JK Cement Works, Nimbahera
A unit of JK Cement Ltd.
CIN: L17229UP1994PLC017199
Kailash Nagar - 312617, Nimbahera Distt., Chittorgarh (Raj.) INDIA
+91-1477-220098, 220087 jkc.nbh@jkcement.com
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Through E-Mail

NBH/PC-14/C11/ **Date: 09.11.2023**

To,
The Director (M),
Ministry of Environment, Forest & Climate Change,
Indira Paryavaran Bhawan, JOR Bagh Road, Aliganj,
New Delhi-110003

Sub: Submission of Half yearly EC compliance report (April 23 to September 23) for Nayagaon & Chenpura Limestone Deposit (ML Area: 206.354 ha) proposed Production Capacity 2.502 Million TPA ROM (Cement Grade Limestone: 0.876 Million TPA & Subgrade Limestone: 1.626 Million TPA), Soil/Alluvium: 0.048 Million TPA, Waste: 0.5 Million TPA; Total Excavation: 3.05 Million TPA along with 2 x 500 TPH Capacity of Crusher with Screening by **J K Cement Ltd, Kanpur (J. K. Cement Works, Nimbahera, Kailash Nagar, District Chittorgarh, Rajasthan-312617)**

Ref: EC letter no. - IA-J-11015/7/2021-IA-II(M) Dated 22/04/2022

Dear Sir,
Kindly refer to the above subject matter and refer to above EC letter no., please find attached herewith compliance of EC for the period of **April 2023 to September 2023**. As per MoEF & CC notification no. S.O. 5845 (E) 26.11.2018 the soft copy of same has been sent through email to tg035.ifs@nic.in , moef@nic.in, ccb.cpcb@nic.in, , cpcb.bhopal@gov.in, monitoring-ec@nic.in , ms-mppcb@mp.gov.in.

We hope that compliance is in order.
Thanking you.
Yours Faithfully
For, Nayagaon-Chenpura Limestone Deposit,
J. K. Cement Limited

R. B. M Tripathi
President (Operations)

Encl: as above

Copy to:

1. The Deputy Director General of Forests (DDGF), Ministry of Environment, Forest and Climate Change, Integrated Regional Office, E-5, Kendriya Paryavaran Bhawan, E-5 Arera Colony, Link Road-3, Ravishankar Nagar, **Bhopal – 462016**
2. The Regional Director Central Pollution Control Board, Paryavaran Parisar, E-5, Arera colony, **Bhopal (M.P) 462016**
3. The Chairman, Central Pollution Control Board, Parivesh Bhawan, CBD-CUM office complex, East Arjun Nagar, **New Delhi 110032.**
4. The Member Secretary, Madhya Pradesh Pollution Control Board, E-5, Arera Colony, Paryavaran Parisar, **Bhopal - 462 016**

Form for Uploading Six Monthly Compliance Report			
Proposal Details			
Proposal No.	**IA/MP/MIN/193710/2021**	**Project Name**	Nayagaon & Chenpura Limestone Deposit (ML Area: 206.354 ha) proposed Production Capacity 2.502 Million TPA ROM (Cement Grade Limestone: 0.876 Million TPA & Subgrade Limestone: 1.626 Million TPA), Soil/Alluvium: 0.048 Million TPA, Waste: 0.5 Million TPA; Total Excavation: 3.05 Million TPA along with 2 x 500 TPH Capacity of Crusher with Screening
Category	**A**	**MoEF File No.**	IA-J-11015/7/2021-IA-II(M) Dated 22/04/2022
Name of the Entity / Corporate Office*	**J K Cement Ltd, Kanpur (J.K. Cement Works, Nimbahera, Kailash Nagar, District Chittorgarh, Rajasthan-312617)**		
Entity's PAN*	**AABCJ0355R**		
Entity Name as per PAN	**J K CEMENT LIMITED.**		
Compliance Letter/Report			
Reporting Year*	2023	**Reporting Period***	April-2023 to September-2023
Remarks (if any)	Submitting herewith the Six-Monthly EC Compliance Report for the period: April-2023 to September-2023 for Nayagaon & Chenpura Limestone Deposit (ML Area: 206.354 ha) proposed Production Capacity 2.502 Million TPA ROM (Cement Grade Limestone: 0.876 Million TPA & Subgrade Limestone: 1.626 Million TPA), Soil/Alluvium: 0.048 Million TPA, Waste: 0.5 Million TPA; Total Excavation: 3.05 Million TPA along with 2 x 500 TPH Capacity of Crusher with Screening		
Details of Production and Project Area			
Date of Commencement of Project /Activity:*	Mining activities not yet commissioned	**Project Area as Per EC Granted (In Case of Mine Lease):***	206.335 ha.
Actual Project Area(In Case of Mine Lease):*			
PRODUCTION CAPACITY			
Name of the Product*	**Units***	**As per EC granted***	**Production during last financial year***
Cement Grade Limestone	Million TPA	0.876	Project not yet commissioned
Subgrade Limestone	Million TPA	1.626	Project not yet commissioned
Soil/Alluvium	Million TPA	0.048	Project not yet commissioned
Waste	Million TPA	0.5	Project not yet commissioned
Total Excavation	**Million TPA**	**3.05**	Project not yet commissioned

Nayagaon - Chenpura Limestone Deposit **J. K. Cement Limited, J. K. Cement Works, Kailash Nagar, Nimbahera, Chittorgarh, Rajasthan-312617** **EC Compliance Report Period April-2023 to September-2023**				
Nayagaon & Chenpura Limestone Deposit (ML area: 206.354 ha) proposed production capacity 2.502 Million TPA ROM (Cement Grade Limestone: 0.876 Million TPA & Subgrade Limestone: 1.626 Million TPA), Soil/Alluvium: 0.048 Million TPA, Waste: 0.5 Million TPA; Total Excavation: 3.05 Million TPA along with 2 x 500 TPH capacity of Crusher with Screening.				
Environment Clearance vide No.: F. No. IA-J-11015/7/2021-IA-II (M) dated 26th August, 2021				
A.	**SPECIFIC CONDITION: -**			
Sr. No.	**Condition Type**	**Condition Details**	**Self Declaration**	**Remarks / Reason**
i.	Statutory compliance	Environment Clearance will be functional only after obtaining No-objection Certificate (NoC) from Railway Board and no production and dispatch will be carried out without obtaining NoC from Railway Board. A copy of the NoC must be submitted to the Ministry, Integrated Regional Office and Madhya Pradesh Pollution Control Board. The conditions/preventive measures prescribed by the Railway Board, if any shall be compiled by the Project Proponent and implementation status should be submitted to the IRO & Railway Board.	Complied	Department of Railways has given permission for mining up to 150 m vide letter No.: W 340/22 dated 28th March 2021, copy of same enclosed in **Annexure-1.**
ii.	Miscellaneous	The Project Proponent shall ensure that no mining activity will be carried out within the distance of 300 m from the **railway boundary**. The pit embankment along the direction of railway should be strengthened using cement mortar or other measures to avoid any danger to railway line. For working beyond 300 m of the **railway boundary** all the precautionary measures for fly rock as mentioned in the section 4.2 of the scientific study report of CIMFR, Dhanbad should be followed.	Complied	Department of Railways has given permission for mining up to 150 m vide letter No.: W 340/22 dated 28th March 2021.
iii.	Miscellaneous	Scientific study carried out by CIMFR for assessment of blasting report shall be sent to Integrated Regional Office for further necessary action.	Complied	A Scientific Study from CIMFR has been carried out and a report has been submitted to IRO office. Copy enclosed as **Annexure-02.**

iv.	Miscellaneous	No mining activity will be allowed to undertake within a distance of 740 m from Gandhi colony and 350 m from Chenpura village.	Yet to be complied	Mining activities yet not started. Mining activity will be carried out as per approved mining plan.
v.	Statutory compliance	The Project Proponent shall strictly follow the mitigation measures provided in MoEFCC's Office Memorandum No. Z-11013/57/2014-IA.II (M) dated 29th October, 2014.	Yet to be complied	MIning activities yet not started. The company will assures that the mitigation measures provided in MoEFCC's Office Memorandum No.: Z-11013/57/2014-IA. II (M), dated 29th October, 2014, titled "Impact of mining activities on Habitations-Issues related to the mining Projects wherein Habitations and villages are the part of mine lease areas or Habitations and villages are surrounded by the mine lease area" will be followed by the company.
vi.	Miscellaneous	The Project Proponent shall carry out the scientific study on slope stability within first 5 years of mining and the report shall be submitted to the Ministry for further review and appraisal. This will be the requisite document for mining after 5 years.	Yet to be complied	Mining activities yet not started.
vii.	Miscellaneous	The Project Proponent shall submit the progress report on the Environmental Management Plan to the Integrated Regional Office every year.	Yet to be complied	Mining activities yet not started. Progress report on the EMP will be submitted to the IRO every year, after operation started.
viii.	Air Quality Monitoring and Preservation	The Project Proponent should collect six monthly data on ambient air quality, noise and ground vibration by installing adequate no. of monitoring station during blasting at the edge of the mine, near the village and railway line and such collected data should be submitted to IRO during EC Compliance monitoring.	Yet to be complied	Mining activities yet not started.
ix.	Miscellaneous	The Project Proponent shall locate the crusher in the western direction at a distance of 590 m distance from railway track as committed by PP during the presentation.	Yet to be complied	The crusher is not yet installed.
x.	Public Hearing	The budget of Rs. 2.67 Crores to address the concerns raised by the public including in the public hearing to be completed within 3 years from the date of start of mining operations. PP shall comply with all action plans made for public hearing concerns	Yet to be complied	Mining activities yet not started.

		and make regular maintenance and record the progressive activity outcomes.		
xi.	Greenbelt	The Project Proponent shall carry out the plantation with the survival rate of not less than 90% by planting 10 ft seedlings. Causalities should be replaced with new saplings every year and be counted separately other that the total proposed saplings. The data for such saplings should be furnished during six monthly compliance reports along with the progressive plantation. PP shall undertake the progressive bench plantation up to HFL for eco restoration of water bodies.	Complying with	In FY 2023-24, a total of 3500 sapling planted in 1.7 ha. The photographs are enclosed as Annexure-3.
xii.	Miscellaneous	The Project Proponent shall also organize an employment-based apprenticeship/ internship training program every year with appropriate stipend for the youth and other programs to enhance the skill of the local people. The data should be maintained for the training imparted to the persons and the outcome of the training, for the assessment of the training program should be analyzed periodically and improved accordingly.	Yet to be complied	Mining activities yet not started. Employment-based apprenticeship/ internship training program will be organized, after started the project activities under CSR activities.
xiii.	Miscellaneous	The Project Proponent should implement the Rehabilitation of project affected families (PAFs) and payment of compensation to PAFs as per the policy and guidelines of the Central/State Government, as provided under the law.	Complied	At present, there is no plan for the rehabilitation.
xiv.	Statutory compliance	The conservation plan in consultation with Forest Department shall be implemented and compliance of the same shall be submitted to IRO of MoEF&CC before 1st July of every year.	Complied	WLCP plan has been submitted to DFO Neemuch. After approval of conservation plan work activities will be started.
xv.	Miscellaneous	The Project Proponent should install suitable water softening plant and ensure the availability of adequate drinking water throughout the year for mine workers and their family as well as residents of Nayagaon & Chenpura Village.	Yet to be complied	Mining activities yet not started. Portable & drinking water facility will be provided to the society under CSR activity.
xvi.	Miscellaneous	PP should also explore the possibility of using water body surface area for installing floating solar panels to generate solar power and supply to the villages.	Yet to be complied	Once mine pit develop then feasibility study will be done for solar panel installation on pit surface water.
xvii.	Miscellaneous	The Project Proponent should explore the possibility for shifting to clean energy using electric equipment for cleaner	Yet to be complied	Mining activities yet not started. Possibilities will be explored.

		production options to reduce the emission generated from various machinery.		
xviii.	Human Health Environment	Regular surveillance on Silicosis shall be carried through regular occupational health check-up of 1/3 of the persons every year.	Yet to be complied	Regular surveillance on Silicosis will be carried through regular occupational health check-up, after started the mining activities.
B.	**STANDARD EC CONDITIONS:**			
I.	**Statutory compliance**			
1)	Statutory compliance	This Environmental Clearances (EC) is subject to orders / judgement of Hon'ble Supreme Court of India, Hon'ble High Court, Hon'ble NGT and any other Court of Law, Common Cause Conditions as may be applicable.	Complied	Agreed and noted for compliance.
2)	Statutory compliance	The Project proponent complies with all the statutory requirements and judgement of Hon'ble Supreme Court dated 2nd August 2017 in Writ Petition (Civil) No. 114 of 2014 in matter of Common Cause versus Union of India & Ors before commencing the mining operations.	Complied	This is a greenfield project.
3)	Statutory compliance	The State Government concerned shall ensure that mining operation shall not be commenced till the entire compensation levied, if any, for illegal mining paid by the Project Proponent through their respective Department of Mining & Geology in strict compliance of Judgment of Hon'ble Supreme Court dated 2nd August 2017 in Writ Petition (Civil) No. 114 of 2014 in matter of Common Cause versus Union of India & Ors.	Complied	This is a greenfield project.
4)	Statutory compliance	The Project Proponent shall follow the mitigation measures provided in MoEFCC's Office Memorandum No. Z-11013/57/2014-IA.II (M), dated 29th October, 2014, titled "Impact of mining activities on Habitations-Issues related to the mining Projects wherein Habitations and Villages are the part of mine lease areas or Habitations and villages are surrounded by the mine lease area."	Complying with	Unit has taken the following measures to reduces the impact of mining activities on habitations: - 1. Garland drain constructed, 2. Siltation pond facilitated, 3. Regular water spray on haul road is being done, 4. Company owns road used for limestone transportation, and

				5. Carried out dense plantation, under progress.
5)	Statutory compliance	A copy of EC letter will be marked to concerned Panchayat / local NGO etc. if any, from whom suggestion / representation has been received while processing the proposal.	Complied	EC letter has been submitted to concerned Panchayat vide letter No.: NBH/Nayagaon/ Mine/EC/c dt. 23.04.2022 and copy of the same already send on 09.05.2022.
6)	Statutory compliance	State Pollution Control Board / Committee shall be responsible for display of this EC letter at its Regional Office, District Industries Centre and Collector's office / Tehsildar's Office for 30 days.	Complied	Agreed & noted.
7)	Statutory compliance	The Project Authorities should widely advertise about the grant of this EC letter by printing the same in at least two local newspapers, one of which shall be in vernacular language of the concerned area. The advertisement shall be done within 7 days of the issue of the clearance letter mentioning that the instant project has been accorded EC and copy of the EC letter is available with the State Pollution Control Board/Committee and website of the Ministry of Environment, Forest and Climate Change (www.parivesh.nic.in). A copy of the advertisement may be forwarded to the concerned MoEFCC Regional Office for compliance and record.	Complied	The advertisement about the grant of EC letter for the project has been published in two local newspapers namely Dainik Bhaskar and Time of India dated 24th April 2022 and 28th April, 2022 and copy of the same already send on 09.05.2022.
8)	Statutory compliance	The Project Proponent shall inform the MoEF&CC for any change in ownership of the mining lease. In case there is any change in ownership or mining lease is transferred. PP needs to apply for transfer of EC as per provisions of the para 11 of EIA Notification, 2006 as amended from time to time.	Complied	Agreed and shall be complied if applicable in future.
II.	**Air quality monitoring and preservation**			
9)	Air Quality Monitoring and Preservation	The Project Proponent shall install a minimum of 3 (three) online Ambient Air Quality Monitoring Stations with 1 (one) in upwind and 2 (two) in downwind direction based on long term climatological data about wind direction such that an angle of 120° is made between the monitoring locations to monitor critical parameters, relevant for mining operations, of air pollution viz. PM10, PM2.5, NO2, CO and SO2 etc. as per the methodology mentioned in NAAQS Notification No. B-	Yet to be complied	CAAQMS ordering is under progress.

