Presented on : 21-09-2024

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL

(SOUTHERN BENCH) AT CHENNAI

Appeal No. 41 OF 2024

Usha Kumari - Appellant

v.

MoEF & 4 Others - Respondents

REPLY FILED BY THE 5TH RESPONDENT

BK & Co

ENOCH DAVID SIMON JOEL (E 68) K/925/09
S SREEDEV (S 2272) K 1219/2006
RONY JOSE (R 1364) K/705/2012
LEO LUKOSE (L 302) K/1131/2016
KAROL MATHEWS SEBASTIAN ALENCHERRY K/126/2010
DERICK MATHAI SAJI K/1901/2021
KARAN SCARIA ABRAHAM K/3189/2023
ITTOOP JOY THATTIL K/2716/2024

COUNSEL FOR THE 5TH RESPONDENT

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL

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I N D E X

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1.	Reply filed by the 5th Respondent.	1- 6
2.	*Exhibit R5(a)*: True copy of the report prepared by Dr. Ram Chandar Karra, Associate Professor of the Department of Mining Engineering of the National Institute of Technology, Surathkal.	7 - 64
3.	*Exhibit R5(b)*: True copy of the abstract of the minutes of the 146th meeting of the 2nd Respondent held on 29 and 30 July, 2024.	65 - 66
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Dated this the 21st day of September 2024.

Counsel for the 5th Respondent

BEFORE THE HON'BLE NATIONAL GREEN TRIBUNAL

(SOUTHERN BENCH) AT CHENNAI

Appeal No. 41 OF 2024

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REPLY FILED BY THE 5TH RESPONDENT

I, C. Krishna Pillai, aged 63 years, S/o. Late Chellappan Pillai, residing at Melathu Lekshmi Bhavan, Thazhakkara, Alappuzha-690102, do take oath and solemnly affirm and state as follows;

1. I am the 5th Respondent in the above Appeal and I am aware of the facts of the case and am competent to swear to this affidavit.

2. The above appeal has been filed inter alia challenging the order dated 17.02.2024 issued by the 2nd Respondent revoking the suspension of the EC granted to the 5th Respondent.

3. All the averments and allegations contained in the appeal memorandum are denied except to the extent admitted hereunder. The above appeal is not maintainable either on law or on the facts and circumstances of the case.

4. At the outset, it is to be pointed out that the present appeal is not maintainable under the provisions of the National Green Tribunal Act. The present appeal has been filed under Section 16(g) of the Act. The order impugned in the appeal is an order issued by the 2nd Respondent revoking the order which had suspended the EC granted to the 5th Respondent. Such an order cannot under any circumstance be treated as a direction issued under Section 5 of the Environment Protection Act,

1986 so as to make it an appealable order under Section 16(g) of the Act. Orders issued by the SEIAA are appealable before this Hon'ble Tribunal under Section 16 only if they fall under Section 16(h) or Section 16(i) of the Act. The order impugned in the present appeal is not an order which falls under Section 16(h) or Section 16(i) of the Act also since it is not an order either granting or rejecting an application for EC. In such circumstances the present appeal is liable to be dismissed as not maintainable.

5. It is also to be pointed out that the appeal is liable to be rejected for suppression of material facts. There is absolutely no bonafides on the part of the Appellant in prosecuting the present appeal. The Appellant had filed a complaint before the 2nd Respondent alleging that I was using electric detonators in violation of the EC condition. Based on the complaint, the 2nd Respondent had conducted a field inspection. In the said inspection, since it was noted that some of the buildings within 200 metres were built directly on rock exposures, I was directed to conduct a vibration study to evaluate the zone of influence and impact of blasting on the neighborhood by an agency of national repute. Since certain other non-compliance of the general condition were observed, the EC issued to me was suspended for a period of 6 months as per Ann.A2 decision of the 2nd Respondent.

6. Pursuant thereto, a detailed study was conducted by the National Institute of Technology, Surathkal which is an agency of national repute as suggested in Ann.A2. As part of the detailed study, the experts from the National Institute of Technology had conducted vibration studies at the house of the Appellant itself so as to observe the influence and impact of blasting. During the study, it was observed that no vibration at

all was recorded at the house of the Appellant. For the purpose of reference, a true copy of the report prepared by Dr. Ram Chandar Karra, Associate Professor of the Department of Mining Engineering of the National Institute of Technology, Surathkal is produced and marked as **Exhibit R5(a)**. Appellant is well aware of the said study. However, for reasons best known to the Appellant, no reference has been made to the said report in the present appeal.

7. The entire allegations raised by the Appellant were found to be false in the scientific study conducted. No vibration at all was recorded at the house of the Appellant. Therefore, the allegation of the Appellant that there are severe vibrations at the house of the Appellant which has resulted in severe damage to the houses and other buildings in the vicinity was proved to be completely false. In these circumstances, the suppression of the study conducted by the National Institute of Technology by the Appellant is to be viewed seriously.

8. The 2nd Respondent while revoking the suspension order had specifically noted Ext.R5(a) scientific report. Since the report had suggested certain blast configurations, certain additional conditions were also imposed while revoking the suspension order. I have complied with all the said conditions mandated by the 2nd Respondent while revoking the suspension order.

9. Be that as it may, the statements contained in paragraphs 1 to 3 of the memorandum of appeal are not fully correct and are hence denied. The statement that I was using electric detonators in utter disregard to the condition imposed in the EC and that it had resulted in cracks in the wall of the house of the Appellant is absolutely false and hence denied. Only NONEL technology is used for blasting as mandated in the EC.

The statement that the 2nd Respondent inspected the site and found that I am using electric detonators and that the blasting has damaged several houses is absolutely false and hence denied. No such finding was ever entered into by the 2nd Respondent.

10. Statements contained in paragraph 4 and 5 are also not correct and are hence denied. The statement in paragraph 5 that the condition in the EC that the blasting should be in a controlled manner using NONEL technique was violated and that the EC was suspended for the said reason is absolutely false and hence denied. A perusal of Ann.A2 order makes it explicitly clear that the EC was suspended for violation of certain general conditions and not for violating the condition that the blasting should be in a controlled manner using NONEL technique, as is sought to be projected by the Appellant. The statement in paragraph 5 that by using electrical detonators I had been quarrying illegally was ignored by the 2nd Respondent while issuing Ann.A4 is absolutely false and hence denied. The statement that damages were caused to the buildings of the Appellant and other residences is also false as is clearly evident from Ext.R5(a) scientific report. The report makes it abundantly clear that no cracks or damage were ever caused in the houses due to the quarrying conducted by the Appellant.

11. In this context it is also relevant to point out that pursuant to the interim order dated 10.05.2024 issued by this Hon'ble Tribunal in the present appeal, a further inspection was conducted by the technical team of the 2nd Respondent along with an Expert Mine Engineer at the quarrying site. During the said inspection, the team had ascertained and was satisfied that I was following only NONEL technology for blasting. In the said inspection it was noted that I had also complied with all

15. Appellant is not entitled for any of the reliefs claimed and the present appeal is only to be dismissed with exemplary costs to this Respondent.

Hence it is humbly prayed that this Hon'ble Tribunal may be pleased to accept this affidavit and dismiss the appeal with exemplary costs to this Respondent.

All the facts stated above are true and correct.

Dated this the 21st day of September 2024.

Deponent

Solemnly affirmed and signed before me by the literate deponent who is personally known to me on this the 21st day of September 2024 at my office in Ernakulam.

Enoch David Simon Joel
Advocate

the EC conditions except 4. The said inspection report was deliberated by the 2nd Respondent in its 146th meeting held on 29 and 30 July, 2024. I was directed to comply with the remaining 4 conditions within a period of one month and to submit a compliance report. True copy of the abstract of the minutes of the 146th meeting of the 2nd Respondent held on 29 and 30 July, 2024 is produced and marked as **Exhibit R5(b)**.

12. On the basis of the said direction, I complied with all the remaining conditions and had submitted a compliance report to the 2nd Respondent on 29.08.2024. True copy of the letter dated 29.08.2024 submitted by the 5th Respondent to the 2nd Respondent is produced and marked as **Exhibit R5(c)**.

13. Statements contained in paragraphs 6 to 9 are not correct and hence denied. The statement that the vibration caused by the quarrying have damaged buildings is utterly false. The statement that a distance criteria of 150m has to be maintained from the nearest house/structure is also not correct and hence denied.

14. The grounds raised are also untenable and hence denied. The grounds raised are mere repetition of the facts and are hence denied. There has not been any damage to the properties of the Appellant as is now sought to be projected. On the contrary, a scientific study report which was prepared on the basis of the complaint preferred by the Appellant herself had clearly brought out the fact that there were no vibrations at the house of the Appellant due to the quarrying activity being conducted by me.

Ext. R5(a)

A SCIENTIFIC STUDY REPORT

ON

ASSESSMENT OF INTENSITY OF GROUND VIBRATIONS GENERATED DUE TO BLASTING OPERATIONS IN GRANITE BUILDING STONE QUARRY OF MR. C. KRISHNA PILLAI, EZHUMATTOOR VILLAGE, MALLAPALLY TALUK, PATHANAMTHITTA DIST OF KERALA.

(CONSULTANCY PROJECT CODE: TC/MN/JB-146)

SUBMITTED TO:

MR. C. KRISHNA PILLAI
MELATHU LAKSHMI BHAVAN,
THAZHAKARA- PO,
ALAPPUZHA DIST, KERALA

Dr. K. RAM CHANDAR
Associate Professor
Dept. of Mining Engineering
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BY

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(MAY, 2023)

R5(a)/2

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ACKNOWLEDGEMENTS

The Principal Investigator is thankful to Mr. C. Krishna Pillai - Owner of the quarry for awarding the scientific study.

The Principal Investigator is grateful to the Director, National Institute of Technology Karnataka, Surathkal (Govt. of India) for permitting to take up the project.

Thanks to the field team for the help rendered during field studies.

Dr. K. Ram Chandar
Principal Investigator
Consultancy Project Code: TC/MN/JB/146

June. 02, 2023

Dr. K. RAM CHANDAR
Associate Professor
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Recipient of : IE (India) Young Engineer Award,
MGMI Engineering Gold Medal
MEAI-SRG IT Award,
ISTE –SGSITS Young Teacher Award,
IE-NDRF-National Design Award
MEAI- Smt. Kiran Devi Singhal Memorial Award

Dr. Ram Chandar Karra, Dept. of Mining Engineering, NITK-Surathkal (Govt. of India)

ABSTRACT

Mr. C. Krishna Pillai resident of Melathu Lakshmi Bhavan, Thazhakara- PO, Alappuzha Dist of Kerala proposed is operating a Granite Building Stone Quarry in Block No: 27, Re-Survey No. 283/1pt, 283/2pt, 283/4, 296/3pt Ezhumattoor Village, Mallapally Taluk, Pathanamthitta Dist of Kerala, over an extent of 0.9705Ha. As there are some houses around the quarry, the Quarry management has approached the Principal Investigator from National Institute of Technology Karnataka (NITK)-Surathkal (Govt. of India) to conduct a scientific study to assess the intensity of ground vibrations generated from blasting operations on the surrounding structures / houses. In view of this, a scientific study is taken up.

A field visit was made to the quarry site in second week of May - 2023 and first reconnaissance survey was made. All the surroundings were inspected and it was found that there are some houses around the quarry. The houses on north west side are owned by the same quarry owner so these are abandoned and no one living there at present. There are some houses on south-east side along the public road. As per DGMS guidelines, all such houses can be assigned a permissible Peak Particle Velocity (PPV) of 5mm/s irrespective of frequency levels.

Blastholes of 35mm diameter drilled by hand held Jackhammer drills for the studies. Depth of Blastholes was 1.51m (5feet) in all blast rounds with 0.91m burden and 0.91m spacing. Number of blastholes per round varied from 10 to 30, covering different locations. 25mm diameter cartridged explosives were used as explosive charge. Explosive charge per hole was 375gm (three cartridges) in all blast rounds. NONEL based shocktube detonators are used for initiating the blastholes. Maximum charge per delay was 375gm and Total explosive charge per blast varied 3.75kg to 11.25kg during the scientific studies.

As the quarry was started recently, there is limited space to conduct the blasts. 4 blasts were conducted under controlled conditions. Ground vibrations generated from different blasts were monitored using One unit of Minimate, and one unit of Minimate Plus of Instantel, Canada. The highest Peak Particle Velocity (PPV) recorded was 1.2mm/s at a distance of 75m in Blast No. 4 & at a distance of 80m in Blast No. 1, the second highest PPV was 1.08mm/s at a distance of 100m in Blast No. 2. In all the other cases, the PPV values are less than 1mm/s, and No vibration was recorded at the house of Mr. Mohan Kurup during the studies conducted. Intensity of ground vibrations mainly depends upon the maximum charge per delay and the distance between the blast location and monitoring point. Further, the level difference between the blast location and monitoring point, direction of propagation etc., also will influence the blast vibration levels.

The highest noise level was 108.8dB in Blast No.1, the second highest was 108.4B in Blast No.2, in many cases the noise level was less than 100dB which is insignificant.

Fly Rock is another problem associated with blasting operations in general. It was observed to a distance of 30-40m from blast site without muffling arrangement and with muffling arrangement it was within 10m.

It may, therefore, be concluded that the intensity of ground vibrations, noise and fly rock caused due to blasting operations carried out in the Granite Building Stone Quarry of Mr. C. Krishna Pillai located in Block No: 27, Re-Survey No. 283/1pt, 283/2pt, 283/4, 296/3pt Ezhumattoor Village, Mallapally Taluk, Pathanamthitta Dist of Kerala are within permissible limits.

INDEX

Dr. Ram Chandar Karra, Dept. of Mining Engineering, NITK-Surathkal (Govt. of India)

INTRODUCTION

Mr. C. Krishna Pillai resident of Melathu Lakshmi Bhavan, Thazhakara- PO, Alappuzha Dist of Kerala proposed is operating a Granite Building Stone Quarry in Block No: 27, Re-Survey No. 283/1pt, 283/2pt, 283/4, 296/3pt Ezhumattoor Village, Mallapally Taluk, Pathanamthitta Dist of Kerala, over an extent of 0.9705Ha. As there are some houses around the quarry, the Quarry management has approached the Principal Investigator from National Institute of Technology Karnataka (NITK)-Surathkal (Govt. of India) to conduct a scientific study to assess the intensity of ground vibrations generated from blasting operations on the surrounding structures / houses. In view of this, a scientific study is taken up.

A field visit was made to the quarry site in second week of May - 2023 and first reconnaissance survey was made.

The following objectives were set to conduct the scientific study on blasting.

Objectives

- ✓ To assess the intensity of ground vibrations caused due to blasting operations carried out in the granite quarry at different distances using ground vibration monitors.
- ✓ To assess the impact of ground vibrations caused due to blasting operations on the surrounding structures.
- ✓ To suggest suitable guidelines for minimizing the impacts if any.

To achieve the above objectives, the following methodology is followed.

Methodology

- ✓ A preliminary reconnaissance survey was done and surrounding areas were inspected.
- ✓ Blasts were conducted at different locations in the quarry area with different blast configurations.
- ✓ Ground vibrations generated from blasting operations were monitored with two units of ground vibration monitors at different distances.
- ✓ Data generated was analyzed systematically and conclusions were drawn. Suitable recommendations are made to conduct the blasting operations in the quarry in a safe manner.

ROCK BLASTING

Explosive energy is the most common form of energy used for fragmenting the hard rock mass in mines and quarries, which is in general called as 'Rock Blasting'. Usage of explosive energy, in addition to fragment and displace the intact rock mass, is always associated with some adverse side effects like ground vibrations, air blast and fly rock. Ground vibrations cause damage to structures and annoyance to residents in neighboring areas, in case the intensity is above threshold values. Threshold value of ground vibration varies for different types of structures. Noise caused due to blasting operations may cause rattling and breaking of window panes if the intensity is above threshold levels. Fly rock is another major problem associated with blasting operations. Fly rock may cause damage to structures in the vicinity and may also result in serious accidents if proper care is not taken. In some cases, fly rock problem may lead to the closure of quarrying operations as well, due to the dangers involved. Necessary care must be taken by the quarry management in executing the blasting operations to control these side effects.

Ground Vibrations

When an explosive charge is detonated in a blasthole, strain waves are generated in the surrounding rock mass carrying huge quantity of energy. This energy generates cracks and fractures in the strata due to various breakage mechanisms such as crushing, radial cracking, reflection breakage etc. Combined, the crushed and fractured zones encompass a certain volume of permanently deformed rock. When the intensity of strain waves diminishes to the level where no permanent deformation occurs in the rock mass, i.e. beyond the fragmentation zone, strain waves propagate through the strata in the form of elastic waves. These waves in the elastic zone are known as ground vibrations. Two groups of seismic waves are generated by the detonation of explosive charges in blastholes. They are classified as body waves and surface waves. Body waves travel through the interior of earth. Ground vibration waves are of two types, Primary (P-wave) and Secondary (S-wave). Surface waves generate when the radiating body waves impinge on a stress-free plane, like surface or any discontinuity. These waves travel along the surface and discontinuities. Rayleigh waves are the best-known surface waves and include both dilation and distortion of the medium. Surface waves carry maximum percentage of the radiated energy and are predominant at longer distances from the blast source, since their attenuation rate is slower than body waves. In addition, the frequency of surface waves is lower than body waves and frequently found to be in the range most favorable for structural response (Holloway et al., 1983). All these waves are characterized by exponential decrease in particle oscillation amplitude as distance from energy source increases (Taqueddin, 1982). Fig. 1 shows the effect of ground vibration waves on the structures.

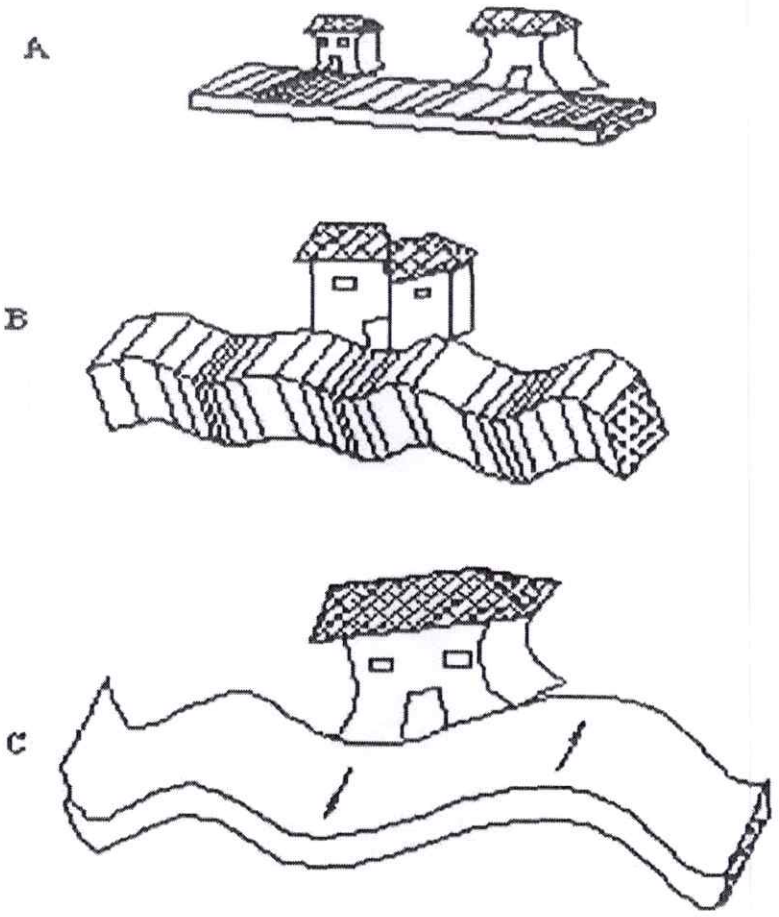
Parameters and Propagation

Whenever blast vibration occurs, it vibrates the ground/soil particle with certain velocity and imparts to it certain amount of acceleration. Intensity of ground vibrations is, therefore, quantified as displacement that varies with time (in terms of 'mm'), acceleration (in terms of 'g') and/or particle velocity (in terms of 'mm/s') at particular ground locations (Duvall and Fogelson, 1962). Wiss and Linehan (1978) made extensive studies to evaluate the influence of 14 blast variables considered to be having an influence on the amplitude of ground vibrations. They found that charge weight per delay and length of delay to be having the most significant influence on the intensity of ground vibrations (Table - 1).

