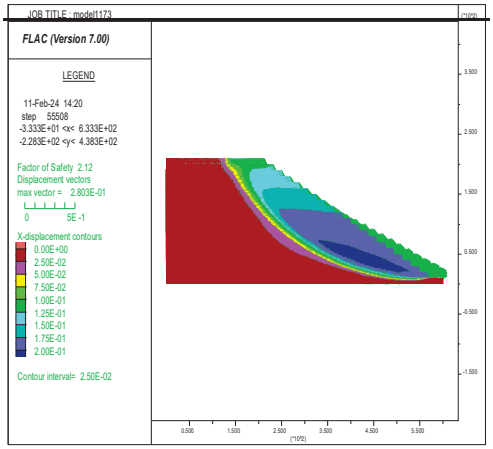


DEPTH 300, SA70, D1500, C600, AF30, YM5

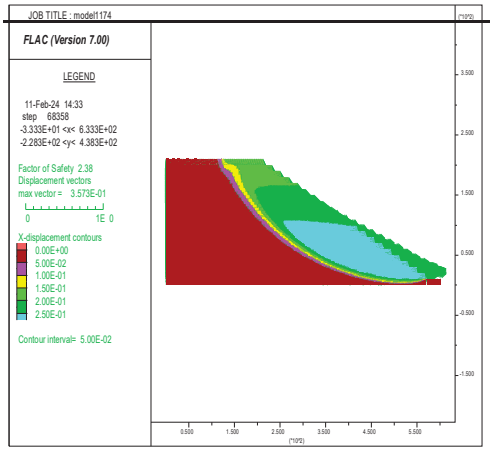


DEPTH 300, SA70, D1800, C600, AF30, YM5

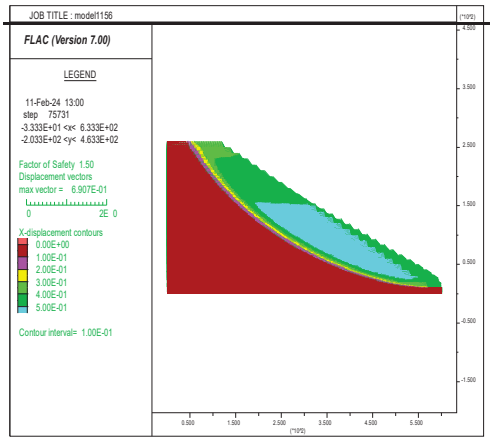
Cohesion vs depth



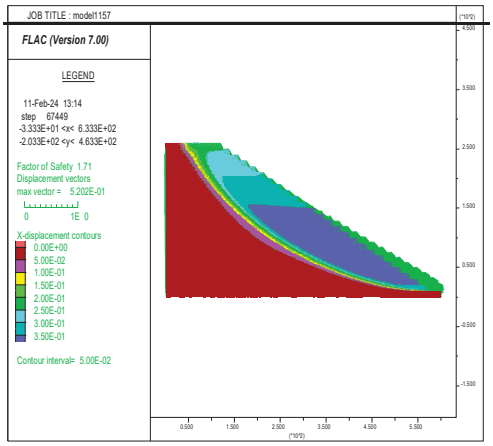
DEPTH 200, SA70, D2500, C450, AF30, YM5



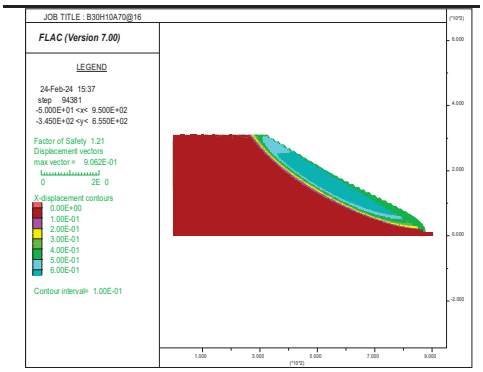
DEPTH 200, SA70, D2500, C600, AF30, YM5



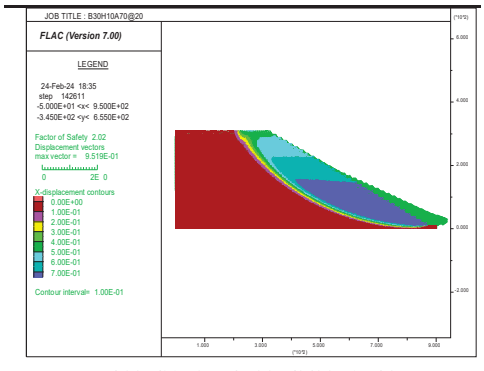
DEPTH 250, SA70, D2500, C180, AF30, YM5



DEPTH 250, SA70, D2500, C300, AF30, YM5

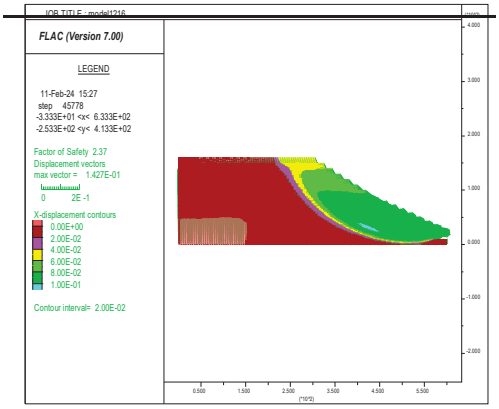


DEPTH 300, SA70, D2500, C60, AF30, YM5

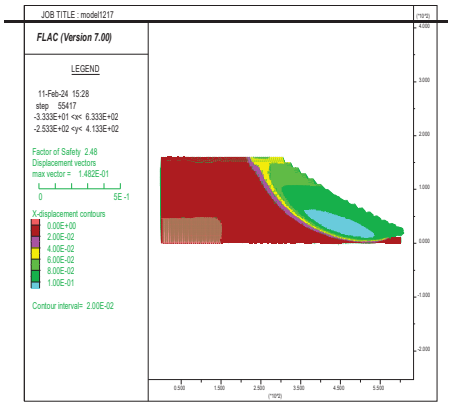


DEPTH 300, SA70, D2500, C600, AF30, YM5

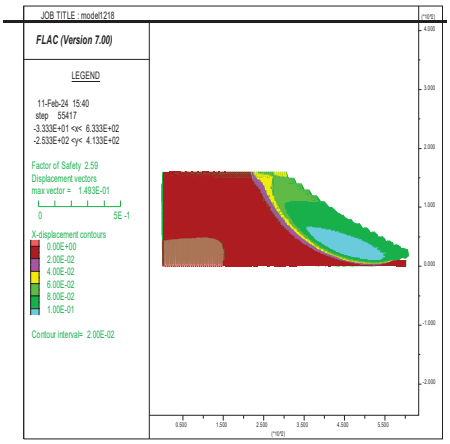
Friction vs depth



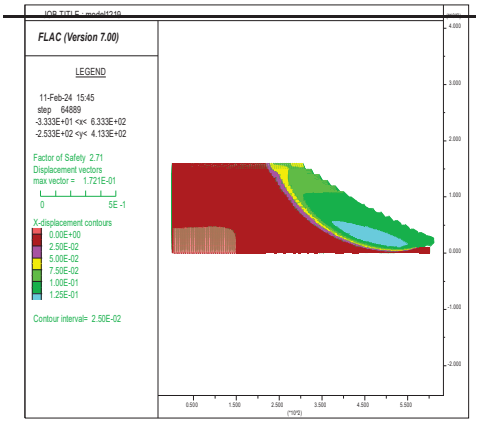
DEPTH 150, SA70, D2500, C600, AF24, YM5



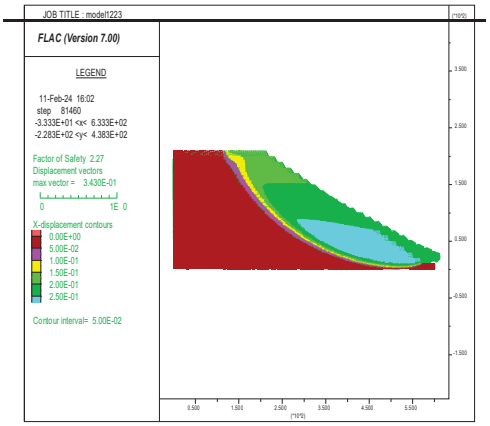
DEPTH 150, SA70, D2500, C600, AF26, YM5