		29016/20/90/PCI/I dated 18.11.2009 covering the aspects of transportation and use of heavy machinery in the impact zone. The ambient air quality shall also be monitored at prominent places like office building, canteen etc. as per the site condition to ascertain the exposure characteristics at specific places. The above data shall be digitally displayed within 03 months in front of the main Gate of the mine site.		
10)	Air Quality Monitoring and Preservation	Effective safeguard measures for prevention of dust generation and subsequent suppression (like regular water sprinkling, metalled road construction etc.) shall be carried out in areas prone to air pollution wherein high levels of PM10 and PM2.5 are evident such as haul road, loading and unloading point and transfer points. The Fugitive dust emissions from all sources shall be regularly controlled by installation of required equipment's/ machineries and preventive maintenance. Use of suitable water-soluble chemical dust suppressing agents may be explored for better effectiveness of dust control system. It shall be ensured that air pollution level conform to the standards prescribed by the MoEFCC/ Central Pollution Control Board	Yet to be complied	Noted, once mining will be started measure to be taken to control the dust.
III.	**Water quality monitoring and preservation**			
11)	Water Quality Monitoring and Preservation	In case, immediate mining scheme envisages intersection of ground water table, then Environmental Clearance shall become operational only after receiving formal clearance from CGWA. In case, mining operation involves intersection of ground water table at a later stage, then PP shall ensure that prior approval from CGWA and MoEFCC is in place before such mining operations. The permission for intersection of ground water table shall essentially be based on detailed hydro-geological study of the area	Complied	CGWA - NOC has already been obtained vide No.: CGWA/NOC/MIN/ORIG/2021/11940 dated 21/02/2021, for the validity extension letter submitted to CGWA. Mining activities is not yet started.
12)	Water Quality Monitoring and Preservation	Project Proponent shall regularly monitor and maintain records w.r.t. ground water level and quality in and around the mine lease by establishing a network of existing wells as well as new piezo-meter installations during the mining operation in consultation with Central Ground Water Authority/ State Ground Water Department. The Report on changes in Ground water level and quality shall be submitted on six-monthly basis	Yet to be complied	Mining activities not yet started.

		to the Regional Office of the Ministry, CGWA and State Groundwater Department / State Pollution Control Board.		
13)	Water Quality Monitoring and Preservation	The Project Proponent shall undertake regular monitoring of natural water course/ water resources/ springs and perennial nallahs existing/ flowing in and around the mine lease including upstream and downstream. A sufficient number of gullies shall be provided at appropriate places within the lease for management of water. The parameters to be monitored shall include their water quality vis-à-vis suitability for usage as per CPCB criteria and flow rate. It shall be ensured that no obstruction and/ or alteration be made to water bodies during mining operations without justification and prior approval of MoEFCC. The monitoring of water courses/ bodies existing in lease area shall be carried out four times in a year viz. pre- monsoon (April-May), monsoon (August), post-monsoon (November) and winter (January) and the record of monitored data may be sent regularly to Ministry of Environment, Forest and Climate Change and its Regional Office, Central Ground Water Authority and Regional Director, Central Ground Water Board, State Pollution Control Board and Central Pollution Control Board. Clearly showing the trend analysis on six-monthly basis.	Complied	There is no water course flowing nearby mine site.
14)	Water Quality Monitoring and Preservation	Quality of polluted water generated from mining operations which include Chemical Oxygen Demand (COD) in mines run-off; acid mine drainage and metal contamination in runoff shall be monitored along with Total Suspended Solids (TDS), Dissolved Oxygen (DO), pH and Total Suspended Solids (TSS). The monitored data shall be uploaded on the website of the company as well as displayed at the project site in public domain, on a display board, at a suitable location near the main gate of the Company. The circular No. "- 20012/1/2006-IA.11 (M) dated 27.05.2009 issued by Ministry of Environment, Forest and Climate Change may also be referred in this regard.	Complying with	Mining activities not yet started.
15)	Water Quality Monitoring and Preservation	Project Proponent shall plan, develop and implement rainwater harvesting measures on long term basis to augment ground water resources in the area in consultation with Central Ground Water Board/ State Groundwater	Yet to be complied	Feasibility to be explored.

		Department. A report on amount of water recharged needs to be submitted to Regional Office MoEFCC annually.		
16)	Water Quality Monitoring and Preservation	Industrial wastewater (workshop and wastewater from the mine) should be properly collected and treated so as to conform to the notified standards prescribed from time to time. The standards shall be prescribed through Consent to Operate (CTO) issued by concerned State Pollution Control Board (SPCB). The workshop effluent shall be treated after its initial passage through Oil and grease trap.	Yet to be complied	Mining activities not yet started.
17)	Water Quality Monitoring and Preservation	The water balance/water auditing shall be carried out and measure for reducing the consumption of water shall be taken up and reported to the Regional Office of the MoEF&CC and State Pollution Control Board / Committee.	Complied	Agreed and water balancing will be carried due course to time.
IV.	**Noise and vibration monitoring and prevention**			
18)	Noise and vibration monitoring and prevention	The peak particle velocity at 500m distance or within the nearest habitation, whichever is closer shall be monitored periodically as per applicable DGMS guidelines	Yet to be complied	Mining activities not yet started.
19)	Noise and vibration monitoring and prevention	The illumination and sound at night at project sites disturb the villages in respect of both human and animal population. Consequent sleeping disorders and stress may affect the health in the villages located close to mining operations. Habitations have a right for darkness and minimal noise levels at night. PPs must ensure that the biological clock of the villages is not disturbed; by orienting the floodlights/ masks away from the villagers and keeping the noise levels well within the prescribed limits for day /night hours	Yet to be complied	Mining activities not yet started.
20)	Noise and vibration monitoring and prevention	The Project Proponent shall take measures for control of noise levels below 85 dBA in the work environment. The workers engaged in operations of HEMM, etc. should be provided with ear plugs /muffs. All personnel, including laborers working in dusty areas shall be provided with protective respiratory devices along with adequate training, awareness and information on safety and health aspects. The PP shall be held responsible in case it has been found that workers/ personals/ laborers are working without personal protective equipment.	Yet to be complied	Mining activities not yet started.

V.	**Mining Plan**			
21)	Miscellaneous	The Project Proponent shall adhere to approved mining plan, inter alia, including, total excavation (quantum of mineral, waste, over burden, inter burden and top soil etc.); mining technology; lease area; scope of working (method of mining, overburden & dump management, O.B. & dump mining, mineral transportation mode, ultimate depth of mining, concurrent reclamation and reclamation at mine closure; land-use of the mine lease area at various stages of mining scheme as well as at the end-of-life; etc.).	Complied with	Mining activities will be carried out as per approved mining plan.
22)	Miscellaneous	The land use of the mine lease area at various stages of mining scheme as well as at the end-of-life shall be governed as per the approved Mining Plan. The excavation vis-a-vis backfilling in the mine lease area and corresponding afforestation to be raised in the reclaimed area shall be governed as per the approved mining plan. PP shall ensure the monitoring and management of rehabilitated areas until the vegetation becomes self-sustaining. The compliance status shall be submitted half-yearly to the MoEFCC and its concerned Regional Office.	Complying with	The company assures that the mining operation will be executed strictly as per approved mining plan.
VI.	**Land Reclamation**			
23)	Miscellaneous	The Overburden (O.B.), waste and topsoil generated during the mining operations shall be stacked at earmarked OB dump site(s) only and it should not be kept active for a long period of time. The physical parameters of the OB / Waste dumps/ Topsoil dump like height, width and angle of slope shall be governed as per the approved Mining Plan and the guidelines/circulars issued by D.G.M.S. The topsoil shall be used for land reclamation and plantation.	Yet to be complied	Mining activities have not yet started. To be complied in accordance with approved mining plan.
24)	Miscellaneous	The slope of dumps shall be vegetated in a scientific manner with suitable native species to maintain the slope stability, prevent erosion and surface run off. The selection of local species regulates local climatic parameters and helps in adaptation of plant species to the microclimate. The gullies formed on slopes should be adequately taken care of as it impacts the overall stability of dumps. The dump mass should	Yet to be complied	Mining activities not yet started.

		be consolidated with the help of dozer/ compactors thereby ensuring proper filling/ leveling of dump mass. In critical areas, use of geo textiles/ geo-membranes / clay liners / Bentonite etc. shall be undertaken for stabilization of the dump.		
25)	Miscellaneous	Catch drains, settling tanks and siltation ponds of appropriate size shall be constructed around the mine working, mineral yards and Topsoil/OB/ Waste dumps to prevent run off of water and flow of sediments directly into the water bodies (Nallah/ River/Pond etc.). The collected water should be utilized for watering the mine area, roads, green belt development, plantation etc. The drains/ sedimentation sumps etc. shall be de-silted regularly, particularly after monsoon season, and maintained properly	Complied	Settling tank and garland rain constructed.
26)	Miscellaneous	Check dams of appropriate size, gradient and length shall be constructed around mine pit and OB dumps to prevent storm run-off and sediment flow into adjoining water bodies. A safety margin of 50% shall be kept for designing of sump structures over and above peak rainfall (based on 50 years data) and maximum discharge in the mine and its adjoining area which shall also help in providing adequate retention time period thereby allowing proper settling of sediments/silt material. The sedimentation pits/ sumps shall be constructed at the corners of the garland drains.	Yet to be complied	Agreed and assured for the compliance as per the given direction.
VII.	**Transportation**			
27)	Miscellaneous	No Transportation of the minerals shall be allowed in case of roads passing through villages/ habitations. In such cases, PP shall construct a 'bypass' road for the purpose of transportation of the minerals leaving an adequate gap (say at least 200 meters) so that the adverse impact of sound and dust along with chances of accidents could be mitigated. All costs resulting from widening and strengthening of existing public road network shall be borne by the PP in consultation with nodal State Govt. Department. Transportation of minerals through road movement in case of existing village/ rural roads shall be allowed in consultation with nodal State Govt. Department only after required strengthening such that the carrying capacity of roads is increased to handle the traffic	Yet to be complied	Mining activities not yet started.

		load. The pollution due to transportation load on the environment will be effectively controlled and water sprinkling will also be done regularly. Vehicular emissions shall be kept under control and regularly monitored. Project should obtain Pollution Under Control (PUC) certificate for all the vehicles from authorized pollution testing centers. [If applicable in case of road transport]		
28)	Miscellaneous	The Main haulage road within the mine lease should be provided with a permanent water sprinkling arrangement for dust suppression. Other roads within the mine lease should be wetted regularly with tanker-mounted water sprinkling system. The other areas of dust generation like crushing zone, material transfer points, material yards etc. should invariably be provided with dust suppression arrangements. The air pollution control equipment's like bag filters, vacuum suction hoods, dry fogging system etc. shall be installed at Crushers, belt-conveyors and other areas prone to air pollution. The belt conveyor should be fully covered to avoid generation of dust while transportation. PP shall take necessary measures to avoid generation of fugitive dust emission.	Yet to be complied	Mining activities not yet started.
VIII.	**Green Belt**			
29)	Greenbelt	The Project Proponent shall develop greenbelt in 7.5m wide safety zone all along the mine lease boundary as per the guidelines of CPCB in order to arrest pollution emanating from mining operations within the lease. The whole green belt shall be developed within the first 5 years starting from the windward side of the active mining area. The development of greenbelt shall be governed as per the EC granted by the Ministry irrespective of the stipulation made in approved mine plan.	Complying with	In FY 2023-24, a total of 3500 sapling planted in 1.7 ha.
30)	Greenbelt	The Project Proponent shall carryout plantation/ afforestation in backfilled and reclaimed area of mining lease, around water body, along the roadsides, in community areas etc. by planting the native species in consultation with the State Forest Department/ Agriculture Department/ Rural development department/ Tribal Welfare Department/ Gram Panchayat such that only those species be selected which are of use to	Complying with	In FY 2023-24, a total of 3500 sapling planted in 1.7 ha.

		the local people. The CPCB guidelines in this respect shall also be adhered. The density of the trees should be around 2500 saplings per Hectare. Adequate budgetary provision shall be made for protection and care of trees		
31)	Greenbelt	The Project Proponent shall make necessary alternative arrangements for livestock feed by developing grazing land with a view to compensate those areas which are coming within the mine lease. The development of such grazing land shall be done in consultation with the State Government. In this regard, Project Proponent should essentially implement the directions of the Hon'ble Supreme Court with regard to acquisition of grazing land. The sparse trees on such grazing ground, which provide mid-day shelter from the scorching sun, should be scrupulously guarded/ protected against felling and plantation of such trees should be promoted	Complied	At present there is no grazing acquired for mining activities.
IX.	**Public hearing and human health issues**			
32)	Public hearing and human health issues	Project Proponent shall make provision for the housing for workers/labors or shall construct labor camps within/outside (company owned land) with necessary basic infrastructure/ facilities like fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, crèche for kids etc. The housing may be provided in the form of temporary structures which can be removed after the completion of the project-related infrastructure. The domestic wastewater should be treated with STP in order to avoid contamination of underground water.	Complied	There is no proposal for any residential facility at site, most of workmen are from nearby villages or employee living in JK Cement colony at Nimbahera.
X.	**Corporate Environment Responsibility (CER)**			
33)	Corporate Environment Responsibility (CER)	The Project proponent shall submit the time-bound action plan to the concerned regional office of the Ministry within 6 months from date of issuance of environmental clearance for undertaking the activities committed during public consultation by the project proponent and as discussed by the EAC, in terms of the provisions of MoEF&CC Office Memorandum No. 22-65/2017-IA.III dated 30 September 2020. The action plan shall be implemented within three years of commencement of project.	Complying with	We have started CSR activities in nearby villages.

XI.	**Miscellaneous**			
34)	Miscellaneous	The Project Proponent shall prepare digital map (land use & land cover) of the entire lease area once in five years purpose of monitoring land use pattern and submit a report to concerned Regional Office of the MoEF&CC.	Yet to be complied	Mining activities not yet started.
35)	Miscellaneous	The Project Authorities should inform to the Regional Office regarding date of financial closures and final approval of the project by the concerned authorities and the date of start of land development work.	Yet to be complied	Mining activities not yet started.
36)	Miscellaneous	The Project Proponent shall submit six monthly compliance reports on the status of the implementation of the stipulated environmental safeguards to the MOEFCC &its concerned Regional Office, Central Pollution Control Board and State Pollution Control Board.	Complying with	Last EC compliance submitted through email on 18.05.2023 for the period of Oct 2022 to March 2023.
37)	Miscellaneous	A separate 'Environmental Management Cell' with suitable qualified manpower should be set-up under the control of a Senior Executive. The Senior Executive shall directly report to Head of the Organization. Adequate number of qualified Environmental Scientists and Mining Engineers shall be appointed and submit a report to RO, MoEFCC.	Complied	A separate 'Environmental Management Cell' set-up under the control of a Senior Executive and the senior Executive directly report to the Unit Head.
38)	Miscellaneous	The concerned Regional Office of the MoEFCC shall randomly monitor compliance of the stipulated conditions. The project authorities should extend full cooperation to the MoEFCC officer(s) by furnishing the requisite data / information / monitoring reports.	Complied	Agreed and noted.
39)	Miscellaneous	In pursuant to Ministry's O.M No. 22-34/2018-IA.III dated 16.01.2020 to comply with the direction made by Hon'ble Supreme Court on 8.01.2020 in W.P. (Civil) No. 114/2014 in the matter Common Cause vs Union of India, the mining lease holder shall after ceasing mining operations, undertake re-grassing the mining area and any other area which may have been disturbed due to other mining activities and restore the land to a condition which is fit for growth of fodder, flora, fauna etc.	Complied	Agreed and noted.