Various other researchers have studied the influence of various parameters on the performance of blast in general and on ground vibrations in particular. Ram Chandar (2010) found that the influence of initiation system along with blast pattern also plays a major role on blast performance, which is a combination of two parameters.

Damage Levels

In India, the Directorate General of Mines Safety (Government of India) suggested safe limits of ground vibrations for different categories of structures, with frequencies of <8Hz, 8-25Hz and >25 Hz, respectively. Details of the permissible ground vibration standards given by DGMS are given in Table - 2.



a. Longitudinal wave
b. Rayleigh wave
c. Transverse wave

FIG. 1 EFFECT OF BODY WAVES AND SURFACE WAVES

TABLE - 1 PARAMETERS INFLUENCING GROUND VIBRATIONS (Wiss and Linehan, 1978)

Parameter	Influence on PPV		
	Significant	*Moderately Significant*	Insignificant
A. Controllable Variables			
1. Charge Weight per Delay	✓		
2. Length of Delay	✓		
3. Burden and Spacing		✓	
4. Stemming Amount		✓	
5. Type of Stemming			✓
6. Charge Length and Diameter			✓
7. Angle of Borehole			✓
8. Direction of Initiation		✓	
9. Charge Weight per Blast			✓
10. Charge Depth			✓
11. Bare Vs. Covered Detonating Cord			✓
B. Uncontrollable Variables			
1. General Surface Terrain			✓
2. Type and Depth of Overburden		✓	✓
3. Wind			✓

TABLE - 2 PERMISSIBLE PPV LEVELS RECOMMENDED BY DGMS, INDIA (Anon, 1997)

Type of Structure	Dominant Excitation Frequency		
	<8Hz	8-25 Hz	>25 Hz
A. Buildings/Structures not belonging to the owner			
Domestic Houses/ Structures / Kuchha Brick & Cement)	5	10	15
Industrial Buildings (RCC and framed structures)	10	20	25
Objects of Historical Importance & Sensitive Structures	2	5	10
B. Buildings/structures belonging to the owner with limited span of life			
Domestic Houses/Structures (kuchha, brick & cement)	10	15	25
Industrial Buildings (RCC & framed structures)	15	25	50

ABOUT THE STONE QUARRY

This section gives brief details of the quarry and the blasting operations carried out. A broad view of the quarry is shown in Fig. 1. There are some houses around the quarry. The houses on north west side are owned by the same quarry owner so these are abandoned and no one living there at present. There are some houses on south- east side along the public road (Fig. 2).. Infact, the nearest house is inspected which is owned by Mr. Mohan Kurup (Fig. 3). As per DGMS guidelines, all such houses can be assigned a permissible Peak Particle Velocity (PPV) of 5mm/s irrespective of frequency levels. Hard massive rock is visible around the houses (Fig. 4), there could be continuation of the quarry rock till the houses

FIG. 1 (A)

FIG. 1(B)

FIG. 1 A BROAD VIEW OF THE QUARRY

Dr. Ram Chandar Karra, Dept. of Mining Engineering, NITK-Surathkal (Govt. of India)

FIG. 2 (A)

FIG. 2 (B)

FIG. 2 A VIEW OF THE HOUSES

FIG. 3 A VIEW OF THE HOUSE INSPECTED BEFORE THE BLAST

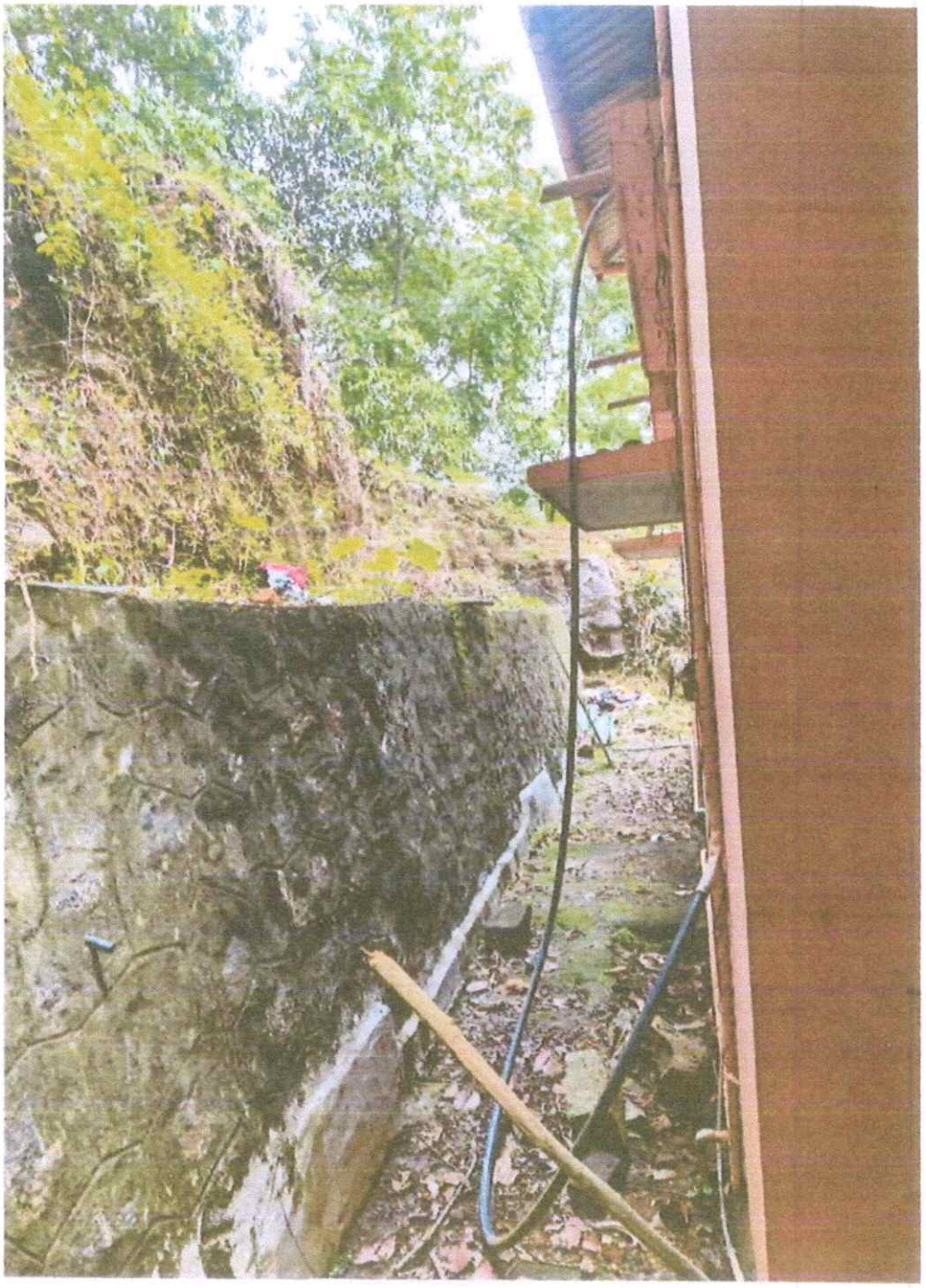


FIG. 4 VIEW OF ROCK AND SOIL BENCH BEHIND THE HOUSE TOWARDS THE QUARRY

Blast Design

Blast design is the important aspect in order to achieve the required blast performance and also in reducing the side effects of blasting like ground vibrations, noise, fly rock etc. Based on the preliminary inspection of the site, required fragmentation, etc., the following blast deign is adopted (Table- 3).

TABLE- 3 BLAST DESIGN ADOPTED IN BUILDING STONE QUARRY

Sl. No.	Parameters	Suggested Value
1	Diameter of Blasthole (mm)	32 to 35
2	Burden (m)	0.91 (3 feet)
3	Spacing (m)	0.91 (3 feet)
4	Depth of Blasthole (m)	1.51 to 1.82(5 to 6feet)
5	No. of Blastholes	Maximum of 30
6	Explosive Charge / Hole (gm)	375 to 500
7	Maximum Charge / Delay (gm)	375 to 500
8	Initiation System	NONEL based shocktube detonators
9	No. of Rows	Maximum of 3

In addition to the above, every blast is prepared with clear free face and the top of the area cleared off any small pieces of rock in order to avoid fly rock problem, before starting drilling operation it self. Effective stemming is also essential for proper confinement of explosive charge inside the blasthole. Some of the blasts are planned with muffling arrangement using sand bags.

FIELD INVESTIGATIONS

As the quarry is started recently and there is very limited space to conduct the blasting operations. So, in total 4 blasts were conducted. Quarrying operation starts with drilling of 35mm small diameter blastholes using hand held Jackhammer drills (Fig. 5). Once the blastholes are ready, these holes are charged with 25mm diameter cartridged explosives weighing 125gm. NONEL based shocktube detonators are used for initiating the blastholes. Fig. 6 shows the explosives, Fig. 7 shows NONEL based shocktube detonators used in the quarry. Required number of cartridges are placed in the blasthole along with initiating device (Fig. 8) and the remaining depth is filled with inert material (Fig. 9). Fig. 10 shows the blasting area after charging and with all the surface connections before blasting. Muffling arrangement to control fly rock is shown in Fig. 11. The fragmented material is found to be as per the requirements (Fig. 12).

Ground Vibration & Noise Monitoring

Scientific study was carried out to assess the intensity of ground vibrations generated due to blasting operations. In total, 4 blasts were conducted at different locations in the quarry. Each blasthole was drilled for 1.51m (5feet) depth with 0.91m burden and 0.91m spacing and charged with an explosive of 375gm (three cartridges). NONEL based shocktube detonators are used for inhole as well as for surface trunkline initiation. The blast rounds were initiated after getting safety clearances from all directions.

Ground vibrations & Noise generated from different blasts were monitored using One unit of Minimate and One unit of Minimate Plus of Instantel, Canada. Geophone of these blast vibration monitors records the ground vibrations in three mutually orthogonal directions

Longitudinal, Transverse and Vertical. Trigger level of these instruments were set to 0.51mm/s. This indicates that the instrument will start monitoring ground vibrations if the intensity is more than the trigger level. Geophone of the instrument was glued to the ground effectively using Plaster of Paris (PoP) and digging a notch of 6-8"in the ground and burying the geophone. Microphone attached to the same unit will measure the noise levels.

Monitoring was done at different distances from blast sites to know the propagation of ground vibrations. Fig. 13 shows the monitoring of ground vibrations near the blast locations/ in the quarry area. Fig. 14 shows the ground vibration monitoring near a house owned by Mr. Mohan Kurup. Blasts location along with monitoring points are shown in Fig. 15. Details of all the blasts studied are given in Table – 4. Summary of the blasts are given in Table-5. All the blasts layouts are given in Appendix-I. Blast events are given in Appendix- II.

FIG. 5 A VIEW OF DRILLING OPERATION IN THE QUARRY

FIG. 6 A VIEW OF EXPLOSIVES USED IN THE QUARRY

R5(a)/22

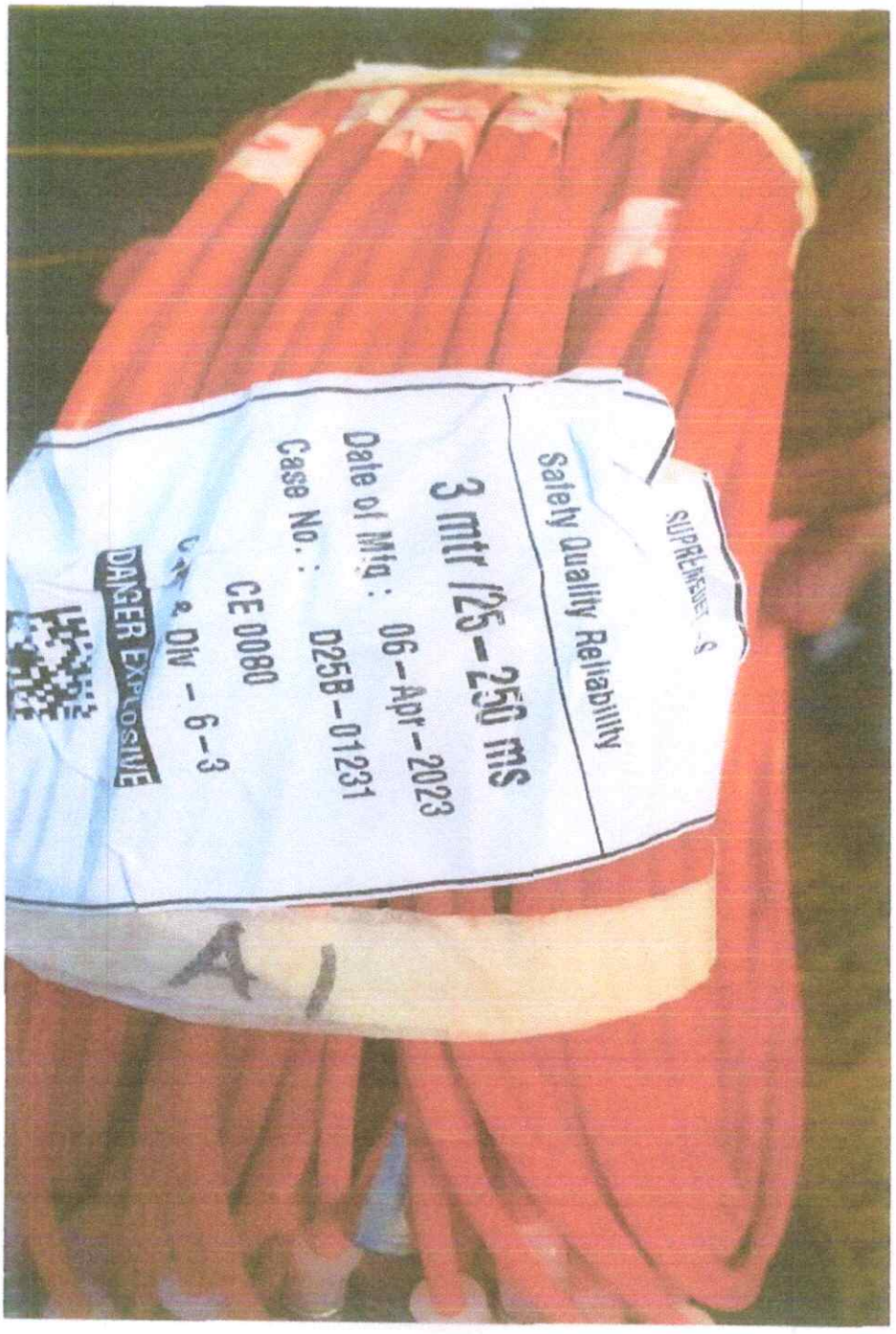


FIG. 7 A VIEW OF NONEL BASED SHOCKTUBE DETONATORS

FIG. 8 CHARGING OF BLASTHOLES

FIG. 9 STEMMING OF BLASTHOLES

FIG. 10 BLASTING AREA AFTER CHARGING OF BLASTHOLES WITH NONELs

FIG. 11 MUFFLING ARRANGEMENT WITH SAND BANGS OVER THE BLASTING AREA

FIG. 12 FRAGMENTED MATERIAL FROM DIFFERENT BLASTS

FIG. 13 (A)

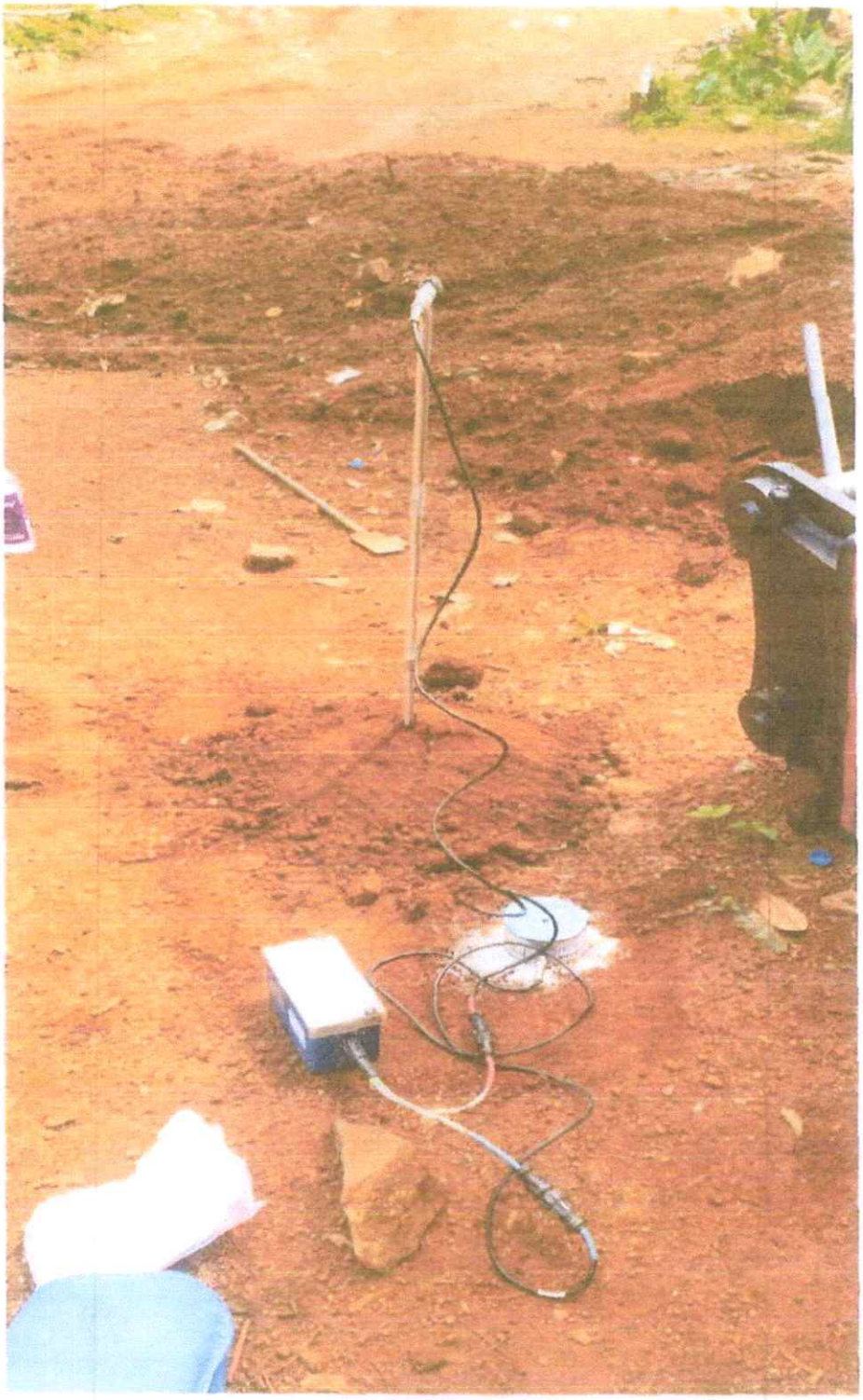


FIG. 13 (B)

FIG. 13 (C)

FIG. 13 GROUND VIBRATION MONITORING AROUND THE QUARRY

FIG. 13 (C)

FIG. 13 GROUND VIBRATION MONITORING AROUND THE QUARRY

FIG. 14 GROUND VIBRATION MONITORING NEAR THE HOUSE OF MR. MOHAN KURUP

R5(a)/31

B1…B4 are the Corresponding Blast Locations

- Instrument Locations

FIG. 15 LOCATION OF BLASTS ALONG WITH MONITORING POINTS

(NOT TO SCALE)

TABLE- 4 DETAILS OF THE BLASTS MONITORED

Sl. No.	Parameters	Blast No. 1	Blast No. 1 (Miss Fire)	Blast No. 2
1	Date of Blast	14-05-2023	14-05-2023	14-05-2023
2	Time of Blast (Hours)	11.16	11.22	11.38
3	Location of Blast	North East Side	North East Side	North Side
4	Diameter of Blasthole (mm)	35	35	35
5	Burden (m)	0.914	0.914	0.914
6	Spacing (m)	0.914	0.914	0.914
7	Depth of Blasthole (m)	1.524	1.524	1.524
8	No. of Blastholes	16	16	30
9	Explosive Charge / Hole (kg)	0.375	0.375	0.375
10	Maximum Charge / Delay (kg)	0.375	0.375	0.375
11	Total Charge / Blast (kg)	6	6	11.25
12	Initiation System	Nonel-based shock tube	Nonel-based shock tube	Nonel-based shock tube
13	Initiation Pattern	Row to row	Row to row	Row to row
14	Location of Instrument 1	Close to lease boundary /entry to quarry	Close to lease boundary /entry to quarry	Close to lease boundary /entry to quarry
15	Distance 1 (m)	80	80	100
16	PPV 1 (mm / s)	0.953	1.207	0.953
17	Noise 1 (dB)	<100	<100	<100
18	Location of Instrument 2	Along approach road	Along approach road	Along approach road
19	Distance 2 (m)	115	115	130
20	PPV 2 (mm / s)	0.635	0.889	0.508
21	Noise 2 (dB)	108.8	<88	105.5

TABLE- 4 DETAILS OF THE BLASTS MONITORED (Cont...)

