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Ref: CCIL/USO/EHS/2022-23/08 **Dated: 15/11/2023**

To,

The Director,
Ministry of Environment Forest & Climate Change
Govt. of India, Integrated Regional Office,
Guwahati, Assam.

Subject: Submission of Six-Monthly Compliance Report of the condition of environment clearance of **New Umrangshu Lime Stone Mines at Jamunanagar, Umrangshu, Dist. Dima Hasao, Assam by M/S Calcom Cement India Ltd.**

Dear Sir,

With reference to the stipulations of Environment Clearance, please find enclosed herewith the Six-Monthly Compliance report for the period of 1st April 2023 to 30th September 2023 for CCIL Mines, Umrongso. The compliance report will be uploaded in our company website www.dalmiabharat.com within 15 days.

Kindly acknowledge the receipt of the same.

Thanking you,

For Calcom Cement India Limited. (MINES)

(Authorized Signatory)

CC to: 1) The Regional Executive Engineer,
Regional Office, Silchar, Pollution Control Board, Assam.

2) The Zonal Officer
Central Pollution Control Board,
Shillong, Meghalaya-793 014.

3) SEIAA Guwahati

Calcom Cement India Ltd.

Environmental Clearance - Half Yearly Compliance Report (April 23- September 23)

Ref: Environment Clearance No. J-11015/202/2011-IA.II(M), dated 11th June 2020. **New Umrangshu Lime Stone Mine at Village-New Umrangshu, Tehsil Umrangshu Dist. Dima Hasao (North Cachar Hills) Assam by M/S Calcom Cement India Ltd.**

	Conditions	Compliance Status
A	**Specific Conditions**	
(i)	An amount of Rs. 251.04 Lakhs allocated for the CER shall be spent within 3 years for the activities such as hospital infrastructures, school infrastructure, village roads, ODF programme, rain water harvesting, and other concerns raised during the public hearing.	**For this Financial year under CER, the proposal is construction of** Village Road – 5 Km stretch from 19 kilo to Hanjanglangso, Bamboo plantation, smart classes, construction of a community hall, construction of boundary wall, with approx. Rs 84.35 Lakh expenses. Out of this, 40.56 Lakh was incurred in completing Bamboo plantation, beautification of smart school. Till date since beginning of the mines, an amount of Rs.198.88 Lakh expenses incurred for the various CER programmes against the planned Rs 251 Lakh. CER activities with expenses attached as **Annexure-1.**
(ii)	Green belt shall be developed with a total of 490890 saplings with a fund allocation of Rs. 6 Crs. At the conceptual stage, out of the total lease area i.e. 417.50 ha, about 327.26 ha area shall be covered under greenbelt and plantation (including 204.08 ha on mined out benches, 55.0 ha area around office and crusher area and 72.0 ha area on dump area). Green belt shall be developed all along the haul roads, around the mine pit, periphery of the mining lease area, etc. Plantation shall be done on mines out benches, waste dump area, around mine office & crusher area. Plantation will be done at @1500 plant/ha. The trees shall be planted at suitable grid spacing to encourage proper growth and species shall be planted according to CPCB	Greenbelt/Plantation done till date in and around mining lease area is given below and photos of the same is attached herewith as **Annexure-2**: Afforestation within lease area (Ha/ No. of Plants): WML: 3045 saplings (1.04 Ha) with 86% of survival rate. Afforestation outside ML (Ha/ No. of plants): 2080 saplings (1.025 Ha) with 88% of survival rate.

	guidelines such as Embolic Officinalis (Amla), Acacia catechu (Kher), Terminalia arjuna (Arjun), Albizziao doratissima (Chichwa), Anthocephalus cadamba (Kadam), Ficusreligiosa (pipal), Aeglemarmelos (Bel), Madhuca indica (Mahua), Terminalia tementosa (Saja), Anogeissuslati folia (Dhaora), Dalbergia sisso (Sisam) etc.	We have planted total no of saplings is 5125 over 2.06 Ha within and around mining lease area as of September 23.
(3)	Garland drain of adequate cross section shall be made all along the quarry area measures shall be taken to avoid the erosion and contamination of the surrounding area.	Garland drain has been constructed in the southwestern part of mines area near by Culvert -1 as per the mining plan. Photo attached as an **Annexure-3**.
(4)	Controlled blasting shall be carried using the NONELs and fly rock control measures.	Controlled blasting is being conducted as per requirement of the material using NONELs.
(5)	In pursuant to ministry OM No 22-32/2018 -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 Causes 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.	Noted and it is the process under the progressive mine planning wherever is applicable and will be completed before the final closure of the mines.
B	**Standard Conditions**	
(I)	**Statutory Compliance**	
(1)	This environmental clearance (EC) is subjected to orders/judgment 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.	Noted.
(2)	The project proponent complies with all the statutory requirements and judgement of Hon'ble Supreme Court dated 2nd August 2017 in write petition (Civil) no 114 of 2014 in matter of Common	Noted.

	Causes versus Union of India & OR's before commencing the mining operations.	
(3)	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 causes verses union of India & OR's.	There was no compensation levied through the Dept. of Geology and Mining or any other statutory bodies and hence not applicable as per the condition.
(4)	This environment clearance shall become operational only after receiving former NBWL clearance from MOEF&CC subsequent to the recommendations of the standing committee of national board for Wildlife, if applicable to the Project.	The entire mining lease area is under unclassified forest land and accordingly, we have obtained the forest clearance, hence it is not applicable as per the condition.
(5)	This environmental clearance shall become operational only after receiving formal forest clearance (FC) under the provision of Forest Conservation Act, 1980, if applicable to the Project.	We have obtained Forest Clearance vide Letter No FG27/Nodal/proposal/Calcom cement Part II.and is attached herewith as **Annexure-4**.
(6)	Project Proponent (PP) shall obtain Consent to Operate after grant of EC and effectively implement all the condition stipulated therein. The mining activities shall not commence prior to obtaining Consent to Establish / Consent to Operate from the Concerned State Pollution Control Board/ Committee.	We have obtained both CTE & CTO as per conditions and are attached herewith as an **Annexure-5**.
(7)	The PP shall adhere to the provision of the Mines Act, 1952, Mines and Mineral (Development & Regulation), Act 2015 and rules & regulations made there under. PP Shall adhere to various circular issued by Directorate General Mines Safety (DGMS) and Indian Bureau of Mines from time to time.	We are being responsible corporate are adhered to the Mines Act, 1952, Mines and Mineral (Development & Regulation), Act 2015 and rules & regulations made there under and always work in compliance.

(8)	The project Proponent shall obtain Consent from all the Concerned land owners, before start of mining operations, as per the provision of MMDR Act, 1957 and rules made there under in respect of lands which are not owned by it.	There was no private land involved in the mining lease area and hence it is not applicable as per condition.
(9)	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".	There was no habitation and a village up to 3 kms range from the mining lease area. Hence, its condition is not applicable.
(10)	The Project Proponent Shall obtain necessary prior permission of the competent authorities for drawl of requisite quantity of surface water and from CGWA for withdrawal of ground water for the project.	There is no ground water withdrawal as per mining plan. We are collecting the rain water, storing it in sump located bottom portion of mines and will reuse it for the dust suppression.
(11)	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.
(12)	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 office for 30 days.	Complied.
(13)	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	Complied and attached as an **Annexure-6.**

	Change (www.parivesh.nic.in). A copy of the advertisement may be forwarded to the concerned MoEFCC Regional Office for compliance and record.	
(14)	The Project Proponent shall inform the MoEFCC for any change in ownership of the mining lease. In case there is any changes in ownership or mining lease is transferred then mining operation shall only be carried out after transfer of EC as per provision of the para 11 of EIA Notification, 2006 as amended from time to time.	Noted.
II	Air quality monitoring and preservation	
(1)	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 ^{0} is made between the monitoring locations to monitor critical parameters, relevant for mining operations of air pollution viz PM10, PM 2.5, NO_2, CO and SO_2 etc. as per the methodology mentioned in NAAQS notification No. B-290 16/20/90/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 Mines site.	We have installed one online Ambient Air Quality Monitoring Stations AAQMS in Southern part of the lease area presently and as per guidance another 2 stations will be installed at 120^0 between the monitoring locations as the mines progresses. Apart from this we are monitoring quarterly the air quality at 4 locations as mentioned below – 1.Near Vie point 2.Near Culvert-1 3.Near Culvert-2 4.Near weighbridge. The ambient air Monitoring reports for the previous quarter is attached herewith as an **Annexure-7**.
(2)	Effective safeguard measures for prevention of dust generation and subsequent suppression (like regular water sprinkling, metalled road construction etc.) shall be carried out in area prone to air pollution wherein high level of PM10 and PM2.5 are evident such as haul road, loading and	We have two water tankers of each 10KL capacity are used dust suppression on the haul road. Haul roads are constructed with aggregate material and properly levelled with material so that there is no dust generation while transportation. Apart from this we are spraying the ware over the muck pile to arrest the dust while loading.

	unloading point and transfer points. The fugitive dust emission from all source shall be regularly controlled by installation of required equipment's/ machineries and preventive maintenance.	
(3)	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.	With our existing dust suppression system all the parameters are well within permissible limits and hence there is no requirement of the water-soluble chemical dust suppressing agents
III.	Water quality monitoring and preservation	
(1)	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 GCWA and MoEFCC is in place before such mining operations. The permission for intersection of groundwater table shall essentially be based on detailed hydro-geological study of the area.	In mine planning period there is no intersection of working with ground water table and hence the condition is not applicable.
(2)	Regular monitoring of the flow rate of the Springs and perennial nallahs flowing in and around the mine Lease shall be carried out and records maintain. The natural water bodies and or streams which are flowing in an around the village, should not be disturbed. The water table should be Nurtured so as not to go down below the pre-mining period. In case of any water scarcity in the area, the Project Proponent has to provide water to the villagers for their use. A provision for regular monitoring of water table in open dug wall located in village should be incorporated to ascertain the impact of mining over groundwater table. The report on changes in groundwater level and quality	Our present work is far away from the springs, natural water bodies. We will ensure all the needed control measure to do not disturb natural water and or streams. There is no open dug well groundwater and hence the regular monitoring of water table in open dug wall located in village condition is not applicable.

	shall be submitted on six- monthly basis to the Regional Office of the Ministry, GCWA and State Groundwater Department / State Pollution Control Board.	
(3)	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 groundwater level and quality shall be submitted on six-monthly basis to the Regional Office of the Ministry, CGWA and State Groundwater Department / State Pollution Control Board.	As there is no groundwater available, and hence the condition is not applicable.
(4)	The project Proponent Shall undertake regular monitoring of natural water course/ water resource/ Springs and perennial nallahs existing/ flowing in and around the mine lease and maintains its records. The Project Proponent shall undertake regular monitoring of water quality upstream and downstream of water bodies passing within and nearby / adjacent to the mine lease and maintain its records. Sufficient number of gullies shall be provided at appropriate places within the lease for management of water. PP shall carryout regular monitoring w.r.t to pH and included the same in monitoring plan. The parameters to be monitored shall include their water quality vis-a-vis suitability for uses 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 carried out four times in a year viz. pre- monsoon (April- may), monsoon (August), post	We have hired the consultant for monitoring of the water from the water course/ water resource/ Springs and in and around the mine lease, all the parameters are within permissible limits and reports for the same is attached herewith as **Annexure-8**.

	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 of six- monthly basis.	
(5)	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 Dissolved Solids (TDS), Dissolved Oxygen (DO), pH and Total Suspended Solid (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 J- 20012/1/2006- IA. II (M) dated 27.05.2009 issued by Ministry of Environment, Forest and Climate Change may also be referred in this regard.	There is no water discharge from mine and hence the condition is not applicable.
(6)	Project proponent shall plan, develop and implement rainwater harvesting measures on long term basis to augment groundwater resources in the area in consultation with Central Ground Water Board/ State Groundwater Department. A report on amount of water recharged needs to be submitted to Regional Office MOEFCC annually.	We have made a sump at bottom of the mines and apart from this we have constructed the rainwater harvesting pond of 15 Cum. capacity outside the lease area.
(7)	Industrial waste water (workshop and waste water 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	We have ETP of capacity of 15 cum for the workshop at our plant premises. There is no waste water discharge from mines and hence the condition is not applicable.

	(SPCB). The workshop effluent shall be treated after its initial passage through Oil and grease trap.	
(8)	The water balance water auditing shall be carried out and measure for reducing the consumption of water shall be taken up and reported on the regional office of the MOEFCC and State Pollution Control Board/ Committee.	Noted for compliance.
IV.	Noise and vibration monitoring and prevention	
(1)	The peak particle velocity of 500 m distance or within the nearest habitation, whichever is closer Shall be monitored periodically as per applicable DGMS guidelines.	We are doing the controlled blasting and for each blasting we are monitoring the peak particle velocity by MINIMATE (instantanel) and it is within permissible limits. There is no habitat within 3kms range.
(2)	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 of the villages located close to mining operations. Habitation have a right for darkness and minimal noise level at night. PPs must ensure that the biological clock of the village is not disturbed, by orienting the floodlights/ masks away from the villagers and keeping the noise levels well within the prescribed limit for day/ night hours.	We are operating the mines with the new machineries and proper lighting away from habitation so there is no disturbance to human and animal population. Noise monitoring is being done quarterly basis and reports for the same is attached herewith as **Annexure-9**.
(3)	The Project Proponent shall take measure for control of noise level below 85 dBA in the work environment. The workers engaged in operations of HEMM, etc. should be provided with earplugs/muffs. All personnel including laborers working in dusty area shall be provided with protective respiratory devices along with adequate training, awareness and information on safety and health aspects. The PP shall be held Reigns responsible in case it has been found that worker/	It is complied, Noise monitoring is being done on quarterly basis and reports for the same is attached herewith as **Annexure-9**.

	personals/laborers are working without personal protective equipment.	
V.	Mining plan	
(1)	The project Proponent shall adhere to the working parameters of mining plan which was submitted at the time of EC appraisal within year -wise plan was mentioned for total excavation i.e. quantum of mineral, Waste, overburden, Inter burden and top soil etc. No change on basic mining proposal like mining technology, total excavation, mineral and waste production, Lease area and a scope of working (viz. method of mining, overburden and dump management, OB and dumping mining mineral transportation mode, ultimate depth of mining etc.) shall not be carried out without prior approval of the Ministry of Environment, Forest and Climate Change, which entail adverse environmental impacts, even if it is a part of approved mining plan modified after grant of EC or granted by State Government in the form of Short Term Permit (STP), Quarry license or any other name.	Noted and Mining Operations are being carried out in accordance with the approved mining plan.
(2)	A Project Proponent Shall get the final mine closure plan along with financial assurance approved from Indian Bureau of Mines Department of Mining and Geology as required under the provision of the MMDR Act, 1957 and Rules/ Guidelines made there under. A copy of approved final mine closure plan shall be submitted within 2 months of the approval of the same from the competent authority to the concerned Regional Office of the Ministry of Environment, Forest and Climate Change for record and verification.	Noted and will be adhered at the closing of the mining plan period.

(3)	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 approved mining plan. PP shall ensure the monitoring and management of rehabilitated area until the vegetation become self- sustaining. The compliance status shall be submitted half-yearly to the MoEFCC and its concerned Regional office.	Noted. Mining operation and reclamation-rehabilitation of mined out area will be carried out in accordance with the approved mining plan.
VI.	Land reclamation	
(1)	The overburden (O.B) 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 overburden dumps like height, width and angle of slope shall be governed as per the approved Mining Plan as per the guidelines/ circulars issued by D.G.M.S w.r.t safety in mining operations shall be strictly adhered to maintain the stability of top soil/ over burden dumps. The topsoil shall be used for land reclamation and plantation.	As per mining plan only overburden (O.B) generated during the mining operations is being stacked at earmarked site(s). The dump will be reclaimed as per mining plan. The physical parameters of the overburden dumps like height, width and angle of slope are maintained as per the approved Mining Plan as per the guidelines/circulars issued by D.G.M.S.
(2)	The reject/waste generated during the mining operations shall be stacked at earmarked waste dump sites only. The physical parameter of the waste dumps like height width and slow and angle of slope shall be governed as per the approved Mining Plan as per the guidelines/circulars issued by DGMS w.r.t safety in mining operations shall be strictly adhered to maintain the stability of waste dumps.	As per mining plan only overburden (O.B) generated during the mining operations is being stacked at earmarked site(s). The dump will be reclaimed as per approved mining plan. The physical parameters of the overburden dumps like height, width and angle of slope are maintained as per the approved Mining Plan as per the guidelines/circulars issued by D.G.M.S.
(3)	The reclamation of waste dump site shall be done in scientific manner as per the approved mining plan cum progressive mine closure plan.	Reclamation is being done as per approved mining plan.

(4)	The slope of dumps shall be vegetated in scientific manner with suitable native species to maintain the slope stability, prevent erosion and surface run off. The selection of local species regulates local climate parameters and help in adaptation of plant species in 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 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.	Presently dump is active and after the certain period suitable native species will be planted over the slope for the stability.
(5)	The Project Proponent shall carry out slope stability study in case the dump height is more than 30 meters. The slope stability report shall be submitted to concerned regional office of MOEFCC.	We are maintaining the dump height within 30 mtrs height, still we have conducted the slope stability study from the IIT-BHU. Slope stability report is attached as **Annexure10**
(6)	Catch drains, settling tanks and siltation ponds of appropriate size shall be constructed around the mine working, mineral yards and top soil/ over burden/ waste dumps to prevent run off of water and flow of sediments directly into the water bodies (Nallah/ River/ Ponds 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.	Noted and will be constructed during the mining operations as per Approved Mining Plan.
(7)	Check dams of appropriate size, gradient and length shall be constructed around mine pit and over burden 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 structured over and above peak rainfall (based on 50-year data) and maximum discharge in the mine an it's adjoining area which shall also help in	Noted.

	providing educate retention time period thereby allowing proper settling of sediments/ silt material. The sedimentation pits/ sumps shall be constructed at the corner of the Garland drains.	
(8)	The topsoil, if any, shall temporarily be stored at earmarked site within the mine lease only and should not be kept unutilized for long. The physical parameter of the topsoil dumps like height, width and angle of slope shall be governed as per the approved mining plan and as per the guidelines framed by DGMS w.r.t safety in mining operations shall be strictly adhered to maintain the stability of dumps. The top soil shall be used for land reclamation and plantation purpose.	There is no top soil generated at present and however we will ensure the compliance of conditions as per requirement in future.
VII.	Transportation	
(1)	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 educated gap (say at least 200 meters), so that the adverse impact of sound and dust along with chances of accident 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 Government Department only after required strengthening such that the carrying capacity of road is increased to handle the traffic 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 of obtain Pollution Under Control (PUC) certificate for all the vehicles from authorized pollution testing centers.	We are having separate private road for mineral transportation and hence the conditions are not applicable.

(2)	The main haulage road within the mine lease should be provided with a permanent water sprinkling arrangement for dust suppression. Other roads within the mines lease should be wetted regularly with tanker -mounted water sprinkling system. The other areas of dust generation like crushing zone, material transfer points, material yard etc. should invariably be provided with dust suppression arrangements. The air pollution control equipment's like bag filter, vacuum suction hoods, dry fogging system etc. shall be installed at crushers, belt-conveyors and other area 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 emissions.	We are having the 2-water tanker of each 10KL capacity deployed for the dust suppression on the haul road. The area is far away from the mines area and sufficient dust suppression systems are available.
VIII.	Green Belt	
(1)	The Project Proponent shall develop Greenbelt in 7.5-meter-wide safety zone all along the mine lease boundary as per the guideline of CPCB in order to arrest pollution emanating from mining operations within the lease. The whole Green belt shall be developed within first 5 years starting from 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.	We have planted total 5125 nos. of saplings over 2.06 Ha within and around mining lease area as of September 23.
(2)	The project proponent shall carryout plantation/ afforestation in backfilled and reclaimed area of mining lease, around water body, along the roadsides, in community area etc. by planting the native species in consultation with the state Forest Department/ Agriculture Department/ Rural development Department/ Tribal Welfare Department/ Gram panchayat t such that only those species be selected which are of use to the	We have planted total 5125 nos. of saplings over 2.06 Ha within and around mining lease area as of September 23.

	local people. The CPCB guidelines in this respect shall also be adhered. The density of the trees should be around 2500 sapling per hectare. Adequate budgetary provision shall be made for protection and care of trees.	
(3)	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 list. The development of such grazing land shall be done in consultation with the state government. In this regard, Project Proponents should essentially implement the directions of the Hon'ble Supreme Court with regard to acquisition of grazing land. The sparse tree on such grazing ground, which provide mid- day shelter from the scorching sun, should be is scrupulously guarded/ protected against felling and plantation of such trees should be promoted.	Not applicable as there is no grazing land exists within mining lease area.
(4)	The Project Proponent shall undertake all precautionary measure for conservation and protection of endangered flora and fauna and schedule-1 species during mining operations. A Wildlife Conservation plan shall be prepared for the same clearly delineating action to be taken for conservation of flora and fauna. The plan shall be approved by Chief Wildlife Warden of the State Govt.	The entire lease area falls under unclassified forest and we have obtained the forest clearance and hence it is not applicable.
(5)	And implemented in consultation with the State Forest and Wildlife Department. A copy of Wildlife Conservation Plan and its implementation status (annual) shall be submitted to the Regional Office of the Ministry.	NA
IX.	Public hearing and human health issues	
(1)	The Project Proponent shall appoint an occupational health specialist for regular as well as	We have appointed occupational health specialist at our dispensary and conduct the medical

	periodical medical examination of the workers engaged in the mining activities, as per the DGM's guidelines. The records shall be maintained properly. PP shall also carry out occupational health Check-ups in respect of workers which are having ailments like BP, diabetes, habitual smoking, etc. The check-ups shall be undertaken once in six months and necessary remedial/ preventive measure be taken. A status report on the same may be sent to MoEFCC Regional Office and DGMS on half yearly basis.	examination of the workers every year engaged in the mining activities, as per the DGM's guidelines and photos for the same along with sample report is attached herewith as **Annexure-11**
(2)	The Project Proponent must demonstrate commitment to work toward 'Zero Harm' from their mining activities and carry out health risk assessment (HRA) for identification workplace hazards and assess their potential risks to health and determine appropriate control measure to protect the health and wellbeing of workers and nearby community. The proponent shall maintain accurate and systematic records of the HRA. The HRA for neighborhood has to focus on Public Health Problem like malaria, tuberculosis, HIV, anemia, diarrhea in children under five, respiratory infections due to bio mass cooking. The proponent shall also create awareness and educate the nearby community and workers for sanitation, personal hygiene, hand washing, not to defecate in open, woman health and hygienic (providing sanitary napkins), hazard of tobacco and alcohol use. The proponent shall carry out baseline HRA for all the category of worker and thereafter every five years.	Noted and will be adhered as per requirement.
(3)	The proponents all carry out occupational health surveillance which be a part of HRA and include biological monitoring where practical and feasible, and the test and investigations relevant to the exposure (e.g. for dust X Ray chest for noise audiometric, for lead exposure blood lead, for	Complied and is being done every year.

	welder full ophthalmologic assessment, for manganese miners a complete neurological assessment by a certified neurologist and manganese (Mn) estimation in blood, for inorganic chromium fortnightly skin inspection of hands and forearms by a responsible person. Except routine test all tests would be carried out in a lab accredited by NABH. Records of health surveillance must be kept for 30 years including the result of and the records of physical examinations and tests. The record of exposure due to material like asbestos, hard rock mining, silica, gold, kaolin, aluminum, iron, manganese, chromium, lead, uranium needs to be handed over to the mining Department of the state in case of life of the mines is less than 30 years. It would be obligatory for the state mines Departments to make arrangement for the safe and secure storage of the records including X- Ray. Only conventional X- Ray will be accepted for record purpose and the digital one). X-Ray must made ILO criteria (17 X 14 inches and of good qualities).	
(4)	The Proponent shall maintain a record of performance indicator for workers which include (a) there should not be a significant decline in their body mass index and it should stay between 18.5 - 24.9 (b) the final chest X- Ray compared with the base line X- Ray should not show any capacities, (c) At the end of their leaving job there should be no Diminution in their lungs functions forced expiratory volume in one second (FEV1), forced vital capacity (FVC) and the ratio unless they are a smoker which has to be adjusted, and the effect of age (d) their hearing should not be affected. As a proof an audiogram (first and last need to be represented), (e) they should not have developed any persistent back pain, neck pain and the moment of their hip, knee and other joint should have	Noted and being done every year.

	normal range of movement, (f) they should not have suffered loss of anybody part. The record of the same should be submitted to the Regional Office, MOEFCC annually along with details of the relief and compensation paid to workers having above indications.	
(5)	The Project Proponent ensure that personal working in dusty area should wear protective respiratory devices and this should also be provided with educate training and information on safety and health aspects.	Each workman has been provided with all the necessary PPE's as per the need of work under our EHS policy and ensuring strictly for compliance.
(6)	Project Proponents shall make provision for the housing for workers/ labor or shall construct labor camp within/outside (company owned land) with necessary basic infrastructure/ facilities like fuel for cooking, mobile toilets, mobile STP, safe drinking water, medical health care, creches for kids etc. The housing may be provided in the form of temporary structure which can be removed after Completion of the project related infrastructure. The domestic waste water should be treated with STP in order to avoid contamination of underground water.	We have provided the housing with all amenities for the workmen outside the mining lease area. STP 's are installed to prevent contamination of surface water.
(7)	The activities proposed in action plan prepared for addressing the issues raised during the public hearing shall be completed as per the budgetary provision mentioned in the action plan and within the stipulated time frame. The status report on implementation of action plan shall be submitted to the concern regional office of the ministry along with district administration.	Noted and complied.
X.	Corporate Environment Responsibility (CER)	
(1)	The activities and budget earmarked for corporate environmental responsibility (CER) as per ministry O.M No 22-65/2017-IA. II (M) dated 01.05.2018 or as proposed by EAC should be kept in a separate	Till date since beginning of the mines, an amount of Rs.198.88 Lakh expenses incurred for the various CER programmes against the planned Rs 251 Lakh.

	bank account. The activities proposed for CER shall be implemented in a time bound manner and annual report of implementation of the same along with documentary proof viz. photographs, purchase documents, latitude and longitude of infrastructure developed and road constructed needs to be submitted to Regional Office MoEFCC annually along with audited statement.	CER activities with expenses attached as **Annexure-1.**
(2)	Project Proponent shall keep the funds earmarked for Environmental Protection measures in a separate account and refrain from diverting the same for other purpose. The year wise expenditure of such funds should be reported to the MOEFCC and its concerned Regional Office.	Noted and complied.
XI.	Miscellaneous	
(1)	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 MoEFCC.	Noted and complied.
(2)	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.	Complied.
(3)	The Project Proponent shall submit 6 monthly compliance reports on the status of the implementation of the stipulated environmental safeguards to the MOEFCC and it concerned Regional Office, Central Pollution Control Board and State Pollution Control Board.	Complied and being done regularly.
(4)	A separate "Environment 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	We have separate Environment management cell with suitable qualified manpower under the senior leadership along with team.