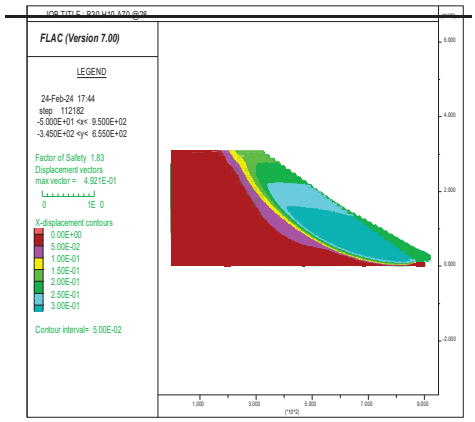
DEPTH 150, SA70, D2500, C600, AF28, YM5



DEPTH 150, SA70, D2500, C600, AF30, YM5

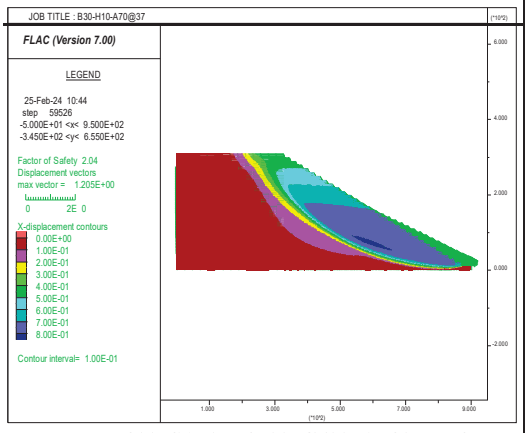


DEPTH 200, SA70, D2500, C600, AF28, YM5

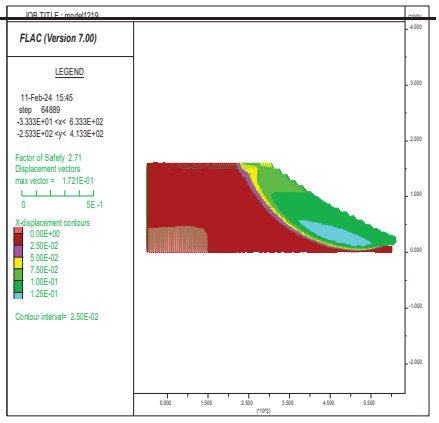


DEPTH 300, SA70, D2500, C600, AF26, YM5

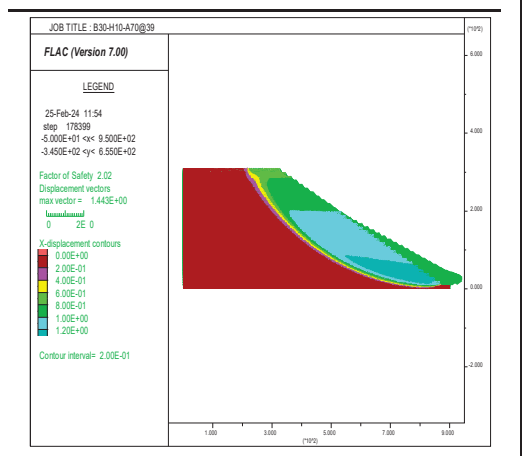
Elastic modulus vs depth



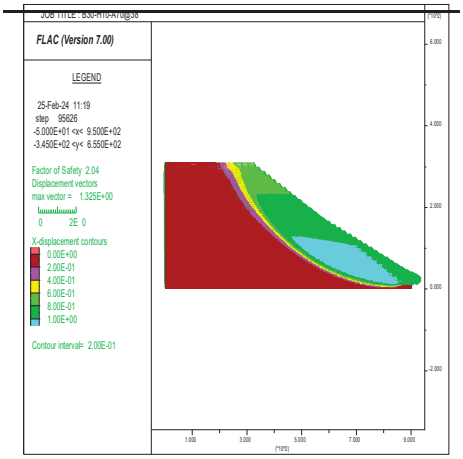
DEPTH 300, SA70, D2500, C600, AF30, YM2



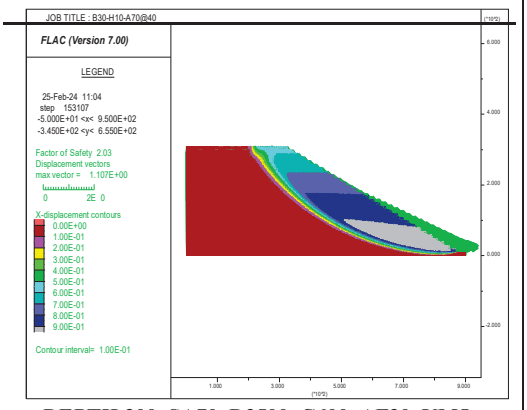
DEPTH 150, SA70, D2500, C600, AF30, YM5



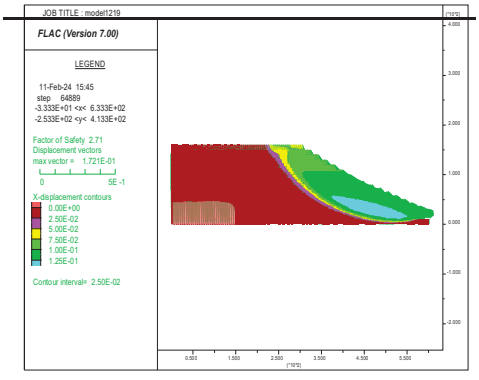
DEPTH 300, SA70, D2500, C600, AF30, YM4



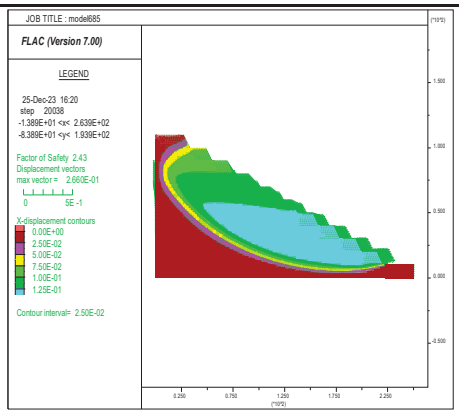
DEPTH 300, SA70, D2500, C600, AF30, YM3



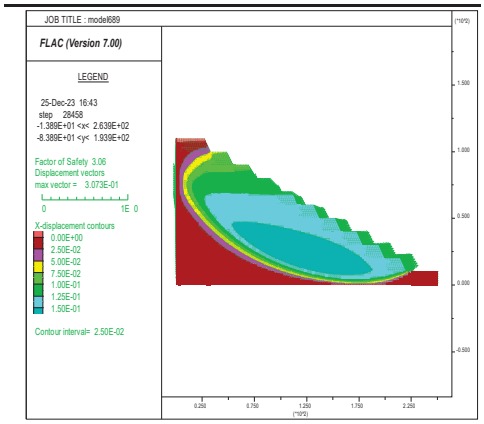
DEPTH 300, SA70, D2500, C600, AF30, YM5



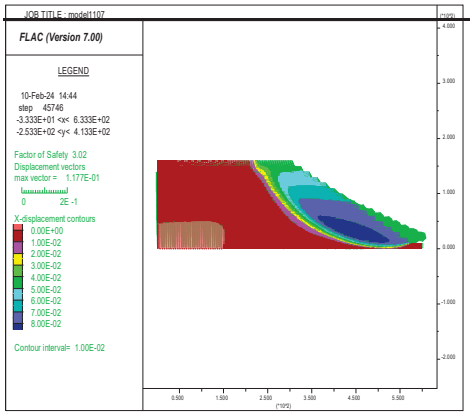
DEPTH 150, SA70, D2500, C600, AF28, YM5



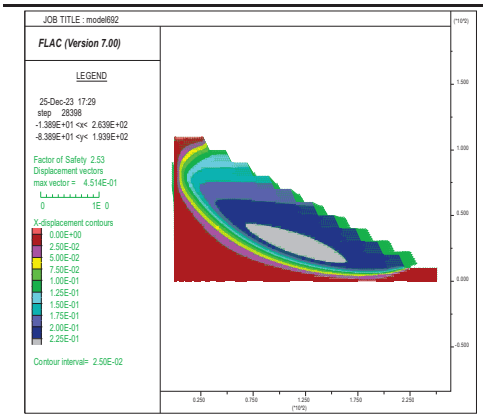