Sl. No.	Parameters	Blast No. 2 (Miss Fire)	Blast No. 3	Blast No. 4
1	Date of Blast	14-05-2023	14-05-2023	14-05-2023
2	Time of Blast (Hours)	12.49	12.56	13.20
3	Location of Blast	North Side	North East Side	North Side
4	Diameter of Blasthole (mm)	35	35	35
5	Burden (m)	0.914	0.914	0.914
6	Spacing (m)	0.914	0.914	0.914
7	Depth of Blasthole (m)	1.524	1.524	1.524
8	No. of Blastholes	30	24	10
9	Explosive Charge / Hole (kg)	0.375	0.375	0.375
10	Maximum Charge / Delay (kg)	0.375	0.375	0.375
11	Total Charge / Blast (kg)	11.25	9	3.75
12	Initiation System	Nonel-based shock tube	Nonel-based shock tube	Nonel-based shock tube
13	Initiation Pattern	Row to row	Row to row	Row to row
14	Location of Instrument 1	Close to lease boundary /entry to quarry	Along approach road	Along approach road
15	Distance 1 (m)	100	130	75
16	PPV 1 (mm / s)	1.080	0.699	1.207
17	Noise 1 (dB)	<100	<100	<100
18	Location of Instrument 2	Along approach road	At the house of Mr. Mohan Kurup	At the house of Mr. Mohan Kurup
19	Distance 2 (m)	130	210	200
20	PPV 2 (mm / s)	0.762	-	-
21	Noise 2 (dB)	108.4	-	-

TABLE- 5 SUMMARY OF THE BLASTS MONITORED

Blast No.	Distance, m	Maximum Charge per Delay, kg	Peak Particle Velocity, mm/s	Noise In (dB)
1	80	0.375	0.953	<100
	115		0.635	108.8
1(miss fire)	80	0.375	1.207	<100
	115		0.889	<88
2	100	0.375	0.953	<100
	130		0.508	105.5
2(miss fire)	100	0.375	1.080	<100
	130		0.762	108.4
3	130	0.375	0.699	<100
	210		-	-
4	75	0.375	1.207	<100
	200		-	-

Data Analysis

Ground vibrations and noise levels were recorded at different locations. From the above Table-5, it can be observed that the highest Peak Particle Velocity (PPV) recorded was 1.2mm/s at a distance of 75m in Blast No. 4 & at a distance of 80m Blast No. 1, the second highest PPV was 1.08mm/s at a distance of 100m in Blast No. 2. In all the other cases, the PPV values are less than 1mm/s, and No vibration was recorded at the house during the studies conducted.

Intensity of ground vibrations mainly depends upon the maximum charge per delay and the distance between the blast location and monitoring point. Further, the level difference between the blast location and monitoring point, direction of propagation etc., also will influence the blast vibration levels.

The highest noise level was 108.8dB in Blast No.1, the second highest was 108.4B in Blast No.2, in many cases the noise level was less than 100dB which is insignificant. The higher noise levels may cause some inconvenience at that particular point of time but it will not affect the structures as it passes through air.

Fly Rock is another problem associated with blasting operations in general. It was observed to a distance of 30-40m from blast site, and it was within 10m with muffling arrangement.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The scientific study carried out in the Granite Building Stone Quarry of Mr. C. Krishna Pillai located in Block No: 27, Re-Survey No. 283/1pt, 283/2pt, 283/4, 296/3pt Ezhumattoor Village, Mallapally Taluk, Pathanamthitta Dist of Kerala, led to draw the following conclusions:

- ✓ In total, 4 blasts were conducted under controlled conditions.
- ✓ Blastholes of 35mm diameter were used in the studies.
- ✓ Depth of blastholes was 5ft (1.51m) in all blast rounds, with 0.91m burden and 0.91m spacing.
- ✓ Number of blastholes during the study varied from 10 to 30.
- ✓ Explosive available in the form of 25mm diameter cartridges, each weighing 125gm was used for charging the blastholes.
- ✓ Explosive Charge per hole was 375gm (three cartridges) in all the blasts rounds.
- ✓ Maximum charge per delay was 375gm and Total explosive charge per round varied from 3.75kg to 11.25kg during the scientific study.

- ✓ All the blasts were initiated using NONEL based shocktube detonators.
- ✓ There are some houses around the quarry. The houses on north west side belongs to the quarry owner only so they have abandoned them and no one living in them. There are some houses on south east side of the quarry along the public road beyond 77m from lease boundary. Such houses/structures, may be assigned with safe ground vibration level of 5mm/s, as per Director General of Mines Safety (DGMS) norms, taking the lowest frequency range of ground vibrations into consideration.
- ✓ Ground vibration levels are recorded for all the blasts using one unit of Minimate and one unit of Minimate-Plus- Instantel Canada. Full event sheets are downloaded using the softwares supplied by the manufacturer.
- ✓ Monitoring distances varied from 75 to 210m from blast locations.
- ✓ The highest Peak Particle Velocity (PPV) recorded was 1.2mm/s at a distance of 75m in Blast No. 4 & at a distance of 80m in Blast No. 1, the second highest PPV was 1.08mm/s at a distance of 100m in Blast No. 2. In all the other cases, the PPV values are less than 1mm/s, and No vibration was recorded at the house during the studies conducted.
- ✓ Intensity of ground vibrations mainly depends upon the maximum charge per delay and the distance between the blast location and monitoring point. Further, the level difference between the blast location and monitoring point, direction of propagation etc., also will influence the blast vibration levels.
- ✓ Based on the ground vibration monitoring, it was found that all the PPV values are less than 5mm/s at all the monitoring points (from 75m onwards), which is safe as per DGMS guidelines and no vibration was recorded beyond 140m (means PPV is less than 0.51mm/s). Inafct, all the structures are Infront of the blast (not behind the blast), so propagation velocity is generally less on the front side.

- ✓ The highest noise level was 108.8dB in Blast No.1, the second highest was 108.4B in Blast No.2, in many cases the noise level was less than 100dB which is insignificant.
- ✓ Fly Rock is another problem associated with blasting operations in general. It was observed to a distance of 30-40m from blast site without muffling arrangement and with muffling arrangement the fly rock is within 10m.

It may, therefore, be concluded that the intensity of ground vibrations, noise and fly rock caused due to blasting operations carried out in the Granite Building Stone Quarry of Mr. C. Krishna Pillai located in Block No: 27, Re-Survey No. 283/1pt, 283/2pt, 283/4, 296/3pt Ezhumattoor Village, Mallapally Taluk, Pathanamthitta Dist of Kerala are within permissible limits.

Recommendations

Blasting operations may be conducted in the Granite Building Stone Quarry of Mr. C. Krishna Pillai located in Block No: 27, Re-Survey No. 283/1pt, 283/2pt, 283/4, 296/3pt Ezhumattoor Village, Mallapally Taluk, Pathanamthitta Dist of Kerala, with the following recommendations:

- ➢ 32-35mm diameter blastholes drilled with hand held Jackhammer drills to a maximum depth of 5feet (1.51), each hole may be charged with 375 to 500gm of explosive.
- ➢ Burden x spacing pattern may be followed as 0.91 to 1.21m (3 to 4ft) based on the required fragmentation.

- NONEL based shocktube detonators may be used for initiation. Hole to hole delay can be 17ms or 25ms and accordingly row to row delay shall be 25 or 42ms respectively.
- Blasting methodology suggested in Table- 6 may be followed.
- If the distance between the blast location and the houses is more than 150m, blasts may be conducted with a maximum of 24 holes in a blast round. If the distance between houses and the blast location is less than 150m then number of holes to be reduced gradually and should not be more than 14.
- Ground vibrations can be controlled with individual hole delay with the help of NONEL based shocktube detonators, but fly rock to be controlled completely as there are houses around. So, it is advised to conduct the blasts under the supervision of atleast a second class mine's a manger certificate holder. Every blast should have a complete free face, all the small rock pieces to be cleared before drilling itself and blast area to be covered completely with sand bags with mesh or blasting mats. In order to reduce the intensity of ground vibrations, as far as possible the structures shouldn't be behind the blast. All the blasts details should be documented as shown in Table-7.
- Blast layout suggested in Fig. 16 may be used with the available NONEL initiation system with specific delay timing of 250/25ms. If row to row surface connectors are available, then the layout shown in Fig. 17 may be used for better results (or similar layout based on number of blastholes).
- As there are rock and top soil benches behind the houses towards the quarry, the top soil erosion may take place during rainy season irrespective of blasting also. So, it has to be observed periodically if any top soil movement towards the houses.

- All other rules and regulations imposed by various agencies like DGMS/ Dept. of Mines & Geology/ any other relevant organization to be followed from time to time.

TABLE-6. SUGGESTED BLAST CONFIGURATION

Sl. No.	Parameters	Suggested Value
1	Diameter of Blasthole (mm)	32 to 35
2	Burden (m)	0.91 to 1.21 (3 to 4 feet)
3	Spacing (m)	0.91 to 1.21 (3 to 4 feet)
4	Depth of Blasthole (m)	1.51 to 1.82 (4 to 5feet)
5	No. of Blastholes	Maximum of 24
6	Explosive Charge / Hole (gm)	375 to 500
7	Maximum Charge / Delay (gm)	375 to 500
8	Total Charge / Blast (kg)	10.0
9	Initiation System	NONEL based shocktube detonators Or Ordinary detonator with safety fuse
10	Initiation Pattern	Row by row or Diagonal
11	Delay timing between any two blastholes	At least 8ms
12	No. of rows	Maximum of 3

TABLE- 7 DETAILS OF THE BLASTS TO BE MONITORED

Sl. No.	Parameters	Blast No.	Blast No.	Blast No.
1	Date of Blast			
2	Time of Blast (Hours)			
3	Location of Blast			
4	Diameter of Blasthole (mm)			
5	Burden (m)			
6	Spacing (m)			
7	Depth of Blasthole (m)			
8	No. of Blastholes			
9	Explosive Charge / Hole (kg)			
10	Maximum Charge / Delay (kg)			
11	Total Charge / Blast (kg)			
12	Initiation System			
13	Initiation Pattern			
14	Remarks			

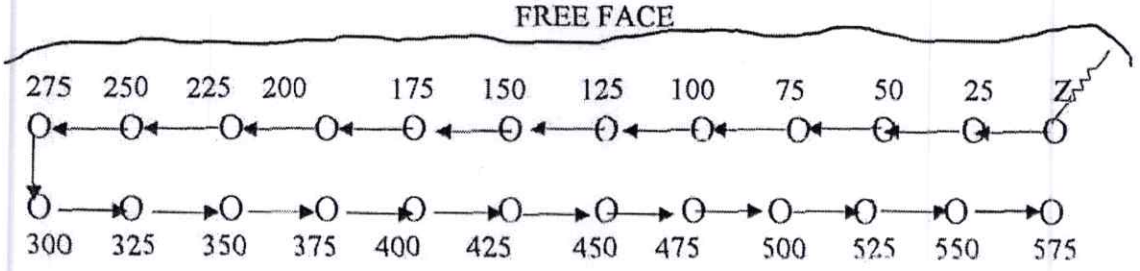
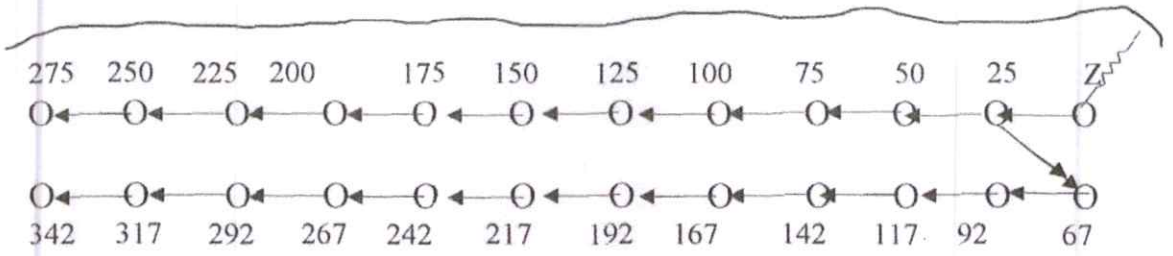


FIG. 16 SUGGESTED BLAST LAYOUT -1



- 25 ms hole-to-hole

- 42 ms row to row

Hole to hole- 25ms & Row to row 42ms delay

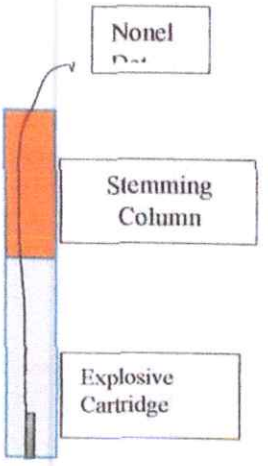


FIG. 17 SUGGESTED BLAST LAYOUT -2

02/06/2023

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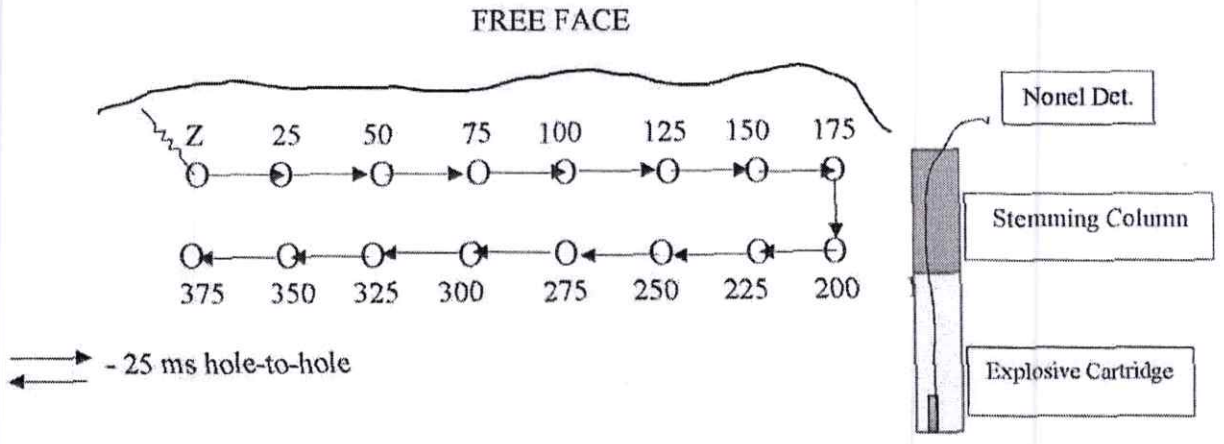
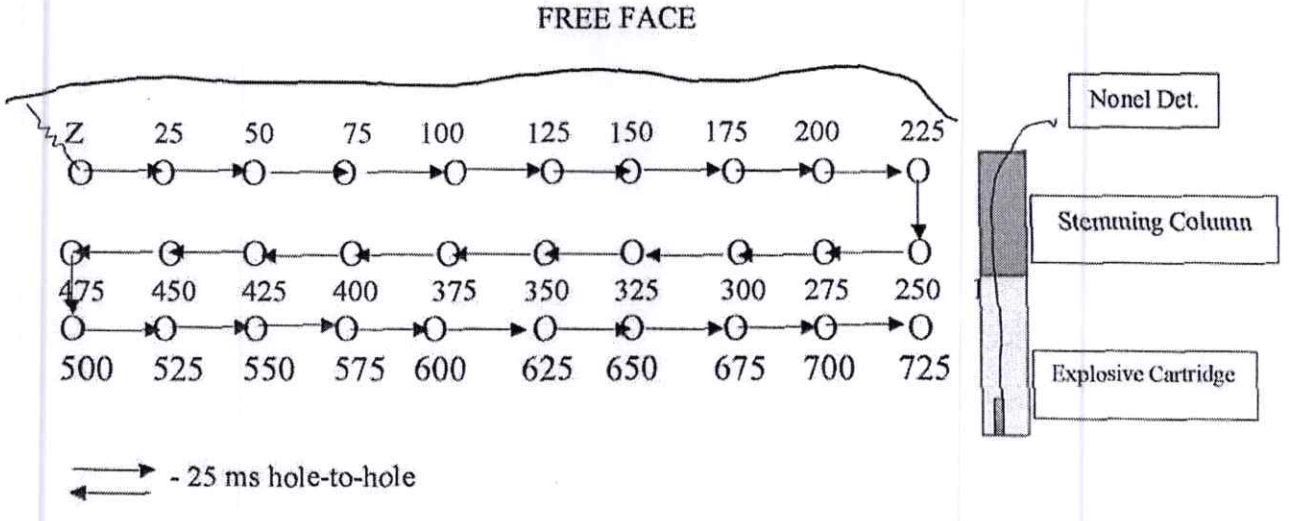
APPENDIX -I

(Layouts of Blasts Studied)

