

**BEFORE THE NATIONAL GREEN TRIBUNAL
SOUTHERN ZONE AT CHENNAI**

O.A No. 270 of 2024

IN THE MATTER OF: -

Tribunal On Its Own Motion Suo Moto
Based On the News Item in Deccan Herald
Dt. 19.06.2024 Titled "Karnataka Govt Okays
Mining Near 1200 Tear Old Temple"

.... Applicants

-Vs-

Central Pollution Control Board &
4 Ors

.....Respondents

INDEX

S.NO	DATE	DESCRIPTION	PAGE NO.
1.	11.03.2025	Counter Affidavit of the 5 th Respondent	1
2.	04.01.1954	The Central Government Notification declared as Protected Monument (Annexure - 1)	9
3.	22.12.2015	ASI Order to constitute Expert Committee to examine the impact of mining (Annexure - 2)	11
4.	12.03.2019	Final Report by National Institute of Rock Mechanics (Annexure-3)	12
5.	22.01.2020	ASI constituted another committee to examine the impact of mining	81

		(Annexure-4)	
6.	30.01.2020 to 02.02.2020	Structural Assessment Study by Archaeologist (Annexure-5)	82
7.	29.05.2020	Permit License for mining activity by Government of Karnataka (Annexure-6)	123
8.	28.12.2020	The Competent Authority grant approval for mining activities (Annexure-7)	125
9.	03.02.2023	Office order issued by the Regional Directorate (South) (Annexure- 8)	126

Dated at Chennai on this the 15th day of March 2025


COUNSEL FOR 5TH RESPONDENT

17

BEFORE THE NATIONAL GREEN TRIBUNAL

SOUTHERN ZONE AT CHENNAI

O.A No. 270 of 2024



IN THE MATTER OF: -

Tribunal on Its Own Motion Suo Moto

Based on the News Item in Deccan Herald

Dt. 19.06.2024 Titled "Karnataka Govt Okays

Mining Near 1200 Tear Old Temple" Applicants

-Vs-

Central Pollution Control Board & 4Ors. Respondents

COUNTER AFFIDAVIT ON BEHALF OF THE 5TH RESPONDENT

I, Dr. Nihildas.N S/o Haridas, aged about 40 years, working in the Archaeological Survey of India as Superintending Archaeologist in the office of the Archaeological Survey of India, Hampi Circle located at Hospet, Vijayanagara district, do hereby solemnly affirm and state as follows:

1. I am filing this affidavit on behalf of the Respondent No.5, and I am duly authorized on this behalf, and I am conversant with the facts of the case as borne out from available official records.


K. SURABHI DURGA
Advocate & Notary Pub
Govt. of India.


अधीक्षक पुरातत्वविद्
Superintending Archaeologist
भारतीय पुरातत्व सर्वेक्षण
Archaeological Survey of India
हम्पी मंडल / Hampi Circle
होसापेटे /Hosapete

2



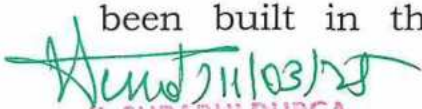
2. I humbly submit that the instant O.A No. 270 of 2024 filed by the applicant lacks merits and not supported by true and correct facts.

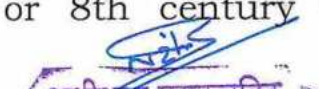
3. At the outset I deny all the averments made in the application and save those that are specifically admitted herein. I am duly authorized to file this Counter Affidavit on behalf of the Respondent No.5 in this Application.

4. I humbly submitted that liberty is further craved in making further submissions or filing additional affidavit as may be required in the facts of the case subsequently or as may be directed by this Hon'ble Tribunal.

Preliminary Submission: -

5. I submit that the National Green Tribunal, Southern Zone, Chennai has filed a SUO MOTU case based on the news item in Deccan Herald dated 19.06.2024, titled "Karnataka Govt. okays mining near 1200 years old Temple". The Hon'ble NGT has observed that the news item relates to the mining near 1200-year-old Kumaraswamy Temple in Sandur, Ballari district (Karnataka). As per the news item, the Karnataka government has recommended the first level clearance for a mining project near the Kumaraswamy temple. The temple is believed to have been built in the 7th or 8th century CE, is a protected


K. SURABHI DURGA
Advocate & Notary Pub
Govt. of India.


अधीक्षक पुरातत्वविद्
Superintending Archaeologist
भारतीय पुरातत्व सर्वेक्षण




monument under the Archaeological Survey of India (ASI). The news item states that the Karnataka Forest Department has requested "In-Principle (Stage-1) approval for mining a 70-acre forest area known as Kumaraswamy Betta. The mining lease boundary approved by the government is within 400 meters of the temple, prompting concern from local activists and citizen.

6. I submit that the NGT, Chennai has impleaded the ASI as also one of the parties and directed to submit the response/comments in the form of affidavit at least one week prior to the next hearing which is scheduled for 03.01.2025.

7. I submit that, The Parvathi and Karthikeya Temple also known as Sri Kumaraswamy Temple situated at Sandur Taluk, Bellary District (hereinafter referred to as the Parvathi and Karthikeya Temple) was built during the 7th to 8th Century AD. It has been declared as a Monument of National Importance by the Central Government. Notification (The Gazette of India. No-04 January 4,1954) in the Official Gazette, declared the Parvathi and Karthikeya Temple, Sandur extending to an area of 2.5 acres as a Protected Monument. Now, provisions of the Ancient Monuments and Archaeological Sites and Remains Act, 1958 shall be applicable on that monument. A copy of the Notification is attached to (**Annexure- R1**).


अधीक्षक पुरातत्वविद्
Superintending Archaeologist
भारतीय पुरातत्व सर्वेक्षण
Archaeological Survey of India
हम्पी मंडल / Hampi Circle
होसापेटे /Hosapete


K. SURABHI DURGA
Advocate & Notary Pub
Govt. of India



8. I submit that the Archaeological Survey of India have utmost respect for the Orders of the Hon'ble Supreme Court of India and have not contravened the Order of the Hon'ble Supreme Court in *Civil Appeal No. 4823/2013 arising out of SLP (C No. 20180 of 2010)*, to constitute an expert committee in the year 2015 vide letter dated 22.12.2015 issued under file No. 25/01/2015-M to examine the impact of mining near the Parvathi and Karthikeya temple, Sandur which was declared as a protected monument under the Ancient Monuments and Archaeological Sites and Remains Act 1958. **(Annexure-R2).**

9. I humbly submit that to ascertain the feasibility of blasting for mining operation around Parvathi and Karthikeya temple, Sandur, National Institute of Rock Mechanics under the Ministry of Mines, Government of India undertook vibration study to establish the safe distance for the blasting as per DGMS Norms **(Annexure-R3).**

10. I further submit that the cultural assessment study within the radius of 1000m on all directions around the Protected limits of Parvathi and Karthikeya temples were undertaken by team of archaeologist from 22.11.2019 to 24.11.2019 to find out any archaeological vestiges if any.

11. I submit that the Director General, Archaeological Survey of India, subsequently constituted another committee vide letter

अधीक्षक पुरातत्वविद्
Superintending Archaeologist
भारतीय पुरातत्व सर्वेक्षण

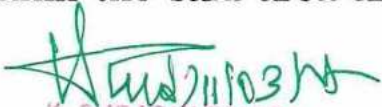
dated 22.01.2020 issued under file No. T-19042/1/2020-M with mandate to thoroughly examine the impact on mining activity near the temple premises **(Annexure-R4)**.




12. I submit that a structural assessment study was undertaken by the Superintending Archaeologist in connection with mining activities in and around Parvathi and Karthikeya temple, Sandur from 30.01.2020 to 02.02.2020. **(Annexure-R5)**.

13. I submit that based on the report of NIRM, Structural assessment and Cultural assessment report of ASI, this Committee recommended for permission to issue license for mining activity by Government of Karnataka beyond 600 meters on all four sides from the protected monuments vide proceedings dated 29/5/2020 **(Annexure R-6)** and accordingly, permission was granted by the competent authority vide letter in F. No. T-19042/1/2020-M dt 28.12.2020 **(Annexure R-7)**.

14. I further submit that an office order has been issued by RD(South), ASI, Bengaluru to take up the survey work within the radius of 600 meters around the Centrally Protected Monument, Parvathi and Karthikeya temple, Sandur to ascertain the encroachments and mining activities, if any, within the said area and to submit the report with supporting


SURABHI DURGA
Advocate & Notary Public
Govt. of India


अधीक्षक पुरातत्वविद्
Superintending Archaeologist
भारतीय पुरातत्व सर्वेक्षण
Archaeological Survey of India
हम्पी मंडल / Hampi Circle
होसापेटे / Hosapete

6





documents vide letter 5/53/2022-2023/RD(S)-816 dated 03.02.2023 (**Annexure- R-8**).

15. I submit that as per the Act 300 meters from the protected area in all directions will come under the purview of the Ancient Monuments and Archaeological Sites and Remains Act 1958. However, in order to preserve the cultural heritage and landscape which were noticed around the temple and to save the present temple, permission for mining activity was recommended beyond 600 meters from the protected monument.

16. I submit that, meanwhile in 2022, A PIL W.P. No. 25173/2022 filed before the Hon'ble High Court of Karnataka, Bangalore, and prayed before the court the continuous mining activity carried out near the temple has been causing severe damage to the temple structure, hence the mining activities regulated.

17. I submit that the Hon'ble Court has sought the opinion of the ASI for a fresh impact assessment since no outside agency was involved in the earlier study. The Director General, ASI has accorded permission for a fresh impact assessment of both environmental and structural aspects with the help of NEERI and IIT Chennai wherein the NEERI will look into the environmental aspects and the IIT Chennai will be doing the


N. SURABHI DURGA
Advocate & Notary Pub
Govt. of India.


अधीक्षक पुरातत्वविद्
Superintending Archaeologist
भारतीय पुरातत्व सर्वेक्षण




vibration analysis of the blasting and its impact on the monument.

18. I submit that the study is in progress and the ASI would submit the outcome of the study to the Hon'ble High Court as soon as it is submitted by the concerned agencies.

19. I submit that ASI has not accorded permission for any activities including the mining that would harm the existence of the temple and the environment around it. Mining operation is being undertaken beyond 600 m from the protected limit of Centrally Protected Monument Parvathi and Karthikeya temple, Sandur. Moreover, an impact assessment study of ongoing mining operation is also under process by two expert institutions of repute and the outcome of the same is yet to come.

20. I submit that neither the State Government nor the Central Government has approached the ASI with regard to granting permission for mining within the 400 m radius of the Kumaraswamy temple at Sandur. At present it is going on at a distance of 600 m from the protected limit.

21. In view of the above, I respectfully submit that this Hon'ble Tribunal may be pleased to consider the facts and submissions


अधीक्षक पुरातत्वविद्
Superintending Archaeologist
भारतीय पुरातत्व सर्वेक्षण
Archaeological Survey of India
हम्पी मंडल / Hampi Circle
होसापेटे / Hosapete


K. SURABHI DURGA
Advocate & Notary Put
Govt. of India.

8

and O.A No. 270 of 2024 may be dismissed in the interest of justice.


It is therefore prayed that this Hon'ble National Green Tribunal may be pleased to dismiss the above O.A No. 270 of 2024 and thus render justice.

Solemnly affirmed this
the 11th day of March 2025 and
Signed his name in my presence



भारीभद्र पुरातत्वविद्
BEFORE ME
Superintending Archaeologist
भारतीय पुरातत्व सर्वेक्षण
Archaeological Survey of India
ADVOCATE, CHENNAI
होसापेटे / Hosapete



Solemnly affirmed and declared
before me on identification"
at Hospet.

K. SUDHAKAR GA
Reg.No: 21637
Advocate & Notary Public
Govt. of India

REGISTERED No. D. 221

The Gazette of India

EXTRAORDINARY

PART II—Section 1

PUBLISHED BY AUTHORITY

No. 4] NEW DELHI, MONDAY, JANUARY 4, 1954

MINISTRY OF LAW

New Delhi, the 4th January 1954

The following Acts of Parliament received the assent of the President on the 2nd January, 1954 and are hereby published for general information:—

THE CANTONMENTS (AMENDMENT) ACT, 1953

No. 2 OF 1954

[2nd January, 1954]

An Act further to amend the Cantonments Act, 1924.

Be it enacted by Parliament as follows:—

1. Short title.—This Act may be called the Cantonments (Amendment) Act, 1953.

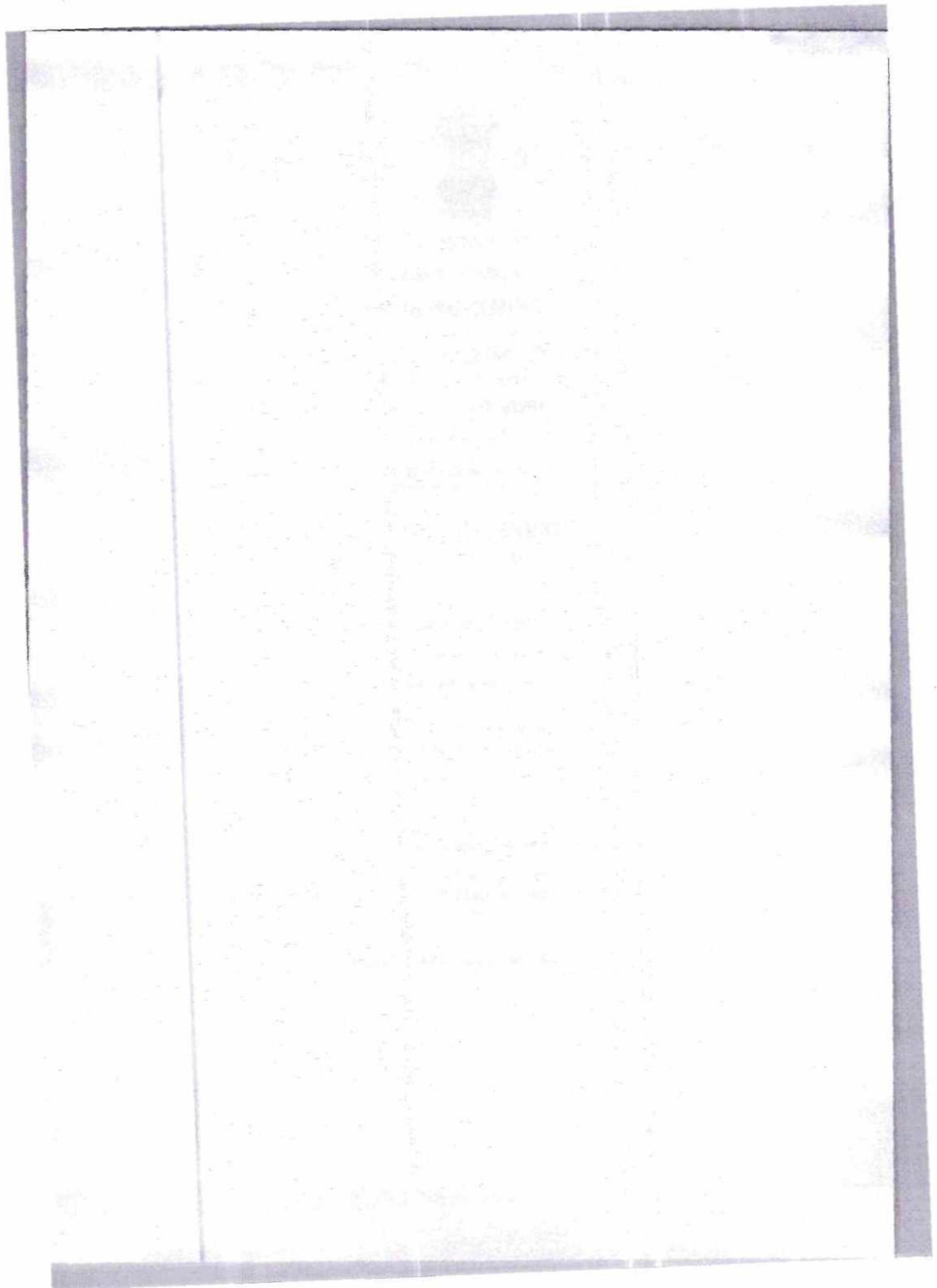
2. Amendment of section 2, Act II of 1924.—In section 2 of the Cantonments Act, 1924 (hereinafter referred to as the principal Act),—

(a) after clause (i), the following clause shall be inserted, namely:—

“(ia) “boundary wall” means a wall which abuts on a street and which does not exceed eight feet in height;”

(b) in clause (iv), for the brackets and words “(other than a boundary wall not exceeding eight feet in height and not abutting on a street)” the brackets and words “(other than a boundary wall)” shall be substituted.

3. Omission of section 2A, Act II of 1924.—Section 2A of the principal Act shall be omitted.



(c) in the entries under the heading 'Hyderabad State' and under the sub-heading 'District Raichur' the following entries shall be added at the end, namely:—

'19A. Rock edicts of Asoka on two hillocks, known as Gavimath and Falkigundu.	Kopba
19B. Rock edicts of Asoka	Maski'.

(d) in the entries under the heading 'Madhya Bharat State',—

(i) entry 33 shall be omitted;

(ii) for the sub-heading 'District Gwalior' after the entries under the sub-heading 'District Dhar' the sub-heading 'District Gird' shall be substituted;

(iii) after entry 97, under the sub-heading 'District Gird' as so amended, the following entries shall be inserted, namely:—

"97A. The following ancient and historical monuments in the Gwalior Fort—

(i) Badal Mahal or Hindola Gate	Gwalior.
(ii) Chaturbhuj temple	Do.
(iii) Ganesha Gate	Do.
(iv) Gwalior or Alamgiri Gate	Do.
(v) Lakshman Gate	Do.
(vi) Mansingh's Palace	Do.
(vii) Rock-cut Jain colossi	Do.
(viii) Sas Bahu temples	Do.
(ix) Teli Ka Mandir	Do.
(x) Urwahil Gate	Do.

97B. Tomb of Abul Fazl.....Antri."

(iv) the sub-heading 'District Gwalior' after entry 104 and the entries under that sub-heading shall be omitted;

(e) in the entries under the heading 'Mysore State' and after the entries under the sub-heading 'District Bangalore' and before the entries under 'District Chitaldrug' the following sub-heading and entry shall be inserted, namely:—

District Bellary

8A. Parvati and Kartikya temples	Kumareswami betta, Sandur.'
--	--------------------------------

(f) in the entries under the heading 'Rajasthan State'—

(i) for entry 36, the following entry shall be substituted, namely:—

"36. Baoris old locally known as Hadi Rani Ka Kund.....Todaraisingh";

ANNEXURE - 2

65812/2020/O/o Director Monument-II

F. No. 25-01-2015-M
Archaeological Survey of India
Government of India

Dated: 22/2/2015
Janpath, New Delhi

Order

With a view to examine the issue and to assess the impact of mining activity going around the Parvathi and Karthikeya Temple, Sundur (near Hospete), Bellari district, the Hon'ble Supreme Court of India has asked to constitute an expert committee.

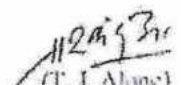
The new expert committee / group will examine the impact of mining on the monuments declared as protected under the 1958 Act and take necessary remedial measures.

The Composition of Committee is as under.

- i. Smt. Satyabhama Badrinath, R.D. South ASI
- ii. N. C. Prakash, Dy.SA (Hampi Mini Circle), ASI
- iii. Director (Department of Archeology, Govt. of Karnataka)
- iv. Shri Keshava, SA, (retired) ASI

Retired officers of the ASI shall be paid conveyance as per eligibility for attending the meeting in addition to honorarium.

This issues with the approval of Director General, ASI.


(T. J. Alane)
Director (Monuments)

**NIRM REPORT
&
DGMS LETTER**

13
Speed post ALD

GOVERNMENT OF KARNATAKA

No.DMG/MLS/ASI/2018-19

Office of the Director
Department of Mines and Geology
Khanija Bhavan, Race Course Road
Bangalore-1, dated: 12.03.2019.

To,
The Director,
Directorate of Archaeology & Museums,
Government of Karnataka,
Karnataka Exhibition Authority Complex,
Mysore-570 010


Sir,

Sub: Proceedings of the State Level Empowered Committee meeting held on 02.03.2019 - Final report submitted by NIRM related to study on the impact of mining on the historically protected Sri Kumaraswamy Temple-reg.

***#

Please find herein attached the copy of the proceedings of the State Level Empowered Committee meeting held on 02.03.2019 and final report submitted by NIRM related to study on the impact of mining on the historically protected Sri Kumaraswamy Temple. You are requested to furnish opinion/comment/suggestions on the report submitted by the NIRM to this office earliest.

Yours faithfully


DIRECTOR
12/3/2019

Proceedings of the State Empowered Committee Meeting held on 02-03-2019 at Vidhana Soudha, Chaired by the Chief Secretary, Government of Karnataka.

List of officers present in the meeting

No	Designation of Members/Invitees	No	Designation of Members/Invitees
1	Chief Secretary, Govt. of Karnataka	7	Director Mines & Geology
2	Principal Secretary Finance Dept	8	Additional Principal Chief Conservator
3	Principal Secretary C & I	9	Dr. Venkatesh, Director NIRM
4	Principal Secretary Law & Parliamentary Affairs	10	Regional Manager IBM
5	Shri. Vijay Kumar Gogi, Principal Secretary Env.	11	Regional Manager MECL
6	Secretary C & I	12	Shri. Yuvaraj Sr. Geologist

At the outset, the Secretary, C & I welcomed the Chairman, Members and invitees to the meeting. He highlighted the issues related to mining operations, explorations and proposed auction of new blocks and requested the Chairman to proceed as per the agenda.

The Chairman noted that both ACS FEE and Principal Secretary FEE on leave, in the absence of ACS FEE and Principal Secretary, he requested Principal Secretary Env. Shri. Vijaykumar Gogi, to attend the meeting as there are several issues to be addressed by the Forest Dept., he attended the meeting along with CCF (JLR).

Agenda No. 1: Confirmation of the proceedings of meeting held on 14.12.2018

DECISION: Committee confirmed the proceedings of the meeting held on 14.12.2018.

Agenda No. 2: Action Taken Report (ATR) on the Proceedings of the Meeting held on 14.12.2018.

Decisions of the meeting held on 14.12.2018	Action Taken	Decision of the Meeting held on 02.03.2019.
Agenda No-2(2): It was intimated to the Committee that a copy of the map and report furnished by the technical committee was sent to the KSMCL and comments of the KSMCL is placed in the agenda note for kind perusal. Decision: The committee resolved to discuss the issue in the regular Agenda.	The subject was discussed in the regular agenda No-3.	Decision recorded at regular Agenda No 3
Decisions of the meeting held on 14.12.2018	Action Taken	Decision of the Meeting held on 02.03.2019.

15

<p><u>Agenda No-2(3)</u> It was intimated to the Committee that in previous meeting it was decided to hold forest review meetings regularly on 3rd and 18th of every month to expedite pending forest clearances. It was informed in the meeting that meetings were held in the month of October, 2018 as scheduled and only one meeting was held in the month of November, 2018. The progress of follow up of forest clearances in case of 12 Auctioned C-category mines in Annexure-A3 was perused by the Committee.</p> <p>Decision: The Chairman of the committee expressed his displeasure for not holding the meeting regularly and instructed to follow it strictly in future. The Committee noted the present status and requested Forest Dept. to expedite the process and also intimated the PCCF to issue circular with regard to the uploading/ submission of documents by user agency as per MoEF guidelines. Further, the Chairman directed Forest Dept and DMG to convene a meeting on 15.12.2018 and discuss about the procedure and also speed up the FC pending proposals.</p>	<p>A meeting was held on 15-12-2018 at Aranya Bhavan. All pending issues were discussed in the meeting in detail. Proceeding of the meeting is enclosed as Annexure-1.</p> <p>Further, a meeting was held on 31.01.2019 under the Chairmanship of ACS, Forest at Vikasa Soudha, Bengaluru to review the pending FC proposals of mining projects.</p>	<p>Committee took note of the proceedings of the meeting held on 15.12.2018 by PCCF Forest, Secretary C&I and DMG to discuss about pending FC proposals and to adopt simplified procedure a speed up FC clearance.</p> <p>The Committee expressed its concerned about the delay in disposing the mining proposals by the Forest Dept at field level and instructed the Forest Dept to expedite the cases on priority specifically auctioned 'C' category mining blocks and the proposals of Central and State PSU's.</p> <p>The Committee also intimated Forest Dept to guide User Agencies (UA)/bidder to fill correct information in the application covering the entire requirements to avoid delay rather than returning application back to the UA.</p> <p>Further, the Chairman intimated the Secretary C&I and DMG to hold regular monthly review meeting with leaseholders/successful bidders to expedite execution of lease agreements.</p>
<p><u>Agenda 2(04-05)</u> The issue of forest clearances including FRA, which was placed at Annexure-A3, was perused by the committee.</p>	<p>No action necessary</p>	

Decisions of the meeting held on 14.12.2018	Action Taken	Decision of the Meeting held on 02.03.2019.
<p><u>Agenda-2(06) Annexure-4</u>, i.e., the status of exploration of leases expiring on 31-03-2020 was perused by the Committee in detail. It was intimated that out of 45-leases; (1) Deemed extension of lease period in respect of MEL is under scrutiny (2) 6 leases are technically not feasible due to less extent and poor quality of ore (3) 5 leases boundary is not finalised due to interstate boundary dispute (4) 12 leases exploration is nearing completion (5) 4 leases of revenue/forest land is being entrusted for exploration under NMET funds (6) 4 leases of forest land is planning to entrust to MFCU for exploration under State budget (7) 13 leases exploration requires forest clearance.</p> <p>Decision: The committee noted the progress and instructed to finalise the boundary of five pending leases at the earliest based on Hon'ble Supreme Court Order. Further the committee instructed to expedite pending forest clearances.</p>	<p>List of pending forest clearances enclosed in Annexure-2. Director, Department of Mines and Geology has convened a meeting under the Chairmanship of the Secretary, Mines on 29.12.2018 in presence of the lessees reviewed the pending the status of Forest Clearance. Commerce and Industries Department has written a letter to MoEF, Government of India ACS, Forest Department and PCCF, Forest Department to expedite the FC proposals. Also, the Director, Department of Mines and Geology has issued notices to the lessees to follow up with the cases and also requested concerned authorities to expedite the process of clearances.</p>	<p>The Secretary C&I Dept. explained the status of working and non working mines in detail. The Committee verified stage of each pending FC proposals case by case as per Annexure-2 enclosed to agenda. The DMG and CCF (JLR) furnished the Committee information about the stage of pendency with necessary details. Updated information provided in the meeting by forest Department is enclosed to this proceedings as Appendix-1. The DMG intimated in the meeting that out of 34 cases listed in Annexure-2, two surrendered leases bearing ML. No. 1710 and 2517 will be dropped based on poor resources. FC proposals for remaining 32 leases are immediate priority. After detailed discussions, the delay at DCF level was viewed seriously, the Chairman informed Forest Dept to expedite the 32 cases on priority and review the progress regularly every month and submit the compliance to the Committee. It was also informed to the Secretary, C&I to convene meeting at his</p>

17

	<p>In SLP No. 7366-67/2010 Surveyor General of India filed final report demarcating the boundary between the states of Andhra Pradesh and Karnataka on 17.09.2018.</p>	<p>level with lease holders to expedite the process. The Committee decided to write letter to the Secretary, Home Affairs, GOI and the Surveyor General of India to complete boundary markings early.</p>
<p><u>Agenda-2(07)</u> The status of exploration works undertaken by MECL under the finance of NMET funds was perused, CMD who was present in the meeting explained the status of exploration works in detail. Decision: The Committee noted the progress achieved by the MECL in respect of exploration undertaken from NMET funds.</p>	<p>Status of exploration given in Annexure-3</p>	<p>The Secretary C&I intimated that the issue of NPV payment was cleared in the previous meeting, accordingly all pending NPV payments have been made. The Committee took note of the Status and NPV payments and informed the Forest Dept to review the status of FC proposals in respect of exploration works in the monthly meeting.</p>
<p><u>Agenda-2(8)</u> The Status of exploration works undertaken by GSI and MECL was perused by the Committee. The CMD of MECL was present in the meeting who intimated that the exploration works cannot be continued for the reason that the Ministry of Mines, Govt. of India has not sanctioned NPV amount so far, for the reason that the state is beneficiary of exploration work once block get auctioned. The Secretary C & I referred a letter at Annexure-5 written to the Secretary Government of India regarding payment of NPV and other forest charges in respect of the exploration blocks entrusted to MECL and GSI. Decision: The Committee noted the action taken. During the course of discussions, it was noticed that GSI and MECL are carrying out the exploration activity on the behalf of State Government and hence ACS, Finance</p>	<p>The decision of the SEC communicated to MECL & GSI and asked to submit NPV bills for making payment. MECL has produced a bill of Rs.64 lakh, and GSI informed that bills of Rs.1.24 crore in case of two mines will be submitted shortly.</p>	<p>Committee noted the action taken.</p>

Department expressed his opinion to pay NPV and other Forest Dept. charges subject to recovery of the cost from the successful bidders. After detailed discussions and deliberations, Committee agreed to pay the NPV and other applicable forest charges for exploration from State Budget subject to recovery of the exploration cost from the successful bidders or reimbursement by Government of India either under planned scheme of Government of India or under NMBT.

Additional Agenda: The Secretary C & I submitted that out of 8 C category mines put to auction; five blocks received requisite number of bids. However, 3 blocks mentioned below did not receive requisite minimum 3 numbers of bids. The subject was deliberated in the previous meeting put to auction again with revised bid conditions 1) the reserve price shall be the highest initial price offer of the annulled auction 2) At least two technically qualified bidders for second phase of auction is mandatory in conformity with Mineral Auction Rules 2015. NIT was issued on 26-09-2018: Kirloskar Ferrous Ind. Ltd. quoted highest for ML.No.2566 and M/s Hottur Ispat quoted highest for ML.2185A, accordingly they were declared as preferred bidders. Required minimum two bids were not received in case of ML. No. 2631 second time also, hence auction process was annulled.

The Chairman asked about the probability of putting to auction the annulled bid again. The Technical Committee and DMG replied that there is no response even after putting the mine in to auction at fourth time and suggested to drop the process for further auction.

Name & ML NO	Bidders	IPO-FPO
M.Chennakeshava Reddy, Shri Lakshmi Narasimha Mining Co ML.2566. Extent 7.5 HA, reserve 3.17 MMT	1.JSW Steel Ltd 2.Kirloskar Ferrous Ind. Ltd.	36.4-36.7 %
M. Sreenivasulu ML. 2631. Extent 75.14	JSW Steel Ltd, only physical	35% IPO No FPO.

LOI issued to the successful bidders on 07-01-2019 as per the bid schedule.

Committee noted the action taken.

19

Mineral & Miners Traders ML No.2185A, 44.42 HA, Reserves 9.224 MMT	1.Hothur ISPAT Pvt. Ltd 2.JSW Steel Ltd.	35.0-39.1 %		
<p>Decision: The Committee noted the auction proceeding</p>				
<p><u>Agenda -3 Exploration in Haddinapade area and auction of new blocks.</u> The State Empowered Committee on 19.09.2018 has directed the Technical Committee of the Department of Mines and Geology to submit its technical justification and recommendation based on the proposed map which was discussed in the meeting. Based on the decision of committee a copy of report furnished by the technical committee was sent to KSMCL along with proposed map for its comment on 06-12-2018. The KSMCL furnished its comments on the report furnished by the technical committee, which is circulated in agenda note as Annexure-2. The report furnished by the technical committee is also circulated as Annexure-6. A brief gist of the opinion and justification rendered by the Technical Committee is as follows:</p> <ul style="list-style-type: none"> • <i>To win the ore blocked in the UPL (ultimate pit level) and also to provide adequate area for dumping to carryout systemic and scientific mining in the existing lease area and also additional area to be granted, provides more production capacity of KSMCL.</i> • <i>The remaining area proposed for auction will fetch increased revenue to the state ex-chequer.</i> <p>The subject was placed before the Committee, to take decision to reserve 160 Hectare of forest land in Haddinapade area to KSMCL as proposed by the technical committee. The Technical Officer of the Dept. of Mines and Geology explained the Committee that, the proposed area is adjacent to the KSMCL mining lease No. 2629 as per</p>			<p>The draft cabinet note prepared and submitted for clearance of finance department.</p>	<p>The Committee noted the action taken.</p>

<p>the Mining Plan of KSMCL, ML No.2629, the existing leased area is entirely occupied by mineralized zone and there is no adequate space for waste dumping, and in order to have a waste dump, non mineralized zone is very much required. The maximum ore to be extracted is blocked in the Ultimate Pit Limit and in order to extract the same (at its western boundary of the leased area) an area of 500-700 meters lateral extension is required beyond the lease towards the west for systematic and scientific extraction of ore.</p> <p>Further, he continued and explained to the Committee, that KSMCL submitted a proposal to enhance the production limit which was turned down by CBC in its letter dated 22.10.2018 with the reasons that, M/s KSMCL, mine ML No. 2629 does not have sufficient dump area for the mining waste that will be generated consequent to the proposed enhanced quantity of iron ore.</p> <p>DECISION: After detail discussions and deliberations, the Committee decided to place the matter before the State Cabinet as the area proposed is partly outside the applied area by KSMCL which was approved in the Cabinet meeting held on 24-02-2018.</p>								
<p>Agenda-4 Progress of exploration by respective agencies and preparation of action plan for the auction of new blocks</p> <p>The Secretary, C&I explained the status of exploration undertaken in forest land for Iron and Manganese ore in respect of 5 blocks entrusted to GSI was reviewed.</p> <p>Status of exploration undertaken in forest land for Iron and Manganese ore in respect of 3 blocks entrusted to MECL was reviewed</p> <p>In respect of following newly identified blocks, MECL started preliminary exploration work. In case of Haddinapadde block extent proposed is not yet finalised, hence MECL has not started exploration.</p>	<p>A meeting was held on 15-12-2018 chaired by PCCF to adopt simplified procedure for getting faster clearance. List of pending forest clearances enclosed in Annexure-3</p>	<p>The Committee took note of the action taken and also requested exploration agency, Forest and Mines Dept to expedite the process and complete exploration as early as possible.</p> <p>Decision with regard to auction of new blocks is recorded in the regular Agenda No 04.</p>						
<table border="1"> <thead> <tr> <th data-bbox="284 1848 574 1937">Location of the block</th> <th data-bbox="574 1848 678 1937">Proposed extent (in Ha)</th> <th data-bbox="678 1848 829 1937">Est Cost of exploration Rs in Cr</th> </tr> </thead> <tbody> <tr> <td data-bbox="284 1937 574 1982">Haddinapadde</td> <td data-bbox="574 1937 678 1982">100</td> <td data-bbox="678 1937 829 1982">100.00</td> </tr> </tbody> </table>	Location of the block	Proposed extent (in Ha)	Est Cost of exploration Rs in Cr	Haddinapadde	100	100.00		
Location of the block	Proposed extent (in Ha)	Est Cost of exploration Rs in Cr						
Haddinapadde	100	100.00						

21

Hoddingside	area	of	274.73	15.00
Subbaryarahalli	village,	(tentative)		
Sandur taluk, Ballari District				

The Secretary C&I requested special invitee CMD, MECL to brief about the exploration status and also any assistance from the State to complete the exploration works as early as possible. In response, CMD MECL gave a brief account on the mineral wise Exploration work being conducted by MECL in the different blocks (total 8 blocks) entrusted to MECL in Karnataka State.

The status of exploration work by MECL is as follows:

Iron Ore: Total five blocks are entrusted, out of which in one block viz. M/s RMMML (M.L.2010) is funded under NMET and remaining four blocks viz. Kumaraswamy, Donimalai, Ettinahatti and Dharmapura are funded by the State Government.

In RMMML block, Stage -I Forest Clearance has been obtained and formalities for stage -II forest clearance is under process.

In respect of Kumaraswamy & Donimalai Range blocks, preliminary work (Geological Mapping & Survey) is completed. Filed Form C for Forest Clearance. For the two blocks viz. Ettinahatti and Dharmapura in Sandur Taluk, Ballari District, Revised Techno-Commercial offer to be submitted by MECL.

Limestone: Two blocks approved under NMET viz. Diggaon and Udagi in Gulbarga district, the exploration work has been taken by MECL. The Survey and Geological work is in Progress.