DEPTH 100, SA70, D1500, C60, AF22, YM1



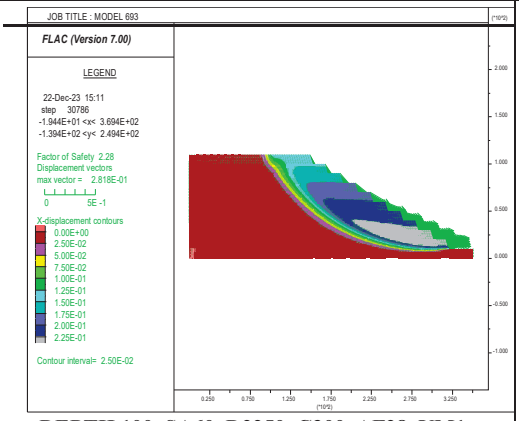
DEPTH 100, SA60, D2500, C300, AF28, YM1



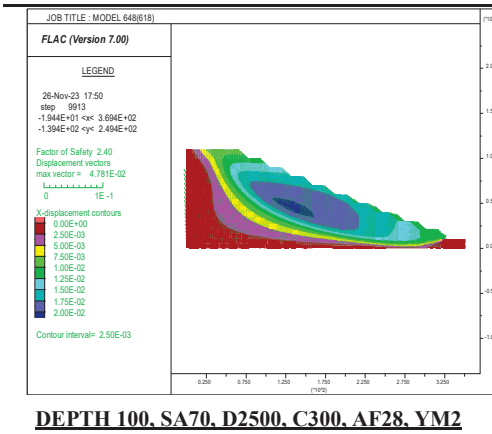
DEPTH 150, SA40, D1500, C60, AF22, YM4



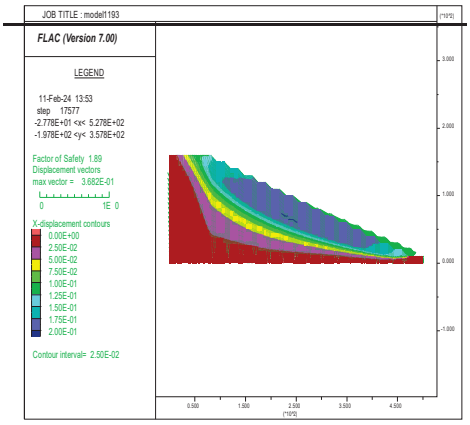
DEPTH 100, SA60, D1950, C300, AF28, YM1



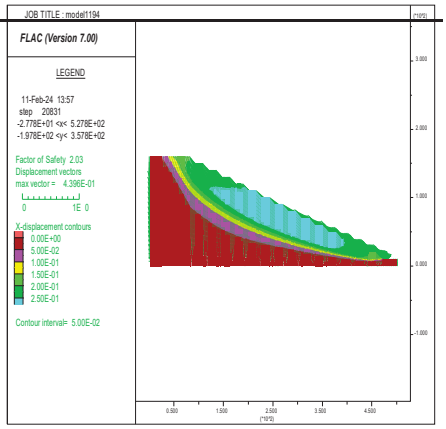
DEPTH 100, SA60, D2250, C300, AF28, YM1



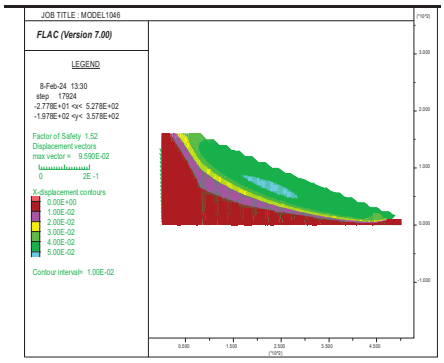
DEPTH 100, SA70, D2500, C300, AF28, YM2



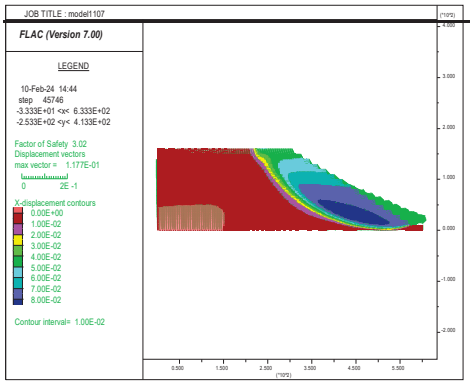
DEPTH 150, SA40, D1500, C60, AF26, YM1



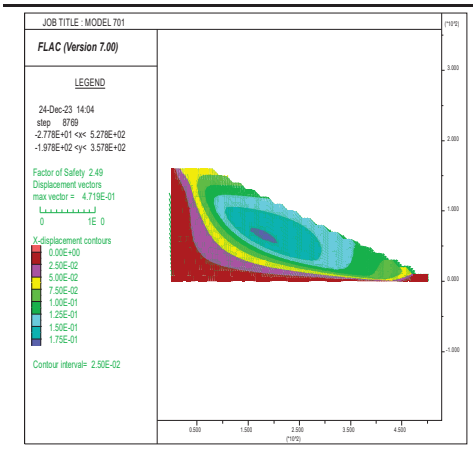
DEPTH 150, SA40, D1500, C60, AF28, YM1



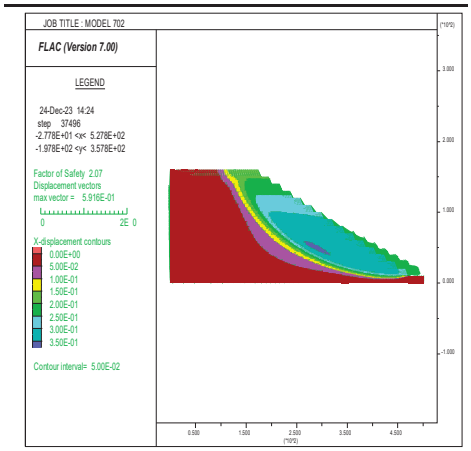
DEPTH 150, SA40, D1500, C60, AF30, YM1



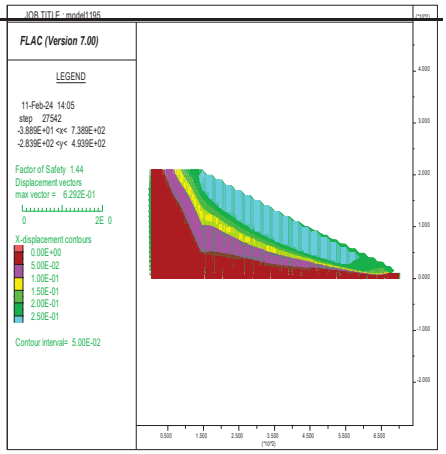
DEPTH 150, SA40, D1500, C60, AF22, YM4



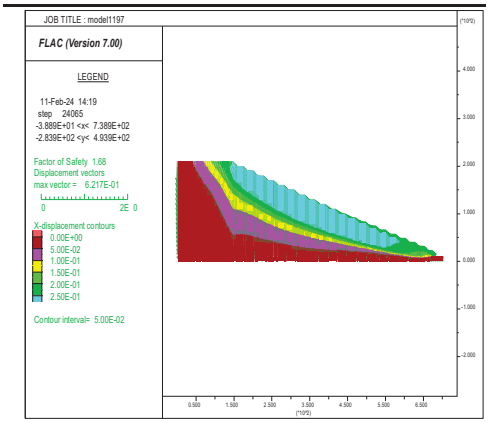
DEPTH 150, SA40, D1500, C60, AF22, YM2



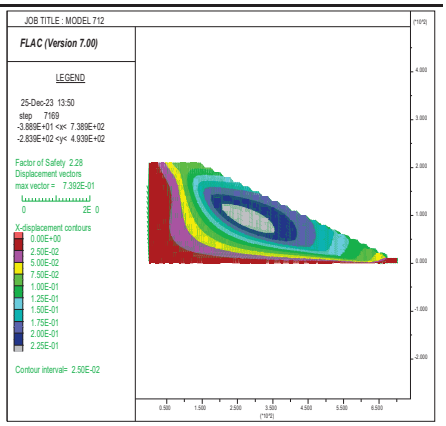