40)	Miscellaneous	The Ministry or any other competent authority may alter/modify the above conditions or stipulate any further condition in the interest of environment protection	Complied	Agreed & noted.
41)	Miscellaneous	Concealing factual data or submission of false/ fabricated data and failure to comply with any of the conditions mentioned above may result in withdrawal of this clearance and attract action under the provisions of Environment (Protection) Act, 19	Complied	Agreed & noted.
24.	Miscellaneous	The above conditions will be enforced inter-alia, under the provisions of the Water (Prevention & Control of Pollution) Act, 1974, the Air (Prevention & Control of Pollution) Act, 1981, the Environment (Protection) Act, 1986 and the Public Liability Insurance Act, 1991 along with their amendments and rules made there under and also any other orders passed by the Hon'ble Supreme Court of India/ High Court and any other Court of Law relating to the subject matter.	Complied	Agreed & noted. Project activities not yet started.
25.	Miscellaneous	Any appeal against this environmental clearance shall lie with the National Green Tribunal, if preferred, within a period of 30 days as prescribed under Section 16 of the National Green Tribunal Act, 2010.	Complied	Agreed & noted.
26.	Miscellaneous	The issues with the approval of competent Authority.	Complied	Agreed.

ANNEXURE-1

आज़ादी का अमृत महोत्सव

पश्चिम रेलवे
Western Railway

पश्चिम रेलवे
,प्रधान कार्यालय,
चर्चगेट,मुंबई-400020
Date: 28.03.2021

No. W340/22

E-office file No.272

Dy. Director/ LML-I,
Railway Board,
New Delhi.

Sub: Proposal for Environment Clearance of M/s. JK Cement Ltd. For Chenpura Limestone deposit with total excavation of 3.05 MTPA in the mine lease area of 206.354 Ha, located at village : Nayagaon, Tehsil:Jawad & Village : Chenpura, Tehsil: Neemuch, District : Neemuch, State: Madhya Pradesh – reg.

Ref: i) Railway Board's letter No. 2022/LML-I/19/2 dated. 21.01 2022.
ii) This office letter of even no. dated. 14.02.2022 to Railway Board.
iii) Sr.DEN(Co)RTM's letter E-office No. 262070 dated 28.03.2022.
iv) M/s. J.K.Cement Works, Nimbahera's letter No. JKCL/NBH/MO-24H/ Nayagaon- Chenpura Mines dated. 23.03.2022.

.....

With reference to above subject, Ministry of Environment, Forest & Climate Change has approached Railway Board vide letter under ref. (i) to grant "No Objection Certificate" (NOC) from Railway to M/s. J.K. Cement Ltd. for carrying out mining activities proposed without affecting and endangering the railway line upto 100 meters from the Railway track for Chenpura Limestone deposit with total excavation of 3.05 MTPA in the mine lease area of 206.354 Ha.

The above proposal has been examined thoroughly by the Railway and M/s. J.K. Cement Ltd. vide letter under ref. (iv) has submitted detailed report of the queries raised by Railway vide ref. (ii). It is mentioned in the above letter that the mining work will be started at a distance of more than 150 meters at a point farthest feasible based on mineral availability and the mining for First 5 years will be restricted beyond 150 meters from track.

In view of above, this office has No objection to carry out the work at nominated distance from railway land subject to condition mentioned in JKCL letter No. JKCL/NBH/MO-24/Nayagaon - Chenpura Mines dated 23.03.2022 (Ref. iv above) are complied and followed completely by JKCL.

DA-As above

Digitally Signed by Amit Gupta
Date: 28-03-2022 17:26:39
Reason: Approved

Chief Engineer (G)

Copy to : M/s. J.K. Cement Ltd. Nimbahera, Chittorgarh (Rajasthan).

सीएसआईआर- केन्द्रीय खनन एवं ईंधन अनुसंधान संस्थान
CSIR-Central Institute of Mining and Fuel Research
(वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद / Council of Scientific & Industrial Research)
(अंतर्गत वैज्ञानिक तथा औद्योगिक अनुसंधान विभाग, विज्ञान और प्रौद्योगिकी मंत्रालय,भारत सरकार)
(Under the Department of Scientific & Industrial Research, Ministry of Science & Technology, Govt. of India)
बरवा रोड, धनबाद - 826015, झारखण्ड, भारत / Barwa Road, Dhanbad - 826015, Jharkhand, India
(आई एस ओ 9001 प्रमाणित संस्थान / ISO 9001 Certified Institute)

ANNEXURE-2

SPEED POST

To:
Sri Manish Toshniwal
Mine Head,
Mines Office, Nimbahera
Kailash Nagar – I, JK Cement Work,
Nimbahera, Chittorgarh
Rajasthan-312617

Ref. CSIR-CIMFR/REED/2021/2157
Date: 12.10.2021
13

Subject: Submission of Report on scientific study for the assessment of blasting impacts on the railway line and advice for designing of controlled blasting patterns at Nayagaon - Chenpura Limestone Deposit in Neemuch District, Madhya Pradesh of JK cement Limited,

Dear Sir,

Please find enclosed the report on scientific study for the assessment of blasting impacts on the railway line and advice for designing of controlled blasting patterns at Nayagaon–Chenpura Limestone Deposit in Neemuch District, Madhya Pradesh of JK Cement Limited.

Kindly acknowledge the receipt of the report in proper order.

With regards,

Sawmliana 12.10.2021

(C. Sawmliana)
Sr. Principal Scientist & Head
Rock Excavation Engineering Division
CSIR-CIMFR, Dhanbad

Encl: One hard copy of the report

Confidential

Report On

SCIENTIFIC STUDY FOR THE ASSESSMENT OF BLASTING IMPACTS ON THE RAILWAY LINE AND ADVICE FOR DESIGNING OF CONTROLLED BLASTING PATTERNS AT NAYAGAON-CHENPURA LIMESTONE DEPOSIT IN NEEMUCH DISTRICT, MADHYA PRADESH FOR AN AREA OF 206.354 HECTARES OF M/s JK CEMENT LIMITED

OCTOBER, 2021

08/10/2021

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Rock Excavation Engineering Division
CSIR-CENTRAL INSTITUTE OF MINING & FUEL RESEARCH
(Council of Scientific & Industrial Research)
Barwa Road, Dhanbad (Jharkhand)

Team Members Associated with the Project

Dr. C. Sawmliana, Sr. Principal Scientist, HoS

Dr. Aditya Rana, Scientist

Sri R. K. Singh, Sr. Technical Officer (2)

Sri N. K. Bhagat, Sr. Technical Officer (1)

Sri P. Hembram, Technical Officer

Sri Saikat Banerjee, Technical Assistant

&

Dr. P. K. Singh, Director

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Dr. C. Sawmliana
Sr. Principal Scientist & HOS
Rock Excavation Engineering Division
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EXECUTIVE SUMMARY

This report relates to the scientific study conducted by the Rock Excavation Engineering Division of CSIR-Central Institute of Mining and Fuel Research (CSIR-CIMFR), Dhanbad at Nayagaon-Chenpura Limestone Deposit, Neemuch District, Madhya Pradesh of M/s JK Cement Limited. The main objective of the study is to assess the possible adverse impacts of blasting operations at the proposed Five Year Workings of the mine to the nearby Railway Line and to recommend controlled blasting patterns for carrying out safe and efficient blasting operations without endangering the safety of Railway Line and residential houses/structures of the nearby villages. The site visit was conducted on 29th September, 2021 to identify and study the different components of Railway Line, residential houses and other structures present near the Mining Lease area. To assess the possible impacts of blasting on the railway line, the ground vibration data recorded in the earlier scientific studies conducted by CSIR-CIMFR at the nearby mines of JK Cement Limited and Vikram Cement Works of M/s UltraTech Limited have been utilized.

The observations made during the site visit, assessment of blasting impacts, conclusions and recommendations made in the report are summarized below.

(1) Khandwa-Ratlam-Ajmer Section of Western Railways is passing along the eastern boundary of the Mining Lease area. The distance of the railway line from the Mining Lease boundary varied from 60 to 100 m. The Minimum and Maximum distance of 1st Five Year Working from the Railway line is 150 m and 290 m respectively.

(2) Amongst the different components of Railway Line, railway sleeper, steel rails, different parts of the overhead line electrifications viz. mast, electric line, insulators, rigid suspension etc. and the underpass are found to be vulnerable from blast induced ground vibration and flyrock.

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(3) Chenpura village is located in the western side of the Mining Lease at the distance of 170 m from the Mining Lease boundary. Gandhi colony is also located just outside the Mining Lease area in the eastern side. However, the distance of Gandhi colony from the proposed 1st Five Year Working is 740 m and Chenpura village is 350 m.

(4) For the assessment possible blasting impacts to the Railway Line and nearby village houses/structures, the ground vibration predictor equation already developed by CSIR-CIMFR at the nearby mine of JK Cement situated at Nimbahera have been used. The mines at Nimbahera have the similar geo-mining condition with the study mine.

(5) Based on the dominant frequencies obtained at different mines of JK Cement Limited at Nimbahera and Vikram Cement of M/s UltraTech at Neemuch, the safe level of PPV for the different structures of Railway Line has been taken as 20 mm/s. However, for the village houses and other structures present at Chenpura village and Gandhi Colony, the safe level of PPV has been considered as 10 mm/s.

(6) **Based on the assessment of ground vibration levels for different explosive charge quantities at various distances, blasting operations can be carried out safely without affecting and endangering the Railway Line. Similarly, blasting operations can be carried out safely without affecting the habitants and residential houses/structures of Chenpura village and Gandhi Colony.**

(7) Controlled blast design patterns have been recommended for conducting safe blasting operations nearby the Railway Line. The recommended blast design parameters and firing patterns of holes are given in **Table 7.1** and **Figures 7.1 to 7.14** of the report. Similarly, the recommended controlled blast design parameters for the safety of residential houses and other structures of the nearby villages are given in **Table 7.2** of the report.

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(8) It is recommended to muffle the entire blasting area using blasting mats/wire-mesh/conveyor belts with sufficient sandbags within the blasting zone of 100 -150 m from the Railway Line. Within the blasting zone of 150 to 200 m from the Railway Line, all the blast holes should be covered with either wire-mesh or conveyor belts and sufficient sandbags.

(9) Blasting time should be fixed in consultation with the Railway Department. No blasting operation should be conducted during any train movement near the mining lease area.

(10) Nonel (Shock Tube) initiation system is recommended for in-hole explosive initiation and surface hole-to-hole firing. For effective control on ground vibrations, the recommended maximum scattering of delays in case of TLD is ± 5 ms and for DTH, the suggested limit for scattering of delay is ± 10 ms.

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1.0 INTRODUCTION

Nayagaon-Chenpura Limestone Deposit is located in Nayagaon and Chenpura villages, Neemuch District in the State of Madhya Pradesh. Nayagaon is located within Jawad Tehsil, whereas Chenpura is in Neemuch Tehsil. This limestone deposit over an area of 206.354 Hectares is planning to be exploited by J. K. Cement Limited, a company belonging to J.K. Organisation. The limestone deposit will be mined by an opencast mining method by adopting a system of deep hole drilling and blasting and/or working with heavy machineries. The mine will thus be falling under 'A' category of fully mechanized type. The proposed drill hole diameter for the blasting operations as per the mine plan is 110 mm with hole depth varying from 6 m to 7 m. The total proposed production of limestone to meet the plant requirement is about 2.50 MT per annum .

A railway line of Western Railway (Khandwa-Ratlam-Ajmer section) is passing all along the eastern boundary of the Mining Lease (ML) area at a distance of about 60 - 100 m from lease boundary. The Minimum and Maximum distance of 1st Five Year Working from the Railway line is 150 m and 290 m respectively. Chenpura village is also located at about 170 m from the mining lease boundary. Gandhi Colony is located at about 740 m from the proposed 1st Five Year Working Area. Hence, the blasting operations at the proposed limestone mine may impact on the nearby railway line as well as the residential houses and others structures of the nearby villages if controlled blasting operations are not followed. Therefore, it is necessary to assess the possible blasting impacts on the railway lines and village houses/structures not belonging to the owner.

The main objective of the study is to assess the possible adverse impacts of blasting operations at the proposed limestone mine on the Railway Line and to recommend controlled blast design patterns for conducting safe and efficient blasting operations without affecting the railway line as well as nearby residential houses/structures of the nearby localities. In order to identify and study the different structures present nearby the mining lease area, a site visit was conducted on 29th September, 2021. The exact location

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of railway line from the mining lease boundary, different features of the railway line, type of the residential houses and other important structures were assessed and studied.

This report contains the assessment of possible impacts of blasting operations to the railway line and other structures of the nearby villages. The controlled blast design patterns for the different blasting zones from the railway line and nearby villages have been recommended for conducting safe and efficient blasting operations at the proposed opencast mine of Nayagaon-Chenpura Limestone Deposit.

2.0 BRIEF INFORMATION AND GEOLOGY OF THE MINE

2.1 Brief Information of the Mine

Nayagaon-Chenpura Limestone Block is located in villages Nayagaon and Chenpura in the district of Neemuch, Madhya Pradesh. Nayagaon is located in Jawad Tehsil and Chenpura is located in Neemuch. The block lies between Latitude 24° 31' 35.78" to 24° 34' 33.65" (Northing) and Longitude 74° 44' 53.91" to 74° 46' 27.65" (Easting). The area is covered by Survey of India Toposheet no. 45 L/14 on 1:50K scale. The total area applied for grant of Mining lease was 206.40 hectares, out of which 0.046 hectares area have been curtailed by the State Government and the balance area of 206.354 ha have been granted for Mining Lease.

The deposit is proposed to be worked by fully mechanized opencast method. Deep hole drilling and blasting will be carried out for the excavation of overburden as well as limestone deposit. The initial box cut of the dimension of 363 m (N-S) x 405m (E-W) will be taken in the southern block of mining lease area demarcated for obtaining the targeted production of first five year period. Mining operation i.e. development will be started from 467/466m and pit bottom will be achieved at 448 m and the sump will be developed at one end and pit bottom gradient will be 1:100 towards the west of the working pit. The targeted production of first year to fifth year will be achieved from an area of the dimension of 146724 m^2 and it will be

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worked down to the depth of 18 meters, touching the level of MRL 448m in the pit floor.

One development cum production bench and two production benches of 6m height each will be excavated to achieve maximum production of 2.50 Million tonnes of Limestone per annum when the mine will be fully developed. The individual bench faces will be kept sloping at 10 degrees of vertical. The ultimate pit slope will be maintained at 45° or less from horizontal. Bench floor will be kept horizontal. Slopes will be directed towards the natural gradient of the adjoining area, away from operating faces. A drainage ditch will be constructed and connect it to the main garland drain around the working pit. The year-wise production planning for the First Five Year period is given in **Table 2.1.**

Table 2.1. Year wise production planning for five years period

YEAR	PIT NO.	OVER-BURDER - M³	CEMENT GRADE LIMESTONE IN TONNES	SUB GRADE LIMESTONE IN TONNES	TOTAL PRODUCTION IN TONNES	STRIPPING RATIO
I	PIT NO. 1	13937	71520	132821	204341	1: 0.06
II		9796	178440	331393	509833	1: 0.02
III		14276	282890	525365	808255	1: 0.02
IV		17483	362135	672535	1034670	1: 0.02
V		34088	875929	1626725	2502654	1: 0.01

2.2 Geology of the Mine

2.2.1 Regional Geology

Geologically, the area represent rocks grouped under Semri, Kaimur, Rewa and Bhander Groups of Vindhyan Super Group of Meso to Neoproterozoic age and is followed by thick pile of basaltic rock of Deccan traps of Upper Cretaceous to Palaogene age, laterite of Cainozoic and Alluvium of Pleistocene to Recent age. The 'Binota Shale' is the lower most unit of the Khorip/Semri Group. It comprises grey shale with thin beds of white and pink clay and is conformably overlain by grey and pink sandstone of the Jhiran

Sandstone which occurs as inliers in the Deccan trap. The Jhiran Sandstone formation is overlain by grey, pale & greenish colour Bari Shale. Nimbahera limestone overlies the Bari Shale. The Nimbahera limestone is fine grained, non crystalline and compact even bedded and slabby. It varies in thickness from 10 cm to more than a meter. The Nimbahera Limestone is overlain by Suket Shale, which occurs in low lying plains facing the Kaimur scarps. It is argillaceous, khaki brown, grey, greenish thinly bedded to laminated shale with interbeds of siltstone, sandstone and thinly laminated limestone and the upper part is Glauconite bearing greenish shale.