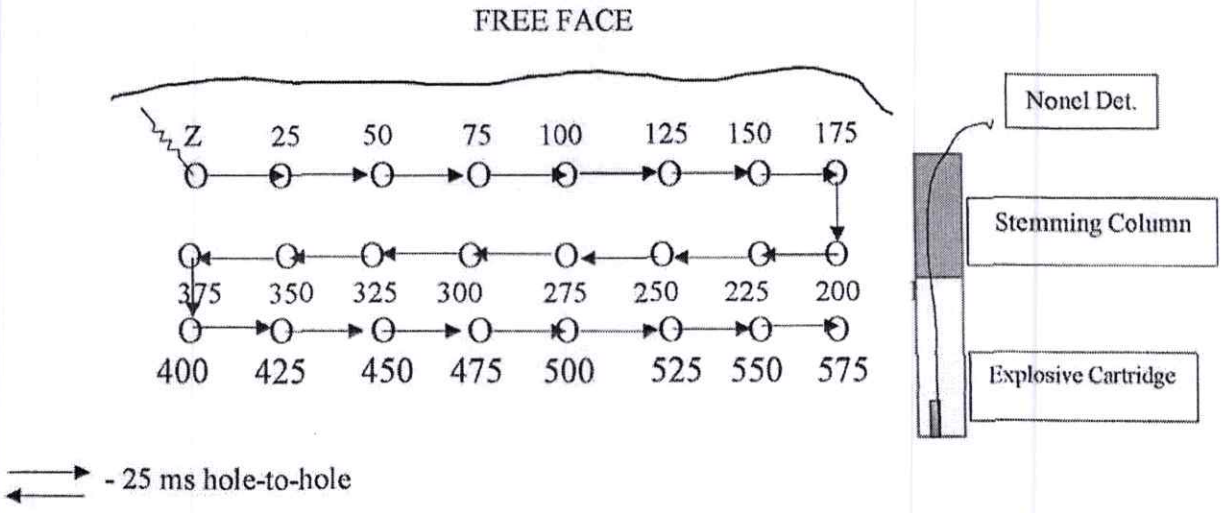
Dr. Ram Chandar Karra, Dept. of Mining Engineering, NITK-Surathkal (Govt. of India)



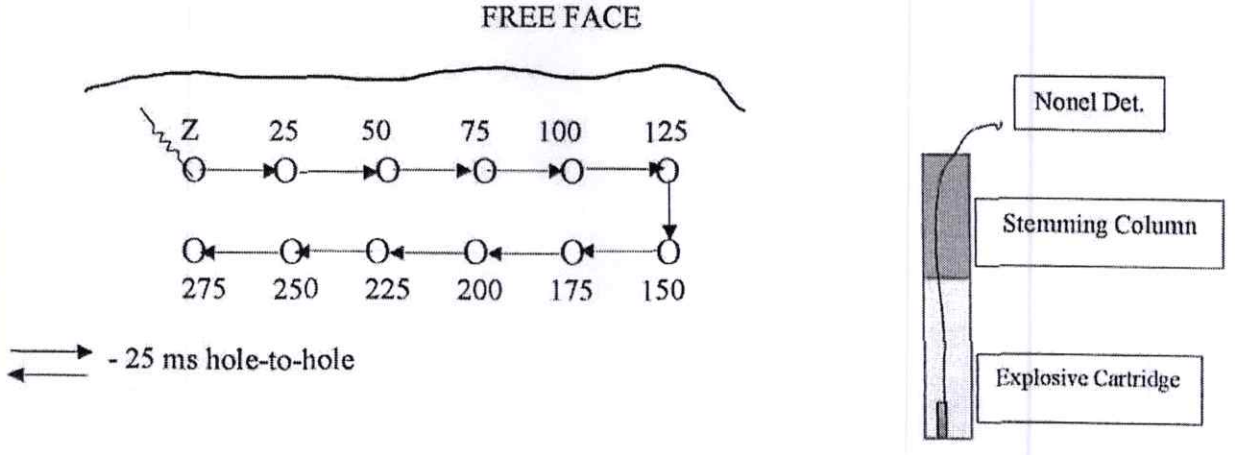
Layout of Blast No. 1



Layout of Blast No. 2



Layout of Blast No. 3



Layout of Blast No .4

APPENDIX -II

BLAST EVENTS

Date/Time	Vert at 11:16:51 May 14, 2023
Trigger Source	Geo: 0.508 mm/s
Range	Geo: 127.0 mm/s
Record Time	2.0 sec at 1024 sps

Serial Number	3720 V 2.61 MiniMate
Battery Level	6.6 Volts
Unit Calibration	December 2, 2022 by UES New Delhi
File Name	E720K0UV.C30

Notes
Location:
Client:
User Name:
Converted: May 18, 2023 16:17:11 (V 10.74)

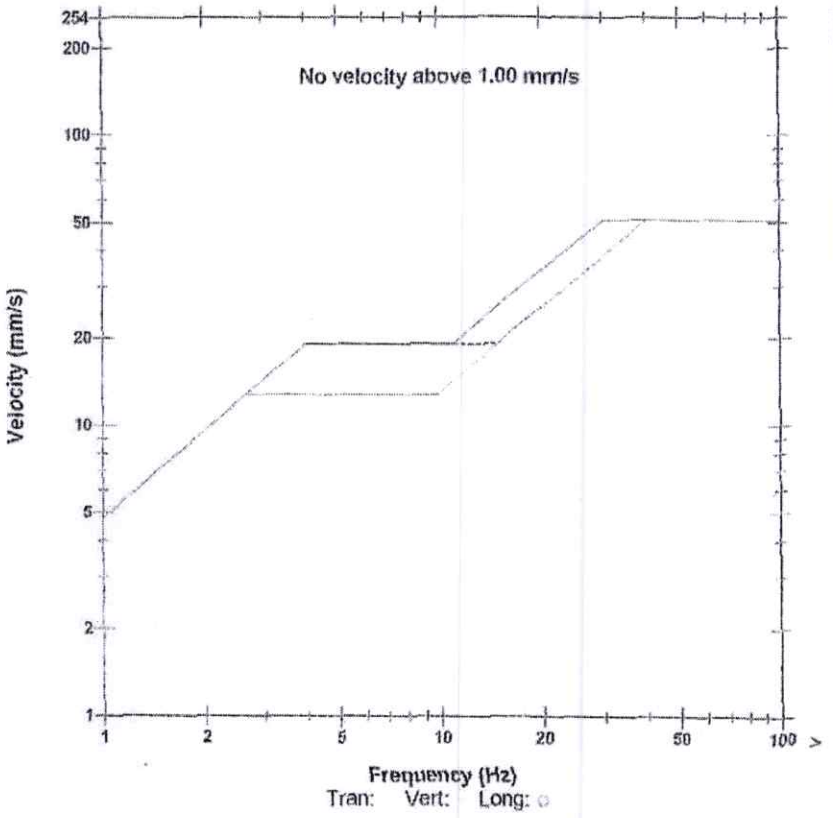
Extended Notes

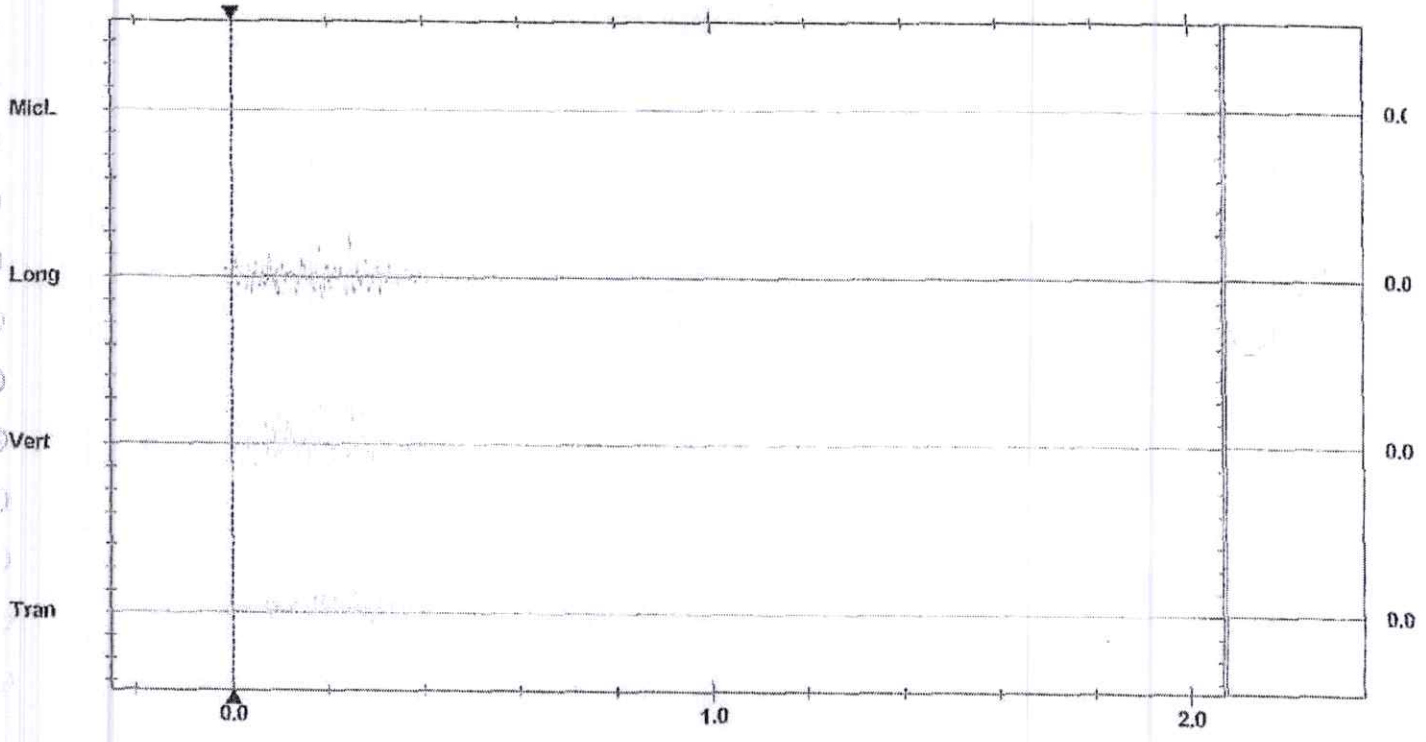
Microphone	Linear Weighting
PSPL	<100 dB(L)
ZC Freq	N/A
Channel Test	Check (Freq = 0.0 Hz Amp = 55 mv)

	Tran	Vert	Long	
PPV	0.508	0.953	0.953	mm/s
ZC Freq	>100	64	73	Hz
Time (Rel. to Trig)	0.258	0.187	0.249	sec
Peak Acceleration	0.040	0.080	0.040	g
Peak Displacement	0.001	0.002	0.002	mm
Sensor Check	Check	Passed	Passed	
Frequency	6.4	8.0	8.2	Hz
Overswing Ratio	4.5	3.4	4.0	

Peak Vector Sum 1.032 mm/s at 0.239 sec
N/A: Not Applicable

USBM RI8507 And OSMRE





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 0.500 mm/s/div Mic: 5.000 pa.(L)/div
Trigger =

Sensor Check

Event Report

Date/Time	Long at 11:16:57 May 14, 2023
Trigger Source	Geo: 0.510 mm/s
Range	Geo: 254.0 mm/s
Record Time	2.0 sec at 1024 sps

Serial Number	BE17439 V 10.72-8.17 MiniMate Plus/8
Battery Level	6.4 Volts
Unit Calibration	December 2, 2022 by UES New Delhi
File Name	S439JZOF.AW0

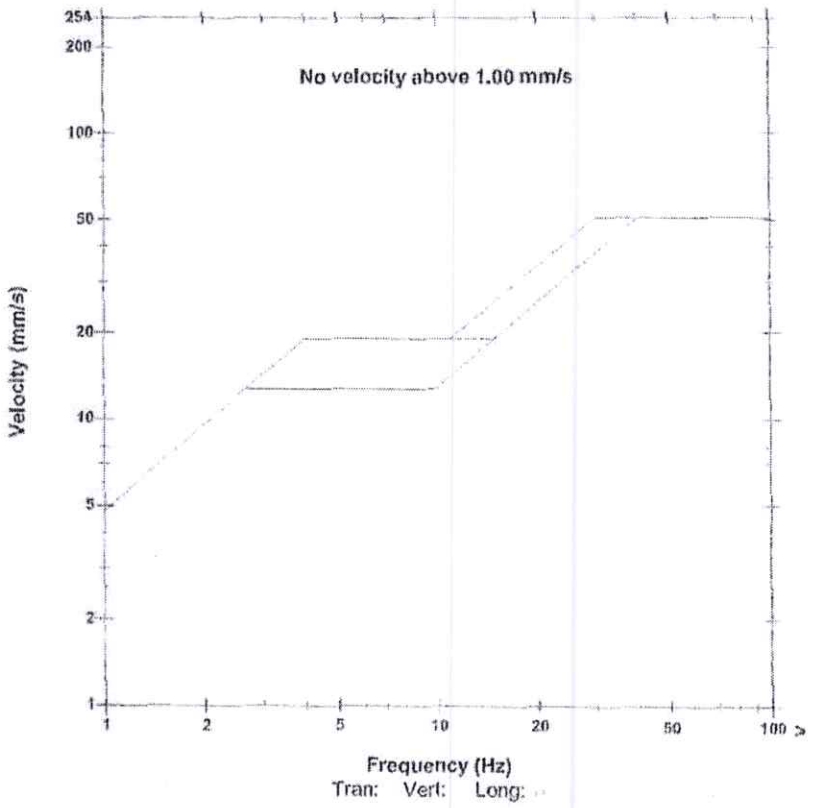
Notes

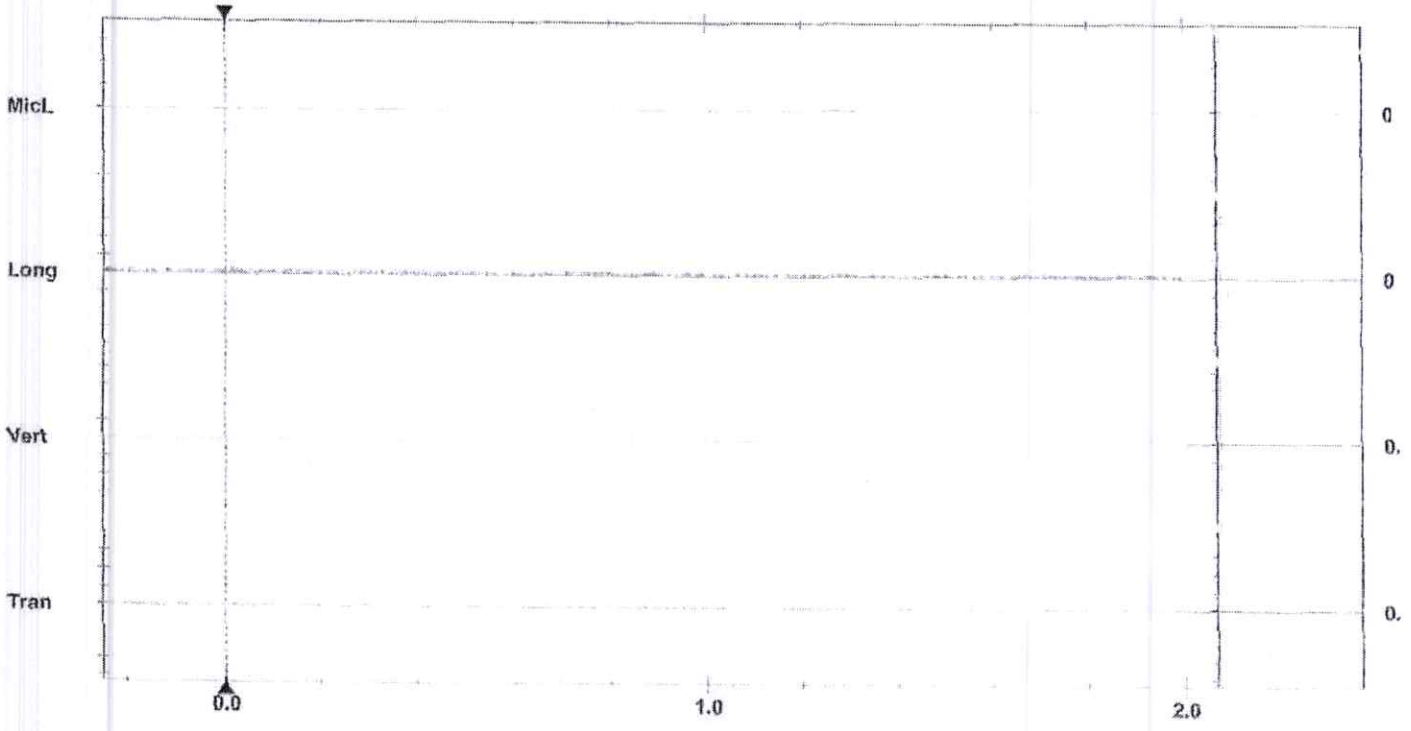
Microphone	Linear Weighting
PSPL	108.8 dB(L) at 0.603 sec
ZC Freq	30 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 438 mv)

	Tran	Vert	Long	
PPV	0.381	0.506	0.635	mm/s
ZC Freq	>100	>100	>100	Hz
Time (Rel. to Trig)	0.013	0.002	0.017	sec
Peak Acceleration	0.040	0.066	0.053	g
Peak Displacement	0.000	0.000	0.005	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.7	7.5	7.8	Hz
Overswing Ratio	3.5	3.5	3.5	

Peak Vector Sum 0.684 mm/s at 0.376 sec

USBM RI8507 And OSMRE





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div

Trigger =

Sensor Check

Printed: May 21, 2023 (V 10.74)

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Instantel

Event Report

Date/Time	Vert at 11:22:13 May 14, 2023
Trigger Source	Geo: 0.508 mm/s
Range	Geo: 127.0 mm/s
Record Time	2.0 sec at 1024 sps

Serial Number	3720 V 2.61 MiniMate
Battery Level	6.6 Volts
Unit Calibration	December 2, 2022 by UES New Delhi
File Name	E720K0UV.L10

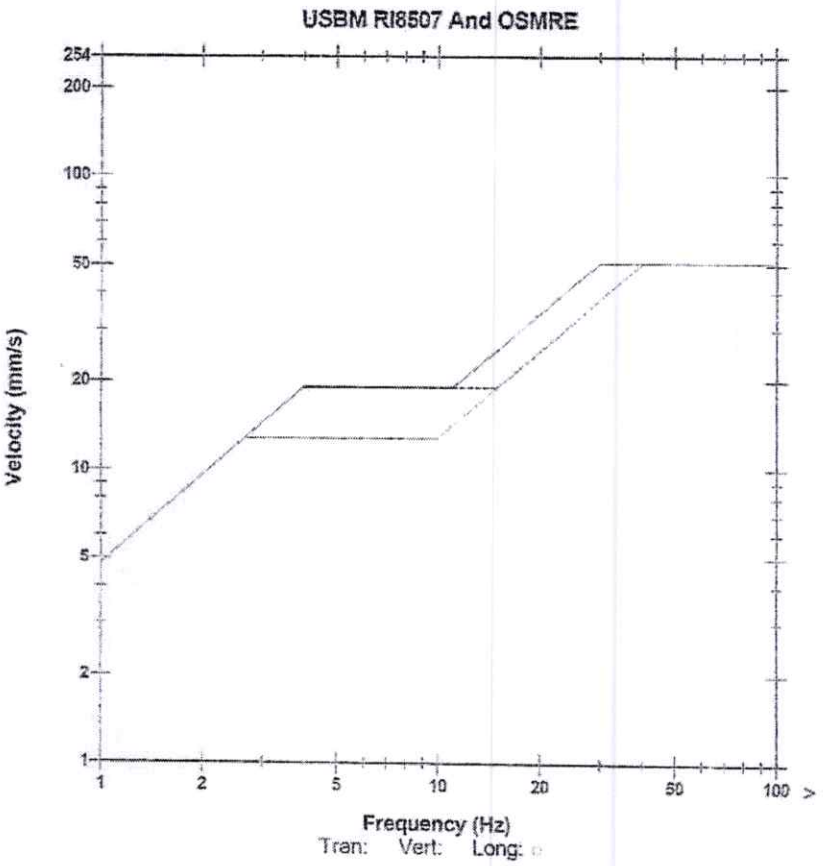
Notes
Location:
Client:
User Name:
Converted: May 18, 2023 16:17:11 (V 10.74)