DEPTH 150, SA40, D2500, C300, AF28, YM1



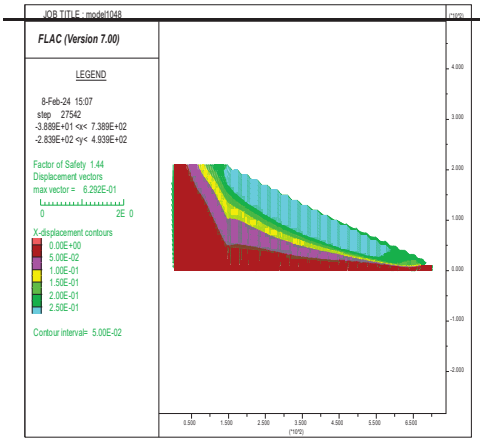
DEPTH 200, SA40, D1500, C60, AF22, YM1



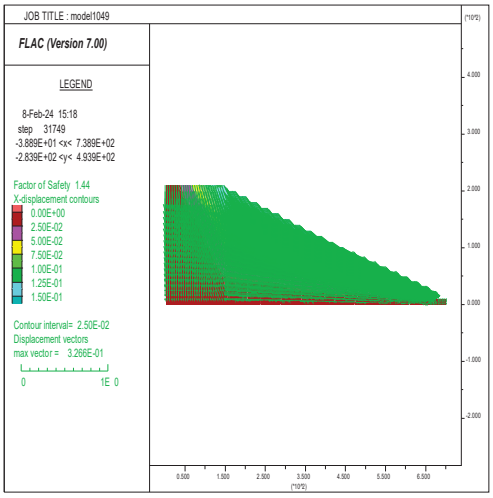
DEPTH 200, SA40, D1500, C60, AF26, YM1



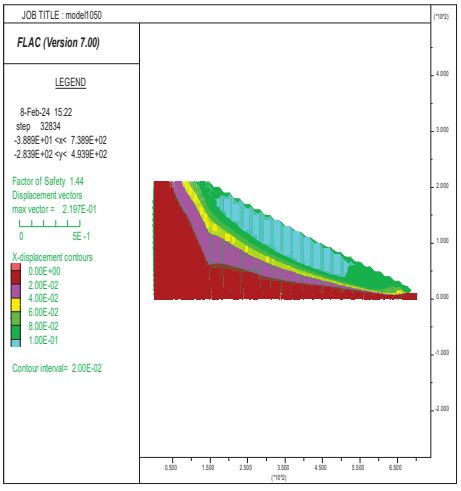
DEPTH 200, SA40, D2500, C300, AF28, YM1



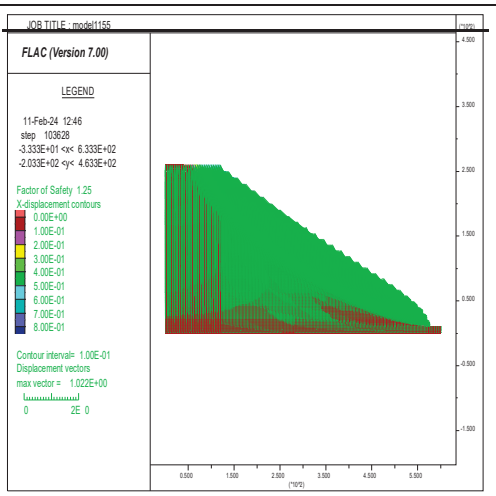
DEPTH 200, SA40, D1500, C60, AF22, YM1



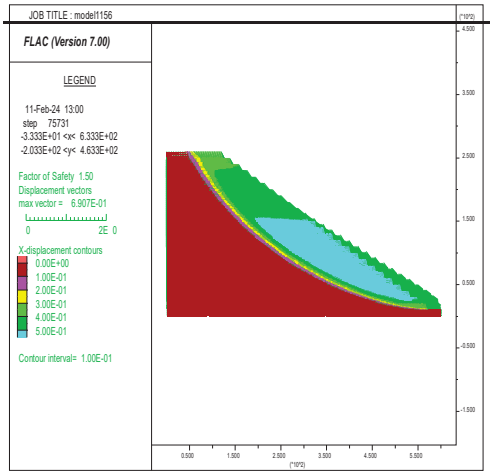
DEPTH 200, SA40, D1500, C60, AF22, YM2



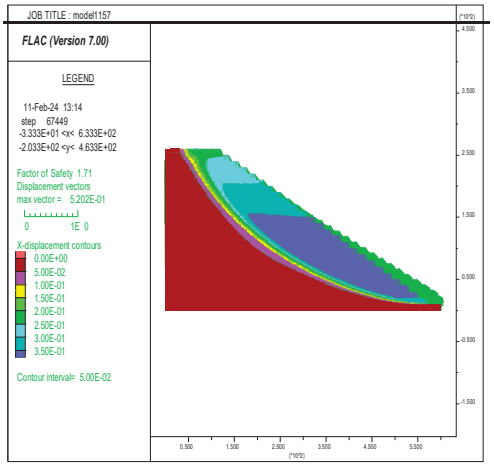
DEPTH 200, SA40, D1500, C60, AF22, YM3



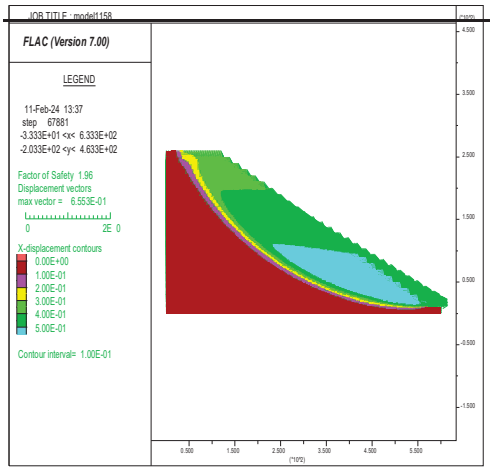
DEPTH 250, SA70, D2500, C60, AF30, YM1



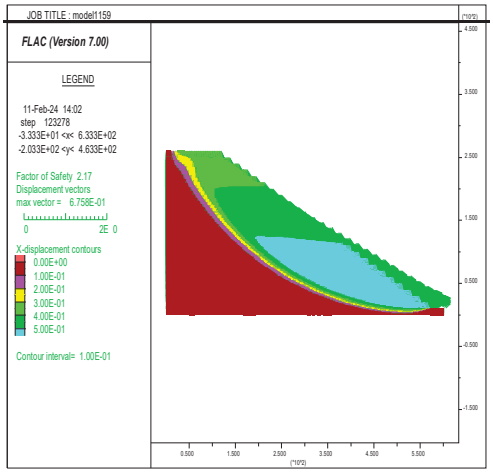
DEPTH 250, SA70, D2500, C180, AF30, YM5



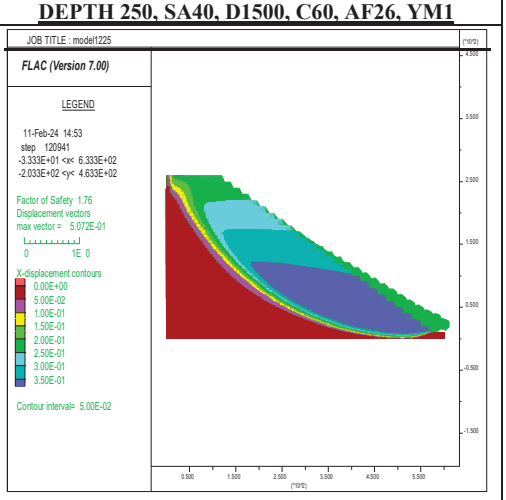
DEPTH 250, SA70, D2500, C300, AF30, YM5



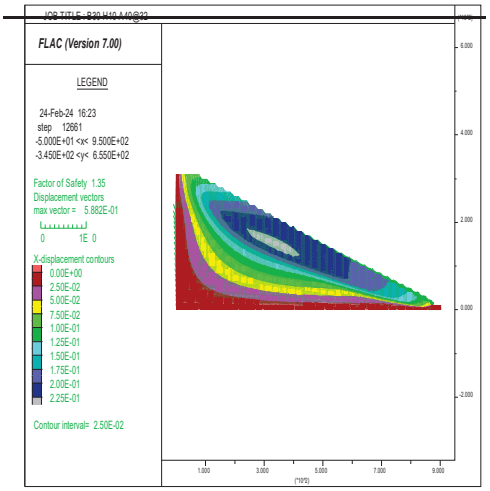
DEPTH 250, SA40, D1500, C60, AF26, YM1



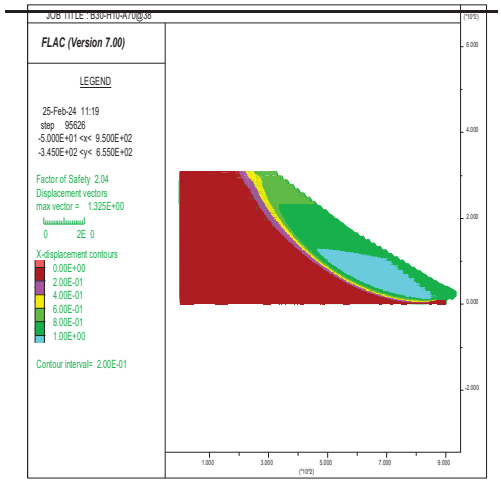