<p>Gold: Regional Exploration (G-4) level for Au, Cu, Pb, Zn, Ni, and Co in Ranibennur block (Block ID SR-KAR-08), District Haveri and Davanagere, Geological mapping and sample collection has been completed and analysis of samples is in progress. This work is entrusted under NMET.</p> <p>The CMD, MECL, expressed serious concern regarding long processing time required for obtaining forest clearance for exploration project and suggested for simplification of procedure involved in getting forest clearance. He also opined that he would provide a list of activity that needs to be followed for FC with possible intervention to expedite the whole process.</p> <p>Decision: The Committee took note of the status of exploration by GSI and MECL. After detailed discussions and deliberations, Committee informed the Secretary, C&I, DMG, Forest Dept and Exploration agency to submit the proposal for simplification of FC for exploration and also informed C&I/DMG to place the blocks which are ready for auction along with schedule of auction.</p>		
<p><u>Agenda-5</u> Issue related to extension of mining lease No 2396 held by Nation Mineral Development Corporation (NMDC)</p> <p>The Secretary, C&I explained the Committee that, the State Cabinet has approved the proposal for extension of mining lease for a period of 20 years w.e.f. 04.11.2018 in respect of ML No: 2396 held by M/s. NMDC Limited, subject to payment of 80% of the average sale value published by IBM from time to time on dispatch of iron ore being payable along with the royalty and all other applicable taxes. Accordingly, informed NMDC to execute the supplementary deed for extension of mining lease deed to avoid</p>	<p>WP No. 53514/2018 filed by NMDC was heard at length. Learned Advocate General had argued the matter and concluded the arguments and on behalf of NMDC, Senior Counsel Mohan Parasharan concluded the arguments and after hearing both parties at length, the Hon'ble Court</p>	<p>Committee took note of the status in the Hon'ble High Court in respect of further extension of lease period of ML. No 2396 held by NMDC.</p>

23

<p>intimated that in absence of execution of mining lease deed, the State Government will take further necessary action, without further delay, to protect both the revenue to state exchequer and smooth supply of raw material to the mineral based industries.</p>	<p>arises at the time of arguments.</p>	
<p>He continued and informed the Committee, that, a meeting was convened on 14.11.2018 under the chairmanship of Hon'ble Chief Minister, Government of Karnataka to withdraw the order of imposition of premium for extension further 20 years of lease period in respect of mining lease No.2396 held by NMDC. After detail discussions and deliberations, it was decided to seek the opinion of the Advocate General on the imposition 80% of the average sale price published by IBM for the respective month under Rule 3(2) of the Mineral (Mining by Government Company) Rules, 2015 and also on the opinion given by the Law Department of the State Government. Accordingly file has been submitted to Advocate General.</p>	<p>a) whether State can levy any fee, offer, condition contrary to Section 2 read with Section 8A(8) and Section 9 of MMDR Act, invoking Rule 3(2) b) whether NMDC has any vested right over the area after expiry of lease to seek a mandamus for extension from the Hon'ble Court.</p>	
<p>Decision: The Committee took note of the above, since, a communication has already been sent to NMDC for execution of supplementary lease deed. The Secretary, C&I informed the Committee that a detailed agenda will be placed in the next meeting about this subject.</p>		
<p>Status of exploration of blocks which are due to expire on 31.03.2020. The Secretary C&I explained the Committee that, State Level Technical Committee constituted by Government of India, has recommended exploration in respect of 33 mining leases, out of 44 mining leases expiring on 31.03.2020. He continued and informed the Committee that exploration work in case of 12 mining leases is nearing completion. The State is planning to propose the exploration in respect of 4 blocks under NMET and also planning to entrust exploration in another 4 blocks to MECL under State budget. Remaining 13 lessees have not carried out exploration as per Rule 12(4A) of MCDR</p>	<p>The latest status of exploration is given in Annexure-3</p>	<p>Committee noted the status of FC for the purpose of further exploration and auction in respect of mining leases expiring on 31.03.2020. Secretary Mines and Director, Mines and Geology, informed the committee that 4 blocks as mentioned in the Agenda No. 4 are ready for auction and 7 more blocks likely to be</p>

<p>Amendment Rules as the said leases are idle and most of the lessees have requested to expedite for FC.</p> <p>Decision: After detailed discussions and deliberations, Committee informed C&I/DMG to prepare auction schedule for 12 mines and place before the Committee in next meeting. Further, in respect of leases falling in forest area, asked the Forest Dept to expedite the FC proposal and also to frame the guidelines as per FC Act and MoEF guidelines to complete exploration by end of 31.03.2019 so as to enable to put for auction on 01.04.2019. Further, Committee decided that in respect of leases expiring on 31.03.2020 where exploration works are to be entrusted under NMET, requested Secretary, C&I to take necessary action.</p>		<p>ready for auction by June, 2019.</p> <p>It was instructed in the meeting to expedite exemption U/s. 4(g) of KTPP Act for hiring Transaction Advisor and e-auction platform from MSTC without delay.</p>
<p>Status of working and non-working category A and B mining leases</p> <p>The Secretary, C&I Dept informed the Committee about the status of R&R implementation and production of iron ore in respect of category 'A', 'B' and 'C' category mines as follows;</p> <p>R & R plans approved for 122 mining leases including all A, B and C category mines. Forty leases implemented R & R works satisfactorily and complied all the conditions stipulated by the Hon'ble Supreme Court in its order dated: 03.09.2012 & 28.09.2012 and resumed mining operations. Remaining Lessees have not complied the said orders hence Monitoring Committee not allowed the mining operations in</p> <p>Decision: After detailed discussions and deliberations, Committee informed the Secretary C&I and DMG to place the present status of working and non-working and reasons for not working mines in the next meeting. The Chairman further intimated the Secretary, C&I Department to dispose pending cases early.</p>	<p>Details of working, non-working pending leases enclosed as Annexure-4</p>	<p>The Committee perused the details provided in Annexure-4</p>

The Secretary, C&I Dept submitted the Committee that, as per the decision of the State Empowered Committee meeting held on 14.12.2018, a draft Cabinet note to reserve 160 Hectare of forest land in Haddinapade area in favor of M/s KSMCL as proposed by Technical Committee and its justification report along with map is circulated to Law Dept., Finance Department and to the Hon'ble Minister for Mines Department to record opinion on 31.01.2019. The Law Dept on 19.02.2019 recorded its opinion and other opinions are awaited.

Decision: After detailed discussion and deliberations, the Committee requested Finance Dept to record its opinion and send the file to C&I Dept and Secretary, C&I to pursue the matter so as to place the proposal in next Cabinet Meeting.

Agenda No: 4 Auction of blocks during 2019-20

The Secretary C&I placed action plan of the Dept of Mines and Geology for auction of new blocks during 2019-20 and below four Iron Ore blocks and two Lime Stone Blocks are ready for auction.

District	Name and address Lessee	ML No.	Area in hectares	Category	Status	Reserves in MMT
Chitradurga	Mineral Enterprises Ltd.	2346	103.81	A	Working	55.90
Bellary	Aswathnarayana Singh & Co.	2531	56.50	B	Working	03.75
Bellary	Narayana Mines P. Ltd	1602	109.27	B	Working	23.22
Bellary	Zeenath Transport Co. Ltd.	2239	44.28	B	Working	13.38
Lime Stone Blocks (Explored by GSI)						
Gulbarga	Kannur Block	-	500	-	New Block	382.21
Bagalkot	Hanamaneeri Block	-	200	-	New Block	75.55

The Secretary, C&I submitted that four iron ore blocks expiring by 31-03-2020 are ready for auction. He further stated that Karnataka State is the first State in the Country to auction leases expiring by 2020, well ahead of schedule notified by the Ministry of Mines. He further stated that this NIT will be issued for these blocks within one week, as KIPP exemption is already obtained for Transaction Adviser and MSTC for e-auction platform.

In case of two lime stone blocks, where reserves are very high, the Tender Documents will be furnished before the committee in the next meeting for approval as these blocks are in patta land. Three options are to be explored 1) to acquire patta land from farmers following land acquisition procedure 2) at the risk of

successful bidders to get the consent of the land owner consent for outright purchase or for 30 years lease 3) or revenue sharing with the farmers with a condition to return the land back to the farmer after lease period.

Decision: After detailed discussion and deliberations, Committee accorded approval to auction four blocks and to issue NET. As far as two lime stone blocks are concerned, it was decided to prepare proper bid documents, keeping the interest of farmers as a focal point.

Agenda No: 5 Discussion about guidelines issued by MoEF for prospecting in respect of Forest land.

The Secretary C&I department placed the guidelines issued by the Ministry of Mines vide letter No. 5-3/2007-FC dated: 24.12.2018 stipulating the norms for Survey and Investigation (Prospecting of ores) on forest land and requested Forest Dept whether prior approval under FC Act is required in case 25 boreholes drilled in the lesser extent say one sq km as in the guidelines it was not mentioned about the prorata basis of distribution of 25 boreholes in 10 Sq Km.

Decision: Forest Dept submitted that these guidelines are applicable to lesser extent also. After detailed discussion and deliberations the committee directed to follow the guidelines issued by the department.

Agenda No: 6. Mining Activity in the vicinity of Sri Karthikeyas Temple.

The Secretary, C&I Dept brought to the notice of the Committee that, two auctioned 'C' category mines namely Hothur Traders ML No.2313 and Karthikeya Traders ML No. 2559 are in the vicinity of protected monument of Karthikeya Temple. The matter was brought to the notice of CEC before putting them to auction. At the time of issue of NIT necessary conditions were imposed to safeguard the interest of the temple as per the directions of CEC. He continued and submitted that, the Hon'ble Supreme Court order dated 01.07.2013 which is as under:

Committee appointed by this Court vide order dated 26.4.2011 shall undertake similar exercise in respect of other protected monuments in the State in whose vicinity mining operations are being undertaken and submit report to the State Government within a maximum period of nine months. The State Government shall release a sum of Rs.30 lacs in favour of the Committee to meet the expenses of survey, investigation etc. The report submitted by the Committee shall be considered by the Government within next two months and appropriate order be passed.

expert committee/group to examine the impact of mining on the monuments declared as protected monuments under the 1958 Act and take necessary remedial measures.

In compliance to the above order, the Secretary, C&I and the Director, Mines & Geology conducted meetings on 09.02.2018, 20.02.2018, 13.04.2018 and 22.06.2018. A meeting was also convened with CEC to review status of the ASI study report relating to impact of mining activities on historically protected monuments particularly relating to Sri Kumaraswamy Temple in Swamymalai range, Sandur taluk, which is long pending in spite of follow up of action. Hence, requested, NIRM to conduct the study and submit report. Accordingly, NIRM submitted report on 28.02.2019 which is placed at Annexure-6.

The Director, NIRM explained the methodology and as per their study it can be observed that all blasts were conducted beyond 800 Meters from the Kumaraswamy temple. The vibration from these blasts attenuated to below the permissible limit of 2mm/s at distance of 330 Meters and beyond from the blast. Considering this, NIRM concluded that blasts can be carried out safely in the mines beyond 500 Meters from the Kumaraswamy temple complying to the permissible limit of 2mm/s.

Decision: After detailed discussions and deliberations it was decided to get the comments of the expert Committee on NIRM report, since the Hon'ble Supreme Court constituted Expert Committee to study the impact of mining on the other protected monuments including Sri Kumaraswamy Temple.

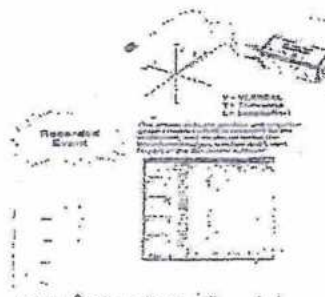
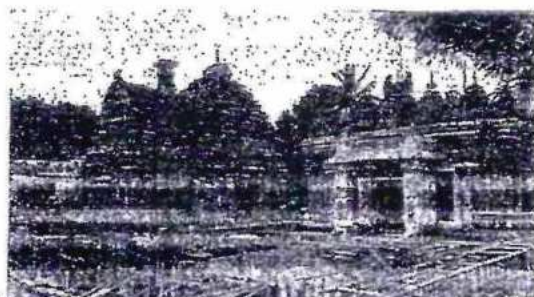
It was also intimated in the committee to the Director NIRM to furnish report/comments on the impact of mining in the vicinity without blasting also.

The meeting ended with vote of thanks to the Chairman and all other members of the Committee.

(T.M. VIJAY BHASKAR)
 (T.M. VIJAY BHASKAR)
 CHIEF SECRETARY
 Government of Karnataka.

Final report on

To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hospet, Department of Mines and Geology, Karnataka



Submitted to:

The Director
Department of Mines and Geology
Khanija Bhavan
Race Course Road
Bangalore - 560 001
Email: dirmines@gmail.com

Project No.: RB 18 05C
February 2019

Investigators:

Dr. H. S. Venkatesh, Scientist & Head
G. Gopinath, Scientist & Co-investigator
G. C. Naveen, Scientist & Co-investigator
R. Balachander, Scientist & Co-investigator

Rock Blasting and Excavation Engineering Department



National Institute of Rock Mechanics
(Ministry of Mines, Govt. of India)
HO: Eshwar Nagar, Outer Ring Road
Banashankari 2nd Stage, BENGALURU - 560 070
Telephone No. : + 91 - 80 - 2693 4400 / + 91 - 80 - 2693 4409
Fax No. + 91 - 80 - 2693 4401
E-mail: dto@nirm.in, rbenirm@gmail.com
Website: www.nirm.in

29

Final report on "To ascertain the feasibility of Blasting for mining operations around Kumaraswamy Temple, Hospet.
Project No.: RB 16 06C Submitted to: Department of Mines and Geology, Karnataka

Contents

	Page No.
Contents	i
Abstract	iii
1.0 INTRODUCTION	1
2.0 SCOPE / OBJECTIVES OF THE STUDY	1
3.0 EFFECTS OF BLASTING	2
3.1 Ground Vibration	2
3.2 Air Overpressure	3
3.3 Human Response to Ground Vibration	4
4.0 FIELD INVESTIGATIONS	5
4.1 Description of the Kumaraswamy Temple and Background of the Study	5
4.2 Details of Experimented Mines	7
4.2.1 Subbarayana Halli Iron Ore Mines	7
4.2.2 Nandi Iron Ore Mines (JSW)	8
4.3 Drilling and Blasting at the Mines	10
4.4 Instrument Used to Monitor Ground Vibration	13
4.5 Ground Vibration Monitoring	14
5.0 ANALYSIS AND DISCUSSION	25
5.1 Estimation of Peak Particle Velocity	25
5.2 Frequency of Ground Motion	26
5.3 Estimation of Air overpressure	26
5.4 Permissible Levels of Ground Vibration and Air overpressure	27
5.5 Attenuation of ground vibration and site observations	28
5.6 Monitoring of ground vibration due to vehicle movement	29
5.7 Control of Ground Vibration	30
6. 0 RECOMMENDED BLAST DESIGN PARAMETERS BASED ON BLASTING ZONES	31
7.0 CONCLUSIONS AND RECOMMENDATIONS	31
ACKNOWLEDGEMENTS	32
REFERENCES	32
APPENDIX -A (Officers of various department witnessed the blasts)	
APPENDIX- B (Sample vibration records of the blasts)	



ABSTRACT

The Department of Mines and Geology, Govt. of Karnataka convened an expert committee meeting to study the impact of mining operations on Kumaraswamy temple, Hospet, which was declared as a Protected Monument by the Government of Karnataka. Subsequently, they requested NIRM to carry out study on ground vibration due to blasting around Kumaraswamy temple. The scope of the study was to identify the target mines which is to be reviewed in the context of influence on Kumaraswamy temple due to proposed blasting at their site and to conduct a vibration study to establish a safe distance for Kumaraswamy temple based on DGMS Norms.

NIRM carried out a vibration study for about two weeks in August – September 2018, which was witnessed by the officers of various concerned department authority. The study was carried in two operating mines adjacent to Kumaraswamy Temple namely the Subbarayana Halli Iron Ore Mine belongings to Karnataka State Mineral Corporation (KSMC) and Nandi Iron Ore Mine belongs to JSW, which were located on either side of the temple. In each mine 10 trial blasts were carried out and ground vibration was measured at different locations and different directions. The trial blasts were representing the normal blasting practices being followed at these two mines.

Based on the data recorded, a site specific predictor equations for ground vibration and air overpressure were derived. A peak particle velocity of 2mm/s was recommended as safe for the temple based on DGMS standard considering the temple as object of historical importance and sensitive structure. It was observed that the ground vibration attenuates to less than 2mm/s beyond a distance of 330m. Safe maximum charge per delay was computed and submitted to keep the vibration level less than 2mm/s at the Kumaraswamy temple. Blast designs were also submitted for different zones from the temple. It is concluded that blasting can be carried out safely in the mines beyond a distance of 500m from the Kumaraswamy temple complying to the permissible limit of 2mm/s. At the request of Department of Mines and Geology, the vibration due to movement of vehicles also measured and it was found that even at a distance of 18m from the road the vibration levels were below the instrument threshold limit of 0.51 mm/s and the Kumaraswamy temple is located much farther from the road. It is deduced that the movement of vehicles from the mines do not pose any vibration issue to the temple.



31

1.0 INTRODUCTION

The Department of Mines and Geology convened an expert committee meeting at Bangalore on 13/04/2018 to study the impact of mining operations on Kumaraswamy temple, Hospet. On invitation, Dr. H. S. Venkatesh, Head of the Department, RBEE, National Institute of Rock Mechanics (NIRM) participated as blasting expert. This meeting was attended by officers from Department of Archaeology, Museums and Heritage, DGMS, IBM, Department of Mines and Geology etc.

Subsequently, the Director, Department of Mines and Geology, Govt. of Karnataka requested NIRM to carry out study on ground vibration due to blasting around Kumaraswamy temple with the scope as given in section 2.0. NIRM carried out field investigation from 23/08/2018 to 08/09/2018 and the study was witnessed by the officers of various concerned department authority. The study was carried in two operating mines adjacent to Kumaraswamy Temple. The following is the detailed final report submitted to the Director, Department of Mines and Geology, Government of Karnataka, Bangalore.

2.0 SCOPE / OBJECTIVES OF THE STUDY

- I. To identify the target mines which is to be reviewed in the context of influence on Kumaraswamy temple due to proposed blasting at their site.
- II. To conduct site specific ground vibration and air overpressure monitoring for the blast design being used/proposed at the target mines.
- III. In case, the target mine(s) is not in operation and that blasting study cannot be conducted, then to identify a close/abutting mine to the target mine(s) and to conduct site specific ground vibration and air overpressure monitoring for the blast design being used/proposed at the mine.
- IV. We shall propose if required the experimental procedure and blast design at the mine in view of target mine and the Kumaraswamy temple in view based on our data with regard to attenuation of ground vibration in other iron ore mines. In that case the mine management shall arrange the requisite blasts, in accordance to our method statement.
- V. Establishment of safe distance for Kumaraswamy temple based on DGMS norms.
- VI. Preparation and submission of a final report.

3.0 EFFECTS OF BLASTING

3.1 Ground Vibration

Blasting is one the most economical way of excavation of rock. However it results in certain adverse effects like ground vibration, air overpressure and flyrock. The ground vibrations are perceived by human being (as low as 0.5mm/s) (ISEE, 1998) and many a time can cause for apprehension. While assessing the ground vibration produced from blasting, the important parameters to be considered are the peak particle velocity and the frequency of ground vibration.

When an explosive charge is detonated inside a blasthole it is instantly converted into hot gases and the expanding gases exert intense pressure on the blasthole walls. A high intensity shock wave travels through the rock mass which attenuates sharply with distance. Simultaneously the rock around the blasthole up to twice the radius of the original hole gets completely crushed. Expanding gases continue to work on the rock, extending the cracks and moving the rock outward and upward. These activities consume a major part of the explosive energy. However, a small left over portion passes beyond the zone of intended work in the form of elastic ground vibrations. As seismic waves travel through the rock mass, they generate particle motions which are termed as ground vibrations. The velocity of oscillation of rock particles is called "particle velocity" and its maximum value is called "peak particle velocity (PPV)". It is measured in millimetres per second. (mm/s). Damage caused by ground vibration is dependent on peak particle velocity and the frequency of the ground motion.

Different countries adopt different standards of safe limits of vibration. In India, for mining blasts, the permissible ground vibration for different types of structures is specified by Directorate General of Mines Safety (DGMS), Ministry of Labour, Government of India. This standard also considers PPV and the frequency of ground vibration for deciding the permissible levels (Table 1) (Arion, 1997).



Table 1 Permissible peak particle velocity (mm/s) as per DGMS (Anon, 1997)

Type of structure	Dominant excitation frequency, Hz		
	< 8 Hz	8 – 25 Hz	> 25 Hz
A) Buildings/ structures not belonging to the owner			
Domestic houses/ structures (Kuchha, brick and cement)	5	10	15
Industrial Buildings RCC and framed structures)	10	20	25
Objects of historical importance and sensitive structures	②	5	10
B. Buildings belonging to owner with limited span of life			
Domestic houses/ structures (Kuchha brick and cement)	10	15	25
Industrial buildings (RCC & framed structures)	15	25	50

The following scaled distance empirical equation proposed by US Bureau of Mines [Siskind, 1980] has been used for prediction of peak particle velocity:

$$V = k \left[\frac{D}{\sqrt{Q}} \right]^b \quad \text{Equation 1}$$

Where,

V is peak particle velocity (mm/s),

D is distance (m),

Q is the maximum charge per delay (kg)

$\left[\frac{D}{\sqrt{Q}} \right]$ is scaled distance (m/kg^{0.5})

Scaled distance is the ratio of distance from the blast to the square-root of the maximum charge per delay.

K and b are site constants (K relates to blast geometry and explosives and b relates to rock attenuation characteristics)

3.2 Air Overpressure

Apart from ground vibration, blasting is accompanied by a loud noise called air blast or air overpressure. Air overpressure, however, is not simply the sound that is heard, it is an atmospheric pressure wave consisting of high frequency sound that is audible (20 – 20000Hz) and low frequency sound or concussion that is sub-audible (< 20 Hz) and cannot be heard. Either or both of the sound waves can cause

damage if the sound pressure is high enough. Air overpressure is generally an annoyance problem which may not cause damage but may result in confrontation between the operator and those affected. Air overpressure is measured in decibels (dB). The permissible level of air overpressure recommended by the US Bureau of Mines (Table 2) is generally adopted (Siskind, 1980). The same is suggested in the IS code (IS 14881:2001).

Table 2 Permissible levels of air Overpressure (Siskind, 1980 and IS 14881:2001)

Type of instrument	Permissible air overpressure level (dB)
0.1 Hz high pass time	134
2.0 Hz high pass time	133
6.0 Hz high pass time	129
C-slow weighing scale (events less than 2 sec. Duration)	105

3.3 Human Response to Ground Vibration

Human beings are more sensitive to ground vibration and noise. People inside buildings will respond differently than people outside. One of the most important factors is the presence of secondary sounds, such as rattling windows and doors. Complaints resulting from blast vibration to a large extent are mainly due to startling effect and fear of damage, rather than damage. The human body is very sensitive to low vibration levels, but unfortunately it is not a reliable damage indicator. Blasting nowadays is highly technological and precisely planned. In spite of this there are complaints because humans are very sensitive to vibration and can detect levels as low as 0.5mm/s. People tend to complain about ground vibrations even below the accepted damage level because of many reasons. How they notice and respond to vibration varies greatly from person to person. For the same intensity different persons may react differently with age, health, state of mind and attitude. Blast vibration effects became intolerable to humans at levels appreciably lower than levels at which structural damage takes place. The result is that often complaints can be received due to human response and not due to situation producing damage.

Bhandari (1997) states that normal activities like walking, door closing, jumping etc. can produce a good amount of vibration and the peak particle velocity generated from normal activities are given below in Table 3.



Table 3 Range of particle velocities from normal activities (Bhandari, 1997)

Activity	Range of velocities observed (mm/s)
	Same room
Walking	0.01-0.10
Door closing	0.02-0.15
Jumping	0.12-12.5

4.0 FIELD INVESTIGATIONS

4.1 Description of the Kumaraswamy Temple and Background of the Study

The Kumaraswamy temple (Figure 1) is located within the Swamimalai forest range of the Krauncha Giri (hill), in the Bellary district of Karnataka. The temple lays around 10 km from the town of Sandur in the Bellary district. The temple complex encompasses separate shrines dedicated to Goddess Parvati and Lord Kumaraswamy. The temple also houses a *vigraha* of Lord Ganesha. According to Legends, the Parvati temple was built by the Badami Chalukyas during the 7th to 8th century AD. This shrine has a *vigraha* of Goddess Parvati who is the main deity. This temple is a part of the Kumaraswamy temple (originally had Shanmukha as the main deity) which was built by the Rashtrakutas during the 8th-10th century AD. Both the parvathi temple as well as the Karthikeya temple stands as Protected Monuments of India under ASI. The temple was discovered later in the 15th century by the local rulers called the Ghorpades, from the dense forests of Swamimalai hill and is surrounded by a range of hillocks rich in good iron-ore.

The temple was declared as a Protected Monument by the Government of Karnataka. While the Karnataka Government entrusted with the task of protecting ancient monuments were taking steps to curb the mining activities within a safe zone from the temple. To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Karnataka Government formed the expert committee and the committee decided to avail the services of National Institute of Rock Mechanics (NIRM) Bangalore. To study this, two operating mines (Subbarayana Halli Iron Ore Mine belongings to Karnataka State Mineral Corporation (KSMC) and Nandi Iron Ore Mine belongs to JSW) are selected which are located on either side of the Kumaraswamy temple (Figure 2). In each mine 10 trial blasts were carried out and test blast faces were identified on solid side to Kumaraswamy Temple such that there is a medium for blast vibrations to travel towards the temple.

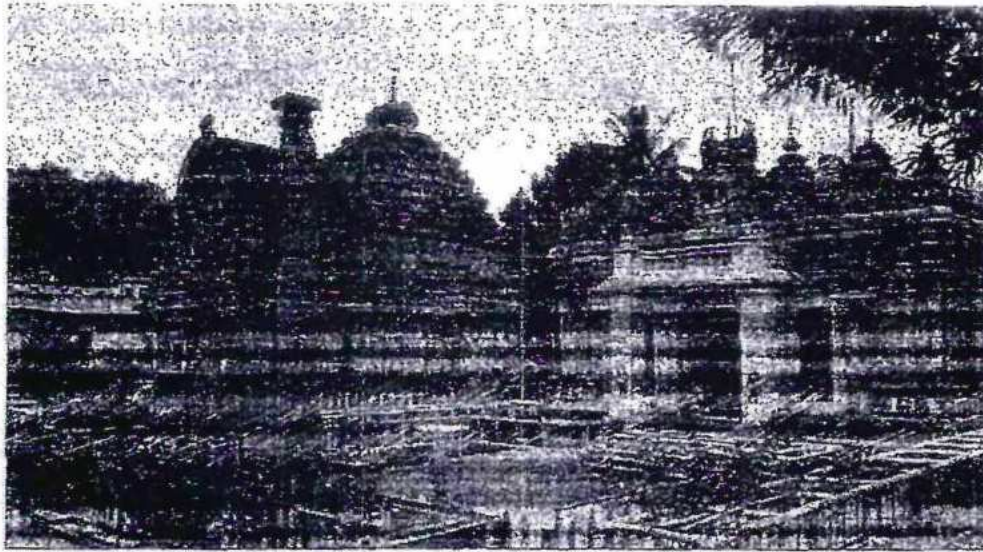


Figure 1 Picture of Kumaraswamy Temple

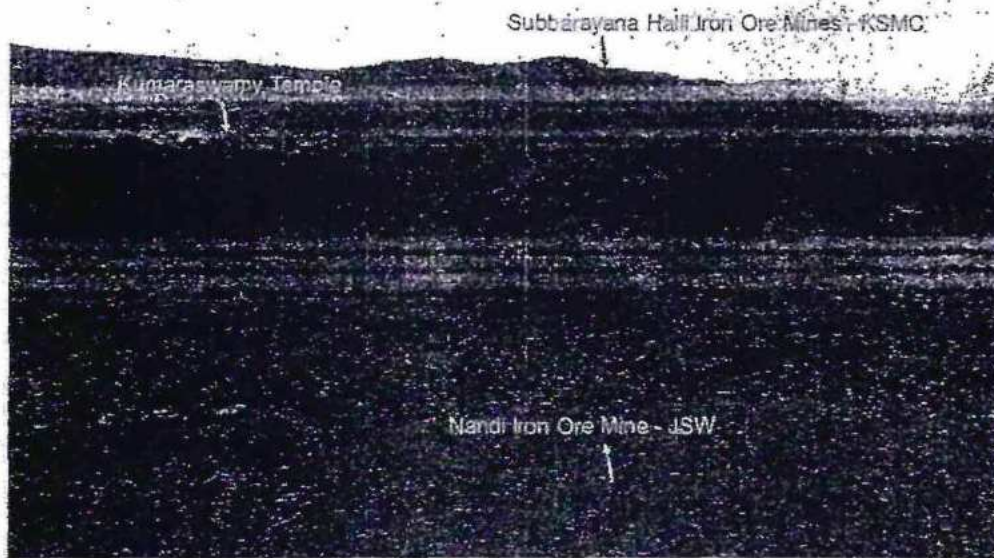


Figure 2 Location of Kumaraswamy Temple and test mines

27

Final report on To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hospet,
Project No.: RB 18 05C Submitted to: Department of Mines and Geology, Karnataka

4.2 Details of Experimented Mines

4.2.1 Subbarayana Halli Iron Ore Mines

Subbarayana Halli Iron Ore Mines is belonging to Karnataka State Mineral Corporation and is located at the north east side of Kumaraswamy temple. Kumaraswamy temple is beyond a distance of 800 m from the mine lease boundary. Mine is fully mechanized with bench height of 6 to 9 m (Figure 3). Ore is excavated with shovel dumper combination and at few places in the top bench the ore being hard is excavated by drilling and blasting method. With the permission, technical discussion and presence of the competent authorities 10 trial blasts were carried out at the south corner of top benches which are closer to the Kumaraswamy temple. The location of 10 blast and instrument location are given in Figure 4.

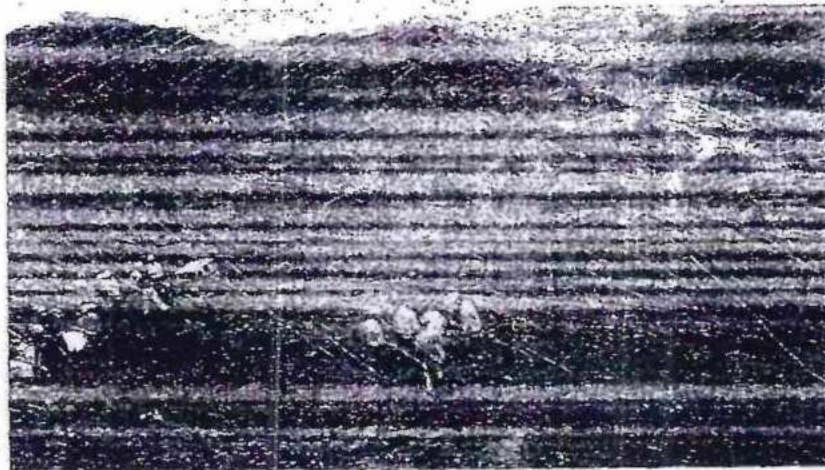


Figure 3 View of Subbarayana Halli Iron Ore Mines

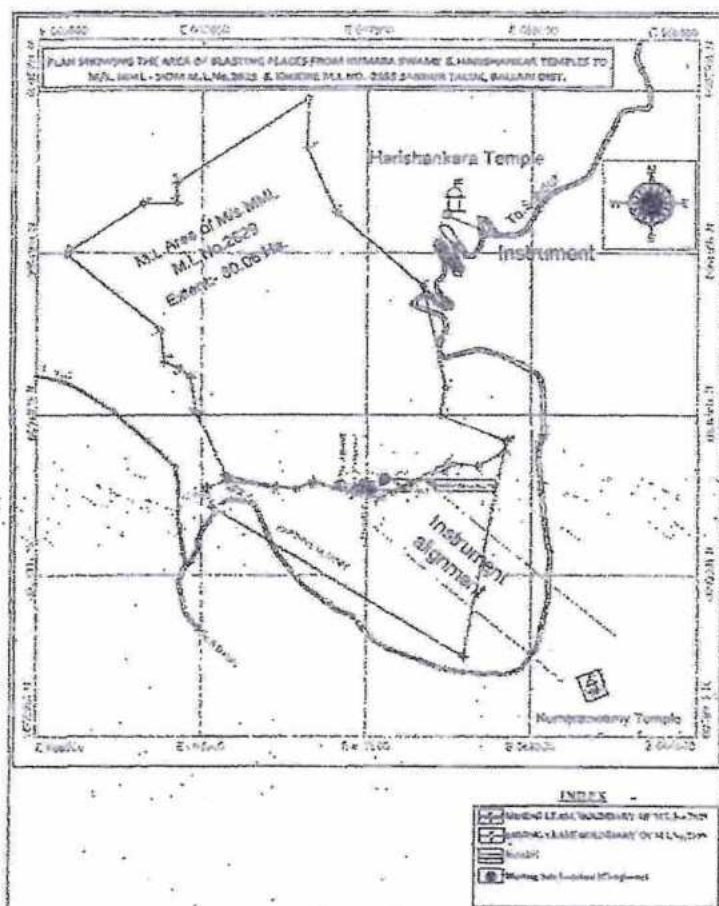


Figure 4 Location of 10 blast, instrument and Kumaraswamy temple

4.2.2 Nandi Iron Ore Mines (JSW)

Nandi Iron ore mine (Figure 5) is a captive mine of JSW and is located at the South east side of Kumaraswamy temple. Kumaraswamy temple is beyond 800 m from the mine lease boundary. Mine is fully mechanized with bench height of 6 to 9 m. Ore is excavated with shovel dumper combination and at few places in the top bench the ore being hard needs to be excavated by drilling and blasting method. Presently ore is extracted from the bottom bench which are beyond 1 km from the Kumaraswamy temple. The Reduced Level of top bench is 1037 m. With the permission, technical discussion and presence of the competent authorities 10 trial blasts were carried out at the north corner of top benches which are closer to the temple. The location of 10 blasts are shown in Figure 5: For all the blasts



39

instruments were placed behind the blast oriented along the path towards Kumaraswamy temple.

Apart from the Kumaraswamy temple the structures not belonging to owner are located beyond 1.9 Km from the experimented blast locations. Figure 6 shows the view of private structure from Nandi Mines.

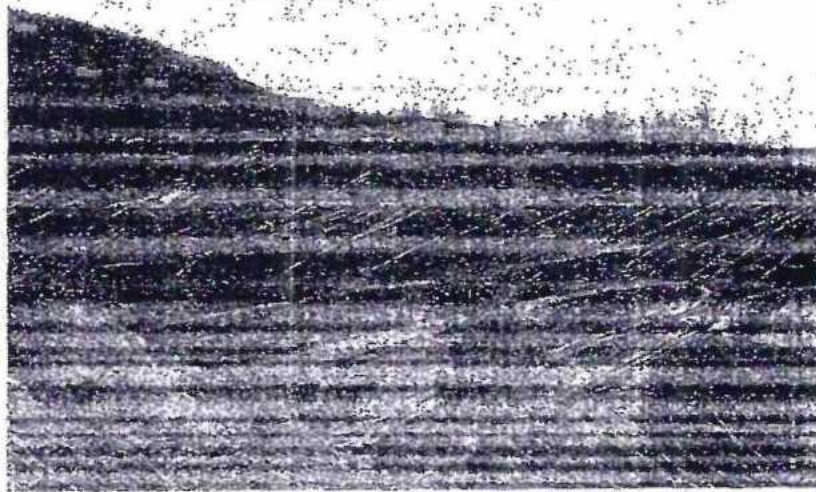


Figure 5 View of Nandi Iron ore Mine and the location of test blast

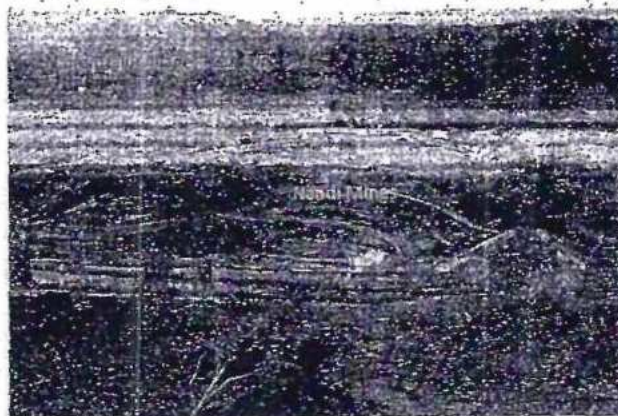


Figure 6 View of private structures from Nandi Mines

4.3 Drilling and Blasting at the Mines

To assess the actual impact of blast, regular blast design parameters practiced at the mine was used for experiment blast too. However, to know the ground vibration intensity the maximum charge per delay was varied from single hole to two hole per delay. For all the blast free face are oriented on solid side to Kumaraswamy temple (Figure 7). At Subbarayana Halli Iron Ore Mines the holes of 115mm diameter were drilled using crawler drilling machines where as in Nandi iron ore mines the holes of 102mm were drilled using hydraulic drill machine. The depth of holes varied from 4 m to 10.5 m depending on the bench height. The burden is 2.0 m and spacing are varied from 2.0 m to 3.0 m. At Subbarayana Halli Iron Ore Mines the holes were charged with Ideal boost (83mm diameter cartridge slurry explosive as primers) and ANFO. To know the actual charged quantity of ANFO in individual holes, mixed ANFO bags were weighed and charged into holes. In watery holes, only Ideal boost were used. Where as in Nandi mines only cartridge based slurry explosive (Ideal boost and Ideal column of 83 mm dia, 2.78 kg per cartridge) were used to charge the holes. The holes were stemmed with 10 mm down crusher material to a height of 2.0 to 6.3 m depending on the depth of the holes. The holes were initiated with non-electric initiation system (200 DTH, 25ms and 42ms TLDs). The charge per hole varied from 11.12 kg to 39.78 kg. The maximum charge per delay in a round varied between 17.78 kg to 69.50 kg. The total charge in a round varied from 191 kg to 1096 kg. The drilling and charging pattern for two of the blasts is given in Figure 8. The details of the blast parameters for the blasts executed during the investigation period are given in Table 4. To know the flyrock distance blast were recorded using video camera (Figure 9).