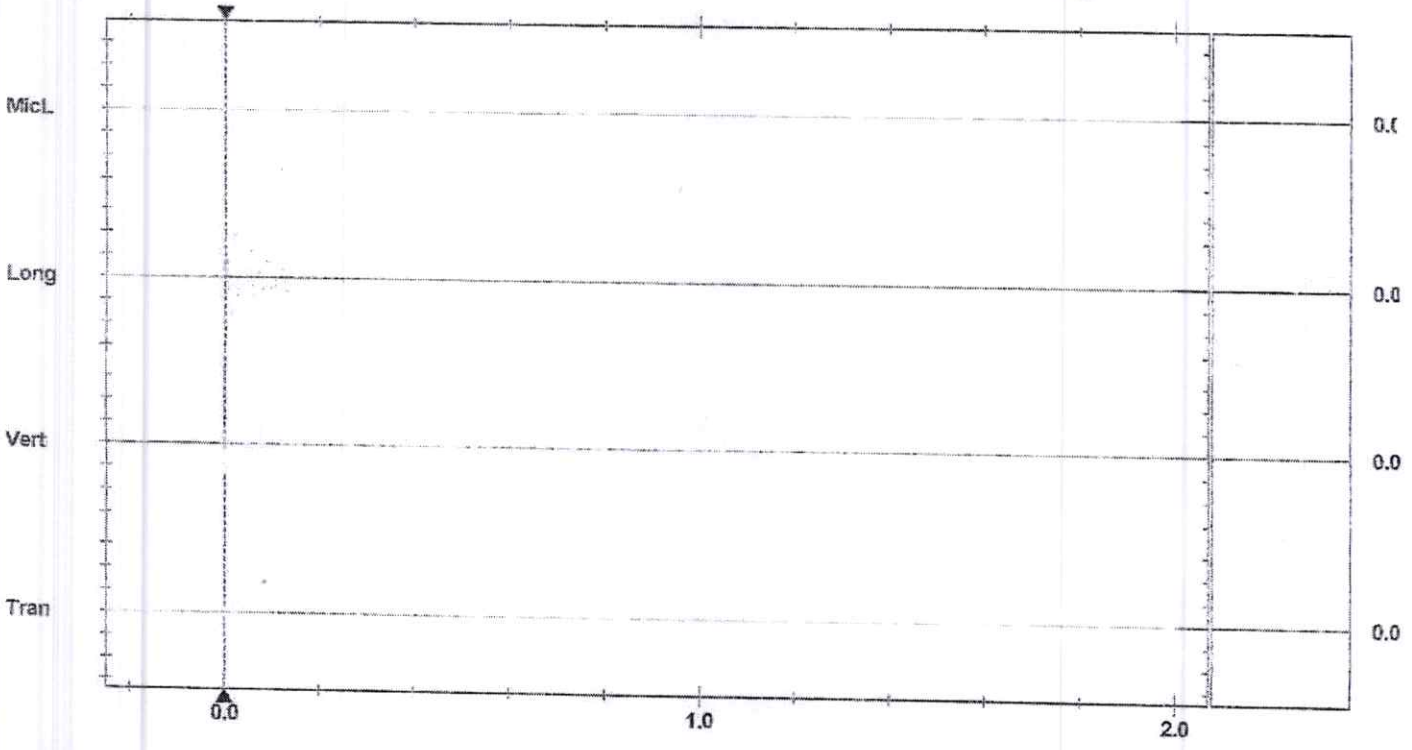
Extended Notes

Microphone	Linear Weighting
PSPL	<100 dB(L)
ZC Freq	N/A
Channel Test	Check (Freq = 0.0 Hz Amp = 55 mv)

	Tran	Vert	Long	
PPV	0.635	1.207	0.953	mm/s
ZC Freq	N/A	57	51	Hz
Time (Rel. to Trig)	0.022	0.019	0.020	sec
Peak Acceleration	0.046	0.093	0.053	g
Peak Displacement	0.001	0.003	0.003	mm
Sensor Check	Check	Passed	Passed	
Frequency	6.4	8.0	8.2	Hz
Overswing Ratio	4.5	3.4	4.0	

Peak Vector Sum 1.461 mm/s at 0.019 sec
N/A: Not Applicable





Time Scale: 0.20 sec/div Amplitude Scale: Geo: 0.500 mm/s/div Mic: 5.000 pa.(L)/div
Trigger =

Sensor Check

Printed: May 20, 2023 (V 10.74)

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Date/Time	Vert at 11:22:18 May 14, 2023
Trigger Source	Geo: 0.510 mm/s
Range	Geo: 254.0 mm/s
Record Time	2.0 sec at 1024 sps

Serial Number	BE17439 V 10.72-8.17 MiniMate Plus/8
Battery Level	6.3 Volts
Unit Calibration	December 2, 2022 by UES New Delhi
File Name	S439JWOR.170

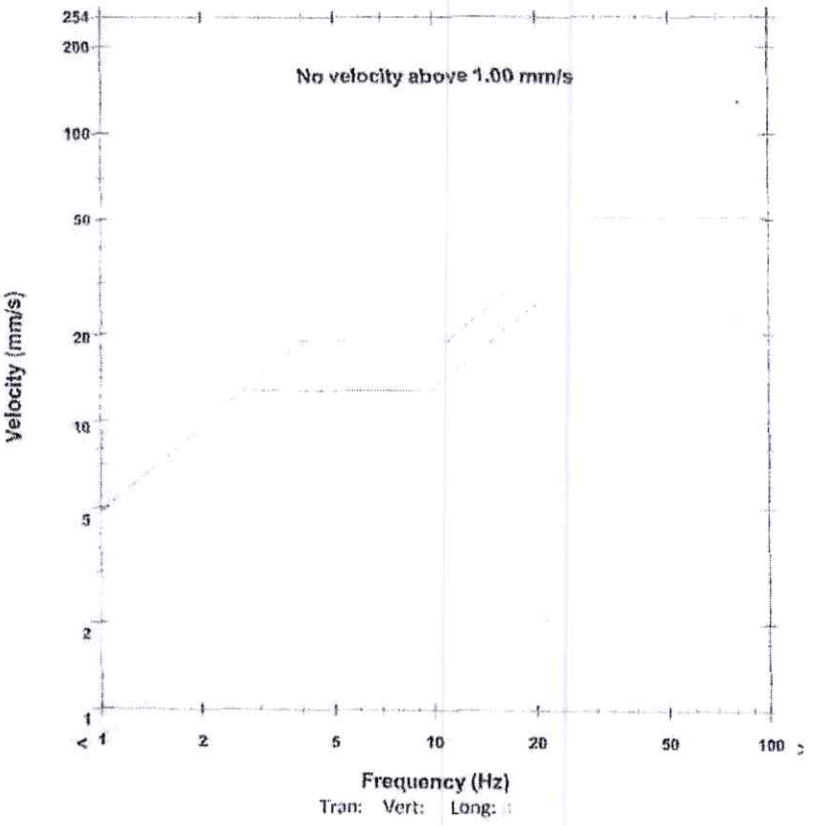
Notes

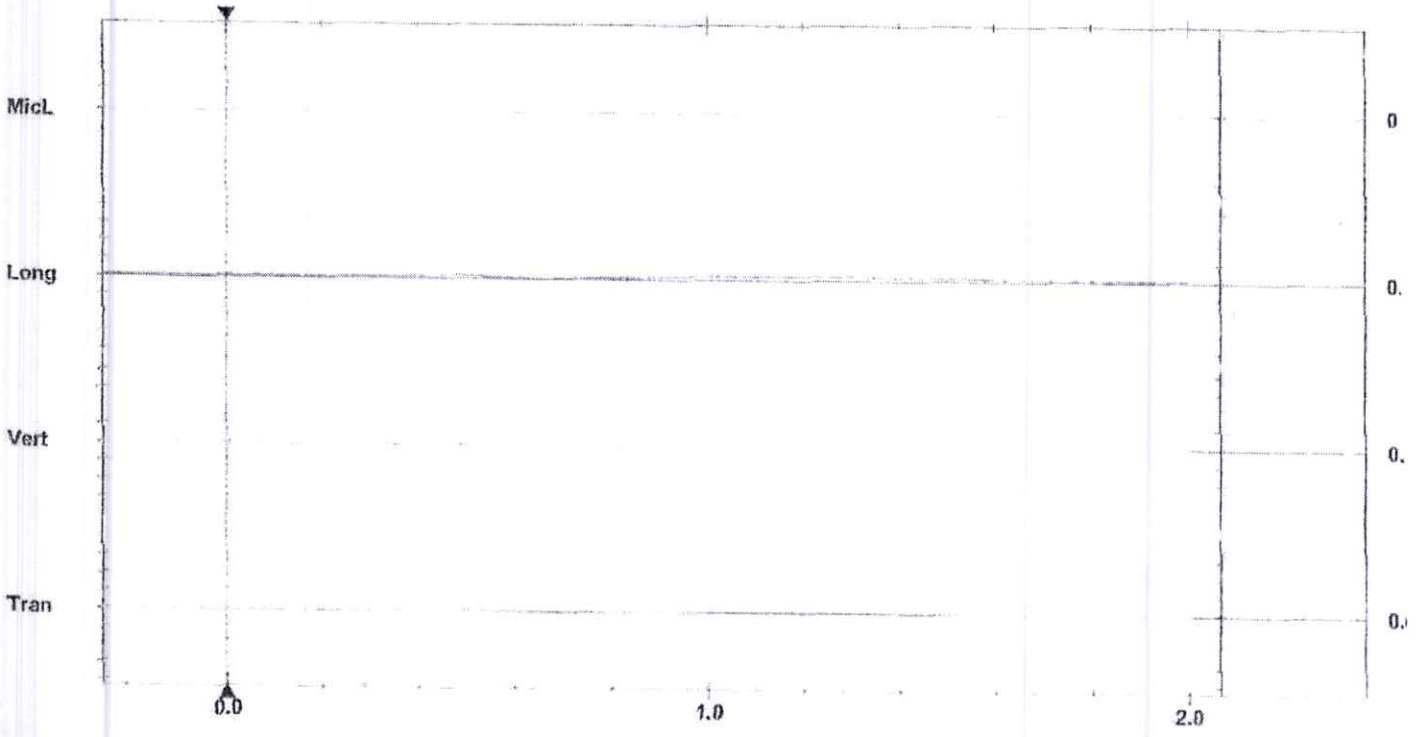
Microphone	Linear Weighting
PSPL	<88 dB(L)
ZC Freq	>100 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 527 mv)

	Tran	Vert	Long	
PPV	0.381	0.889	0.508	mm/s
ZC Freq	>100	>100	6.7	Hz
Time (Rel. to Trig)	0.644	0.350	0.519	sec
Peak Acceleration	0.040	0.066	0.027	g
Peak Displacement	0.001	0.001	0.128	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.8	7.7	8.1	Hz
Overswing Ratio	3.6	3.7	3.6	

Peak Vector Sum 0.933 mm/s at 0.350 sec
N/A: Not Applicable

USBM RI8507 And OSMRE





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

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R5(a)/52

Date/Time	Vert at 11:38:22 May 14, 2023
Trigger Source	Geo: 0.508 mm/s
Range	Geo: 127.0 mm/s
Record Time	2.0 sec at 1024 sps

Serial Number	3720 V 2.61 MiniMate
Battery Level	6.6 Volts
Unit Calibration	December 2, 2022 by UES New Delhi
File Name	E720K0UW.BY0

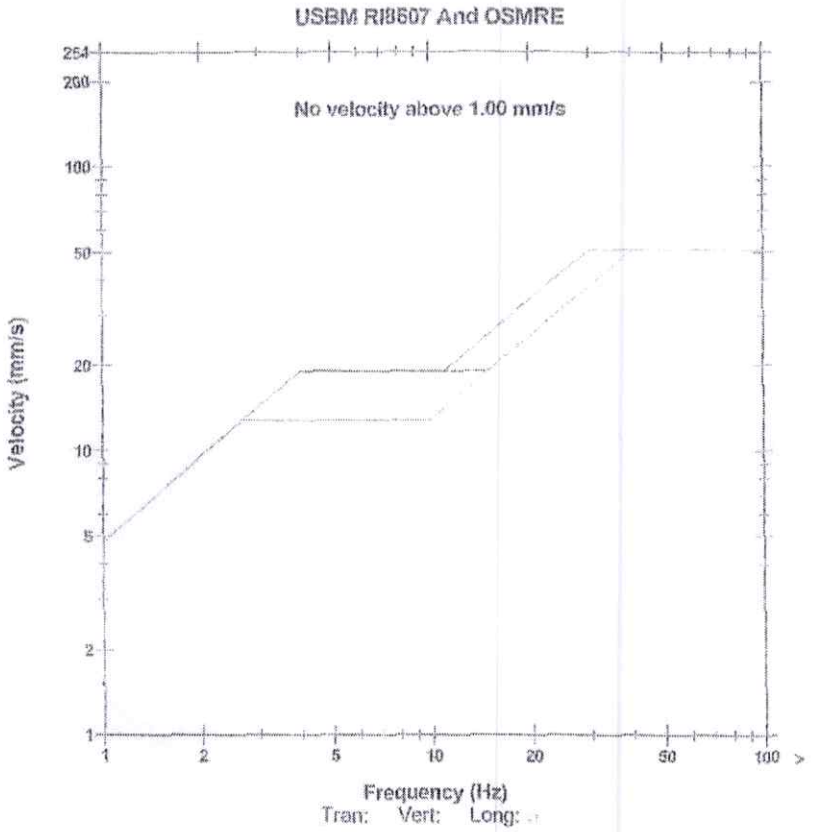
Notes
Location:
Client:
User Name:
Converted: May 18, 2023 16:17:11 (V 10.74)

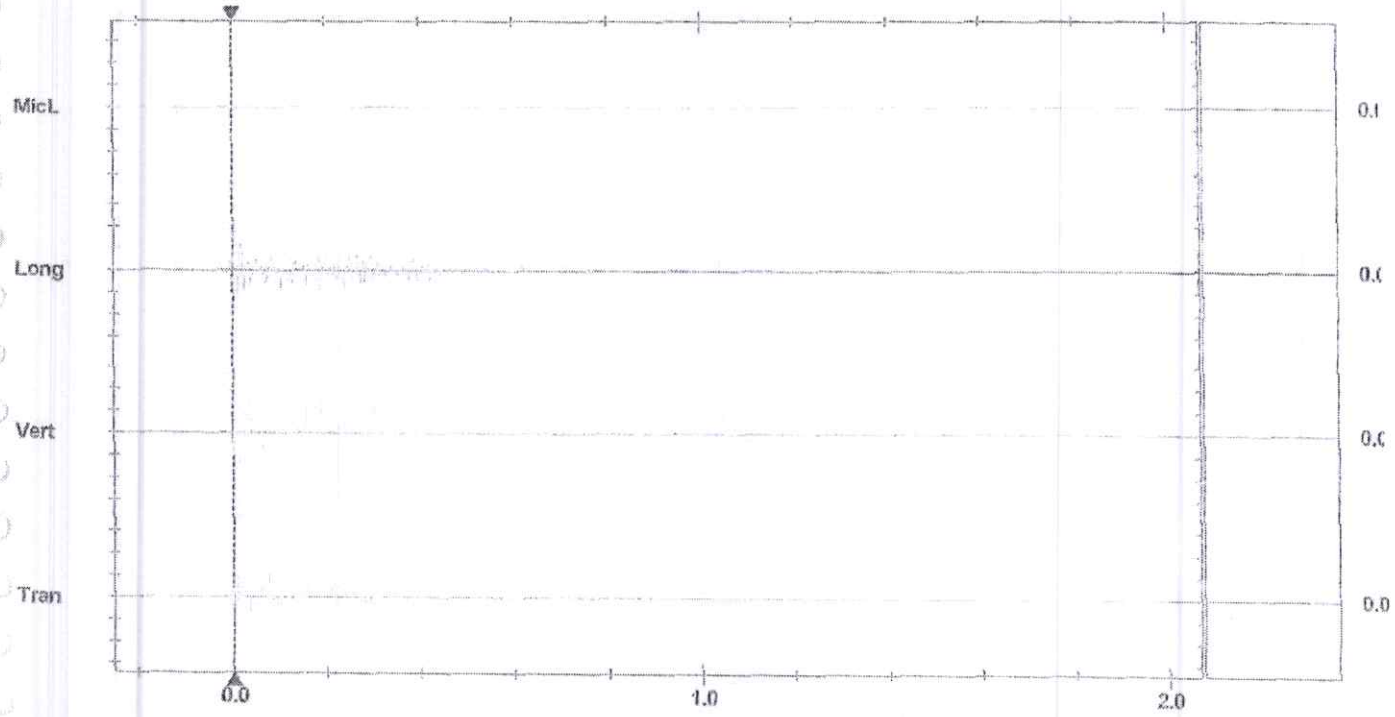
Extended Notes

Microphone	Linear Weighting
PSPL	<100 dB(L)
ZC Freq	N/A
Channel Test	Check (Freq = 0.0 Hz Amp = 55 mv)

	Tran	Vert	Long	
PPV	0.635	0.953	0.572	mm/s
ZC Freq	>100	N/A	47	Hz
Time (Rel. to Trig)	0.077	0.286	0.011	sec
Peak Acceleration	0.046	0.066	0.033	g
Peak Displacement	0.001	0.002	0.002	mm
Sensor Check	Check	Passed	Passed	
Frequency	6.4	8.0	8.2	Hz
Overswing Ratio	4.1	3.5	4.0	

Peak Vector Sum 1.016 mm/s at 0.286 sec
N/A: Not Applicable





Time Scale: 0.20 sec/div Amplitude Scale: Geo: 0.500 mm/s/div Mic: 5.000 pa.(L)/div
Trigger = ▶

Sensor Check

Printed: May 20, 2023 (V 10.74)

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R5(a)/53

Instantel

Event Report

Date/Time	Long at 11:38.28 May 14, 2023
Trigger Source	Geo: 0.510 mm/s
Range	Geo: 254.0 mm/s
Record Time	2.0 sec at 1024 sps

Serial Number	BE17439 V 10.72-8.17 MiniMate Plus/S
Battery Level	6.3 Volts
Unit Calibration	December 2, 2022 by UES New Delhi
File Name	S439JZOP.U60