	Organization. Adequate number of qualified environmental scientists and mining engineers shall be appointed and submitted a report to RO, MOEFCC.	
(5)	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.	Noted.

Annexure-1

Activity wise expenditure detail of plant EC commitment					
SL No	**Activity**	**Location**	**Expenditure (Lakh)**	**Year of execution**	**Remarks**
1	Bamboo plantation	Borolobang, Mirphung, Chotolobang, Rongmepi	16.4	2022	Completed
	Plantation and beautification of school campus	SVM and Garampani Govt. High school	9.66	2022	Completed
	Community Hall Construction	Kamala Bagan	18.96	2022	Completed
	Sports gallery construction	Dithur playground	11.93	2022	Completed
	Boundary wall construction of school	Umrangso 19 KM L P school	13.23	2022	Completed
	Mid-day meal cooking house	Umrangso 19 KM L P school	12.23	2022	Completed
	Construction of spring water storage tank	Amramlangso & New Borolarpheng	12.62	2022	Completed
	Water Tanker for community service	Near by village	26.95	2022	Completed
	Village road development	Umrangso 19 KM to Hanjanglangso	19.5	2022	Completed
	Solar Street installation	Langcherui, Hanjanglangso, Dithur	2.5	2022	Completed
	Skill training for local youths	Nagaon ITI	7.14	2022	Completed
	Ring well construction- 6 Nos	Langcherui, Hanjanglangso, Borolokhindong, Thrvelangso, Khrongma	7.2	2022	Completed
	Bamboo plantation	Dorbinsip, Kekrangsip, Waridiplai, Nobodi Longukro, Sibraidisa, Chotolangfer	23.1	2023	Completed
	Plantation and beautification of school campus	Dimarazi school, Rongbonhom school, Karbi club, Umrangso 19 KM school and playground	9.66	2023	Completed
	Community Hall Construction	Umrangso 19 KM	23.83	2023	PR raised, awaitng for PO
	Boundary wall at Thongnokbe school	Langmeklu	19.96	2023	PR raised, awaitng for PO
	Vision document preparation	Near by village	7.8	2022	Completed
		Total Expenditure	242.67		

Garland Drain Provided at New Umrangshu Limestone Mines

Annexure-2

Plantation carried out at safety zone of New Umrangshu Limestone Mines

Annexure-4

GOVERNMENT OF ASSAM
OFFICE OF THE PRINCIPAL CHIEF CONSERVATOR OF FORESTS AND HEAD OF FOREST FORCE, ASSAM
ARANYA BHAWAN, PANJABARI, GUWAHATI-37

Email: addlpccf.nodal@gmail.com

No. FG.27/ Nodal/ Proposal/ Calcom Cement/ Part-II *Date: 09.12.2019*

To

The Chief Conservator of Forests
Dima Hasao District, Assam, Haflong

Sub: **Diversion of 425.5 Ha of Forest land of USF area in New Umrangso Village, Dima Hasao District (N.C. Hills) for open cast mining of limestone in favour of M/s Calcom Cement India Ltd.**

Ref: Government of India's letter No. 8-11/2019Fc dated 25.11.2020.

Sir,

With reference to the above, Please find enclose herewith the "**Final Approval**" letter granted by Government of India vide letter No. 8-11/2019Fc dated 25.11.2020 against diversion of diversion of 425.5 Ha of Forest land of USF area in New Umrangso Village, Dima Hasao District (N.C. Hills) for open cast mining of limestone in favour of M/s Calcom Cement India Limited. You are, therefore, requested to provide your comments on whether to go for the Final Notification as the Compensatory Afforestation land is already handed over to department by Council taking all the clearances from claims and encumbrances

Please note that issue of final notification for the proposed Compensatory Afforestation area as reserved forest/protected forest prior to handing over the land to the user agency is mandatory.

Encl: As stated above.

Yours faithfully,

(Dr. C Muthu Kumaravel, IFS)
Chief Conservator of Forest &
Nodal Officer, (F.C. Act), Assam

Copy to:

1. The Principal Secretary to the Government of Assam, Environment & Forest Department, Dispur, Guwahati-6 for kind information.
2. The Divisional Forest Officer, Dima Hasao Forest Division (West), Haflong for information.
3. M/s Calcom Cement India Ltd., 4th Floor, Anil Plaza-II, ABC, G.S. Road Guwahati -5 for information.

Chief Conservator of Forests &
Nodal Officer (FC Act), Assam

(338)

Government of India
Ministry of Environment, Forest and Climate Change
(F.C. Division)

Indira ParyavaranBhawan,
JorBagh Road, Aliganj,
New Delhi: 110003,

Dated: 25th November, 2020

To,

The Addl. Secretary (Forests),
Government of Assam,
Environment and Forest Department,
Dispur, Guwahati-6.

Sub:Diversion of 425.5 Ha. Forest land of USF area in New Umrangshu Village, Dima Hasao Dist. (North Cachar Hills) for opencast mining of limestone in favour of M/s Calcom Cement India Ltd.:reg.

Sir,

I am directed to refer to the State Govt. of Assam's letter No.FRS.53/2019/93 dated 15.03.2019 on the subject mentioned above seeking prior approval of the Central Govt. under Section-2 of the Forest (Conservation) Act, 1980 (FCA-1980) and to say that the proposal has been examined by the Forest Advisory Committee (FAC) constituted by the Central Govt. under Section-3 of the aforesaid Act. After careful consideration of the proposal by the FAC and after its recommendation, and approval of competent authority in the Ministry, ***In-principle/Stage-I*** approval was accorded vide this Ministry's letter of even number dated **23.08.2019** subject to fulfillment of certain conditions. The State Govt. has furnished compliance report in respect of the conditions stipulated in the approval and has requested the Central Govt. to grant the final approval.

2. In this connection, I am directed to say that on the basis of the compliance report furnished by the State Govt. of Assam's letters No. FRS.53/2019/93 dated 27.07.2020 and No. FRS.53/2019/189 dated 28.08.2020, and clarification on FRA by Ministry of Tribal Affairs vide its letter No.23011/20/2020-FRA dated 30.10.2020, ***approval*** of the Central Govt. is, hereby, accorded under Section-2 of the FCA-1980 for diversion of 425.5 Ha. Forest land of USF area in New Umrangshu Village, Dima Hasao Dist. (North Cachar Hills) for opencast mining of limestone in favour of M/s Calcom Cement India Ltd., subject to following conditions:

A: Conditions which need to be complied prior to handing over of forest land to user agency by the State Govt.:

i. The Govt.of Assam, Environment and Forest Department shall issue final notification for the proposed CA area as reserved forest/protected forest prior to handing over the land to the user agency . State Govt. shall ensure that the CA area in the final notification shall not be changed without prior approval of Govt. of India and shall not be less than 425.5 ha as proposed in the in the government of Assam notification no FRS 53/2019/123 dated 1st June 2020.

ii. The State Govt. shall ensure the complete compliance on FRA, 2006 ;

B: Conditions which need to be complied after handing over of forest land to the user agency by the State Govt.:

Chief Conservator... Forces Force, Assam
Regd. No. 1473
Date. 08/12/2020

(33)

i. Legal status of the diverted forest land shall remain unchanged;
ii. The State Govt. shall ensure that the State Forest Department will raise the Compensatory Afforestation in identified 425.5 ha. non -forest land in village Boro Langherang Village of Dima Hasao West Forest Division, Dima Hasao Distt., Assam in lieu of 425.5 Ha. of forest land, within three years from the issue of approval and maintained thereafter, from the funds deposited by the User Agency. At least 1000 plants per hectare shall be planted as per approved plan/scheme and maintained thereafter subsequently for ten years'. The approved Soil and Moisture Conservation (SMC) activities on the CA land shall be carried out by the State Forest Department;
iii. The User Agency shall pay the additional amount of NPV, if so determined, as per the final decision of the Hon'ble Supreme Court of India;
iv. The State Govt. and the user agency shall ensure that 11 ha of moderately dense forest as identified by Regional office in SIR and for which KML/shape file provided, shall maintain as green belt under supervision of State Forest Department;
v. The State Govt. and the user agency shall ensure that no residential or labour colony shall be constructed over forest land;
vi. The State Govt. and the user agency shall ensure that period of diversion of the said forest land under this approval shall be for a period co-terminus with the period of the mining lease granted under the Mines and Minerals (Development and Regulation) Act, 1957, as amended and the Rules framed there-under;
vii. The State Govt. shall ensure that the User Agency shall obtain the Environment Clearance as per the provisions of the Environmental (Protection) Act, 1986, if required;
viii. The State Govt. shall ensure that no labour camp shall be established on the forest land and the User Agency shall provide fuels preferably alternate fuels to the labourers and the staff working at the site so as to avoid any damage and pressure on the nearby forest areas;
ix. The State Govt. shall ensure that the forest land proposed to be diverted shall under no circumstances be transferred to any other agency, department or person without prior approval of the Central Government and the layout plan of the proposal shall not be changed without the prior approval of the Central Government;
x. The State Govt. shall ensure that no damage to the flora and fauna of the adjoining area shall be caused;
xi. The State Govt. shall ensure that the user agency shall explore the possibility of translocation of maximum number of trees identified to be felled and any tree felling shall be done only when it is unavoidable and that too under strict supervision of the State Forest Department;
xii. The State Govt. shall ensure that the User Agency shall carry out mining in a phased manner after taking due care for reclamation of the mined over area. The concurrent reclamation plan as per the approved mining plan shall be executed by the User Agency from the very first year, and an annual report on implementation thereof shall be submitted to the Nodal Officer, FCA-1980, in the concerned State Govt. and the concerned Regional Office of the Ministry. If it is found from the annual report that the activities indicated in the concurrent reclamation plan are not being executed by the User Agency, the Nodal Officer or the concern Dy. Director General (Central) may direct that the mining activities shall remain suspended till such time, reclamation activities in the area is satisfactorily executed;
xiii. It may please note that violation of any of these conditions will amount to violation of FCA-1980 and action would be taken as prescribed in para 1.21 of Chapter 1 of the Handbook of comprehensive guidelines of FCA-1980 as issued by this Ministry's letter No. 5-2/2017-FC dated 28.03.2019;
xiv. The State Govt. shall ensure that the User Agency shall submit the annual self -compliance report in respect of the above stated conditions to the State Govt., concerned Regional Office and to this Ministry by the end of March every year regularly; and
xv. The State Govt. shall ensure that the user agency shall comply all the provisions of the all Acts, Rules, Regulations, Guidelines, Hon'ble Court Order (s) and NGT Order (s) pertaining to this project, if any, for the time being in force, as applicable to the project.

(33)

Yours faithfully,

Sd/
(Sandeep Sharma)
Assistant Inspector General of Forests (FC)

Copy to:

1. PCCF (HoFF), Govt. of Assam, Guwahati.
2. Nodal Officer, Office of the PCCF (HoFF) Govt. of Assam, Guwahati.
3. Dy. Director General (Central), Integrated Regional Office, Shillong.
4. User Agency.
5. Monitoring Cell of FC division, MoEF&CC, New Delhi.
6. Guard file.

Pollution Control Board:: Assam
Bamunimaidam; Guwahati-21
(Department of Environment & Forests :: Government of Assam)
Phone: 0361-2652774 & 2550258; Fax: 0361-2550259
Website: www.pcbassam.org

No.WB/SLC/T-1113/20-21/10 447 Dated Guwahati, the 30/9/ 2020

"CONSENT TO ESTABLISH"

"CONSENT TO ESTABLISH" is hereby granted to **M/S. CALCOM CEMENT INDIA LIMITED** for setting up a Lime Stone Mining project with production capacity – 7.77 MTPA to be located at New Umrangshu, Tehsil, Umrangshu, Pin-788931, Dist.: Dima-Hasao (Assam) under Section 25 of Water (Prevention & Control of Pollution) Act, 1974 and Section 21 of Air (Prevention & Control of Pollution) Act, 1981 as amended under the following terms & conditions:

1. No Air, Water, Soil pollution shall be created by the industry beyond the permissible limits prescribed by the Board. The industry would incorporate adequate pollution control measures before they put the plant into operation.
2. To maintain the environment and ecology in the area provisions for planting selected species of tree within the compound and approaches along with provisions for park, garden and fountain shall have to be made. Massive aforestation will have to be made by the industry in the factory and township if any.
3. As per provisions of Water (Prevention & Control of Pollution) Act, 1974 and Air (Prevention & Control of Pollution) Act, 1981 any officer, employed by this Board on its behalf shall without any interruption, shall have the right at any time to enter the industry for inspection, to take samples for analysis and any call for any information etc. violation of this right will lead to the withdrawal of this permission.
4. As per provisions of the Act, regular monitoring of Air, Water etc. is to be done by the industry from the location/points fixed by the Board and the report to be submitted to the board monthly.
5. Effluent carrying drains must be segregated from storm water drain. Any effluent generated must be treated and disposed after compliance of prescribed standard fixed by the Authority.
6. Standard linings on flat embankment of effluent pond shall have to be provided in the pond to prevent and control of overflow seepage and leakage of effluent to the nearby areas and ground water.
7. To regularise the subsequent "Consent to Operate" the legal provisions of "Consent to Operate" as per Act and Cess Returns as per Cess Act, 1977 shall have to be timely adhered to.
8. Gaseous pollution due to the burning of fuel to run engine boiler, kiln etc. should be controlled by adopting preventive measures adequately.
9. Solid waste that arises during the operation should be properly graded and disposed of scientifically without causing environmental degradation.
10. For Low lying areas, special care is to be taken by the industry to prevent any overflow, seepage and leakage of effluent.

Contd....p/2

11. Fire warning (Alarm, Siren) is to be installed by the unit to guard against accidental pollution/ mishap together with fire fighting devices.

12. All pipe connection, Joints; fittings etc. in the factory and plant are to be frequently checked and shall be leak proof all the time.

13. Proper housekeeping and adequate maintenance has to be ensured/ enforced as per provisions of Acts.

14. All unwanted Toxic Chemical/Fluid/Gases are to be taken care of as per prescribed norms.

15. Production process is to be monitored and in the event of danger immediate shut down is to be ensured by the industry.

16. **"CONSENT TO ESTABLISH"** has been issued basing on the particulars furnished by the applicant and subject to imposition to further/more conditions if warranted by the subsequent development.

17. **"CONSENT TO ESTABLISH" will be valid till the date of commissioning of the unit or 5 (five) years whichever is earlier.**

18. Healthy working environment for the worker must be maintained and there should not be health Hazard to the workers for in adequate arrangement for ventilation, dust removal arrangements should be adequate and full proof for the health of the workers. Their health should be regularly monitored.

19. The unit must submit compliance report of action taken on the conditions given by the Board before commissioning of the plant.

20. Adequate trees should be planted and maintained in the vacant space of the premises and all around the factory and township if any.

21. The Board will be at liberty to withdraw the **"CONSENT TO ESTABLISH"** at any time without notice, if necessary steps for prevention of pollution and prevention of degradation of environment is not taken by the industry as per mentioned conditions.

22. This issuance of the **"CONSENT TO ESTABLISH"** does not convey any property right in their real or personal property or any exclusive privileges nor does it authorize any injury to private property nor any invasion right any infringement of Central, State or Local Laws or Regulations.

23. The **"CONSENT TO ESTABLISH"** does not authorize or approve the construction of any physical structures or facilities or the undertaking of any work in any natural watercourse except of the works specially instructed herein.

24. The industry shall not discharge any wastewater outside the campus.

25. No fugitive emission shall be created by the unit.

26. The applicant shall maintain the general ambient air quality standards.

27. The industry shall not use any fuel, which may create pollution problem.

28. No noise pollution is to be created by the industry.

29. Noise dampening wall have to be arranged.

Contd....p/3

30. The industry must comply to the National Ambient Air Quality Standards as per Schedule – VII under Rule, 3(3B) of the Environment (Protection) Rules, 1986.

31. Necessary steps are to be taken to maintain Ambient Air Quality standards in respect of Noise as per the Noise Pollution (Regulation and Control) Rules, 2000 as amended till date.

32. Adequate fire fighting measures with fitting like fire hydrant etc. shall have to be provided in order to prevent accident.

33. The Board will have the liberty to withdraw the **"CONSENT TO ESTABLISH"** if adequate pollution control and safety measures are not taken.

Sd/-
Member Secretary (i/c)

Memo No.WB/SLC/T-1113/20-21/10–A, Dated Guwahati, the 30/9/ 2020

Copy to:

1. M/s. Calcom Cement India Limited; C/o Padmanav Chakravarty (Regional Manufacturing Head), New Umrangshu, Tehsil, Umrangshu, Pin-788931, Dist.: Dima-Hasao (Assam) for information & necessary action. The "**CONSENT TO ESTABLISH"** is valid subject to fulfillment of above terms & conditions and also subject to obtaining necessary permission from other Competent Authorities. This has the reference to your online application vide **No. 14684**
2. The Under Secretary to the Govt. of Assam, Department of Environment & Forests, Dispur, Guwahati – 6 for favour of information.
3. The Deputy Commissioner, Dima-Hasao district for favour of information.
4. The General Manager, DI&CC, Dima-Hasao for favour of information.
5. The Regional Executive Engineer (i/c); Regional Lab cum Office, Silchar; Pollution Control Board, Assam for information & necessary action. The **"CONSENT TO ESTABLISH"** is valid subject to fulfillment of above terms and conditions and also subject to obtaining necessary permission from other Competent Authorities.

Member Secretary (i/c)

Pollution Control Board:: Assam
Bamunimaidam; Guwahati-21
(Department of Environment & Forests :: Government of Assam)
Phone: 0361-2652774 & 2550258; Fax: 0361-2550259
Website: www.pcbassam.org

No. WB/SLC/T-1113/20-21/21 Dated Guwahati, the 6th Apr , 2023

"CONSENT TO OPERATE"

"CONSENT TO OPERATE" (CTO) under Section 25 of the Water (Prevention & Control of Pollution) Act, 1974 and Section 21 of the Air (Prevention & Control of Pollution) Act, 1981 as amended and Rules Framed there under is granted to:

i)	Name of Industry	:	M/s Calcom Cement India Ltd.
ii)	Name of the Occupier / Applicant and Designation	:	Sri Padmanav Chakravorty, Regional Manufacturing Head
iii)	Address of the unit	:	New Umrangsho, Umrangsho, Dist. Dima Hasao, Assam - 781005
iv)	Cost of the project	:	Rs. 12000.00 Lakhs.
v)	Details of the project & category	:	Lime Stone Mining (417.50 Ha) (Red category)

Sl. No.	Product	Capacity
1.	Lime Stone Mining	7.77 MTPA

TERMS AND CONDITIONS:

1. The Consent to Operate (CTO) has been accorded based on the particulars furnished by the applicant vide Application ID: 1626961 and subject to addition of further or more conditions if so warranted by subsequent developments. The CTO will automatically become invalid if there is any changes, modification, alteration, expansion or deviation is made in actual practice.
2. The CTO is valid till **31.03.2024**.
3. The CTO may be modified, suspended in whole or in part or withdrawn by the Board during its term for cause including, but not limited to the following:-
   a) Violation of any Terms and Conditions of this CTO;
   b) Obtaining the CTO by misrepresentation or failure to disclose fully all relevant facts;
   c) If any genuine complaint received.
4. The unit shall comply with all the stipulated and general conditions of Environment Clearance granted to the unit by MoEF vide EC No.J-11015/202/2011-IA.II(M); dtd: 11th June 2020.
5. The project proponent shall develop a greenbelt / Plantation area with native trees covering at-least 33% of total plot area for the development of greenbelt and carbon sink.
6. The project authority should install a Display Board as per the Boards notification No.PCBA/LGL-95/2021/Notification/01 dtd.11.11.2021 (Appendix-A).

Contd…p/2

7. As per the provisions of the Water (Prevention and Control of Pollution) Act, 1974 as amended and the Air (Prevention and Control of Pollution) Act, 1981, as amended, any Officer empowered by the Board on its behalf shall have without interruption, the right at any reasonable time to enter the unit for inspection, collection of sample for analysis and may call for any information as deemed necessary. Denial of this right will cause withdrawal of the Consent to Operate.
8. The unit shall apply for renewal of CTO atleast 90 days before expiry. The Board has decided to renew CTO for five (5) years, if the project proponent submits application with due payment of CTO fees.

Specific Conditions:

A) Air Aspects:

1. The following pollution control measures shall be implemented by the project authority-
   a) Dust containment cum suppression system at the material handling points to minimize fugitive emission.
   b) Haul road shall be made metallic.
   c) Regular cleaning and wetting of ground within the premises.
   d) Water sprinklers along the haul roads connecting the mine and cement plant.

2. The Ambient Air Quality within the mine premises and surrounding areas shall be maintained within the National Ambient Air Quality Standards as notified by MoEF&CC, Govt. of India, vide G.S.R.826(E) dtd.18.11.2009, especially w.r.t. $PM_{2.5}$ and PM_{10}, as mentioned herein under:

Sr. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air	
			Industrial, Residential, Rural & Other Area	Ecologically Sensitive Area (notified by Central Government)
1.	Particulate Matter (size less than 10µg) or PM_{10} ($\mu g/m^3$)	Annual* 24 hours**	60 100	60 100
2.	Particulate Matter (size less than 2.5µg) or $PM_{2.5}$ ($\mu g/m^3$)	Annual* 24 hours**	40 60	40 60

3. The unit shall comply with the Noise Level Standards, notified by MoEF&CC, Govt. of India, vide as per GSR. 7, dated: Dec.22, 1998, as mentioned herein under:

Limit in dB (A) Leq	
Day Time (6:00AM-10:00PM)	Night Time (10:00PM-6:00AM)
75	70

B) Solid Waste Aspects:

1. Top soil shall be stacked properly for further reclamation of mine.

2. Over burden dumps (OBD) shall be properly managed.

3. Adequate system should be adopted on reduction of waste generation and enhancement of re-utilization & recycling of waste material.

Contd...p/3

4. Adequate facility should be created for collection, storage, transportation, treatment and disposal of non-hazardous solid waste generated from the unit.
5. Adequate system should be adopted on reduction of waste generation and enhancement of re-utilization and recycling of waste materials.
6. Solid waste generated in the unit shall be disposed of as per the provisions of the Solid Waste Management Rules, 2016.
7. The unit shall compost organic waste generated in the canteen/kitchen within the premises

C) Hazardous Waste Aspects:

1. The unit shall obtain Authorization under the Hazardous and Other Waste (Management & Trans-boundary Movement) Rules, 2016 from the Board.
2. Adequate facility shall be provided for collection and storage of used spent oil, which shall be sent to registered recyclers for recycling.
3. The unit shall maintain a record regarding generation of hazardous wastes in Form-III of the Rules.
4. Appropriate facility shall be created for handling, storage, treatment & disposal of any Hazardous waste generated by the industry in accordance to the provisions of the H&OW Rule including Notification, Guidelines issued there under.
5. The unit shall identify and quantify all streams of Hazardous Waste generation as per Schedule-I and maintain proper record in Form-III of the said Rules.
6. The unit shall submit the annual return under the said Rule, in Form-IV, within 30th June every year.

The unit shall submit compliance report of the mandated conditions by April 15 of every year to Member Secretary, PCBA as well as to Regional Office, Silchar. The Board will have the liberty to withdraw the CTO if adequate pollution control and safety measures are not taken.

(Shantanu Kr. Dutta)
Member Secretary

Memo No. WB/SLC/T-1113/20-21/21-A Dated Guwahati, the 6th Apr , 2023

Copy to:

1. M/s. Calcom Cement India Ltd., New Umrangsho, Umrangsho, Dist. Dima Hasao, Assam - 781005 – for information & compliance of conditions.

(Shantanu Kr. Dutta)
Member Secretary

Appendix-A

pcba

Pollution Control Board, Assam
Bamunimaidam, Guwahati-21

NOTIFICATION

No. PCBA/LGL-95/2021/Notification/01 Dated Guwahati, the 11th Nov, 2021

In exercise of the powers conferred under Section-5 of the Environment (Protection) Act, 1986 as amended till date and keeping in view the need of public interest towards dissemination of vital information regarding Consent/Authorization of this Board, all industries are hereby directed to install a Display Board of minimum size 5'x4', near the main entrance gate.

The format of the display board is given below:

Name and Address of the Unit : M/s.

Description of Consent/Authorization	Details
Consent to Establish (CTE)	**No.:** **Date of Issue:**
Consent to Operate (CTO)	**No.:** **Date of validity:**
Authorization under Hazardous & Other waste (Management & Transboundary Movement) Rules, 2016 (if applicable)	**No.:** **Date of Issue:** **Date of validity:**

Member Secretary

Memo No. PCBA/LGL-95/2021/Notification/01-A/993 Dated Guwahati, the 11th Nov, 2021

Copy to:

1. The Commissioner & Secretary to the Govt. of Assam, Department of Environment & Forest, Dispur for kind information.
2. P.A. to the Chairman, PCBA for kind appraisal of the Hon'ble Chairman.
3. The All Regional Heads, PCBA for information & necessary action.
4. M/S APS Advertising Pvt. Ltd, Guwahati-1. They are requested to publish the "NOTICE" in "the Assam Tribune" and "Dainandin Barta" on **12.11.2021**.
5. Notice Board, Head Office / Website (www.pcbassam.org), PCBA.