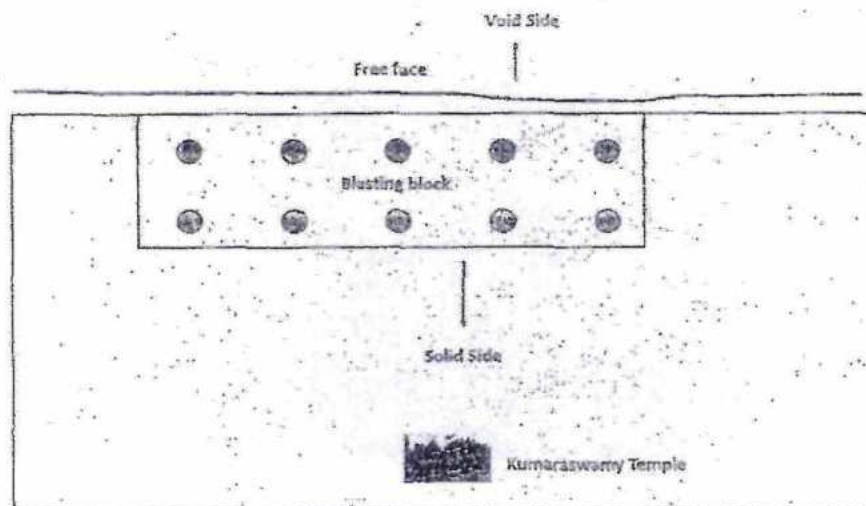


Figure 7 Blast orientation with reference to temple



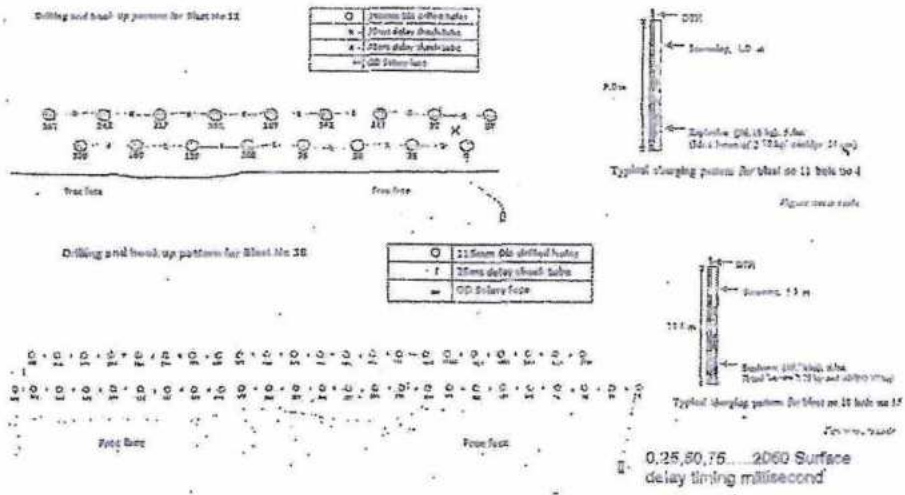


Figure 8 Charging and initiation sequence followed for the blast No11 and 18

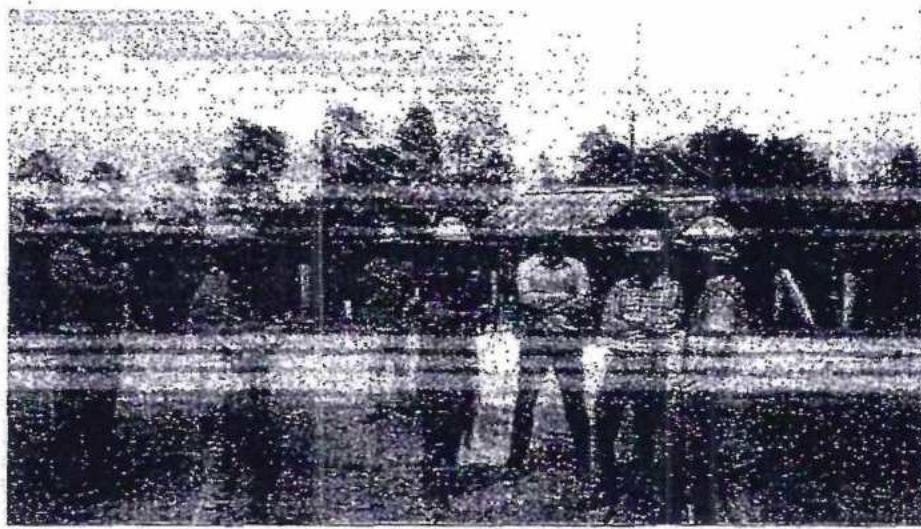


Figure 9 Blast recorded using video camera

Final report on "To ascertain the feasibility of blasting for mining operations around Kuntaraswamy Temple, Hoopet, Project No.: RB 12 05C Submitted to: Department of Mines and Geology, Karnataka

Table 4 Details of the test blasts monitored

Blast No	Date	Blast Location	Number of holes	Avg. Hole depth, m	Burden, m	Spacing, m	Charge per hole, kg	Stemming length, m	Total explosive, kg	Volume, m ³	Specific charge, kg/m ³	Observed flyrock distance,
1	24-08-18	S- Mine-Top Bench RL 1022	18	7.8	2.0	2.0	22.78 to 32.78	4.2	501	561	0.89	<100
2	25-08-18	S- Mine-Top Bench RL 989	41	9.0	2.0	2.5	17.78 to 32.78	2.4 to 5.2	1095	1845	0.59	<100
3	25-08-18	S-Mine Top Bench RL-1004	13	9.5	2.0	2.0	32.78 to 6.3	4.0	390	483	0.8	<100
4	29-08-18	N-Mine Top bench RL 1020	30	9.0	2.0	2.5	19.48 to 33.34	4.2 to 6.3	817.3	1360	0.6	<100
5	30-08-18	S- Mine-Top Bench RL 992	35	8.8	2.0	2.0	22.78 to 32.78	2.4 to 5.4	1070	1232	0.88	<100
6	30.8-18	S- Mine-Top Bench RL 1007	17	6.47	2.0	2.0	12.78 to 22.78	2.9 to 4.8	352.2	440	0.8	<100
7	30-08-18	S- Mine-Top Bench RL	20	8.63	2.0	2.0	27.78 to 6.0	4.4 to 6.0	535.6	688	0.8	<100
8	31-08-18	N-Mine Top bench RL 1020	22	7.6	2.0	3.0	22.2 to 47.25	2.1 to 3.4	772.8	1003	0.76	<100
9	31-08-18	N-Mine Top bench RL 1018	13	4.2	2.0	3.0	11.1 to 22.24	1.3 to 2.3	191.8	327	0.58	<100
10	01-09-18	N-Mine Top bench RL 1018	31	6.2	2.0	2.5	11.12 to 38.92	2.0 to 4.5	736.7	961	0.76	<100
11	01-09-18	N-Mine Top bench RL 982	17	8.7	2.0	2.5	30.58 to 36.12	2.0 to 4.5	589.36	739	0.79	<100
12	04-09-18	N-Mine Top bench RL 995	17	9.2	2.0	2.0	25.0 to 44.4	2.9 to 5.0	519.45	625	0.83	<100
13	05-09-18	S- Mine-Top Bench RL 998	20	6.2	2.0	2.0	17.78 to 4.0	3.3 to 4.0	385.6	496	0.71	<100
14	05-09-18	S- Mine-Top Bench RL 1010	12	8.48	2.0	2.0	17.78 to 32.78	3.7 to 6.3	308.3	407	0.75	<100
15	06-09-18	N-Mine Top bench RL 989	23	9.6	2.0	2.5	25.0 to 41.7	3.3 to 5.5	875	1104	0.79	<100
16	08-09-18	N-Mine Top bench RL 999	23	6.76	2.0	2.0	22.24 to 33.38	2.8 to 4.0	569	616	0.92	<100
17	08-09-18	N-Mine Top bench RL 1012	19	8.1	2.0	2.0	11.12 to 33.36	2.0 to 4.8	555.6	615	0.9	<100



43

Final report on 'To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hospet,
Project No.: RB 18 05C Submitted to: Department of Mines and Geology, Karnataka

Table 4 cont.,

Blast No	Date	Blast Location	Number of holes	Avg. Hole depth, m	Burden, m	Spacing, m	Charge per hole, kg	Stemming length, m	Total explosive, kg	Volume, m ³	Specific charge, kg/m ³	Observed flyrock distance,
18	07-09-18	S- Mine-Top Bench RL 986	47	9.95	2.0	2.0	32.78 to 9.78	3.3 to 5.7	1355	1872	0.99	<100
19	07-09-18	S- Mine-Top Bench RL 1001	11	8.05	2.0	2.0	22.78 to 27.78	4.7 to 5.1	205.58	354	0.83	<100
20	08-09-18	N-Mine Top bench RL 1023	42	7.5	2.0	2.0	11.12 to 36.42	2.0 to 5.1	1125	1260	0.89	<100

Note: S Mine- Subbarayana Halli Iron Ore Mines, N Mine- Nandi Iron ore Mine
Common parameter: Initiation system: Non-electric shocktube, DTH of 200 ms with TLD 17ms, 25 ms and 42 ms, Stemming material: Crusher material and drill cutting
At Subbarayana Halli Iron Ore Mine:- Hole diameter, 115mm, Explosives used: Ideal Boost (63mm diameter, weighing 2.78kg/cartridge) and ANFO
At Nandi Iron ore mine:- Hole diameter, 102mm, Explosives used: Ideal Boost and Ideal column (63mm diameter and weighing 2.78kg/cartridge)

4.4 Instrument Used to Monitor Ground Vibration

Minimate Plus seismographs from Instantel (Figure 10), Canada were used for monitoring ground vibration and air overpressure levels. These instruments are microprocessor-based, portable units and each unit consists of a standard external triaxial transducer for monitoring ground vibration in transverse, vertical and longitudinal. Transverse ground vibration agitate particle in a side to side motion. Vertical ground vibrations agitate particles in an up and down motion. Longitudinal ground vibration agitate particle in forward and back motion progressing outward from the event site. This instrument also having a microphone for measuring air overpressure.



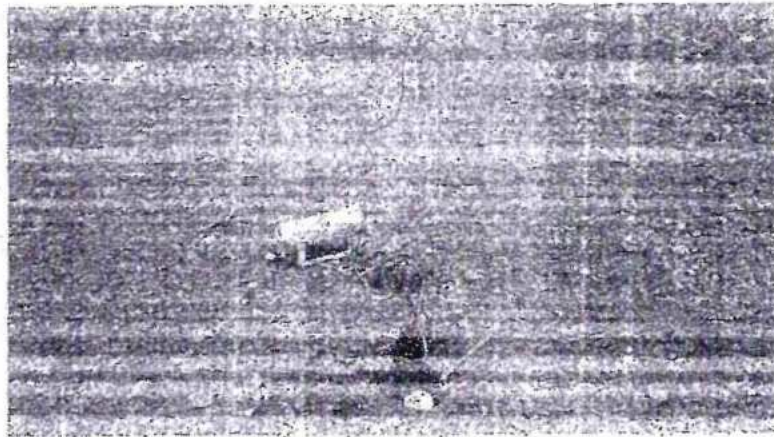


Figure 11 Photograph shows the burring of geophone in ground

In total 20 blast were monitored at 100 recorded locations using five seismographs. The radial distance between instrument and blast locations are varied from 95 m to 979 m and the horizontal distance are 92 m to 972 m. The horizontal distances between the blast location and the seismograph locations were measured at the site using a Global Positioning System (GPS) and Differential Global Positioning Systems (DGPS)(Figure 12) and the radial distance are calculated by taking the difference of reduce level of blast location and instrument location into account.

For the blast carried out at Nandi iron ore Mines one seismograph was placed near the Kumaraswamy temple and the rest of the four seismographs were placed behind the blast, directed towards the Kumaraswamy temple. For the blast carried out at Subbarayana Halli Iron Ore Mines one seismograph was placed near Kumaraswamy temple, one near Harishankara temple and remaining three are placed behind the blast directed towards the Kumaraswamy temple (Figure 13). All the blast were witnessed by officers of various competent authority, general public and press and the details are given in Appendix A with few photographs. Figure 14 to 17 illustrate ground vibration monitoring near the Kumaraswamy temple, Harishankara temple and within mine directed towards Kumaraswamy temple. The details of the monitored ground vibration and air overpressure for different blasts at different locations are given in Table 5. Sample printouts of the monitored ground vibration and air overpressure are given in Appendix-B.

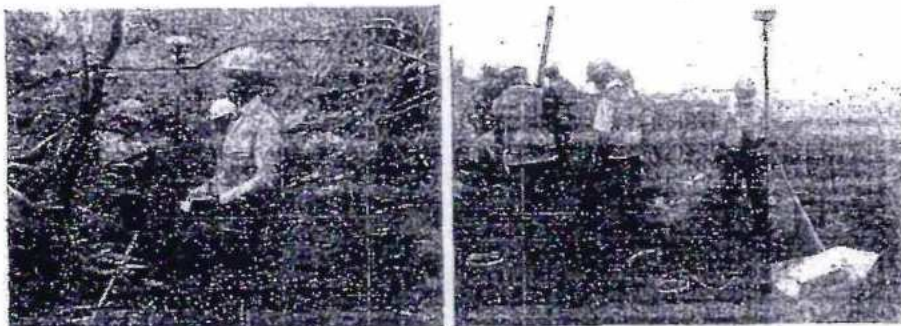


Figure 12 Measurement of radial distances between the blast location and the seismograph locations using GPS and DGPS

15

Final report on 'To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hospet,
 Project No.: RB 18 06C Submitted to: Department of Mines and Geology, Karnataka

30.08.2018 (NIRM BLAST NO-5)

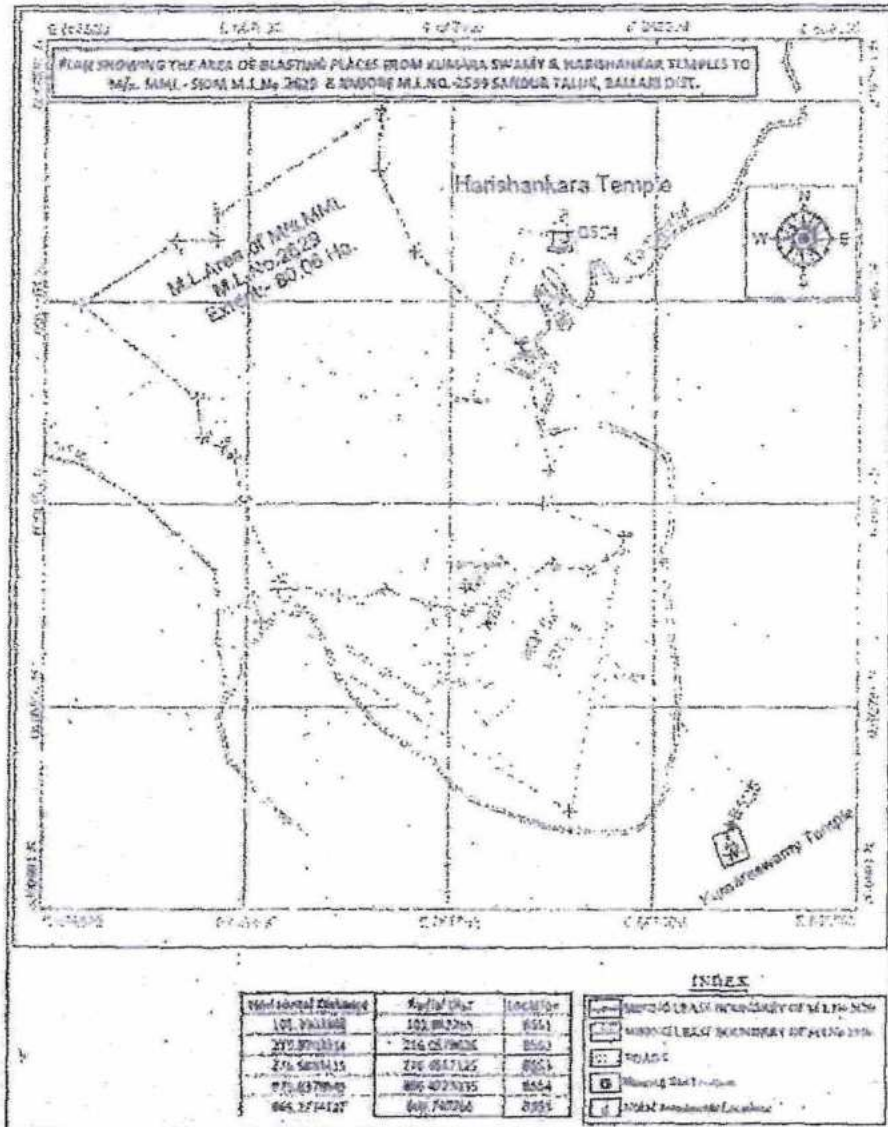


Figure 13 Blast and instrument location for test blast 5



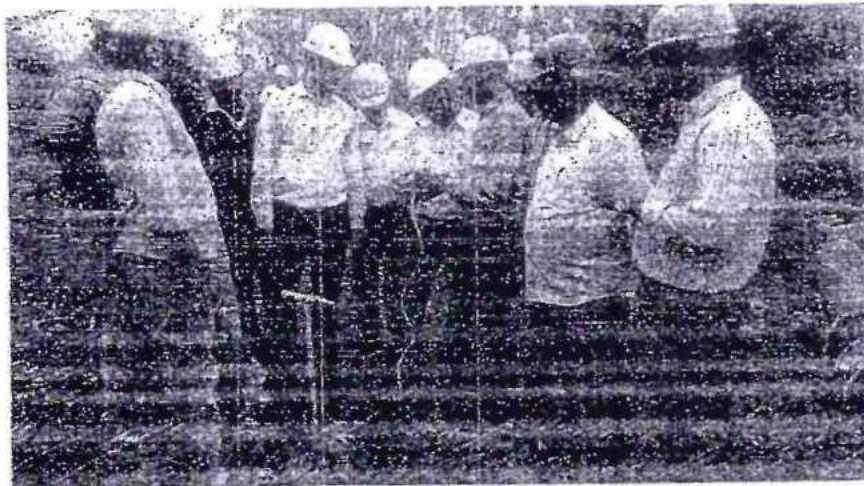


Figure 14 Monitoring of ground vibration within the mine and towards Kumaraswamy temple



Figure 15 Monitoring of ground vibration near Kumaraswamy temple

49

Final report on 'To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hospet,
Project No: RB 18 05C
Submitted to: Department of Mines and Geology, Karnataka

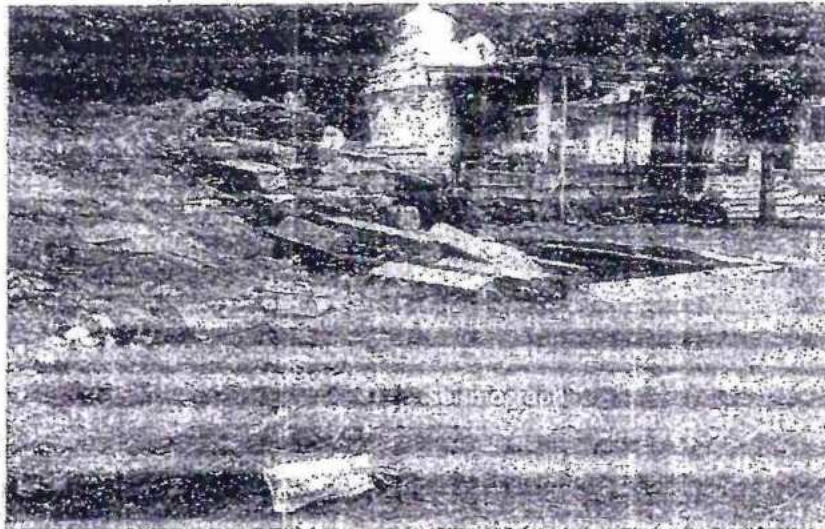


Figure 16 Monitoring of ground vibration near Harishankara temple

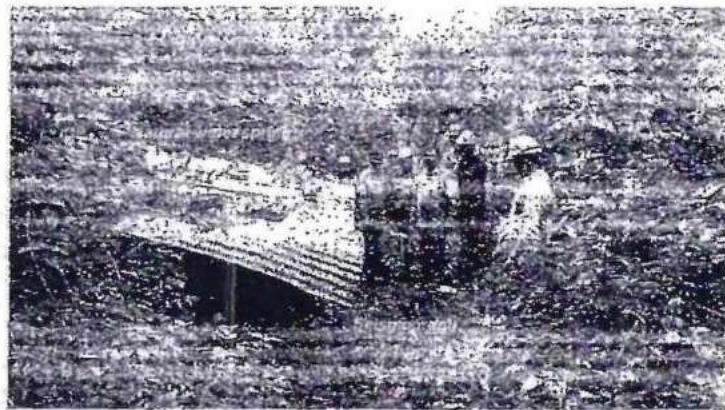


Figure 17 Monitoring of ground vibration near water spring location and Harishankara temple



Table 5. Details of the ground vibration and air overpressure monitored

Bl No.	Date	Blast Location	Instrument Location	MCD, Kg	Dist., m	SD, D/√Q	PPV, mm/s	FFT, Hz	CRSD	AOP, dB
B1	24-08-2018	S-Mine-Top Bench RL 1022	B1S1-Behind the blast towards Kumaraswamy temple	32.8	104	18	4.0	12	33	Not recorded
			B1S2-Behind the blast towards Kumaraswamy temple	32.8	211	37	2.9	10	86	Not recorded
			B1S3-Behind the blast towards Kumaraswamy temple	32.8	310	64	2.2	9	97	108.0
			B1S4-Behind the blast towards Kumaraswamy temple	32.8	370	65	1.5	12	115	108.8
			B1S5-Behind the blast adjacent to Kumaraswamy temple	32.8	964	168	NOT	—	302	NOT
B2	25-08-2018	S-Mine-Top Bench RL 989	B2S1-Behind the blast towards Kumaraswamy temple	32.8	96	17	5.5	11	30	111.2
			B2S2-Behind the blast towards Kumaraswamy temple	32.8	108	36	4.7	10	52	114.2
			B2S3-Behind the blast towards Kumaraswamy temple	32.8	258	45	4.5	6	81	Not recorded
			B2S4-Void side of blast adjacent to Harishankara temple	32.8	658	150	NOT	—	268	NOT
			B2S5-Behind the blast adjacent to Kumaraswamy temple	32.8	844	147	NOT	—	264	NOT
B3	25-08-2018	S-Mine Top Bench RL-1004	B3S1-Behind the blast towards Kumaraswamy temple	32.8	180	30	5.2	158	53	108.8
			B3S2-Behind the blast towards Kumaraswamy temple	32.8	252	44	4.3	15	79	117.1
			B3S3-Behind the blast towards Kumaraswamy temple	32.8	315	55	3.0	8	98	NOT
			B3S4-Behind the blast adjacent to Harishankara temple	32.8	910	159	NOT	—	285	NOT
			B3S5-Behind the blast adjacent to Kumaraswamy temple	32.8	912	159	NOT	—	285	NOT
B4	29-08-2018	N-Mine Top bench RL 1020	B4S1-Behind the blast towards Kumaraswamy temple	33.3	106	16	5.5	11	33	111.1
			B4S2-Behind the blast towards Kumaraswamy temple	33.3	208	36	2.8	11	65	98.8
			B4S3-Behind the blast towards Kumaraswamy temple	33.3	315	55	2.0	11	95	100.0
			B4S4-Behind the blast towards Kumaraswamy temple	33.3	440	76	NOT	—	137	NOT
			B4S5-Behind the blast adjacent to Kumaraswamy temple	33.3	858	154	NOT	—	276	NOT



51

Final report on 'To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hospet, Project No.: RB 16 05C Submitted to: Department of Mines and Geology, Karnataka

Table 5 cont..

Bl No.	Date	Blast Location	Instrument Location	MICD, Kg	Dist., m	SD, D/NQ	PPV, mm/s	FFT, Hz	CRSD	AOP, dB
B5	30-08-2018	S-Mine-Top Bench RL 992	B5S1-Behind the blast towards Kumaraswamy temple	65.6	101	12	6.7	13	25	113.8
			B5S2-Behind the blast towards Kumaraswamy temple	66.8	216	27	4.8	13	54	112.0
			B5S3-Void side of blast adjacent to Harishankara temple	65.6	276	34	2.2	4	69	97.5
			B5S4-Behind the blast towards Kumaraswamy temple	65.6	896	111	NOT	—	223	NOT
			B5S5-Behind the blast adjacent to Kumaraswamy temple	65.6	889	107	NOT	—	218	NOT
B6	30-08-2018	S-Mine-Top Bench RL 1007	B6S1-Behind the blast towards Kumaraswamy temple	45.6	102	16	5.5	5	29	116.1
			B6S2-Behind the blast towards Kumaraswamy temple	45.6	225	33	3.2	8	63	108.8
			B6S3-Behind the blast towards Kumaraswamy temple	45.6	267	43	0.9	5	80	94.0
			B6S4-Void side of blast adjacent to Harishankara temple	45.6	948	140	NOT	—	266	NOT
			B6S5-Behind the blast adjacent to Kumaraswamy temple	45.6	881	131	NOT	—	247	NOT
B7	30-08-2018	S-Mine-Top Bench RL	B7S1-Behind the blast towards Kumaraswamy temple	27.8	129	24	2.3	18	43	111.2
			B7S2-Behind the blast towards Kumaraswamy temple	27.8	251	48	1.9	7	33	109.9
			B7S3-Behind the blast towards Kumaraswamy temple	27.8	314	60	1.0	5	104	91.5
			B7S4-Void side of blast adjacent to Harishankara temple	27.8	950	180	NOT	—	314	NOT
			B7S5-Behind the blast adjacent to Kumaraswamy temple	27.8	907	172	NOT	—	300	NOT
B8	31-08-2018	N-Mine-Top bench RL 1020	B8S1-Behind the blast towards Kumaraswamy temple	47.3	173	25	3.1	17	48	105.5
			B8S2-Behind the blast towards Kumaraswamy temple	47.3	250	36	2.4	9	69	104.2
			B8S3-Behind the blast towards Kumaraswamy temple	47.3	327	48	2.4	11	91	94.0
			B8S4-Void side of blast adjacent to Harishankara temple	47.3	403	59	NOT	—	112	NOT
			B8S5-Behind the blast adjacent to Kumaraswamy temple	47.3	979	142	NOT	—	271	NOT



Final report on 'To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hoispet,
Project No.: RB 16 05C Submitted to: Department of Mines and Geology, Karnataka

Table 5 cont.

Bl No.	Date	Blast Location	Instrument Location	MCD, Kg	Dist., m	SD, D/NQ	PPV, mm/s	FFT, Hz	CRSD	AOP, dB
B9	31-08-2018	N-Mine Top bench RL 1018	B9S1-Behind the blast towards Kumaraswamy temple	22.2	95	20	6.1	5	34	108.0
			B9S2-Behind the blast towards Kumaraswamy temple	22.2	170	38	4.8	5	61	107.5
			B9S3-Behind the blast towards Kumaraswamy temple	22.2	246	52	2.9	5	88	91.5
			B9S4-Behind the blast towards Kumaraswamy temple	22.2	321	68	NOT	—	114	NOT
			B9S5-Behind the blast adjacent to Kumaraswamy temple	22.2	399	191	NOT	—	320	NOT
B10	01-09-2018	N-Mine Top bench RL 1018	B10S1-Behind the blast towards Kumaraswamy temple	69.5	221	27	3.6	8	54	111.2
			B10S2-Behind the blast towards Kumaraswamy temple	69.5	285	34	2.9	6	60	106.5
			B10S3-Behind the blast towards Kumaraswamy temple	69.5	350	43	1.4	8	87	98.8
			B10S4-Behind the blast towards Kumaraswamy temple	69.5	451	64	NOT	—	110	NOT
			B10S5-Behind the blast adjacent to Kumaraswamy temple	69.5	531	112	NOT	—	227	NOT
B11	01-09-2018	N-Mine Top bench RL 982	B11S1-Behind the blast towards Kumaraswamy temple	36.1	106	16	9.7	10	32	113.5
			B11S2-Behind the blast towards Kumaraswamy temple	36.1	184	31	5.8	10	56	108.0
			B11S3-Behind the blast towards Kumaraswamy temple	36.1	263	42	3.3	10	77	97.5
			B11S4-Behind the blast towards Kumaraswamy temple	36.1	396	66	NOT	—	120	NOT
			B11S5-Behind the blast adjacent to Kumaraswamy temple	36.1	530	138	NOT	—	251	NOT
B12	04-09-2018	N-Mine Top bench RL 995	B12S1-Behind the blast towards Kumaraswamy temple	44.4	99	15	7.2	18	26	104.2
			B12S2-Behind the blast towards Kumaraswamy temple	44.4	145	22	5.0	18	41	108.4
			B12S3-Behind the blast towards Kumaraswamy temple	44.4	220	34	3.0	10	65	91.5
			B12S4-Behind the blast towards Kumaraswamy temple	44.4	382	62	NOT	—	111	NOT
			B12S5-Behind the blast adjacent to Kumaraswamy temple	44.4	514	137	NOT	—	258	NOT



53

Final report on 'To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hospet,
Project No.: RB 18 09C Submitted to: Department of Mines and Geology, Karnataka

Table 5 cont..

Bl No.	Date	Blast Location	Instrument Location	MCD, Kg	Dist., m	SD, DNQ	PPV, mm/s	FFT, Hz	CRSD	AOP, dB
B13	05-09-2018	S- Mine- Top Bench RL 998	B13S1-Behind the blast towards Kumaraswamy temple	17.8	102	24	3.0	20	39	115.2
			B13S2-Behind the blast towards Kumaraswamy temple	17.6	275	65	3.3	6	105	105.6
			B13S3-Behind the blast towards Kumaraswamy temple	17.8	351	88	1.1	12	138	94.0
			B13S4-Void side of blast in front of water spring at Halshankara temple	17.6	919	218	NOT	—	352	NOT
			B13S5-Behind the blast adjacent to Kumaraswamy temple	17.8	906	215	NOT	—	347	NOT
B14	05-09-2018	S- Mine- Top Bench RL 1010	B14S1-Behind the blast towards Kumaraswamy temple	55.0	110	15	3.7	14	29	113.3
			B14S2-Behind the blast towards Kumaraswamy temple	55.9	280	38	3.2	13	73	105.5
			B14S3-Behind the blast towards Kumaraswamy temple	55.6	366	40	1.7	8	96	94.0
			B14S4-Void side of blast in front of water spring at Halshankara temple	55.6	914	123	NOT	—	240	NOT
			B14S5-Behind the blast adjacent to Kumaraswamy temple	55.6	901	121	NOT	—	236	NOT
B15	05-09-2018	N-Mine Top bench RL 989	B15S1-Behind the blast towards Kumaraswamy temple	41.0	578	89	NOT	—	167	NOT
			B15S2-Behind the blast towards Kumaraswamy temple	41.6	648	100	NOT	—	187	NOT
			B15S3-Behind the blast towards Kumaraswamy temple	41.8	720	111	NOT	—	208	NOT
			B15S4-Behind the blast towards Kumaraswamy temple	41.8	786	122	NOT	—	227	NOT
			B15S5-Behind the blast adjacent to Kumaraswamy temple	41.8	907	150	NOT	—	279	NOT
B16	06-09-2018	N-Mine Top bench RL 999	B16S1-Behind the blast towards Kumaraswamy temple	33.4	561	97	NOT	—	174	94.0
			B16S2-Behind the blast towards Kumaraswamy temple	33.4	635	110	NOT	—	197	NOT
			B16S3-Behind the blast towards Kumaraswamy temple	33.4	706	123	NOT	—	220	NOT
			B16S4-Behind the blast towards Kumaraswamy temple	33.4	777	135	NOT	—	242	NOT
			B16S5-Behind the blast adjacent to Kumaraswamy temple	33.4	971	168	NOT	—	302	NOT



Final report on 'To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hospet,
Project No.: RD 18 05C Submitted to: Department of Mines and Geology, Karnataka

Table 5 cont..

Bl No.	Date	Blast Location	Instrument Location	MCD, Kg	Dist., m	SD, D/√Q	PPV, mm/s	FFT, Hz	CRSD	AOP, dB
B17	06-09-2018	N-Mine Top bench RL 1012	B17S1-Behind the blast towards Kumaraswamy temple	66.7	478	59	0.6	5	118	95.9
			B17S2-Behind the blast towards Kumaraswamy temple	66.7	529	64	0.5	10	130	91.5
			B17S3-Behind the blast towards Kumaraswamy temple	66.7	602	74	NOT	—	149	NOT
			B17S4-Behind the blast towards Kumaraswamy temple	66.7	847	79	NOT	—	160	NOT
			B17S5-Behind the blast adjacent to Kumaraswamy temple	66.7	825	101	NOT	—	204	NOT
B18	07-09-2018	S-Mine Top Bench RL 986	B18S1-Behind the blast towards Kumaraswamy temple RL	39.8	283	45	1.7	8	83	112.3
			B18S2-Behind the blast towards Kumaraswamy temple	39.8	379	50	1.5	8	111	113.8
			B18S3-Behind the blast towards Kumaraswamy temple	39.8	479	76	1.0	12	141	95.9
			B18S4-Void side of blast in front of water spring at Harishankara temple	39.8	851	136	NOT	—	250	NOT
			B18S5-Behind the blast adjacent to Kumaraswamy temple	39.8	851	135	NOT	—	250	NOT
B19	07-09-2018	S-Mine Top Bench RL 1001	B19S1-Behind the blast towards Kumaraswamy temple	27.6	317	60	0.8	11	105	102.8
			B19S2-Behind the blast towards Kumaraswamy temple	27.6	408	77	0.9	12	135	101.9
			B19S3-Behind the blast towards Kumaraswamy temple	27.6	504	95	0.6	10	167	94.0
			B19S4-Void side of blast in front of water spring at Harishankara temple	27.6	880	167	NOT	—	291	NOT
			B19S5-Behind the blast adjacent to Kumaraswamy temple	27.6	880	168	NOT	—	294	NOT
B20	08-09-2018	N-Mine Top bench RL 1023	B20S1-Behind the blast towards Kumaraswamy temple	38.4	477	77	1.0	9	142	104.2
			B20S2-Behind the blast towards Kumaraswamy temple	38.4	573	92	0.6	13	170	103.5
			B20S3-Behind the blast towards Kumaraswamy temple	38.4	584	94	0.5	8	173	NOT
			B20S4-Behind the blast towards Kumaraswamy temple	38.4	678	110	NOT	—	201	NOT
			B20S5-Behind the blast adjacent to Kumaraswamy temple	38.4	930	153	NOT	—	262	NOT

S-Mine : Subbarayana Halli Iron Ore Mines, N-Mine: Nandi Iron ore Mine, MCD: Maximum charge per delay, Dist: Radial distance from blast location to sensor, SD: Square root scaled distance, PPV: Peak particle velocity, CRSD: Cube root scaled distance, AOP: Air overpressure, NOT: Not over threshold (0.65mm/s)



55

5.0 ANALYSIS AND DISCUSSION

5.1 Estimation of Peak Particle Velocity

The ground vibration data generated from twenty blasts were used for regression analysis. In total, 54 sets of readings were used for regression analysis. Figure 18 shows a plot of peak particle velocity against square-root scaled distance plotted on a log-log graph. Scaled distance is the ratio of distance from the blast to the square root of the maximum charge per delay. Based on the field data generated, the following predictor equation was derived with a correlation coefficient of r^2 0.67 at 95% confidence level.

$$V_{(95\%)} = 428 (D/\sqrt{Q})^{-1.18} \quad \text{Equation-2}$$

Where, V = peak particle velocity (mm/s),
 D = radial distance from blast to monitoring station (m) and
 Q = maximum charge per delay (kg).

Equation 2 or Figure 17 may be used to estimate the peak particle velocity for known distance and maximum charge per delay

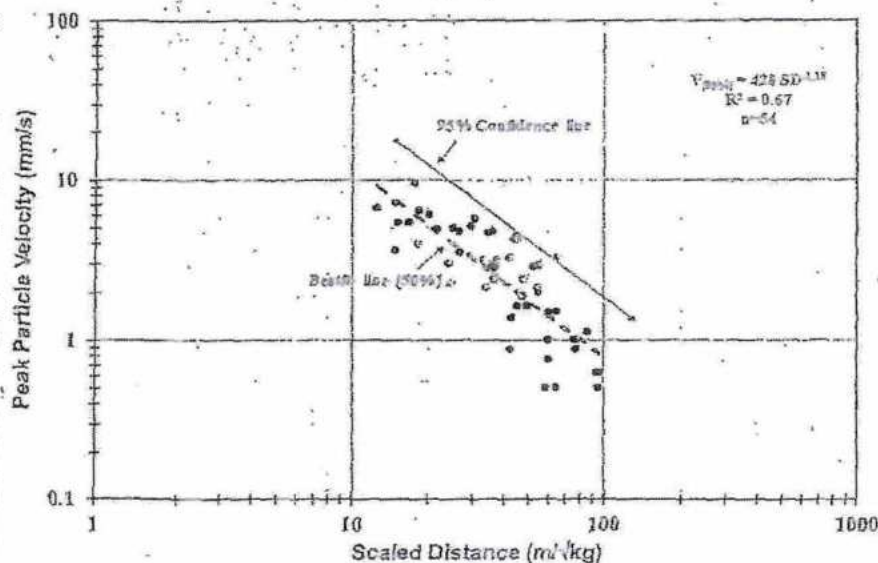


Figure 18 Peak particle velocity Vs scaled distance for blasts carried out at Subbarayana Halli Iron Ore Mine and Nandi Iron Ore mine



5.2 Frequency of Ground Motion

The frequency of the ground vibration was determined by analysing the records of the blasts using the software provided with the instruments. The Fast Fourier Transform (FFT) analysis of vibration data revealed that the dominant frequency of vibration waves varied between 4.3 Hz to 19.7 Hz (Figure 19). In most of the cases, the dominant frequency were higher than 8 Hz. Taking into account of Kumaraswamy temple is a monument structure, the FFT recorded less than 8 Hz is considered for fixing the permissible ground vibration limits.

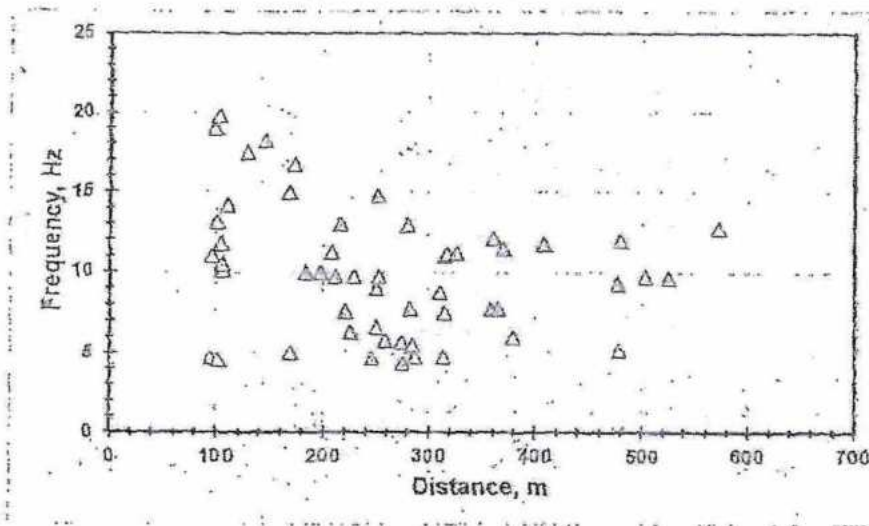


Figure 19 Frequency of ground vibration versus distance for the blasts monitored at Subbarayana Halli Iron Ore Mines and Nandi Iron Ore mine.

5.3 Estimation of Air overpressure

The measured air overpressure levels were plotted against cube root scaled distance (Figure 20). The cube root scaled distance is the distance divided by the cube root of the maximum charge per delay. In total, 49 sets of air overpressure data were used for statistical analysis to derive an empirical equation. The following equation was derived for estimating the air overpressure with a correlation coefficient of -0.34



57

$AOP = -20 \log (D/Q^{1/3}) + 142$ Equation-3

Where, AOP is the air overpressure level in dB,
D is the distance from the blast to monitoring station in m and
Q is the maximum charge per delay in kg.

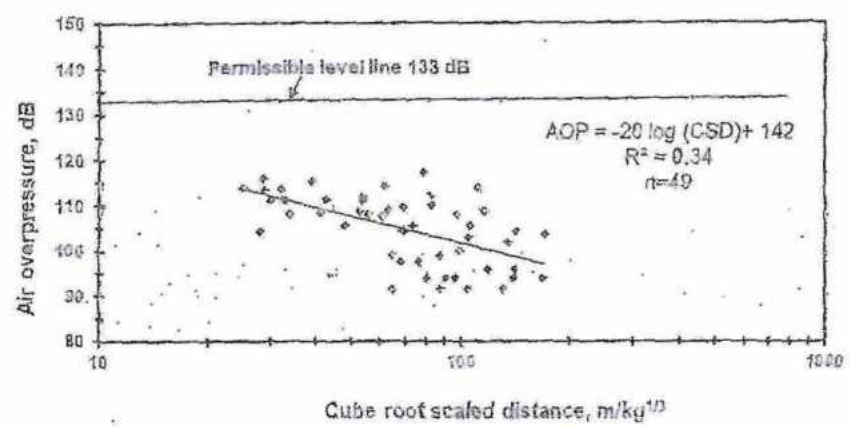


Figure 20 Plot showing air overpressure versus cube root scaled distance at Subbarayana.Halli Iron Ore Mines and Nandi Iron Ore mine

In general, the air overpressure is influenced by a number of factors like weather condition, topography of the area, direction of the wind etc. Unlike ground vibration, predictions of air overpressure do not follow a definite trend and it is common to have large scatter in the data sets. The site specific equation derived in case of air overpressure is an indicator rather than a predictive tool. It can be observed that the air overpressure levels have been far below the permissible limit of 133dB and the structures were safe with regard to air overpressure during entire field investigation.

5.4 Permissible Levels of Ground Vibration and Air overpressure

For the recorded frequency range (less than 8Hz), the permissible peak particle velocity as per the DGMS circular happens to be 2mm/s for the Objects of historical importance and sensitive structures (Kumaraswamy Temple) not belonging to the owner and for structures in the village is happen to be 10 mm/s. Similarly based on the US Bureau of Mines and IS code recommendations the permissible level of air overpressures 133dB.