DEPTH 250, SA70, D2250, C600, AF30, YM5



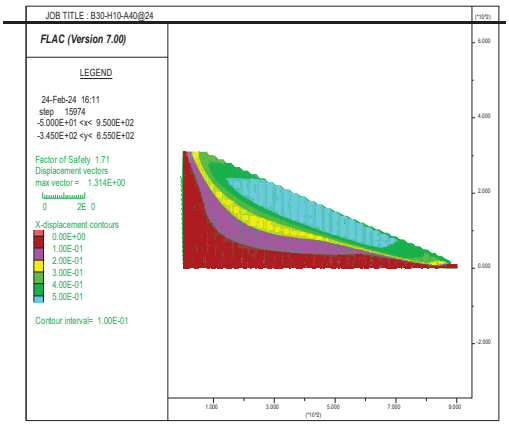
DEPTH 250, SA70, D2500, C600, AF22, YM5



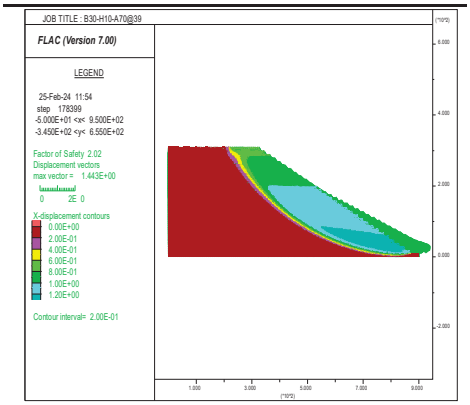
DEPTH 300, SA40, D1500, C60, AF22, YM2



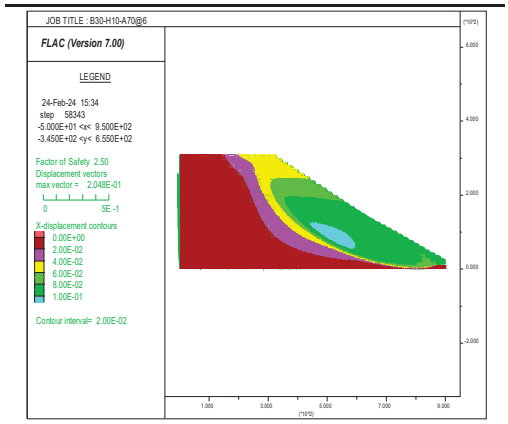
DEPTH 300, SA70, D2500, C600, AF30, YM3



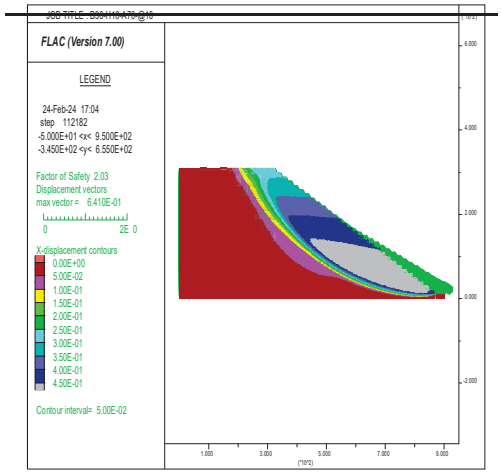
DEPTH 300, SA40, D1500, C60, AF28, YM1



DEPTH 300, SA70, D2500, C600, AF30, YM4



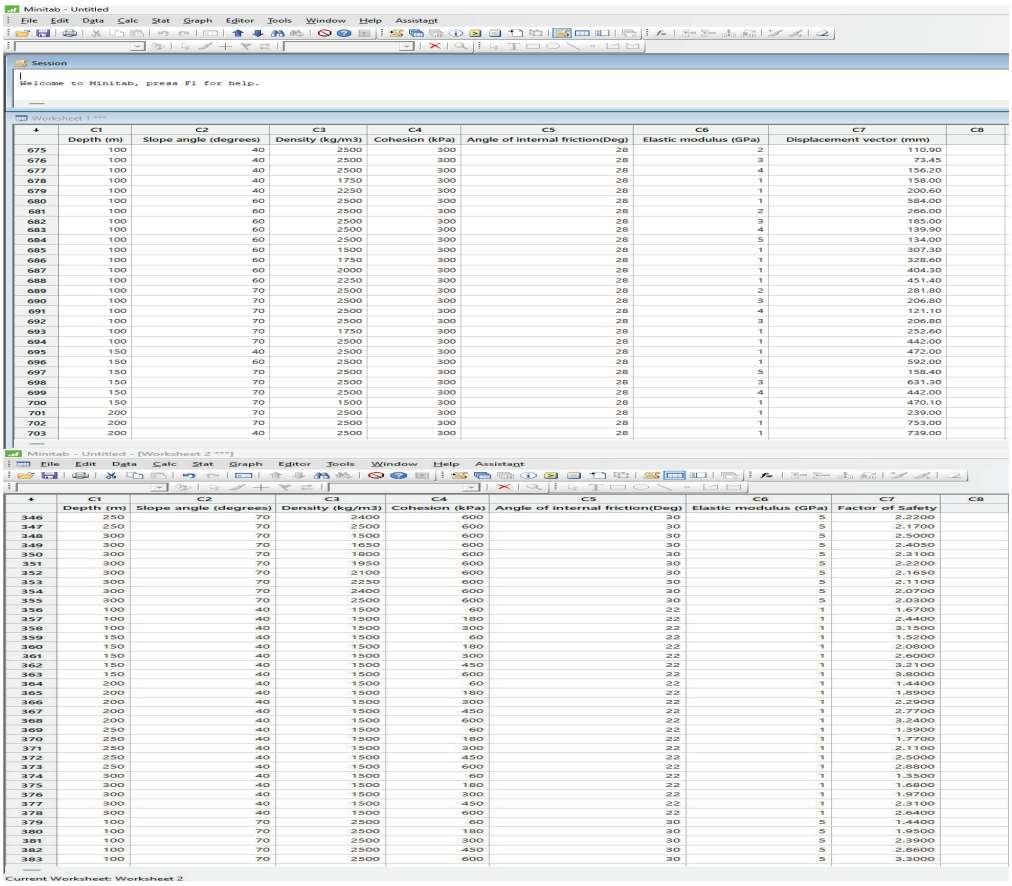
DEPTH 300, SA70, D1500, C600, AF30, YM5



DEPTH 300, SA70, D2500, C600, AF30, YM5

APPENDIX – VI (ANOVA using Minitab)

In this study, Minitab is used for multiple regression analysis. The procedure followed in Minitab software (step by step process) to develop mathematical models for displacements and FoS as given below.



Minitab - Untitled

File Edit Data Calc Stat Graph Editor Tools Window Help Assistant

Session

Welcome to Minitab, press F1 for help.