Member Secretary

শোণিতপুৰত পাঁচজনৰ শৰীৰত কৰ'না পজিটিভ

আক্ৰান্তৰ সংখ্যা ৭৩ জনলৈ বৃদ্ধি

আমাৰ খবৰ, তেজপুৰ, ১৬ জুন ঃ শোণিতপুৰত আৰু পাঁচগৰাকী লোকৰ শৰীৰত কৰ'না পজিটিভ ধৰা পৰিছে। আনুষ্ঠানিক আৰু হোম কোৱাৰেণ্টীনত থকা লোককেইজন ক্ৰমে— জিলাখনৰ ২নং মিছামাৰী ধনমাৰীৰ সুমন দাস (১৮), বাতাচীপুৰৰ ৰবী বসুমতাৰী (২১), অকাৰবস্তি মিৰিৰ সুৰজ ভক্ত (২৫), চিতলমাৰীৰ পৰিমল মণ্ডল (২১) আৰু ৰঙাপৰাৰ তনয়া আগৰবালা (১৯) বুলি চিনাক্ত কৰা হৈছে। ইয়াকে লৈ শোণিতপুৰত কৰ'না পজিটিভৰ সংখ্যা ৭৩লৈ বৃদ্ধি পালে।

গৌৰীপুৰত পুনৰ কৰ'নাত আক্ৰান্ত চাৰি বছৰীয়া শিশু

আমাৰ খবৰ, আশাৰীকান্দি, ১৬ জুন ঃ ধুবুৰী জিলাৰ গৌৰীপুৰ চহৰৰ ৩নং বাৰ্ডৰ বাসিন্দা তথা চাৰি বছৰীয়া শিশু জুই সাহাৰ শৰীৰত কৰ'না সংক্ৰমণৰ ঘটনা পোহৰলৈ অহাত গৌৰীপুৰত সংক্ৰমণৰ ঘটনা তিনিলৈ বৃদ্ধি পায়। প্ৰশান্ত সাহা আৰু মাতৃ ববিতা সাহাৰ কন্যা জুই সাহাই যোৱা ১১ জুনত পশ্চিমবংগৰ বকলা অঞ্চলত থকা মোমায়েকৰ ঘৰৰ পৰা গৌৰীপুৰৰ নিজ ঘৰলৈ আহি ঘৰতে কোৱাৰেণ্টীন হৈছিল। উক্ত দিনা স্বাস্থ্য বিভাগে স্বাস্থ্য পৰীক্ষাৰ প্ৰক্ৰিয়া সম্পন্ন কৰি কোৱাৰেণ্টীন হোৱাৰ অনুমতি দিয়ে। এনে সময়তে আজি উক্ত স্বাস্থ্য পৰীক্ষাত জুই সাহাৰ শৰীৰত কৰ'না সংক্ৰমণ হোৱা বুলি জনা গৈছে। প্ৰশাসনে জুই সাহা আৰু মাতৃ ববিতা সাহক বৰপেটালৈ প্ৰেৰণ কৰা বুলি জনা গৈছে।

কেৰালাৰ পৰা অহা 'শ্ৰমিকৰেল'ত মেৰাপানীৰ মহিলাই জন্ম দিলে সন্তান

আমাৰ খবৰ, বৰপেটাৰোড, ১৬ জুন ঃ লকডাউনৰ ফলত কেৰালাত আবদ্ধ হৈ পৰা এগৰাকী মহিলাই ৰেলযোগে আহি থকা সময়ত সোমবাৰে ৰেলৰ দবাৰ ভিতৰতে সন্তান জন্ম দিবলগীয়া ঘটনা সংঘটিত হৈছে। মহিলাগৰাকীৰ নাম নিমা চেতিয়া। মহিলাগৰাকীৰ ঘৰ গোলাঘাট জিলাৰ মেৰাপানীত। কেৰালাৰ পৰা শ্ৰমিক স্পেচিয়েল ৰেলযোগে মহিলাগৰাকী গোলাঘাটৰ মেৰাপানীৰ নিজ গৃহলৈ আহি থকা সময়ত সোমবাৰে পুৱা ৰেলখন বৰপেটাৰোড ৰেলৱে ষ্টেচনত উপস্থিত হোৱাৰ লগে লগে মহিলাগৰাকী প্ৰসৱ বেদনাত ছটফটাই আছিল। ঠিক তেনে সময়তে মহিলাগৰাকীয়ে ৰেলৰ দবাৰ ভিতৰতেই এটি কন্যা সন্তান জন্ম দিয়ে। মহিলাগৰাকীৰ লগত অইন কোনো লোক নথকাৰ ফলত বৰপেটাৰোডৰ ৰেলৱে ষ্টেচন কৰ্তৃপক্ষই ১০৮ এম্বুলেঞ্চক খবৰ দি মহিলাগৰাকীক বৰপেটাৰোডৰ চিকিৎসালয়ত ভৰ্তি কৰায়। জন্ম দিয়া কন্যা সন্তানটিৰ লগতে মহিলাগৰাকী বৰপেটাৰোডৰ চিকিৎসালয়ত সম্প্ৰতি সুস্থ অৱস্থাত আছে বুলি চিকিৎসকে জানিবলৈ দিয়ে। গোলাঘাটৰ মেৰাপানীৰ মহিলাগৰাকীৰ গিৰীয়েক ভাইটি চেতিয়াৰ লগত কেৰালাৰ টাইলছ কোম্পানীত কৰ্মৰত আছিল। লকডাউনৰ পূৰ্বে নিমা চেতিয়া নামৰ মহিলাগৰাকীৰ গিৰীয়েক ভাইটি চেতিয়াই বিশেষ কামত মেৰাপানীস্থিত নিজ ঘৰলৈ আহিছিল যদিও লকডাউনৰ বাবে কেৰালালৈ উভতি যাব পৰা নাছিল।

ৰূপহী প্ৰাথমিক শিক্ষা খণ্ডৰ দুৰ্নীতি উদঙালে শিক্ষক-শিক্ষয়িত্ৰীয়ে

টাইম স্কেলৰ নামত ব্যাপক ধন সংগ্ৰহ

আমাৰ খবৰ, বঢ়মপুৰ, ১৬ জুন ঃ বিজেপি নেতৃত্বাধীন ৰাজ্য চৰকাৰে দুৰ্নীতিৰ ক্ষেত্ৰত শূন্য সহনশীলতা নীতি গ্ৰহণ কৰাৰ বিপৰীতে একাংশ কাৰ্যালয়ৰ বিষয়া-কৰ্মচাৰীয়ে কৰা দুৰ্নীতি-অনিয়মে চৰকাৰৰ এই বিষয়টো ফুটুকাৰ ফেনত পৰিণত কৰিছে। প্ৰতিটো কাৰ্যালয়ত হোৱা দুৰ্নীতি সন্দৰ্ভত বিভিন্ন সংবাদ মাধ্যমত বাতৰি পৰিৱেশন হৈ আহিলেও গা-লৰা নাই চৰকাৰৰ। দুৰ্নীতি নিবাৰক শাখাই বিভিন্ন সময়ত এনেধৰণৰ বিষয়া-কৰ্মচাৰীৰ বিৰুদ্ধে ব্যৱস্থা গ্ৰহণ কৰি আহিলেও কোনো কাৰণতে দুৰ্নীতি নিৰাময় হোৱা পৰিলক্ষিত হোৱা নাই। আমাৰ হাতত পৰা তথ্য অনুসৰি নগাঁও জিলাৰ ৰূপহী প্ৰাথমিক শিক্ষা খণ্ডৰ কাৰ্যালয়ত চলি আহিছে বিয়াগোম দুৰ্নীতি-অনিয়ম। এই কাৰ্যালয়টোৰ জনৈক দাসগুপ্তা উপাধিৰ এগৰাকী কৰ্মচাৰীয়ে খণ্ড প্ৰাথমিক শিক্ষাবিষয়াগৰাকীৰ সেউজ সংকেতত বিভিন্ন সময়ত কাৰ্যালয়টোৰ অধীনৰ বিদ্যালয়সমূহৰ শিক্ষক-শিক্ষয়িত্ৰীৰ পৰা ধন সংগ্ৰহ কৰাৰ অভিযোগ উত্থাপিত হৈ আহিছে। শেহতীয়াকৈ ৰাজ্য চৰকাৰৰ বিত্ত বিভাগে শিক্ষক-কৰ্মচাৰীক নিয়ম অনুসাৰে দৰমহাৰ ওপৰত নিৰ্দিষ্ট শতাংশ অনুসৰি টাইম স্কেল প্ৰদান কৰি আহিছে। এই টাইম স্কেল প্ৰদানৰ নামত সকলো শিক্ষক-শিক্ষয়িত্ৰীৰ পৰা ২০০০-৩০০০ টকাকৈ সংগ্ৰহ কৰিছে। শিক্ষক-শিক্ষয়িত্ৰীসকলে দিবলৈ অমান্তি হ'লে টাইম স্কেল নাপাব বুলি ভাবুকি প্ৰদান কৰিছে। কাৰ্যালয়টোৰ অধীনৰ দহখনৰো অধিক বিদ্যালয়ৰ অৰ্ধ-শতাধিক শিক্ষক-শিক্ষয়িত্ৰীয়ে অভিযোগ কৰা অনুসৰি খণ্ড প্ৰাথমিক শিক্ষাবিষয়াগৰাকীৰ লগতে কৰ্মচাৰী জনৈক দাসগুপ্তা আৰু আন কেইবাগৰাকীও কৰ্মচাৰীয়ে টাইম স্কেলৰ উপৰিও দৰমহাৰ বিল, বাৰ্ষিক আয়কৰ ৰেহাইৰ নামত ধন সংগ্ৰহ কৰাৰ লগতে মধ্যাহ্ন ভোজনৰ নামত অহা টকাৰ সিংহভাগ লৈ আহিছে। লকডাউন চলি থকাৰ সময়ত বিদ্যালয়লৈ অহা চাউল, দাইলৰ ধন আদি মধ্যাহ্ন ভোজনৰ শিতানত আহিছে যদিও বহু বিদ্যালয়ে এই সমূহ ছাত্ৰ-ছাত্ৰীক নিৰ্দিষ্ট পৰিমাণতকৈ কমকৈ বিতৰণ কৰি সেইসমূহৰ অংশ কাৰ্যালয়টোৰ বিষয়া-কৰ্মচাৰীক দিব লগা হৈছে। উল্লেখ্য যে খণ্ড প্ৰাথমিক শিক্ষাবিষয়াগৰাকীৰ লগতে জনৈক দাসগুপ্তা উপাধিৰ কৰ্মচাৰীজন দীৰ্ঘদিন ধৰি কাৰ্যালয়টোত থকাৰ বাবে বিভিন্ন দুৰ্নীতি-অনিয়ম সংঘটিত কৰিবলৈ সাহস গোটাব পাৰিছে। যাৰ পৰিপ্ৰেক্ষিতত বিদ্যালয়ৰ শিক্ষাগুৰুসকলে বিভিন্ন সময়ত অসুবিধাৰ সন্মুখীন হ'বলগা হৈছে। বিগত কংগ্ৰেছ চৰকাৰৰ দিনত দুৰ্নীতি-অনিয়ম সংঘটিত কৰি বাতৰি কাকতৰ শিৰোনাম দখল কৰা খণ্ড প্ৰাথমিক শিক্ষা বিষয়াগৰাকীৰ ওপৰত বিজেপি চৰকাৰ গঠন হোৱা চাৰি বছৰ অতিক্ৰম হোৱাৰ পাছতো কিয় ব্যৱস্থা গ্ৰহণ কৰা নহ'ল সেইটো ডাঙৰ প্ৰশ্ন হিচাপে চৰ্চিত হৈছে। বিশেষকৈ মেনেজ মাষ্টাৰ হিচাপে পৰিচিত খণ্ড প্ৰাথমিক শিক্ষা বিষয়াগৰাকীয়ে উৰ্দ্ধতন কৰ্তৃপক্ষক মেনেজ কৰি একেখন চকী খামোচ মাৰি ধৰি ৰাখিছে। এইক্ষেত্ৰত অসম চৰকাৰৰ শিক্ষা, স্বাস্থ্য, বিত্ত আদি বিভাগৰ মন্ত্ৰী ড° হিমন্ত বিশ্ব শৰ্মাই কি ব্যৱস্থা গ্ৰহণ কৰে সেয়া লক্ষণীয় বিষয় হিচাপে বিবেচিত হ'ব।

শিক্ষা মন্ত্ৰী হিমন্ত বিশ্ব শৰ্মাক ব্যৱস্থা গ্ৰহণৰ দাবী

পথৰ দুৰৱস্থা পথত ভুঁই ৰুই প্ৰতিবাদ ৰাইজৰ

বিতৰ্কিত বিধায়ক শিলাদিত্যৰ অকৰ্মণ্যতাক ধিক্কাৰ

আমাৰ খবৰ, হোজাই, ১৬ জুন ঃ সকলো সময়তো বিতৰ্কিত মন্তব্য কৰা বিশেষকৈ বাংলাদেশী মুছলমানক টাৰ্গেট কৰি লোৱা হোজাইৰ বিধায়ক শিলাদিত্যৰ সমষ্টিত এইবাৰ জনতাৰ উত্তাল প্ৰতিবাদ। পথৰ দুৰৱস্থাৰ বাবে হোজাইৰ ২নং আমতলা গাঁৱৰ ৰাইজে পথত ভুঁই ৰুই সাব্যস্ত কৰিলে প্ৰতিবাদ। এজাক বৰষুণে ব্যাহত কৰিছে যাতায়াত ব্যৱস্থা। পথৰ মেৰামতিৰ দাবীত শতাধিক গাঁওবাসীয়ে পথৰ মাজত ভুঁই ৰুই প্ৰতিবাদ সাব্যস্ত কৰাৰ লগতে বিধায়ক শিলাদিত্য হায় হায় ধ্বনি দিয়ে। হোজাই চহৰৰ পৰা মাত্ৰ তিনি কিলোমিটাৰ নিলগৰ পথছোৱাৰ দুৰৱস্থাৰ বুজ ল'বলৈ আহৰি নাই বিতৰ্কিত বিধায়কগৰাকীৰ। শীঘ্ৰে পথছোৱা মেৰামতি নকৰিলে পৰৱৰ্তী নিৰ্বাচনত বিজেপিক ভোট নিদিয়াৰ সিদ্ধান্ত স্থানীয় ৰাইজৰ। সৰহ সংখ্যক বিজেপি দলৰ সমৰ্থক থকা গাঁওবাসীয়ে তীব্ৰ ক্ষোভত বিজেপি চৰকাৰ হায় হায়, শিলাদিত্য হায় হায় আদি শ্ল'গানেৰে প্ৰতিবাদ সাব্যস্ত কৰে।

বিশ্বনাথৰ অৰুণাচল সীমান্তৰ পাচলগীত খৰিকটীয়াক গুলীয়াই হত্যা

অৰুণাচলী দুৰ্বৃত্ত-এনডিএফবি জড়িত থকাৰ সন্দেহ

আমাৰ বিশেষ খবৰ, বিশ্বনাথ চাৰিআলি, ১৬ জুন ঃ বিশ্বনাথ জিলাৰ বালিচাঙৰ পাচলগীৰ অসম-অৰুণাচল সীমান্ত ৰক্তাক্ত হৈ পৰিল দুৰ্বৃত্তৰ গুলীচালনাত। সীমান্ত অঞ্চলত বসবাস কৰা এজন আদিবাসী লোকক হত্যা কৰাক লৈ তীব্ৰ উত্তেজনাৰ সৃষ্টি হৈছে সীমান্ত অঞ্চলটোত। ঘটনা সন্দৰ্ভত একাংশ সীমান্তবৰ্তী লোকে জনোৱা মতে পুনৰ অসমীয়াৰ ওপৰত সন্দেহজনক অৰুণাচলীয়ে গুলীবৰ্ষণ কৰিছে। আনহাতে আন একাংশৰ মতে এনডিএফবিৰ দ্বাৰা সংঘটিত হৈছে এই নৃশংস হত্যাকাণ্ড। উল্লেখ্য যে অসম-অৰুণাচল সীমান্তত খৰি কাটিবলৈ যোৱা এজন আদিবাসী লোকক দুৰ্বৃত্তই গুলীয়াই হত্যা কৰাক কেন্দ্ৰ কৰি এক উত্তপ্ত পৰিস্থিতিৰ সৃষ্টি হয়। নিহত ব্যক্তিজনৰ নাম হৈছে বিনোদ ৰাজগড়। উল্লেখ্য যে সোমবাৰে বিনোদ ৰাজগড় আৰু তেওঁৰ বন্ধু সোমাইনা দৈমাৰীয়ে বিশ্বনাথৰ অসম-অৰুণাচল সীমান্তলৈ গৈছিল খৰি কাটিবলৈ। কিন্তু কোনো দুৰ্বৃত্তই বিনোদ ৰাজগড়ক গুলীয়াই হত্যা কৰি সেই স্থানতে পেলাই থৈ যায়। লগে লগে সেই স্থানৰ পৰা মৃত বিনোদৰ বন্ধু সোমাইনা দৈমাৰীয়ে পলায়ন কৰি মৃত বিনোদৰ পৰিয়ালক জনাই এই ঘটনা। তাৰ পাছতে মৃত বিনোদৰ পৰিয়ালৰ লোকে গাঁৱৰ কেইজনমান লোকক লৈ সেই স্থানৰ পৰা লৈ আহে মৃত বিনোদৰ নিথৰ দেহ। ইতিমধ্যে মৃত বিনোদৰ ঘৰত উপস্থিত হৈছে দণ্ডাধীশৰ লগতে বিশ্বনাথ জিলাৰ উচ্চপদস্থ আৰক্ষী বিষয়া আৰু আৰম্ভ কৰিছে ঘটনা সন্দৰ্ভত তদন্ত। সম্প্ৰতি আৰক্ষীয়ে সোধা-পোছাৰ বাবে বিনোদৰ বন্ধু সোমাইনা দৈমাৰীকো আৰক্ষীয়ে নিজৰ জিম্মাত লৈছে। উল্লেখ্য যে সীমাক কেন্দ্ৰ কৰি অসম আৰু অৰুণাচলৰ মাজত দীৰ্ঘদিন ধৰি বিবাদ চলি আছে। বিগত সময়ত অৰুণাচলী দুৰ্বৃত্তই কেইবাবাৰো সীমান্তত গুলীচালনাৰ দৰে ঘটনা সংঘটিত কৰিছে। আনহাতে প্ৰশাসনে এয়া দুৰ্বৃত্তৰ দ্বাৰা সংঘটিত হৈছে বুলি মন্তব্য কৰাৰ বিপৰীতে স্থানীয় লোকে এই ঘটনাত এনডিএফবি জড়িত আছে বুলি মন্তব্য কৰিছে। সীমান্তবাসীৰ এনে দুখ-দুৰ্দশাৰ মাজতে বালিচাং আৰক্ষীয়ে গ্ৰেপ্তাৰ কৰিছে বিশ্বজিৎ দৈমাৰী নামৰ এজন যুৱকক। বিশ্বজিৎ দৈমাৰী নামৰ যুৱকজনে গুলী মৰা লোকজনৰ লগতে থকা বুলি আৰক্ষীক স্বীকাৰোক্তি দিছে। প্ৰত্যক্ষদৰ্শী বিশ্বজিতে সম্প্ৰতি উগ্ৰপন্থীৰ ভয়ত প্ৰকাশৰ পৰা বিৰত আছে। ইতিমধ্যে বিশ্বনাথ জিলা আৰক্ষী অধীক্ষকে এক গোপন স্থানত হত্যাকাণ্ড সন্দৰ্ভত জেৰা অব্যাহত ৰাখিছে বিশ্বজিতক। প্ৰত্যক্ষদৰ্শী বিশ্বজিতে এই প্ৰতিবেদকক জানিবলৈ দিয়া মতে যোৱা দেওবাৰে কাঠ কাটিবলৈ বিনোদ আৰু সোমাইনাক বিশ্বজিতে জোৰকৈ অসম-অৰুণাচল সীমান্তলৈ লৈ গৈছিল। বিশ্বজিতে কোনে নিছে খৰি কাটিবলৈ তাক কৌশলেৰে এৰাই চলিছে আৰু আনসকল দেওবাৰে হোৱাৰ বাবেই কাঠ কাটিবলৈ যোৱা নাছিল বুলি উল্লেখ কৰিছে। প্ৰকৃততে বিনোদৰ হত্যাকাণ্ড এক পূৰ্ব পৰিকল্পিত হত্যাকাণ্ড হোৱাৰ যথেষ্ট থল আছে।

তীব্ৰ নিন্দা, ২০ লাখ টকাৰ ক্ষতিপূৰণৰ দাবী আটছাৰ

অৰুণাচলী দুৰ্বৃত্তই গুলীয়াই হত্যা কৰা বিনোদ ৰাজগড়ৰ হত্যাকাণ্ডৰ তীব্ৰ গৰিহণা দিছে বিশ্বনাথ জিলা আটছাৰ সভাপতি ধীৰাজ তাঁতী আৰু সম্পাদক নীলোৎপল ৰবি দাসে। আটছাই বিনোদ ৰাজগড়ৰ হত্যাকাৰীক কৰায়ত্ত কৰি উপযুক্ত শাস্তি বিহিবলৈ দাবী জনায়। বিনোদৰ পৰিয়ালক ২০ লাখ টকাৰ ক্ষতিপূৰণ দিয়াৰ বাবে দাবী জনাই সংগঠনটোৱে। বিশ্বনাথ শাখা আটছু, যুৱ ছাত্ৰ পৰিষদ, সংগ্ৰামী যুৱ ছাত্ৰ পৰিষদ, বিশ্বনাথ আচা, আগছু, কাৰ্বি ছাত্ৰ সন্থা আদি বিভিন্ন সংগঠনে এই হত্যাকাণ্ডৰ তীব্ৰ গৰিহণা দিছে আৰু দোষীক উপযুক্ত শাস্তি প্ৰদানৰ দাবী তুলিছে।

বাঘজান কাণ্ডৰ ভুক্তভোগীক আজমল ফাউণ্ডেচনৰ সাহায্য, মঙলবাৰে

হত্যাকাৰীক ফাঁচীৰ দাবী উঃ পূঃ সংখ্যালঘু ছাত্ৰ সংস্থাৰ

তেজপুৰত প্ৰেমিকাক ডিঙি ৰেপি হত্যা ঃ উটুৱাই দিলে মৃতদেহ

আমাৰ বিশেষ খবৰ, আমাৰ খবৰ, তেজপুৰ, ১৬ জুন ঃ তেজপুৰ চহৰৰ সমীপৱৰ্তী শিঙিতলী অঞ্চলত সংঘটিত এক হত্যাকাণ্ডই সমগ্ৰ অঞ্চলটোতে ব্যাপক চাঞ্চল্যৰ সৃষ্টি কৰে। জানিব পৰা মতে শিঙিতলীৰ চমেদ আলী আৰু চমলা খাতুনৰ ২৬ বছৰীয়া কন্যা মঞ্জুমা খাতুনক ভাল পাইছিল একেখন গাঁৱৰে আব্দুল মন্নাচৰ পুত্ৰ তথা পেছাত ৰাজমিস্ত্ৰী ছান্দাম হুছেইনে। আনকি দুয়োৰে মাজত অহিনী বিবাহো সম্পন্ন হৈছিল। দুই সন্তানসহ প্ৰথমা পত্নী থকা ছান্দামে কিছুদিনৰ পূৰ্বে মঞ্জুমাক লৈ গৈছিল যদিও প্ৰথমা পত্নী থকাত মঞ্জুমা ঘূৰি আহিছিল মাতৃগৃহলৈ। ইয়াৰ মাজতে মঞ্জুমা অন্তঃসত্ত্বা হয়। মৃত্যুৰ পূৰ্বে ছয় মাহৰ অন্তঃসত্ত্বা মঞ্জুমাই সেয়ে প্ৰেমিক ছান্দামৰ পৰা বিচাৰিলে পত্নীৰ মৰ্যাদা। ইয়াকে লৈ দুয়োৰে মাজত সৃষ্টি হয় সংঘাত। এই সংঘাতৰ পৰিণতিত ছান্দামে মঞ্জুমাক ডিঙি চেপি হত্যা কৰে আৰু কাষৰীয়া জীয়াভৰলীত পেলাই দিয়ে। এই ঘটনা ছান্দামক গ্ৰেপ্তাৰ কৰাৰ পাছতহে আহে পোহৰলৈ। উল্লেখ্য যে যোৱা ৫ জুনৰ পৰা হঠাৎ মঞ্জুমা মোমায়েকৰ ঘৰলৈ বুলি ওলাই অহাৰ পাছৰে পৰা ৰহস্যজনকভাৱে সন্ধানহীন হোৱাত মঞ্জুমাৰ ভাতৃ জিয়াবুৰ ৰহমানে স্থানীয় বৰঘাট আৰক্ষী চকীত এখন এজাহাৰ দাখিল কৰে আৰু এই এজাহাৰৰ ভিত্তিত অনুসন্ধান চলাই হত্যাকাৰী প্ৰেমিক ছান্দামক গ্ৰেপ্তাৰ কৰে। অৱশেষত আৰক্ষীৰ জিম্মাত থকা ছান্দামে হত্যাৰ কথা স্বীকাৰ কৰাত আৰক্ষীয়ে সহায় লয় এছডিআৰএফৰ। সোমবাৰে বিয়লি জীয়াভৰলীত এছডিআৰএফৰ দলে অভিযান চলাই যদিও মঞ্জুমাৰ কোনো সন্ধান নাপালে। সন্ধিয়া হোৱা বাবে এছডিআৰএফে অভিযান সামৰে যদিও আজি পুনৰ মঞ্জুমাৰ সন্ধানত অভিযান চলায়। ইফালে এই ঘটনাক কেন্দ্ৰ কৰি অঞ্চলটোত নিশা দুপৰলৈ সৃষ্টি হয় উত্তেজনা। স্থানীয় লোক তথা উত্তৰ-পূৰ্বাঞ্চল সংখ্যালঘু ছাত্ৰ ইউনিয়নৰ প্ৰতিনিধিয়ে হত্যাকাৰী ছান্দামৰ ফাঁচীৰ দাবী তুলি পৰিৱেশ উত্তাল কৰি তোলে। ঘটনাস্থলীত তেজপুৰ আৰক্ষীৰ এটা বৃহৎ দল লৈ উপস্থিত হয় শোণিতপুৰৰ উপ-আৰক্ষী অধীক্ষক ড° ৰশ্মিৰেখা শৰ্মা। সম্প্ৰতি বৰঘাট আৰক্ষী চকীত থকা হত্যাকাৰী ছান্দামে ডিঙি চেপি মঞ্জুমাক হত্যা কৰাৰ কথা স্বীকাৰ কৰাৰ বিপৰীতে অন্তঃসত্ত্বাৰ বিষয়টো অস্বীকাৰ কৰিছে।