5.5 Attenuation of ground vibration and site observations

In order to know the attenuation of ground vibration, the recorded peak particle velocity and distance were plotted (Figure 21). From this graph, a clear trend of attenuation of ground vibration was observed and it indicates that the ground vibration attenuates below 2mm/s at a distance of 330m from the blast for the used maximum charge per delay of 17.7 kg to 69.4 kg. The distances of the vibration monitoring stations from the blasting locations varied between 96 m and 964m. No vibration data was recorded by the seismographs which were placed beyond 590 m from the blast for which the triggering levels of the instruments were set at sensitive mode of 0.55 mm/s.

Blast videos reveled that no flyrock were observed beyond a distance of 100 m from the blast face in any of the twenty experimental trial blasts conducted during the field investigation. Figure 22 shows the few trial blast video screen shot.

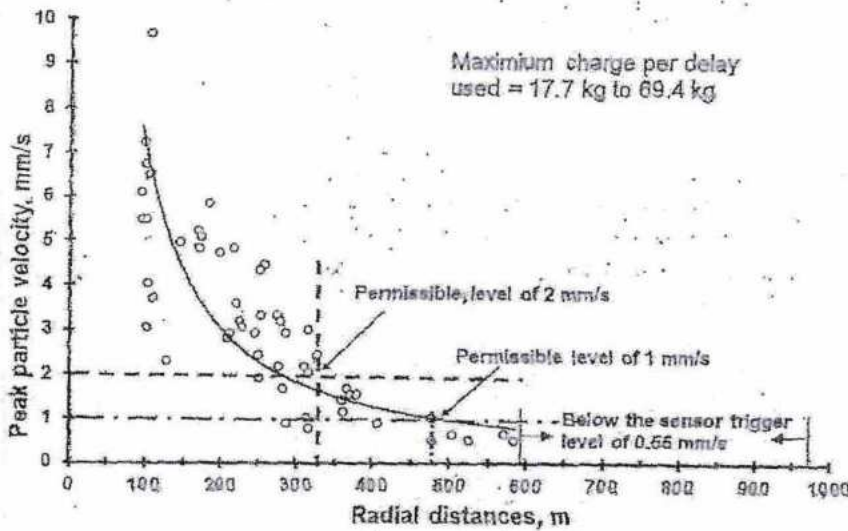


Figure 21 Peak particle velocity versus distance for blasts conducted at Subbarayana Halli Iron Ore Mines and Nandi Iron Ore mine

Based on the above full scale scientific experiment it can be concluded that blast vibrations have attenuated below 2 mm/s at a distance of 330 m and to below 1 mm/s beyond a distance of 500 m from the blast (for the MCD range of 17.7 kg to 69.4 kg).



59

Final report on 'To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hospet.
Project No.: RB 18 05C Submitted to: Department of Mines and Geology, Karnataka

The most conservative permissible limit of ground vibrations based on the DGMS standard is 2 mm/s for Kumaraswamy temple. Considering the above it can be established that blasting can be permitted at a distance of 500 m and beyond from the Kumaraswamy temple. For this distance of 500 m and a permissible limit of 2 mm/s the computed safe maximum charge per is 28.1 kg and the recommended safe maximum charge per delay is 18.0 kg.

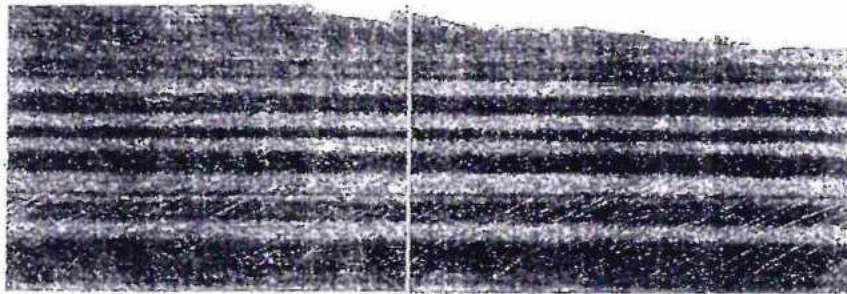


Figure 22 Screen shot photographs of trial blast video conducted during investigation period

5.6 Monitoring of ground vibration due to vehicle movement

There was a request from client to monitor ground vibration due to vehicle movement near Kumaraswamy temple (Reference letter dated DMG/MLS/ASI/2017-2018/8194 and meeting held on 07-01-2019 at Khanija Bhavan, Bangalore). NIRM recorded the vibration due to running of heavy vehicle that includes dumper carrying iron ore load, empty dumpers, civil buses and other light vehicles. Three seismographs were placed at 18 m, 80 m and 120 m (adjacent to temple) from the road to monitor the ground vibration due to vehicles movement. The seismograph were kept in continues monitoring mode for a period of one hour, the trigger level of seismographs set to the lowest of 0.51 mm/s and the recorded readings are less than 0.51 mm/s at the above three instrument locations. Figure 22 and 23 illustrate vibration monitoring due to vehicle movement at different locations.



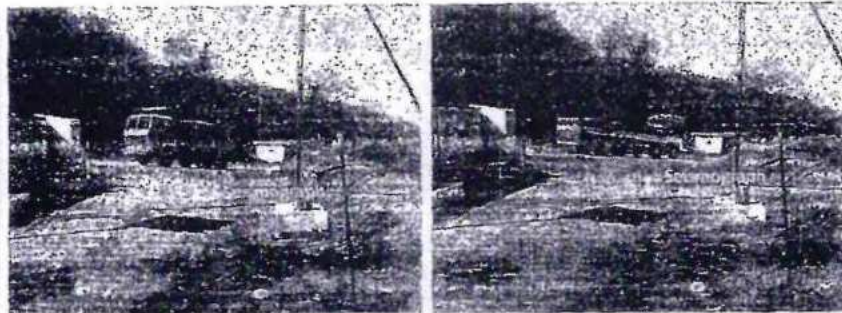


Figure 23 Vibration monitoring near to road

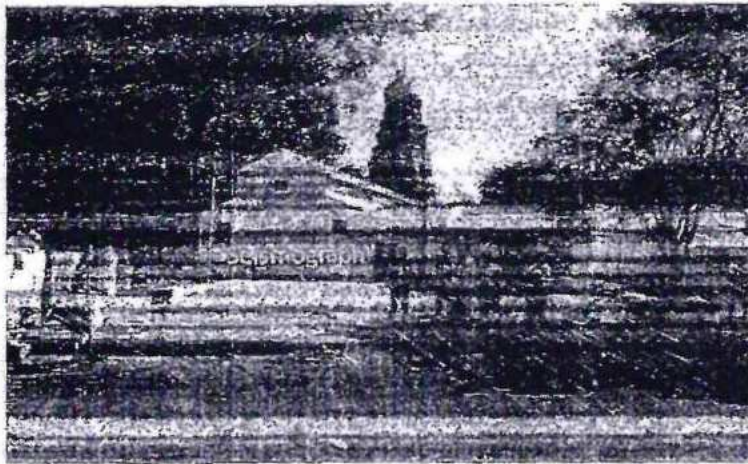


Figure 24 Vibration monitoring nearer to Kumaraswamy temple

5.7 Control of Ground Vibration

The most practical method of controlling ground vibration is to restrict the maximum charge per delay. This can be achieved by delay blasting which permits to divide the total charge into smaller charges. Substituting the permissible vibration level of ground vibration of 2mm/s for different distances in Equation-2, the safe maximum charge per delay for different distances is estimated and is presented in Table 6.

61

Table 6. Estimated safe maximum charge per delays for different distances to keep the vibration less than 2mm/s at 95% confidence level and the recommended maximum charge per delay with distance from the temple

Radial distance, m	Estimated Safe maximum charge per delay to keep the vibration less than 2mm/s at 95% confidence level, kg	Recommended safe maximum charge per delay to keep the vibration less than 2mm/s, kg
300	10.1	No blasting zone
350	13.7	
400	18.0	
499	27.9	
500-599	28.1	18.0
600-699	40.4	28.0
700-799	55.0	40.0
800-899	71.8	55.0
900-999	90.8	71.0
beyond 1000	112.2	90.0

As the villages are located beyond a distance of 1.9 km, the suggested maximum charge per delay (Table 6) shall control the ground vibration within permissible limit of 10 mm/s at the structures of these villages too.



6. 0 RECOMMENDED BLAST DESIGN PARAMETERS BASED ON BLASTING ZONES

Blast design parameters	Blasting zone (distance from the Kumaraswamy temple)		
	500-599 m	600-699 m	Beyond 700 m
Bench height, m	6-7.5	6-8	8-10
Hole diameter, mm	115/102	115/102	115/102
Depth of holes, m	6.5-8.0	6.5-8.5	8.5-10.5
Burden, m	2.0	2.0	2.0
Spacing, m	2.0	2.5	2.5
Number of holes	Maximum of 100	Maximum of 100	Maximum of 100
Number of rows	Maximum three	Maximum three	Maximum three
Drilling pattern	Staggered	Staggered	Staggered
Charge per hole, kg	18	18-28	28-40
Maximum charge per delay, kg	To restrict as per Table 6	To restrict as per Table 6	To restrict as per Table 6
Stemming material	Drill cutting / crushed 6mm down material	Drill cutting / crushed 6mm down material	Drill cutting / crushed 6mm down material
Stemming length, m	4.0 to 5.0	4.0 to 5.0	4.0 to 5.0
Initiation system	Shock tube (nonelectric delay detonator)	Shock tube (nonelectric delay detonator)	Shock tube (nonelectric delay detonator)
Specific charge kg/cum	0.6 to 0.8	0.6 to 0.8	0.6 to 0.8

7.0 CONCLUSIONS AND RECOMMENDATIONS

1. Studies were under taken at one of the abutting operating mine of Karnataka State Mineral Corporation (Subbarayana Halli Iron Ore Mines) which happens to be the adjacent mine of the target mine of MSPL (Karthikaya Iron Ore Mine) which is not in operation as of now and the other mine of JSW (Nandi Iron Ore Mine), which is one of the target mines as per the scope.
2. Blast vibration studies were carried out for the regular and routine blasts that are under taken for production of iron ore in their benches. In case of JSW mine, the mine authorities organised blasting only for the purpose of vibration monitoring as per request.
3. From the analysis of the data it can be observed that, from production blasting the frequency of vibration is 4.3 Hz to 19.7 Hz and considering DGMS standard, the most conservative permissible limit for "Objects of historical importance and sensitive structures" (Kumaraswamy Temple) not belonging to the owner happens to be 2mm/s.
4. Similarly based on the IS code (14881:2001) and USBM guidelines (USBM RI 8485), the permissible air overpressure level is 133dB.



5. From the study it can be observed that all blasts were conducted beyond 800m from the Kumaraswamy temple. The vibration from these blasts attenuated to below the permissible limit of 2mm/s at distance of 330m and beyond from the blast.
6. Considering this, it is concluded that blasts can be carried out safely in the mines beyond 500m from the Kumaraswamy temple complying to the permissible limit of 2mm/s.
7. Site specific predictor equation at 95% confidence level was arrived to estimate the safe maximum charge per delay for different distances. Keeping in view of Kumaraswamy temple, 100 m overlap was considered and recommended the safe maximum charge per delay to be followed for all the future blasts in Table 6.
8. Blast design for different blasting zone for the future excavation is suggested. Blasts with Detonating cord is not permitted.
9. Ground vibration due to vehicle movements were monitored and the readings are below 0.51 mm/s even at a close monitoring distance of 18m from the road.

ACKNOWLEDGEMENTS

We are thankful to the Director, Department of Mines and Geology, Govt. of Karnataka for awarding this work to us. We also thankful to the expert committee for recommending NIRM to carry out this study.

We are thankful to all the officers from various departments for their co-operation extended during the field investigation.

We are extremely thankful to the Director, NIRM for the technical guidance, valuable suggestions and permitting us to take up this study.

Last but not least we thank all those who involved directly or indirectly for successful completion of this study.

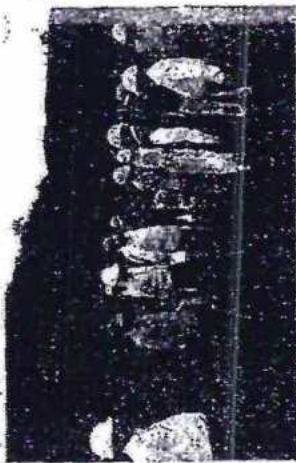
REFERENCES

1. ISEE, Blaster's Hand Book (1998)
2. Anon, (1997), "Damage of structures due to blast induced ground vibrations in the mining areas", DGMS (Tech)(S&T) Circular No. 7 of 1997 dated 29.08.1997
3. IS code 6922-1973
4. Siskind, D.E., et al, (1980), "Structure response and damage produced by air blast from surface mining", USBM RI 8485.
5. IS code 14881:2001
6. Bhandari.S.(1997), "Engineering rock blasting operations", A.A. Balkema, Netherlands, Pg.305



65

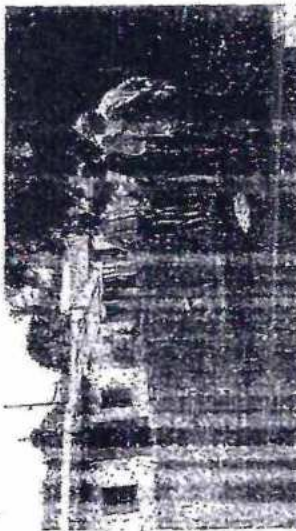
Final report on To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hospet,
Project No.: RB 13 05C
Submitted to: Department of Mines and Geology, Kamalake



Weighing of ANFO, DMS



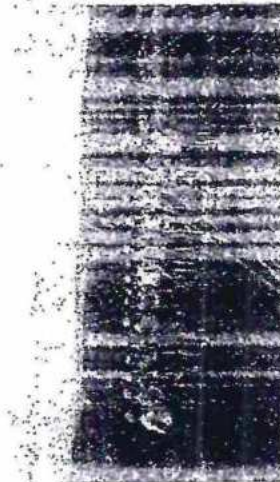
Monitoring within mine- Director NIRM,DDMS, DDMG & Geologist



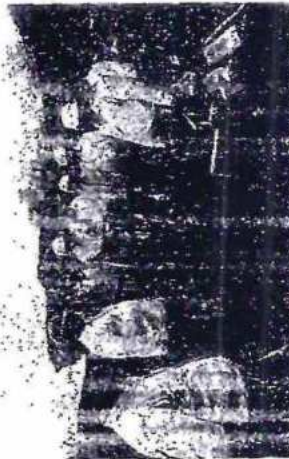
Monitoring Near Kumaraswamy Temple- Dy. Superintendent, AE & CA of ASI



Monitoring Near Kumaraswamy Temple- DGM, AE from ISM, DDMG, RFO & VP JSW



Dy. Superintendent, AE & CA of ASI, DCF, ACF, RFO, DDMG



DDMG, Press & Jans asangram Perchath

Photographs of officer present during the trial blast



Final report on 'To ascertain the feasibility of blasting for mining operations around Kumbhara village, Karnataka
 Project No: RB 18 050 Submitted to: Department of Mines and Geology, Karnataka

Instantel Blast Vibration Event Report

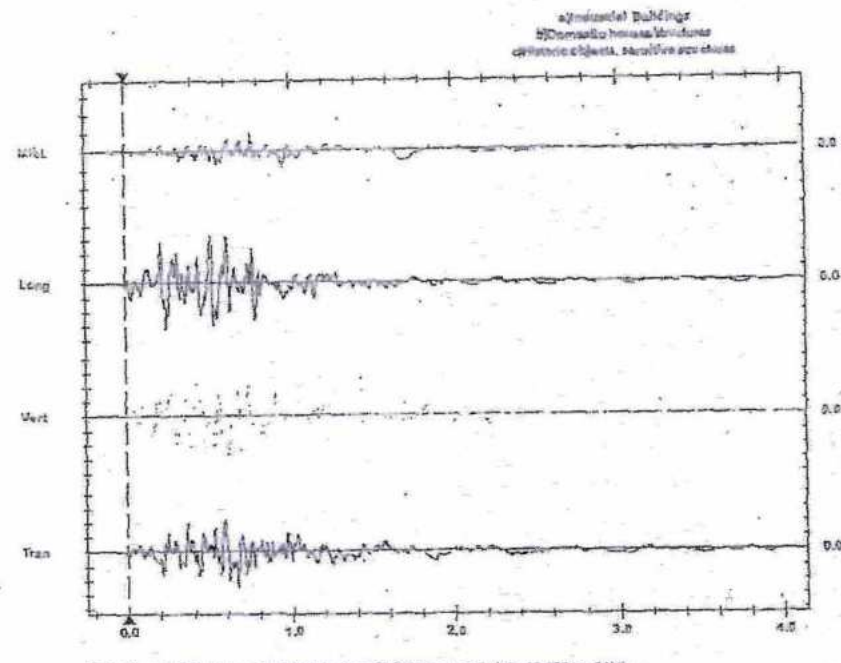
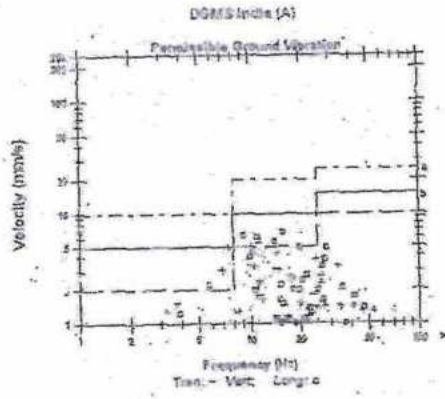
Date/Time Long at 19:21:10 August 30, 2013
 Trigger Source Dao: 0.000 mm/s
 Range Dao: 204.0 mm/s
 Record Time 4.0 sec at 2048 sps

Serial Number 989037 V 10.720.17 MiniRate Plus
 Battery Level 6.1 Volts
 Unit Calibration January 31, 2010 by USS, New Delhi
 File Name 1007190701.M40

Notes
 Location: Kumbhara village, Mysore
 Client: Dept of Mines and Geology, Karnataka
 User Name: RB & ES, 10/10
 General: Ground vibration study

Microphone Linear Weighting
 PzPL 113.9 dB(S) at 0.761 sec
 ZC Freq 20 Hz
 Channel Test Passed (Freq = 20.1 Hz Amp = 500 mv)

	Tran	Vert	Long	Unit
PPV	4.953	0.004	0.721	mm/s
ZC Freq	7.4	19.7	15.6	Hz
Time (Rel. to Trig)	0.004	0.000	0.010	sec
Peak Amplitude	0.000	0.100	0.100	g
Peak Displacement	0.000	0.101	0.001	mm
Sensor Check	Passed	Passed	Passed	



Printed: October 28, 2013 [V 10.24] Format: 1000000 Instek Corporation

BT

Final report on To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hospet,
 Project No.: RB 18 050 Submitted to: Department of Mines and Geology, Karnataka



Blast Vibration Event Report

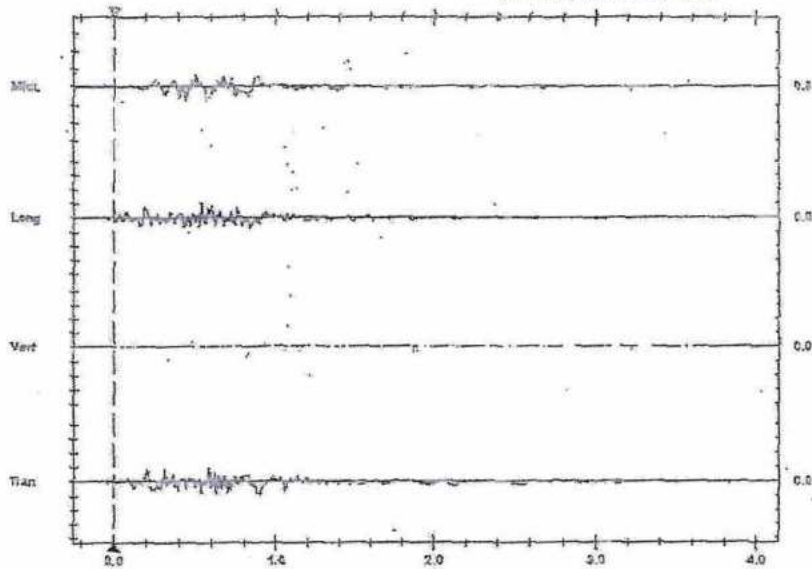
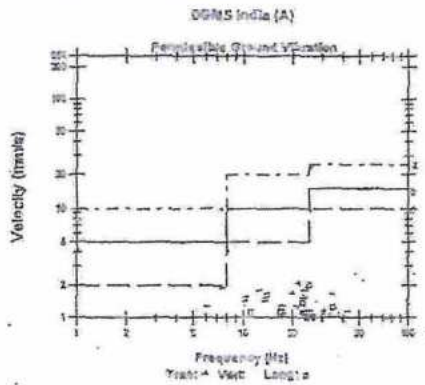
Date/Time Long at 15:37:15 August 20, 2018
 Trigger Source Geor 2.000 mm/s
 Range Geor 254.0 mm/s
 Record Time 4.0 sec at 2048 sps

Serial Number 888037 V 10 73-8.17 Mic/Mate Plus
 Battery Level 8.1 Volts
 Unit Calibration January 31, 2018 by UES, New Delhi
 File Name K0371808V000

Miles
 Location Kumaraswamy Temple, Hospet
 Client Dept of Mines and Geology, Karnataka
 User Name RB 18 050, NIRM
 Contact Geomac vibration study

Microphone Linear Weighting
 PSPL 111.2 dB @ 1.0 sec
 ZC Freq 10.4 Hz
 Channel Test Passed (Fmax = 20.1 Hz Amp = 635 mV)

	Tran	Vert	Long	
PPV	2.002	2.005	2.032	mm/s
ZC Freq	22	11.1	25	Hz
Time (Ref. to Trig)	0.003	0.004	0.002	sec
Peak Acceleration	0.005	0.005	0.010	g
Peak Displacement	0.007	0.006	0.021	mm
Sensor Check	Passed	Passed	Passed	



Printed: October 28, 2018 (V 18.2)

Formal © 1995-2018 Geomac Corporation



Final report on To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hoopel,
 Project No.: RB 16 09C Submitted to: Department of Mines and Geology, Karnataka



Blast Vibration - Event Report

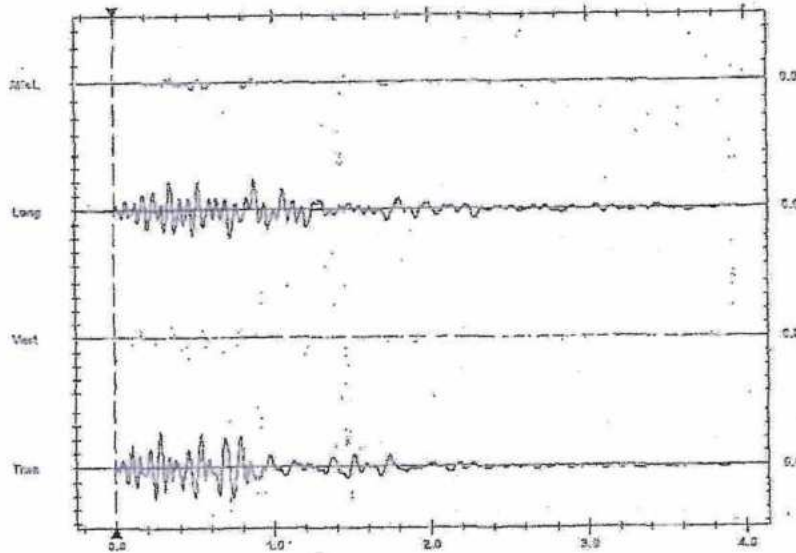
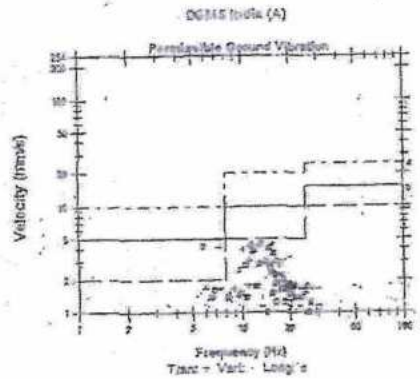
Date/Time: Wed 14:11:58 August 31, 2018
 Trigger Source: Gen 0.000 mm/s
 Range: Gen: 20.0 mm/s
 Record Time: 4.0 sec at 2048 sps

Serial Number: 688037 V 10.720.17 MiniScale Plus,
 Battery Level: 6.1 Volts
 Unit Calibration: January 21, 2018 by USG, New Delhi
 File Name: MS3790001.BVD

Notes:
 Location: Kumaraswamy Temple, Hoopel
 Client: Dept of Mines and Geology, Karnataka
 User Name: BS S.E. NIPGT
 Geokit: Geokit v8.6.6.0 study

Microphone: Linear Weighting
 FSPL: 106.5 dB(1) at 0.493 sec
 ZC Freq: 5.0 Hz
 Channel Test: Passed (Tag = 10.7 Hz Amp = 499 mV)

	Tran	Vert	Long	units
PPV	5.060	2.921	3.310	mm/s
ZC Freq	15.3	16.0	6.8	Hz
Time (Rel. to Trig)	0.285	0.428	0.389	sec
Peak Amplitude	0.060	0.060	0.060	g
Peak Displacement	0.008	0.007	0.008	mm
Sensor Check	Passed	Passed	Passed	



Time Scale: 0.20 sec/div Amplitude Scale: Gen: 2.000 mm/s/Div Min: 10.000 ps (1/div)

Printed: October 23, 2018 (V1427)

Formed © 1999-2015 Sierra Corporation



69

Final report on 'To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hospet,
 Project No.: RB.16.05C Submitted to: Department of Mines and Geology, Karnataka



Blast Vibration Event Report

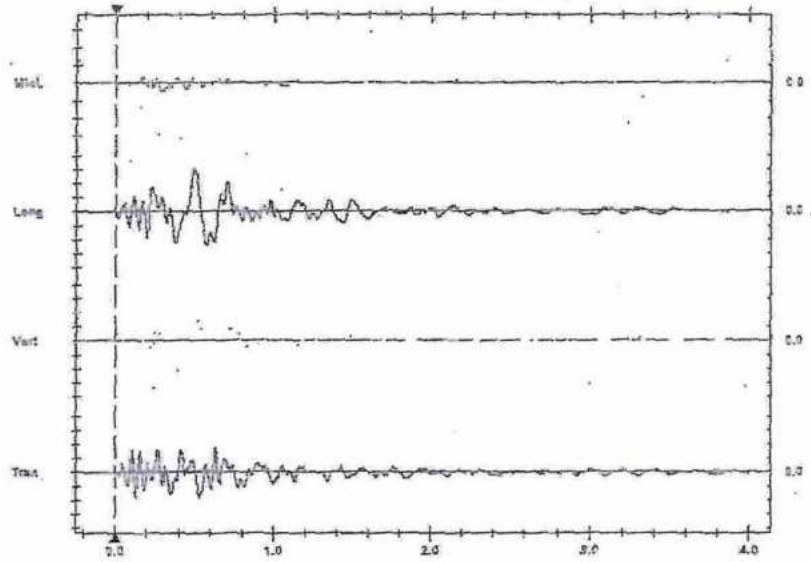
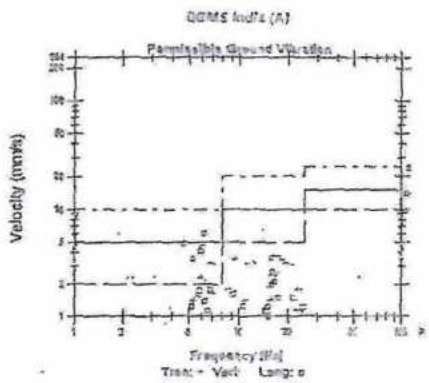
Date/Time: Sat at 14:12:08 August 21, 2016
 Trigger Source: Dist: 0.300 mms
 Range: Dist: 254.0 mms
 Record Time: -0.5 sec at 2048 sps

Serial Number: 888027 V 10,728,17 MiniMag Plus
 Battery Level: 9.1 Volts
 Unit Calibration: January 21, 2015 by UES, New Calif
 File Name: 1037909M.500

Notes:
 Location: Kumaraswamy temple, Hospet
 Client: Dept of Mines and Geology, Karnataka
 User Name: RB & EG, MPM
 Dataset: Ground vibration study

Microphone: Linear Weighting
 PSPC: 126.0 dB at 0.100 sec
 3C Frag: 5.1 Hz
 Channel Test: Passed (Freq = 10.7 Hz Amp = 500 mV)

	Time	Virt	Long	mm/s
PPV	3.682	0.063	0.090	
3C Freq	17.1	6.0	6.3	Hz
Time (Rel. to Trig)	0.023	0.000	0.404	sec
Peak Acceleration	0.002	0.005	0.020	g
Peak Displacement	0.001	0.110	0.170	mm
Sensor Check	Passed	Passed	Passed	



Time Scale: 0.20 sec/div Amplitude Scale: Dist: 2.000 mm/div Virt: 10.000 psd/div

Printer: Colson B. 2/15 (1/13) Filed: © 1997-2015 Imtek Corporation



Final report on "To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hospet, Submitted to: Department of Mines and Geology, Karnataka Project No.: RB 18 03C



Blast Vibration Event Report

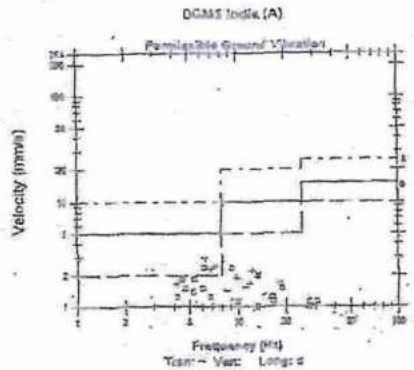
Date/Time: Sat, 14:17:44 September 1, 2018
 Trigger Source: Dist: 0.200 mm/s
 Range: Dist: 251.0 mm/s
 Record Time: 4.0 sec at 2048 SPS

Serial Number: 859056 V 10.72 2.17 Wireless Plus
 Battery Level: 6.3 Volt
 Unit Calibration: January 21, 2018 by VES, New Delhi
 File Name: K18RB18L180

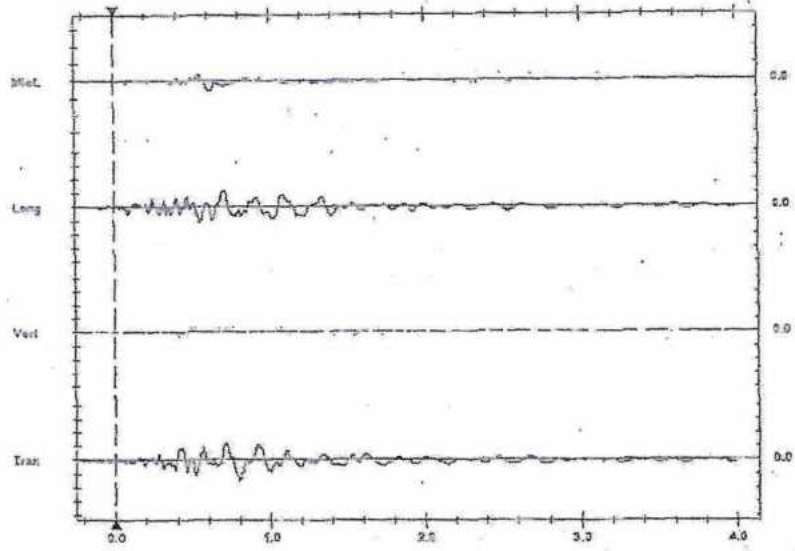
Notes:
 Location: Kumaraswamy Temple, Hospet
 Client: Dept. of Mines and Geology, Karnataka
 User Name: RB & BE, NRIU
 General: Ground vibration study

Microphone: Linear Weighting
 F.S.P.L: 108.8 dB @ 2.525 sec
 ZC Freq: 2.5 Hz
 Channel Test: Passed (Frag = 20.1 Hz Amp = 215 mv)

	East	West	Long	units
PPV	2.021	1.779	2.119	mm/s
ZC Freq	6.2	6.1	6.2	Hz
Time (Rel. to Trig)	0.780	1.082	0.886	sec
Peak Acceleration	0.027	0.023	0.023	g
Peak Displacement	0.071	0.034	0.031	mm
Sensor Check	Passed	Passed	Passed	



Industrial Buildings
 Domestic houses/structure
 Sensitive objects, sensitive structures



Time Scale: 0.20 sec/div Amplitude Scale: Dist: 2.000 mm/s/div MIC: 10.000 ps.5/1hr

Printed: October 23, 2018 (v 1.0.1)

Format: 1995-09-01:2008:2008



Final report on "To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hospet,
 Project No: RB 16,05C Submitted to: Department of Mines and Geology, Karnataka



Blast Vibration Event Report

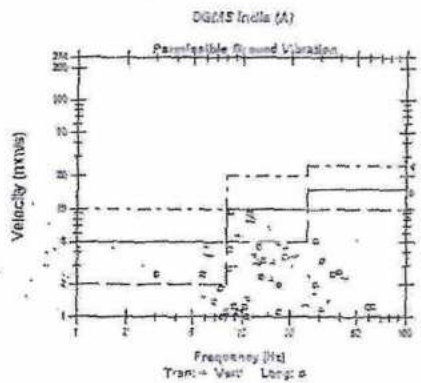
Date/Time: Wed: 14:10:43 September 4, 2018
 Trigger Source: Geol: 5.560 mm/s
 Range: Geol: 284.0 mm/s
 Record Time: 4.0 sec at 20.48 sps

Serial Number: ESE007 V 10.75-8.17 MiniMata Plus
 Battery Level: 5.1 Volts
 Orig. Calibration: January 31, 2018 by IBSR, New Delhi
 File Name: K0370624.D72

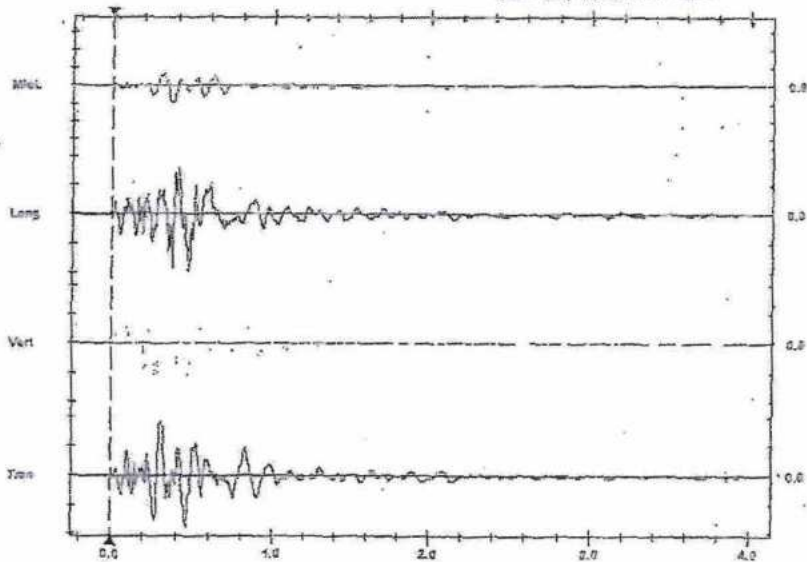
Notes:
 Location: Kumaraswamy temple, Hospet
 Client: Dept of Mines and Geology, Karnataka
 User Name: RS & EE, NIRM
 General: Blast vibration study

Microphones: Linear Weighting
 PZP: 113.5 dB(A) at 0.362 sec
 ZC Freq: 8.2 Hz
 Channel Test: Passed (Pass = 20.1 Hz Amp = 490 mv)

	Trans	Vert	Long	units
PPV	5.328	0.204	9.052	mm/s
ZC Freq	11.5	10.9	8.0	Hz
Time (Ref. to Trig)	0.308	0.272	0.470	sec
Peak Acceleration	0.100	0.100	0.150	g
Peak Displacement	0.150	0.025	0.120	mm
Tension Check	Passed	Passed	Passed	



Structural Buildings
 Vibration sensitive structures
 Sensitive objects, sensitive structures



Time Scale: 0.20 sec/div Amplitude Scale: Div: 5.000 mm/s/div Min: 10.000 ps (LVL)

Model: orbherst_2018 (V 10.7)

Format: 1000-0111 10min, Corporation



Final report on To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hosur,
 Project No.: RB 18 05C Submitted to: Department of Mines and Geology, Karnataka



Blast Vibration Event Report

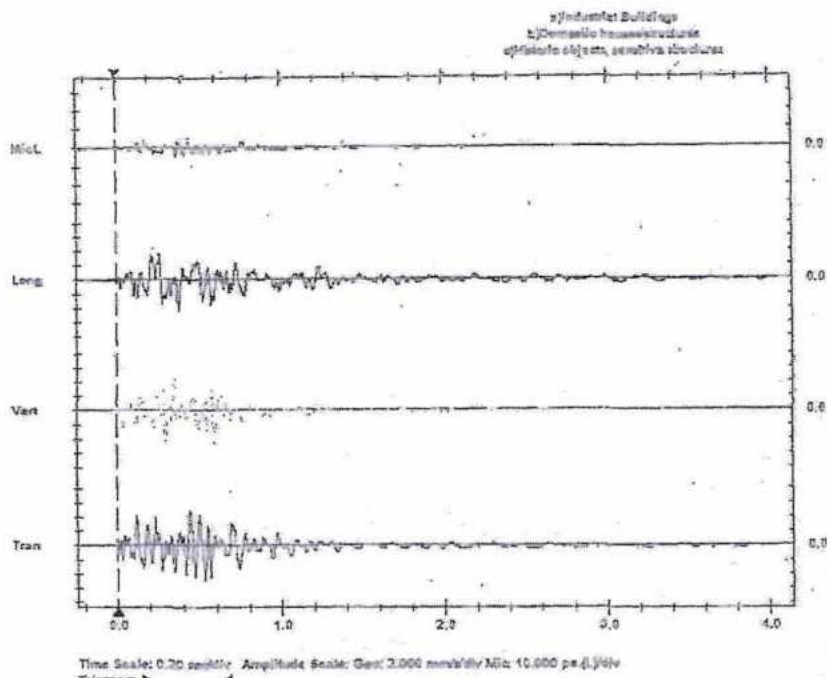
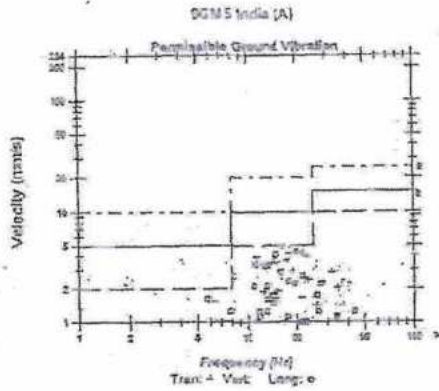
Date/Time: VERT 11:00:41 September 4, 2018
 Trigger Source: Geo: 0.000 mm/s
 Range: Geo: 251.0 mm/s
 Record Time: 4.0 sec of 2048 sps

Serial Number: 858007 V 10.726.17 MiniVibes Plus
 Battery Level: 6.1 Volts
 Unit Calibration: January 31, 2018 by URS, New Delhi
 File Name: 102079070.C00