The general trend of the formations is N-S& NNE-SSW to NE-SW with generally shallow dip to both east and west. In the northeast part of the area, Suket Shale is grouped under Khorip Group/Semri Group. The Suket Shale is overlain by Morwan Sandstone of Kaimur Group of Upper Vindhyan Group on the north western side and Deccan traps on the northeast side. The beds are sub horizontal with a shallow dip towards North. In the northern part of the area, the sandstone is thickly bedded near Rawatbhata and the top is characterised by glauconitic bearing thick coarse friable sandstone. Cross bedding and ripple marks on primary structures indicate that Palaeo current direction is towards west. The Panoli Shale overlies the Marwan Sandstone followed by Diken Sandstone. These rocks are well developed in valley portion. The Panoli Shale occurs as lensoidal, buff and greenish grey shale and has a varying thickness from one meter to 30 meters.

The Panoli Shale with increasing arenaceous content grades into purple fine grained thin to thickly bedded Diken Sandstone. The primary structure cross bedding and ripple marks are also prominent. Rewa Group is represented by Panna Shale, Dehpura Sandstone (correlated with lower Rewa Sandstone), Ratangarh Shale (equivalent of Jhiri Shale) and Umar Sandstone (correlated with upper Rewa Sandstone) and conformably overlies the Diken Sandstone in the NW part. The regional geological successions are given in **Table 2.2.**

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Table 2.2. The regional Geological successions

LITHOLOGY	STATIGRAPHIC STATUS		AGE
ALLUVIUM	RECENT		PLEISTOCENE TO RECENT
LATERITE	-		CAINOZOIC
5 AA & 2 PAHOEHOE TYPE BASALTIC FLOW 3 AA BASALTIC FLOWS	KANKARIYA PIRUKHERI FORMATION	MALWA GROUP	UPPER CRETACEOUS TO PALEOGENE
PEBBLES, COBBLES AND BOULDERS EMBEDDED IN A FERRUGINOUS AND SANDY CLAY MATRIX	ANTRALIA BOULDER BED (=TALCHIR)	LOWER GONDWANA	UPPER CARBONIFEROUS TO PERMIAN
SINGOLI LIMESTONE WITH ARGILLACEOUS BANDS GANURGARH SHALE WITH SILTSTONE INTERBEDS	BHANDER GROUP	**VINDHYAN SUPER GROUP**	NEO PROTEROZIC
UMAR SANDSTONE RATANGARH SHALE WITH SILTSTONE INTERBEDS DEHPURA SANDSTONE, AGRILLACEOUS AT TOP & BOTTOM PANNA SHALE WITH SILTSTONE, LIMESTONE INTERBED	REWA GROUP		
DIKEN QUARTZITIC SANDSTONE PANOLI SHALE WITH INTERBEDS OF SILTSTONE MORWAN QUARTZITIC SANDSTONE, COARSE AND GITTY NEAR THE BASE	KAIMUR GROUP		
SUKET SHALE WITH INTERBEDS OF SILTSTONE AND SANDSTONE. NIMBAHERA LIMESTONE BARI SHALE JHIRAN SANDSTONE	KHORIP/SEMRI		MESO PROTEROZOIC
BINOTA SHALE	BHILWARA GROUP		ARCHAEAN

***Ref: -GSI** District Resource Map*

2.2.2 Local Geology (Geology of Mining Lease Area)

The rocks exposed in the area, under consideration, apparently belong to Khorip Group (previously known as Semri Series) under the Lower Vindhyan of Vindhyan Super Group. In Nayagaon - Chenpura Limestone Mine/Deposit, vast area comprising 206.354 ha consists of a conformable sedimentary package of shale and limestone. The general trend of rock formations is N-S, NNE-SSW to NE-SW with generally shallow to moderate dip either easterly or westerly.

The western part of the area is occupied by Shale or it is terminal area of mineralization while eastern part of the area shows limestone mineralization proved from 17 m to 98 m depth i.e. middle to eastern part of central zone in Chenpura village and northern part of the area i.e. Nayagoan village has

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been proved for 40-69mthick limestone and this limestone is resting over the Calcareous Shale/Shale. The local stratigraphic succession in the ML area is as follows:

Soil/ Alluvium
Grey Limestone (GL)
Pink Limestone-2
Light Greenish Grey Limestone with thin interbands of greenish calcareous Chert (LGL)
Pink Limestone-1
Limestone interbanded with shale
Calcareous Shale
Grey, green, brown Shale
Sandstone/Grit/Conglomerate
---------- Base not seen ----------

3.0 BASIC BLAST DESIGN PARAMETERS

Many factors influence rock breakage by blasting. These factors can be classified broadly into two categories, such as uncontrollable and controllable factors. The uncontrollable factors are the geology and nature of the rock deposit. These are mainly rock and rock mass properties such as lithology, joint and bedding parameters, stress field, water content and different physico-mechanical properties of the rocks. The controllable factors are the basic blast design parameters including explosive properties. The basic blast design parameters and environmental impacts thereof resulted in a blasting operation are described in the following section.

3.1 Bench Height

The selection for an optimum bench height and width depends on inherent stability of the formation, thickness of the formation, drilling and loading equipment to be deployed etc. Higher bench height required more blasthole length and larger drill diameter. This could also result in ground

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vibration and flyrock problems when the dwelling areas and different structures are existed near by the blasting site.

3.2 Hole Diameter

The choice of blasthole diameter depends mainly on fragmentation size required, bench height and geology of the formation. It also depends on the overall economics in relation to the initial investment and the operating cost. Better and finer fragmentation could be achieved with smaller hole diameter. Control of ground vibration and flyrock are also much easier in smaller diameter than larger hole diameter. However, drilling cost generally increases as blasthole diameter decreases.

3.3 Hole Depth

The required hole depth depends on the bench height, inclination of hole and sub-grade drilling. Sub-grade drilling, on the other hand, depends on the strata condition at the toe portion. With a horizontal bedding plane and softer formation at the toe, use of sub-grade drilling may not be necessary. However, with higher dip of bedding plane or presence of harder strata at the toe portion, more sub-drilling length is required to avoid toe problem and irregular floor. Length of sub-grade drilling generally varies between zero and 0.3 times the burden.

3.4 Burden and Spacing

Burden is the minimum distance from the axis of a blasthole and the free face whereas spacing is the distance between consecutive blastholes in the same row. The values of burden and spacing depend upon blasthole diameter, properties of rock and explosive, bench height and the desired degree of fragmentation as well as muck displacement. Depending upon the properties of rock mass, burden value generally varies between 25 and 40 times the hole diameter. Different researchers to calculate burden value have suggested numerous formulas. Out of these formulae, the most commonly used equation for the calculation of burden value as given by Konya and Walter (1990) is:

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$$B = \left[\frac{2\rho_e}{\rho_r} + 1.5\right] \times D_e \qquad \text{..... (3.1)}$$

Where,

B = Burden in inches

ρ_e = Specific gravity of explosive

ρ_r = Specific gravity of rock

D_e = Diameter of explosive in inches (for bulk explosive, it is the diameter of drill hole)

The value of spacing is calculated in function with the burden, delay timing between blastholes and the initiation sequence. In general, spacing value varies between 1.2 and 2.0 times the burden value.

3.5 Stemming Length

Stemming is the portion of blast hole which has been packed with inert material above the charge so as to confine and retain the gases produced by the explosion before the actual burden movement. Stemming length depends upon the nature of rock blasted, required throw, fragmentation as well as the type and size of stemming materials. Stemming length can be varied widely, ranging between 20 and 60 times the hole diameter. Whenever possible, stemming length of more than 25 times the blasthole diameter should be maintained in order to avoid flyrock, air blast, cutoffs and overbreak.

3.6 Explosive Type

The type of explosives to be used depends on properties of rock to be fragmented, ground water condition and availability in market. In hard and massive formations, explosive with higher density and higher strength is required for proper fragmentation. However, in softer formation and heavily jointed rock mass, low density explosive with lower strength may be used.

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3.7 Specific Charge/Powder Factor

The quantity of explosive (kg) required to fragment one cubic metre of rock is called as specific charge or charge factor (kg/m^3). The specific charge increases with an increase in diameter of blasthole, rock strength, degree of fragmentation, displacement and swelling desired. The wide range of specific chare for different types for rock in case of surface bench blasting is given in **Table 3.1**. In some places, specific charge is also termed as charge factor (kg/m^3).

Table 3.1: Ranges of specific charge for bench blasting in surface mines (after Jimeno et al., 1995)

Types of rock	Specific charge (kg/m^3)
Massive and high strength rock	0.60 – 1.50
Medium strength rock	0.30 – 0.60
Highly fissured rocks, weathered or soft	0.10 – 0.30

4.0 IMPACT OF BLASTING ON SURROUNDING ENVIRONMENTS

Only 15-30% of the total energy generated from the detonation of an explosive charge inside a blasthole is estimated to be used for the actual rock breakage. Rest of the energy is wasted in the form of ground vibration, noise and flyrock. These are the main environmental impacts resulted from surface blasting operations. Toxic fumes generated from blasting can also affect the working environment, especially in underground mines, tunnel, etc. However, this effect is less environmental concerned in case of surface blasting in comparison to ground vibration, flyrock and noise. Hence, fundamental concepts on these three environmental impacts created by surface blasting are discussed in this section.

4.1 Blast Induced Ground Vibration

When an explosive charge inside a blasthole is detonated, the explosive is converted into a hot gas at intense pressure. A steep wave front travels into the rock, crushing it for roughly twice the radius of the original blasthole,

depending upon the resistance of the rock (**Figure 4.1**). In many rock types, the cavity that is formed has about four times the volume of the original hole around the charge. Many radial cracks start to form as the cavity expands. However, a few of the cracks become dominant and the other stop growing. The expanding gases continue to work on the rock, extending the cracks, and moving the rock upward and outward. This activity takes place in the zone of intended work on the rock, breaking it and moving it for excavation.

Beyond the perimeter of damage rock zone, the pulses are called elastic waves or seismic waves, meaning that there is no further damage to the rock or any permanent displacement of the rock properties. Seismic waves generated from blasting source travel in all directions. As they travel through the medium, they cause particle of the medium in motion which is called vibration.

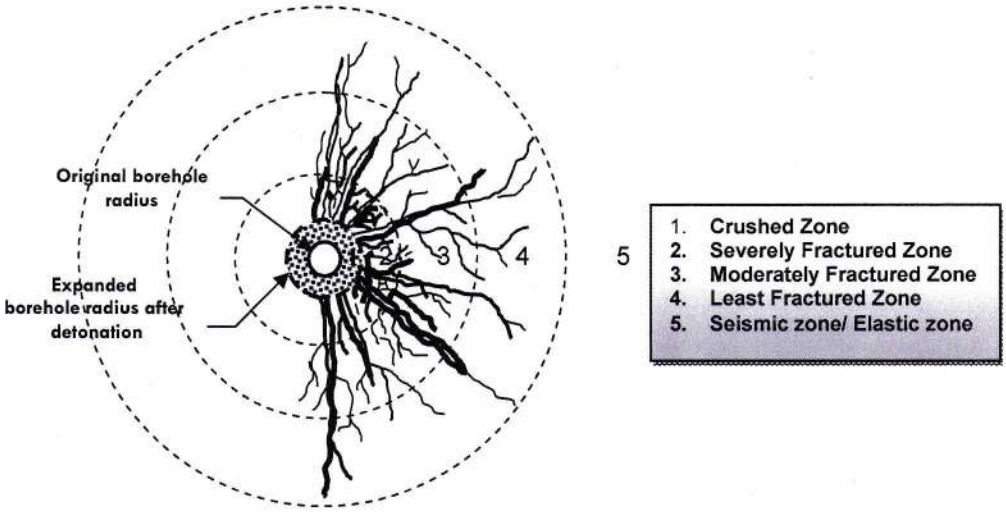


Fig. 4.1: Different zones of rock deformation around a blast hole

The velocity of a particle at any instant of time during the vibration disturbance is called as particle velocity. The maximum velocity from the position of rest is peak particle velocity or in short 'PPV'. PPV has traditionally been used as a mean to establish the degree of blast damage.

4.1.1 Factors Affecting Vibration Intensity and Characteristics

The intensity and characteristics of ground vibration generated from a blasting source depend upon different parameters such as:

- Local geology
- Charge weight per delay
- Distance from the point of blast
- Delay period
- Spatial distribution of explosive charge
- Confinement
- Type of explosive

The local surrounding geology has a great influence on the intensity and characteristics of ground vibration. The frequencies of seismic waves produced from blasting mainly depend on nature of the transmitting medium and the distance of measurement. If geological formation of the rock strata in a particular area is having massive formation with shallow soil cover, the blast vibration will be characterized by relatively lower frequencies. However, if the area around the blasting site has a deep covering of soil and jointed rock formations, the vibration will be characterized by relatively lower frequencies and larger displacement. Also with increasing the distance, high frequency waves attenuate and only lower frequency wave can travel to a larger distance. The magnitude of ground vibration also increases with decrease in distance of observation from the blasting source and vice-versa.

In a blast where more than one period number of detonators is used, the largest charge per delay has the most direct influence on vibration intensity and not the total charge used for the blast, as long as the delay interval is sufficient to avoid constructive interferences between the waves generated by the different group of holes (Jimeno et al., 1995). A delay interval of 8 and 9 ms were suggested by Duval & Petkof (1959) and Duval & Fogelson (1962) to eliminate constructive interferences of different seismic waves generated from blasting. For the same charge weight per delay, vibrations produced from a single large hole diameter would be more than those generated from

more number of holes with smaller diameter due to the spatial distribution of explosive charge (Oriard, 2002).

The confinement of explosive charge such as more burden and spacing values, deeply buried charge (excessive stemming length) and presence of blasted material at the face (choked face) generally increase the level of ground vibration. Explosives having lower borehole pressures also produce lower vibration than those explosives having higher strength with more detonation pressure.

4.1.2 Ground Vibration Standards in India

Peak particle velocity (PPV) is mainly used to form the basis of blast damage criteria for different types of structures. The prescribed permissible limits of the Directorate General of Mines Safety (DGMS) on ground vibrations for different type of structures depending on the frequency of blast waves (Technical Circular No. 7, 1997) are given in **Table 4.1**. The ground vibration standards have also been given by the Indian Standard of Institution (IS: 6922) on the basis of the ground condition as given in **Table 4.2**. The IS:6922 (1973) is applicable to normal structures like building, elevated structures, bridges, retaining walls, concrete and masonry dams constructed in materials like brick walls, stone masonry and concrete.

Table 4.1: DGMS-prescribed permissible limit of ground vibrations (Technical Circular No. 7, 1997)

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

Table 4.2: Peak Particle velocity as damage criteria for different types of rocks (after Indian Standard Institution, IS:6922, Sec. 4.1.1.2, 1973)

Soil, weathered or soft rock conditions	70 mm/s
Hard rock conditions	100 mm/s

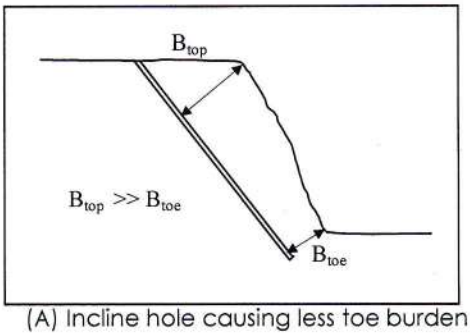
4.1.3 General Control Measures to Reduce Ground Vibration

The followings are some of the principal reasons that can be taken into account for reducing blast generated ground vibrations:

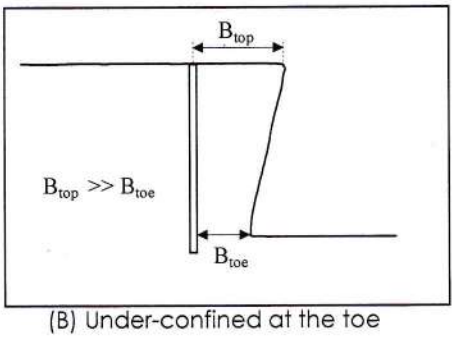
- Minimizing the explosive charge per delay by reducing drill hole diameter, blasthole depth, decking the explosive charges in a hole and initiating them at different times.
- Reduce the number of blastholes having instantaneous detonators by using more number of delay detonators.
- Choose effective delay time between holes and rows which avoid wave interaction and give good rock displacement.
- Set the initiation sequence in a way that it progresses away from the structures to be protected.
- Maintain bench height to burden ratio more than two and use adequate powder factor to decrease over confinement of explosive charge.
- Use the largest possible free face blast area and avoid choked face blasting.