ফজল হকক সুঁৱৰি বৰনগৰ প্ৰেছ ক্লাবৰ শোকসভা

আমাৰ খবৰ, সৰভোগ, ১৬ জুন ঃ কালি বৰপেটাৰোডত এক পথ দুৰ্ঘটনাত পতিত হৈ গুৱাহাটীৰ চিকিৎসালয়ত মৃত্যু ঘটা বৰনগৰ প্ৰেছ ক্লাবৰ বিত্ত সম্পাদক, প্ৰাক্তন সাংবাদিক, নতুন সাহিত্য পৰিষদৰ বৰনগৰ শাখাৰ উপ-সভাপতি তথা চকচকা চন্দ্ৰ শৰ্মা ছোৱালী হাইস্কুলৰ অৱসৰপ্ৰাপ্ত শিক্ষক ফজল হকৰ প্ৰতি শ্ৰদ্ধা জনাই আজি সৰভোগৰ নিভিয়া ক্লাবৰ কাৰ্যালয় কক্ষত এক শোকসভা অনুষ্ঠিত কৰা হয়। সন্ধিয়া ছয় বজাত ক্লাবৰ সভাপতি প্ৰবীণ কুমাৰ ৰয়ৰ সভাপতিত্বত অনুষ্ঠিত শোকসভাত প্ৰথমে প্ৰয়াত সাংবাদিকগৰাকীৰ প্ৰতিচ্ছবিৰ সন্মুখত বন্তি প্ৰজ্বলন কৰে ক্লাবৰ উপদেষ্টা ভৱানন্দ পাঠক আৰু সভাপতি প্ৰবীণ ৰয়ে। তাৰ পাছতে সভাত উপস্থিত থকা সমূহ সদস্যই তেওঁৰ প্ৰতি শ্ৰদ্ধাঞ্জলি জনাই বন্তি প্ৰজ্বলন কৰে। সভাৰ উদ্দেশ্য ব্যাখ্যা কৰে ক্লাবৰ সম্পাদক পুলেন কুমাৰ দাসে। সভাত তেওঁৰ স্মৃতি আৰু বৰনগৰ সমাজ জীৱনলৈ আগবঢ়াই যোৱা অৱদানৰ কথা সুঁৱৰি কেইবাজনেও বক্তব্য ৰাখে। নিৰ্ভীক, স্পষ্টবাদী আৰু যুক্তিশীল মনোভাবেৰে তেওঁ প্ৰায় এটা দশক জুৰি নতুন দৈনিক কাকতত সাংবাদিকতা কৰিছিল। প্ৰাক্তন ছাত্ৰ নেতা, যুৱ সংগঠক তথা ইলোৰা বিজ্ঞান মঞ্চৰ সদস্য ফজল হকৰ মৃত্যু বৰনগৰ প্ৰেছ ক্লাবৰ বাবে এক অপূৰণীয় ক্ষতি। আজিৰ শোক সভাত বৰনগৰ প্ৰেছ ক্লাবৰ উপ-সভাপতি ধ্ৰুৱজ্যোতি দাস আৰু প্ৰাণজিৎ ৰয়, সহকাৰী সম্পাদিকা প্ৰীতিষা গোস্বামী, সদস্য ৰাহুল দেব দাস আৰু নীতিশ ৰঞ্জন পাটগিৰি উপস্থিত থাকে। সভাৰ শেষত এক মিনিট মৌনতা অৱলম্বনেৰে তেওঁৰ প্ৰতি শ্ৰদ্ধাঞ্জলি জ্ঞাপন কৰা হয়। ইপিনে আজি গুৱাহাটী চিকিৎসা মহাবিদ্যালয়ত মৰণোত্তৰ পৰীক্ষা সম্পন্ন কৰাৰ পাছত তেওঁৰ মৃতদেহ সৰভোগৰ চকাচকাস্থিত বাসগৃহলৈ লৈ অনা হয়। সন্ধিয়া সাত বজাত তেওঁৰ জানাজা সম্পন্ন কৰা হয়। ইফালে ফজল হকৰ মৃত্যুত গভীৰ শোক প্ৰকাশ কৰে বিশিষ্ট বামপন্থী নেতা তথা প্ৰাক্তন বিধায়ক হেমেন দাস, প্ৰাক্তন সাংসদ তথা বিধায়ক উদ্ধৱ বৰ্মন আৰু মনোৰঞ্জন তালুকদাৰে। ভাৰতৰ ছাত্ৰ ফেডাৰেচনৰ বৰপেটা জিলা সম্পাদক হৰ্ষ দাস আদি কৰি বিভিন্নজনে শোক প্ৰকাশ কৰে।

চৰকাৰীভাৱে সংৰক্ষণৰ আহ্বান চন্থলীয়া ভাতৃদ্বয়ৰ

গহপুৰৰ গিমিৰিত সংৰক্ষিত অৱস্থাত ৰূপকোঁৱৰৰ আৰামী চকী

আমাৰ খবৰ, কলাবাৰী, ১৬ জুন ঃ প্ৰথম অসমীয়া কথাছবি 'জয়মতী'ৰ জনক, সুন্দৰৰ পূজাৰী, ৰূপকোঁৱৰ জ্যোতিপ্ৰসাদ আগৰৱালাই বহা এখন কাঠৰ আৰামী চকী নিজ বাসগৃহত সুদীৰ্ঘ বছৰ ধৰি আটোমটোকাৰীকৈ সংৰক্ষণ কৰি ৰাখিছে গহপুৰ মহকুমাৰ গিমিৰিৰ প্ৰতিষ্ঠিত ব্যৱসায়ী ভাতৃদ্বয় ৰাজু চন্থলীয়া আৰু উদয় চন্থলীয়াই। ... ৰূপকোঁৱৰ জ্যোতিপ্ৰসাদ আগৰৱালাৰ কৰ্মস্থলী আছিল বৰ্তমানৰ গহপুৰ মহকুমাৰ ভোলাগুৰি চাহ বাগিচা। ভোলাগুৰি চাহ বাগিচাত সেই সময়ত জ্যোতিপ্ৰসাদ আগৰৱালাই আৰম্ভ কৰিছিল প্ৰথম অসমীয়া কথাছবি 'জয়মতী'ৰ নিৰ্মাণৰ কাম। কথাছবি নিৰ্মাণৰ বাবে সা-সৰঞ্জামৰ সৰবৰাহ তথা অভিনেতা-অভিনেত্ৰী অনা ... মোৱাৰকাৰ বাসগৃহত থকা উক্ত কাঠৰ আৰামী চকীখনত জিৰণি লোৱাৰ লগতে ৰাইজৰ লগত মত বিনিময় কৰিছিল। কেৱল জ্যোতিপ্ৰসাদ আগৰৱালাই বহাৰ বাবে ৰখা উক্ত চকীখন পাছত কেশৰদেউ মোৱাৰকাৰ তিনি পুত্ৰ দামোদৰ মোৱাৰকা, শ্যাম সুন্দৰ মোৱাৰকা আৰু সজল মোৱাৰকাই ... চকীখনো চন্থলীয়া ভাতৃদ্বয়ে লাভ কৰে। মোৱাৰকা পৰিয়ালৰ পৰা লাভ কৰা চকীখন সন্দৰ্ভত সকলো কথা জানিব পাৰি চন্থলীয়া ভাতৃদ্বয়ে ৰূপকোঁৱৰ জ্যোতিপ্ৰসাদ আগৰৱালাৰ স্মৃতি বিজড়িত উক্ত কাঠৰ আৰামী চকীখন সযতনে সংৰক্ষণ কৰি ৰাখিছে। এই ক্ষেত্ৰত জনতাৰ শিল্পীগৰাকীয়ে বহা উক্ত ...

ৰাজহুৱা জাননী

এই জাননীৰ দ্বাৰা জনোৱা হ'ল যে মেছাৰ্ছ কেলক'ম চিমেণ্ট ইণ্ডিয়া লিমিটেড (ডালমিয়া চিমেণ্ট (ভাৰত) লিমিটেডৰ এক সহায়ক) পঞ্জীকৃত ঠিকনা ঃ অনিল প্লাজা II, চতুৰ্থ মহলা, এবিচি, জি.এছ. ৰোড, গুৱাহাটী, কামৰূপ, অসম-৭৮১০০৫য়ে পৰিৱেশ, বন আৰু জলবায়ু পৰিবৰ্তন মন্ত্ৰালয় (এমঅ'ইএফচিচি), ভাৰত চৰকাৰৰ এফ.নং জে-১১০১৫/২০২/২০১১-IA II(এম) দিনাংক ১১ জুন, ২০২০ৰ জৰিয়তে ইয়াৰ প্ৰস্তাৱিত প্ৰকল্পসমূহৰ বাবে এনভাইৰ'নমেণ্টেল ক্লিয়াৰেন্সৰ হেতু সন্মতি লাভ কৰিছে - নিউ উমৰাংছু লাইমষ্ট'ন মাইন (মাইনিং লীজ এলেকা-৪১৭.৫০ হেক্টৰ), লগতে লাইমষ্ট'ন উৎপাদন ক্ষমতা ৭.৭৭ মিলিয়ন টিপিএ, ট'প-ছ'ল ০.৩৫ মিলিয়ন টিপিএ, ছাব গ্ৰেড ৩.৮৭ মিলিয়ন টিপিএ আৰু অ'বি/ৰেইষ্ট ৩.৩৯ মিলিয়ন টিপিএ (মুঠ খনন ১৫.৩৮ মিলিয়ন টিপিএ) লগতে ২×১০০০টিপিএইচ ক্ৰাছাৰ, গাঁও-নিউ উমৰাংছু, টেহছিল-উমৰাংছু, জিলা- ডিমা হাছাও (উত্তৰ কাছাৰ হিলছ), অসম। ইচি লেটাৰৰ এটা কপি ৰাজ্যিক প্ৰদূষণ নিয়ন্ত্ৰণ বোৰ্ড, অসম আৰু পৰিৱেশ, বন আৰু জলবায়ু পৰিবৰ্তন মন্ত্ৰালয়ৰ ৱেবছাইট ...

International Space University's tributes to Sushant Singh Rajput

MUMBAI, June 16: The International Space University (ISU) in France has paid homage to Sushant Singh Rajput in a statement, saying the news of the actor's death was "deeply saddening".

Rajput was found dead in his Bandra apartment on Sunday.

The official Twitter handle of ISU on Monday tweeted how Rajput was supposed to visit the campus last year but was unable to due to scheduling conflict. "We are deeply saddened by the dramatic news on the death of well known Indian actor Sushant Singh Rajput. Mr Singh Rajput was a believer and strong supporter of STEM education and was following ISU on social media. He had even accepted an invitation to visit ISU's central campus in the summer of 2019 but other agenda priorities prevented him from travelling to Strasbourg," the statement by the university read.

ISU paid condolences to Rajput's family and friends, saying the actor's memory will "remain among his thousands of followers across India and all over the world".

Rajput had enrolled at Delhi Technical University (DTU) in 2003, which was then known as Delhi College of Engineering, but left the course to pursue his showbiz dreams.

As part of his research for the film *Chanda mama dur ke*, he also visited the National Aeronautics and Space Administration in 2017. Rajput had stayed in NASA to train for his role as an astronaut for the film, which was eventually shelved. The actor also owned a Meade 14" LX600 telescope. – PTI

US hands over 1st shipment of 100 ventilators to India

NEW DELHI, June 16: The US on Tuesday handed over to India 100 ventilators, valued at about $ 1.2 million, as part of President Donald Trump's offer of assistance to New Delhi in the fight against the COVID-19 pandemic.

US Ambassador to India Kenneth Juster handed over the first shipment of 100 ventilators to Indian Red Cross Society secretary general RK Jain at an event at the IRCS headquarters here.

The US government, through the US Agency for International Development (USAID), donated the first shipment of 100 brand-new, state-of-the-art ventilators to India to assist its fight against COVID-19, the American Embassy said in a statement.

The ventilators, produced in the United States by Massachusetts-based Zoll Medical Corp, reflect leading-edge technology, are compact and deployable, and provide India with flexibility in treating patients affected by the virus.

USAID is also funding a comprehensive package of support, which includes accompanying equipment and medical supplies, technical assistance, and service plans.

This donation builds on the $ 9.5 million that USAID and the US Centers for Disease Control and Prevention have committed to India in response to the pandemic, and this is helping to strengthen clinical care, disseminate essential health messages, improve disease surveillance, and more.

The Indian Red Cross said it extends its heartfelt thanks to the US government for gifting the ventilators to assist India's fight against COVID-19, the IRCS said.

An American official had said last month that the US government is planning to "donate" 200 ventilators to India as part of efforts to strengthen bilateral cooperation in the fight against the COVID-19 pandemic. – PTI

Hefty fee forces Ambala parents to look for govt schools

AMBALA, June 16: Facing financial problems due job loss and pay cut in the wake of the coronavirus pandemic, parents in Haryana's Ambala are turning to government schools to reduce their expenses on their children's education.

Some parents said they have been paying a hefty fee but private schools are not ready to give much concession in the present situation.

Private schools are not giving any relaxation in fee despite the fact that they are closed and many of the expenses which they incur in normal times are not there, said a man whose son studies in Class 7 at a private school.

He said there is also uncertainty in view of the prevailing situation and no one knows for how long schools will remain closed.

Another parent, whose daughter studies in Class 9, said the private company where he is employed had introduced heavy pay cut and he was finding it hard to pay fee and decided to shift his child to a government school.

He said at least three to four people known to him have lost their jobs and are looking to get their children admitted to government schools.

Another parent, Kamal Kumar, said he admitted two of his children to a private school in the beginning of the year.

Due to the present situation with financial constraints, I realised that it will not be possible for me to afford a hefty fee, he said, adding that he recently approached the State education department for getting his children admitted to some government school where the fee was comparatively less.

Ambala Deputy District Education Officer Sudhir Kalra said in the past some time, the department has received complaints from parents that private schools are not issuing school-leaving certificates to their children.

He said many parents wanted that their children be admitted to government schools.

On Monday, according to an order issued by the Haryana's school education department, seeking admission in government schools will not require a school-leaving certificate now. Many students studying in private schools are seeking admission to government schools, an official spokesperson of the department said on Monday.

In a set of instructions issued by the department, it is mentioned that students can be admitted to a government schools even if they do not have a school-leaving certificate. – PTI

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AMBIENT AIR QUALITY TEST REPORT

ULR No.	NA		
Report No.	ENV/TR/DCNEL/DMH/23-24/A-04	**Issue Date**	27/09/2023
Order No.	4556001700/236	**Order Date**	09/09/2023
Report Issued To	DALMIA CEMENT (NORTH EAST) LIMITED Jamunanagar-16 Kilo, Umrangshu, Dist.- Dima Haso (N. C. Hills), Assam - 788931		

Sample Ref. No.:	DCNEL/2023/A-1209/01	Sample Source:	On Main Haul Road Near Culvert No. 1	Weather Condition:	Clear & Calm
Date of Sampling:	12.09.2023	Sample Receipt Date:	16.09.2023	Instrument Used:	FPS, RDS & Gaseous Attachment
Analysis Start Date:	19.09.2023	Analysis End Date:	27.09.2023	Sampled By:	Bidyut Kalita, Envirocon

TEST RESULTS

Sl. No.	Parameters	Test Method	Results	Units	Limits*
1.	Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	IS 5182 (Part 24)	36.4	µg/m³	60 (24 Hours Average)
2.	Particulate Matter (size less than 10 µm) or PM_{10}	IS 5182 (Part 23)	63.7	µg/m³	100 (24 Hours Average)
3.	Sulphur Dioxide (as SO_2)	IS 5182 (Part 2)	7.2	µg/m³	80 (24 Hours Average)
4.	Nitrogen Dioxide (as NO_2)	IS 5182 (Part 6)	8.9	µg/m³	80 (24 Hours Average)
5.	Ozone (as O_3)	CPCB Guidelines	BDL [MDL: 1.0]	µg/m³	180 (1 Hour Average)
6.	Lead (as Pb)	IS 5182 (Part 22)	BDL [MDL: 0.01]	µg/m³	1.0 (24 Hours Average)
7.	Carbon Monoxide (as CO)	IS 5182 (Part 10)	BDL [MDL: 0.01]	mg/m³	4.0 (1 Hour Average)
8.	Ammonia (as NH_3)	CPCB Guidelines	BDL [MDL: 5.0]	µg/m³	400 (24 Hours Average)
9.	Benzene (as C_6H_6)	CPCB Guidelines	BDL [MDL: 0.01]	µg/m³	5.0 (Annual Average)
10.	Benzo(a)Pyrene (as BaP) - Particulate Phase Only	CPCB Guidelines	BDL [MDL: 0.1]	ng/m³	1.0 (Annual Average)
11.	Arsenic (as As)	CPCB Guidelines	BDL [MDL: 0.01]	ng/m³	6.0 (Annual Average)
12.	Nickel (as Ni)	CPCB Guidelines	BDL [MDL: 0.01]	ng/m³	20 (Annual Average)

NA: Not Applicable, **BDL**: Below Detectable Limit, **MDL**: Minimum

*** Limits as per G.S.R. 826(E), 16.11.2009**

***********End of Report***********

ENVIROCON * DIGBOI, ASSAM * Date

Authorised Signatory: Mr. Pankaj Baroi (Director)

NOTE:
1. Results reported are valid at the time of and under the prevailing conditions of measurement.
2. Results refer only to the particular parameters tested.
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AMBIENT AIR QUALITY TEST REPORT

ULR No.	NA		
Report No.	ENV/TR/DCNEL/DMH/23-24/A-05	**Issue Date**	27/09/2023
Order No.	4556001700/236	**Order Date**	09/09/2023
Report Issued To	DALMIA CEMENT (NORTH EAST) LIMITED Jamunanagar-16 Kilo, Umrangshu, Dist.- Dima Haso (N. C. Hills), Assam - 788931		

Sample Ref. No.:	DCNEL/2023/A-1209/02	Sample Source:	On Main Haul Road Near New Weigh Bridge	Weather Condition:	Clear & Calm
Date of Sampling:	12.09.2023	Sample Receipt Date:	16.09.2023	Instrument Used:	FPS, RDS & Gaseous Attachment
Analysis Start Date:	19.09.2023	Analysis End Date:	27.09.2023	Sampled By:	Bidyut Kalita, Envirocon

TEST RESULTS

Sl. No.	Parameters	Test Method	Results	Units	Limits*
1.	Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	IS 5182 (Part 24)	34.1	µg/m³	60 (24 Hours Average)
2.	Particulate Matter (size less than 10 µm) or PM_{10}	IS 5182 (Part 23)	57.6	µg/m³	100 (24 Hours Average)
3.	Sulphur Dioxide (as SO_2)	IS 5182 (Part 2)	8.1	µg/m³	80 (24 Hours Average)
4.	Nitrogen Dioxide (as NO_2)	IS 5182 (Part 6)	9.4	µg/m³	80 (24 Hours Average)
5.	Ozone (as O_3)	CPCB Guidelines	BDL [MDL: 1.0]	µg/m³	180 (1 Hour Average)
6.	Lead (as Pb)	IS 5182 (Part 22)	BDL [MDL: 0.01]	µg/m³	1.0 (24 Hours Average)
7.	Carbon Monoxide (as CO)	IS 5182 (Part 10)	BDL [MDL: 0.01]	mg/m³	4.0 (1 Hour Average)
8.	Ammonia (as NH_3)	CPCB Guidelines	BDL [MDL: 5.0]	µg/m³	400 (24 Hours Average)
9.	Benzene (as C_6H_6)	CPCB Guidelines	BDL [MDL: 0.01]	µg/m³	5.0 (Annual Average)
10.	Benzo(a)Pyrene (as BaP) - Particulate Phase Only	CPCB Guidelines	BDL [MDL: 0.1]	ng/m³	1.0 (Annual Average)
11.	Arsenic (as As)	CPCB Guidelines	BDL [MDL: 0.01]	ng/m³	6.0 (Annual Average)
12.	Nickel (as Ni)	CPCB Guidelines	BDL [MDL: 0.01]	ng/m³	20 (Annual Average)

NA: Not Applicable, **BDL**: Below Detectable Limit, **MDL**: Minimum

*** Limits as per G.S.R. 826(E), 16.11.2009**

***********End of Report***********

ENVIROCON * DIGBOI, ASSAM * Date

Authorised Signatory: Mr. Pankaj Baroi (Director)

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AMBIENT AIR QUALITY TEST REPORT

ULR No.	NA		
Report No.	ENV/TR/DCNEL/DMH/23-24/A-06	**Issue Date**	27/09/2023
Order No.	4556001700/236	**Order Date**	09/09/2023
Report Issued To	DALMIA CEMENT (NORTH EAST) LIMITED Jamunanagar-16 Kilo, Umrangshu, Dist.- Dima Haso (N. C. Hills), Assam - 788931		

Sample Ref. No.:	DCNEL/2023/A-1209/03	Sample Source:	On Haul Road Inside The Mines Near View Point	Weather Condition:	Clear & Calm
Date of Sampling:	12.09.2023	Sample Receipt Date:	16.09.2023	Instrument Used:	FPS, RDS & Gaseous Attachment
Analysis Start Date:	19.09.2023	Analysis End Date:	27.09.2023	Sampled By:	Bidyut Kalita, Envirocon

TEST RESULTS

Sl. No.	Parameters	Test Method	Results	Units	Limits*
1.	Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	IS 5182 (Part 24)	28.3	µg/m³	60 (24 Hours Average)
2.	Particulate Matter (size less than 10 µm) or PM_{10}	IS 5182 (Part 23)	52.4	µg/m³	100 (24 Hours Average)
3.	Sulphur Dioxide (as SO_2)	IS 5182 (Part 2)	6.2	µg/m³	80 (24 Hours Average)
4.	Nitrogen Dioxide (as NO_2)	IS 5182 (Part 6)	8.3	µg/m³	80 (24 Hours Average)
5.	Ozone (as O_3)	CPCB Guidelines	BDL [MDL: 1.0]	µg/m³	180 (1 Hour Average)
6.	Lead (as Pb)	IS 5182 (Part 22)	BDL [MDL: 0.01]	µg/m³	1.0 (24 Hours Average)
7.	Carbon Monoxide (as CO)	IS 5182 (Part 10)	BDL [MDL: 0.01]	mg/m³	4.0 (1 Hour Average)
8.	Ammonia (as NH_3)	CPCB Guidelines	BDL [MDL: 5.0]	µg/m³	400 (24 Hours Average)
9.	Benzene (as C_6H_6)	CPCB Guidelines	BDL [MDL: 0.01]	µg/m³	5.0 (Annual Average)
10.	Benzo(a)Pyrene (as BaP) - Particulate Phase Only	CPCB Guidelines	BDL [MDL: 0.1]	ng/m³	1.0 (Annual Average)
11.	Arsenic (as As)	CPCB Guidelines	BDL [MDL: 0.01]	ng/m³	6.0 (Annual Average)
12.	Nickel (as Ni)	CPCB Guidelines	BDL [MDL: 0.01]	ng/m³	20 (Annual Average)

NA: Not Applicable, **BDL**: Below Detectable Limit, **MDL**: Minimum

*** Limits as per G.S.R. 826(E), 16.11.2009**

***********End of Report***********

ENVIROCON * DIGBOI, ASSAM * Date

Authorised Signatory: Mr. Pankaj Baroi (Director)

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AMBIENT AIR QUALITY TEST REPORT

ULR No.	NA		
Report No.	ENV/TR/DCNEL/DMH/23-24/A-07	**Issue Date**	27/09/2023
Order No.	4556001700/236	**Order Date**	09/09/2023
Report Issued To	DALMIA CEMENT (NORTH EAST) LIMITED Jamunanagar-16 Kilo, Umrangshu, Dist.- Dima Haso (N. C. Hills), Assam - 788931		

Sample Ref. No.:	DCNEL/2023/A-1309/01	Sample Source:	Near Culvert No. 2	Weather Condition:	Clear & Calm
Date of Sampling:	13.09.2023	Sample Receipt Date:	16.09.2023	Instrument Used:	FPS, RDS & Gaseous Attachment
Analysis Start Date:	19.09.2023	Analysis End Date:	27.09.2023	Sampled By:	Bidyut Kalita, Envirocon

TEST RESULTS

Sl. No.	Parameters	Test Method	Results	Units	Limits*
1.	Particulate Matter (size less than 2.5 µm) or $PM_{2.5}$	IS 5182 (Part 24)	27.8	µg/m³	60 (24 Hours Average)
2.	Particulate Matter (size less than 10 µm) or PM_{10}	IS 5182 (Part 23)	50.5	µg/m³	100 (24 Hours Average)
3.	Sulphur Dioxide (as SO_2)	IS 5182 (Part 2)	BDL [MDL: 5.0]	µg/m³	80 (24 Hours Average)
4.	Nitrogen Dioxide (as NO_2)	IS 5182 (Part 6)	BDL [MDL: 5.0]	µg/m³	80 (24 Hours Average)
5.	Ozone (as O_3)	CPCB Guidelines	BDL [MDL: 1.0]	µg/m³	180 (1 Hour Average)
6.	Lead (as Pb)	IS 5182 (Part 22)	BDL [MDL: 0.01]	µg/m³	1.0 (24 Hours Average)
7.	Carbon Monoxide (as CO)	IS 5182 (Part 10)	BDL [MDL: 0.01]	mg/m³	4.0 (1 Hour Average)
8.	Ammonia (as NH_3)	CPCB Guidelines	BDL [MDL: 5.0]	µg/m³	400 (24 Hours Average)
9.	Benzene (as C_6H_6)	CPCB Guidelines	BDL [MDL: 0.01]	µg/m³	5.0 (Annual Average)
10.	Benzo(a)Pyrene (as BaP) - Particulate Phase Only	CPCB Guidelines	BDL [MDL: 0.1]	ng/m³	1.0 (Annual Average)
11.	Arsenic (as As)	CPCB Guidelines	BDL [MDL: 0.01]	ng/m³	6.0 (Annual Average)
12.	Nickel (as Ni)	CPCB Guidelines	BDL [MDL: 0.01]	ng/m³	20 (Annual Average)

NA: Not Applicable, **BDL**: Below Detectable Limit, **MDL**: Minimum

*** Limits as per G.S.R. 826(E), 16.11.2009**

***********End of Report***********

ENVIROCON * DIGBOI, ASSAM * Date

Authorised Signatory: Mr. Pankaj Baroi (Director)

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ISO 9001:2015 Certified
ISO 45001:2018 Certified

Format No.: ENV/R/TR/19/SW-01 Rev. No.: 00

SURFACE WATER TEST REPORT

ULR No.	NA		
Report No.	ENV/TR/DCNEL/DMH/23-24/SW-01	**Issue Date**	27/09/2023
Order No.	4556001700/236	**Order Date**	09/09/2023
Report Issued To	DALMIA CEMENT (NORTH EAST) LIMITED Jamunanagar-16 Kilo, Umrangshu, Dist.- Dima Haso (N. C. Hills), Assam - 788931		

Sample Ref. No.:	DCNEL/2023/SW-1509/01	Sample Source:	Amrang Seasonal Nala	Sample Type:	Surface Water
Date of Sampling:	15.09.2023	Sample Receipt Date:	16.09.2023	Sample Quantity:	2 L
Analysis Start Date:	19.09.2023	Analysis End Date:	25.09.2023	Sampled By:	Bidyut Kalita, Envirocon

TEST RESULTS

Sl. No.	Parameters	Test Method	Results	Units	Acceptable Limit*	Permissible Limit* in the Absence of Alternate Source
1.	Colour	IS 3025 (Part 4)	**29**	PCU	5	15
2.	Odour	IS 3025 (Part 05)	Odourless	-	Agreeable	Agreeable
3.	pH	IS 3025 (Part 11)	6.74	-	6.5 – 8.5	No Relaxation
4.	Total Suspended Solids	IS 3025 (Part 17)	61	mg/l	-	-
5.	Total Dissolved Solids	IS 3025 (Part 16)	127	mg/l	500	2000
6.	Conductivity	IS 3025 (Part 14)	218		-	-
7.	Dissolved Oxygen	IS 3025 (Part 38)	5.6	mg/l	-	-
8.	Biochemical Oxygen Demand	IS 3025 (Part 44)	2	mg/l	-	-
9.	Chemical Oxygen Demand	IS 3025 (Part 58)	19	mg/l	-	-
10.	Oil and Grease	IS 3025 (Part 39)	BDL[MDL:4.0]	mg/l	-	-
11.	Free Residual Chlorine	IS 3025 (Part 26)	BDL[MDL:0.01]	mg/l	0.2	1
12.	Total Hardness (as $CaCO_3$)	IS 3025 (Part 21)	6.5	mg/l	200	600
13.	Calcium (as Ca)	IS 3025 (Part 40)	8	mg/l	75	200
14.	Magnesium (as Mg)	IS 3025 (Part 46)	2	mg/l	30	100
15.	Iron (as Fe)	IS 3025 (Part 53)	0.031	mg/l	0.3	No Relaxation
16.	Ammonical Nitrogen (as N)	IS 3025 (Part 34)	3.2	mg/l	-	-
17.	Total Kjeldahl Nitrogen	IS 3025 (Part 34)	12	mg/l	-	-
18.	Free Ammonia (as NH_3)	IS 3025 (Part 34)	0.4	mg/l	-	-
19.	Nitrate Nitrogen	IS 3025 (Part 34)	5.6	mg/l	-	-