Notes:
 Location: Kumaraswamy Temple, Hosur
 Client: Dept of Mines and Geology, Karnataka
 User Name: PS S. SE, HIRAC
 Details: Ground vibration study

Microphone: Linear Weighing
 PSPL: 109.5 dB(A) at 0.448 sec
 ZC Freq: 17.7 Hz
 Channel Test: Passed (Freq = 20.5 Hz, Amp = 470 mV)

	Trans	Vert	Long	
PMV	4.826	4.805	4.181	mm/s
ZC Freq	15.0	24	14.5	Hz
Time (Pct. to Trig)	0.442	0.246	0.351	sec
Peak Acceleration	0.080	0.100	0.080	g
Peak Displacement	0.080	0.042	0.080	mm
Sensor Check:	Passed	Passed	Passed	



Probe: Octave 25.393 (V18.74)

Format: 1005-0111 Rock Corporation



78

Final report on 'To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hospet,
Project No: RB 16 05C Submitted for Department of Mines and Geology, Karnataka



Blast Vibration Event Report

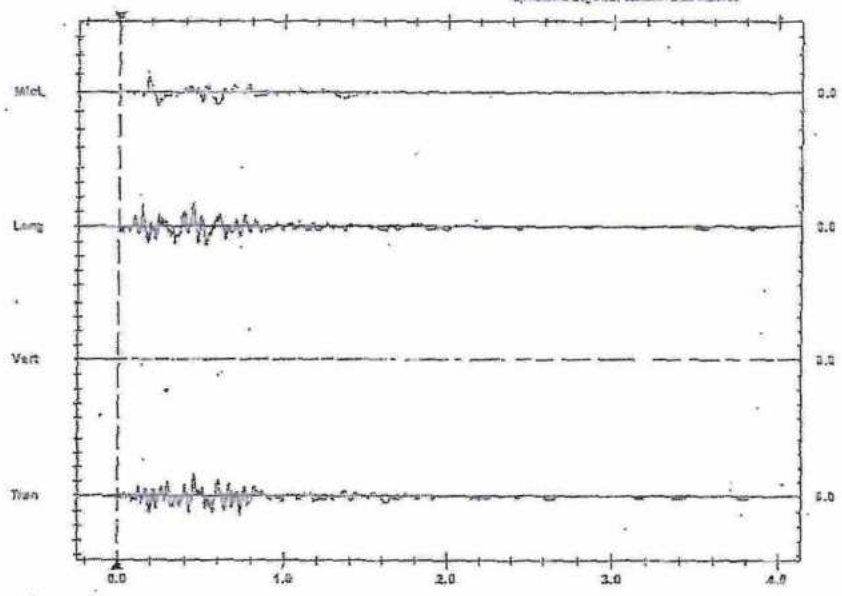
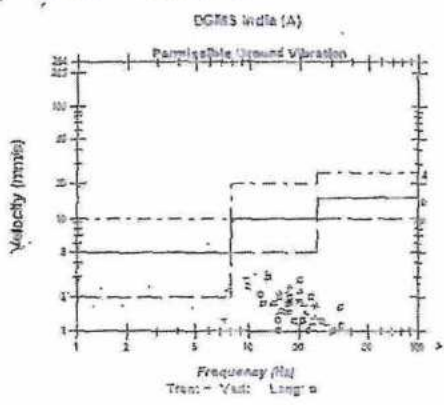
Date/Time Long at 14:27:28 September 5, 2018
Trigger Source Gen: 0.000 mm/s
Range Gen: 204.0 mm/s
Record Time: 4.0 sec at 2048 sps

Serial Number BSB007 V 10.72-8.17 MiniMata Plus
Battery Level 6.1 Volts
Unit Calibration January 31, 2018 by UES, New Delhi
File Name RB1605C04.B00

Notes
Location: Kumaraswamy Temple, Hospet
Client: Dept of Mines and Geology, Karnataka
User Name: RS 623, NIRM
Service: Ground vibration study

Microphone Linear Weighting
P&P: 115.2 dB(L) at 0.178 sec
ZC Freq: 11.1 Hz
Channel Test Passed (Freq = 20.1 Hz, Amp = 515 mv)

	Trans	Vert	Long	mm/s
PPV	2.921	2.007	3.048	
ZC Freq	9.5	10.3	13.1	Hz
Time (Rel. to ZC)	0.450	0.483	0.450	sec
Peak Acceleration	0.005	0.003	0.003	g
Peak Displacement	0.007	0.005	0.003	mm
Sensor Check	Passed	Passed	Passed	



Product: October 24, 2010 (v 10.72) Serial: 2 100-010-0001-000000



74

Final report on 'To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hospet,
Project No: RG 18 05C Submitted to Department of Mines and Geology, Karnataka



Blast Vibration Event Report

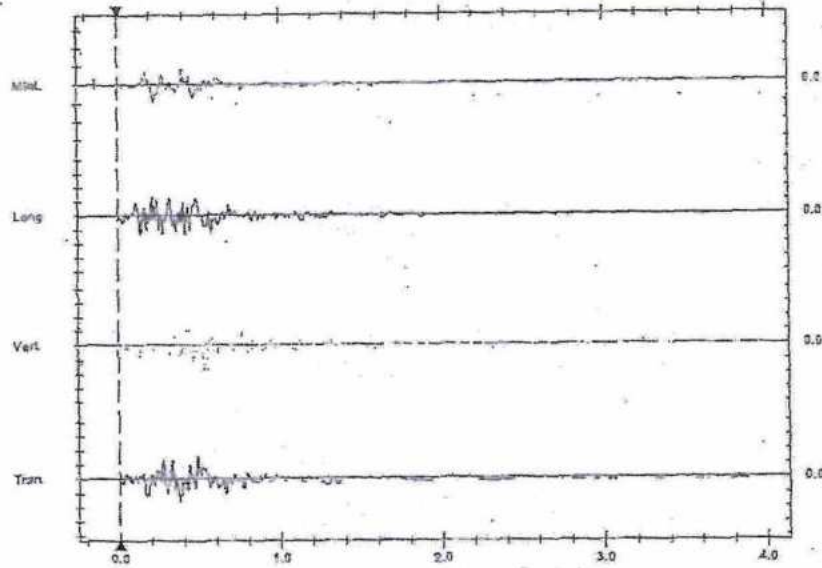
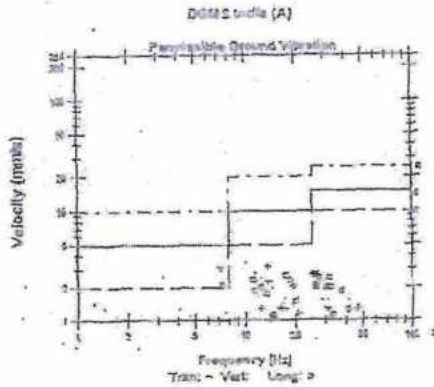
Date/Time: Tue at 14:26:19 September 8, 2016
Trigger Source: Geo: 0.050 mm/s
Range: Geo: 254.0 mm/s
Record Time: 4.0 sec at 2048 sps

Serial Number: SE8037 V 10.72 B.17 MiniMain Plus
Battery Level: 6.1 Volts
Unit Calibration: January 31, 2016 by USE, New Delhi
File Name: RG27910W.770

Notes:
Location: Kumaraswamy temple, Hospet
Client: Dept of Mines and Geology, Karnataka
User Name: NS S S, NRRM
General: General vibration study

Microphone: Linear Weighting
PSPL: 113.3 dB(L) at 0.225 sec
ZC Freq: 7.5 Hz
Channel Test: Passed (Freq = 20.1 Hz, Amp = 515 mv)

	Trans	Vert	Long	Units
PPV	3.175	3.880	3.087	mm/s
ZC Freq	13.7	5.8	17.4	Hz
Time (Rel. to Trig)	0.375	0.258	0.140	sec
Peak Acceleration	0.082	0.083	0.080	g
Peak Displacement	0.009	0.008	0.008	mm
Sensor Check:	Passed	Passed	Passed	



Profile: October 25, 2016 (v 9.74)

Formal © 1990-2015 IMV Corporation



75

Final report on To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hoopet,
 Project No: RB 18 05C Submitted to Department of Mines and Geology, Karnataka



Blast Vibration Event Report

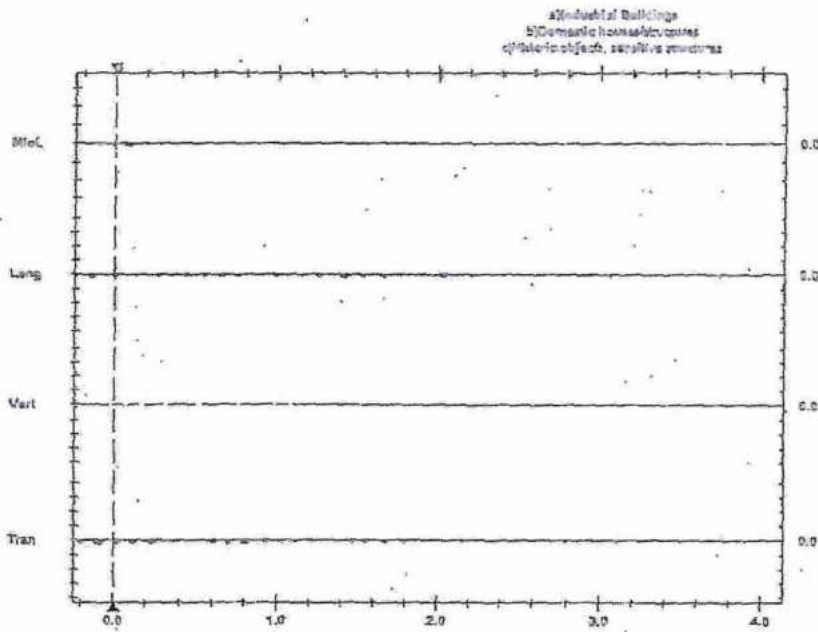
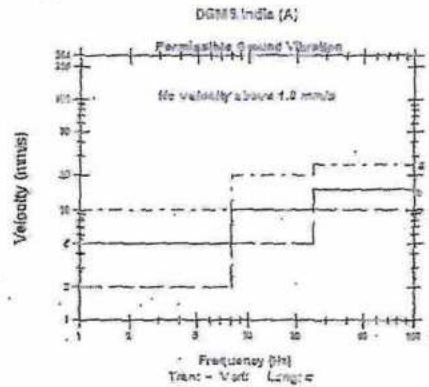
Date/Time: Tran at 14:27:20 September 5, 2018
 Trigger Source: Geo: 0.553 mm/s
 Range: Geo: 254.0 mm/s
 Record Time: 4.2 sec at 2048 sps

Serial Number: BSB038 V 10.72 8.17 MiniMote Plus
 Battery Level: 5.3 Volts
 Unit Calibration: January 21, 2013 by UES, New Delhi
 File Name: M066KBDQ.THO

Notes:
 Location: Kumaraswamy temple, Hoopet
 Client: Dept of Mines and Geology, Karnataka
 User Name: SP & SE, MPM
 Demand: Ground vibration study

Microphone: Linear Weighting
 PzPL: 55.0 dB(1) at 0.05 sec
 ZC Freq: 7.5 Hz
 Channel Test: Passed (Freq = 20.1 Hz, Amp = 536 mv)

	Tran	Vert	Long	mm/s
PPV	0.008	0.551	0.001	
ZC Freq	11.6	47	12.3	Hz
Time (Ref. to Trig)	0.000	0.000	-0.150	sec
Peak Acceleration	0.027	0.002	0.000	g
Peak Displacement	0.000	0.000	0.000	mm
Sensor Check	Passed	Passed	Passed	



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2.000 mm/s (Min 10 000 ps/n, 7.5V)

Perfor: October 28, 2018 (V 10.14)

Perfor: 2018-09-05, 14:27:20



76

Final report on "To ascertain the feasibility of blasting for mining operations around Kumarakavay Temple, Hospet,
 Project No: RB 18 DGG Submitted to: Department of Mines and Geology, Karnataka



Blast Vibration Event Report

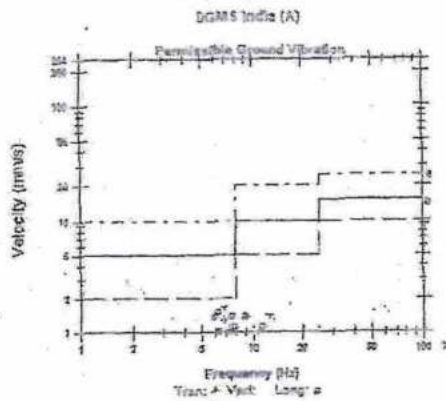
Date/Time: Tran at 14:03:20 September 7, 2018
 Trigger Source: Geo: 0.500 mm/s
 Range: Geo: 2048 mm/s
 Record Time: 4.0 sec at 2048 sps

Serial Number: 882037 v 10.734.17 MiniMote Plus
 Battery Level: 6.1 Volts
 Unit Calibration: January 31, 2018 by UES, New Delhi
 File Name: 10217100MC5E0

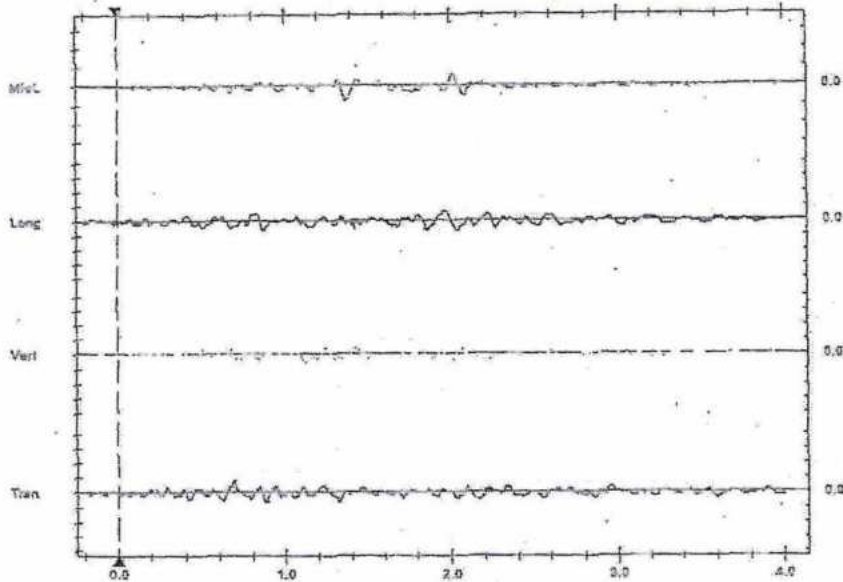
Notes:
 Location: Kumarakavay Temple, Hospet
 Client: Dept of Mines and Geology, Karnataka
 User Name: RS & SE, NIRM
 Demand: Ground vibration study

Microphone: Linear Weighting
 P SPL: 112.3 dB@1 at 1.371 sec
 ZC Freq: 7.1 Hz
 Channel Test: Passed (Frac = 20.1 Hz, Amp = 521 mV)

	Tran	Vert	Long	
PPV	1.651	1.270	1.624	mm/s
ZC Freq	6.8	12.5	6.9	Hz
Time (Rel. to Trig)	0.997	1.119	2.035	sec
Peak Acceleration	0.003	0.003	0.003	g
Peak Displacement	0.029	0.028	0.030	mm
Sensor Check	Passed	Passed	Passed	



a) Instanbel Building
 b) Domestic houses/structures
 c) Sensitive objects, sensitive structures



Time Scale: 0.20 sec/div Amplitude Scale: Gear 2000 mm/s/div Mic: 10.000 ps/0.1div

Printed: October 23, 2018 11:47:17 AM

Format: © 1999-2018 Ikonix Corporation



79

Final report on To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hoopet,
 Project No: RB 18 05C Submitted to: Department of Mines and Geology, Karnataka



Elast Vibration Event Report

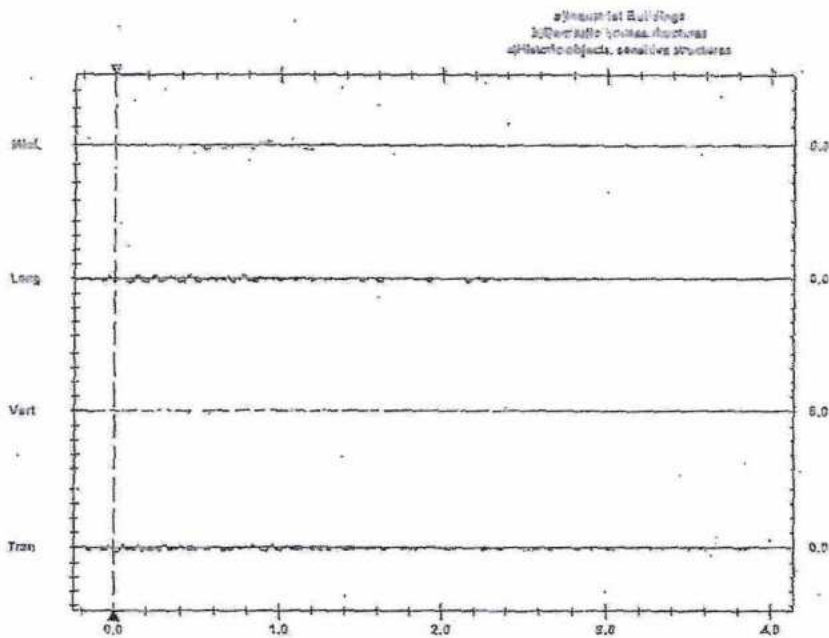
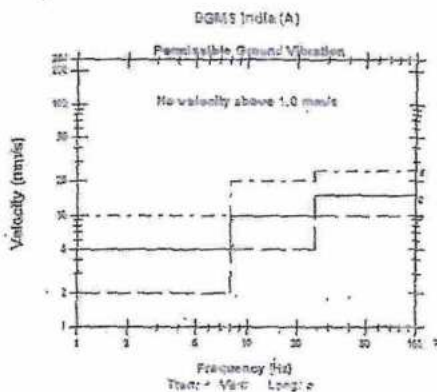
Date/Time: Tran at 14:04:46 September 7, 2018
 Trigger Source: Geo: 0.500 mm/s
 Range: Geo: 204.0 mm/s
 Record Time: 4.0 sec at 2048 sps

Serial Number: 889038 V 10.73-9.17 MiniMata Plus
 Battery Level: 6.2 V/10
 Unit Calibration: January 31, 2018 by UES, New Delhi
 File Name: 00389038.D

Notes:
 Location: Kumaraswamy temple, Hoopet
 Client: Dept of Mines and Geology, Karnataka
 User Name: RE & EE, M&G
 General: Ground vibration study

Microphone: Linear Weighting
 FBP: 101.2 dB at 0.630 sec
 ZC Freq: 8.5 Hz
 Channel Test: Passed (Freq = 20.1 Hz Amp = 012 mV)

	Tran	Vert	Long	
PPV	0.006	0.006	0.006	mm/s
ZC Freq	10.0	10.7	10.1	Hz
Time (rel. to sig)	0.010	0.003	0.003	sec
Peak Acceleration	0.001	0.007	0.002	g
Peak Displacement	0.011	0.006	0.006	mm
Sensor Check	Passed	Passed	Passed	



Time Scale: 0.20 sec/div Amplitude Scale: Geo: 2.000 mm/s/div Mic: 10.000 ps/div

Instantel Software 2018 (V10.33)

Formal © 1985-2018 Peak Corporation



Final report on "To ascertain the feasibility of blasting for mining operations around Kumaraswamy Temple, Hospet, Submitted to: Department of Mines and Geology, Karnataka Project No.: RB 18 05C



Blast Vibration Event Report

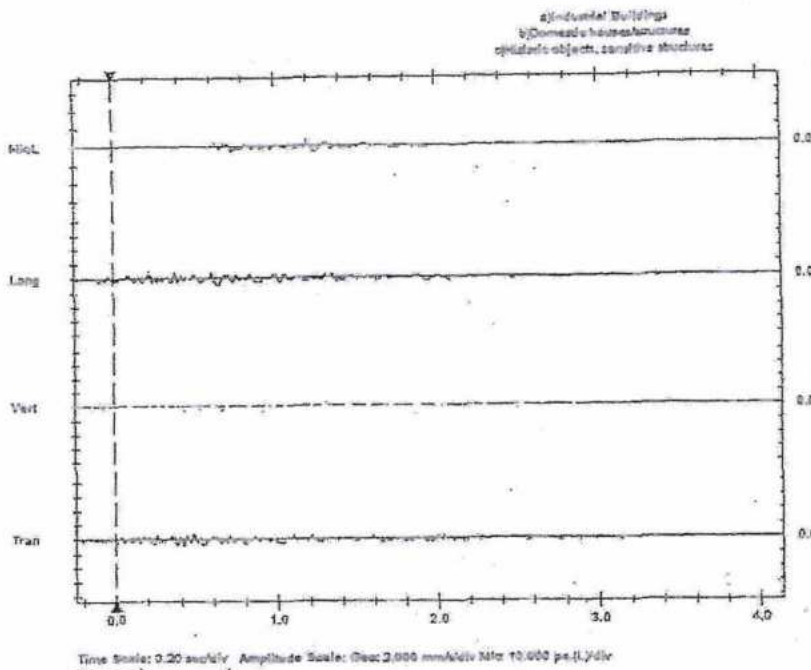
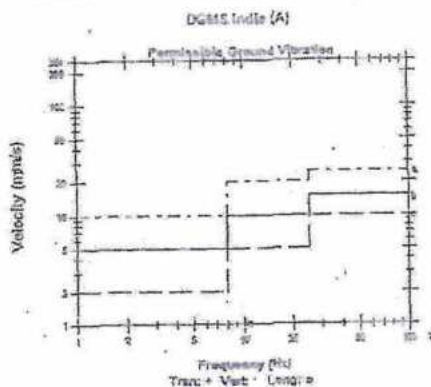
Date/Time: Trial at 14:42:28 September 2, 2012
 Trigger Source: Chk: 0.550 mm/s
 Range: Gsc: 254.0 mm/s
 Record Time: 4.0 sec at 2048 cps

Serial Number: SE0087 V 10.734.17 MiniMata Plus
 Battery Level: 6.0 Volts
 Unit Calibration: January 31, 2012 by UES, New Delhi
 File Name: R0379040.VXD

Notes:
 Location: Kumaraswamy Temple, Hospet
 Client: Dept of Mines and Geology, Karnataka
 User Name: RB & SE, NIRM
 General: Sound vibration study

Microphone: Linear Weighting
 PSP: 104.248[.] at 1.241 sec
 ZC Freq: 9.0 Hz
 Channel Test: Passed (Freq = 20.1 Hz; Amp = 003 mv)

	Tran	Vert	Long	mm/s
PPV	0.009	0.005	1.016	
ZC Freq	10.0	24	10.8	Hz
Time (Ref. to Trig)	0.204	0.204	0.204	sec
Peak Acceleration	0.263	0.060	0.062	g
Peak Displacement	0.012	0.005	0.014	mm
Sensor Check	Passed	Passed	Passed	



Version: October 23, 2012 (V 12.7)

Forum: © 1995-2012 Instantel Corporation



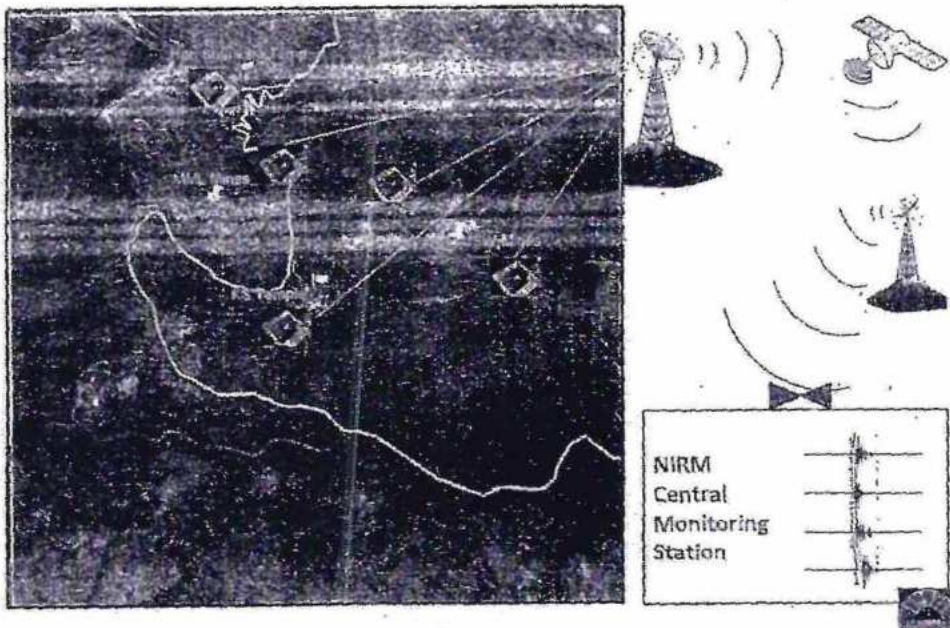
79



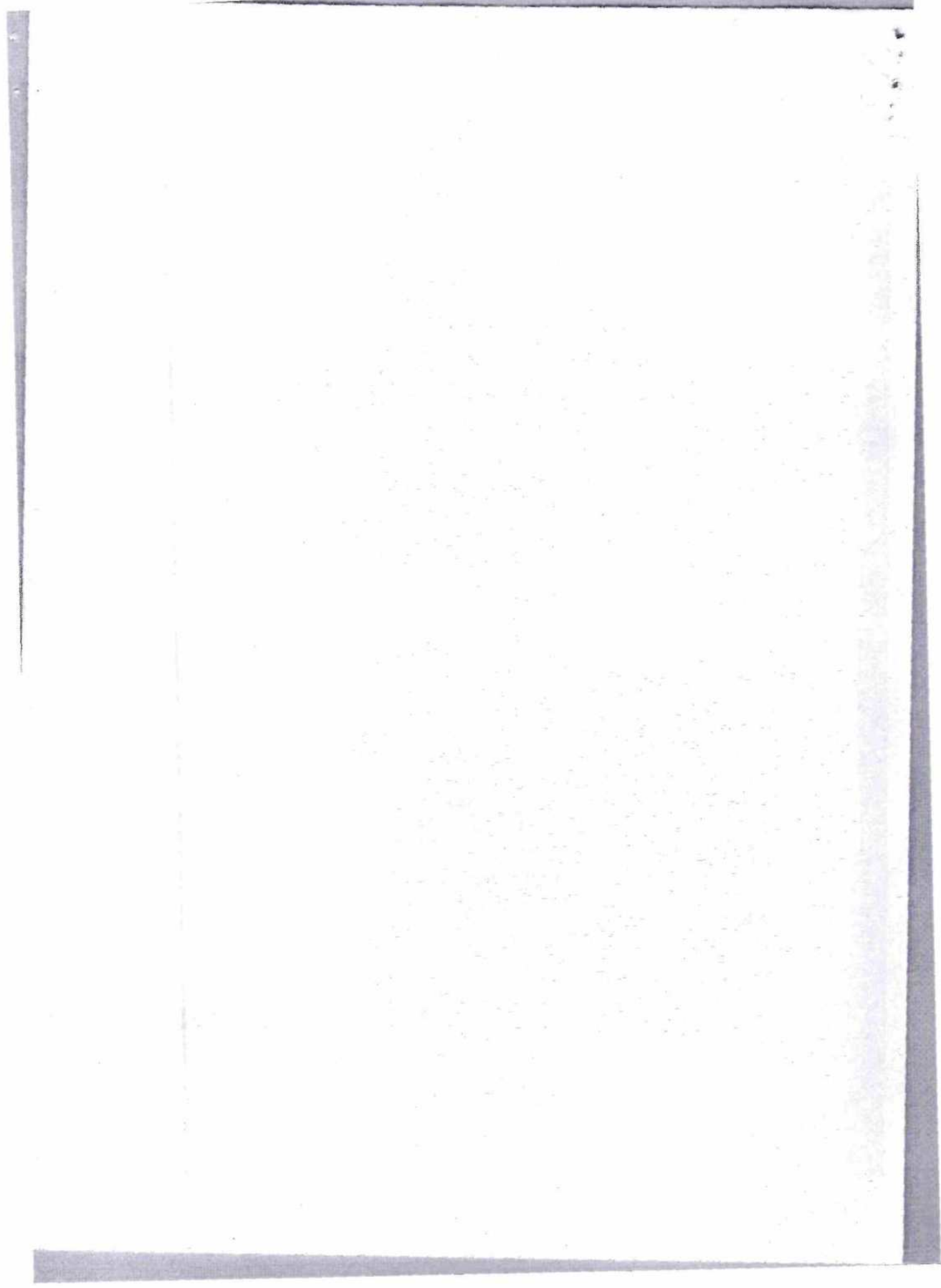
National Institute of Rock Mechanics Expertise in Rock Blasting

The Rock Blasting & Excavation Engineering Department (RB & EE) of NIRM has an experienced team of Scientists and is equipped with latest instruments. This department has seismographs, VOD measuring systems, laser based survey systems, fragmentation assessment system, vibration analysis system (Signature hole), state-of-the art software for blast design and digital video camera. The department has been providing innovative solutions to challenging problems in blasting for various mining, hydroelectric and civil engineering projects for more than two decades. Apart from providing solutions to conventional blasting problems, NIRM has been providing customized solutions to Metro rail projects, controlled blasting problems, graded material requirements (Rip rap / Armour rock / aggregate), pre-splitting for high wall stability, underground caverns (power houses / crude & gas storages), integrating blasting and other excavation techniques etc. The department is carrying out the preparation of blasting related pre-construction reports, method statement, proof checking etc. The department has been organizing customized training programs and workshops to officers of various organization. The Rock Blasting & Excavation Engineering department has provided technical solutions in more than 180 projects (Sponsored and S&T), published over 130 technical papers and extended their services to more than 90 clients.

NIRM Proposed continues monitoring station for open cast blast



Web: www.nirm.in, email: rbeenirm@gmail.com



80



भारत सरकार/Govt. of India
श्रम एवं रोजगार मंत्रालय
Ministry of Labour & Employment
खान सुरक्षा महानिदेशालय
Directorate General of Mines Safety
बल्लारी क्षेत्र/Ballari Region



31, Infantry Road, Cantonment, Ballari-592 104, Karnataka,
Tel.No.08392-240614, Fax No.08392-240664, Email: domsballari@gmail.com

No.BLR/Genl-55/2019/510

Ballari, Dated the 26/3/2019

प्रेषक/From

खान सुरक्षा निदेशक / Director of Mines Safety,
बल्लारी क्षेत्र, बल्लारी / Ballari Region, Ballari.

सेवा में/To

The Director of Mines & Geology,
Department of Mines & Geology,
Govt. of Karnataka, Khanij Bhavan,
Race Course Road, Bengaluru-5.

विषय / Sub: Proceedings of the State Level Empowered Committee meeting held on
02.03.2019- Final report submitted by NIRM related to study on the impact of
mining on the historically protected Sri Kumaraswamy Temple-regarding.

महोदय / Dear Sir,

Please refer to your letter vide No. DMG/MLS/AST/2018-19/9426, dated 13.03.2019 on the
above subject enclosing a copy of the proceedings of the State Level Empowered Committee held on
02.03.2019 and final report submitted by NIRM related to study on the impact of mining on the
historically protected Sri Kumaraswamy Temple.

As desired, this is to inform you that the study report submitted by NIRM enclosed with the
proceedings on the subject and the recommendations made by the NIRM to allow the blasting
operations based on the site specific conditions appear to be in order and in line with provisions of
Metaliferous Mines Regulations, 1961 read with the DGMS Technical Circular No.7 of 1997.

However, no blasting shall be conducted within a horizontal distance of 500m from the
historically protected Sri Kumaraswamy Temple and all the blasts shall be monitored to ensure the
PPV to be below 2mm/sec as per DGMS Technical Circular No. 7 of 1997. A record of every blast
shall be maintained with in bound paged register.

No additional comments are made in this regard.

भवती य / Yours faithfully,
Sd/-

(मनीष मुरकुटे / Manish Murkute)
खान सुरक्षा निदेशक / Director of Mines Safety,
बल्लारी क्षेत्र, बल्लारी / Ballari Region, Ballari.

Ballari, Dated the 26/3/2019

No.BLR/Genl-55/2019/511

Copy for information to the Dy. Director General of Mines Safety, Southern Zone, Bengaluru.

खान सुरक्षा निदेशक / Director of Mines Safety,
बल्लारी क्षेत्र, बल्लारी / Ballari Region, Ballari.

APPENDIX R - A
81

F.No.T-19042/1/2020-M
Government of India
Archaeological Survey of India

"Dharohar Bhawan"
24, Tilak Marg, New Delhi
Dated: 22.01.2020

Order

22 JAN 2020

In suppression of the office order No. 25-01-015-M dated 22.12.2015 regarding to constitute an Expert Committee as per the direction of Supreme Court of India to examine the issue and to assess the impact of mining activity going around the Parvathi and Karthikeya Temple, Sandur (near Hospete), Bellari district, the revised Expert Committee /group is formed which is as under:

1. Director General of Mines Safety (DGMS)
2. Regional Director (South)
3. Director, National Institute of Rock Mechanics (NIRM)
4. Director, Department of Archaeology, Government of Karnataka
5. Shri. Keshava, SA, (retired) ASI.
6. Dy. SA (Hampi Mini Circle), ASI

The above Expert Committee will examine the impact of mining on the monuments declared as protected under the 1958 Act in accordance with Environment (Protection) Rules 1986. A copy of the same is enclosed herewith for ready reference.

This issues with the approval of Director General, ASI.

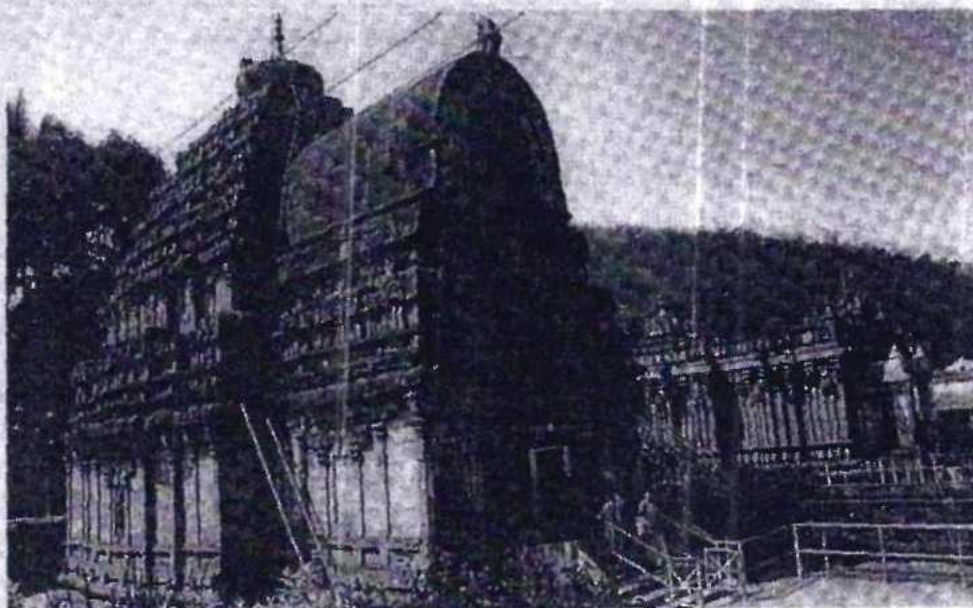
Arvin
22.1.2020
(Arvin Manjul)
Director (Monument-II)

**PARVATHI & KARTHIKEYA TEMPLE,
SANDUR, DIST. BALLARI**

STRUCTURAL ASSESSMENT STUDY

83

A report on the Structural Assessment Study
undertaken in connection with Mining activities around
Parvati and Karthikeya Temple, Sandur, Dist. Ballari,
Karnataka



By,
Ramesh S Mulimani
Superintending Archaeologist,
Regional Director (South),
Archaeological Survey of India.

A report on the Structural Assessment Study undertaken in connection with Mining activities around Parvati and Karthikeya Temple, Sandur, Dist. Ballari, Karnataka

Structural Assessment Study was carried out adjacent to the back walls (west side) of the temples of Parvathi and Karthikeya- a centrally protected monument under the jurisdiction of Archaeological Survey of India, Hampi Mini Circle. The team comprises of Dr. Ramesh S. Mulimani, Superintending Archaeologist, office of the Regional Director (South), Archaeological Survey of India, Shri. M.Kalimuthu, Deputy Superintending Archaeologist, In-charge Hampi Mini Circle, Dr. H.R.Desai, Asst. Superintending Archaeologist (Hampi Site Museum) and Dr. Ravikumara J, Asst. Archaeologist, Hampi Mini Circle Archaeological Survey of India, Kamalapur executed the work from 30.01.2020 to 02.02.2020. The work was inspected on 06.02.2020 by Dr. G. Maheshwari, Regional Director(South), Archaeological Survey of India, Bangalore.

The main aim of the study is to get to know the stability and state of preservation of the stone structures as well as the nature of foundation as the mining operation is proposed in the vicinity of the monument by government of Karnataka.

Notification

As per the Gazette Notification No. 8A/January 04,1954, Part-II-Section-1, Extraordinary Gazette of India, Page No.-25, these two temple complex are brought under the protection of the Central Government as the Monument of National Importance under Section 3(1), of Ancient Monument Preservation Act 1904 (VII of 1904). As per official record the area extant is 2.30 acres along with the tank in the north eastern corner and the boundary stones are fixed on all four sides.

Geo-Morphological features

The Sandur hills occupying the native state of that name in the center of the district are the most noticeable physical feature of this district. The range touches the river Thungabhadra at Mullapuram and runs south east upwards for about 48 km and joins the Kudligi-Rayadurga group of hills (Shodhganga.mflibnet.ac.in). The distinctive feature of these hills is its elliptical shape with a diametric narrow pass falls under the Sandur Schist belt-the pre-Cambrians of Karnataka, rich in iron and manganese ores. The soil and lake here are red marshy that owes to presence of rich ferrous deposits. The district consists mainly of Archean complex of crystalline schist, epidiorites, granite gneisses and later granites. The crystalline schist and epidiorites of the Dharwar system are reckoned as the oldest rocks which, due to lateral pressure were crumpled into folds with a general north-west-south-east strike. The Dharwar series of rocks occur in the form of four prominent bands of which Sandur synclines and the copper mountain (Suggamadevibetta) range are the one (Abhishankar, 1972: 9-19_Dist. Gazetteer).