4.2 Flyrock

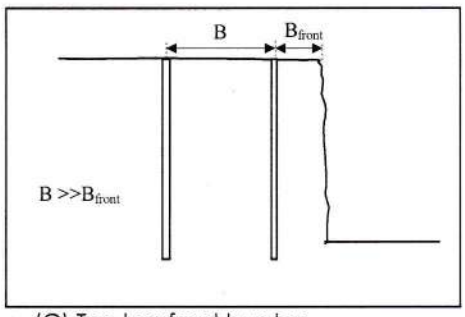
Flyrock, also called rock throw, is the uncontrolled propelling of rock fragments produced in blasting. Flyrock constitutes one of the main sources of material damage and harm to people. The possible causes of flyrock, which are commonly encountered during any bench blasting in surface mine, are depicted in **Figures 4.2 (A to G)**.



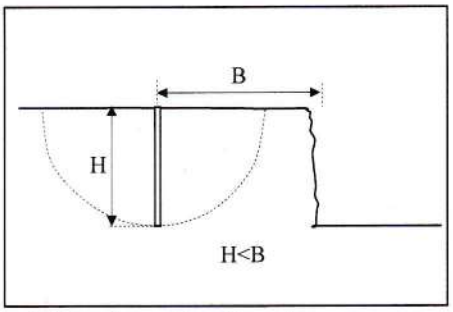
(A) Incline hole causing less toe burden



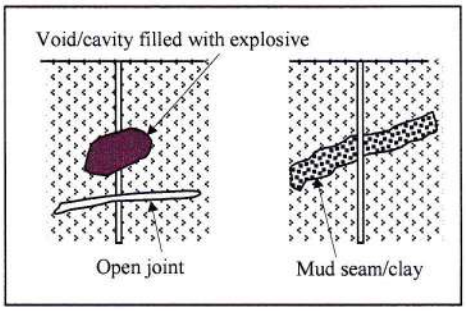
(B) Under-confined at the toe



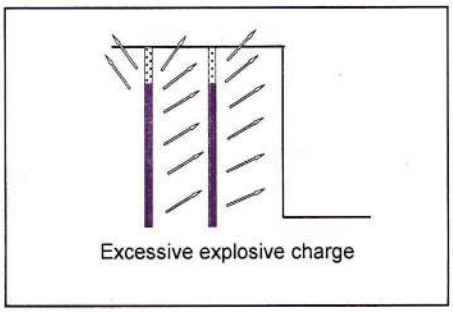
(C) Too less front burden



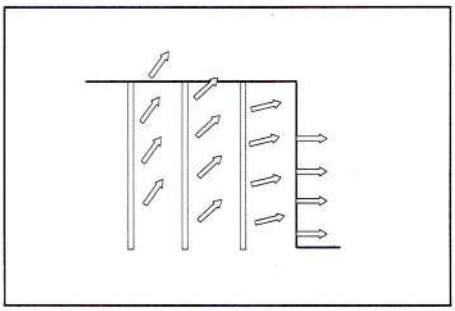
(D) Too large front burden



(E) Cavity, open joint and mud seam



(F) Excessive charge and very small top stemming



(G) Inadequate delay timing (Back rows)

Fig. 4.2: Common causes of flyrock in surface bench blasting

The control measures of flyrock in surface blasting operation are given below-

- The primary means of controlling flyrock is through proper blast design and delay timing. The consistency of the burden, specially the front burden (distance between first row to free face) must be maintained.
- Bench height to burden ratio less than 1.5 should be avoided. The spacing of about 1.2 - 2.0 times the burden is suggested to reduce the flyrock.
- While loading a shot, the blaster must be aware of his true powder factor (in m^3/kg i.e. reverse of charge factor) in terms of the amount of explosive to be charged for the quantity of rock to be fragmented. Charging of excessive explosive quantity must be avoided.
- When firing more than one row of holes, sufficient delays should be used between the two sequence of rows of holes. Based on the observations, delays of at least 50 ms or more should be used between two consecutive rows.
- Length of stemming column should be greater than or at least equal to 25 times the hole diameter. For better protection, it may also be taken as greater than or equal to the burden.
- The blasting site should always be inspected before marking the holes. If any open joints and clay fillings are present in the bench, an adjustment should be made in the drilling pattern.
- Before loading, blasting officials should always check the hole depths and ensure that the holes are drilled as per the blast design. Any change in the blast design should be carefully considered from the standpoint of its potential effect on flyrock.
- All loose pieces of rock from the blasting site should be cleared before charging.

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Accidents due to lack of blast area security are commonly caused in the mines due to following reasons, which should be strictly taken care of in all the blasting operations.

- Failure to evacuate the blast area by employees and visitors,
- Failure to understand the instructions of the blaster or supervisor,
- Inadequate guarding of the access roads leading to the blast area,
- Taking shelter at an unsafe location or inside a weak structure.

4.3 Blast-induced Noise/air overpressure

Noise or air blast/air overpressure is considered to be one of the most hazardous environmental disturbances created by blasting operation. Blast-induced air overpressure is the energy transmitted from the blast site within the atmosphere in the form of a series of pressure waves. Overpressure simply means the pressure over and above that of atmospheric pressure being present and the term air overpressure is used to describe the airwave generated by blasting. Air overpressure is formed either by the direct action of the explosion products from an unconfined explosive in the air or by the direction of a confining material subjected to blast loading. The pressure wave consists of both audible (noise) and sub-audible (concussion) energy. The maximum excess pressure in this wave is known as the peak air overpressure, generally measured in decibels (dB) using the linear frequency-weighting (L). The decibel is defined in term of air overpressure with the equation:

$$AOP = 20 \times \log\left[\frac{P}{P_o}\right] \qquad \text{..... (4.1)}$$

Where,

AOP = air overpressure in dB,

P = measured overpressure in N/m^2, and

P_o = pressure of the lowest audible sound (2.0×10^{-6} N/m^2).

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4.3.1 Factors Affecting Air overpressure

Oriard (2002) listed out the various factors contributing to air overpressure and arranged roughly in order of decreasing importance as follow:

- Maximum charge weight per delay
- Depth of burial of the explosive charges
- Exposed detonating materials on the ground surface
- Atmospheric condition
- Topography
- Volume of displaced rock
- Delay interval and orientation

4.3.2 Air overpressure Standards

Air overpressure generated due to blasting generally causes minor structural damage such as glass window breakage. No major structural damage is usually reported due to air overpressure unlike in the case of ground vibration. Presently, no standard / regulation or guidelines are available in India by the regulatory agencies regarding the permissible levels of air overpressure and noise from blasting operation. The typical air overpressure limits as given by Oriard (2002) and the limits recommended by United States Bureau of Mines (USBM) for surface mine blasting are given in **Table 4.3** and **Table 4.4** respectively. **Table 4.5** shows Central Pollution Control Board (CPCB), India's permissible levels for noise exposure for work zone area as prescribed under Model Rules of Factories Act, 1948.

Table 4.3: Typical air overpressure criteria (After Oriard, 2002)

171 dB	General window breakage
151 dB	Occasional window breakage
140 dB	Long-term history of application as a safe project specifications
134 dB	Bureau of Mines recommendation following a study of large-scale surface mine blasting

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Table 4.4: Air overpressure limits recommended by USBM for surface mining (RI 8485)

134 dB	0.1 Hz high pass measuring system
133 dB	2.0 Hz high pass measuring system
129 dB	6.0 Hz high pass measuring system
105 dB	C-slow weighting scale on a sound level meter
(Events less than or equal to 2 – sec duration)	

Table 4.5: Central Pollution Control Board (CPCB) permissible levels for noise exposure for work zone area

Peak sound pressure in dB	Permitted number of impulse or impact/day
140	100
135	315
130	1000
125	3160
120	10000

Note:

1. No exposure in excess of 140 dB peak sound pressure level is permitted.

2. For any peak sound pressure level falling in between any figure and the next higher or lower figure as indicated in column 1, the permitted number impulses or impacts per day is to be determined extrapolation on a proportionate basis

4.3.3 General Control Measures to Reduce Noise/Air overpressure

- Increase confinement of explosive charge (i.e. burial depth of explosive) with longer stemming height (greater than 25 times the blasthole diameter) and avoid shallow hole depth and plaster shooting.
- Minimize explosive charge weight per delay by using proper delay to reduce direct influence on air overpressure.
- Choose delay times so that the blast progresses along the face velocity lower than that of sound in the air (320 m/s).
- Avoid using detonating cord, and when it is completely unavoidable, cover it with sand/soil/drill cuttings of a minimum thickness of 10 to 15 cm.
- Never conduct blasting when the direction of the wind is critical.
- Avoid blasting in cloudy weather.

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5.0 FIELD INVESTIGATIONS

The field visit was conducted on 29th September, 2021 to identify and study the different structures present near the mining lease area which will require protection from blast induced ground vibrations, flyrock and air overpressure. The following different structures were identified:

(1) Railway Line of Khandwa-Ratlam-Ajmer section, Western Railways with the following components:
   (a) Railway Sleeper (railroad tie/cross tie),
   (b) Steel rail,
   (c) The different parts of Overhead Line Electrifications - Mast, electric line, insulator, rigid suspension, steady arm etc.,
   (d) Railway underpass for road and drainage.

(2) Residential houses, School and other important structures in Chenpura village and Gandhi colony.

Plate 5.1: View of the investigating team at the site to identify the different structures present near the ML

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The Railway line of Kandwa-Ratlam-Ajmer Section of Western Railways is running parallel to the mining lease area along the eastern side. The distance of the Railway Line from the mining lease boundary varied from 60 to 100 m (**Figure 5.1**). It was observed that the Minimum & Maximum distance from the 1st Five Year Plan to the Railway Line would be 150 m and 290 m respectively (**Figure 5.2 & 5.3**). The Railway Line, Overhead Line Electrifications and the underpass (for road and drainage) which will require protection from blast induced ground vibration and flyrock are shown in **Plates 5.2 to 5.6**.

Plate 5.2. View of the Railway Line passing near the ML in the eastern side

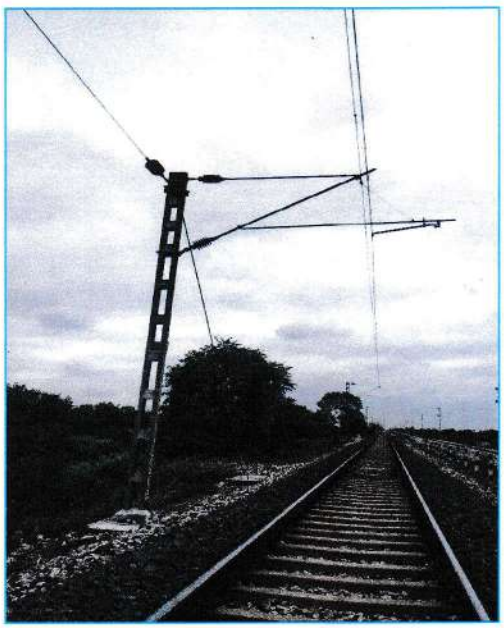

Plate 5.3. View of the Overhead Line Electrifications

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Plate 5.4. View of the underpass for drainage below the new railway line

Plate 5.5. View of the underpass for drainage below the old railway line

Plate 5.6. View of the underpass for road below the new & old railway lines

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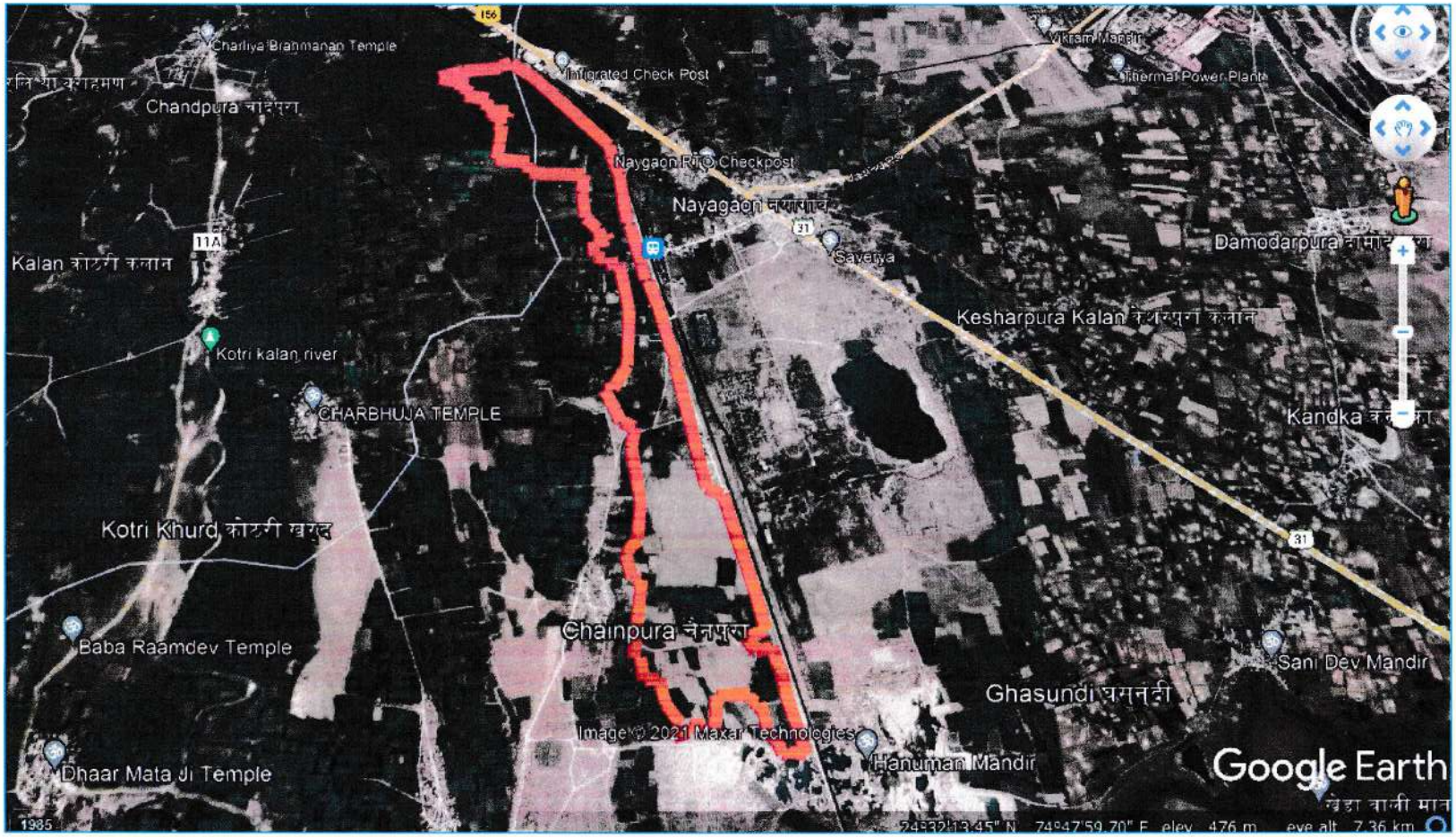

Fig. 5.1. Google Earth showing the Mining Lease area and Railway Line at Naygaon-Chenpura Limstone deposit of M/s JK Cement Limited