NA: Not Applicable, **BDL**: Below Detectable Limit, **MDL**: Minimum Detectable Limit

*** Limits as per IS 10500:2012**

ENVIROCON Date: DIGBOI, ASSAM

Authorised Signatory: Mr. Pankaj Baroi (Director)

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Format No.: ENV/R/TR/19/N-01 Rev. No.: 00

NOISE LEVEL TEST REPORT

ULR No.	NA		
Report No.	ENV/TR/DCNEL/DMH/23-24/N-01	**Issue Date**	27/09/2023
Order No.	4556001700/236	**Order Date**	09/09/2023
Report Issued To	DALMIA CEMENT (NORTH EAST) LIMITED Jamunanagar-16 Kilo, Umrangshu, Dist.- Dima Haso (N. C. Hills), Assam - 788931		

Sample Type:	Ambient Noise	**Category of Area/Zone:**	Industrial Area	**Date of Monitoring:**	12.09.2023
Sound Meter Used:	SL-4030/Lutron		**Sampled By:**	Bidyut Kalita, Envirocon	

TEST RESULTS

Sl. No.	Locations	Time Duration	Test Method	Result Leq dB (A)
1.	Near Kali Mandir	Day Time	IS 9989 (RA 2020)	53.6
2.	Near Weighbridge	Day Time	IS 9989 (RA 2020)	60.2
3.	View Point Mine	Day Time	IS 9989 (RA 2020)	47.2
4.	CCR Building	Day Time	IS 9989 (RA 2020)	61.4
5.	Near Shiv Temple	Day Time	IS 9989 (RA 2020)	59.7
6.	Near Dispensary	Day Time	IS 9989 (RA 2020)	52.8
7.	Crusher	Day Time	IS 9989 (RA 2020)	74.2
8.	Cooler Section	Day Time	IS 9989 (RA 2020)	**81.5**
9.	Near RABH	Day Time	IS 9989 (RA 2020)	72.4
10.	Near Coal Mill	Day Time	IS 9989 (RA 2020)	70.5
11.	Compressor Room	Day Time	IS 9989 (RA 2020)	73.5
12.	Raw Mill	Day Time	IS 9989 (RA 2020)	74.1
13.	Kiln Area	Day Time	IS 9989 (RA 2020)	74.9
14.	Landing Silo	Day Time	IS 9989 (RA 2020)	**79.1**
15.	Near Pre Heater	Day Time	IS 9989 (RA 2020)	**78.6**
16.	Near Culvert No. 1	Day Time	IS 9989 (RA 2020)	56.5
17.	New View Point Mine	Day Time	IS 9989 (RA 2020)	43.8
18.	Near New Weigh Bridge	Day Time	IS 9989 (RA 2020)	58.7
19.	Near Culvert No. 2	Day Time	IS 9989 (RA 2020)	61.2

NA: Not Applicable

Limit :

Category of Area/ Zone	Limit in dB (A) L_{eq}	
	Day Time	Night Time
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

ENVIROCON * DIGBOI, ASSAM * Date

**********End of Report**********

Authorised Signatory: Mr. Pankaj Baroi (Director)

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Format No.: ENV/R/TR/19/N-01 Rev. No.: 00

NOISE LEVEL TEST REPORT

ULR No.	NA		
Report No.	ENV/TR/DCNEL/DMH/23-24/N-02	**Issue Date**	27/09/2023
Order No.	4556001700/236	**Order Date**	09/09/2023
Report Issued To	DALMIA CEMENT (NORTH EAST) LIMITED Jamunanagar-16 Kilo, Umrangshu, Dist.- Dima Haso (N. C. Hills), Assam - 788931		

Sample Type:	Ambient Noise	**Category of Area/Zone:**	Industrial Area	**Date of Monitoring:**	12.09.2023
Sound Meter Used:	SL-4030/Lutron		**Sampled By:**	Bidyut Kalita, Envirocon	

TEST RESULTS

Sl. No.	Locations	Time Duration	Test Method	Result Leq dB (A)
1.	Near Kali Mandir	Night Time	IS 9989 (RA 2020)	53.6
2.	Near Weighbridge	Night Time	IS 9989 (RA 2020)	60.2
3.	View Point Mine	Night Time	IS 9989 (RA 2020)	47.2
4.	CCR Building	Night Time	IS 9989 (RA 2020)	61.4
5.	Near Shiv Temple	Night Time	IS 9989 (RA 2020)	59.7
6.	Near Dispensary	Night Time	IS 9989 (RA 2020)	52.8
7.	Crusher	Night Time	IS 9989 (RA 2020)	74.2
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14.	Landing Silo	Night Time	IS 9989 (RA 2020)	**79.1**
15.	Near Pre Heater	Night Time	IS 9989 (RA 2020)	**78.6**
16.	Near Culvert No. 1	Night Time	IS 9989 (RA 2020)	56.5
17.	New View Point Mine	Night Time	IS 9989 (RA 2020)	43.8
18.	Near New Weigh Bridge	Night Time	IS 9989 (RA 2020)	58.7
19.	Near Culvert No. 2	Night Time	IS 9989 (RA 2020)	61.2

NA: Not Applicable

Limit :

Category of Area/ Zone	Limit in dB (A) L_{eq}	
	Day Time	Night Time
Industrial Area	75	70
Commercial Area	65	55
Residential Area	55	45
Silence Zone	50	40

ENVIROCON Date DIGBOI, ASSAM

**********End of Report**********

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काशी हिन्दू विश्वविद्यालय

IIT

INDIAN INSTITUTE OF TECHNOLOGY
BANARAS HINDU UNIVERSITY

Serving the nation since 1919

Report of

Scientific Study at New Umrangshu Limestone mine, Calcom Cement India, Limited, a subsidiary of Dalmia Cement Bharat Limited

By

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Dr C S Singh,

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Dr N Kishore

Department of Mining Engineering

Indian Institute of Technology

Banaras Hindu University, Varanasi 221005

July 2023

Content

Executive Summary

The management of Calcom Cement India Limited entrusted the work of Scientific Study of the New Umrangshu Limestone mine vide its PO Number 4556001064/149 Dated 03.11.2022 to the Department of Mining Engineering, IIT (BHU). The scope of the project comprised the following:

Part A: Geo-technical, Petrographic, Mineralogical and Dump density tests

- Testing for determination of Specific gravity, Density, Compressive Strength, Shear Strength, Shear Modulus, Young's Modulus, Poisson's Ratio, Angle of Internal Friction of intact rock specimen
- Particle size analysis & compaction, Drained & Undrained Cohesion, Consistency Limits, Natural & Saturated unit weight for dump material
- Petrographic and mineralogical studies and the bulk density test

Part B: Hydrological Study for the mine and the Design of Pit and Dump Slopes

- Design of operating Pit slope including the height, angle and width of benches for depth of working varying from 70-100m
- Design of the ultimate pit slope
- Design of the 30m high dump

A field visit was conducted by the project team to assess the condition on-site and collection of pertinent data from the mine under study to meet the above objectives of the project. Based on the understanding of field investigation and data provided by the mines, the stability condition of the open pit high wall and dump slopes has been carried out. The geo-technical tests of dump material samples collected from

different dump locations were conducted at the Department of Civil Engineering, IIT (BHU), following standard test procedures.

The database of the geo-technical property of intact strata, as determined at the Rock Mechanics Laboratory of the Department of Mining Engineering, IIT (BHU) Varanasi was used after appropriate downgrading for the stability analysis of pit slopes. All the numerical modelling studies were done on extremely high-end Dell Precision workstations, which run on 24 x 7 basis to meet the various technical and operational requirements of the project. The suggested method of working has been worked out based on machine specifications and other geo-mining information provided by the mine.

Based on the findings of the field visit, analysis of data provided by the mine and the study conducted in the laboratory, the following conclusions and recommendations may be inferred in this project:

(i) The laboratory testing results of limestone samples and overburden, as provided by the mine, are compiled in Table 5. The bulk density of the intact rock samples varies from 2460-2640 kg/m^3, while the UCS of the specimens varies from 21.42 – 32.7 MPa. The tensile strength of the rock varies from 2.05 – 3.55 MPa.

(ii) The cohesive strength of the rock varies from 6.19 – 8.58 MPa, while the shear strength varies from 9.3 – 17.8 MPa. The angle of internal friction varies from 30 - 36°. The Young's modulus of rock varies from 2.4 – 4.05 GPa while the Poisson's ratio ranges from 0.21 – 0.24. The shear modulus of the rock varies from 0.97 – 1.66 GPa.

(iii) The laboratory study of the dump sample collected from the New Umrangshu mine shows an OMC of 16.3% with a maximum dry density (MDD)

of 1.74t/m^3. The cohesive strength and friction angle were 0.60MPa and 32°. The grain size analysis of the sample revealed 14% of clay, 36% of silt, 47% of sand and 3% of gravel as its representative constituent.

(iv)The petrographic and mineralogical studies of the samples provided by the mine are given in Table 9. The Lower ferruginous limestone sample contained grey-coloured fine to medium-grained minerals, slightly hard in nature. Fine-grained calcite was the major constituent. Fine to medium-grained groundmass consisted of micro and macro fossils. It also contained some amount of quartz, dolomite and opaque minerals.

(v) The Upper ferruginous limestone sample contained fine to medium-grained, grey colour and slightly hard minerals. The fossils were also visible in the hand specimen. The sample contained fine-grained calcite. Fine to medium-grained groundmass consisted of micro and macro fossils. It also had some amount of quartz and dolomite. The opaque minerals were less in comparison to lower ferruginous limestone.

(vi)The shaly limestone sample contained medium to coarse-grained, grey colour hard minerals. The sample contained fine-grained calcite. Fine to medium-grained groundmass consisted of micro and macro fossils. It also included some amount of quartz and dolomite. The opaque minerals were more in comparison to samples of Lower and Upper ferruginous limestones.

(vii) The sample of shaly Upper ferruginous limestone was medium to coarse-grained, grey in colour and hard. The fossils were also visible in the hand specimen. The sample contained fine-grained calcite. Fine to medium-grained groundmass consisted of micro and macro fossils. It also included some amount of quartz and dolomite. The opaque minerals were more in comparison to Lower and Upper ferruginous and shaly limestone samples.

(viii) The sample of cement-grade limestone was fine-grained, whitish-grey in colour and hard in nature. The fossils were visible in the hand specimen. The sample contained calcite more dominantly. Fine to medium-grained groundmass consisted of micro and macro fossils. It also contained a small amount of dolomite, quartz and opaque minerals.

(ix) The sample of 'rejects' was medium to fine-grained, grey in colour and hard in nature. The fossils were visible in the hand specimen. The sample contained calcite. Fine to medium-grained groundmass consisted of micro and macro fossils. It also contained a small amount of dolomite, quartz and opaque minerals.

(x) The 'Rejects – red colour' sample was fine-grained, slightly brick in colour and hard in nature. It contained calcite along with dolomite, quartz and opaque minerals. The opaque minerals were more in comparison to dolomite and quartz. The fine-grained groundmass consisted of microfossils.

(xi) The Cement Grade Limestone (Old Mine) sample was fine-grained, grey in colour and hard in nature. It contained calcite as the most dominating mineral. Dolomite, quartz and opaque minerals are also observed in small amounts. The fine-grained groundmass consisted of micro and macro fossils.

(xii) The operating pit slope at a depth of 70 – 100 m and the ultimate pit slope as planned by the mine for the working depth of 70-100m have adequate stability with FoS of 2.06-3.42 for acceptable safety in the mine working. Hence, it has a low risk of long-term instability under dry conditions. A similar result is noted for long-term average rain fall as well. However, the slope structures are vulnerable to instability when exposed to short-term intensive rain fall. Hence, it is critically important to manage the inflow of rainwater

inside the mine by adopting proper drainage and water diversion strategy to minimise the impact.

(xiii) An embankment of 162 m length, 60 m width and 8.67 m height is proposed to provide a physical barrier and avoid inundation due to inadvertent ingress of water from the seasonal nallah to the open pit while approaching its ultimate depth.

(xiv) The stability of the slope is extremely sensitive to undercutting at the toe of the benches and blast-induced ground vibration. Hence, suitable measures of controlled blasting need to be taken on a regular basis to ensure that the ground vibration induced during blasting does not trigger instability of jointed rock blocks in the nearby benches due to the dynamic loading.

(xv) The modelling study confirmed that the stability of the open pit slope is highly sensitive to short-term heavy rain fall. It is recommended to adopt all possible measures for proper management of rainwater to mitigate its adverse effect on the stability of the open pit slope in the mine.

(xvi) As per the specification of HEMMs deployed in the mine, the maximum bench height should not be more than 10.8m. The width of the benches should not be less than 10m in general.

(xvii) The optimal safe design of a 30m high dump slope can be achieved by maintaining the maximum slope angle not exceeding 50°. However, the base of the dump slope should be almost flat and free from any interface to ensure that the dump does not undergo failure along its base at any point in time.

(xviii) Proper drainage arrangements should be provided along the periphery of the dump base to avoid any accumulation of rainwater.

(xix) The short-term mining plan of the mine should ensure that the movement of the face is not aligned in the direction of the true dip of the

major joint sets prevailing in a given patch of the mine. Adoption of better mining practices in terms of avoidance of undercut, effective control of blasting induced ground vibration and management of rain water are also required for the safe performance of operating and ultimate pit slopes in the mine.

(xx) The instrumentation scheme as suggested in this study, should be implemented for monitoring the stability of dump and open-pit slopes in the mine. Special emphasis should be given to the targeted slope sections of the high wall and dump slopes for mitigating failure hazards.

(xxi) The mine should arrange for trend analysis of the displacement data to obtain the displacement rate (mm/hour). A code of conduct/SoP should be developed by the mine for utilising the slope monitoring results for assessing the TLV and mitigating the risk of slope instability during the actual mining operation.

(xxii) The mining operation should be so planned and executed that the geometry of the high wall and its individual benches suffer minimum deviation from their recommended design. Any significant deviation, particularly in terms of the slope angle, height and width of benches, should be rectified at the earliest possible opportunity.

Scientific Study at New Umrangshu Limestone mine, Calcom Cement India, Limited, a subsidiary of Dalmia Cement Bharat Limited

1.0 Introduction

The management of Calcom Cement India Limited (a unit of Dalmia Cement (Bharat) Limited awarded a consultancy project to the Department of Mining Engineering, IIT (BHU) Varanasi through its PO No. 4556001064/149 dated 03.11.2022. The main objective of the work was as follows:

Part A: Geo-technical, Petrographic, Mineralogical and Dump density tests

- Testing for determination of Specific gravity, Density, Compressive strength, Shear strength, Shear modulus, Young's modulus, Poisson's ratio, Angle of internal friction of intact rock specimen
- Particle size analysis & compaction, Drained & Undrained Cohesion, Consistency Limits, Natural & Saturated unit weight for dump material
- Petrographic and mineralogical studies and the bulk density test

Part B: Hydrological Study for the mine and the Design of Pit and Dump Slopes

- Design of operating Pit slope including the height, angle and width of benches for depth of working varying from 70-100m
- Design of the ultimate pit slope
- Design of the 30m high dump

The project team visited the mine in January 2023 to develop familiarity with the prevailing condition and collect the samples from the mine site. All the overburden, orebody and dump material samples were provided by the mine and tested at IIT

(BHU) laboratories. This report encompasses the outcomes of the laboratory tests and numerical modelling studies accomplished in this work to meet the project requirements.

2.0 Geo-mining Details

The New Umrangshu Limestone mine (Fig. 1, Annexure 1) is located near the village – New Umrangshu, District - Dima Hasao (N. C. Hills), Assam. It is situated on the Eastern side of the Umrangshu-Lanka road at a distance of about 5 km from the New Umrangshu basti, which is about 12 km from the Umrangshu township. The mine has a leasehold area of 417.5 hectares with a mineable reserve of 162.56 million tonnes.

The planned production of the mine is 1.5 million tonnes per year. The minimum and maximum RL at the surface is 265m and 420m, respectively. The limestone belt constitutes the SE flank of the Shillong plateau comprising of small flat-topped hillocks with elevations varying from 580 – 840 m above MSL. A mantle of soil and decomposed weathered rock, ranging in thickness from 0.5 - 4.0 m, covers most of the area. Limestone beds are exposed along the Amrang nalla following the lithological sequence shown in Table 1.

The general geology of the lease area reveals the occurrence of 0-6m thick shale and sandstone formation followed by two layers of limestone: The top limestone horizon is 16-32.9m thick while the bottom limestone horizon is 49-52m thick, separated by intermediate 5.1-10m thick layer of shale. The top limestone has the presence of shale bands, while the bottom limestone is cement grade. Sandstone rock forms the base of the bottom limestone horizon.

Table 1. Lithographic units in the New Umrangshu mine

Litho Type	Thickness Range (m)
Kopili Shale Sandstone alternation	0-54.0 (variable)
Top limestone horizon (inferior)	16.0-32.9 (variable)
Shale	5.1-10.0 (mostly 6m)
Bottom limestone horizon (Cement grade)	49.0-52.0 (mostly 50m)
Basal Sandstone	Not proved

The annual precipitation of around 1539 mm (Table 2) and 40-90% relative humidity occurs in the area. The minimum annual rainfall is 1285mm, while the maximum is 2189mm. The rainfall is mostly distributed between July and September, with about 90% of the annual rainfall being received from June to September. The months of July and August receive the maximum rain. The year-to-year variation of annual rainfall is not very large. Because of high rainfall in the region, the upper ridges have undergone heavy denudation leaving a thick mantle of highly weathered zone all along the slope. The inter-banding of ferruginous, Siliceous and Calcareous shale and sandstone further accentuated differential weathering.

The Amrang nallah flows through the central part of the block in the South-Eastern direction dividing the area into two separate zones. In the Northern part of the leasehold area, a tributary of the Amrang nallah, flowing North to South, joins the nallah creating a separate zone in the North-Western part. On the Eastern side of the nallah, the land rises from 260m to 430m, while on the Western side, it rises from 270m to 420m. Thus, the Amrang nallah, with its tributary, broadly subdivides the limestone-bearing area into Eastern, Western and Northern sectors.

Table 2. Annual rainfall in New Umranshu mine

Year	Total rainfall, mm
2011	1584
2012	1482
2013	1451
2014	1417
2015	1326
2016	1768
2017	2189
2018	1359
2019	1533
2020	1285
Average	1539

The drainage of the area is collected through many small nallas discharging in the Amrang and Langyen nallas. Both these nallas join in the South – Eastern side of the area near the Langyen basti and flow in the SE direction in the name of Langyen nalla, which ultimately flows in the Kopili river, which controls the master drainage of the region. The water level of these nallas rises considerably from the bottom for a short period of heavy rains. The annual precipitation of rainfall varied from 1500-2000mm, averaging 1673mm. About 90% of the rainfall occurs from June to September, while July and August have the maximum rainfall.

Based on the understanding of field investigation, it was concluded that the accumulation of water in the mine was mainly due to the seasonal nallah, flowing rise to dip through the middle of the mine. The physical observation of the adjacent mine also revealed that the water table was not encountered in the pit depth of 100 m. Hence, deployment of any geophysical method for specific delineation of the

hydrological condition of the mine was not required. Instead, considering the surface topography, seasonal rain fall and precipitation characteristics at the base of the mine sump, the mine should focus on the estimation of the sump size and pump capacity with due consideration of the presence of the seasonal nallah on the water surcharge and its effect on the make-up of mine water for an appropriate drainage planning.

The limestone mine is characterised by formation strike along NNE-SSW in conformity with the regional trend. The dip is in-between 2 - 4° towards SE. Because of the low dip of strata, the outcrops of lithological units are in conformity with the surface contour pattern. The deposit is generally free from any major structural disturbance.

Mechanised opencast mining has been taken up to extract the limestone with the use of drill machine, excavator and dumper for drilling, loading and transportation of overburden and the mineral. The ultimate pit limit is planned to be 7.5m from the lease boundary and 15m on either side of Amrang nallah. The planned maximum bench height is 10m, while the bench width is 20-25m at the operating stage and 10m at the closing stage. The planned slope angle of individual benches is 85°. The overall slope angle of the ultimate pit slope is planned to be 45°. The haul roads will have a gradient of 1 in 16 and 15m in width. The mine is using wagon drill machine of 115mm diameter along with excavators of 3.3 m^3 and tippers of 40 t capacity to meet the planned production. ANFO with cap-sensitive explosive is being used for primary fragmentation, while the hydraulic rock breaker has been deployed for secondary fragmentation as per the approved mining plan.

Fig. 2 shows the stratigraphic section of the mine obtained at 400m intervals in theNorth–South (strike) direction. The thickness of the overburden and mineral

body, as encountered in these sections, are given in Table 3. The thickness of overburden varies from 8 – 59m. The upper layer of ferruginous limestone is 2-40m thick, while the lower layer of cement-grade limestone is 20-50m thick. The thickness of the inter-band between the two limestone layers varies from 3-16m.

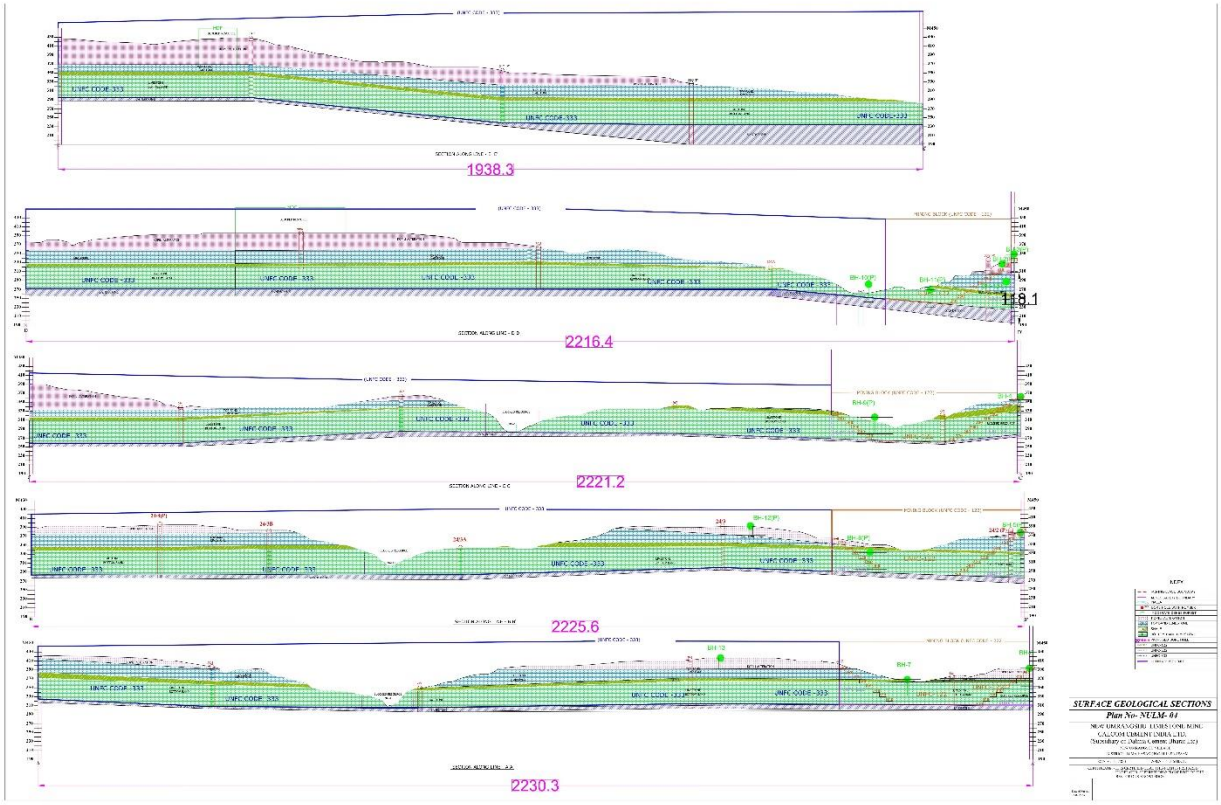


Fig. 2. Stratigraphic sections of the mine

Table 3. The thickness of overburden and mineral body in different sections

Strata	Section 1		Section 2		Section 3		Section 4		Section 5	
	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min
OB	58	0	30	0	59	0	18	0	30	8
Limestone Top	30	20	40	25	12	0	30	0	30	2
Limestone Bottom	50	50	50	25	50	30	51	20	51	35
Band	8	8	9	3	16	3	9	6	12	3

The mine has planned to construct and operate the open pit benches as given in Table 4 (a-e) during the first five years of operation. It is noted that three OB benches are planned to be operated of 8-10 m height and 20m width along with 5-6 mineral benches of 10m height and 20m width during the first three years. The third OB bench will be formed between the upper and lower limestone horizons. In the fourth and fifth years, the mine would be working with five OB benches and six mineral benches of similar dimensions. The bench slope angle is planned to be 85°. The ultimate pit limit is to be maintained at 7.5m within the lease boundary and 15m on either side of Amrang nallah, wherein the overall slope angle will reduce to 45° with reduced bench width of 10m.