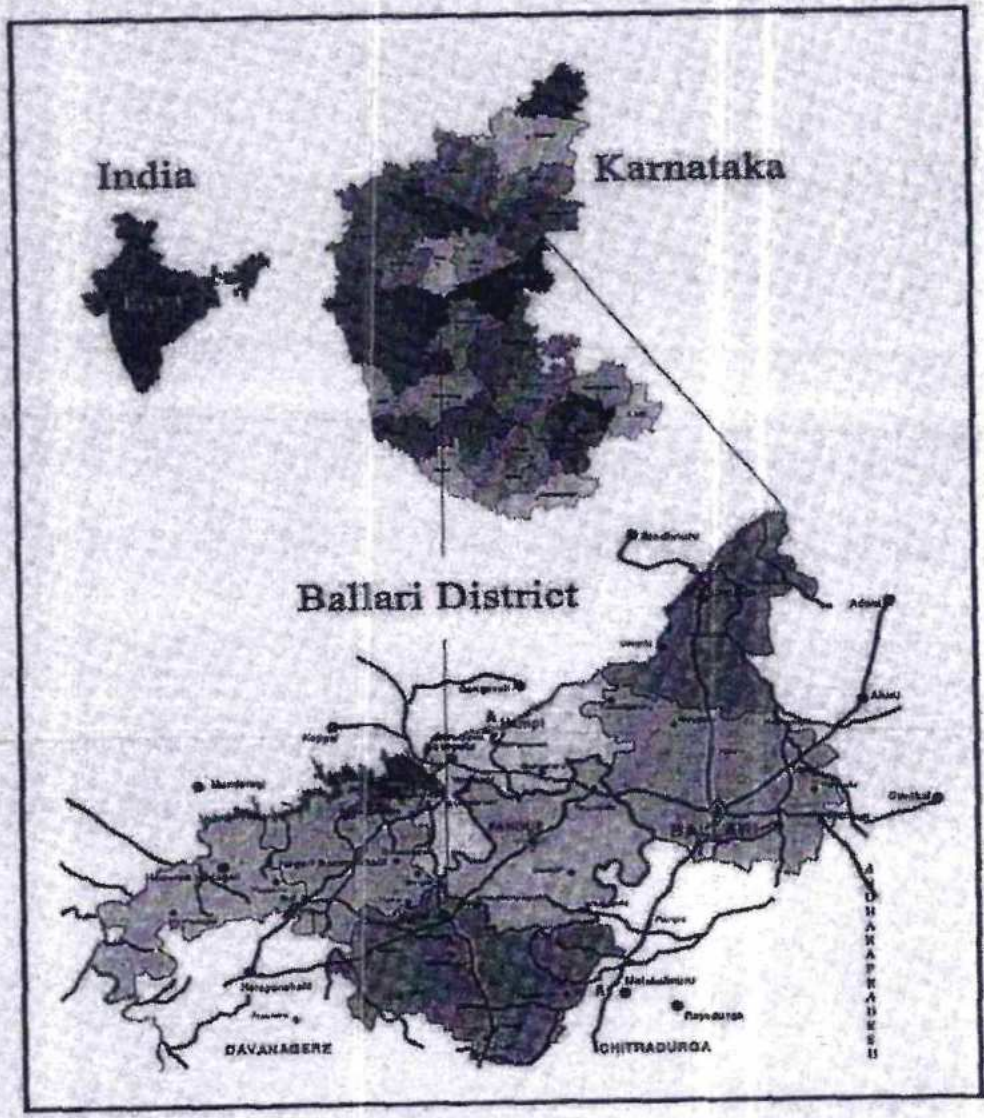


Figure 1: Location Map of District Ballari

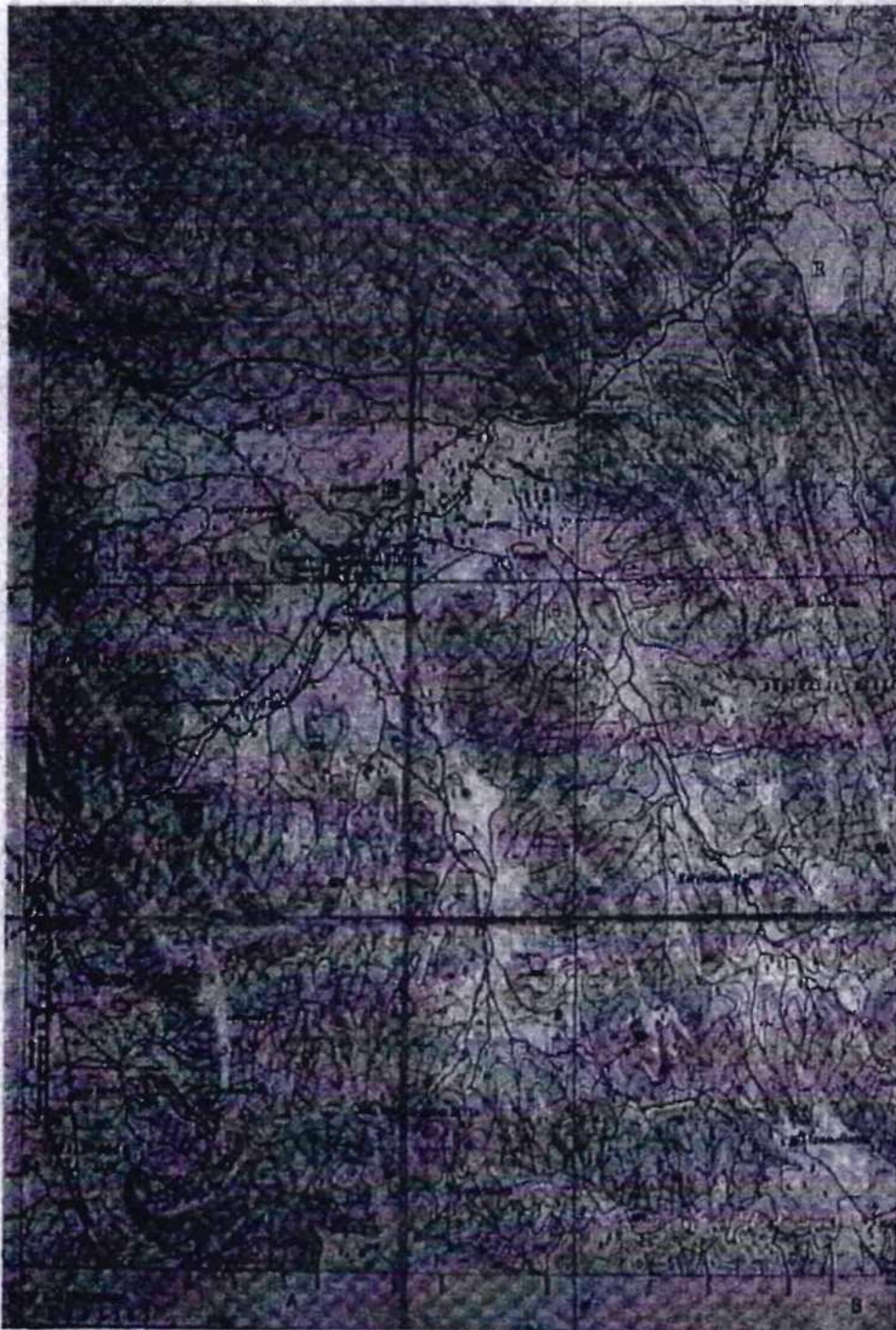


Figure 2: Toposheet of Sandur Area

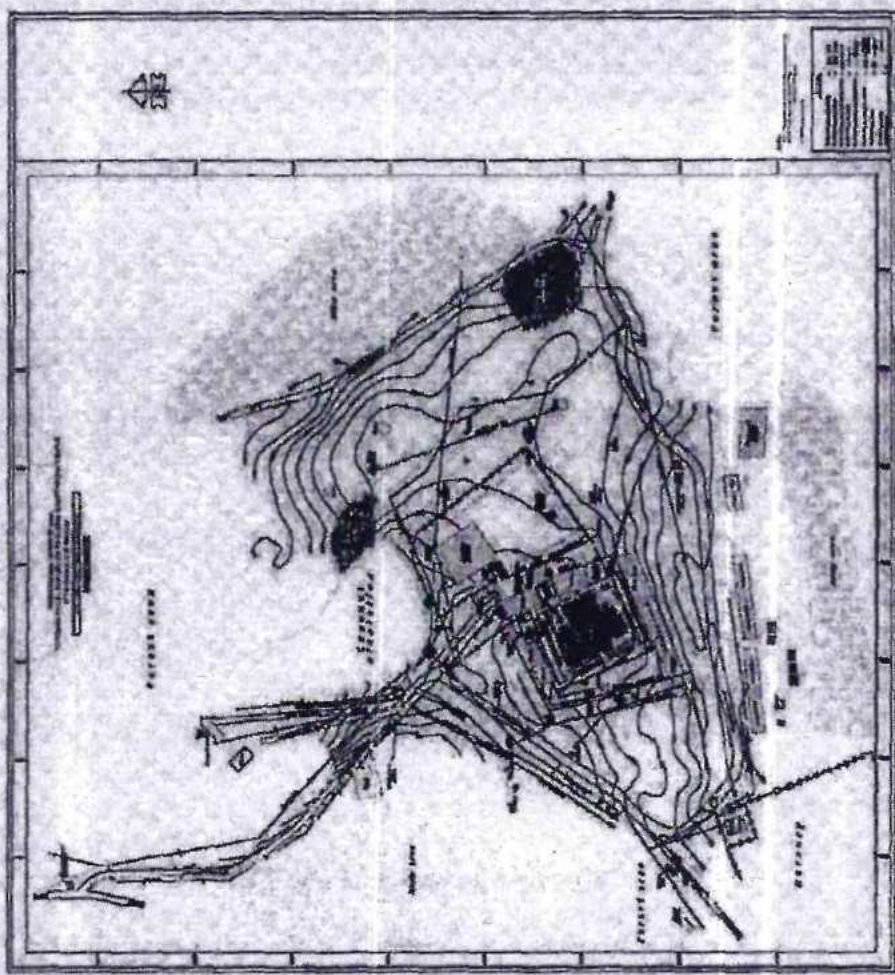


Figure 3: Contour Plan of Parvathi and Karthikeya Temple, Sandur and its Surroundings.

Approach to the Temple:

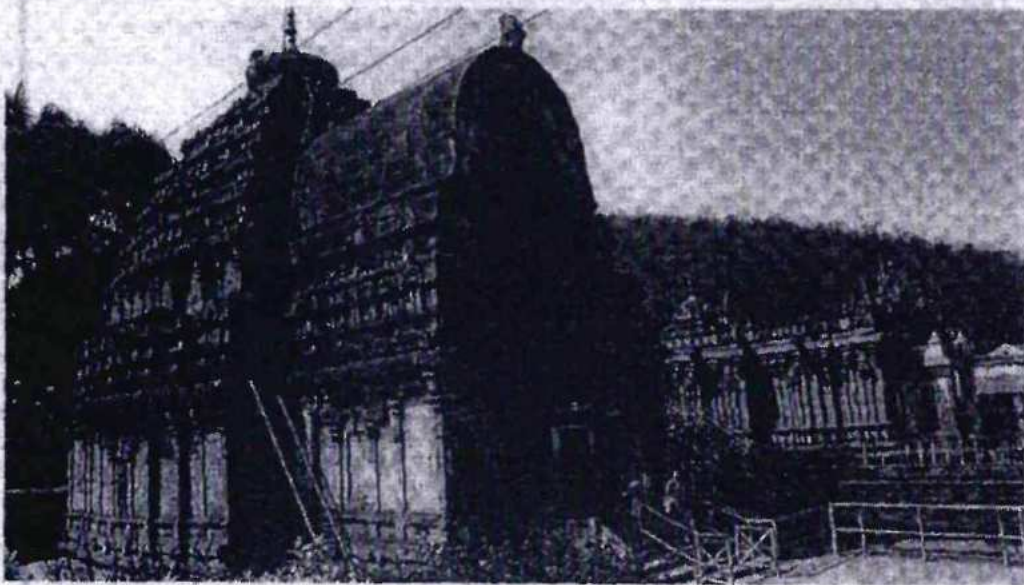
The District Head quarter, Ballari is well connected by bus through State Highway and National Highway, where buses are available from all major cities. From Ballari to Sandur is 60 km and 35 km from Hosapetta Sandur. The nearest railway station is Toranagal which is 30 km from Sandur, where daily rail services are available from Hubli and Guntakal junctions to Toranagal. Daily flights are also available between Jindal Vijayanagar Airport (20 Kms from Sandur) to Bengaluru and Hyderabad under UDAAN Scheme. Flights are also available to Hubballi Airport which is 180 Kms away from Sandur.

The Parvathi and Karthikeya temple is located 12 km, south west from Sandur and is approachable by road.

Google imagery of Parvathi and Karthikeya Temple, Sandur



General view of Parvathi & Karthikeya temple, Sandur



History of the Temple

The Parvathi and Karthikeya temples are located within the Swaminimalai forest range of the Karaunchagiri.

The Parvati Temple was built in early Chalukyan style between circa 650 and 750 C.E., in pale brown sandstone. It is believed that the temple that now houses the shrine to Goddess Parvati was the original Subramanya temple. The temple, facing east, on plan it consists of a *garbhagriha*, an *ardha-mandapa* and a *mukha-mandapa* having niches on outer walls. Tall pillars carry the simple ceiling. The temple consists of a *chaturstala* superstructure which was later renovated to appear as a stepped *sikhara*. The large sized *mahanavika* has a frontal projection equal to the width of the *garbhagriha*. A large decorated door-frame having multiple *sahas*. On either side of the main entrance flanked by *dwarapalas* while the outer wall niches adorned with Siva, Karthikeya and Vishnu etc.,

To the north of the Parvati shrine is the stone built Karthikeya shrine built by Rastrakutas datable to late eleventh century C.E. the presiding deity is Shanmukha (Karthikeya). On plan it consists of a *garbhagriha*, an *anatarala*, and *mukhamandapa* and two-pillared porch in front. The superstructure over the *garbhagriha* is a dwarf *sikhara* of eighteenth century and devoid of any architectural merit.

A small Shiva temple is located on the north-east corner of the temple complex at a lower level of the Karthikeya temple along with few loose sculptures stylistically datable between sixth and twelfth centuries C.E.

The entire complex is enclosed by a *prakara* with an entrance *gopura* from the east. This *gopura* is made of brick and lime is of late medieval period. Outside the entrance towards north-east is situated a tank (*pushkarani*) locally known as *Agastiyathirtha* and a few other minor structures.

The temple was later on patronized in the 18th century CE by the local rulers – the Ghorpades.

Epigraphical records

Around 10 inscriptions noticed in the temple complex. Parvathi temple has revealed 4 inscriptions and the oldest being in the *Sankh-lipi* characters records that Jinaalayan (who was caused to make this temple) of the 8th century Characters while another one which is obliterated mentions only 'Sri'. Another inscription in the same temple of Saka 967 corresponds to 1045 C.E records the installation of (an image of) a peacock by the goldsmith (akkasale) Chandachari, son of Hamplachari of Oruvayi, while another one of Sanskrit and Nagari script and language of 8th-9th century CE.

The inscriptions at the Karthikeya temple on the left entrance datable to Saka 996 corresponds to 1074 CE records the construction of the temple for God Swamideva, the *tapovanadhija* Cahadarasa donates the land to stone cutters and black smiths.

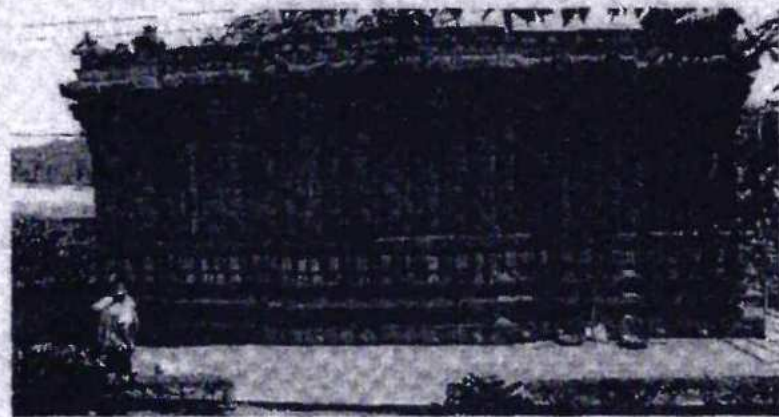
The second one belongs to HoysalaViraBallala II (1127 CE) and records the renewal of the grant of the village called Keriya-palli to the Karthikeya temple for its daily offering to the GodShannuga and placed it in the charge of VishnukaraBrachmacharin which was formerly granted by Krishna raja of the Rashtrakuta family, while another inscription in the same temple on the right side mentions that one KachiyaDesika son of ChakanacheriHampiala has provided steps to the temple on its north and it belongs to 17th century characters.

The inscription on the bell dated Saka 1752 corresponds to 1830 CE mentions that Singappa grandson of Barlabasappa of Guhesvaranadurga donated this jagate (Gadiyara) of weight of 56 seers. In the year of Saka 1776, Pramadhicha, Asviya, Su.10 (1854 CE), Sairappa and Kumarappa son of Sannabasappa donated the chain to clock which is weighted total 81 seers.

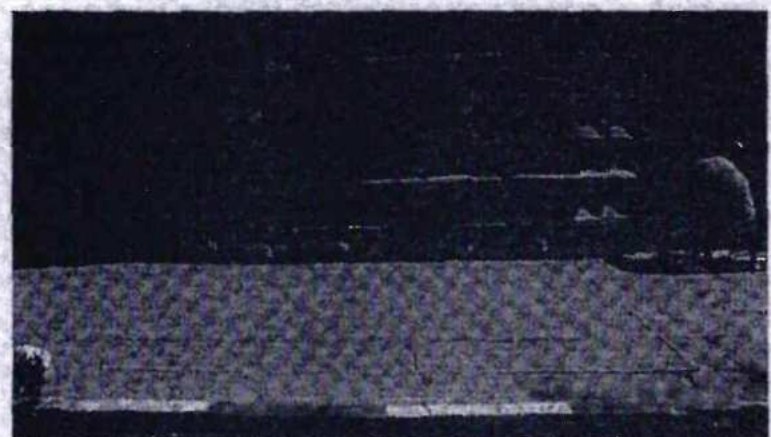
Structural Assessment

Trail trenches were probed just adjacent to the plinth portions of Karthikeya and Parvathi temples to know the type of foundations were originally made admeasuring 3 x 3m and 4x4 m respectively.

Back side view (west wall portion) of Kartikeya Temple



Close up view of proposed area for trial trench.

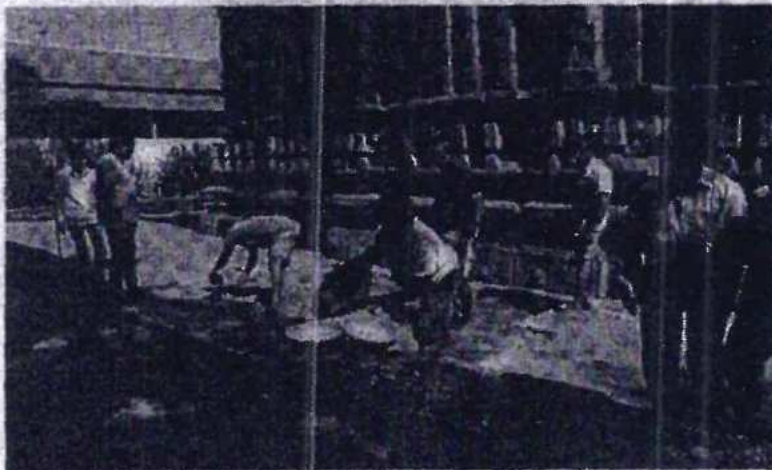


91

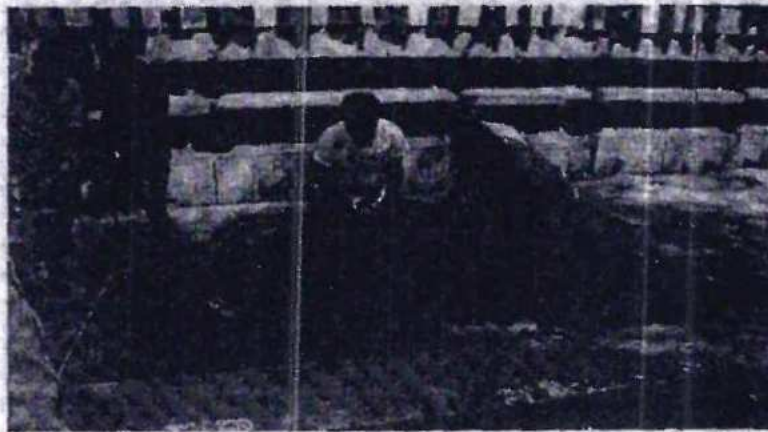
Removal of granite stone slabs – apron - During



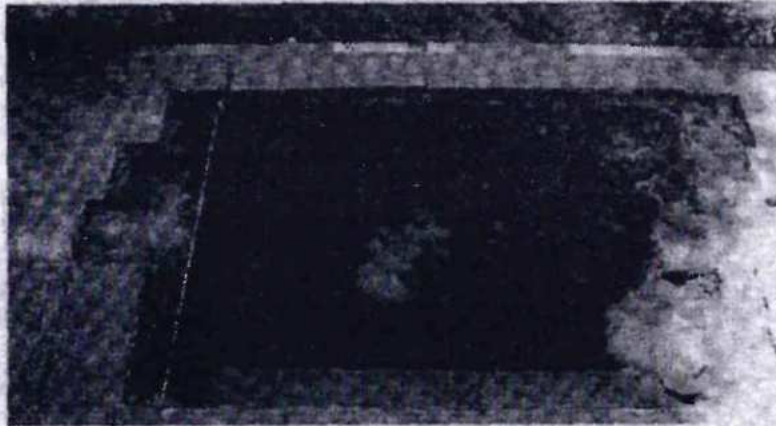
Removal of granite stone slabs – apron - During



Removal of uneven sized boulder just below the sand cushion



Uneven sized boulders in all three sections – facing north, south and east



Reused brick structure just below the random uneven sized boulders - During

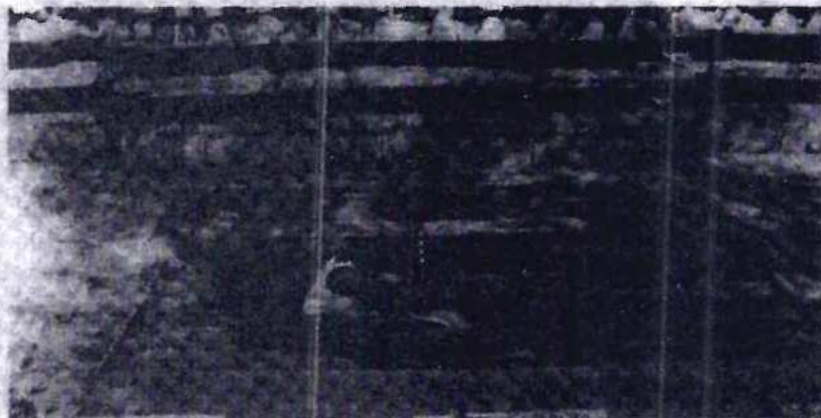


Reused brick structure just below the random uneven sized boulders
- During - closer view - Section facing north

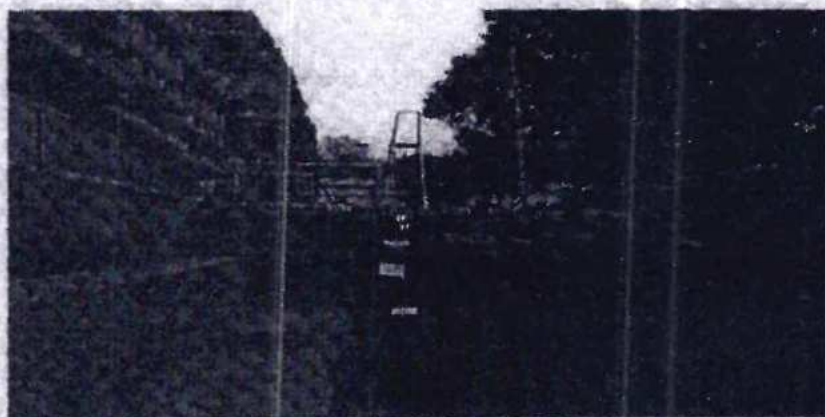


93

Granite stone foundation – section facing west



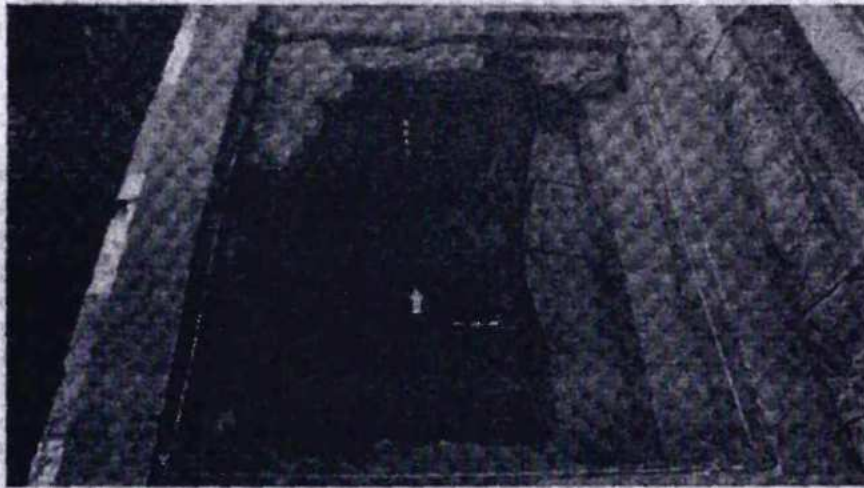
Granite stone foundation – section facing north showing the brick structure all along the foundation



Granite stone foundation – section facing north showing the brick structure all along the foundation – Closer view



Bird eye view of the plan showing the entire stratigraphy of the trench

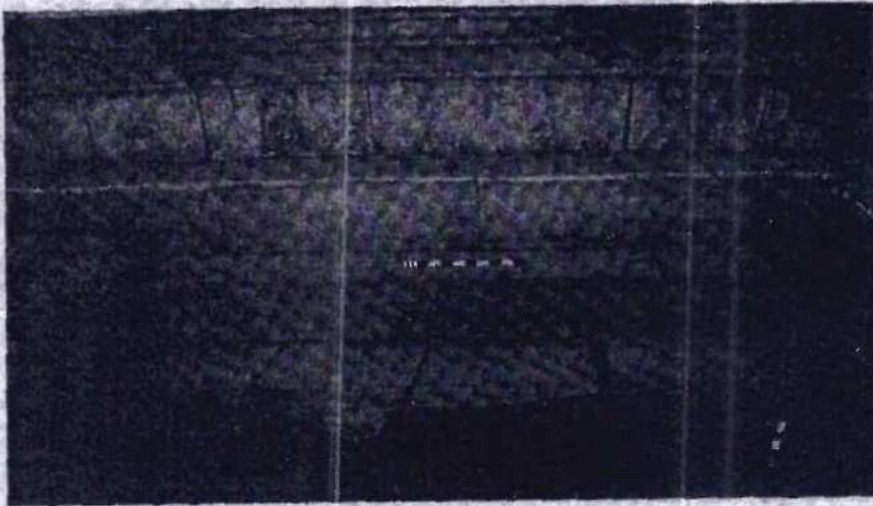


Section & plan facing south and the closer view of the brick structure pattern

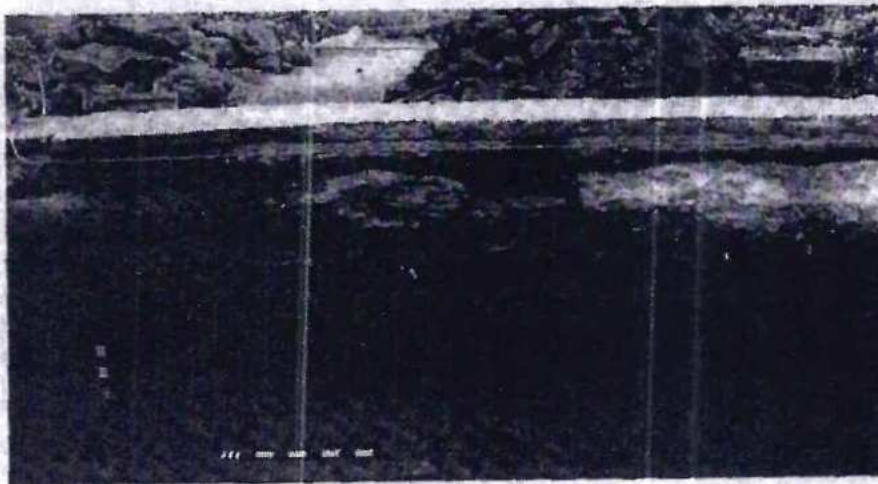


95

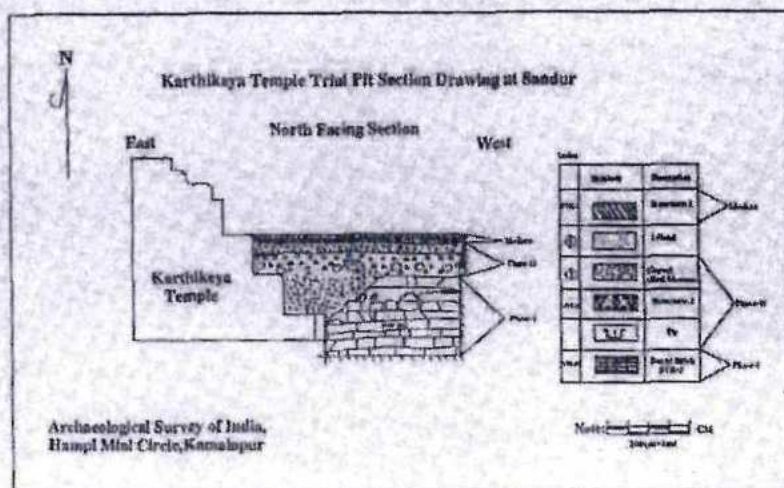
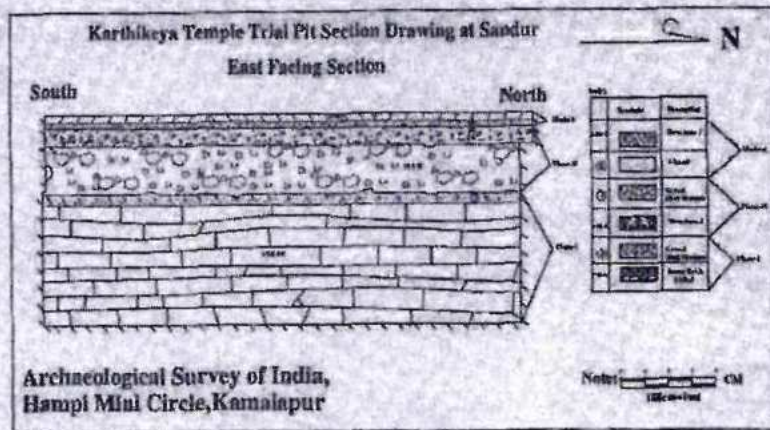
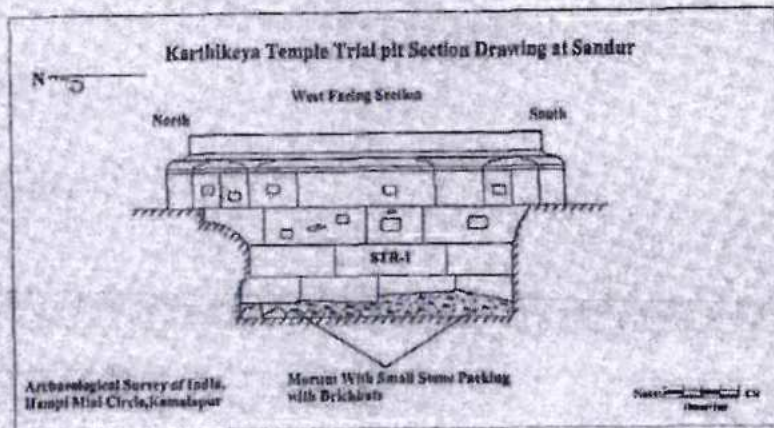
Section facing west showing the random rubble strata below the last layer of the granite stone foundation



Section facing east showing the brick structure below the random boulder



Section drawing showing the Karthikeya Temple



#6

To retrace the brick structure is a plinth protection wall done probably in ancient times all around the temple after the construction of the main temple to protect the structure from water percolation as these twin temples are located in the slops of the hillocks all around.

The fourth layer is consists of brick structure. Initially it was felt it could be a brick pavement and to ascertain the nature of structure the top most brick course was removed and found brick courses are continuing downwards. Up to the depth of 1.06 m excavation was carried out and nine courses of brick masonry were removed and excavation was stalled as the structure is still continuing vertically. Width of the brick structure (wall) is about 4.0 mtrs. The brick sizes are not uniform, in some places broken bricks were also used. The bricks sizes encountered are of 34cm x 7cm (LW) and 35cm x 19cm x 7cm - Early historical period. The binding material of the brick structure is mud/clay and the pattern of structure is not well defined as there is no proper header stretcher method was noticed. The entire structure is made of reused bricks.

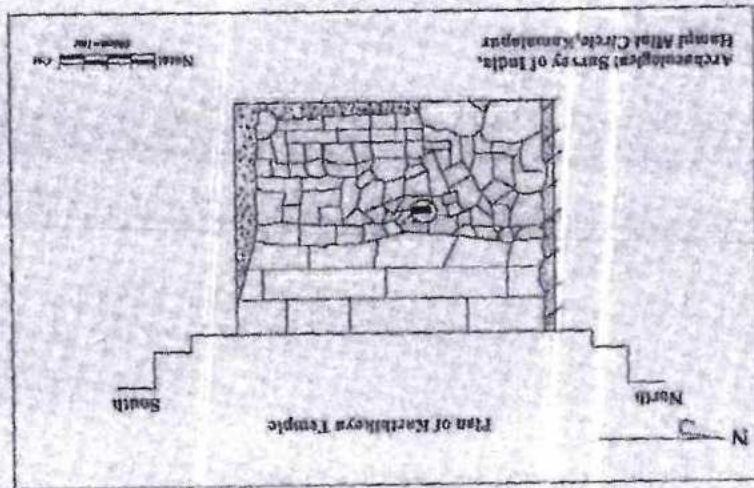
The third layer is consists of the thin spread of red soil or murram

The second layer is consists of uneven sized random boulders of local variety horizontally spread and thickness is approximately 0.40 mtrs.

The top most layer is the granite stone slab pavement - apron with sand cushion (0.6 m) executed by the Archaeological Survey of India.

As mentioned above, a trial trench measuring 3 x 3 mtr was probed just adjacent to the west wall of the Karthikeya shrine in north south orientation.