Worksheet 1 ***

	C1	C2	C3	C4	C5	C6	C7	C8
	Depth (m)	Slope angle (degrees)	Density (kg/m3)	Cohesion (kPa)	Angle of internal friction(Deg)	Elastic modulus (GPa)	Displacement vector (mm)	
675	100	40	2500	300	28	2	110.90	
676	100	40	2500	300	28	3	73.45	
677	100	40	2500	300	28	4	156.20	
678	100	40	1750	300	28	1	158.00	
679	100	40	2250	300	28	1	200.60	
680	100	60	2500	300	28	1	584.00	
681	100	60	2500	300	28	2	266.00	
682	100	60	2500	300	28	3	185.00	
683	100	60	2500	300	28	4	139.90	
684	100	60	2500	300	28	5	134.00	
685	100	60	1500	300	28	1	307.30	
686	100	60	1750	300	28	1	328.60	
687	100	60	2000	300	28	1	404.30	
688	100	60	2250	300	28	1	451.40	
689	100	70	2500	300	28	2	281.80	
690	100	70	2500	300	28	3	206.80	
691	100	70	2500	300	28	4	121.10	
692	100	70	2500	300	28	3	206.80	
693	100	70	1750	300	28	1	252.60	
694	100	70	2500	300	28	1	442.00	
695	150	40	2500	300	28	1	472.00	
696	150	60	2500	300	28	1	592.00	
697	150	70	2500	300	28	5	158.40	
698	150	70	2500	300	28	3	631.30	
699	150	70	2500	300	28	4	442.00	
700	150	70	1500	300	28	1	470.10	
701	200	70	2500	300	28	1	239.00	
702	200	70	2500	300	28	1	753.00	
703	200	40	2500	300	28	1	739.00	

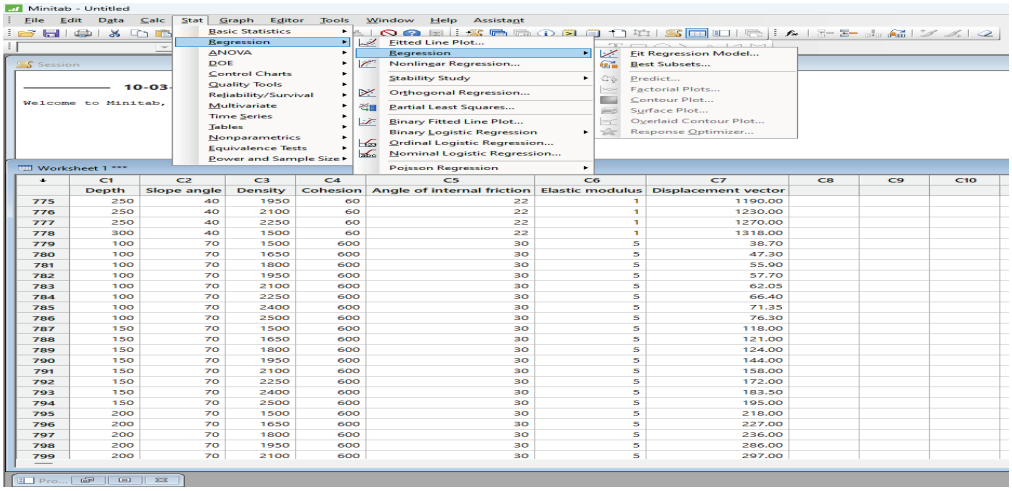
Minitab - Untitled - [Worksheet 2 ***]

File Edit Data Calc Stat Graph Editor Tools Window Help Assistant

	C1	C2	C3	C4	C5	C6	C7	C8
	Depth (m)	Slope angle (degrees)	Density (kg/m3)	Cohesion (kPa)	Angle of internal friction(Deg)	Elastic modulus (GPa)	Factor of Safety	
346	250	70	2400	600	30	5	2.2200	
347	250	70	2500	600	30	5	2.1700	
348	300	70	1500	600	30	5	2.5000	
349	300	70	1650	600	30	5	2.4050	
350	300	70	1800	600	30	5	2.3100	
351	300	70	1950	600	30	5	2.2200	
352	300	70	2100	600	30	5	2.1650	
353	300	70	2250	600	30	5	2.1100	
354	300	70	2400	600	30	5	2.0700	
355	300	70	2500	600	30	5	2.0300	
356	100	40	1500	60	22	1	1.6700	
357	100	40	1500	180	22	1	2.4400	
358	100	40	1500	300	22	1	3.1500	
359	150	40	1500	60	22	1	1.5200	
360	150	40	1500	180	22	1	2.0800	
361	150	40	1500	300	22	1	2.6000	
362	150	40	1500	450	22	1	3.2100	
363	150	40	1500	600	22	1	3.8000	
364	200	40	1500	60	22	1	1.4400	
365	200	40	1500	180	22	1	1.8900	
366	200	40	1500	300	22	1	2.2900	
367	200	40	1500	450	22	1	2.7700	
368	200	40	1500	600	22	1	3.2400	
369	250	40	1500	60	22	1	1.3900	
370	250	40	1500	180	22	1	1.7700	
371	250	40	1500	300	22	1	2.1100	
372	250	40	1500	450	22	1	2.5000	
373	250	40	1500	600	22	1	2.8800	
374	300	40	1500	60	22	1	1.3500	
375	300	40	1500	180	22	1	1.6800	
376	300	40	1500	300	22	1	1.9700	
377	300	40	1500	450	22	1	2.3100	
378	300	40	1500	600	22	1	2.6400	
379	100	70	2500	60	30	5	1.4400	
380	100	70	2500	180	30	5	1.9500	
381	100	70	2500	300	30	5	2.3900	
382	100	70	2500	450	30	5	2.8600	
383	100	70	2500	600	30	5	3.3000	