Table 4a. Planned configuration of OB and mineral benches in the first year of mine operation

Bench #	Rock Type	RL, m		Height, m	Bench slope angle, °	Bench width, m
		From	To			
1	OB	393	385	8	85	20
2	OB	385	375	10		
3	limestone	375	365	10		
4	limestone	365	355	10		
5	limestone	355	345	10		
6	OB	345	335	10		
7	limestone	335	325	10		
8	limestone	325	315	10		

Table 4b. Planned configuration of OB and mineral benches in the second year of mine operation

Bench #	Rock Type	RL, m		Height, m	Bench slope angle, °	Bench width, m
		From	To			
1	OB	405	395	10	85	20
2	OB	395	385	10		
3	limestone	385	375	10		
4	limestone	375	365	10		
5	limestone	365	355	10		
6	OB	343	335	8		
7	limestone	335	325	10		
8	limestone	325	315	10		
9	limestone	315	305	10		

Table 4c. Planned configuration of OB and mineral benches in the third year of mine operation

Bench #	Rock Type	RL, m		Height, m	Bench slope angle, °	Bench width, m
		From	To			
1	OB	405	395	10	85	20
2	OB	395	385	10		
3	limestone	385	375	10		
4	limestone	375	365	10		
5	limestone	365	355	10		
6	OB	343	335	8		
7	limestone	335	325	10		
8	limestone	325	315	10		
9	limestone	315	305	10		

Table 4d. Planned configuration of OB and mineral benches in the fourth year of mine operation

Bench #	Rock Type	RL, m		Height, m	Bench slope angle, °	Bench width, m
		From	To			
1.	OB	413	405	8		
2.	OB	405	395	10	85	20
3.	OB	395	385	10		
4.	OB	385	375	10		
5.	limestone	375	365	10		
6.	limestone	365	355	10		
7.	limestone	355	345	10		
8.	OB	343	335	8		
9.	limestone	335	325	10		
10.	limestone	325	315	10		
11.	limestone	315	305	10		

Table 4e. Planned configuration of OB and mineral benches in the fourth year of mine operation

Bench #	Rock Type	RL, m		Height, m	Bench slope angle, °	Bench width, m
		From	To			
1.	OB	413	405	8		
2.	OB	405	395	10	85	20
3.	OB	395	385	10		
4.	OB	385	375	10		
5.	limestone	375	365	10		
6.	limestone	365	355	10		
7.	limestone	355	345	10		
8.	OB	343	335	8		
9.	limestone	335	325	10		
10.	limestone	325	315	10		
11.	limestone	315	305	10		

3.0 Study of Physico-mechanical Properties

The mine was required to provide NX size cylindrical core samples of ore and host rocks as per the mutually agreed mandate, for evaluation of the physico-mechanical properties. Later, it was found that the core samples kept in the mine premise had been vertically split and, thus, were not suitable for the laboratory tests. Hence, the project team requested the mine official present at the site to provide field representative rock blocks to meet the requirement. Table 5 shows the test results of the eight rock samples as provided by the mine for laboratory studies.

The new Umrangshu mine is in the process of constructing an external dump of 30m in height. The grain size distribution of the overburden dump sample was done by sieve analysis following IS:2720 Part 4. About 1000 gm of the sample was oven dried for 24 hours. The oven-dried dump soil was washed with water on the 75-micron sieve. Dump soil retained on the sieve was again dried and used in the sieve analysis. The sieve arrangement was made such that the coarser sieve was above the finer sieve and the pan below the finest sieve. The entire assembly of the sieve was placed on the sieve shaker and was covered properly. The dump soil retained on each of the sieves was weighed.

The findings of grain size analysis of the dump sample are shown in Fig. 3. It shows 14% of clay (particle size less than 0.002mm). The silt content (particle size >0.002mm but <0.075mm) was 36%. The percentage content of sand (>0.075mm but less than 4.75mm) was 47. Similarly, the gravel content (particle size >4.75mm but less than 20mm) was 3%. The sand was the major constituent in the sample.

Table 5. Details of rock samples and their physico-mechanical test results.

Sample #	1	2	3	4	5	6	7	8
Rock type	Lower Ferruginous limestone	Upper Ferruginous limestone	Shaly limestone	Shaly upper ferruginous limestone	Cement grade limestone	Rejects	Rejects red colour	Cement grade limestone
Bulk Density, kg/m^3	2570	2610	2600	2580	2620	2640	2460	2620
Specific gravity	2.57	2.61	2.6	2.58	2.62	2.64	2.46	2.62
UCS, MPa	21.42	27.22	31.33	28.22	31.57	29.57	29.23	32.7
Tensile strength, MPa	2.05	2.5	3.35	2.82	3.25	3.05	2.85	3.55
Cohesive strength, MPa	6.19	7.55	8.17	7.83	8.58	7.87	7.78	8.34
Shear strength, MPa	9.30	12.75	16.45	13.25	15.40	15.00	14.75	17.80
Young's Modulus, GPa	2.60	3.30	3.75	2.40	3.80	3.55	3.50	4.05
Shear modulus, GPa	1.07	1.34	1.52	0.97	1.56	1.44	1.42	1.66
Poisson's ratio	0.21	0.23	0.23	0.24	0.22	0.23	0.23	0.22
Angle of internal friction, °	30	32	35	32	33	34	34	36

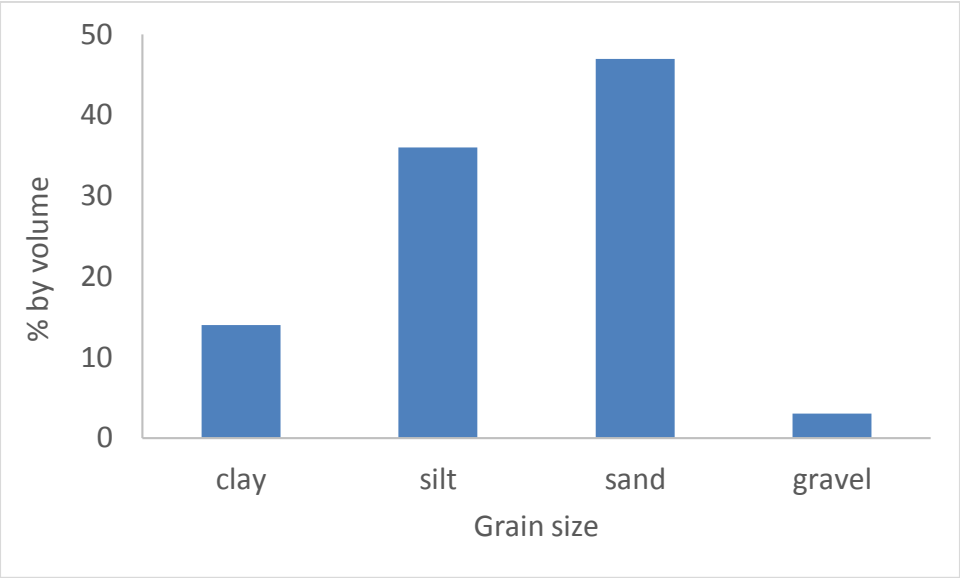


Fig. 3. Grain size distribution of the dump sample

Determination of the optimum moisture content and the corresponding value of the maximum density of the dump material is very important for a meaningful slope stability analysis using a numerical modelling study. For this purpose, The Standard Proctor Compaction test was undertaken to determine the maximum dry density (MDD) and optimum moisture content (OMC) of a given sample using the standard proctor method (IS:2720). This test determines the optimum amount of water being added with the dump in order to obtain the maximum compaction of the dump material. Maximum compaction leads to maximum dry density, and hence the deformation and strength characteristics of the dump turnout to be the best possible value.

The test apparatus consists of a cylindrical mould, collar, base plate, and rammer. The test was carried out by weighing the empty mould. The mould was fixed to the base plate, and the collar is attached to the mould. Subsequently, a thin layer of grease was applied to the inner surface of the mould and collar. The dump sample

was divided into three equal parts. In the first stage, the mould was filled with one part of the soil, and it was compacted with 25 evenly distributed blows with the standard rammer. This process was repeated for the second and the third parts of the sample, taking precautions to scratch the top of the previously compacted layer with a spatula in order to avoid stratification and achieve homogeneity. Then the mould was detached (with compacted soil on it) from the base plate. After this, the weight of compacted soil along with the mould was noted. This procedure was repeated by the incremental addition of water in the sample and repeating the experiment for the measurement of its density in each case until it gets optimised. The results obtained from this test on the dump sample show OMC of 16.3% with Max. Dry Density of 1.74 t/m^3.

Figure 4 shows the plot of dry density vs. moisture content of the samples. The peak point in the ordinate direction shows the Optimum moisture content of respective samples. All the subsequent tests related to the assessment of strength properties have been conducted at the Optimum Moisture Content.

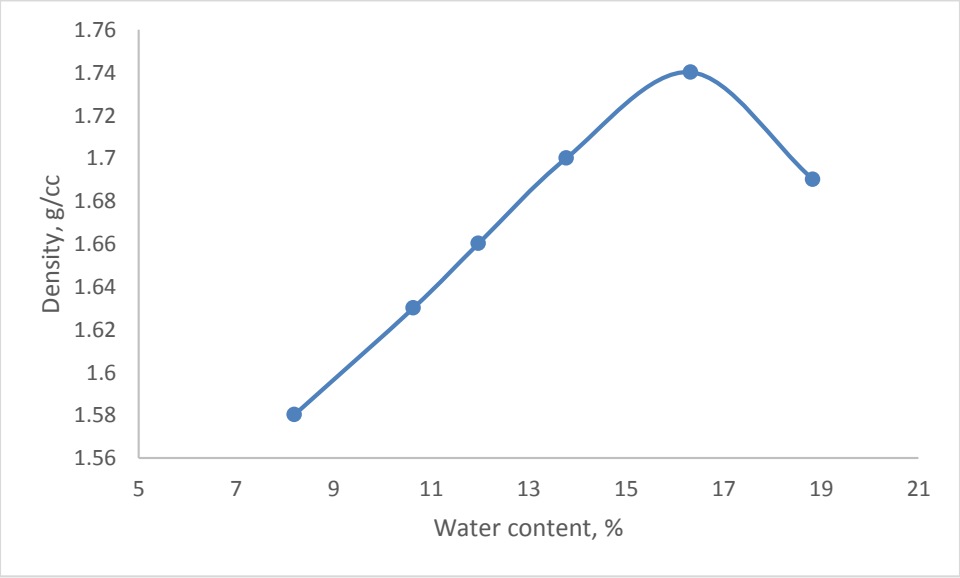


Fig. 4. Plot of water content density of the dump sample

The Tri-axial Compression test was conducted to determine the strength parameters of the given dump soil sample by unconsolidated un-drained tri-axial test following IS:2720 Part 11. The cohesive strength and the angle of internal friction were obtained by this test.

A tri-axial test is intended to provide strength data of a dump soil sample subjected to compressive stresses in three mutually perpendicular directions. The analysis is based on Coulomb's envelope combined with Mohr's Failure Criteria. A Mohr circle with σ_3 and σ_1 at failure represents the state of the specimen at shear. The limitations of a predetermined plane of failure, non-uniform stress distribution, inadequate control of drainage and ignoring the effects of minor principal stresses in direct shear stresses are avoided by using this test. The test specimen is subjected to the all-round pressure equal to the lateral pressure $\sigma_3$and the applied vertical or deviatoric stress σ_d such that the total vertical stress $\sigma_1 = \sigma_d + \sigma_3$.

For conducting the tri-axial test on dump samples, about 1000gm of dump sample was dried in an oven for 24 hours. The weight equivalent to the maximum dry density multiplied by the volume of the mould was taken. Then, water equivalent to the optimum moisture content was added in the sample and it was properly mixed. The dump sample was then put in the mould and properly compacted. The final compaction of the soil sample was done by the compaction machine. After that, the compacted soil sample was nicely taken out from the mould by unscrewing the knot. After the sample preparation, it was then tested in the triaxial testing machine. Three samples were prepared and tested following this procedure.

The sample was put in the rubber membrane using a sheath stretcher with a solid base at the bottom and a loading cap on the top. The rubber membrane was sealed

on both the top and bottom with the rubber band. The sample was on the base of the triaxial cell. The tri-axial cell was then carefully put into position, checking that the plunger just rested on the top cap of the sample. The tri-axial cell was properly tightened with the screws. The steel ball was placed in the central groove of the top cap, and the tri-axial cell assembly was carefully raised just enough to touch the proving ring of the upper assembly. The tri-axial chamber was filled with water leaving some air space at the top of the cell to facilitate the escape of air. The required pressure from the compressor cylinder was maintained in the cell. The proving ring and the dial gauge reading were adjusted to zero. The motor was started, and the observations were recorded. Table 6 shows the results of the test at the different confining stresses.

Table 6. Tri-axial test result of dump sample

Confining stress, Kg/cm2	Normal stress, Kg/cm2
0.5	3.79
1.0	5.73
1.5	6.93

Mohr stress circles were plotted at normal stress intercepts σ_3 and σ_1. Mohr envelopes were obtained by drawing a tangent to the Mohr's circles obtained for both samples. The intercept with Y-axis represents the cohesion, C, and the inclination with X-axis represents the angle of internal friction, φ. Table 7 shows the particle size and other physico-mechanical properties of the dump material of the New Umrangshu mine.

The geo-technical properties of high wall for numerical modelling have been derived from Table 5. The cohesive strength (c) is calculated with the help of Equation 1.

$$UCS = 2 * c * \tan(\frac{\emptyset}{2} + 45) \quad \ldots (1)$$

Table 7. Physico-mechanical properties of dump material

Particle size analysis	Drained cohesion	Undrained cohesion, MPa	Consistency limit	Natural unit weight, gm/cc	Saturated unit weight, gm/cc
Clay – 14% Silt – 36% Sand – 47% Gravel – 3%	Not tested	0.06	LL – 34% PL – 22% PI – 12%	1.74	1.95

The intact rock strength so estimated has been suitably downgraded to obtain long-term residual rock mass strength along the exposed surface of the pit slopes under extreme weathering conditions. The downgraded rock mass data of the high wall strata were arrived using the laboratory test data, the influence of joints and the possible strength loss under extreme weathering of different rock formations on a long terms basis. The Shear (G) and the Bulk (K) modulus of rock have been calculated from Equation 2 & 3.

$$G = \frac{E}{2*(1+\mu)} \quad \ldots \quad (2)$$

$$K = \frac{E}{3*(1-2*\mu)} \quad \ldots \quad (3)$$

Where, μ = Poisson's ratio (μ = 0.25)

Table 8 (a, b) shows the finally obtained parameters of the dump and highwall samples through a set of steps as illustrated above, for extracting input to the

numerical models. These data have finally been used for the numerical modelling study of selected slope structures of the mine. The rock mass data of the high wall strata were arrived using the laboratory test data, the influence of joints and the possible strength loss under extreme weathering of different rock formations on a long terms basis.

Table 8 (a). Input data for numerical modelling of dump slope structures

Sample location	Bulk Modulus, GPa	Shear Modulus, GPa	Density, kg/m^3	Cohesive strength, MPa	Friction angle, °
Dump material	0.41	0.14	1740	0.06	32

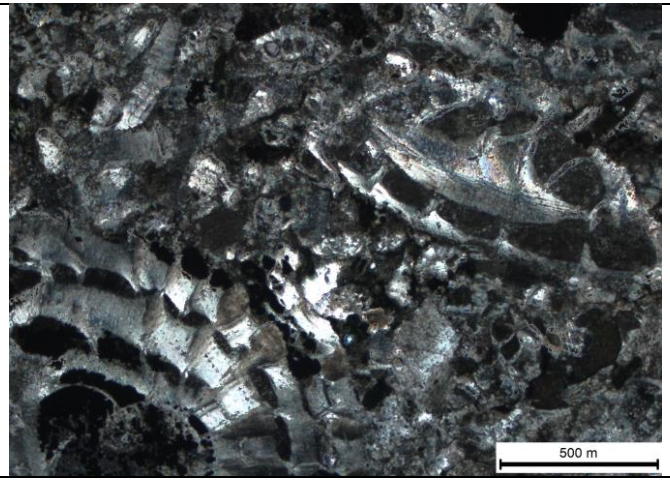
Table 8 (b). Input data for numerical modelling of high wall slope structures

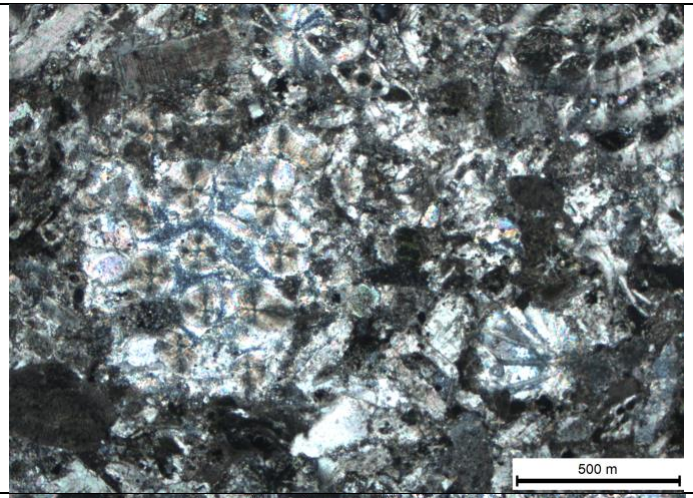
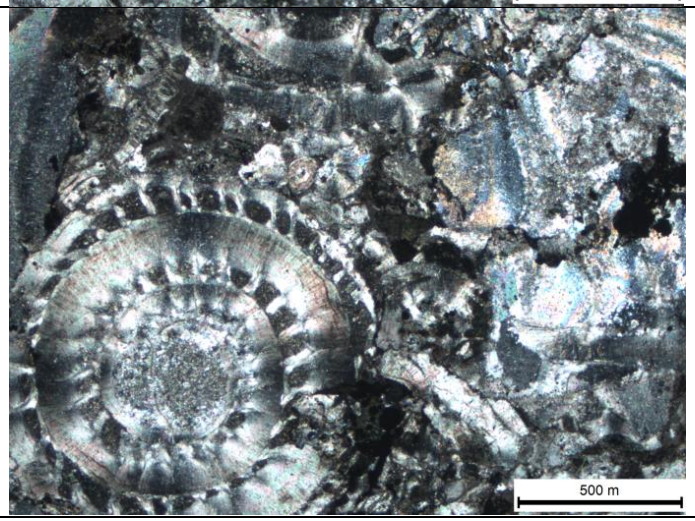
Rock Layer	Bulk Modulus (GPa)	Shear Modulus (GPa)	Density (kg/m^3)	Cohesive strength (MPa)	Friction angle, (°)	Dilation angle, (°)	Tensile strength (MPa)
overburden	0.22	0.25	2567	0.40	34	5	0.15
Ferruginous limestone	0.17	0.19	2587	0.36	31	5	0.12
Cement grade limestone	0.24	0.27	2620	0.43	31	5	0.17
Floor	0.22	0.25	2567	0.40	34	5	0.15

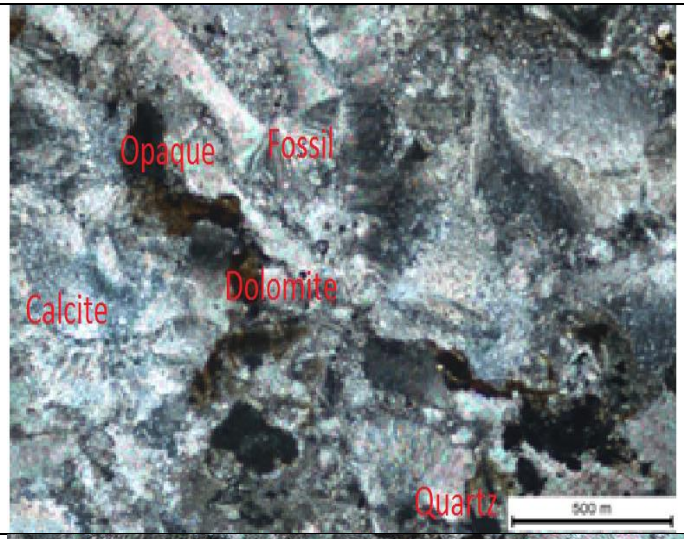
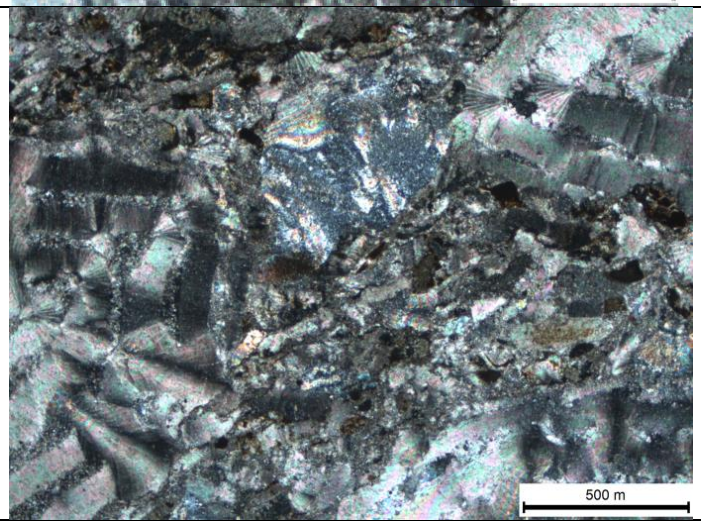
4. 0 Petrographic and Mineralogical Studies

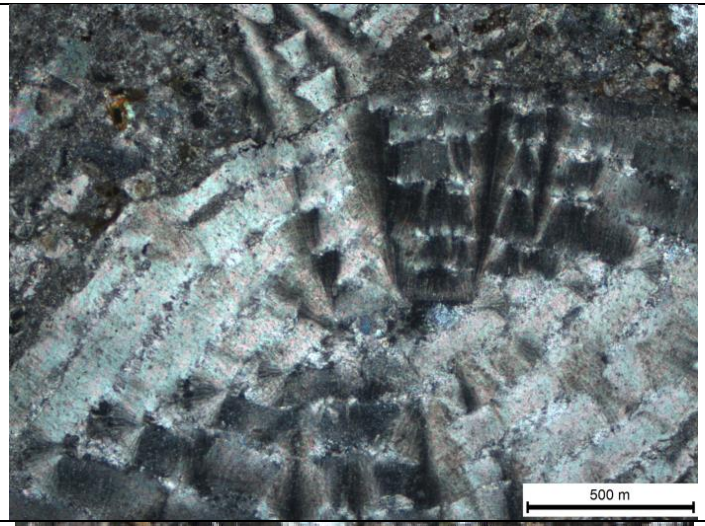
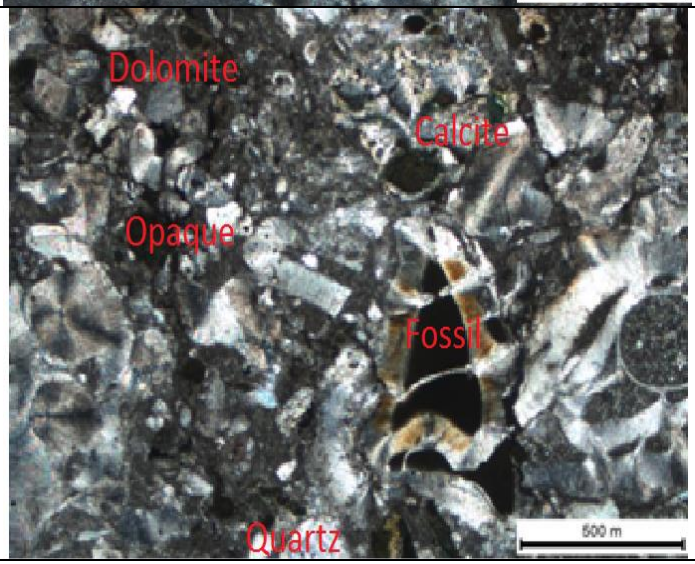
The study of the petrographic and mineralogical properties of all eight samples was carried out by studying the slides under a microscope for each case. Table 9 provides the outcome of this study.

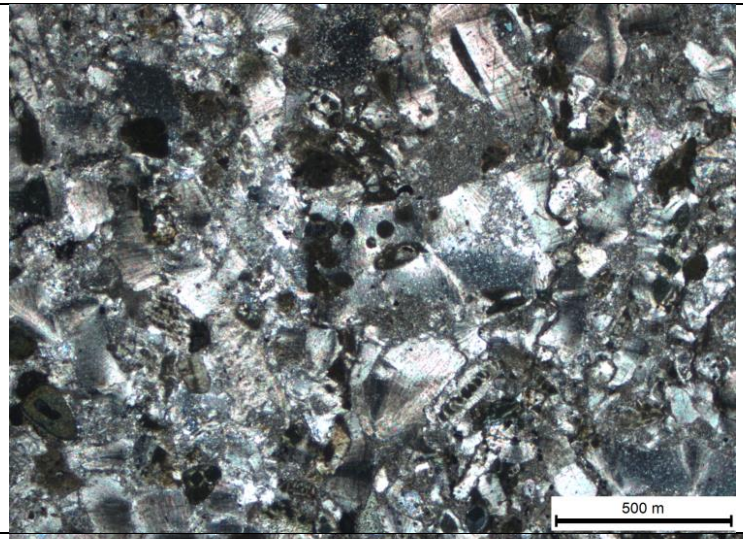
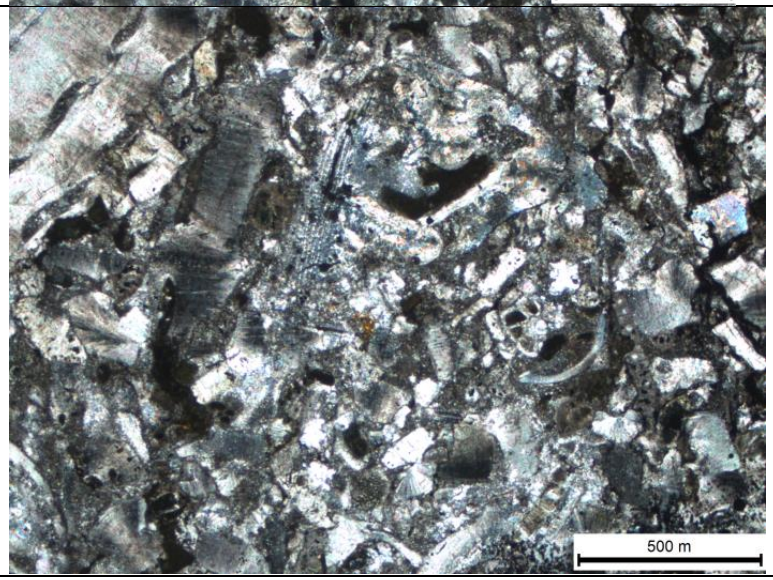
Table 9. Petrological and Mineralogical Study of Samples

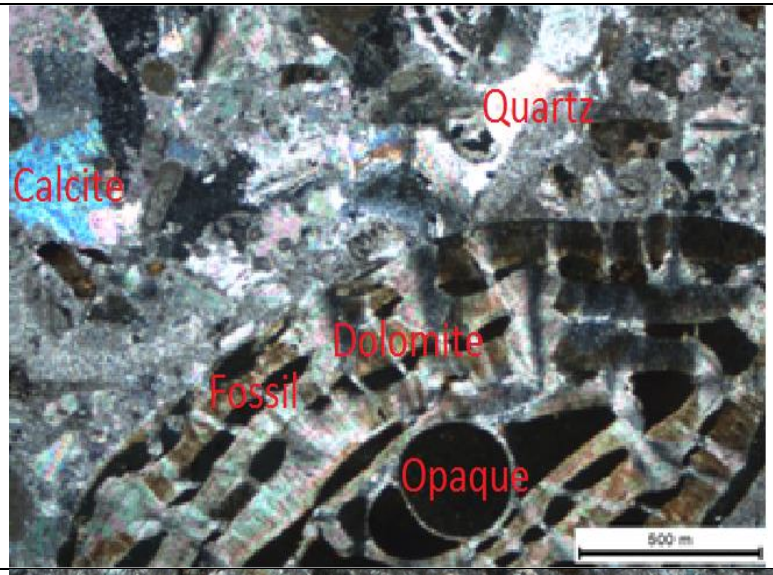
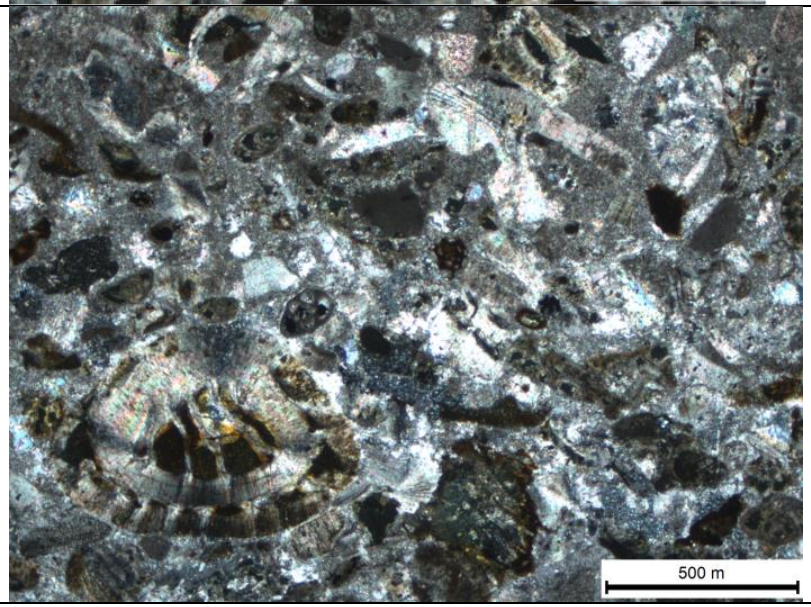
Sl. No.	Sample	Pictorial view of the slide	Megascopic Characteristics	Microscopic Characteristics observed under Petrological Microscope	Remarks
1 (a)	Lower Ferruginous Limestone		The sample is fine to medium grained, grey in colour and slightly hard in nature.	The sample contains fine grained calcite more dominantly. Fine to medium grained ground mass consists of micro and macro fossils. It also contains some amount	It is a fossiliferrous limestone.