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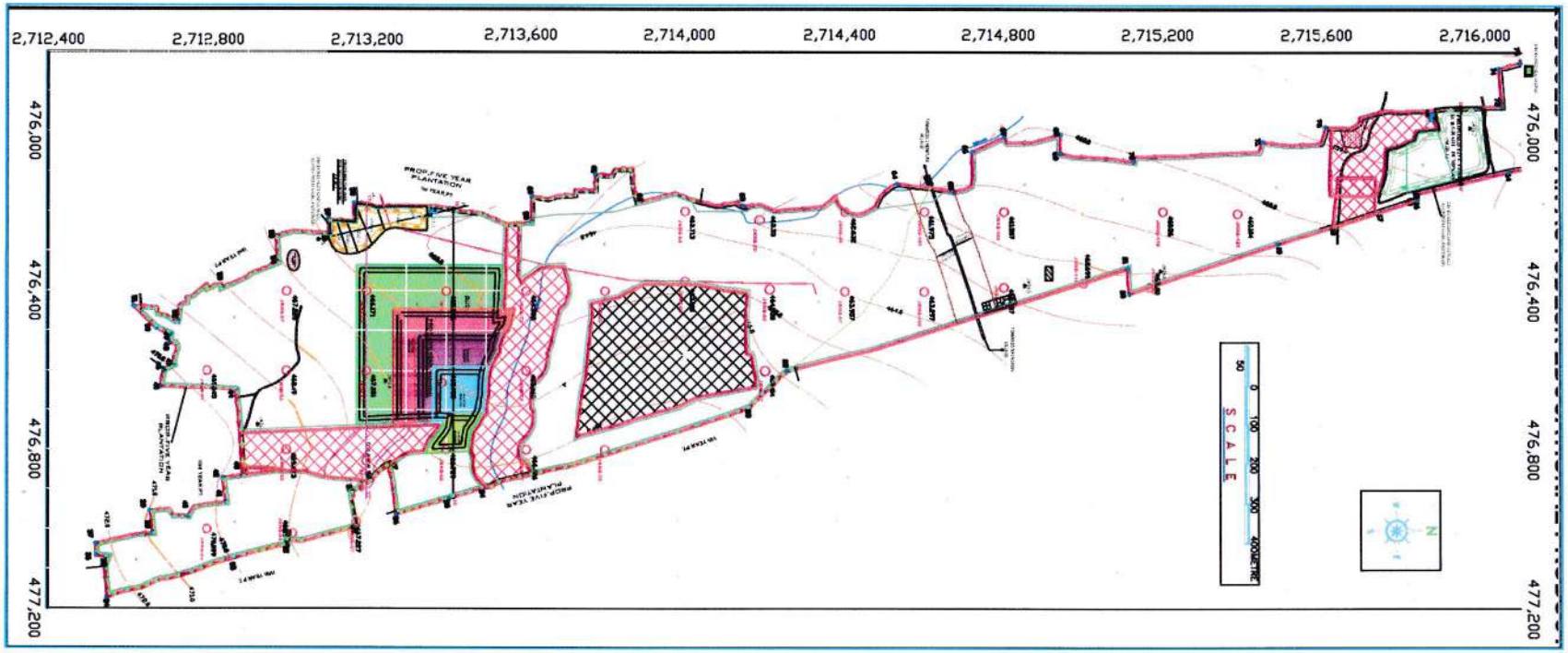

Fig.5.2. Five Year Development and Production Plan at Naygaon - Chenpura Limstone Mine of M/s JK Cement Limited

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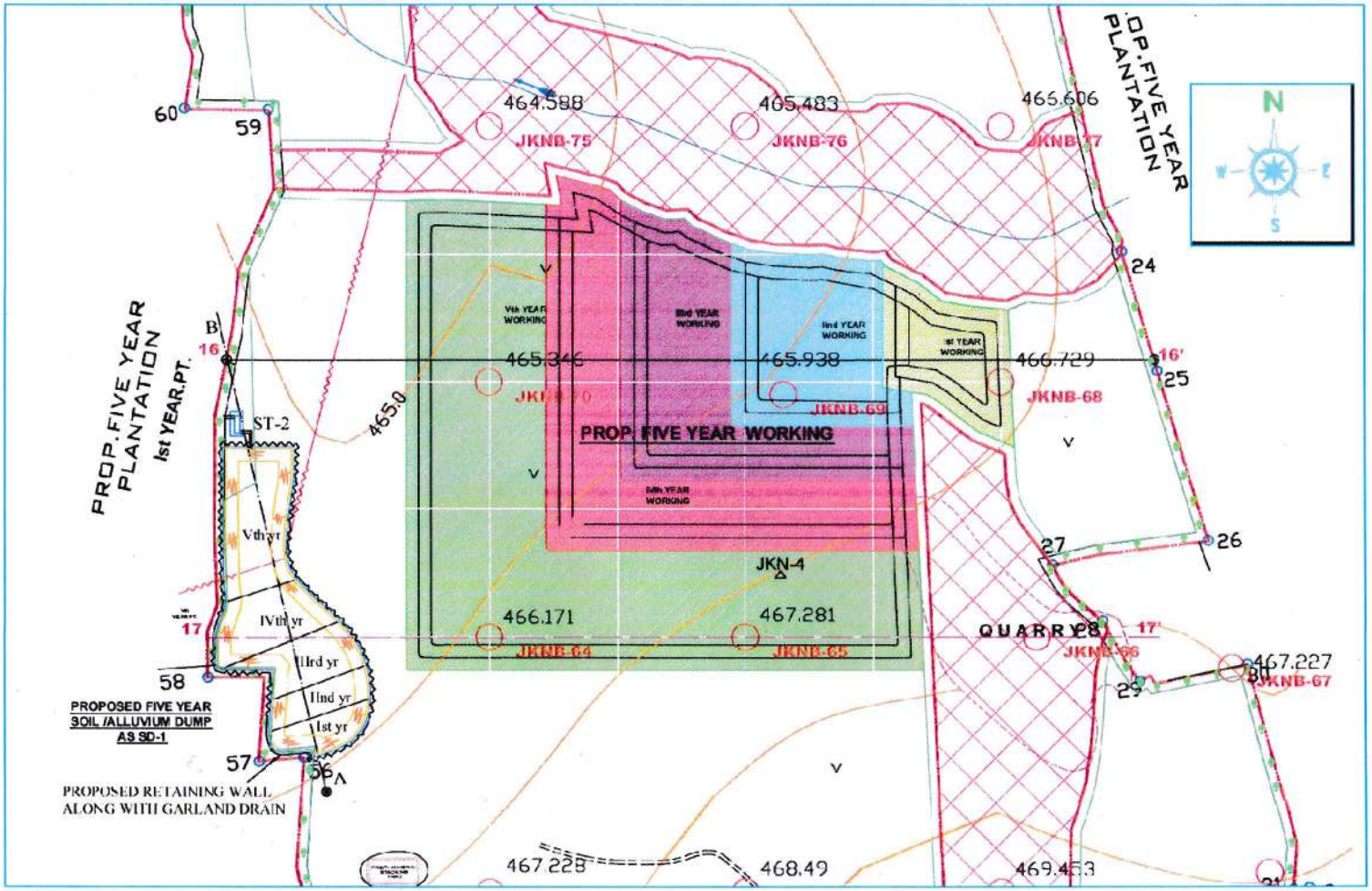

Fig.5.3. Closer view of Five Year Development and Production Plan at Naygaon - Chenpura Limstone Mine of M/s JK Cement Limited

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Chenpura village is located in the western side of the ML and the distance from the ML boundary near the 1st Five Year Working is 170 m (**Figure 5.4**). There are residential houses as well as schools and other public structures present in the Chenpura village. Most of the houses are single storey with bricks and cement structures. Gandhi Colony is also located in the eastern side, near the ML boundary. However, the residential houses in this colony are located more than 740 m from the proposed site of 1st Five Year Working (**Figure 5.5**).

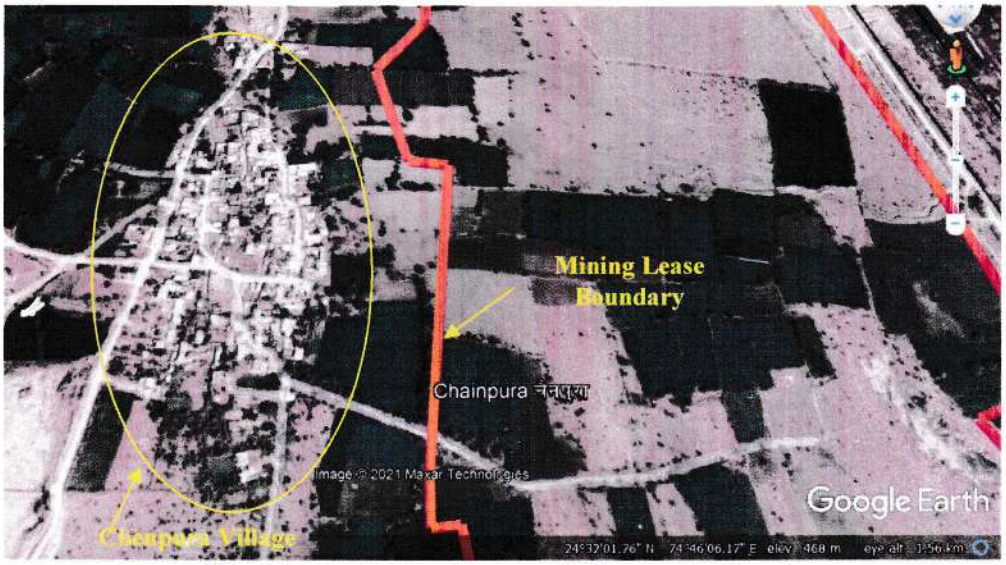

Fig. 5.4. Google Earth view of Chenpura village

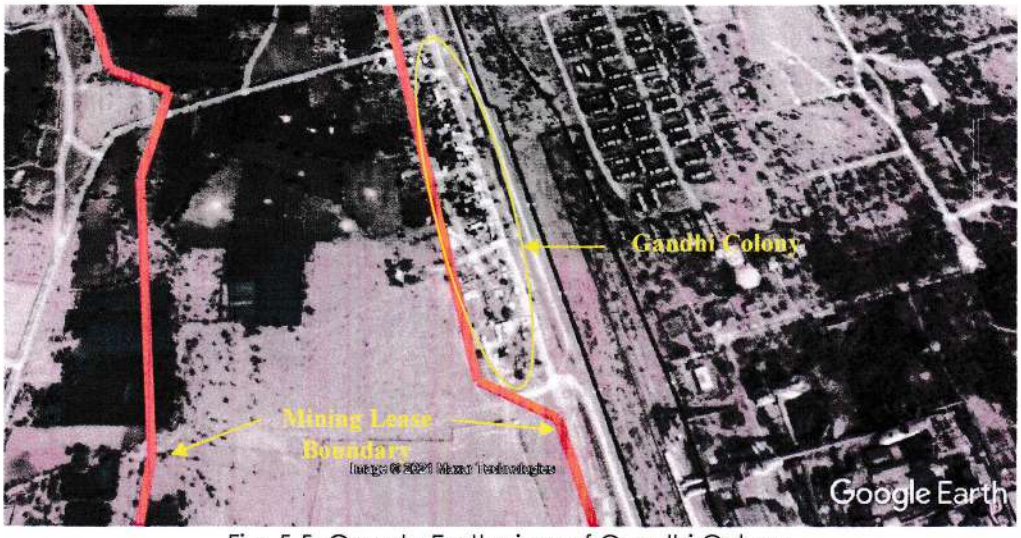

Fig. 5.5. Google Earth view of Gandhi Colony

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6.0 ASSESSMENT OF BLASING IMPACTS TO RAILWAY LINE AND OTHER STRUCTURES

In order to assess the magnitude of ground vibrations generated by the blasting operations at the proposed Five Years Workings of the mine, the ground vibration predictor equation already developed by CSIR-CIMFR at the nearby mines of JK Cement having similar geo-mining conditions has been used (*CSIR-CIMFR Technical Report: CNP/3080/11-12, 2012*). CSIR-CIMFR carried out extensive field investigations for the development of controlled blasting at the different opencast mines of JK Cement situated at Nimbahera. The regression analysis of ground vibration data recorded at different distances is given in **Figure 6.1**. The established ground vibration predictor equation based on extensive experimental blasts is given as:

$$V = 3216 \times \left[\frac{D}{\sqrt{Q_{max}}}\right]^{-1.58} \quad \text{---------- (1)}$$

Coefficient of determination = 0.802
Standard Deviation = 0.127

Where,

P = Peak particle velocity (mm/s)

D = Distance of vibration monitoring point from the blast face (m).

$Q_{max,}$ = Maximum explosive weight per delay (kg).

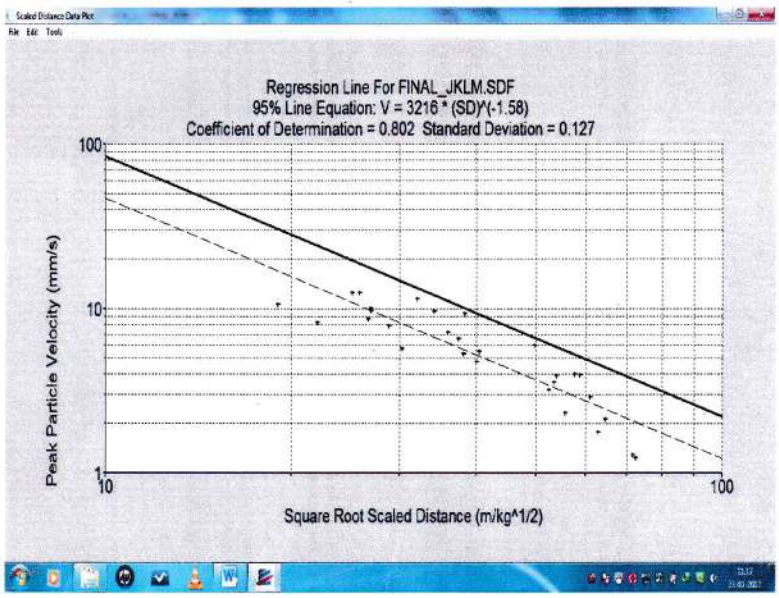

Fig 6.1 Regression plot of vibration data recorded at JK Limestone Mine

Using the ground vibration predictor equation given in Equation-1, the magnitude of ground vibrations generated for different values of maximum explosive charge per delay at different distances have been determined and are given in **Table 6.1.**

Table 6.1. Predicted ground vibration for different Qmax and Distances

Dist. (m)	Ground Vibration for Different Q_{max}								
	20 kg	30 kg	40 kg	50 kg	60 kg	70 kg	80 kg	90 kg	100 kg
50	70.9	97.7	122.6	146.3	168.9	190.8	212.0	232.7	252.9
60	53.2	73.2	91.9	109.7	126.6	143.0	159.0	174.5	189.6
70	41.7	57.4	72.1	86.0	99.3	112.1	124.6	136.7	148.6
80	33.7	46.5	58.4	69.6	80.4	90.8	100.9	110.7	120.3
90	28.0	38.6	48.4	57.8	66.7	75.4	83.8	91.9	99.9
100	23.7	32.7	41.0	48.9	56.5	63.8	70.9	77.8	84.6
125	16.7	23.0	28.8	34.4	39.7	44.9	49.8	54.7	59.5
150	12.5	17.2	21.6	25.8	29.8	33.6	37.4	41.0	44.6
175	9.8	13.5	16.9	20.2	23.3	26.4	29.3	32.1	34.9
200	7.9	10.9	13.7	16.4	18.9	21.3	23.7	26.0	28.3
225	6.6	9.1	11.4	13.6	15.7	17.7	19.7	21.6	23.5
250	5.6	7.7	9.6	11.5	13.3	15.0	16.7	18.3	19.9
275	4.8	6.6	8.3	9.9	11.4	12.9	14.3	15.7	17.1
300	4.2	5.8	7.2	8.6	10.0	11.2	12.5	13.7	14.9

Based on the field investigations carried out by CSIR-CIMFR at different limestone mines located near Nayagaon-Chenpura Limestone Deposit such as different mines JK Cement at Nimbaehra *(CSIR-CIMFR Technical Report: CNP/3080/11-12, 2012)* and Vikram Cement Mines of M/s UltraTech Cement Limited, Neemuch *(CSIR-CIMFR Report: CNP/3215/2011-12, 2012)*, higher frequencies of ground vibration waves of more than 8 Hz were obtained. Hence, based on the ground vibration standard prescribed by the DGMS, the safe values of peak particle velocity (PPV) for different structures present at the proposed limestone mine can be assigned as given in **Table 6.2**. The safe level of ground vibration for the different structures of Railway Line has been taken as 20 mm/s. Similarly, for residential houses, schools and other surface structures, not belonging to the owner i.e. JK Cement Limited, the safe level of PPV has been taken as 10 mm/s. The calculated value of maximum explosive charge per delay for the different distances keeping PPV as 20 mm/s and 10 mm/s for Railway Line and Residential houses are given in **Table 6.3**.