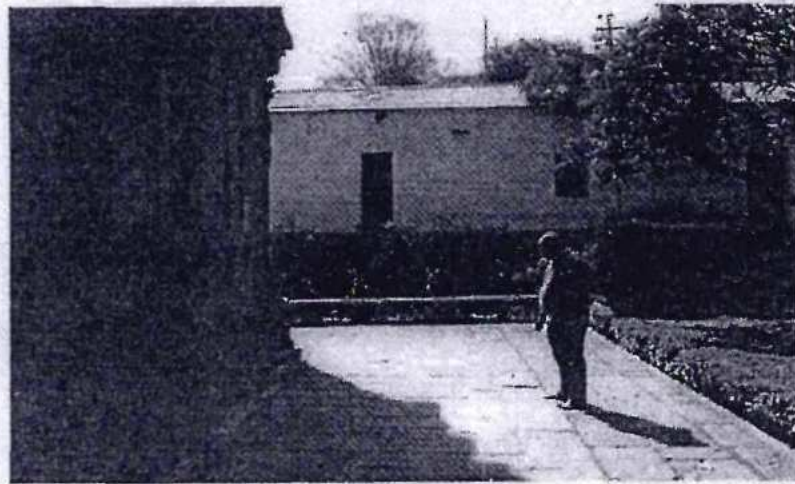
Stratigraphy details of the trial trench (Karthikeya shrine):



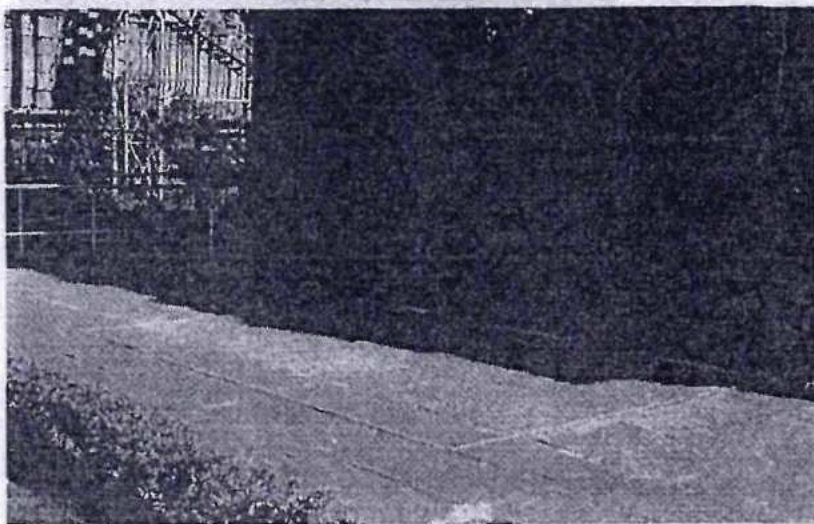
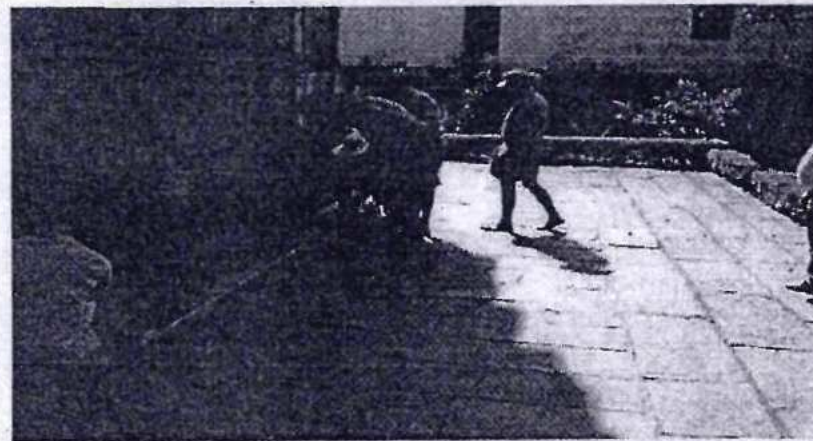
Brick Structure of Karthikeya Temple Plan

Parvathi shrine

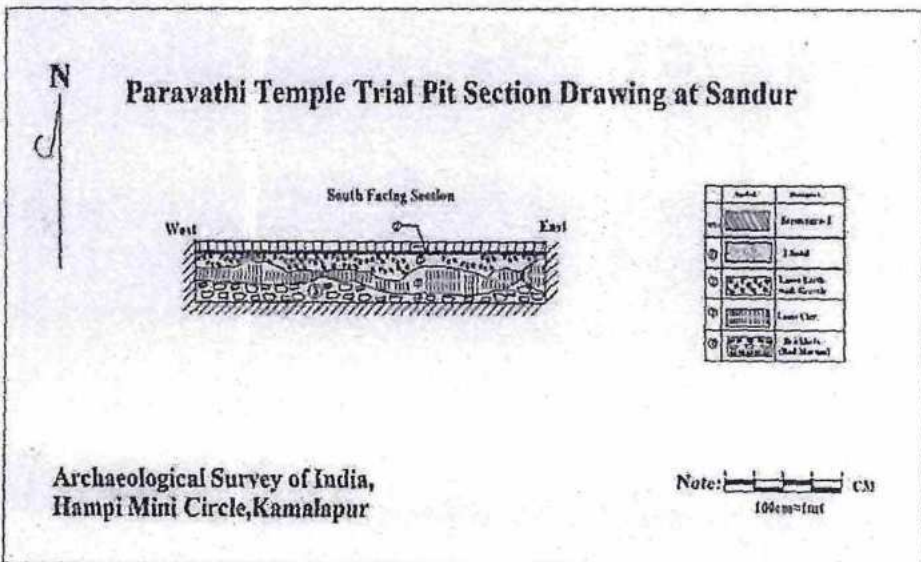
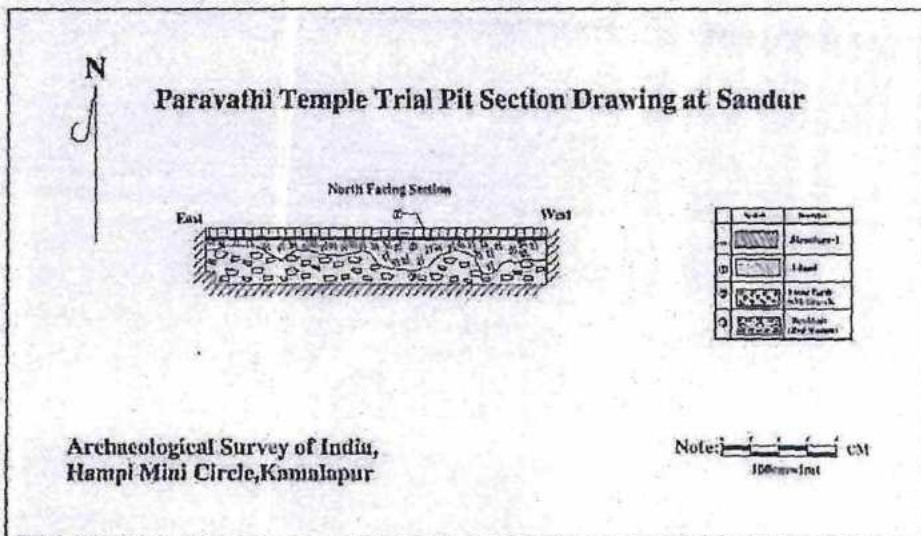
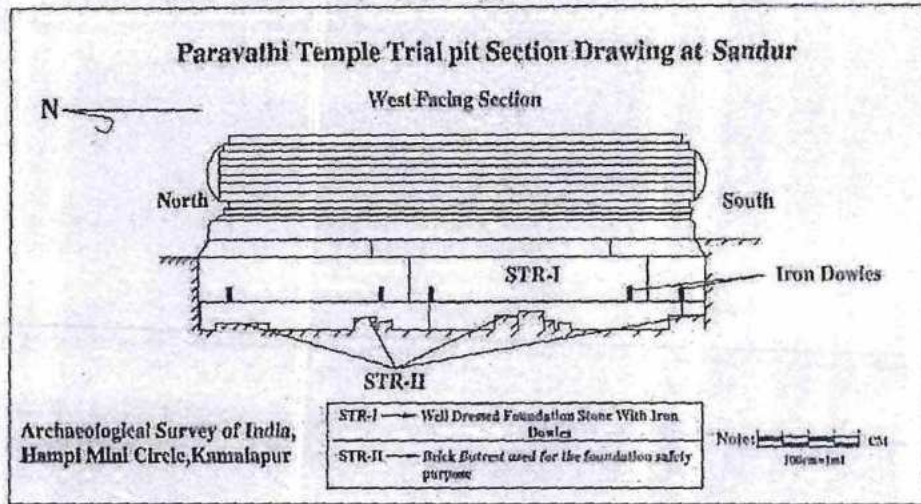
Back wall of the Parvathi shrine – Before probing



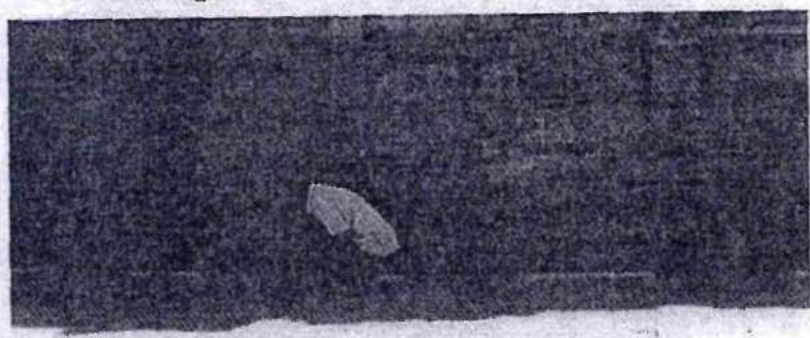
Selected area 4 x 4 m for excavation



Section & Plan drawings of Parvathi Temple



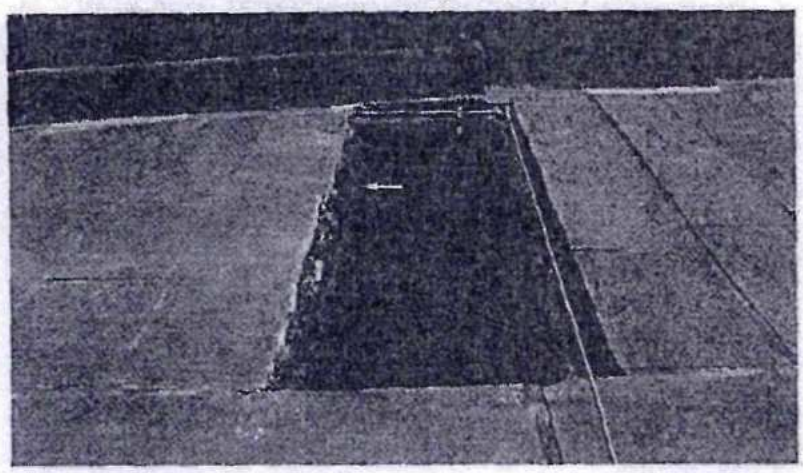
Numbering of stone slabs – pathway - before removal



Removal of the stone slabs - During

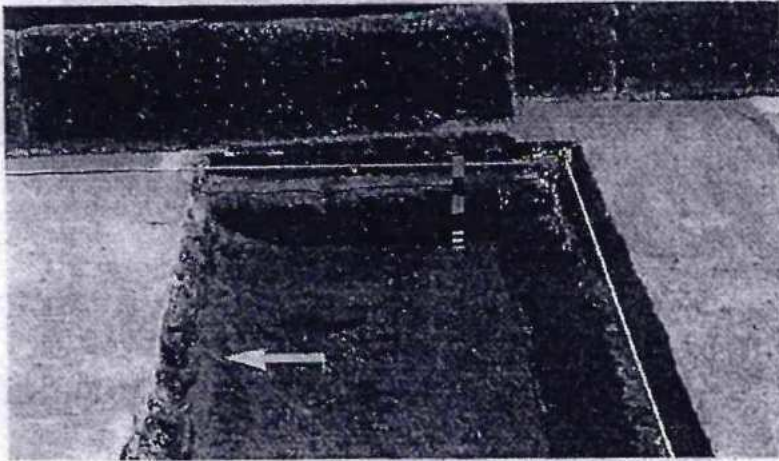


Removal of stone slabs – During – view from west

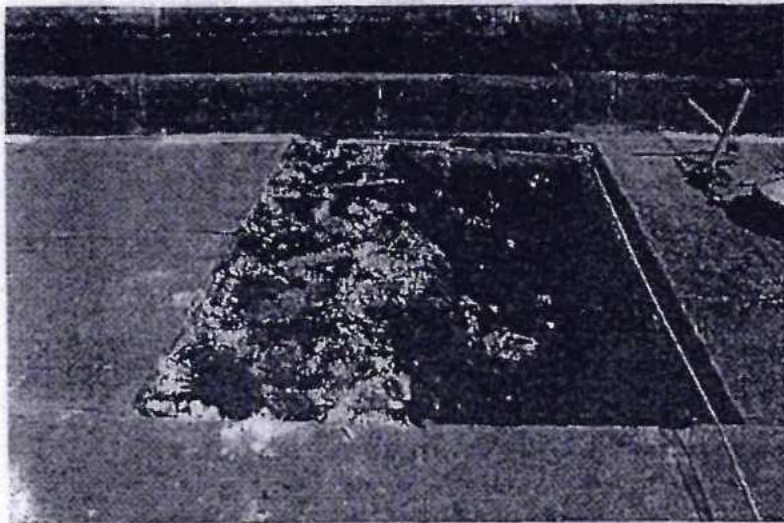


(1, 2, 3)

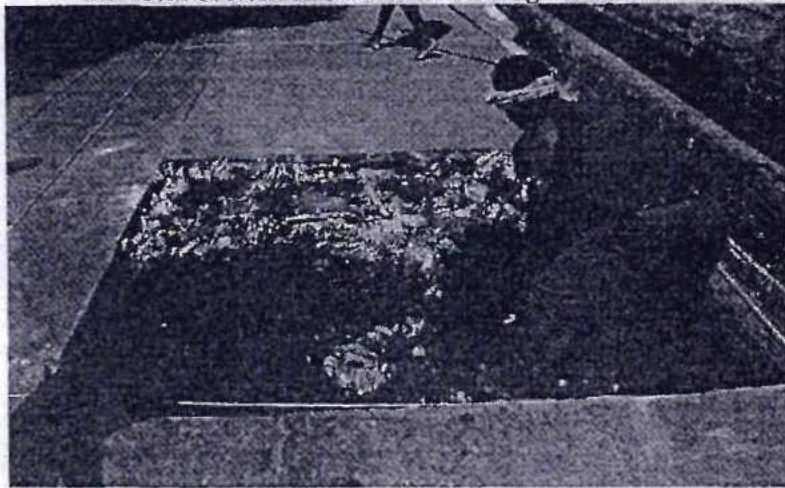
Removal of stone slabs – During – view from west



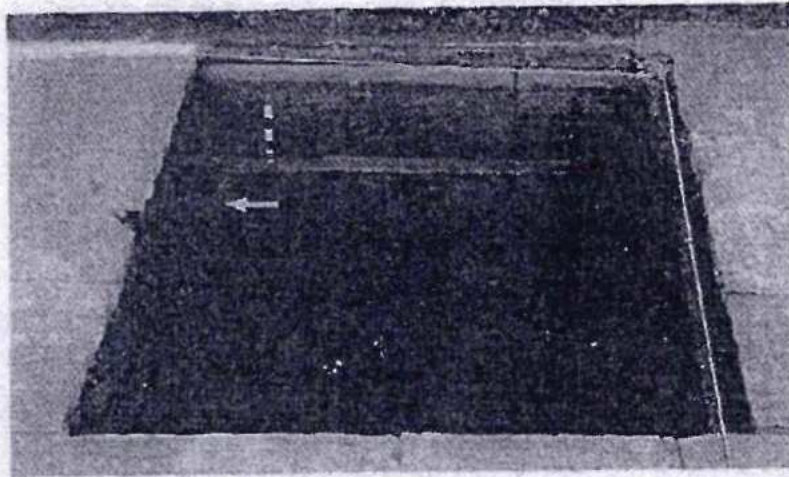
Removal of stone slabs – During – view from west



Removal of stone slabs & soil – During – view from south



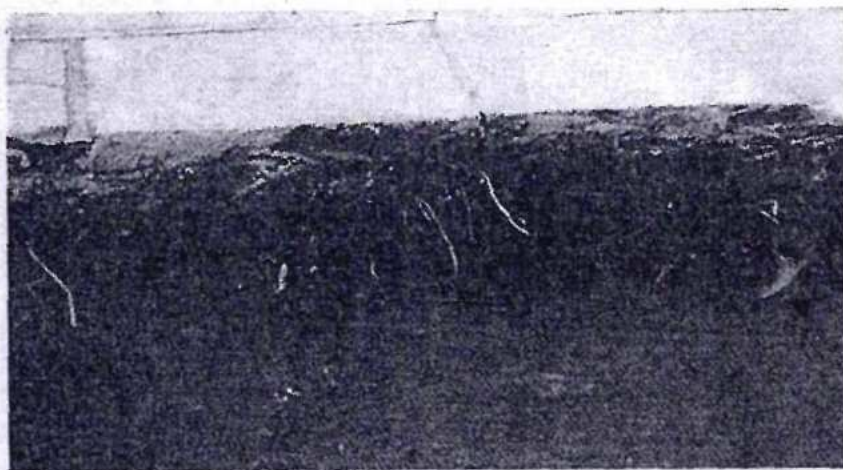
Removal of stone slabs & soil - During - view from west



Removal of stone slabs & soil - During - view from south



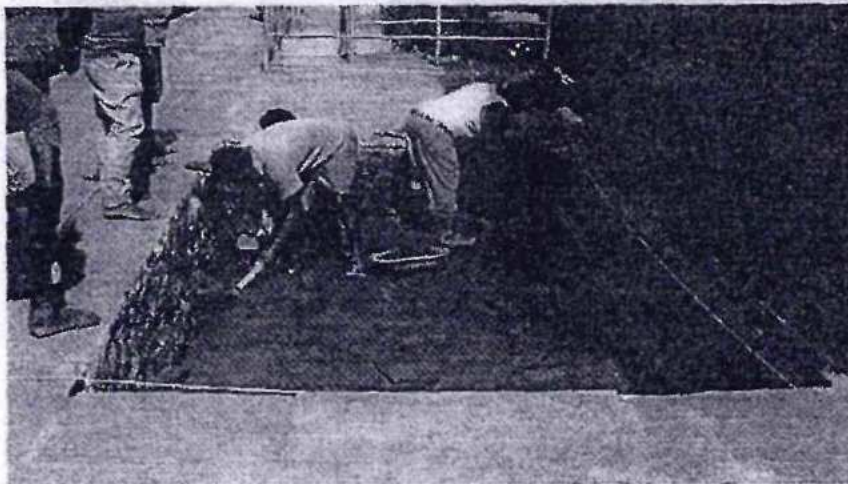
Removal of stone slabs & soil - During - view from east



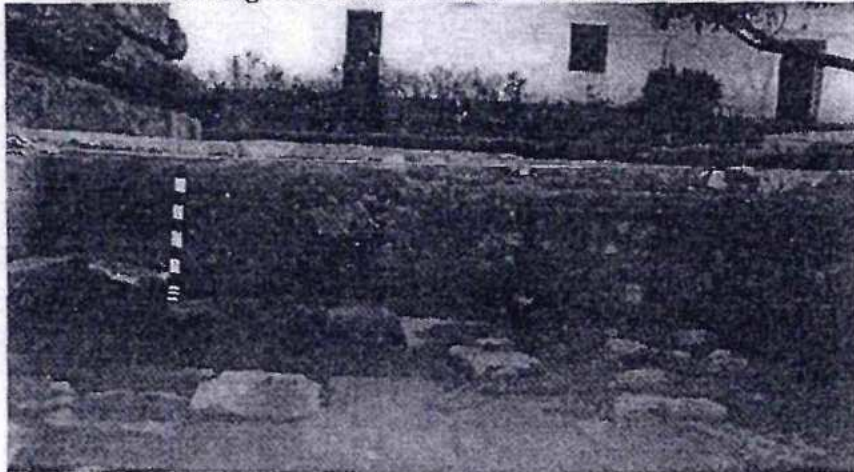
Removal of stone slabs & soil - After - view from south



Exposing the brick masonry wall - During - view from south



Section showing the accumulated soil - view from north

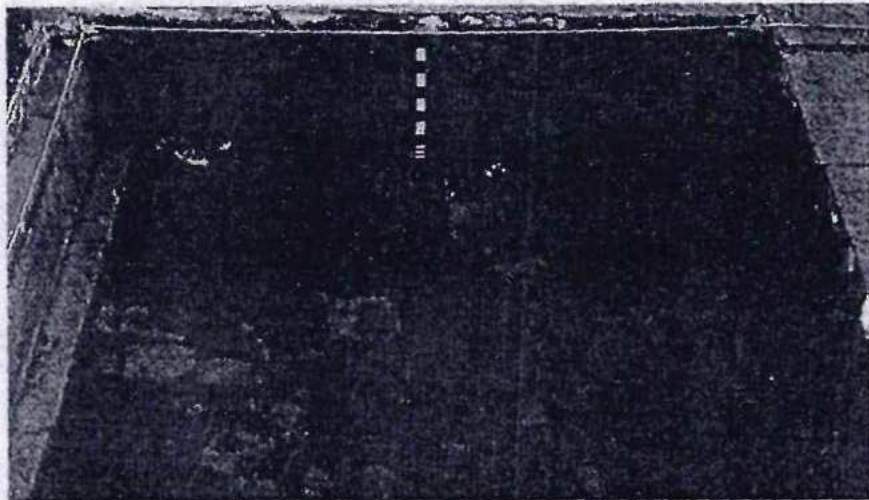


104

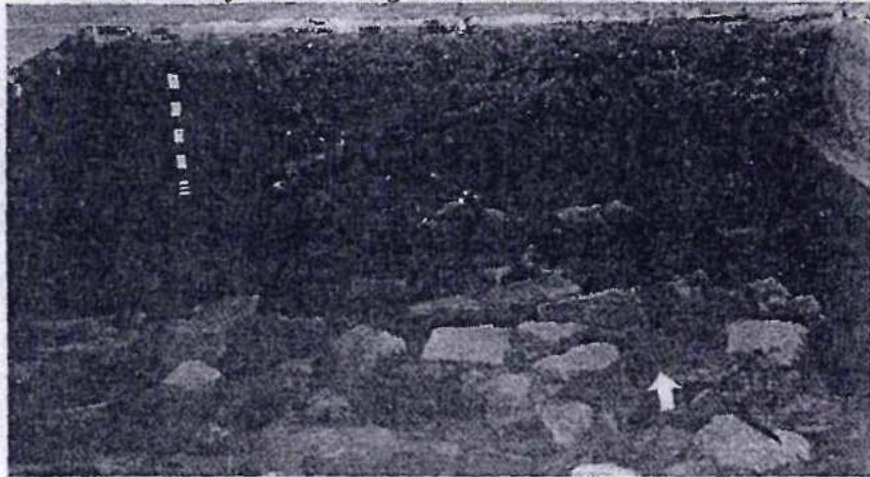
Brick masonry wall all along the foundation wall – view from east



Brick masonry wall all along the foundation wall – view from north

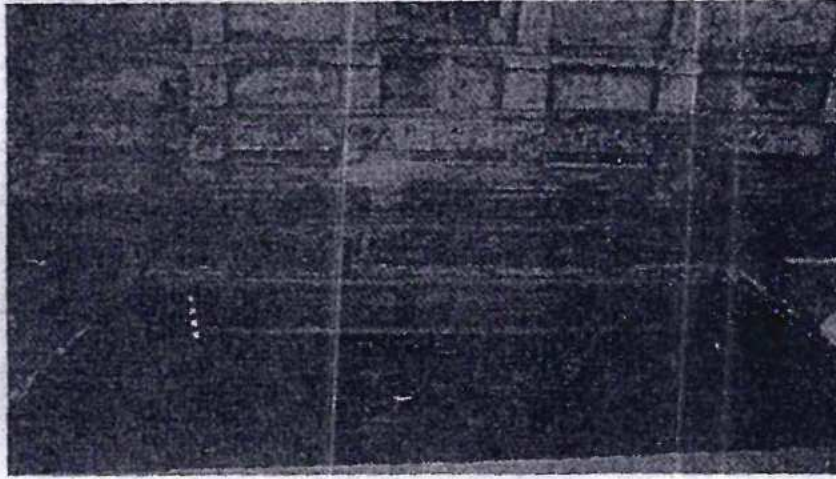


Brick masonry wall all along the foundation wall – view from south

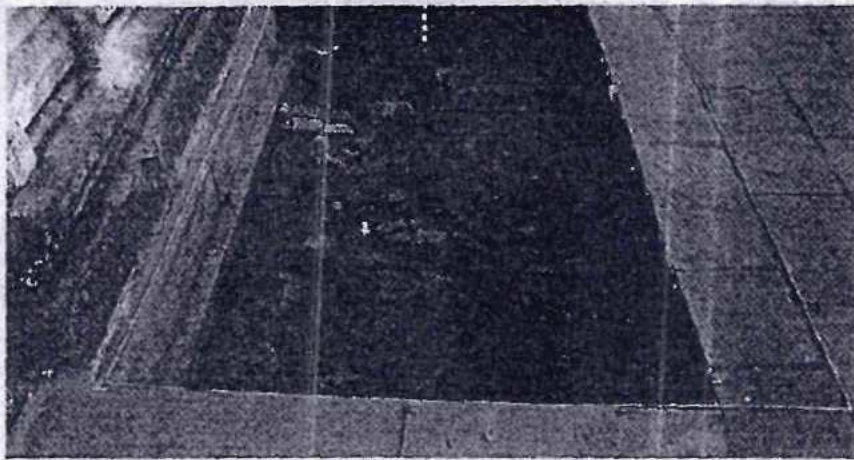


105

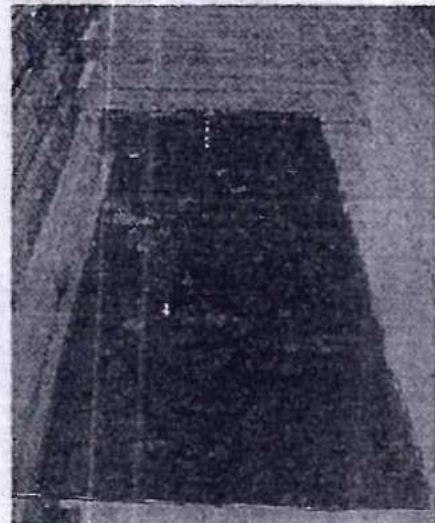
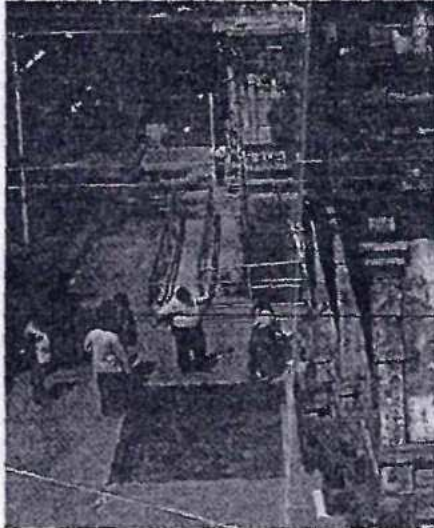
Section facing west showing the brick masonry wall all along the foundation wall



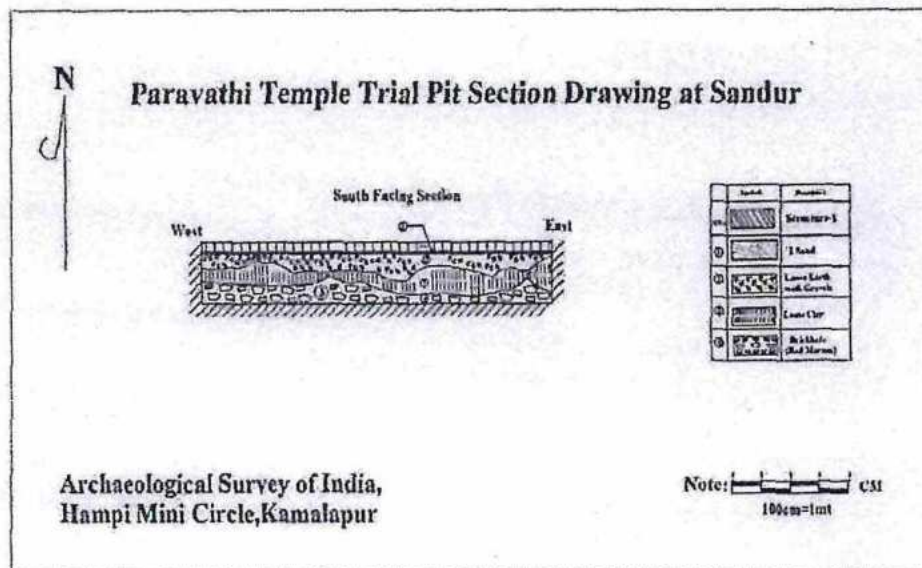
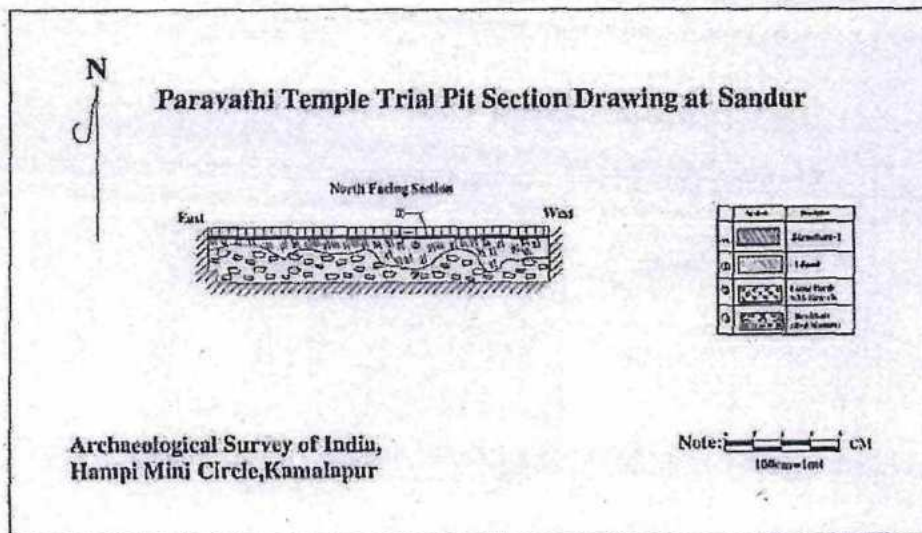
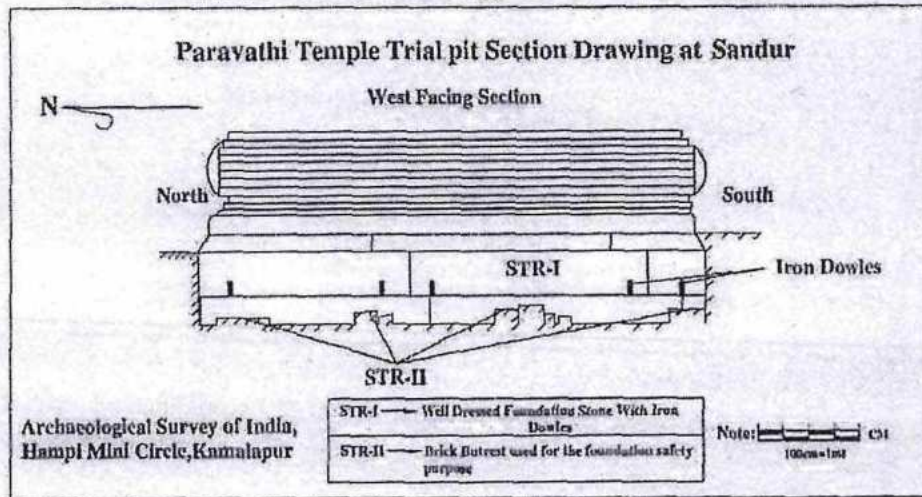
Brick masonry wall all along the foundation the foundation wall – view from north



Aerial view of the trial trenches Brick structure adjacent to the foundation



Section & Plan drawings of Parvathi Temple



To reiterate the brick structure is a plinth protection wall done probably in ancient times all around the temple after the construction of the main temple to protect the structure from water percolation as these twin temples are located in the slopes of the hillocks all around.

Human intervention causes further deterioration of the temples

1. Parvathi temple is made of sand stone in dry masonry, iron dowels were used to connect the architectural stone blocks. In several places the rusted iron dowels splitting the sand stone architectural members. As the sand stone is weak in nature susceptible for flaking due to rigorous extreme weather and human intervention.
2. Heavy vehicular traffic on the northern side of the temple complex accelerates the vibration and the stone members of the temple particularly Karthikoya temple is dislodged and out of plumb.
3. The dust formation created due to constant vehicular movements very close proximity of the temple complex discoloring the monument as well as causes chemical reaction on sand stone structure.
4. Intensive air pollution in this area badly affecting the flora and fauna and the ambience of the temple complex.

Google map view showing the roads leading to the nearby mines situated very close to the monument

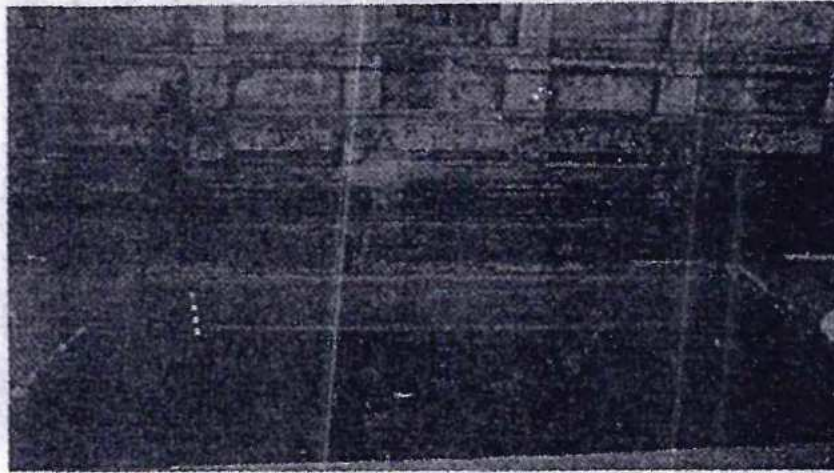


Entrance gopura of the temple complex on east and mining operation on the hillock



109

Section facing west showing the brick masonry wall all along the foundation wall



Brick masonry wall all along the foundation the foundation wall – view from north



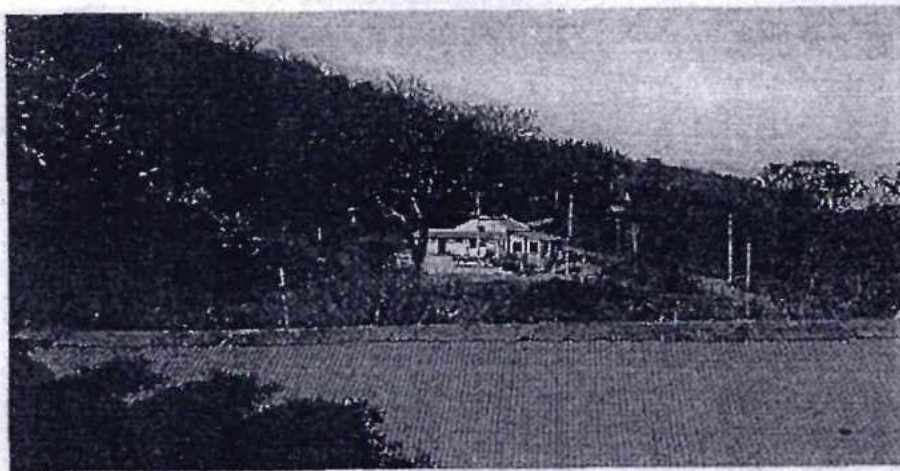
Arial view of the trial trenches Brick structure adjacent to the foundation



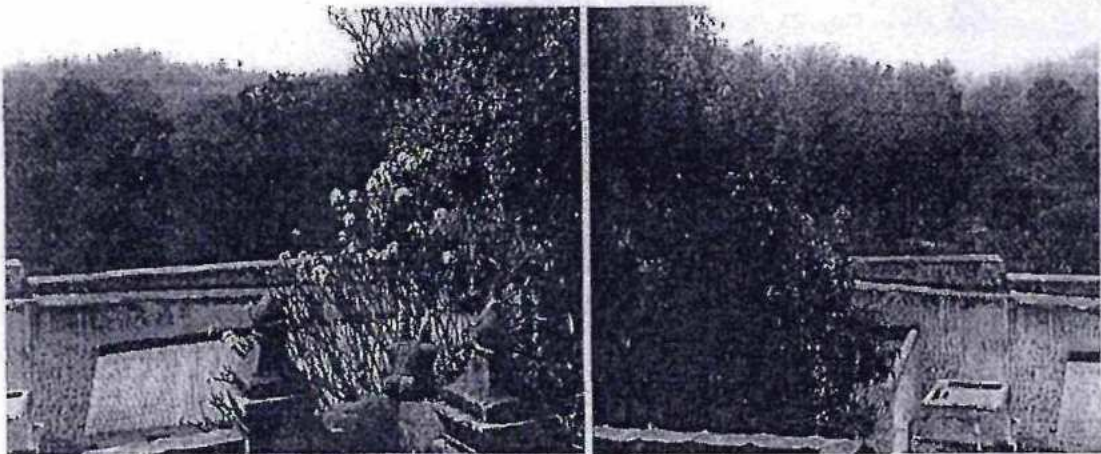
Air pollution on flora as well as on monuments – hillock on east side



Hillock on northern side



Hillock on west side



4 1 1

1

1

1

1

1

1

1

1

1

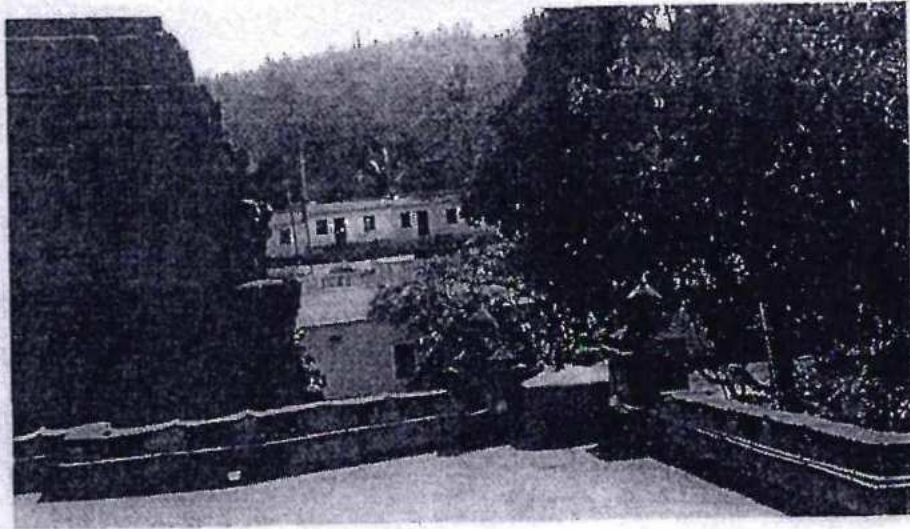
1

1

1

1

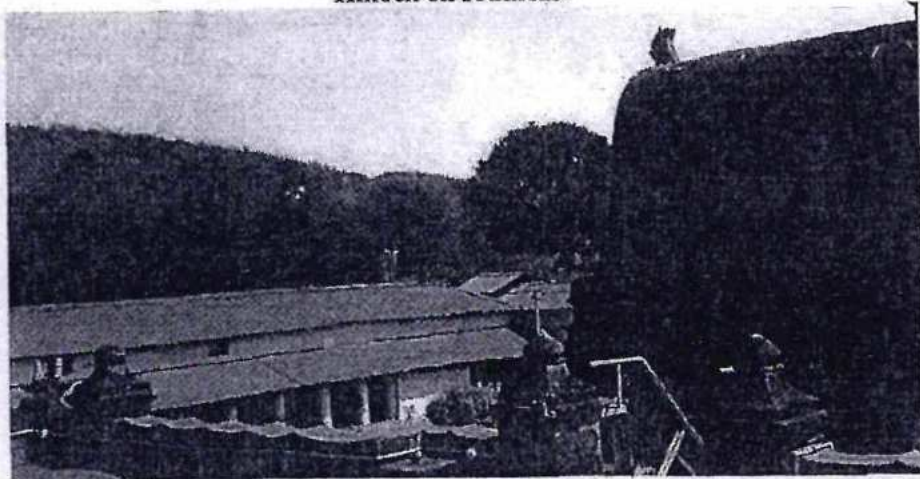
Hillock on southwest



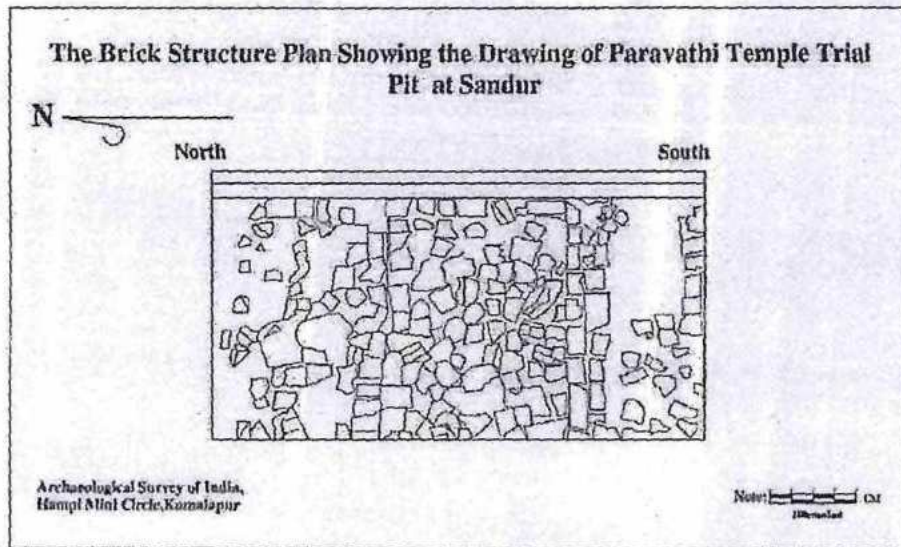
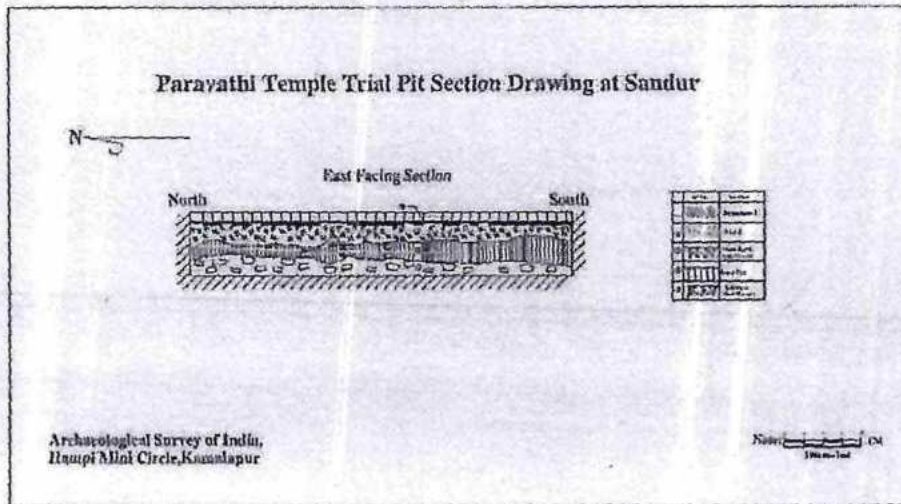
Hillock on southeast



Hillock on southeast



112



Stratigraphy details of the trial trench (Parvathi shrine):

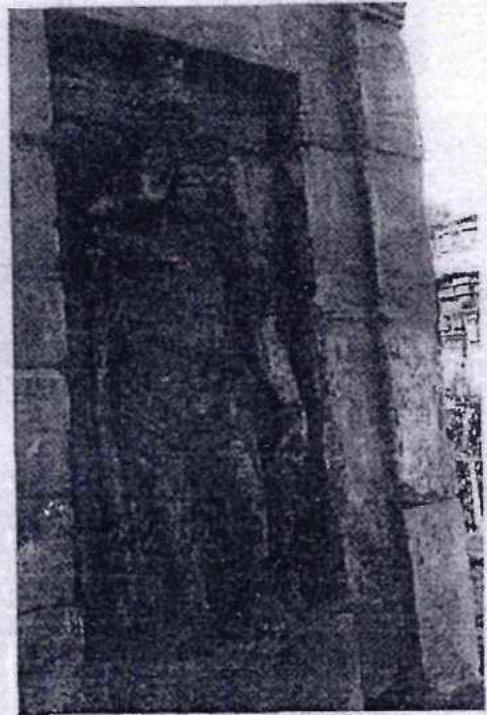
As mentioned above, a trial trench measuring 4 x 4 m was probed just adjacent to the west wall of the Parvathi shrine in north-south orientation.