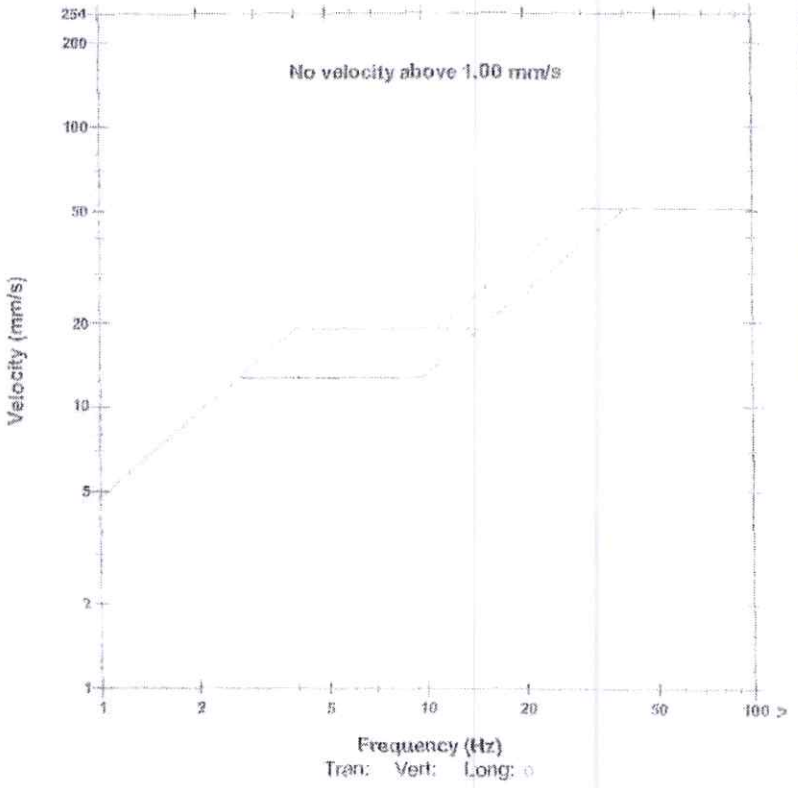
Notes

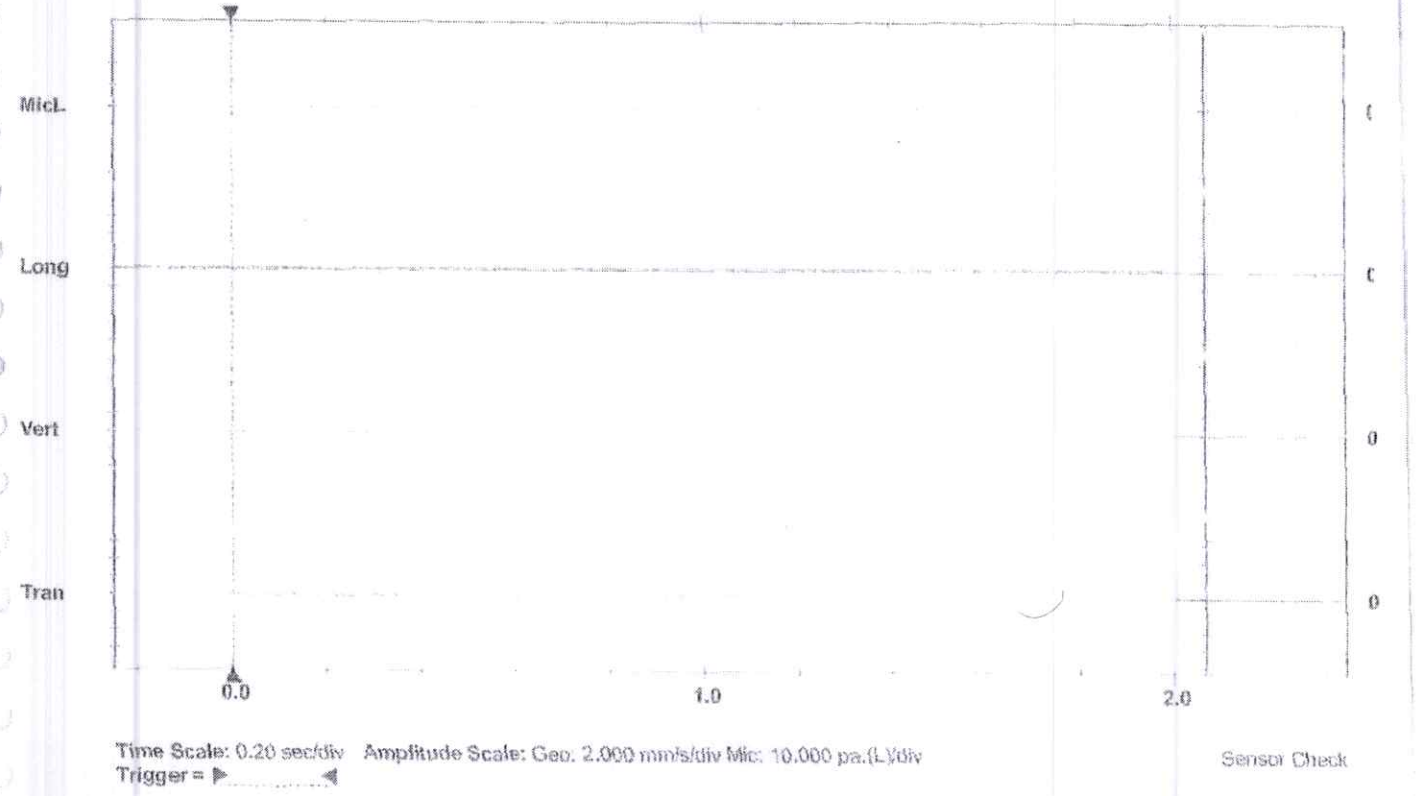
Microphone	Linear Weighting
PSPL	105.5 dB(L) at 1.484 sec
ZC Freq	43 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 480 mv)

	Tran	Vert	Long	
PPV	0.508	0.381	0.508	mm/s
ZC Freq	>100	>100	37	Hz
Time (Rel. to Trig)	0.018	0.077	0.000	sec
Peak Acceleration	0.040	0.040	0.040	g
Peak Displacement	0.001	0.001	0.006	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.7	7.6	7.9	Hz
Overswing Ratio	3.5	3.6	3.5	

Peak Vector Sum 0.718 mm/s at 0.018 sec

USBM RI8507 And OSMRE





Time Scale: 0.20 sec/div Amplitude Scale: Geo. 2.000 mm/s/div Mic. 10.000 pa.(L)/div
Trigger = ▶ ◀

Sensor Check

Printed: May 21, 2023 (V 10.74)

60

R5(9) / 54

instantel

Event Report

Date/Time	Long at 12:49:32 May 14, 2023
Trigger Source	Geo: 0.508 mm/s
Range	Geo: 127.0 mm/s
Record Time	2.0 sec at 1024 sps

Serial Number	3720 V 2.61 MiniMate
Battery Level	6.6 Volts
Unit Calibration	December 2, 2022 by UES New Delhi
File Name	E720K0UZ.MK0

Notes
Location:
Client:
User Name:
Converted: May 18, 2023 16:17:11 (V 10.74)

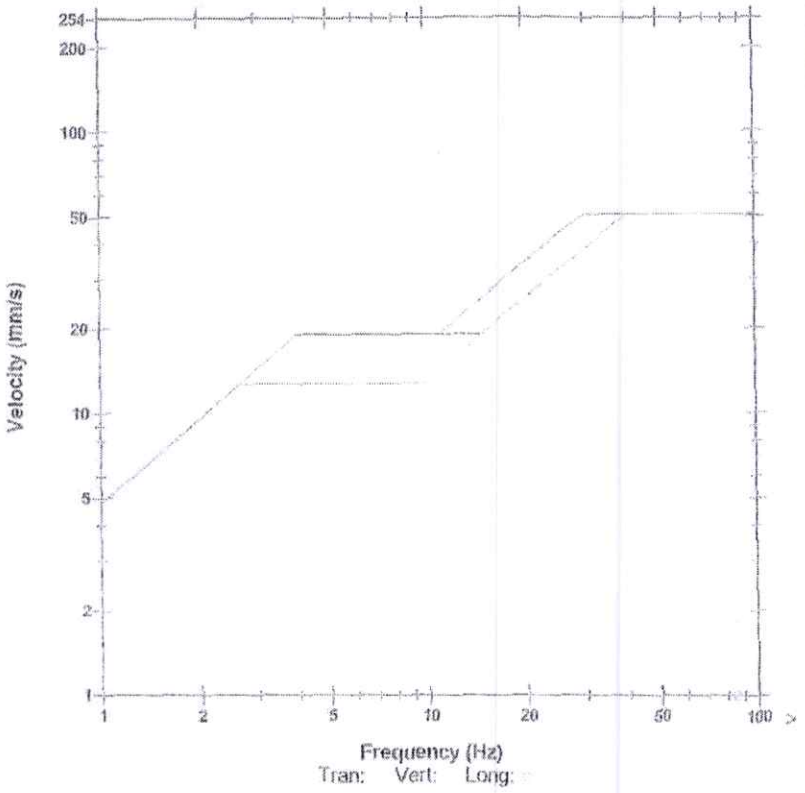
Extended Notes

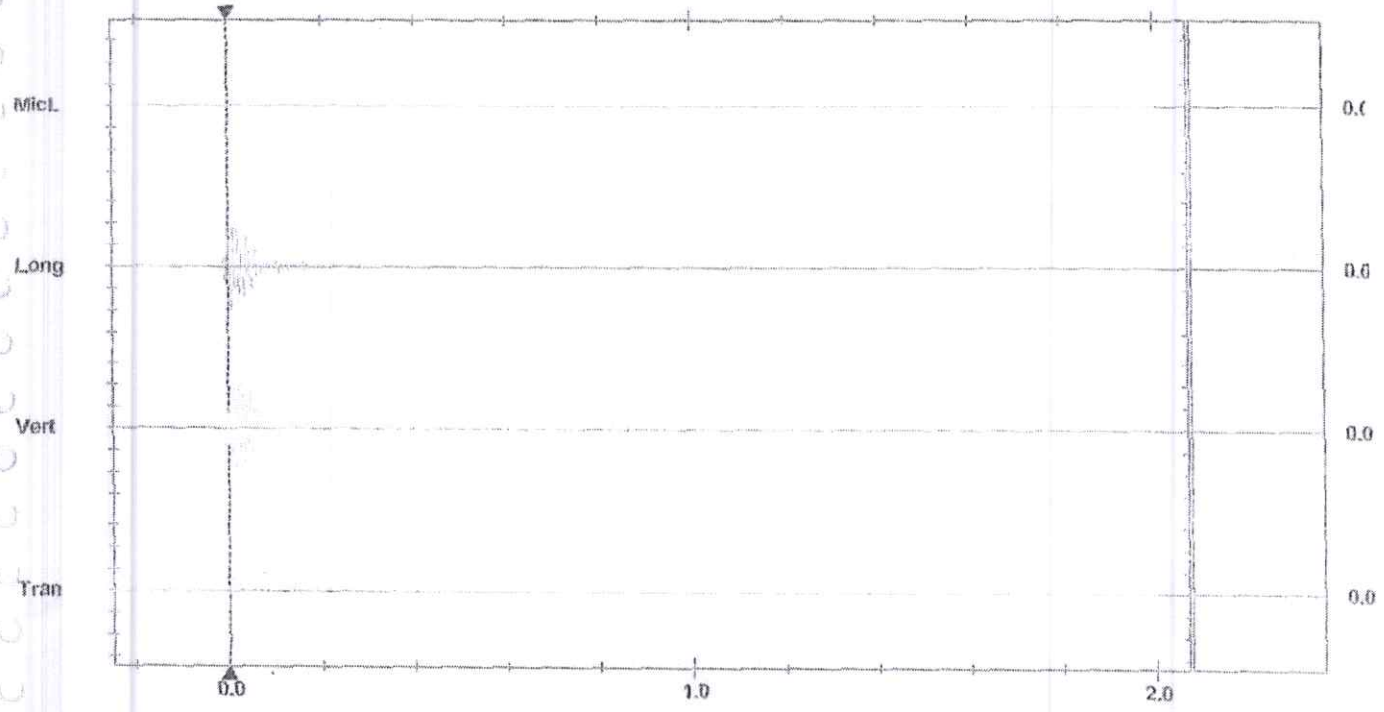
Microphone	Linear Weighting
PSPL	<100 dB(L)
ZC Freq	N/A
Channel Test	Check (Freq = 0.0 Hz Amp = 55 mv)

	Tran	Vert	Long	
PPV	0.445	1.080	1.016	mm/s
ZC Freq	57	>100	>100	Hz
Time (Rel. to Trig)	0.053	0.013	0.006	sec
Peak Acceleration	0.033	0.080	0.060	g
Peak Displacement	0.001	0.002	0.002	mm
Sensor Check	Check	Passed	Passed	
Frequency	6.0	7.8	8.1	Hz
Overswing Ratio	4.1	3.4	3.7	

Peak Vector Sum 1.175 mm/s at 0.006 sec
N/A: Not Applicable

USBM RI8507 And OSMRE





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 0.500 mm/s/div Mic: 5.000 pa.(L)/div
Trigger =

Sensor Check

instantel

Event Report

Date/Time	Long at 12:49:37 May 14, 2023
Trigger Source	Geo: 0.510 mm/s
Range	Geo: 254.0 mm/s
Record Time	2.0 sec at 1024 sps

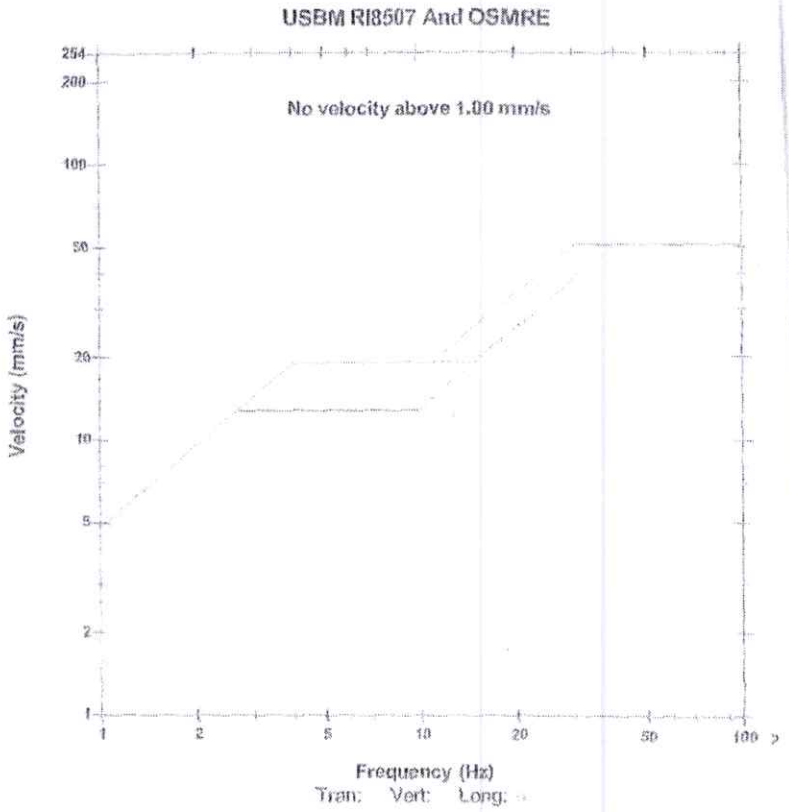
Serial Number	BE17439 V 10.72-8.17 MiniMate Plus/8
Battery Level	6.3 Volts
Unit Calibration	December 2, 2022 by UES New Delhi
File Name	S439JZOG.050

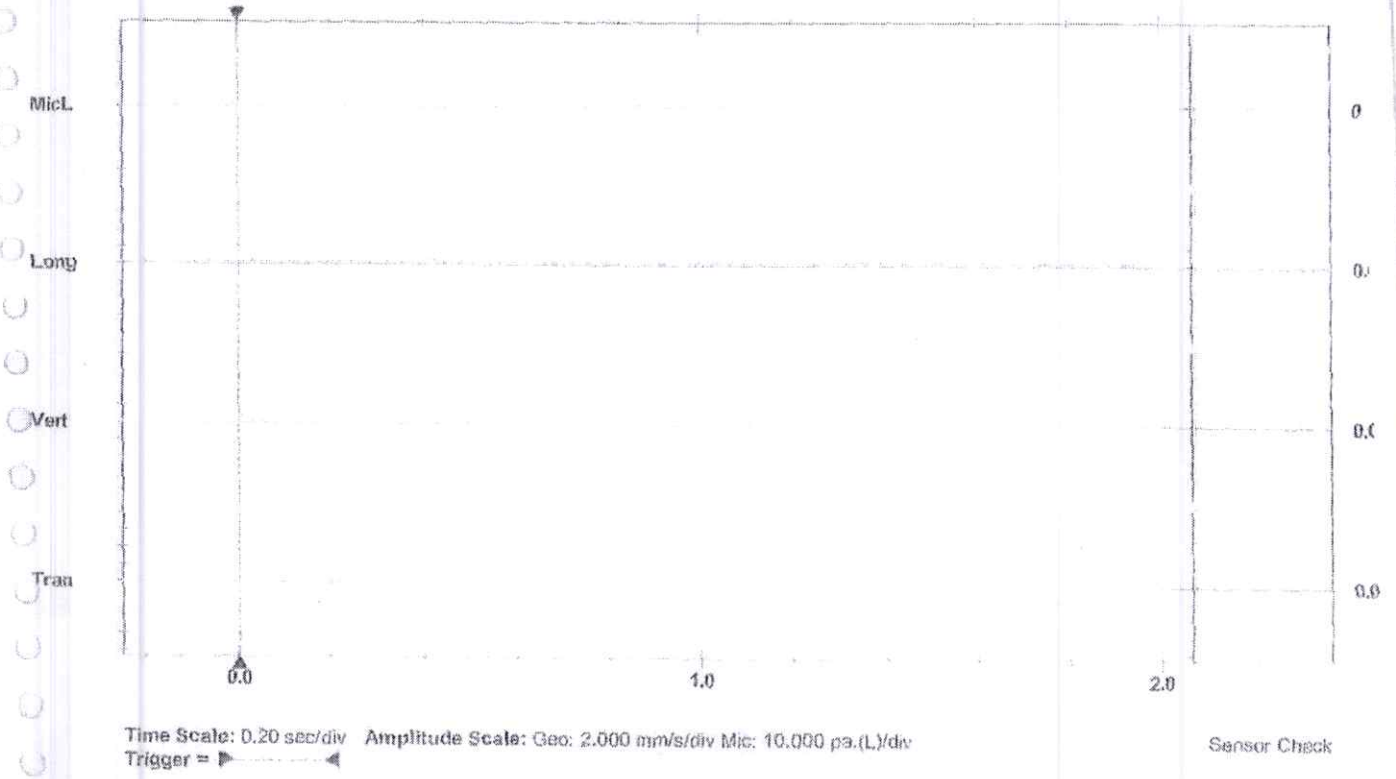
Notes

Microphone	Linear Weighting
PSPL	108.4 dB(L) at 0.437 sec
ZC Freq	30 Hz
Channel Test	Passed (Freq = 20.1 Hz Amp = 441 mv)

	Tran	Vert	Long	
PPV	0.635	0.508	0.762	mm/s
ZC Freq	>100	>100	>100	Hz
Time (Rel. to Trig)	0.431	0.049	0.034	sec
Peak Acceleration	0.093	0.066	0.066	g
Peak Displacement	0.001	0.001	0.006	mm
Sensor Check	Passed	Passed	Passed	
Frequency	7.7	7.5	7.9	Hz
Overswing Ratio	3.4	3.6	3.5	

Peak Vector Sum 0.852 mm/s at 0.413 sec





Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2.000 mm/s/div Mic: 10.000 pa.(L)/div
Trigger =

Sensor Check

Printed: May 24, 2023 (V 10.74)