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Table 6.2. Threshold level of PPV for different structures near the ML Area of Nayagaon-Chenpura Limestone Deposit

Sl. No.	Structures	Safe Level of PPV
1.	Railway Line with the following structures (a) Railway Sleeper (b) Steel raily (c) Overhead Line electrifications (mast, insulators, electric line etc.) (d) Railway Underpass Structures	20 mm/s
2.	Residential Houses, Schools and other important structures of the villages (Chenpura & Gandhi Colony)	10 mm/s

Table 6.3. Calculated values of maximum charge per delay for different distances from ground vibration predictor equation developed for KJ Cement Limited keeping PPV values of 10 mm/s and 20 mm/s

Distance [m]	Calculated safe value of maximum explosive charge per delay	
	For residential houses and other structures not belonging to owner (PPV = 10 mm/s)	For different structures of the Railway Line (PPV = 20 mm/s)
50	1.67 kg	4.00 kg
60	2.40 kg	5.76 kg
70	3.27 kg	7.84 kg
80	4.27 kg	10.24 kg
90	5.40 kg	12.96 kg
100	6.67 kg	16.00 kg
125	10.42 kg	25.00 kg
150	15.01 kg	36.00 kg
175	20.43 kg	49.00 kg
200	26.68 kg	64.00 kg
225	33.77 kg	81.00 kg
250	41.69 kg	100.00 kg
275	50.44 kg	121.00 kg
300	60.03 kg	144.00 kg
325	70.45 kg	169.00 kg
350	81.71 kg	196.00 kg
375	93.80 kg	225.00 kg
400	106.72 kg	256.00 kg
325	70.45 kg	169.00 kg
350	81.71 kg	196.00 kg
375	93.80 kg	225.00 kg
400	106.72 kg	256.00 kg

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The Minimum and Maximum distance of 1st Five Year Working from the Railway Line is 150 m and 290 m respectively. Similarly, the distance of Chenpura Village is 170 m from the ML boundary and the distance of Five Year Working is 350 m. The proposed hole depth for deep-hole blasting operation is 6 to 7 m with hole diameter of 110 m. Depend on the nature of limestone deposit encountered, the explosive charge per hole for 6 to 7 m hole depth will vary from 20.00 to 35.00 kg.

Therefore, based on the assessment of ground vibration levels produced by different explosive charge per delay for the different distances from the Railway Line, blasting operations can be carried out safely without affecting the Railway Line due to blast induced ground vibration. Similarly, blasting operations can be carried out safely without affecting the residential houses and other structures present at Chenpura village and Gandhi Nagar Colony. However, flyrock should be completely controlled in all the blasting operations. The controlled on flyrock can be done by using muffling arrangements.

Hence, the adverse impacts on Railway Line as well as residential houses/structures of the nearby villages due to blasting operations can be controlled effectively by following controlled blasting operations at the proposed limestone mine.

7.0 RECOMMENDED CONTROLLED BLASTING PATTERNS

7.1 Controlled Blasting Patterns for the Safety of Railway Line

The Minimum and Maximum distance of 1st Five Year Working from the Railway Line is 150 m and 290 m respectively. However, it was observed that blasting operations can also be carried out safely at the distance of 100 m from the Railway Line. Therefore, looking into the future possibility of working closure the railway line, the different blasting zone have been classified for designing of controlled blasting as:

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(1) 100 - 200 m from Railway Line
(2) 200 - 300 m from Railway Line
(3) Beyond 300 m from Railway Line

The recommended controlled blast design parameters for the different blasting zones from the Railway Line are given in **Table 7.1**. Within the blasting zone of 100 to 200 m from the Railway Line, the number of rows should be limited to two only. The charge factor value ranging from 0.42 to 0.57 kg/m^3 have been considered for calculation of the explosive charge per hole. The charge factor may be changed based on the actual nature of limestone deposits encountered at the mine to achieve the required fragment size. The recommended charging patterns, drilling patterns and firing patterns of holes for the different blasting zones from the Railway Line are given in **Figure 7.1 to 7.14**.

Table 7.1: Recommended controlled blast design parameters for different blasting zone from Railway Line at Nayagaon-Chenpura Limestone Deposit

Blast Design parameters	Distance from Railway Line		
	100 - 200 m	200 - 300 m	Beyond 300 m
Hole diameter (mm)	100 -115	100 -115	100 -115
Hole depth (m)	6.0 - 7.0 m	6.0 - 7.0 m	6.0 - 7.0 m
No. of holes	20 - 25	25 - 30	30 - 50
Drilling pattern	Staggered	Staggered	Staggered
No. of rows	1 to 2	2 to 3	3 to 4
Burden (m)	2.5	3.0	3.0
Spacing (m)	3.0	4.0	4.0
Top Stemming column (m)	3.0 - 3.2	2.5 - 2.8	2.5 - 2.8
Charge per hole (kg)	22.50 - 30.00	30.00 - 35.00	30.00 - 35.00
Max. charge/delay (kg)*	22.50 - 30.00	30.00 - 70.00	60.00 - 70.00
Total charge (kg)	450.00 - 750.00	750.00 - 1050.00	900.00 - 1750.00

** Holes fired within 8 milliseconds window*

The following precautionary measures are recommended for controlled blasting operations nearby the Railway Line.

(1) The entire blasting area should be muffled using blasting mats/wire-mesh/conveyor belts within the blasting zone of 100 to 150 m. If wire-mesh or conveyor belts are used for muffling arrangement, a minimum

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three number of sandbags having sufficient weight should be placed over each blast hole to prevent stemming ejection.

(2) Within the zone of 150 to 200 m, all the blast holes should be covered with either wire-mesh or conveyor belts. A minimum three number of sandbags with sufficient weight should be placed over each hole to prevent the stemming ejection.

(3) Beyond 200 m of the Railway Line, muffling arrangement may not be required. However, all other precautionary measures for flyrock as given in ***Section 4.2*** of the report should be followed.

(4) Within the blasting zone of 100 to 150 m, if any hole contains water, it should be dewatered before charging of explosive. If holes are filled with water, it is recommended to use stone chips of 6 - 8 mm sizes for stemming materials.

(5) Blasting time should be fixed in consultation with the Railway Management. Blasting should not be conducted during any train movement near the mining lease area.

(6) All other additional safety measures given by the DGMS should be strictly followed.

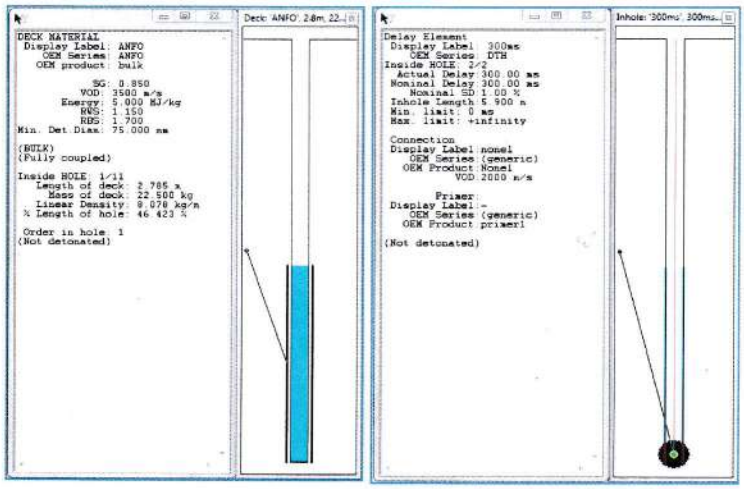

Fig. 7.1. Suggested charging pattern of holes for 6 m hole depth of 110 mm hole diameter

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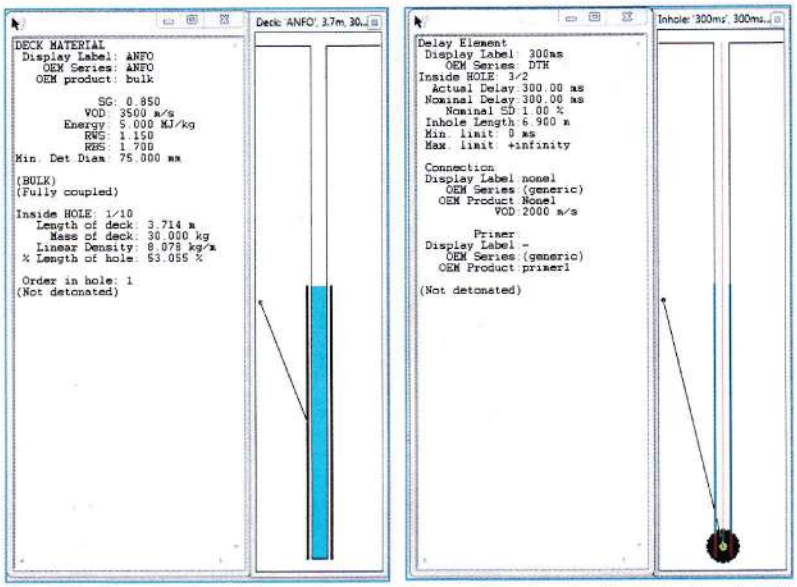

Fig. 7.2. Suggested charging pattern of holes for 7 m hole depth of 110 mm hole diameter

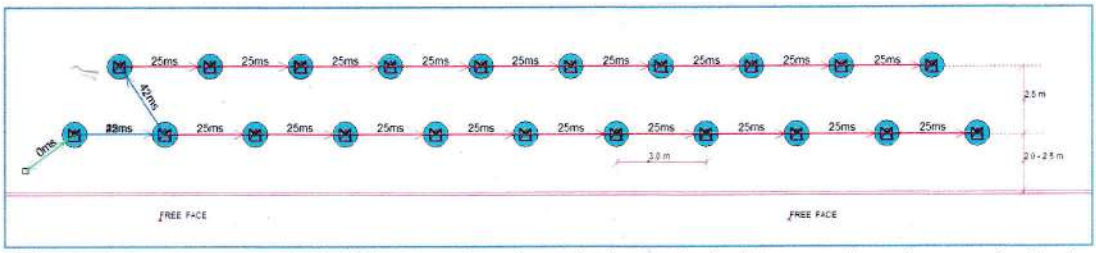

Fig. 7.3. Recommended drilling and surface hole-to-hole firing pattern for controlled blasting operations within 100 - 200 m from the Railway Line
[Inter-Hole Delay = 25 ms & Inter-Row Delay = 42 ms]

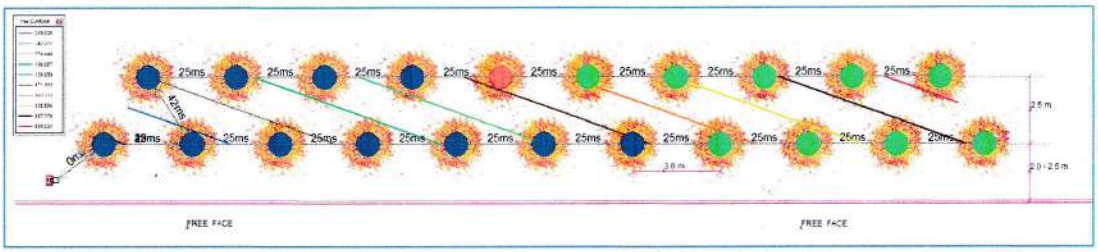

Fig. 7.4: Diagonal sequence of rock movement and time contour obtained from the recommended firing pattern in Figures 7.3

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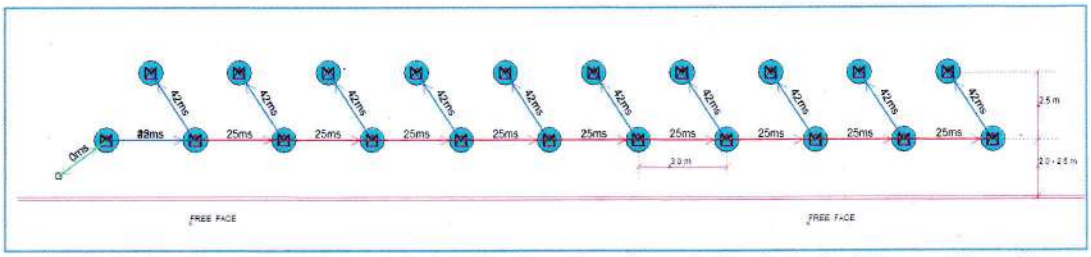

Fig. 7.5. Another recommended drilling and surface hole-to-hole firing pattern for controlled blasting operations within 100 - 200 m from the Railway Line
[Inter-Hole Delay = 25 ms & Inter-Row Delay = 42 ms]

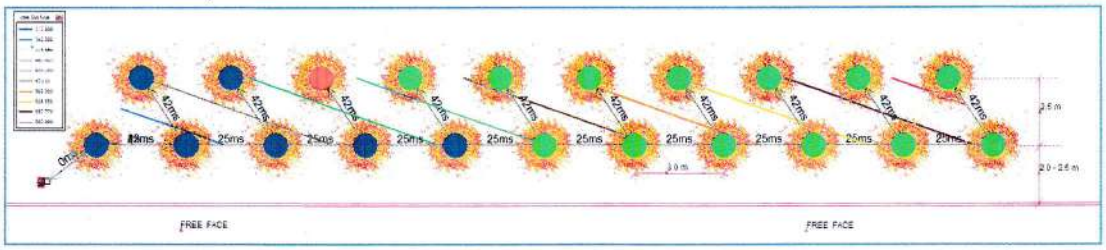

Fig. 7.6: Diagonal sequence of rock movement and time contour obtained from the recommended firing patterns in Figures 7.5

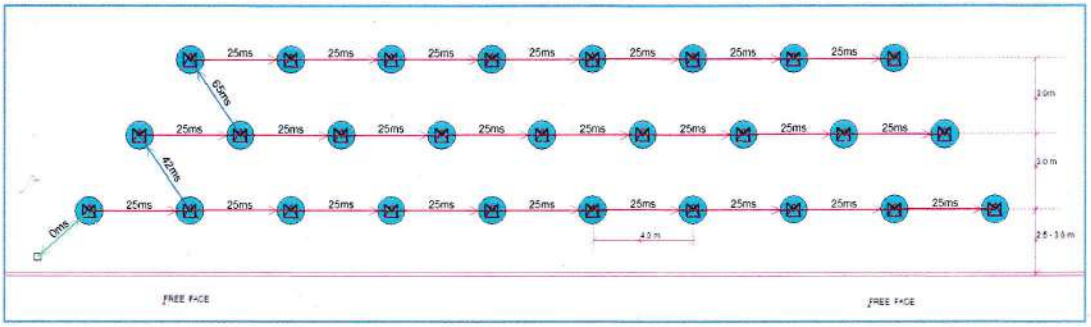

Fig. 7.7. Recommended drilling and surface hole-to-hole firing pattern for controlled blasting operations within 200 - 300 m from the Railway Line
[Inter-Hole Delay = 25 ms & Inter-Row Delay = 42 ms & 65 ms]