The top most layer is the granite stone slab pavement - apron with sand cushion (0.6 mtr) executed by the Archaeological Survey of India.

The second layer consists of loose soil and thickness is approximately 0.40 mtrs.

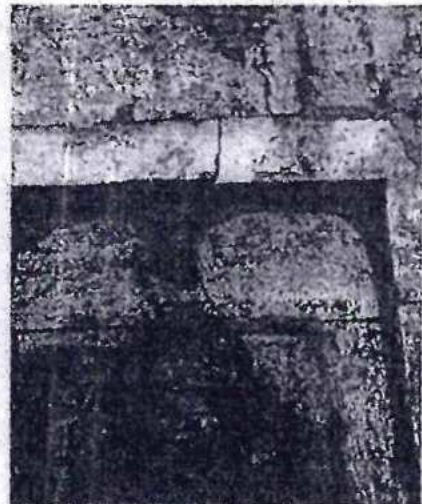
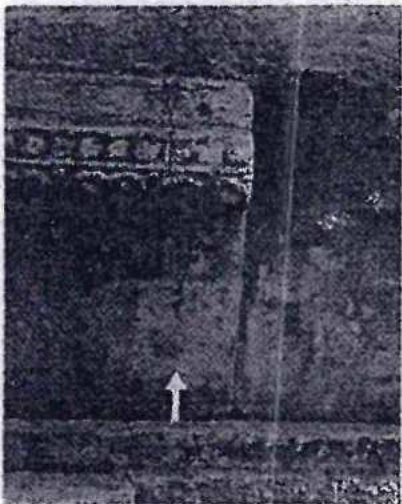
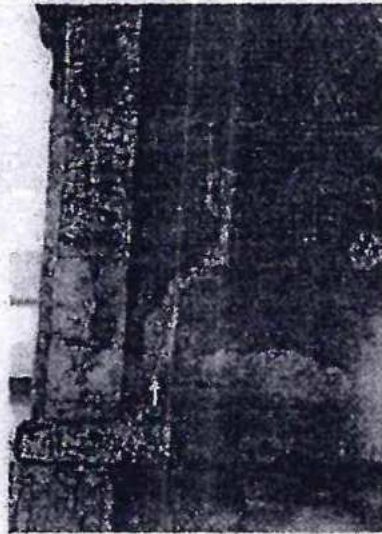
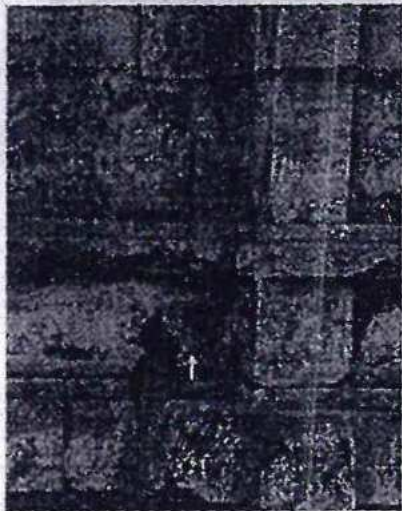
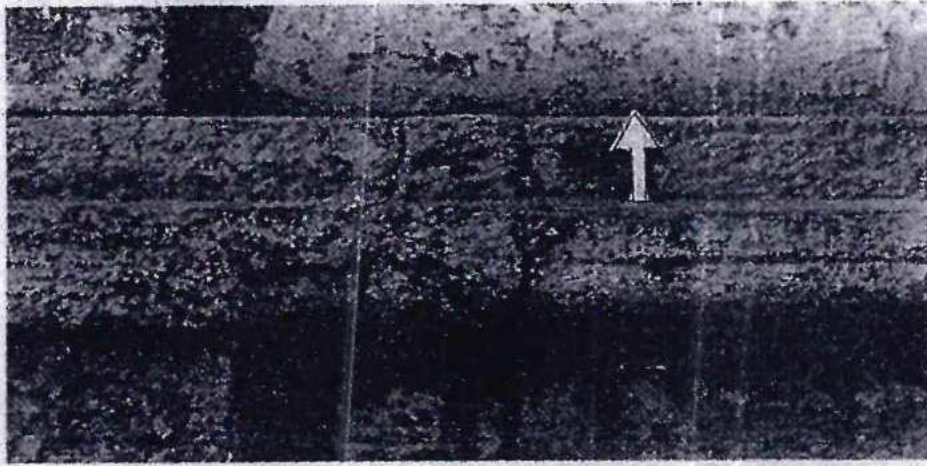
The third layer consists of the brick structure made of irregular shaped bricks - reused bricks. The brick structure is all along the foundation wall of the temple foundation.

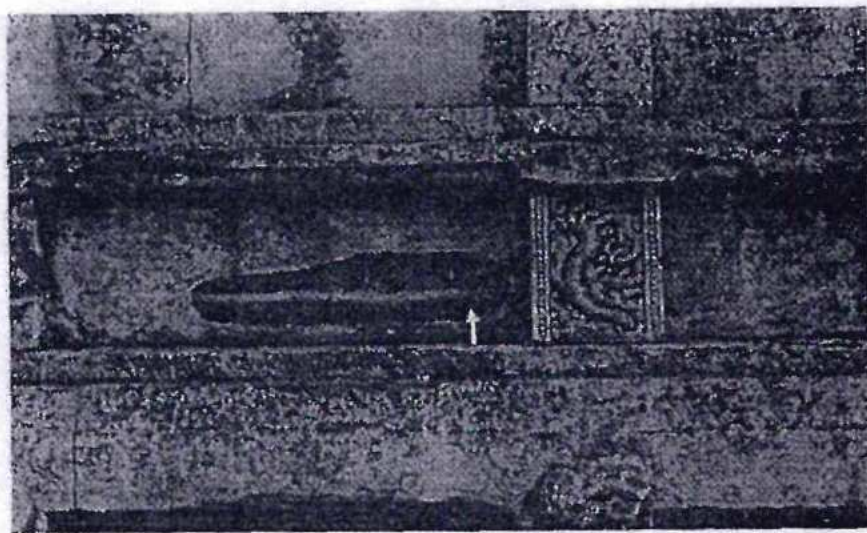
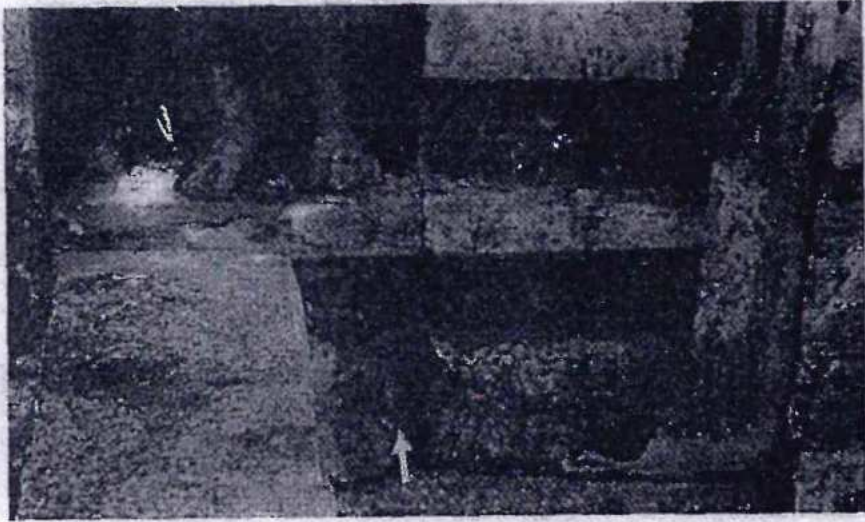
Air pollution discolouring the monuments and its ancient features – Parvathi shrine



114

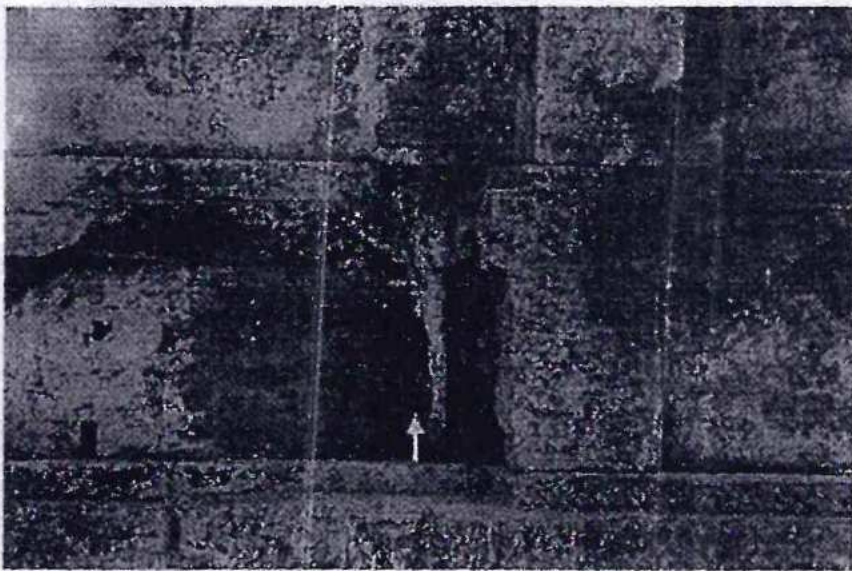
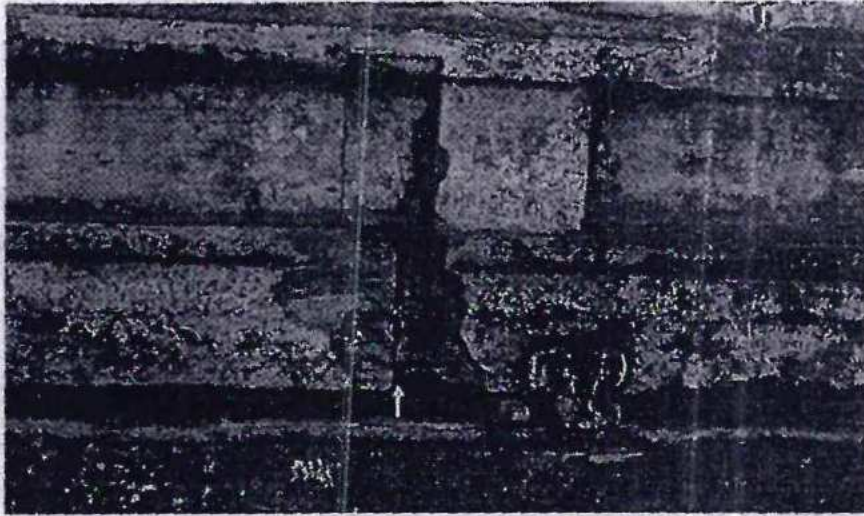
Cracks developed due to various reasons – Parvathi temple



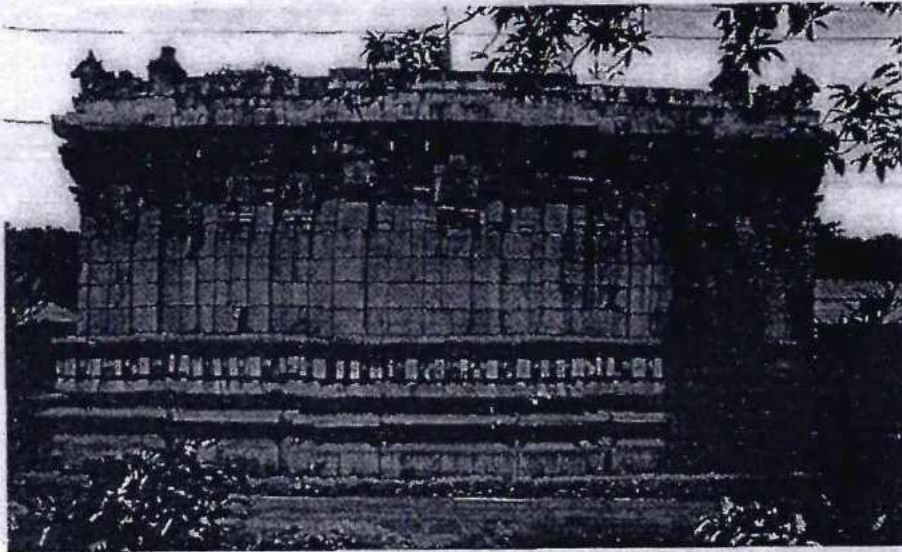


MLB

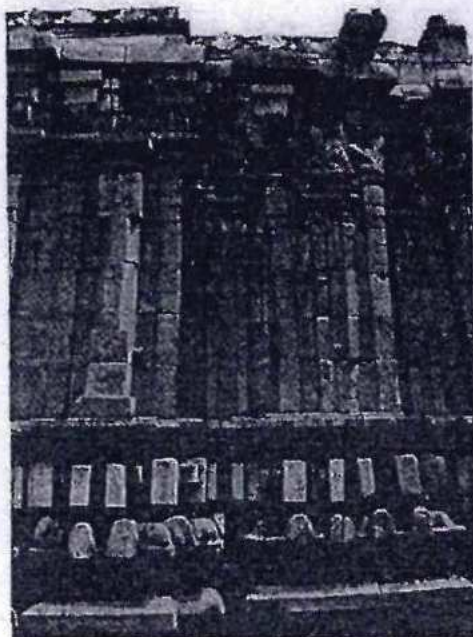
Iron dowels used for extra protection for stone blocks



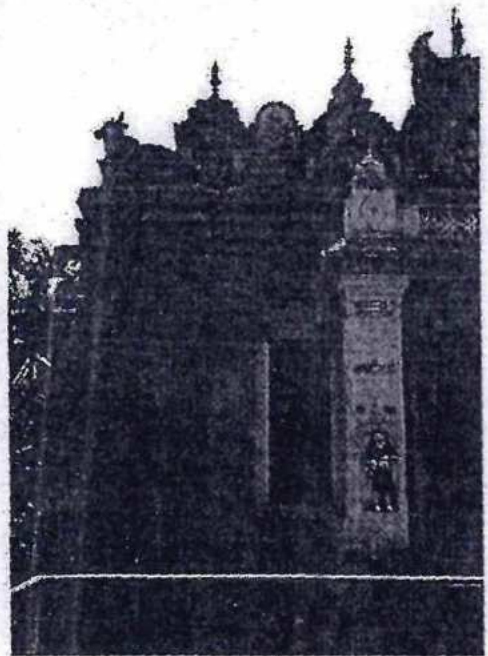
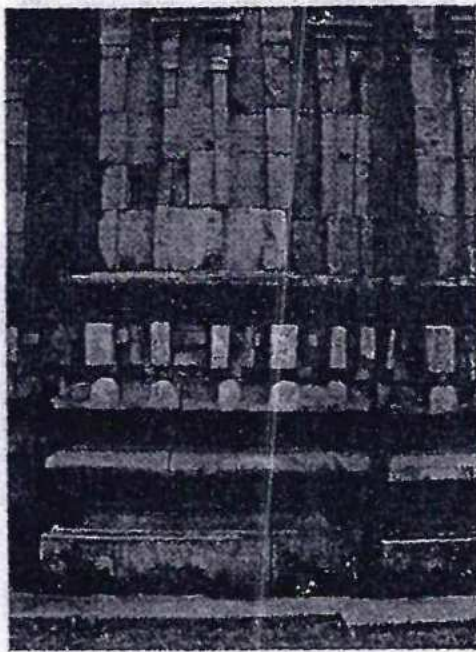
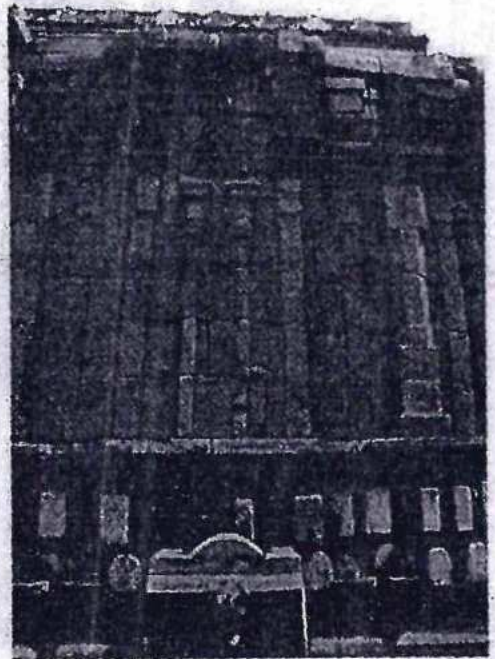
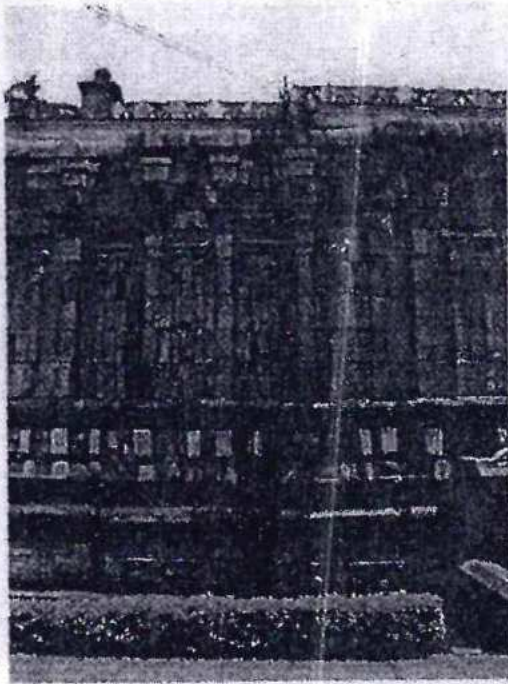
Back wall of the Karthikeya temple



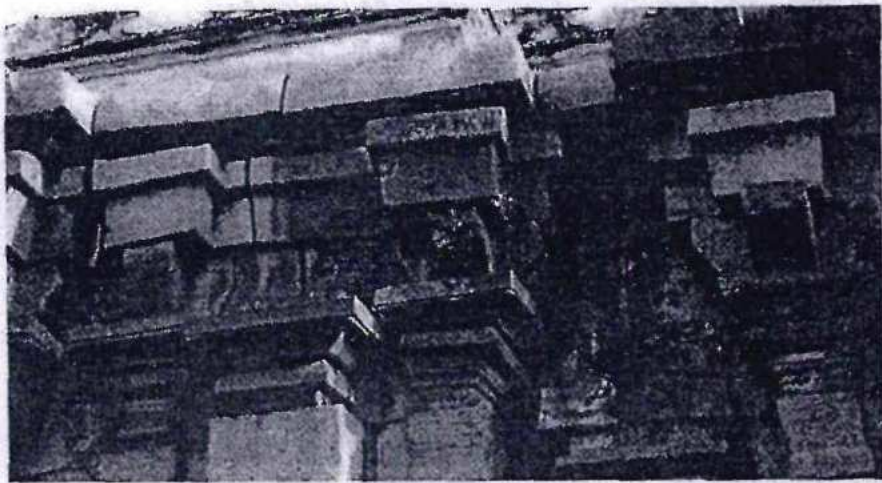
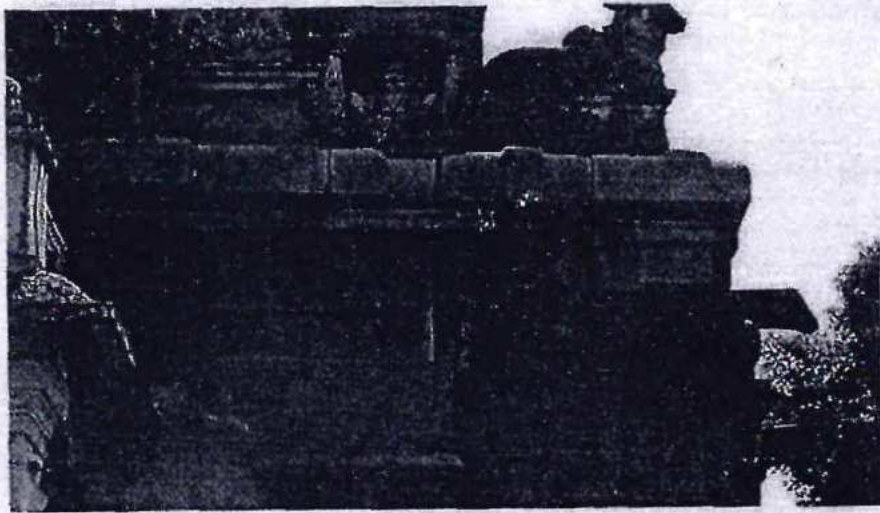
Dislodged architectural members – Wall portion of Karthikeya temple



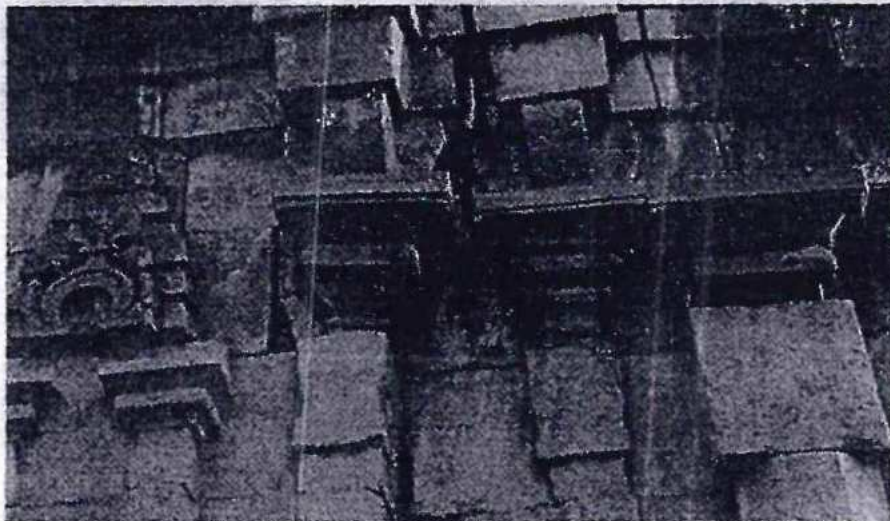
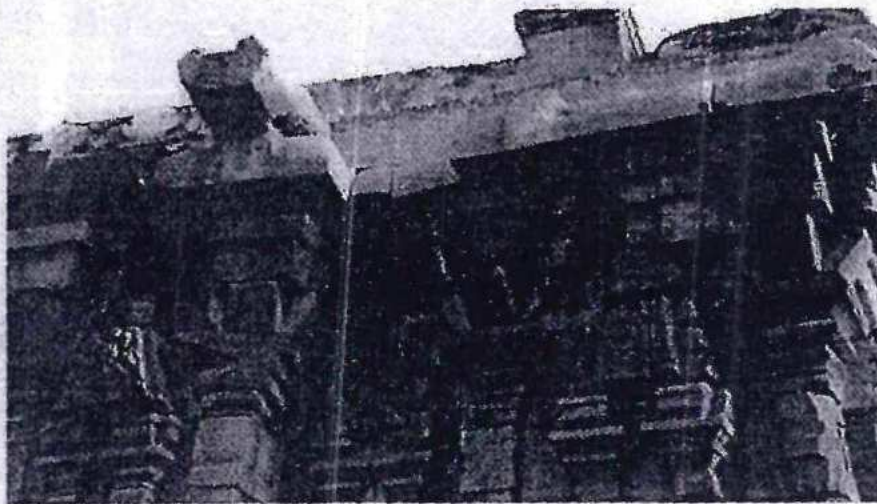
118



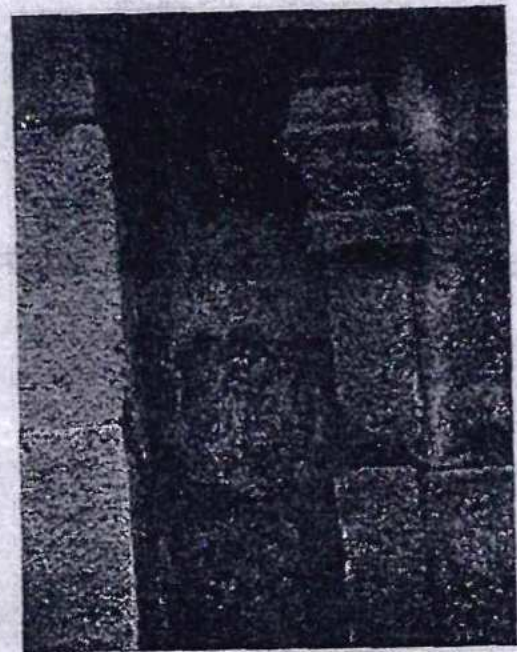
119



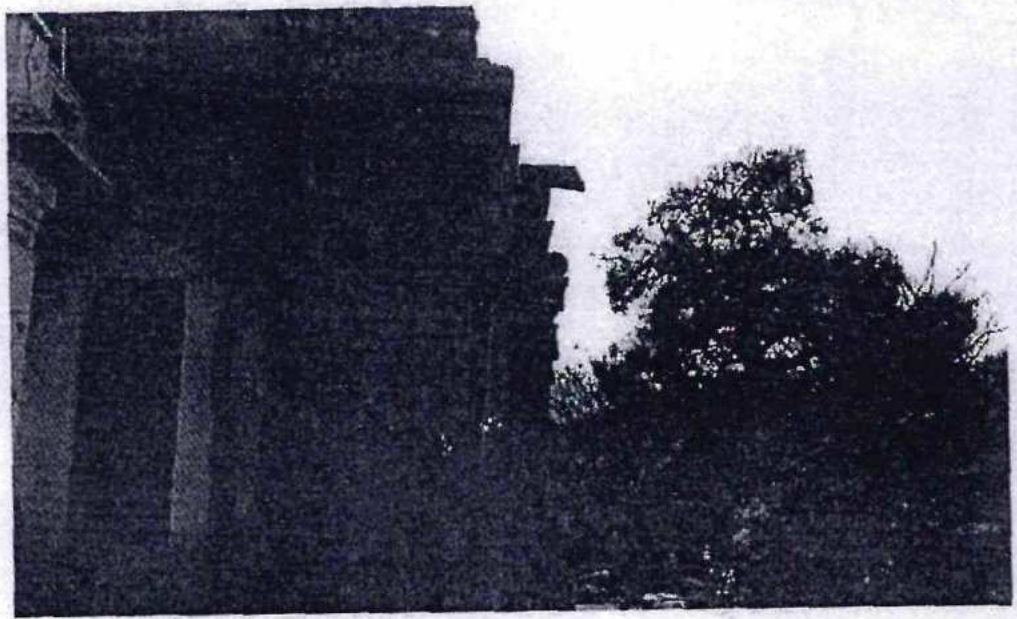
120



Closer view of the dislodged architectural members – Karthikeya temple

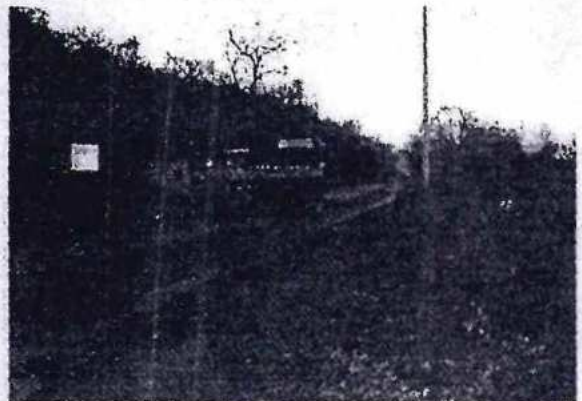
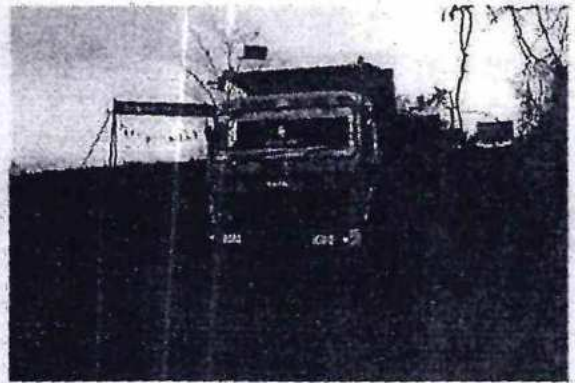
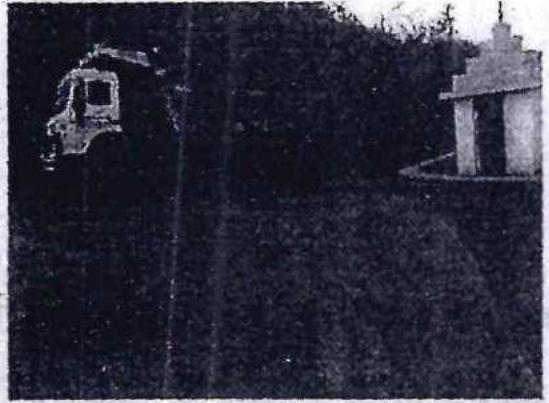
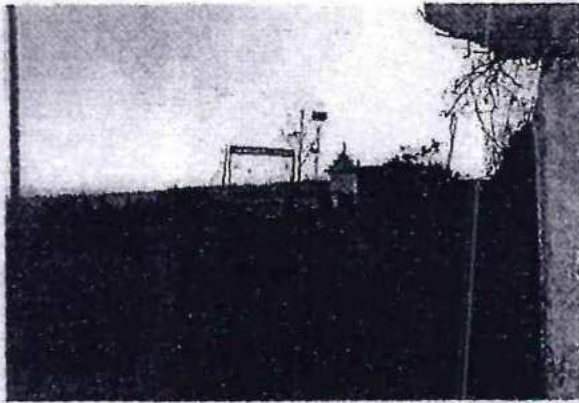


North side wall – out of plumb – Karthikeya temple



122

Heavy mobility of heavy vehicles of mining purpose- near the monument



By,

Ramesh S Mullmani
Superintending Archaeologist,
Regional Director (South),
Archaeological Survey of India.

Annexure R-6

PROCEEDINGS OF THE EXPERT COMMITTEE MEETING CONVENED THROUGH WEBEX BY THE REGIONAL DIRECTOR (SOUTHERN REGION), ASI, BANGALORE, ON 26TH MAY 2020 TO SUBMIT THE FINAL RECOMMENDATIONS ON THE FEASIBILITY OF BLASTING AND MINING OPERATIONS AROUND THE PARVATHI AND KARTHIKEYA TEMPLE, SANDUR, DIST. BALLARI, KARNATAKA

The following members were present in the Meeting:

Sl. No.	Name of the Officer	Designation
1	Dr. G Maheshwari	Regional Director (South) & Chairperson
2	Dr. H S Venkatesh	Director & Head of Blasting Department, National Institute of Rock Mechanics (NIRM), Bengaluru
3	Sh. T M Keshava	Retd. Superintending Archaeologist, ASI, Bengaluru
4	Sh. M Kalimuthu	Deputy Superintending Archaeologist, ASI, Hampi Mini-Circle, Kamalapur

The following members were not present:

Sl. No.	Name of the Officer	Designation
1	Sh. Umesh M Sawarkar	Director of Mines Safety, Ballari Region
2	Dr. R Gopal	Director of Archaeology, Museums & Heritage, Bengaluru

The Chairperson while welcoming the members once again briefed about the agenda of the meeting and the decision taken in the last meeting held on 12.03.2020 wherein the committee recommended permission of blasting operation on all the sides around Parvathi & Karthikeya Temple, Sandur, beyond 500-600 m. except between North and North-western regions wherein no decision could not be arrived at due to diverse opinions. The same decision of the committee was communicated to the Director General, ASI, New Delhi.

The Chairperson, while briefing about necessity of this meeting, highlighted about the earlier meeting convened on 06.05.2020, by the Chief Secretary, Govt. of Karnataka, wherein ASI was requested to take a decision in respect of the mining operations between North & Northwestern regions. The second meeting in this regard convened by the Secretary (Commerce & Industry), Govt. of Karnataka, on 19.05.2020, wherein ASI was requested to hasten the decision, was also highlighted upon. During the above said meeting the Director, Mines and Geology informed the Secretary (Commerce & Industry) that MML mines are already functioning in that area (north-north-west) hence ASI has to take appropriate decision.

RECOMMENDATIONS:

Accordingly, the committee after a thorough examination and deliberation decided to recommend the following decision of the members to the Director General, ASI, New Delhi:

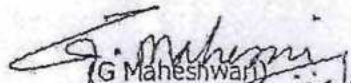
1. From the protected limits of Parvathi & Karthikeya Temple, Sandur, mining with blasting can be permitted as follows:

Sl. No.	Direction	Recommendation*
1	North-Northeast-East-Southeast	Can be permitted beyond 600m.
2	Southeast-South-Southwest-West-Northwest	Can be permitted beyond 500m.
3	Northwest-North	Can be permitted beyond 500 m. from the protected boundary of Parvathi & Karthikeya Temple and radius of 300 m. from Harishankar Temple (small medieval period temple situated 1.49km from the Parvathi & Karthikeya temple)

[* - Google Imagery representation enclosed]

2. To ensure safety of the centrally protected monument, It is recommended that blast vibration monitoring be conducted at Parvathi and Karthikeya Temple complex and also regional micro-seismic monitoring of the mining blasts within about 30 sq.km. with the Parvathi and Karthikeya Temple as the center.

The Chairperson thanked the members for their participation.


(G Maheshwari)
Regional Director (South) 29/5/2

F.No. T-19042/1/2020-M
Government Of India
Archaeological Survey of India

"Dharamhar Bhawan"
24 Tilak Marg, New Delhi
Dated 28.12.2020

To,
The Secretary
Government of Karnataka
Commerce and Industries
(MSME and Mines)
Bengaluru

Subject:- Mining activity in the vicinity of Parvathi and Karthikeya Temples, Sandur,
District Bellari (Karnataka) ...reg.

Sir,

With reference to your letter No. E-CI 68 MMM 2019 dated 12.12.2019 on the subject cited above. I am directed to convey the approval of Hon'ble Minister on the report of Expert Committee on mining activities beyond 600 meter at all four sides of Parvathi and Karthikeya Temple subject to following conditions:-

1. All the orders of the Hon'ble High Court of Karnataka and Hon'ble Supreme Court shall be strictly adhered to.
2. All the clearances from all relevant agencies may be obtained.
3. Vibration and dust settlement on the centrally protected monuments may be continuously monitored by appropriate agency at no cost of ASI. However, no device shall be permanently fixed on the walls of the monument. The data may be shared with ASI on monthly basis.
4. Regional Director (South) shall personally monitor vibration level
5. If any Archaeological Remains noticed during mining activities shall be reported to the State Government and Archaeological Survey of India.
6. Superintending Archaeologist, Hampi shall ensure that Archaeological Remains, if any, found during the mining activities are documented properly.

This issue with the approval of the Competent Authority.

Yours faithfully


(Arvin Manjul)
Director (Monuments)



Annexure R-8 126

ARCHAEOLOGICAL SURVEY OF INDIA

भारत सरकार
संस्कृति मंत्रालय
भारतीय पुरातत्व सर्वेक्षण
क्षेत्रीय निदेशक का कार्यालय (दक्षिण)
बैंगलूरु




GOVERNMENT OF INDIA
Ministry of Culture
Archaeological Survey of India
REGIONAL DIRECTORATE
(SOUTHERN REGION)
Bangalore

No.5/53/2022-23/RD(S)-816

Dated: 3.2.2023

Office Order

In connection with WP. No 25173/2022, Parvathi and Karthikeya Temple, Sandur, before the Hon'ble High Court of Karnataka, Bangalore, Shri I.V.M Sarma, Surveyor Officer of this office and Shri MG Murali Mohan, Surveyor Gr. I, O/o the Superintending Archaeologist, Bangalore Circle are hereby deputed to Hampi Circle to take up the survey work within radius of 600 metres around the Centrally Protected Monument of Parvathi and Karthikeya Temple, Sandur, Dist. Ballary, immediately to ascertain the encroachments and mining activities, if any, within the said area and to submit the report accordingly supported with necessary site maps and drawings.


(G. Maheshwari)
Regional Director (South) 03/2/23

To

- (1) Shri I.V.M Sarma, Surveyor Officer, O/o the Regional Director (South), ASI, Bengaluru
- (2) Shri MG Murali Mohan, Surveyor Gr. I, ASI, Bangalore Circle – through the SA, ASI Bangalore Circle, Bengaluru, with a request to depute Shri MG Murali Mohan to Hampi Circle immediately

Copy to

The SA, ASI, Hampi Circle for information and immediate necessary action.

राजाजिनगर इंडस्ट्रियल इस्टेट, बैंगलूरु - ५६००१०

KSIMC Building, Industrial Estate, Rajajinagar, Bangalore - 560010

☎ 080-23409598, 23409597 (w)

✉ rdsouth.asi@gmail.com

🌐 www.asi.nic.in

127

BLASTING & MINING OPERATION AROUND THE PARVATHI & KARTHIKEYA TEMPLE, SANDUR, BELLARY DIST, KARNATAKA - GOOGLE IMAGERY REPRESENTING THE RECOMMENDATION OF THE COMMITTEE. (26.05.2020.)



BLASTING & MINING OPERATION AROUND THE PARVATHI & KARTHIKEYA TEMPLE, SANDJUR, BELLARY DIST., KARNATAKA - GOOGLE IMAGERY REPRESENTING THE RECOMMENDATION OF THE COMMITTEE. (26.05.2020.)



10/10/10

**BEFORE THE NATIONAL
GREEN TRIBUNAL
SOUTHERN ZONE AT
CHENNAI
O.A No. 270 of 2024**

Tribunal On Its Own Motion
Suo Moto

.... Applicants

-Vs-

Central Pollution Control
Board & 4 Ors

.....Respondents

**COUNTER AFFIDAVIT
ALONG WITH ANNEXURES**

R. RAJESH VIVEKANANTHAN
DEPUTY SOLICITOR GENERAL
OF INDIA
ADVOCATE.NO.1304/1998
MADRAS HIGH COURT (PB),
CHENNAI – 600 001.
CONTACT NO. 98402 60631.
**COUNSEL FOR 5TH
RESPONDENT**