Event Report

Date/Time	Long at 12:56:15 May 14, 2023
Trigger Source	Geo: 0.508 mm/s
Range	Geo: 127.0 mm/s
Record Time	2.0 sec at 1024 sps

Serial Number	3720 V 2.61 MiniMate
Battery Level	6.6 Volts
Unit Calibration	December 2, 2022 by UES New Delhi
File Name	E720K0UZ.XR0

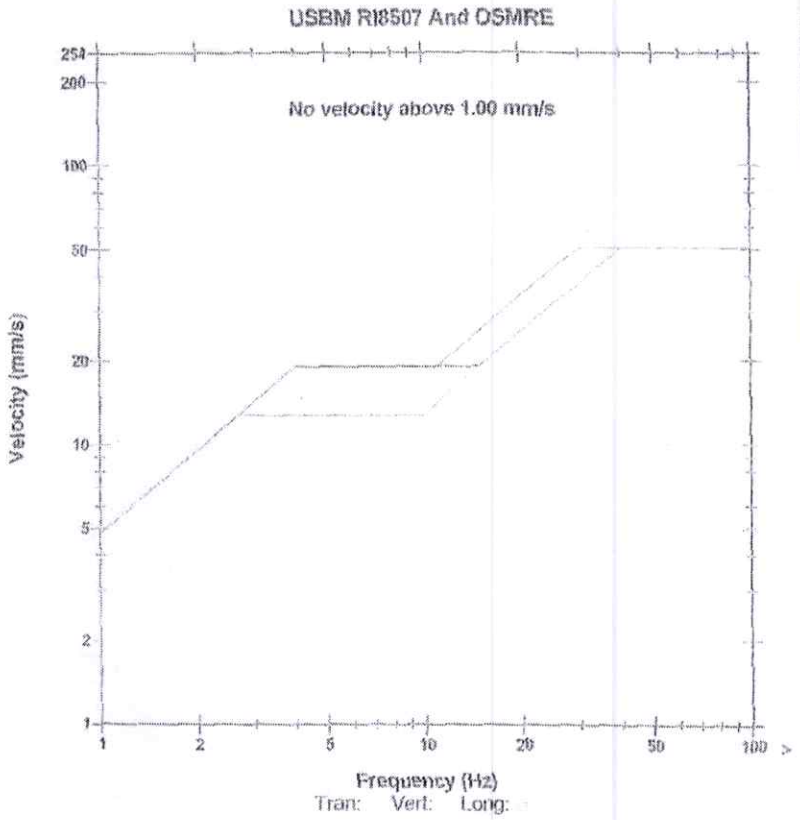
Notes
Location:
Client:
User Name:
Converted: May 18, 2023 16:17:11 (V 10.74)

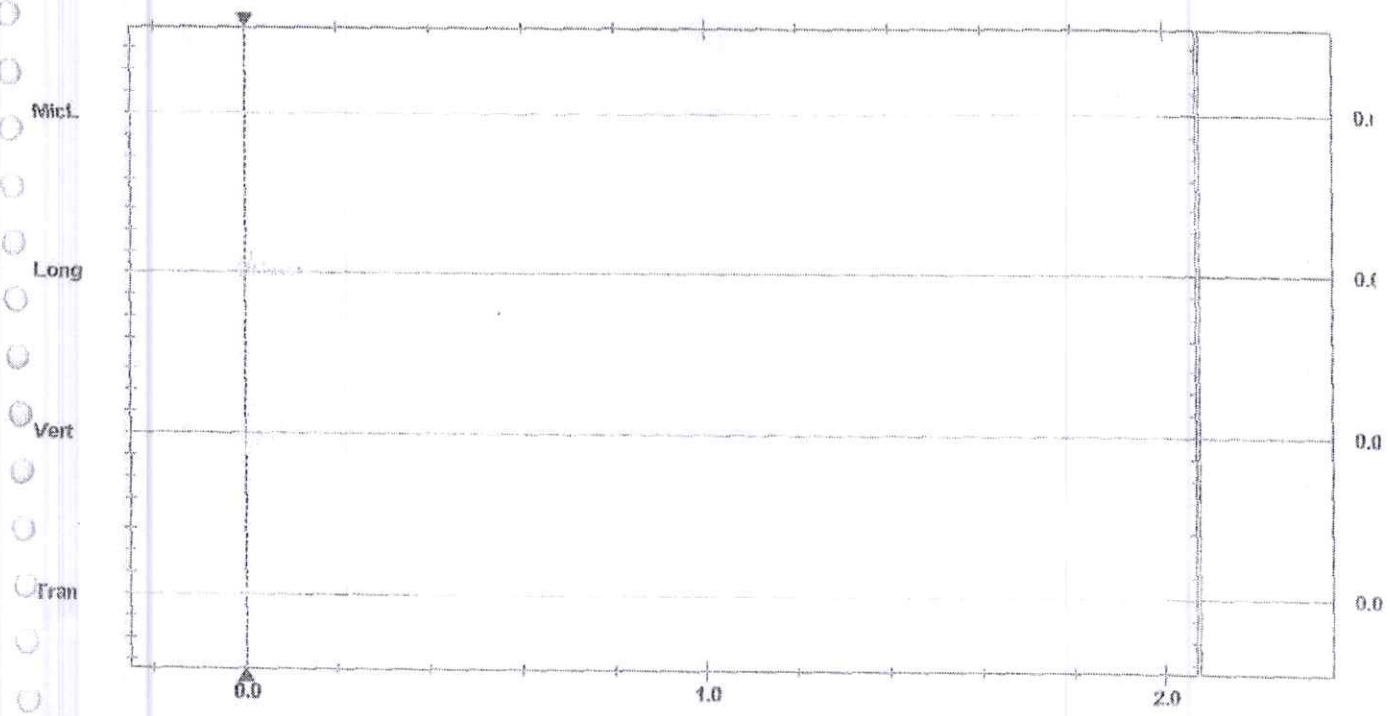
Extended Notes

Microphone	Linear Weighting
PSPL	<100 dB(L)
ZC Freq	N/A
Channel Test	Check (Freq = 0.0 Hz Amp = 55 mv)

	Tran	Vert	Long	
PPV	0.381	0.699	0.635	mm/s
ZC Freq	73	85	85	Hz
Time (Rel. to Trig)	0.049	0.023	0.001	sec
Peak Acceleration	0.020	0.033	0.033	g
Peak Displacement	0.001	0.001	0.001	mm
Sensor Check	Check	Passed	Passed	
Frequency	6.0	7.8	8.1	Hz
Overswing Ratio	4.1	3.4	3.7	

Peak Vector Sum 0.778 mm/s at 0.001 sec
N/A: Not Applicable





Time Scale: 0.20 sec/div **Amplitude Scale:** Geo: 0.500 mm/s/div Mic: 5.000 pa.(L)/div
Trigger =

Sensor Check

Instantel

Event Report

Date/Time	Vert at 13:20:48 May 14, 2023
Trigger Source	Geo: 0.508 mm/s
Range	Geo: 127.0 mm/s
Record Time	2.0 sec at 1024 sps

Serial Number	3720 V 2.61 MiniMate
Battery Level	6.6 Volts
Unit Calibration	December 2, 2022 by UES New Delhi
File Name	E720K0V1.200

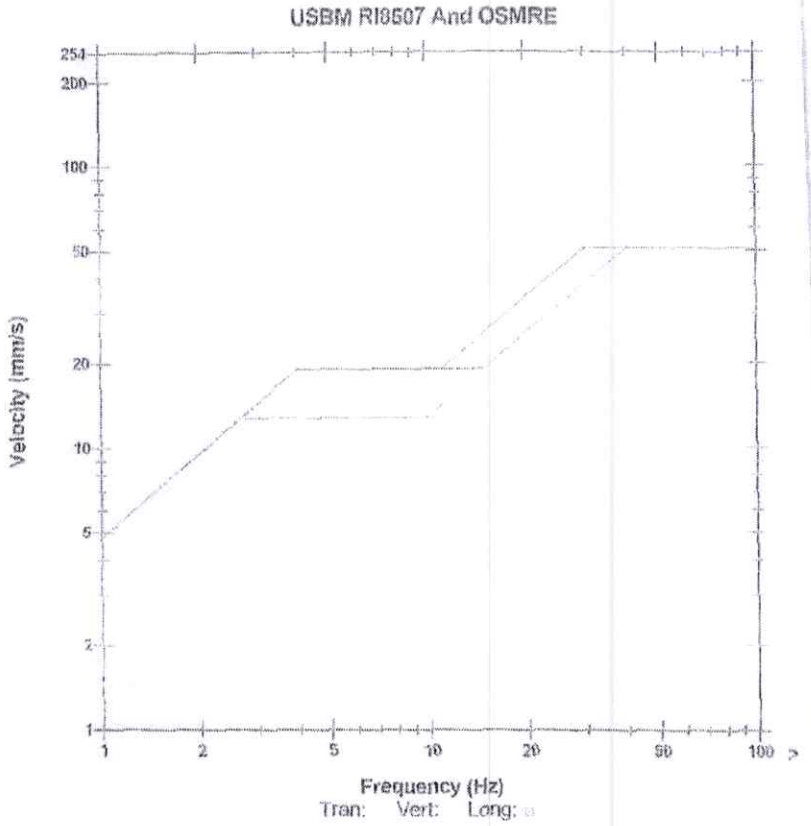
Notes
Location:
Client:
User Name:
Converted: May 18, 2023 16:17:11 (V 10.74)

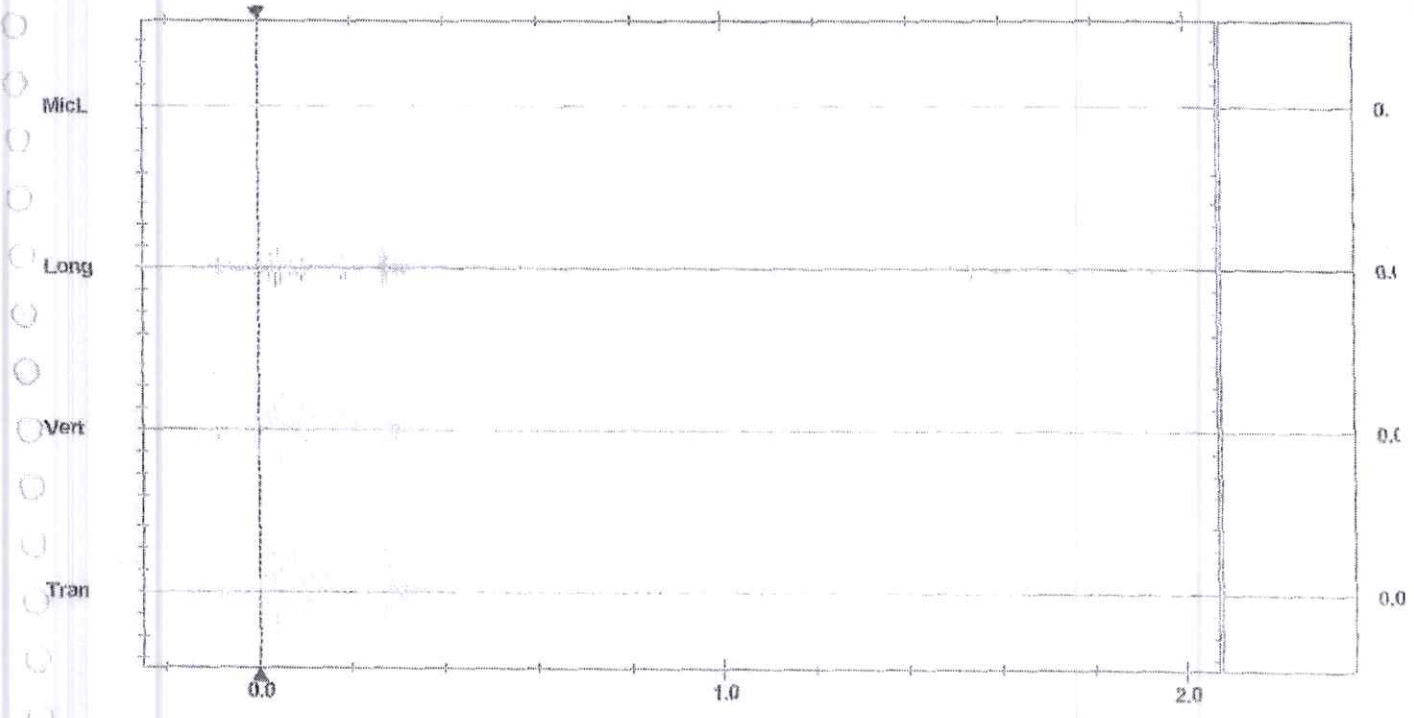
Extended Notes

Microphone	Linear Weighting
PSPL	<100 dB(L)
ZC Freq	N/A
Channel Test	Check (Freq = 0.0 Hz Amp = 55 mv)

	Tran	Vert	Long	
PPV	1.207	1.143	0.508	mm/s
ZC Freq	64	85	>100	Hz
Time (Rel. to Trig)	0.068	0.267	0.043	sec
Peak Acceleration	0.119	0.106	0.060	g
Peak Displacement	0.014	0.002	0.001	mm
Sensor Check	Check	Passed	Passed	
Frequency	6.0	7.8	8.1	Hz
Overswing Ratio	4.1	3.4	3.7	

Peak Vector Sum 1.461 mm/s at 0.267 sec
N/A: Not Applicable





Time Scale: 0.20 sec/div Amplitude Scale: Geo: 0.500 mm/s/div Mic: 5.000 pa.(L)/div
Trigger =

Sensor Check

Printed: May 20, 2023 (V 10.74)

R5(a)/58

Our main consultancy services are offered in the areas of "Rock Blasting" and "Slope / Dump Stability"

SOME OF OUR RECENT CLIENTS ARE:

- The Singareni Collieries Company Limited- Kothagudem. Govt. of Telangana (Mines in Telangana & Odisha)
- IREL (India) Limited – Govt. of India (Mines in Tamil Nadu)
- Dept. of Mines & Geology- Govt. of Karnataka.
- Southern Railways, Mangalore
- Hindustan Petroleum Corporation Limited, Mangalore
- MSPL Limited, Hospet, Karnataka
- Vedanta Limited, Karnataka
- Bharathi Cements, Andhra Pradesh
- Ultratech Cements Private Limited, Andhra Pradesh
- Chettinad Cements Limited, Karnataka
- VESCO Limited, Sandur, Karnataka.
- TJN Construction Pvt Ltd- Bangalore
- Aastraa Resources- Goa
- M/s. Utkal Coal Mining India Private Limited- Odisha
- Lafarge Umiam Mining Private Limited, Meghalaya
- Various granite quarries in the state of Karnataka
- Various granite quarries in the state of Kerala
- Various granite quarries in the state of Tamil Nadu
- Various granite quarries in the state of Andhra Pradesh

Principal Investigator
Dr. Ram Chandar Karra
Associate Professor & Former Head of the Department
Dept. of Mining Engineering
NITK, Surathkal (Govt. of India), Mangalore-575025
Email: krc_karra@yahoo.com, krc@nitk.edu.in
Mob: 94486 27564

This is the true copy of the document marked as Ext. R5(a)

Advocate

Ext. R5(b)

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MINUTES OF THE 146th MEETING OF THE STATE LEVEL ENVIRONMENT IMPACT ASSESSMENT AUTHORITY (SEIAA) KERALA,

HELD ON 29th and 30th JULY 2024

Present:

1. **Dr H Nagesh Prabhu IFS (Retd), Chairman, SEIAA, Kerala**
2. **Sri. K Krishna Panicker, Member, SEIAA**
3. **Dr Rathan U. Kelkar IAS, Member Secretary, SEIAA**

The 146th meeting of the SEIAA, Kerala was held on 29th and 30th June 2024. The meeting started at 10.30 A.M. Dr. H. Nagesh Prabhu, Chairman, SEIAA Kerala chaired the meeting, Dr Rathan U. Kelkar IAS, Member Secretary, SEIAA and Sri. K. Krishna Panicker, Expert Member, SEIAA attended the meeting. Authority took note of the untimely and sad demise of Smt. Beena Govindan, a sincere and highly knowledgeable member of SEAC. Authority appreciated the dedicated efforts put in by Smt. Beena Govindan and paid rich tributes to departed noble soul. The Authority considered the agenda for the 146th meeting and took the following decisions:

Physical Files

Item No. 146.01 **Minutes of the 144th meeting of SEIAA held on 28th - 29th June 2024 and Minutes of the 145th meeting of SEIAA held on 04th July 2024.**

Noted.

Item No. 146.02 **Action Taken Report on 142nd meeting of SEIAA held on 30th - 31st May 2024 and 143rd meeting of SEIAA held on 04th June 2024.**

Noted.

R5(b)/2

Item No. 146.34 **Environmental Clearance issued to the Granite Building Stone Quarry of Sri. C. Krishna Pillai for an area of 0.9705 Ha at Block No - 27, Re-Sy Nos. 283/1pt, 283/2pt, 283/4, 296/3pt in Ezhumattoor Village, Mallapally Taluk, Pathanamthitta – Complaint received from Smt. Usha Mohan**

(SIA/KL/MIN/165625/2020, 1440/EC1/2019/SEIAA)

The Authority deliberated the item and noted the decisions of SEIAA/SEAC in its various meetings, the Interim Order in Appeal No. 41 of 2024 dated 10.05.2024, received on 25.06.2024 and the field inspection report of the Technical Team of SEIAA. The Authority noticed that the Hon'ble NGT vide the interim order dated 10.05.2024 directed the SEIAA, Kerala (Respondent No. 2) to inspect the unit and if the Project Proponent is not using the NONEL technology, appropriate action may be taken. The SEIAA – Kerala is also directed to address the complaint of the appellant received earlier addressing the damages caused to her house.

The Authority noticed that the Technical Team of SEIAA along with the Expert Mine Engineer conducted the field inspection on 22nd July 2024. Based on the field inspection report and proof of documents, the Authority inferred that the Project Proponent is following NONEL technology for blasting. The Project Proponent also complied with all the EC conditions, except the following:

1. Garlands drains and the drainage channels leading to the desiltation tank (3 Nos) were found not properly constructed to contain the silt.
2. Planting of trees (Green Belt) as per EMP started; but not maintaining properly.
3. Top soil and overburden are found more than the quantity projected in the mining plan and is being stacked in the designated dumping area however the retaining boulder wall is not constructed.
4. Rainwater harvesting pond is not properly maintained.

In the above circumstances, the Authority decided to direct the Project Proponent to comply with the above observations within 1 month and submit the compliance report. The Authority also decided to accept the field inspection report and submit the same to Hon'ble NGT.