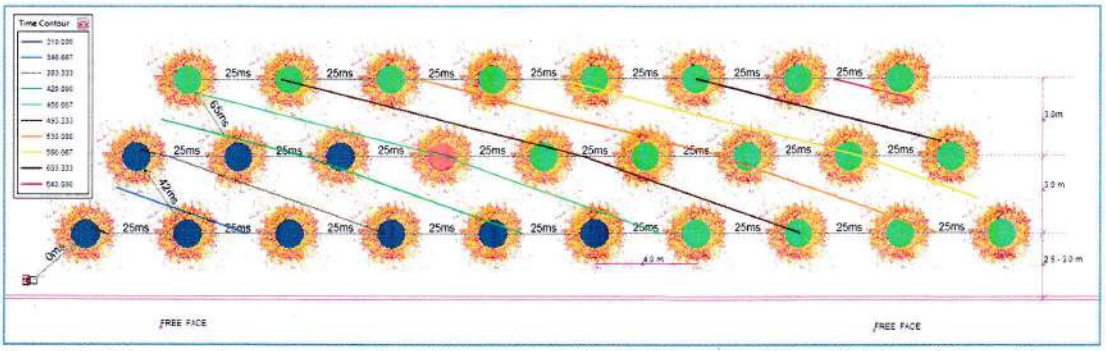

Fig. 7.8: Diagonal sequence of rock movement and time contour obtained from the recommended firing patterns in Figures 7.7

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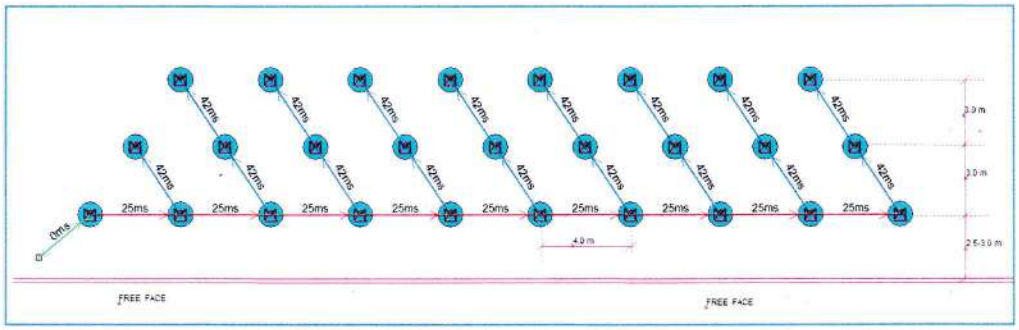

Fig. 7.9. Another recommended drilling and surface hole-to-hole firing pattern for controlled blasting operations within 200 - 300 m from the Railway Line [Inter-Hole Delay = 25 ms & Inter-Row Delay = 42 ms]

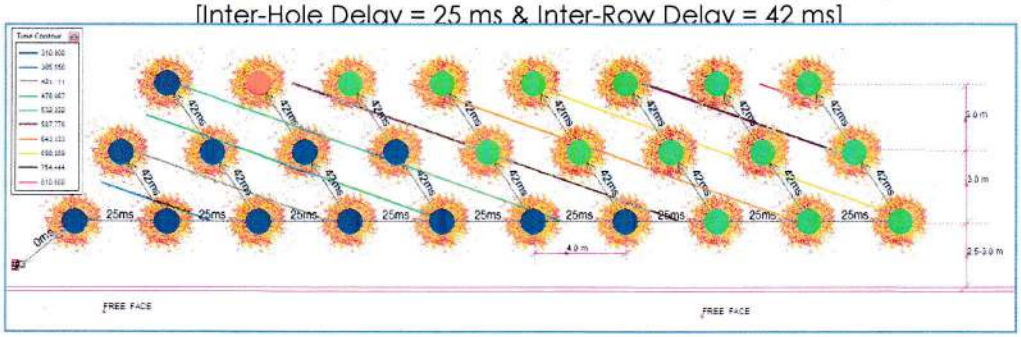

Fig. 7.10: Diagonal sequence of rock movement and time contour obtained from the recommended firing patterns in Figures 7.9

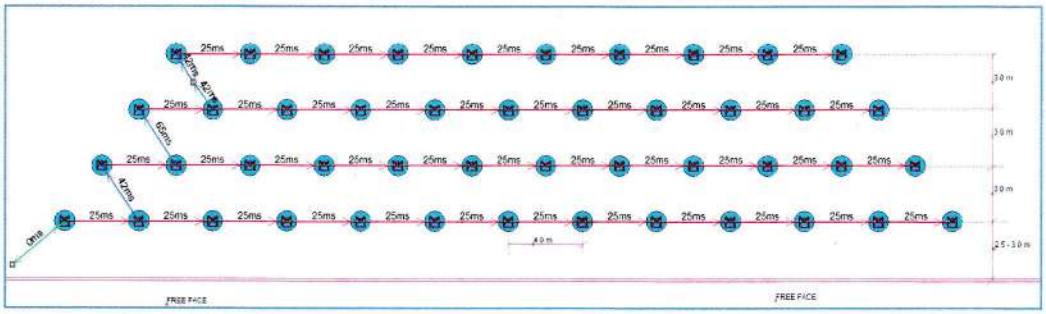

Fig. 7.11. Recommended drilling and surface hole-to-hole firing pattern for controlled blasting operations beyond 300 m of the Railway Line [Inter-Hole Delay = 25 ms & Inter-Row Delay = 42 ms, 65 ms & 84 ms]

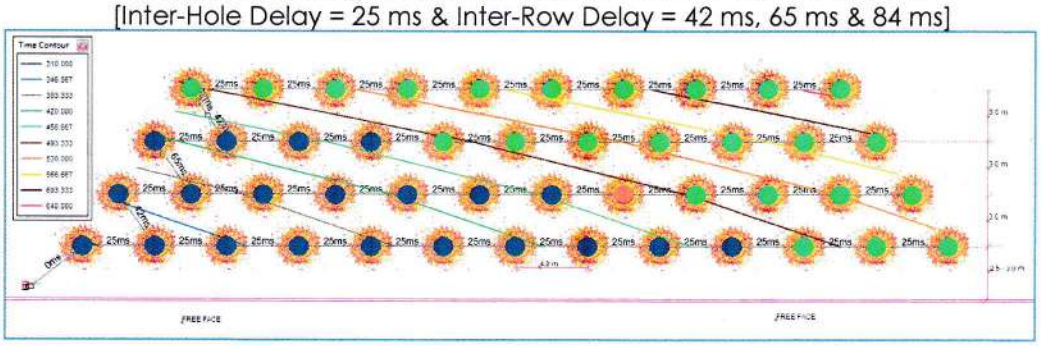

Fig. 7.12: Diagonal sequence of rock movement and time contour obtained from the recommended firing patterns in Figures 7.11

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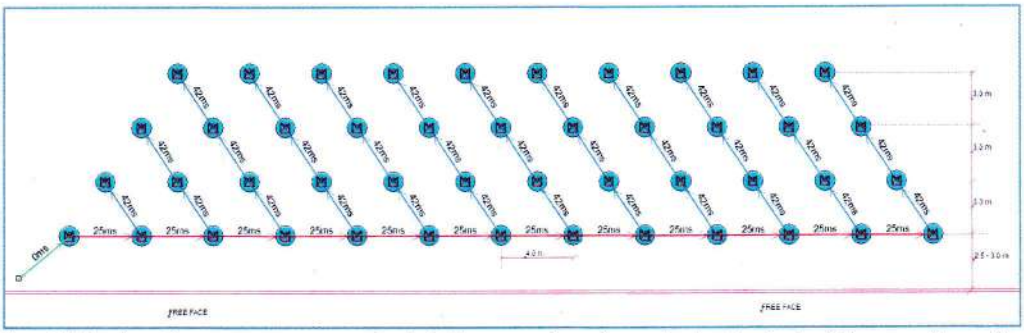

Fig. 7.13. Another recommended drilling and surface hole-to-hole firing pattern for controlled blasting operations beyond 300 m of the Railway Line [Inter-Hole Delay = 25 ms & Inter-Row Delay = 42 ms]

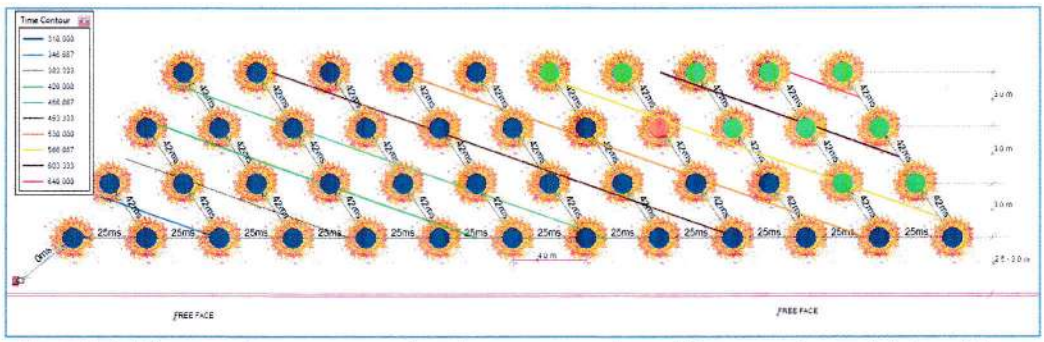

Fig. 7.14: Diagonal sequence of rock movement and time contour obtained from the recommended firing patterns in Figures 7.13

7.2 Controlled Blasting Patterns for the Safety of Village Houses/Structures

During the 1st Five Year Working, the blasting operations will be conducted at 350 m from the Chenpura village. Gandhi colony will also be located more than 740 m from the 1st Five Year Working site. Hence, the controlled blast design patterns recommended for the safety of the Railway Line will also be applicable for the residential houses and other structures present at Chenpura village as well as Gandhi colony. However, as the working faces advance toward the western side of the mining lease area (2nd Year to 5th Year), the distance of Chenpura village will be nearer. In contrast, the Railway Line will also be further in the successive years. Hence, control on ground vibration and flyrock will also be necessary for the safety of habitats, residential houses and other structures in Chenpura village.

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Chenpura village is located in the western side, at 170 m from the mining lease boundary. The safe value of PPV for the residential houses and other surface structures present at Chenupra village and Gandhi Colony has been taken as 10 mm/s. The recommended controlled blast design patterns for conducting safe blasting operations from the village houses/structures are given in **Table 7.2.**

Table 7.2: Recommended controlled blast design parameters for different blasting zone from village houses/structures at Nayagaon-Chenpura Limestone Deposit

Blast Design parameters	Distance from Village Houses/Structures		
	170 - 200 m	200 - 300 m	Beyond 300 m
Hole diameter (mm)	100 -115	100 -115	100 -115
Hole depth (m)	6.0 - 7.0 m	6.0 - 7.0 m	6.0 - 7.0 m
No. of holes	20 - 25	25 - 30	30 - 50
Drilling pattern	Staggered	Staggered	Staggered
No. of rows	1 to 2	2 to 3	3 to 4
Burden (m)	2.0 - 2.5	2.5 - 3.0	3.0
Spacing (m)	2.5 - 3.0	2.3 - 4.0	4.0
Top Stemming column (m)	3.2 - 4.0	2.80 - 3.5	2.5 - 2.8
Charge per hole (kg)	15.00 - 22.50	22.50 - 35.00	30.00 - 35.00
Max. charge/delay (kg)*	15.00 - 22.50	22.50 - 35.00	60.00 - 70.00
Total charge (kg)	300.00 - 560.00	560.00 - 1050.00	900.00 - 1750.00

** Holes fired within 8 milliseconds window*

7.3 Recommended Explosive Types and Initiation System

The recommended explosive types are both ANFO explosive and Large Diameter (LD) cartridge explosive of 83 mm diameter, 2.78 kg weight per cartridge. In case of LD explosives, the quantity of primer charge in a blast hole should be more than 25% of the explosive charge in the hole. The recommended properties for the LD explosives for better blast performance/fragmentation are given in **Tables 7.3 & 7.4.**

Table 7.3: Recommended properties of Primer Charge of LD explosives

Sl. No.	Properties	Acceptable Limit
1	Density (g/cc)	1.15 ± 0.10
2	Cap/booster sensitivity	Fire
3	Air-gap sensitivity (AGS) - 2 cm	Fire
4	Velocity of detonation (m/s)	4200 ± 500

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Table 7.4: Recommended properties of Column Charge of LD explosives

Sl. No.	Properties	Acceptable Limit
1	Density (g/cc)	1.15 ± 0.10
2	Cap/booster sensitivity	Fire
3	Air-gap sensitivity (AGS) - 2 cm	Fire
4	Velocity of detonation (m/s)	3800 ± 500

For in-hole explosive initiation and surface hole-to-hole firing, either non-electric (nonel)/Shock-tube initiation system or electronic detonators can be used. Detonating Fuse (DF) should not be used for in-hole explosive and surface hole-to-hole initiation. For inter-hole delay, either 17 ms or 25 ms TLD have been recommended. However, for the inter-row delay, 42 ms TLD or 65 ms TLD should be used. If more number of rows are blasted in a single round, the Inter-Row Delay should be increased to 65 ms or 84 ms delay for the last rows. The recommended maximum scattering of delays in case of TLD is ± 5 ms and for DTH, the permissible scattering is ± 10 ms.

8.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the observations made during the site visit and the assessment of possible blasting impacts on the Railway Line, Residential Houses and other structures present near the Mining Lease Area of Nayagaon-Chenpura Limestone Deposit/Mine, the following conclusions and recommendations have been made.

(1) Khandwa-Ratlam-Ajmer Section of Western Railways is passing along the eastern boundary of the Mining Lease area. The distance of the railway line from the Mining Lease boundary varied from 60 to 100 m. The Minimum and Maximum distance of 1st Five Year Working from the Railway line is 150 m and 290 m respectively.

(2) Amongst the different components of Railway Line, railway sleeper, steel rails, different parts of the overhead line electrifications viz. mast, electric line, insulators, rigid suspension etc. and the underpass are

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found to be vulnerable from blast induced ground vibration and flyrock.

(3) Chenpura village is located in the western side of the Mining Lease at the distance of 170 m from the Mining Lease boundary. Gandhi colony is also located just outside the Mining Lease area in the eastern side. However, the distance of Gandhi colony from the proposed 1st Five Year Working is 740 m and Chenpura village is 350 m.

(4) For the assessment possible blasting impacts to the Railway Line and nearby village houses/structures, the ground vibration predictor equation already developed by CSIR-CIMFR at the nearby mine of JK Cement situated at Nimbahera have been used. The mines at Nimbahera have the similar geo-mining condition with the study mine.

(5) Based on the dominant frequencies obtained at different mines of JK Cement Limited at Nimbahera and Vikram Cement of M/s UltraTech at Neemuch, the safe level of PPV for the different structures of Railway Line has been taken as 20 mm/s. However, for the village houses and other structures present at Chenpura village and Gandhi Colony, the safe level of PPV has been considered as 10 mm/s.

(6) **Based on the assessment of ground vibration levels for different explosive charge quantities at various distances, blasting operations can be carried out safely without affecting and endangering the Railway Line. Similarly, blasting operations can be carried out safely without affecting the habitants and residential houses/structures of Chenpura village and Gandhi Colony.**

(7) Controlled blast design patterns have been recommended for conducting safe blasting operations nearby the Railway Line. The recommended blast design parameters and firing patterns of holes are given in **Table 7.1** and **Figures 7.1 to 7.14** of the report. Similarly, the recommended controlled blast design parameters for the safety of

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residential houses and other structures of the nearby villages are given in **Table 7.2** of the report.

(8) It is recommended to muffle the entire blasting area using blasting mats/wire-mesh/conveyor belts with sufficient sandbags within the blasting zone of 100 -150 m from the Railway Line. Within the blasting zone of 150 to 200 m from the Railway Line, all the blast holes should be covered with either wire-mesh or conveyor belts and sufficient sandbags.

(9) Blasting time should be fixed in consultation with the Railway Department. No blasting operation should be conducted during any train movement near the mining lease area.

(10) Nonel (Shock Tube) initiation system is recommended for in-hole explosive initiation and surface hole-to-hole firing. For effective control on ground vibrations, the recommended maximum scattering of delays in case of TLD is ± 5 ms and for DTH, the suggested limit for scattering of delay is ± 10 ms.

Acknowledgement

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ANNEXURE-3