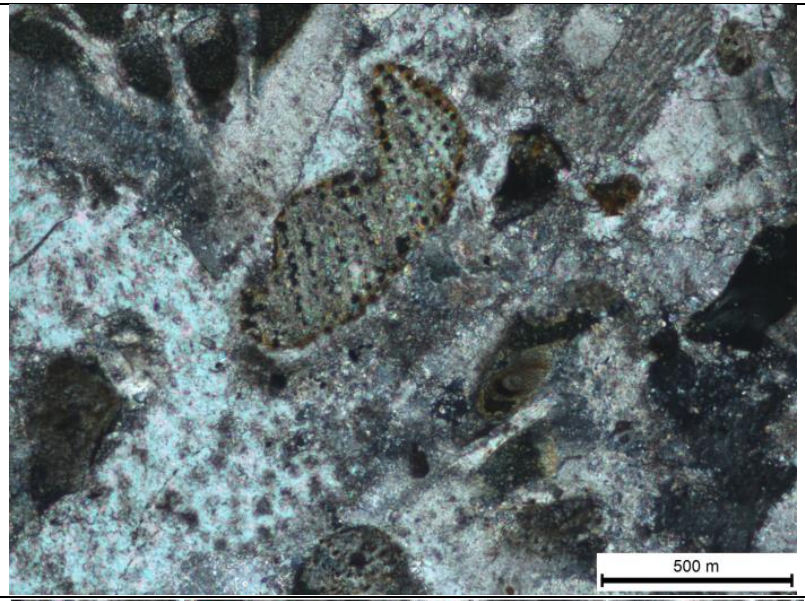
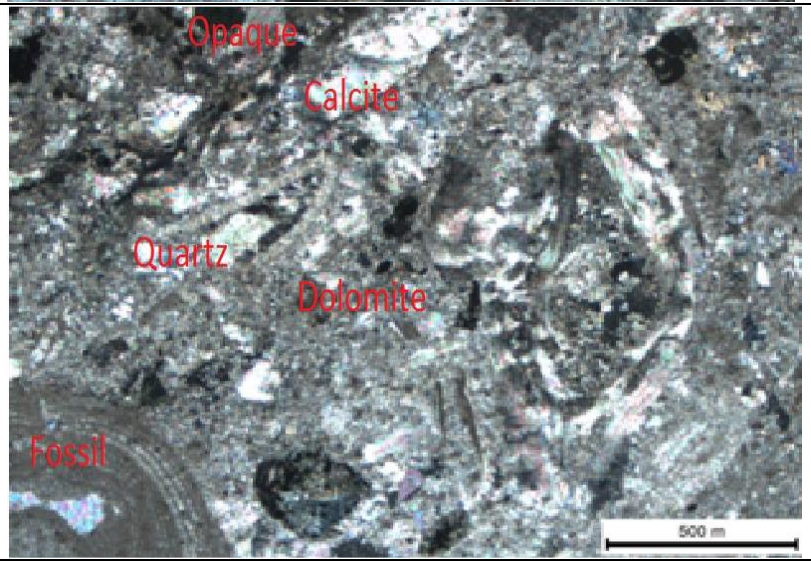
(b)				of quartz, dolomite and opaque minerals.	
(c)					

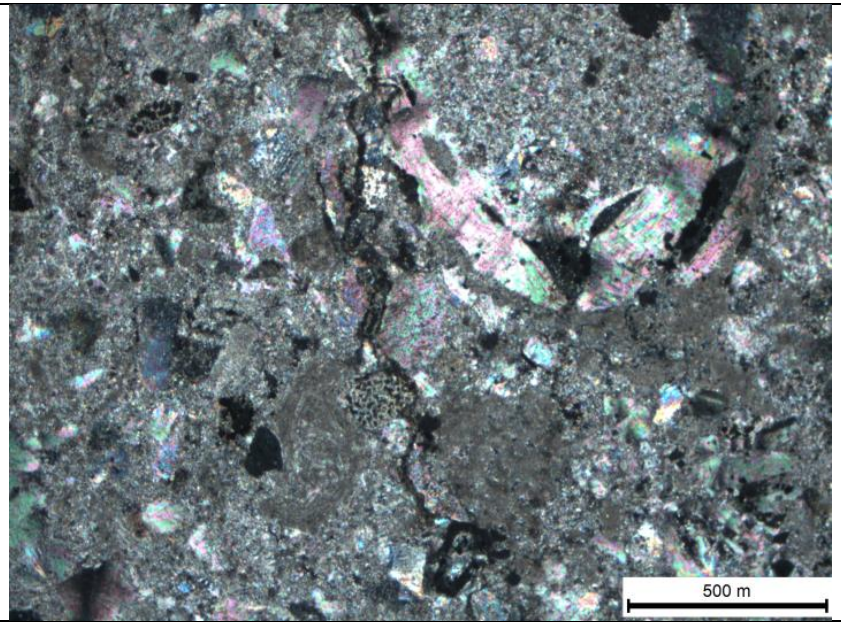
2 (a)	Upper Ferruginous Limestone		The sample is fine to medium grained, grey in colour and slightly hard. The fossils are visible in hand specimen.	The sample contains fine grained calcite. Fine to medium grained ground mass consists of micro and macro fossils. It also contains some amount of quartz and dolomite. The opaque minerals are less in comparison to lower ferruginous limestone.	It is a fossiliferrous limestone
(b)					

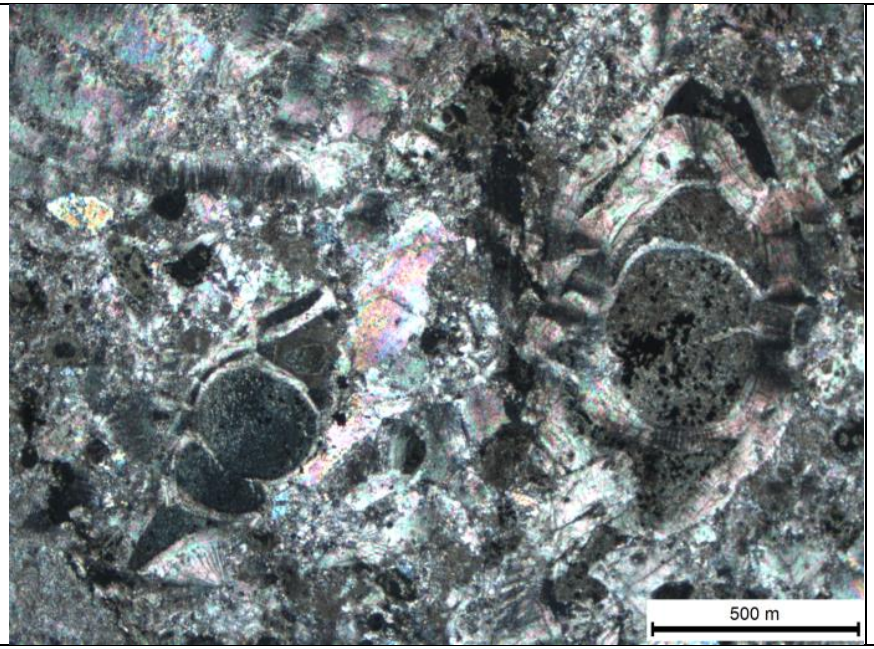
(c)					
3 (a)	Shaly Limestone		The sample is medium to coarse grained, grey in colour and hard.	The sample contains fine grained calcite. Fine to medium grained ground mass consists of micro and macro fossils. It also contains some amount of quartz and dolomite. The opaque minerals are	It is a fossiliferrous limestone.

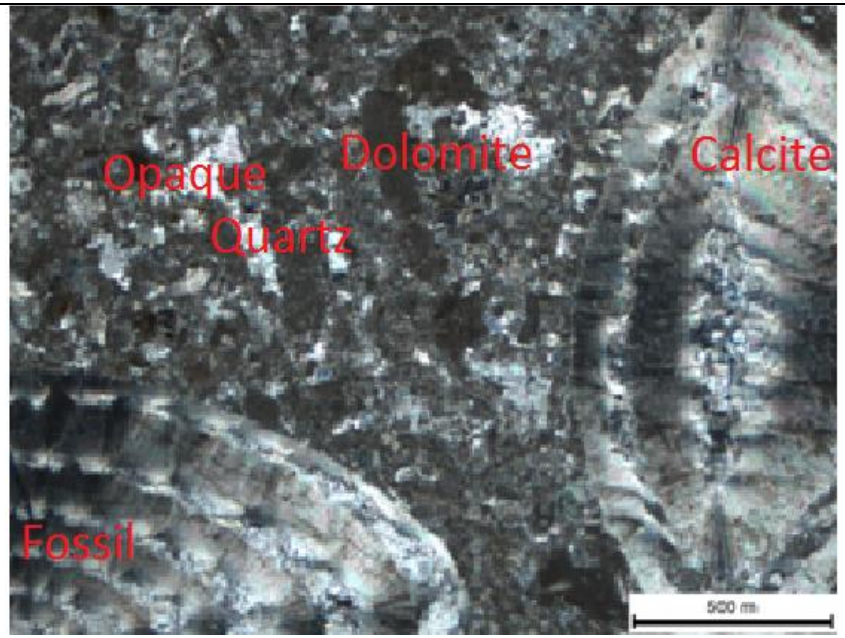
(b)				more in comparison to samples of lower and upper ferruginous limestone.	
(c)					

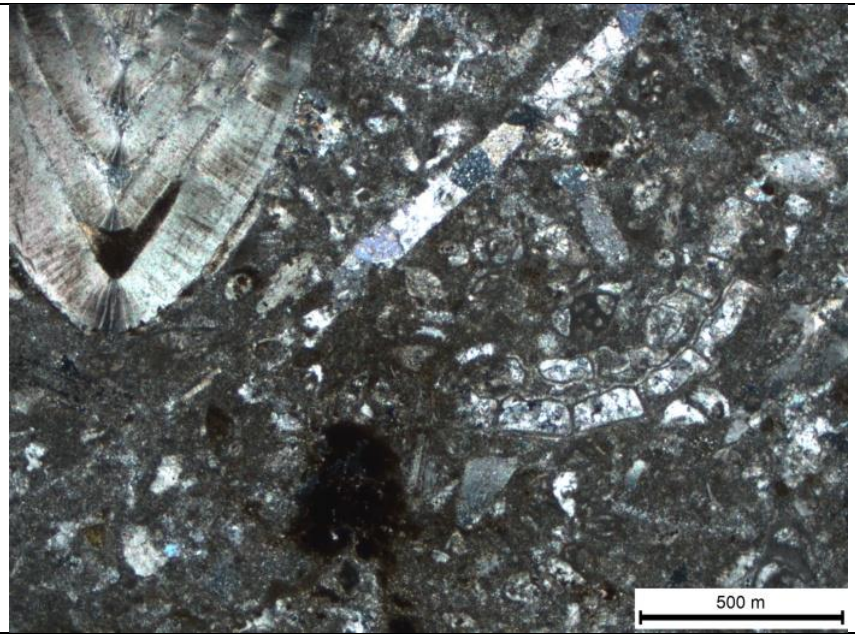
4 (a)	Shaly Upper Ferruginous Limestone		The sample is medium to coarse grained, grey in colour and hard. The fossils are also visible in hand specimen.	The sample contains fine grained calcite. Fine to medium grained ground mass consists of micro and macro fossils. It also contains some amount of quartz and dolomite. The opaque minerals are more in comparison to samples of lower & upper ferruginous limestone and shaly limestone.	It is a fossiliferrous limestone.
(b)					

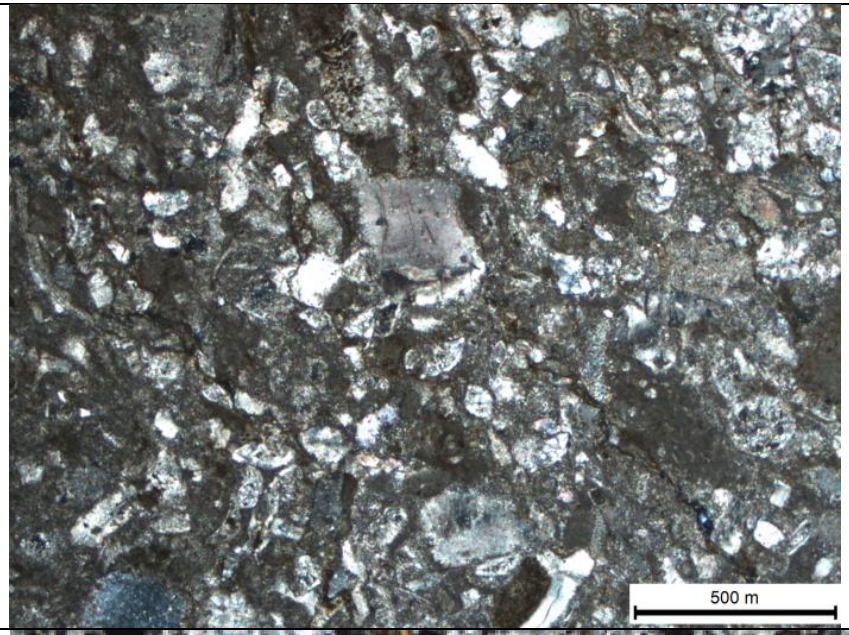
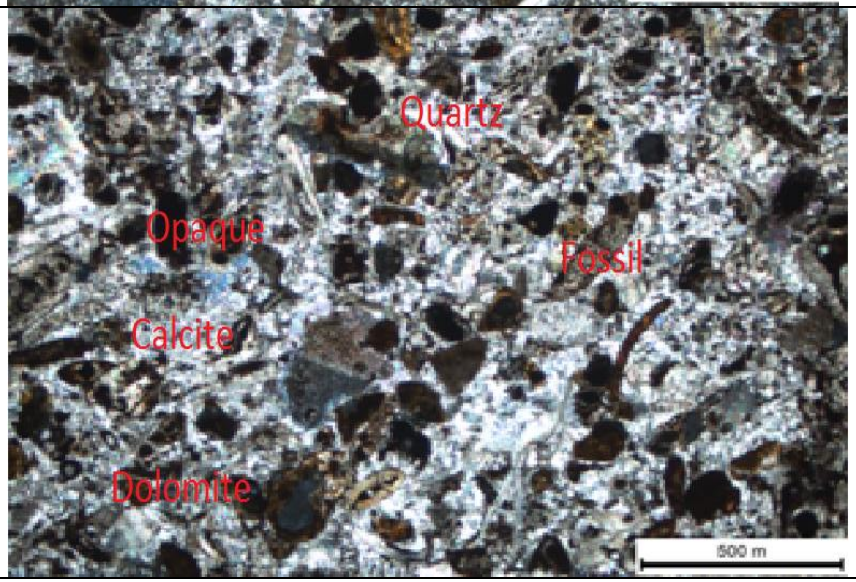
(c)					
5 (a)	Cement Grade Limestone		The sample is fine grained, whitish grey in colour and hard in nature. The fossils are visible in hand specimen.	The sample contains calcite more dominantly. Fine to medium grained ground mass consists of micro and macro fossils. It also contains small amount of dolomite, quartz and	It is a fossiliferrous limestone. The opaque minerals are less as compared with other samples.

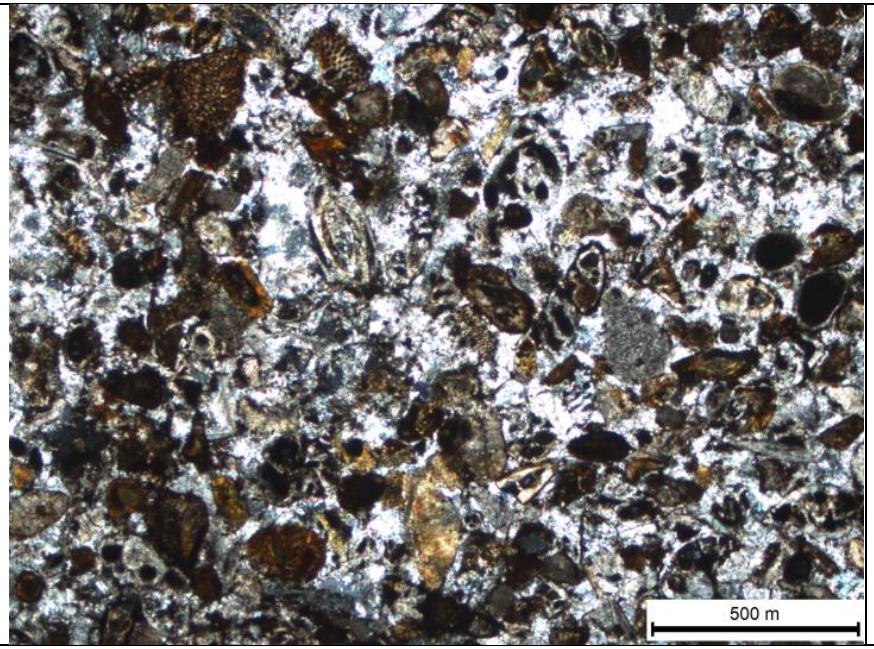
(b)				opaque minerals.	

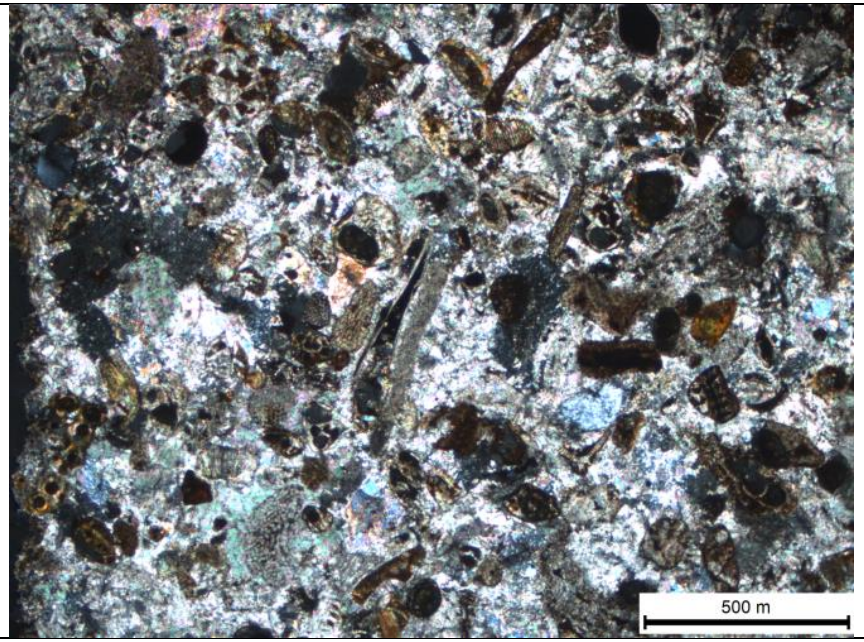
(c)					

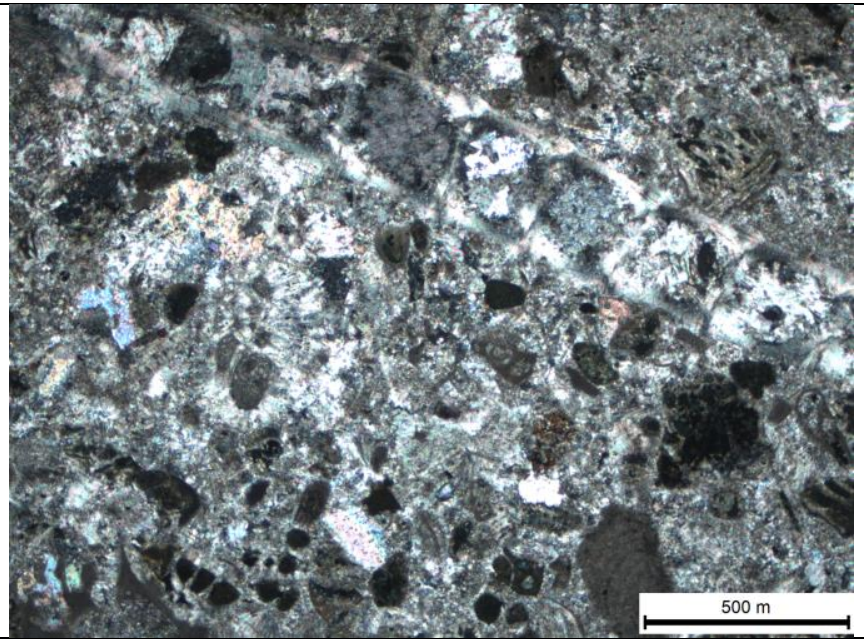
6 (a)	Rejects		The sample is medium to fine grained, grey in colour and hard in nature. The fossils are visible in hand specimen.	The sample contains calcite. Fine to medium grained ground mass consists of micro and macro fossils. It also contains small amount of dolomite, quartz and opaque minerals.	It is a fossiliferrous limestone. The opaque minerals are very less as compared with others except sample 5.

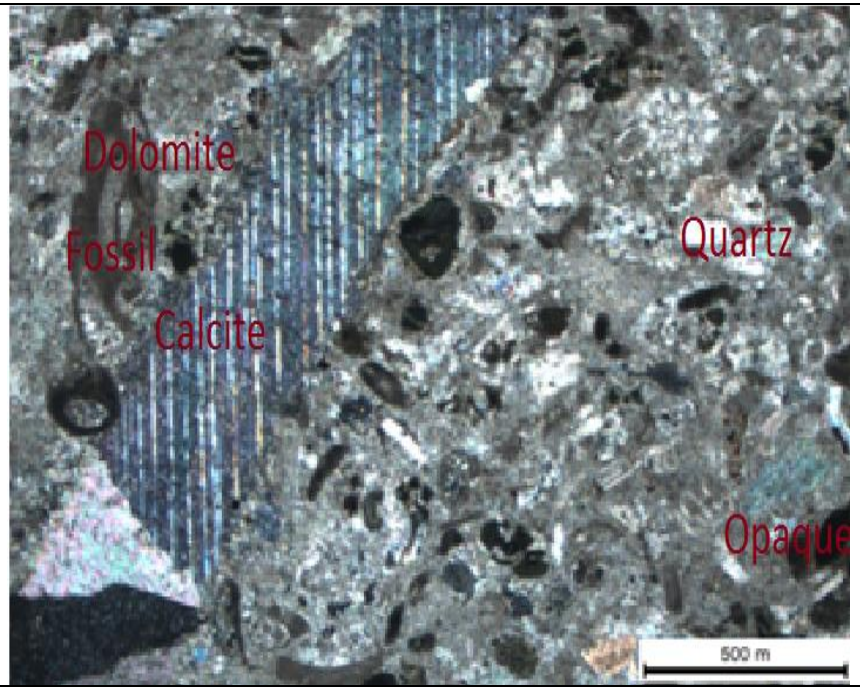
(b)					

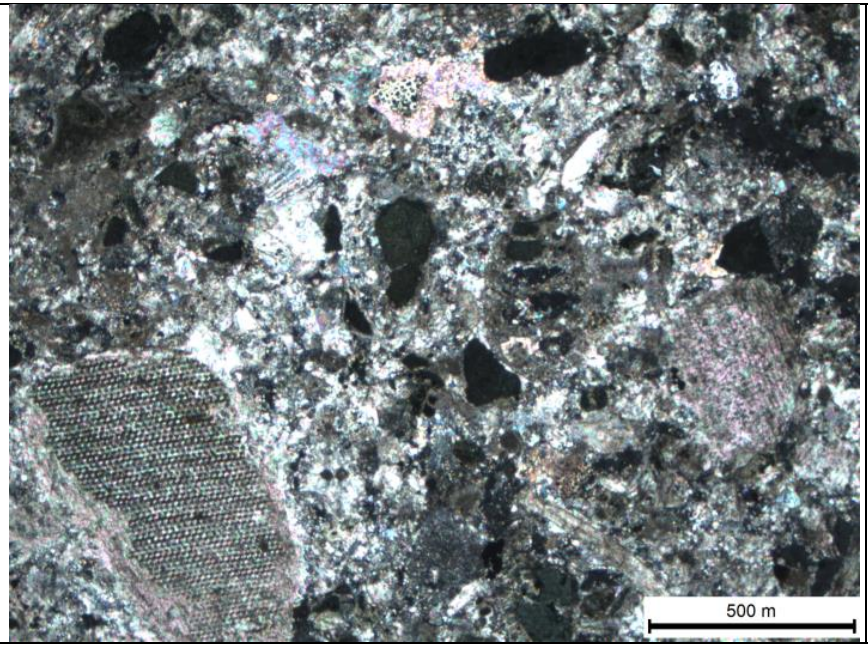
(c)					
7 (a)	Rejects Red Colour		The sample is fine grained, slightly brick in colour and hard in nature.	The sample contains calcite along with dolomite, quartz and opaque minerals. The opaque minerals are more in comparison to dolomite and quartz. Fine grained ground mass consists	It is a fossiliferrous limestone. The opaque minerals are more as compared with all other samples.