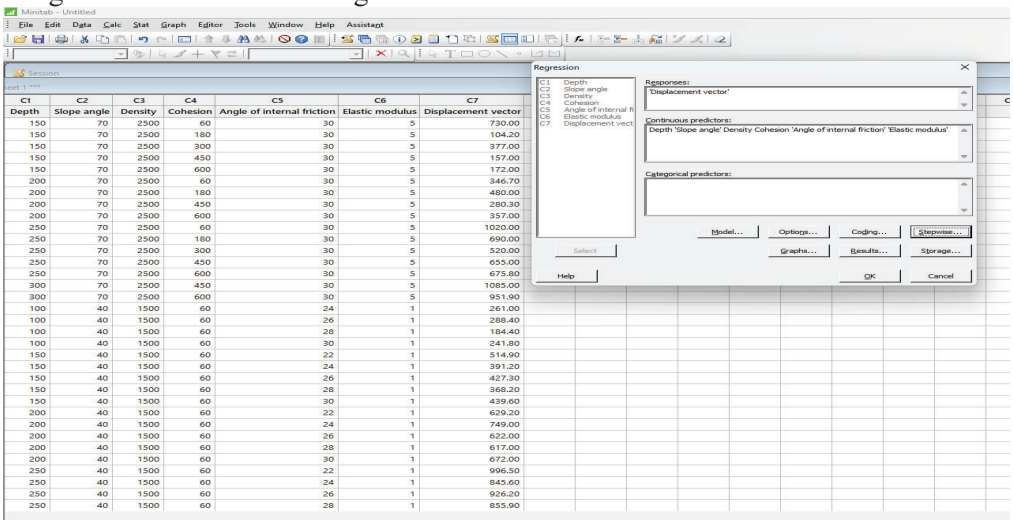
Current Worksheet: Worksheet 2

Figure VI A Importing input data into worksheets of Minitab



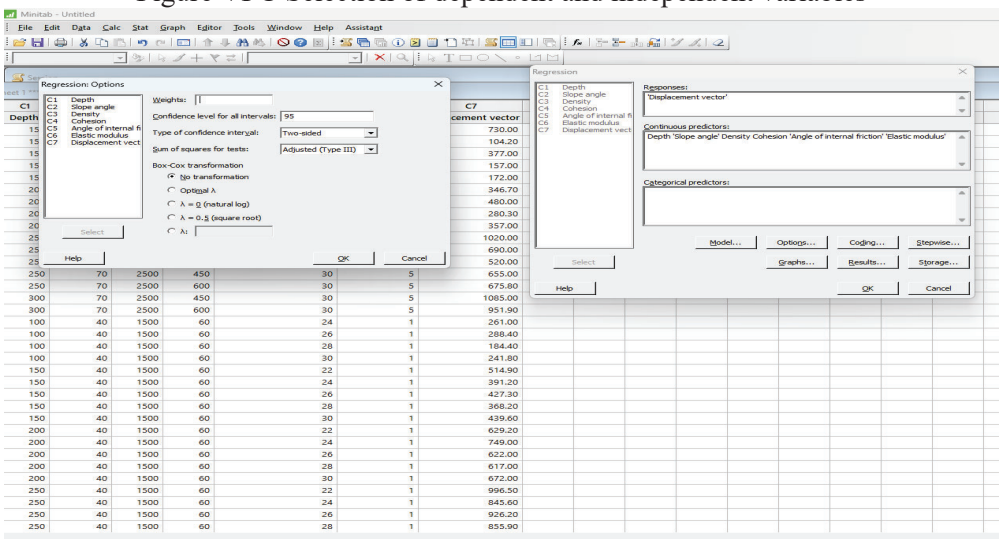
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10
	Depth	Slope angle	Density	Cohesion	Angle of internal friction	Elastic modulus	Displacement vector			
775	250	40	1950	60	22	1	1190.00			
776	250	40	2100	60	22	1	1230.00			
777	250	40	2250	60	22	1	1270.00			
778	300	40	1500	60	22	1	1318.00			
779	100	70	1500	600	30	5	38.70			
780	100	70	1650	600	30	5	47.30			
781	100	70	1800	600	30	5	55.90			
782	100	70	1950	600	30	5	57.70			
783	100	70	2100	600	30	5	62.05			
784	100	70	2250	600	30	5	66.40			
785	100	70	2400	600	30	5	71.35			
786	100	70	2500	600	30	5	76.30			
787	150	70	1500	600	30	5	118.00			
788	150	70	1650	600	30	5	121.00			
789	150	70	1800	600	30	5	124.00			
790	150	70	1950	600	30	5	144.00			
791	150	70	2100	600	30	5	158.00			
792	150	70	2250	600	30	5	172.00			
793	150	70	2400	600	30	5	183.50			
794	150	70	2500	600	30	5	195.00			
795	200	70	1500	600	30	5	218.00			
796	200	70	1650	600	30	5	227.00			
797	200	70	1800	600	30	5	236.00			
798	200	70	1950	600	30	5	286.00			
799	200	70	2100	600	30	5	297.00			

Figure VI B Selection of Regression model for the data into worksheets of Minitab



C1	C2	C3	C4	C5	C6	C7
Depth	Slope angle	Density	Cohesion	Angle of internal friction	Elastic modulus	Displacement vector
150	70	2500	60	30	5	730.00
150	70	2500	180	30	5	104.20
150	70	2500	300	30	5	377.00
150	70	2500	450	30	5	157.00
150	70	2500	600	30	5	172.00
200	70	2500	60	30	5	346.70
200	70	2500	180	30	5	480.00
200	70	2500	450	30	5	280.30
200	70	2500	600	30	5	357.00
250	70	2500	60	30	5	1020.00
250	70	2500	180	30	5	690.00
250	70	2500	300	30	5	520.00
250	70	2500	450	30	5	655.00
250	70	2500	600	30	5	675.80
300	70	2500	450	30	5	1085.00
300	70	2500	600	30	5	951.90
100	40	1500	60	24	1	261.00
100	40	1500	60	26	1	288.40
100	40	1500	60	28	1	184.40
100	40	1500	60	30	1	241.80
150	40	1500	60	22	1	514.90
150	40	1500	60	24	1	391.20
150	40	1500	60	26	1	427.30
150	40	1500	60	28	1	368.20
150	40	1500	60	30	1	439.60
200	40	1500	60	22	1	629.20
200	40	1500	60	24	1	749.00
200	40	1500	60	26	1	622.00
200	40	1500	60	28	1	617.00
200	40	1500	60	30	1	672.00
250	40	1500	60	22	1	996.50
250	40	1500	60	24	1	845.60
250	40	1500	60	26	1	926.20
250	40	1500	60	28	1	855.90

Figure VI C Selection of dependent and independent variables



C1	C2	C3	C4	C5	C6	C7
Depth	Slope angle	Density	Cohesion	Angle of internal friction	Elastic modulus	Displacement vector
250	70	2500	450	30	5	655.00
250	70	2500	600	30	5	675.80
300	70	2500	450	30	5	1085.00
300	70	2500	600	30	5	951.90
100	40	1500	60	24	1	261.00
100	40	1500	60	26	1	288.40
100	40	1500	60	28	1	184.40
100	40	1500	60	30	1	241.80
150	40	1500	60	22	1	514.90
150	40	1500	60	24	1	391.20
150	40	1500	60	26	1	427.30
150	40	1500	60	28	1	368.20
150	40	1500	60	30	1	439.60
200	40	1500	60	22	1	629.20
200	40	1500	60	24	1	749.00
200	40	1500	60	26	1	622.00
200	40	1500	60	28	1	617.00
200	40	1500	60	30	1	672.00
250	40	1500	60	22	1	996.50
250	40	1500	60	24	1	845.60
250	40	1500	60	26	1	926.20
250	40	1500	60	28	1	855.90

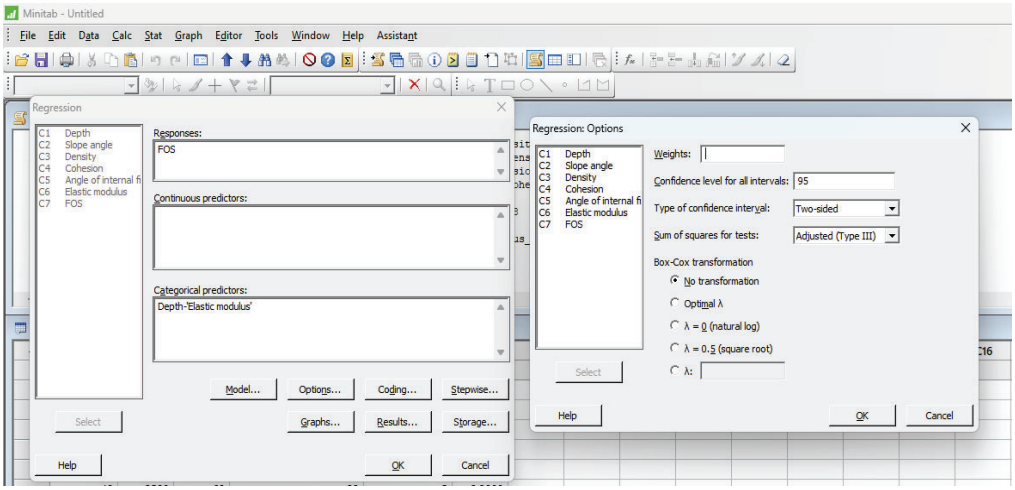
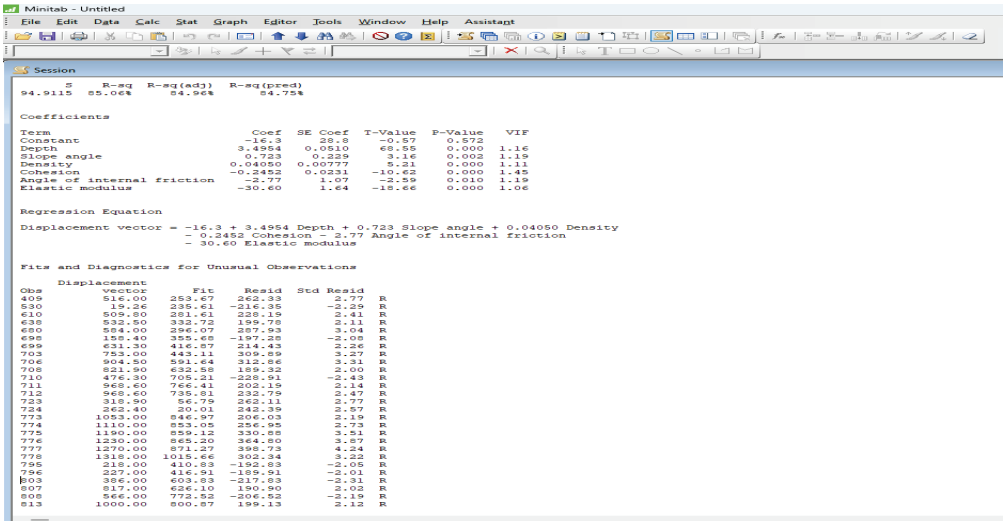