This is the true copy of the document marked as Ext. R5(b)

Advocate

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Ext. R5(c)

Date: 29-08-2024

From

C. Krishna Pillai,
Melathu Lakshmi Bhavan,
Thazhakkara P.O,
Alappuzha – 690102, Kerala

To

The Chairman
State Level Environment Impact Assessment Authority (SEIAA)
Kerala

Sub: Regarding complying with four the EC conditions

Ref: 1. Minutes of the 146th meeting of the State Level Environment Impact Assessment Authority (SEIAA) Kerala, held on 29th and 30th July 2024 - Item No. 146.34

2. Proposal No: SIA/KL/MIN/165625/2020 File No. 1440/EC1/2019/SEIAA)

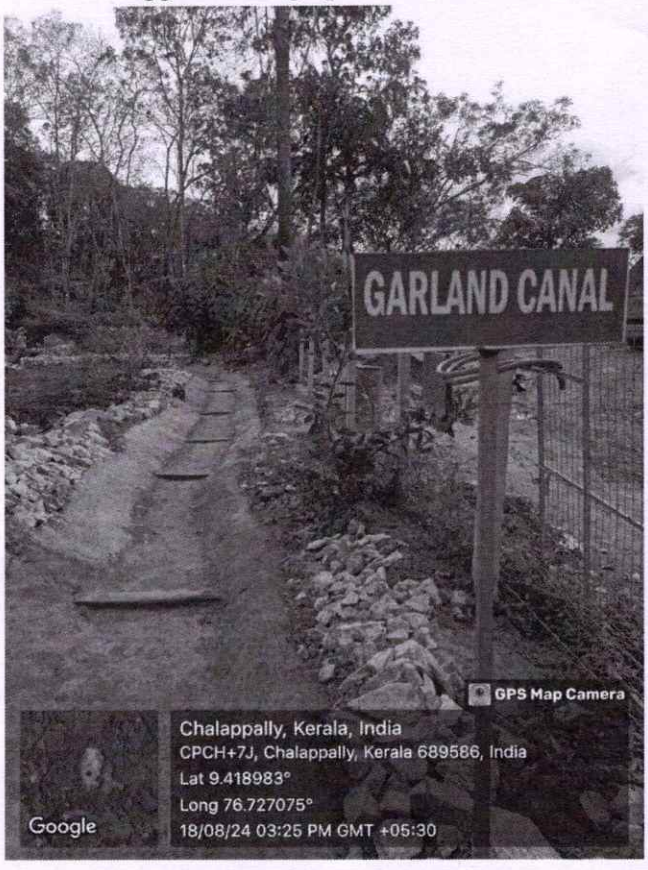
With respect to the reference cited 1 above, the Authority noticed that the Technical Team of SEIAA along with the Expert Mine Engineer conducted the field inspection on 22nd July 2024. Based on the field inspection report and proof of documents, the Authority inferred that the Project Proponent is following NONEL technology for blasting. The Project Proponent also complied with all the EC conditions, except the following:

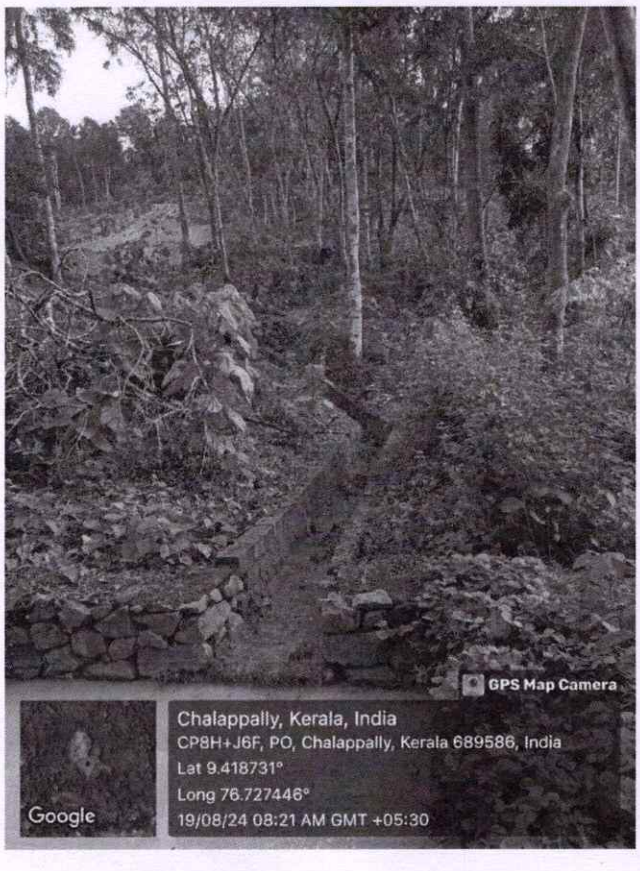
1. Garlands drains and the drainage channels leading to the desiltation tank (3 Nos) were found not properly constructed to contain the silt.
2. Planting of trees (Green Belt) as per EMP started; but not maintaining properly.
3. Top soil and overburden are found more than the quantity projected in the mining plan and is being stacked in the designated dumping area however the retaining boulder wall is not constructed.
4. Rainwater harvesting pond is not properly maintained

In the above circumstances, I have complied the above mentioned EC conditions and as proof geo tagged photographs are submitted with this letter.

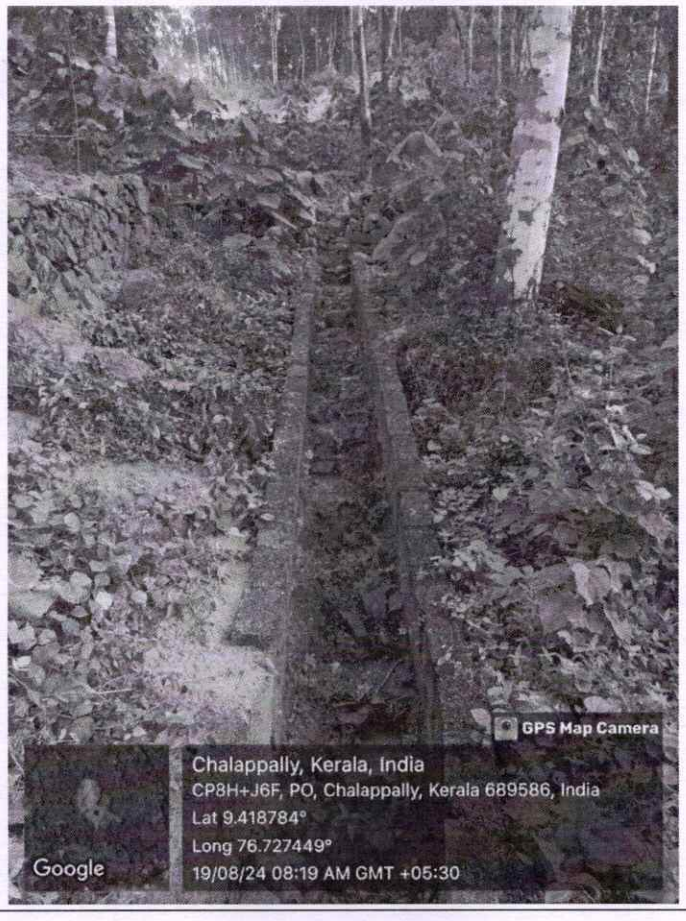
Sl No	Conditions	Remarks
1	Garlands drains and the drainage channels leading to the desiltation tank (3 Nos) were found not properly constructed to contain the silt	Garlands drains and the drainage channels leading to the desiltation tank (3 Nos) is properly constructed to contain the silt

Geo tagged Photographs of Garland canal



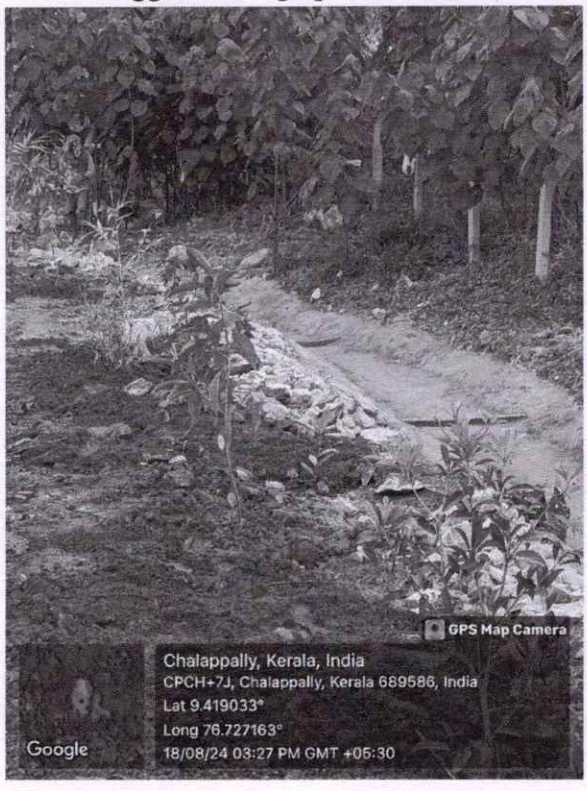


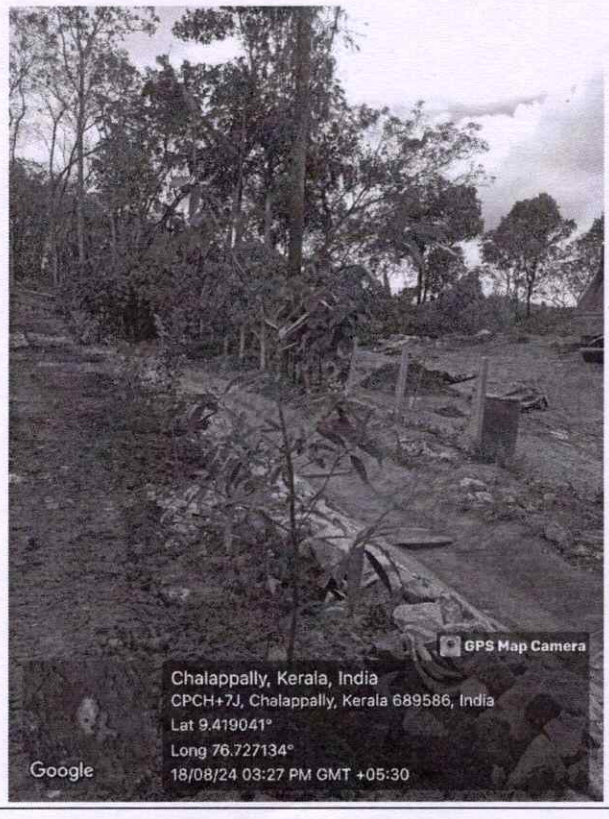

GPS Map Camera
Chalappally, Kerala, India
CPCH+7J, Chalappally, Kerala 689586, India
Lat 9.4189°
Long 76.727449°
19/08/24 08:17 AM GMT +05:30
Google


GPS Map Camera
Chalappally, Kerala, India
CP8H+J6F, PO, Chalappally, Kerala 689586, India
Lat 9.418784°
Long 76.727449°
19/08/24 08:19 AM GMT +05:30
Google

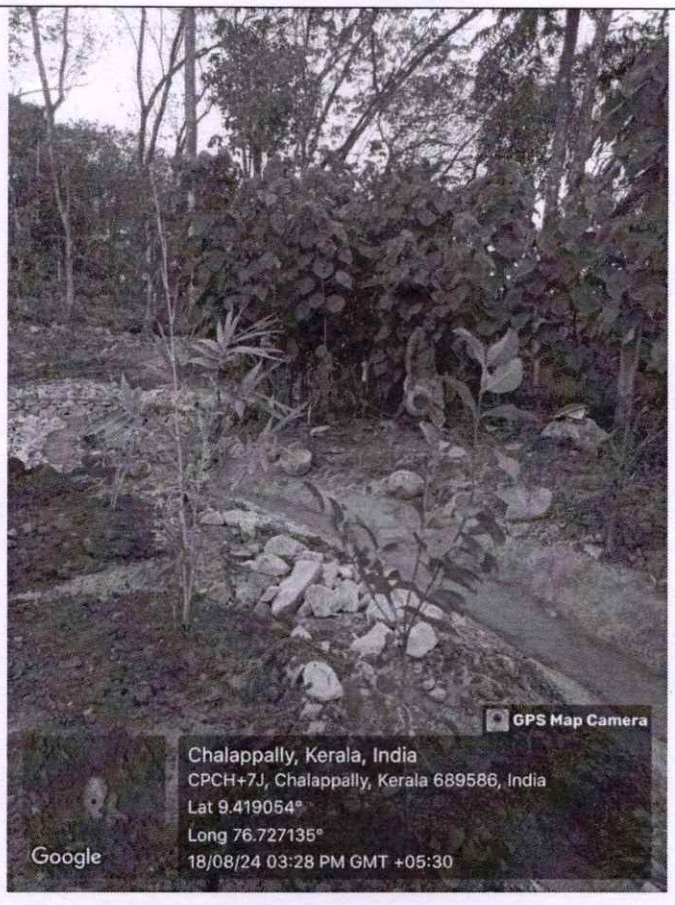
2	Planting of trees (Green Belt) as per EMP started; but not maintaining properly	Planting of trees (Green Belt) is properly maintained

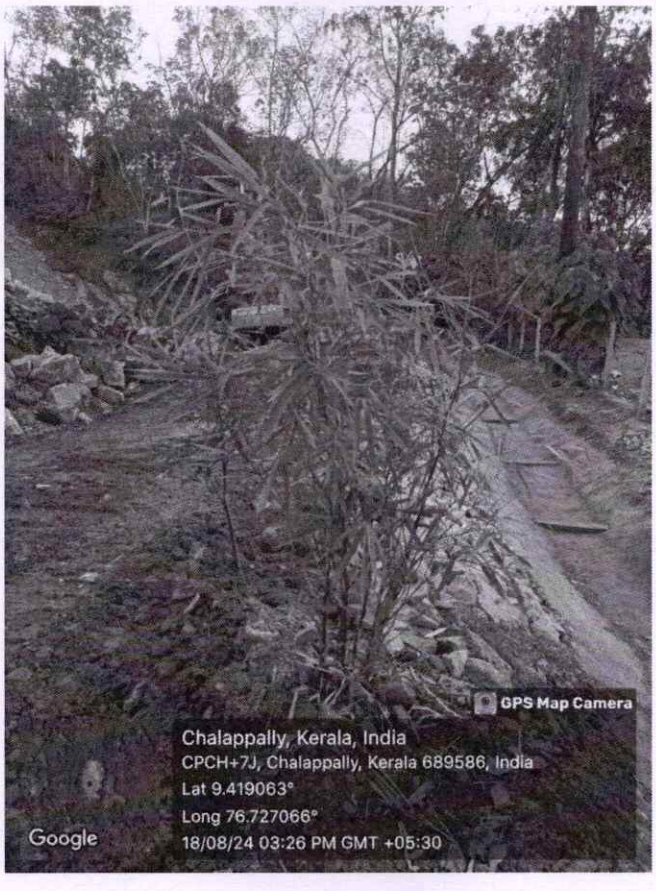
Geo tagged Photographs of Green Belt





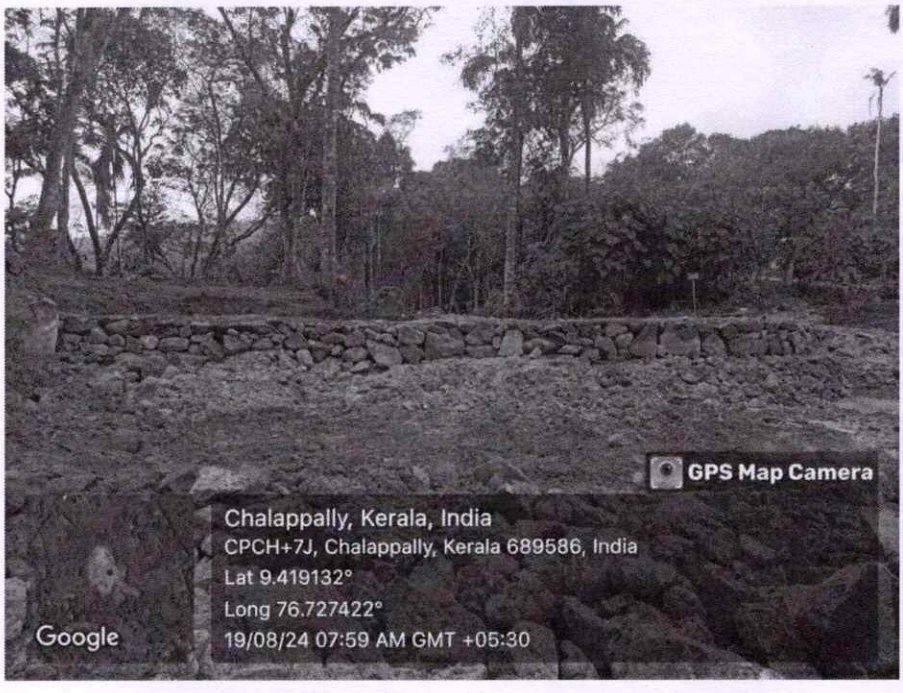
R5(C)/5

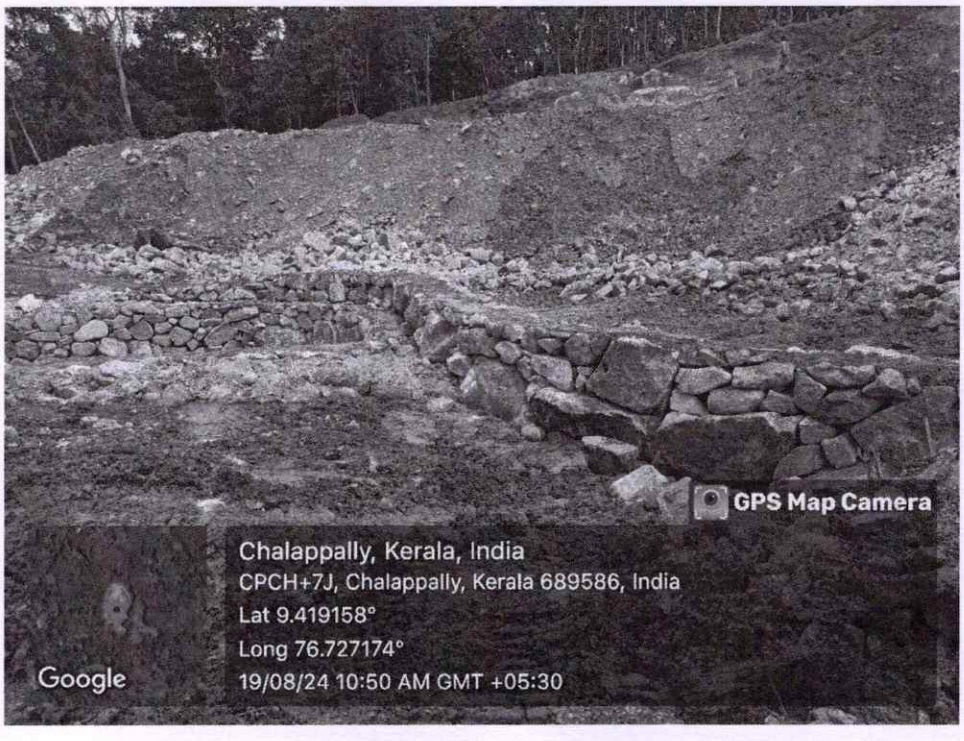

GPS Map Camera
Chalappally, Kerala, India
CPCH+7J, Chalappally, Kerala 689586, India
Lat 9.419054°
Long 76.727135°
18/08/24 03:28 PM GMT +05:30
Google


GPS Map Camera
Chalappally, Kerala, India
CPCH+7J, Chalappally, Kerala 689586, India
Lat 9.419063°
Long 76.727066°
18/08/24 03:26 PM GMT +05:30
Google

3	Top soil and overburden are found more than the quantity projected in the mining plan and is being stacked in the designated dumping area however the retaining boulder wall is not constructed	A retaining boulder wall is constructed around the top soil and overburden stacked area

Geo tagged Photographs of retaining boulder wall with top soil and overburden





R5(c)/7

4	Rainwater harvesting pond is not properly maintained	Rainwater harvesting pond is properly maintained

Geo tagged Photographs of Rainwater harvesting pond

I have complied all the mentioned EC conditions.

Kindly considered my letter as an evident to comply the EC conditions.

Thanking you

C. Krishna Pillai

This is the true copy of the document marked as Ext. R5 (c)

Advocate