Figure VI D Statistical models in Minitab



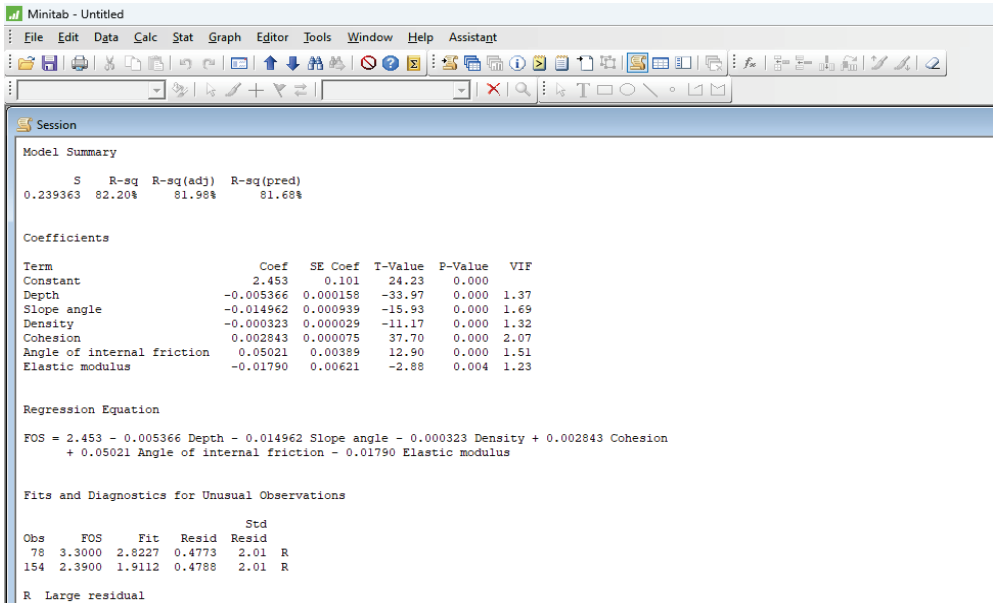


Figure VI E Results of Minitab software

Figure VI Regression analysis based on numerical data in Minitab

LIST OF PUBLICATIONS

LIST OF PUBLICATIONS BASED ON PH.D. RESEARCH WORK

International/National Journals:

1) **Sathish Kumar Mittapally** & Ram Chandar Karra (2023), "Functions and performance of sensors for slope monitoring in opencast coal mines – laboratory experimentation", Petroleum Science and Technology. (SCI - Q3 Journal). DoI: https://doi.org/10.1080/10916466.2023.2175858.
2) **Kumar, M. S.,** & Karra, R. C. (2023). Applications of Wireless Sensor Network for Displacement Monitoring in Opencast Coal Mine Slopes. Journal of Mines, Metals and Fuels, 71(9), 1346–1358. (Scopus).
   DoI: https://doi.org/10.18311/jmmf/2023/32032.
3) **Kumar, M. S.,** & Chandar, K.R (2023) 'Development of an alert system in slope monitoring using wireless sensor networks and cloud computing technique – a laboratory experimentation', International Journal of Mining and Mineral Engineering, Vol. 14 (2), 205-221. (SCI - Q3 Journal).
   DoI: https://doi.org/10.1504/IJMME.2023.133652.
4) **Sathish Kumar M** and Ram Chandar Karra, "Applications of IoT in Slope Monitoring in Opencast Mines – A Critical Review" Journal of Mines, Metals and Fuels, Vol. 70, No 12(A), Pp 47-58. May (2022). (Scopus Journal).
   DoI: https://doi.org/10.18311/jmmf/ 2022/29942.
5) **Sathish Kumar Mittapally**, M Shyam Sunder & Ram Chandar Karra (2023). Cloud Computing- Based Advanced Slope Monitoring System for Opencast Coal Mines. Easy Chair Preprint, No.9716, Pp:1-11.
   Link: https://easychair.org/publications/preprint/65zfC.

International Conferences/Seminars:

1) **Sathish Kumar Mittapally** & Ram Chandar Karra (2023), "Real-time Slope Monitoring System based on Cloud Computing for Opencast Coal Mines." Proceedings of 1st Srilankan Rock Mechanics and Engineering Society (SLRMES), Srilanka, 3-7, December, 2023, 55-56. (Sponsored by International Society for Rock Mechanics (ISRM)).

2) **Sathish Kumar Mittapally** & Ram Chandar Karra (2024), "IoT based Slope Monitoring Systems in Opencast Mines" International Conference on Mining for a Greener Future: Technological Developments and Sustainable Practices (ICMFGF-2024), NITK, Surathkal, Karnataka, 16-17, February, 2024, Pp-20.

BIO-DATA

PERSONAL PROFILE

Name	: M Sathish Kumar
Father's Name	: Uppalaiah,
Address	: H.No. 5-53/1, Kamalapur, Hanamkonda, Telangana.
Mobile No.	: 8332974511
Marital Status	: Married
E-mail	: sathi.raa1980@gmail.com

ACADEMIC DETAILS:

- M.Tech. with 9.68 CGPA in Mining Engineering, from VNIT, Nagapur, during 2012-15.
- B.Tech. with 78.29% First Class with Distinction in Mining Engineering, in University College of Engineering, Kakatiya University, during 1999-2003.
- Diploma with 74.13% First Class with Distinction in Mining Engineering, Govt. Polytechnic Kothagudem, during 1996-1999.
- Secondary School Certificate (SSC) with 79.83% First Class with Distinction in ZPSS, Kamalapur, Telangana in 1995.

EXPERIENCE:

- Worked as Under Manager, Asst. Manager and Addl. Manager in the Singareni Collieries Company Limited, Telangana State from 2005 to 2020.
- Working as Professor of Practice, Department of Mining Engineering, University College of Engineering, Osmania University, Hyderabad from 2020 to till date (on deputation from SCCL).

MEMBERSHIPS:

- Life member in Mining Engineering Association of India (MEAI) Journal.
- Life member in the Institution of Engineers Indian (IEI).
- Life member in Mining, Geological & Metallurgical Institute of India (MGMI) Journal.
- Elected as Council Member in MEAI Journal for the term period of 2019-21.
- Elected as Council Member in MEAI Journal for the term period of 2023-25.

AWARDS/HONORS/ACHIEVEMENTS:

- China Visit - Training on different technologies in mining (45 days during 2012).
- Second Class Mine Manager Certificate - Certificate of Competency under Coal Mine Regulations 2017
- First class Mine Manager Certificate - Certificate of Competency under Coal Mine Regulations 2017

WORKSHOPS AND FDP PROGRAMS

- Attended online short-term course on “Machine Learning with Python for beginners” during 2020, organized by Department of CSE, NIT Warangal.
- Participated in the International Webinar on “Safe Mining and Advanced Resources Technology-2020 (SMART-2020)” organized by the Department of Mining Engineering, IIT Kharagpur.
- Faculty Development Program on Internet of Things (IOT) using Amazon AWS (2021), organized by Finland Labs (A Unit of Revert Technology Pvt. Ltd.).
- Online FDP on "Planning of Surface Mining Projects" during 2021 at the National Institute of Technology Karnataka, Surathkal.
- Attended Virtual Faculty Development Program on "Role of Engineers in Mineral Exploration & Mining" during 2021, organized by the Department of Mining Engineering, AMET Deemed to be University, Chennai.
- Participated in “Two Days Offline cum Online Seminar on Advanced Softwares' in Blasting Technologies” (2022), organised by Department of Mining Engineering, Malla Reddy Engineering College, HYD.
- Attended Online Faculty Development Program on "Rock Mechanics Application in Mining and Allied Industries" during 2022, conducted by the Department of Mining Engineering, Thimmaiah Institute of Technology, KGF.
- Attended online FDP on “Recent Advancements in Mine Safety” on during 2023, organized by the Department of Mining Engineering, Godavari Institute of Engineering & Technology, AP, Telangana.
- Attended Faculty Development Program on "Information Technology for Earth Science Community" during 2023, organized by the Department of Mining Engineering, AMET Deemed to be University, Chennai.