(b)				of micro fossils.	

(c)					

8 (a)	Cement Grade Limestone (Old Mine)		The sample is fine grained, grey in colour and hard in nature.	The sample contains calcite which is most dominating mineral. However, dolomite, quartz and opaque minerals are also observed in small amount. Fine grained ground mass consists	It is a fossiliferrous limestone. The opaque minerals are less as compared with other samples.

(b)				of micro and macro fossils.	

(c)					

5.0 Numerical Model Formulation

The high wall slopes were considered for slope stability analysis using Finite Difference software. The model formulation consisted of defining the slope geometry in terms of height and slope angle of individual benches, defining the constitutive model and relevant material properties of the constructional material, and setting field representative loading and boundary conditions.

The left-hand boundary was fixed at 100m from the lowermost bench, whereas the right-side boundary was placed at 200m away from the topmost bench. The thickness of the floor was taken as 50m. These boundaries were considered to satisfy the requirement of infinite elastic boundary with due consideration of the vertical and lateral extension of the slope to be modelled. Both the side boundaries were prescribed roller boundaries where only vertical settlement but no lateral movement was allowed. The bottom surface of the base was rigidly fixed in X and Y, in both directions. The models were discretised in such a way as not to have element size exceeding 1m in either direction.

The (x,y) coordinates of various benches of the slopes were mapped from the approved mine plan as well as the stratigraphic details. The left and right side boundary and the floor base were added in all the models. In all the models, a uniform discretisation scheme was adopted with a constant and uniform zone size of 1m in X and Y directions. In-house developed user-defined subroutines using 'FISH' functions were used to calculate the width and height of individual benches and update their coordinates incorporating their boundaries and the base. 'FISH' functions were also used for layer-wise formation and grouping of the dump elements. Gravity loading was done in the Mohr-Coulomb model charged with field representative data of associated parameters as given in Table 8(a) except the Cohesive strength and the tensile strength, which were prescribed a very high value

in the initial stage, obtaining an elastic solution of the model during the equilibration process. Once the unbalanced force becomes negligible, all the velocities and displacement components are set to zero, and the actual cohesion and tension values are assigned to the model, and it is rerun to obtain the final solution. An in-depth study of vital stability indicators like horizontal displacement, shear strain rate (SSR) and shear strain increment (SSI) has been done to evaluate the performance of specific slope benches as well as the overall structure. The output of the model has also been obtained in terms of its Factor of Safety.

6.0 Stability Assessment and Design of Optimally Safe Highwall Slopes

The approved mining plan of the New Umransgshu mine and the borehole-based stratigraphic sections of its mining area were referred to assess the variation in the thickness of the OB and mineral body at different stages of the mine operation. The study revealed that the thickness of upper OB varies from 18 to 38 m while the thickness of parting OB varies from 8 to 10 m. The thickness of cement-grade limestone varies from 20 to 30 m, while the ferruginous limestone thickness is consistently 30m. The profile of operating slope sections for the second and third years are the same. Similarly, the slope profiles in the 4^{th} and 5^{th} years of the mine operation are also the same.

In consideration of the above, three slope sections have been analysed for the working of open pit slope corresponding to the slope profile of the first to fifth years.

6.1 Stability analysis of the slope section proposed for the first year

Fig. 5a shows the planned profile of the OB and mineral benches during the first year of mining operation. It has eight benches in total with a depth of 78m. The

cement-grade limestone of 20m thickness has two benches of 10m each. A bench of 10m height has been planned in the parting between the cement-grade limestone, and the ferruginous limestone is only one. The ferruginous limestone of 30 m has three benches of 10 m in height, while the overburden of 10m in thickness has one bench. The width of each bench is 20m while the bench slope angle is 85°. Table 10 compiles the stability study results of this open pit slope structure.

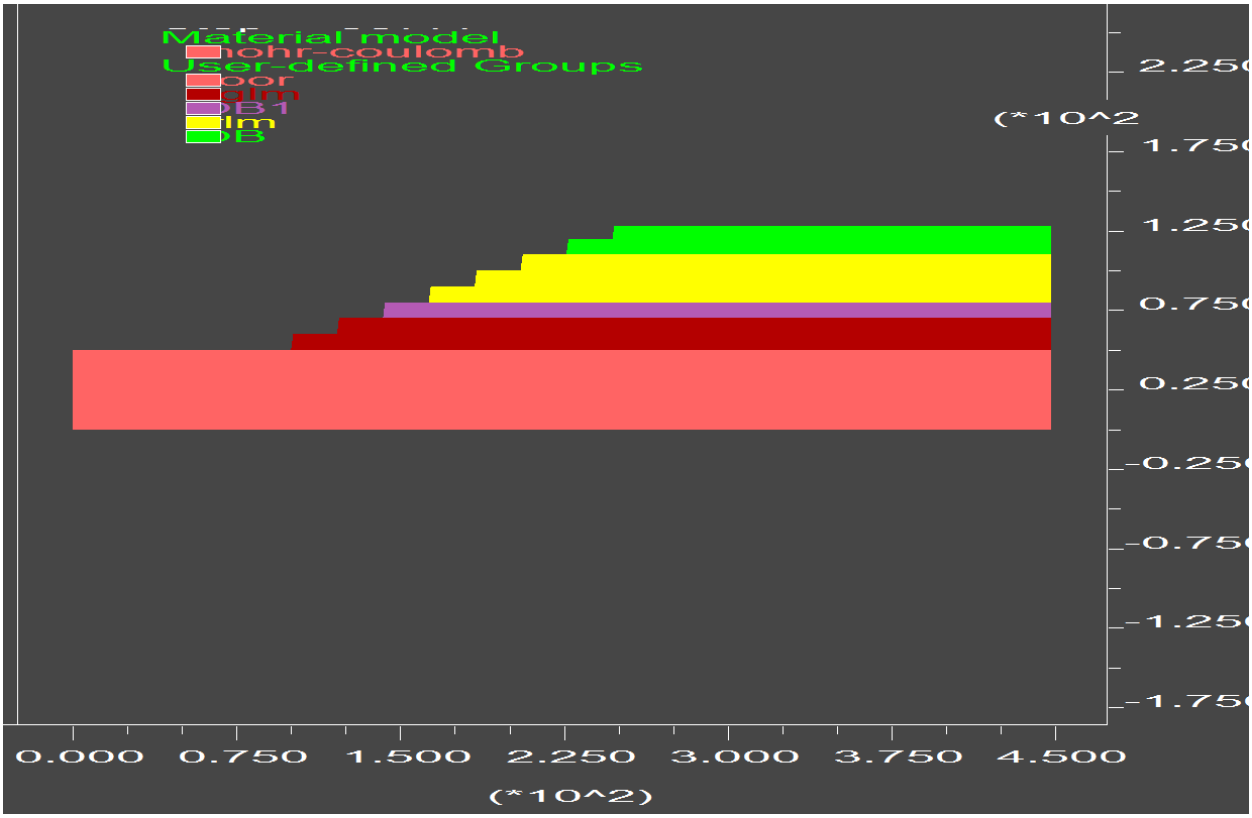


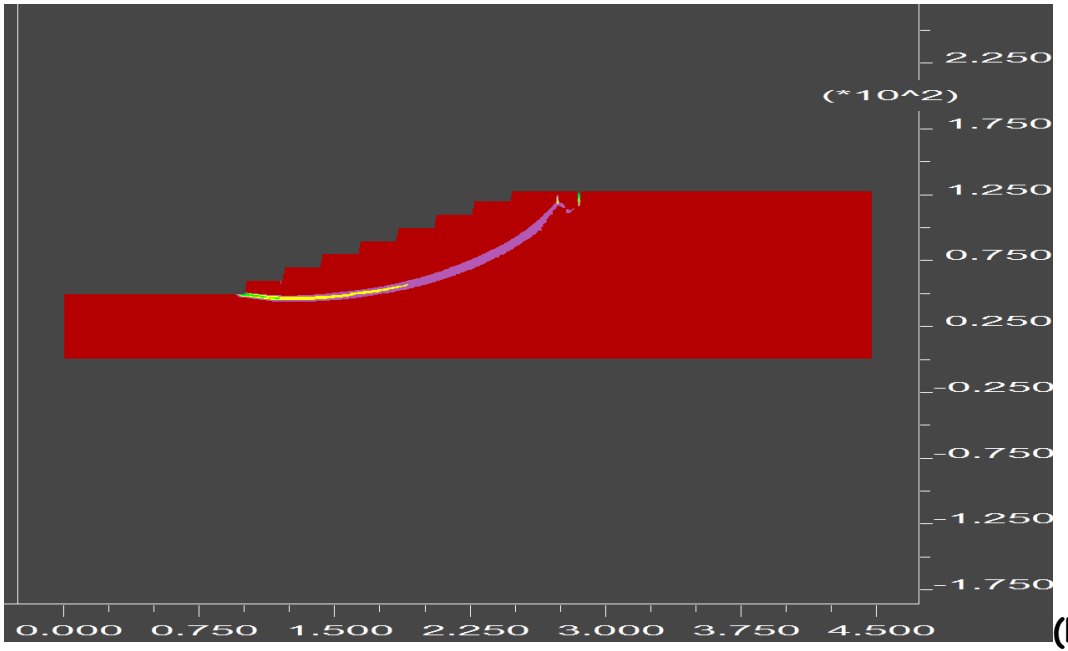
Fig. 5a. Numerical model of open pit slope planned in the first year of operation

Table 10. Stability indicators of open pit slope planned in the first year

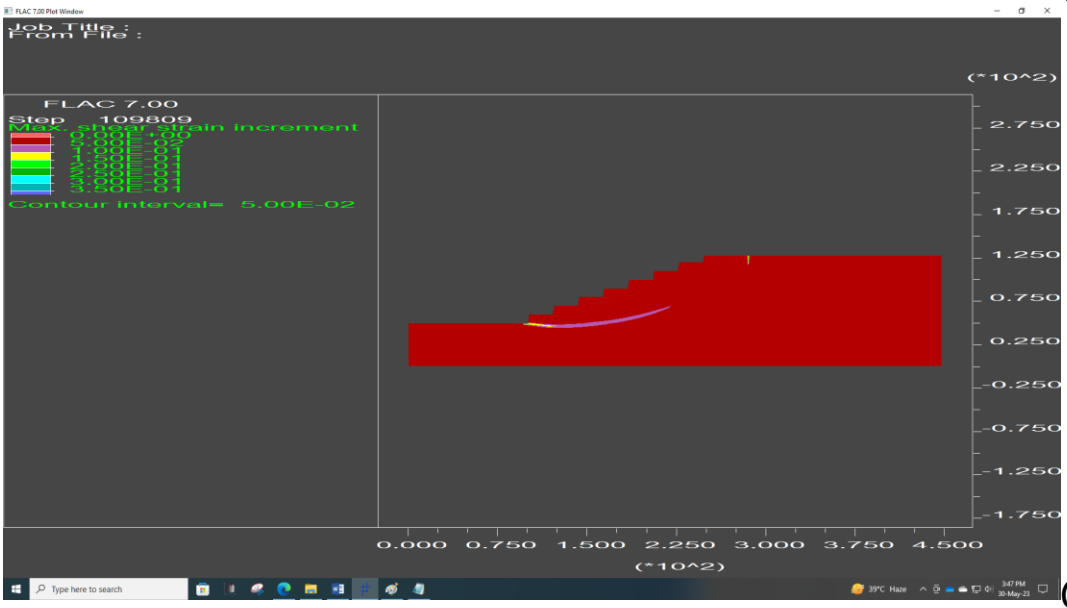
FoS	Maximum horizontal displacement, m	Maximum shear strain rate	Maximum shear strain increment
3.42	3e-3	6e-9	2.25e-4

The Factor of Safety of 3.42, along with the maximum horizontal displacement of 3mm indicates a stable slope profile. The plot of shear strain rate (Fig. 5b) anticipates a deep-seated failure in a favourable condition that may be triggered by

tensile cracking at the topmost crest and water saturation along the potential failure surface. The indication of the onset of such failure could be anticipated in terms of shear failure at the toe of the bottom most bench and tensile failure at the crest of the top most bench (Fig. 5c). It would be critical to avoid undercutting and near parallel exposure of pre-existing rock joint planes to avoid the failure of benches in the pit.



(b)



(c)

Fig. 5. Plot of plastic shear strain increment (b) and shear strain rate (c) in the open pit slope planned in the first year of operation

6.2 Stability analysis of the slope section proposed for the second and third years

Fig. 6a shows the planned profile of the OB and mineral benches during the second year of the mining operation. It has nine benches in total, with a total depth of 88m. The cement-grade limestone of 30m thickness has two benches of 10m each. One bench of 8m in height has been planned in the parting between the cement-grade lime stone and the ferruginous limestone. The ferruginous limestone of 20 m has two benches of 10 m in height, while the overburden of 20m thickness has two benches. The width of each bench is 20m while the bench slope angle is 85°.

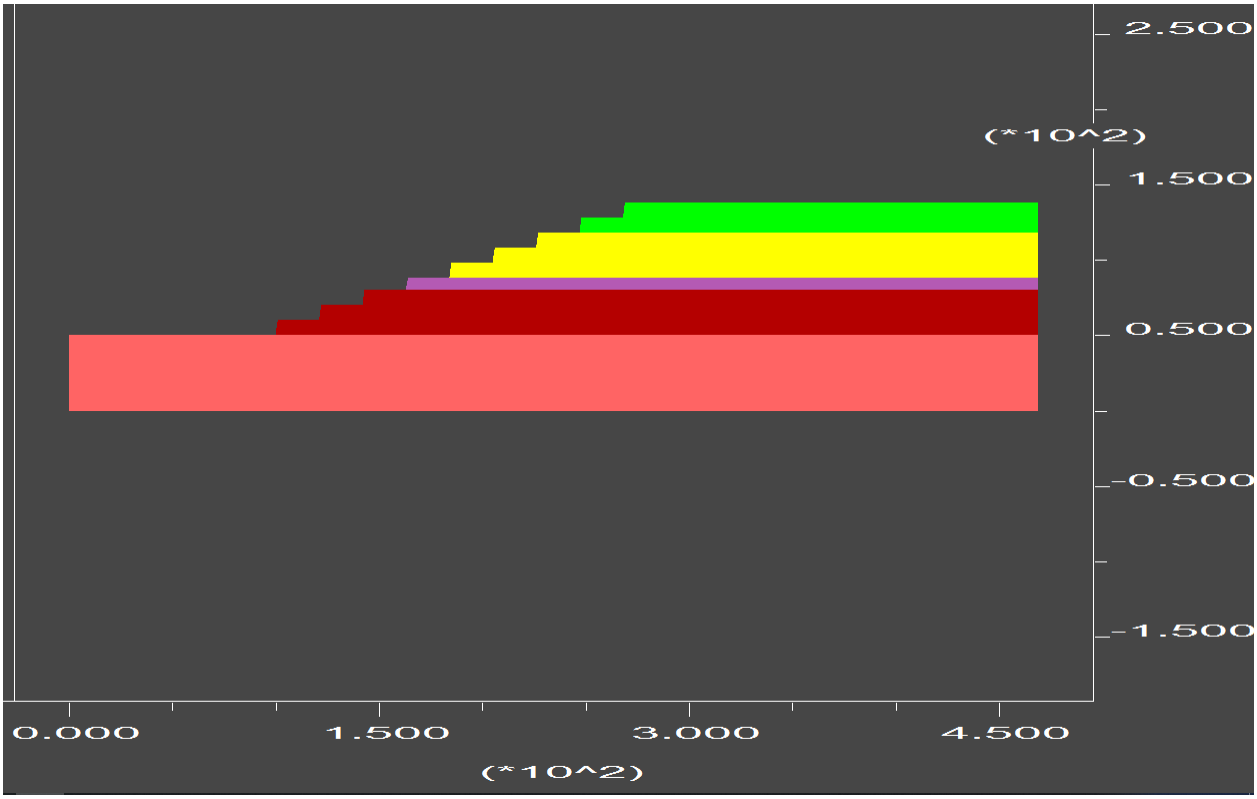


Fig. 6a Numerical model plot showing the geometry of the planned open pit slope structure in the second and third years of mine operation

The Factor of Safety of 3.29, along with the maximum horizontal displacement of 4mm, indicates a stable slope profile (Table 11). The plot of shear strain increment

(Fig. 6b) anticipates a deep-seated failure in a favourable condition that may be triggered by tensile cracking the top most crest and water saturation along the potential failure surface. The indication of the onset of such failure could be anticipated in terms of shear failure at the toe of the bottom most bench and tensile failure at the crest of the top most bench. It would be critical to avoid undercutting and near-parallel exposure of pre-existing rock joint planes to avoid the failure of benches in the pit.

Table 11. Slope stability of planned open pit slope structure in the second and third years

FoS	Maximum horizontal displacement, m	Maximum shear strain rate	Maximum shear strain increment
3.29	4e-3	6e-9	2.5e-4

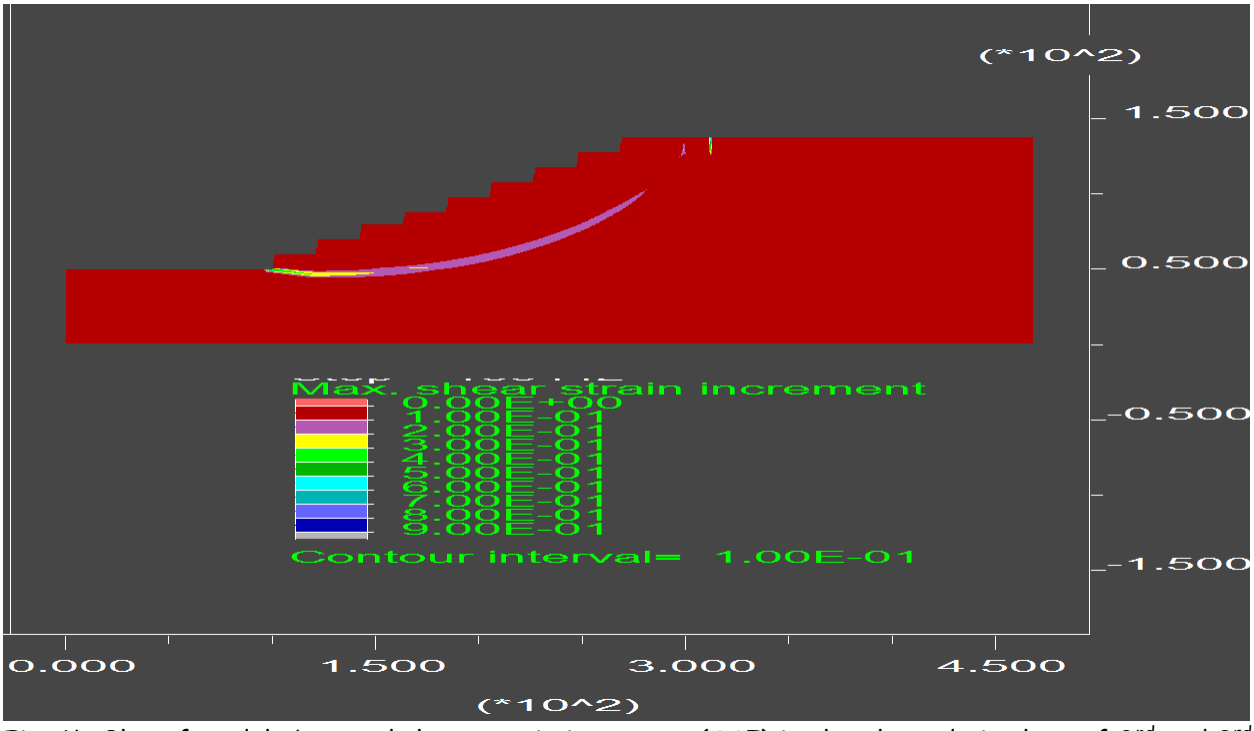


Fig. 6b. Plot of model observed shear strain increment (SSI) in the planned pit slope of 2nd and 3rd year of mine operation

6.3 Stability analysis of the slope section proposed for the fourth and fifth year

Fig. 7 shows the planned profile of the OB and mineral benches during the second year of the mining operation. It has 12 benches in total with a depth of 106m. The cement-grade limestone of 30m thickness has two benches of 10m each. One bench of 8m in height has been planned in the parting between the cement-grade limestone and the ferruginous limestone. The ferruginous limestone of 30 m has three benches of 10 m height, while the overburden of 38m thickness has four benches of 8-10 m height. The width of each bench is 20m while the bench slope angle is 85°. Table 12 compiles the stability study results of this open pit slope structure.

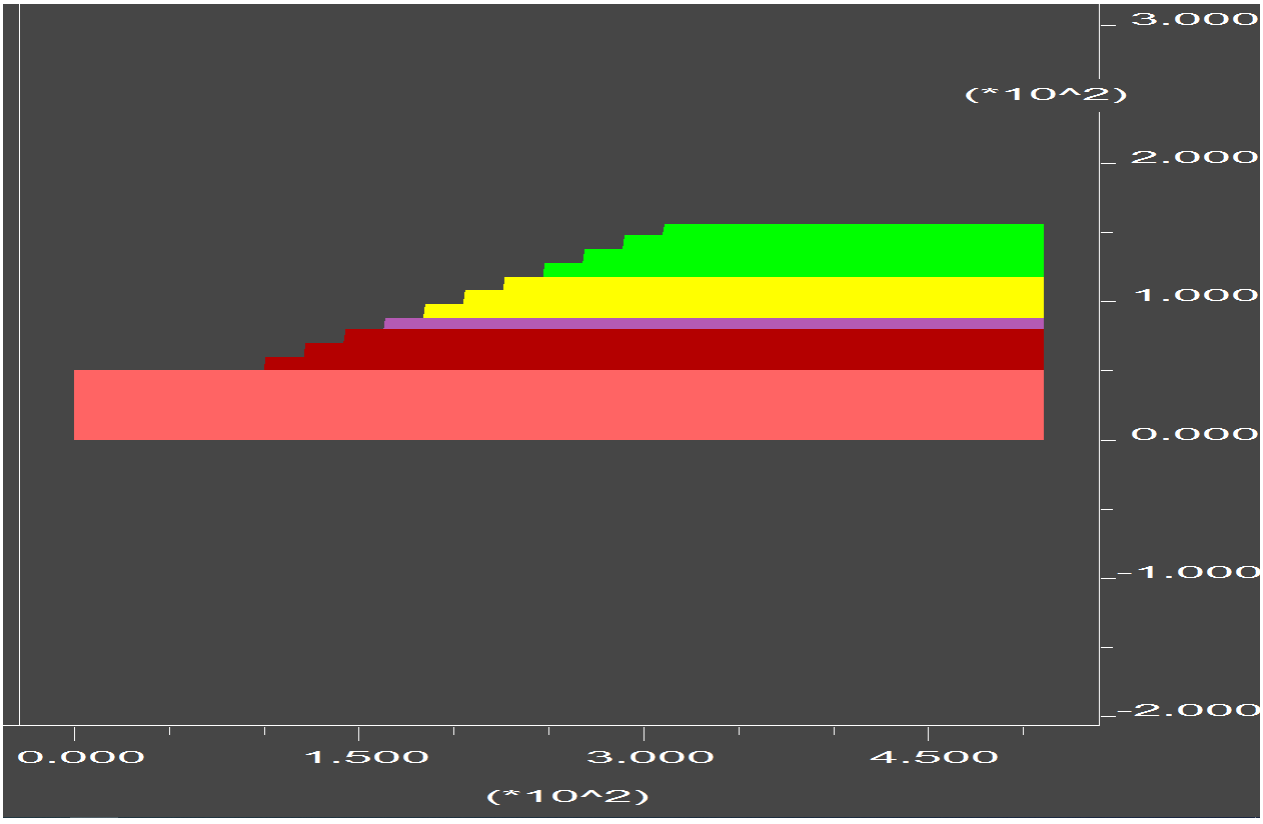


Fig. 7. Numerical model plot showing the geometry of the planned open pit slope structure in the 4th and 5th years of mine operation

Table 12. Stability indicators of open pit slope structure planned in the 4th and 5th years of mine operation

FoS	Maximum horizontal displacement, m	Maximum shear strain rate	Maximum shear strain increment
3.03	7.5e-3	1e-8	4e-4

The Factor of Safety of 3.03, along with the maximum horizontal displacement of 7.5mm indicates a stable slope profile. The plot of shear strain increment anticipates a deep-seated failure in a favourable condition that may initiate at the toe of the bottom most bench. The indication of the onset of such failure could be anticipated in terms of shear failure at the toe of the bottom most bench and tensile failure at the crest of the top most bench.

6.4 Stability of Ultimate Pit Slope

The ultimate pit slope of 106m depth is planned with reduced bench width of 10m as per the diagram shown in Fig. 8. It has a bench height of 10m in the Cement grade limestone and the ferruginous limestone strata. The parting strata and the overburden have bench heights of 8-10m. Table 13 compiles the stability study results of this open pit slope structure.

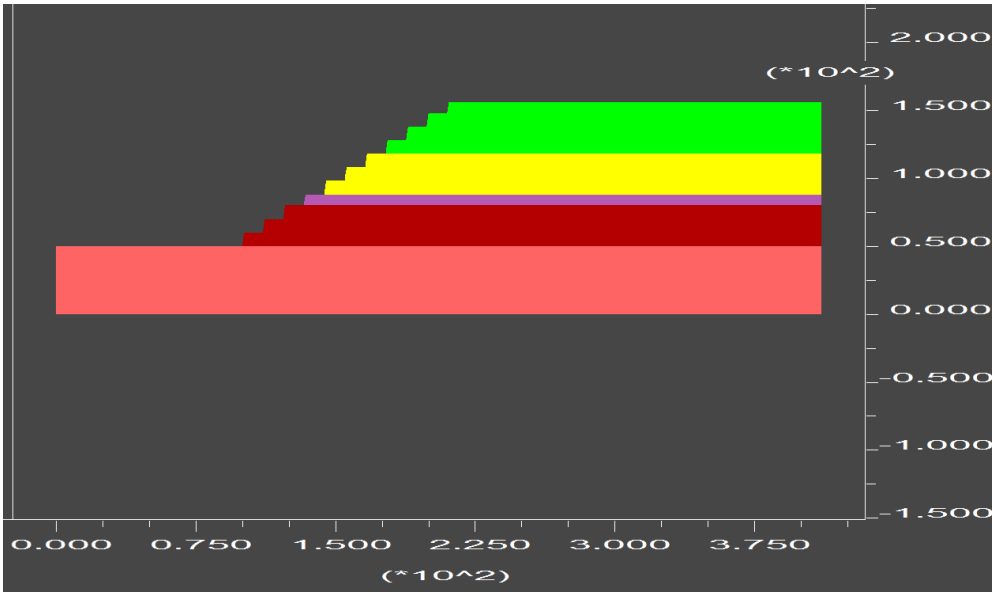


Fig. 8. Numerical model plot of the planned ultimate pit slope

Table 13. Stability parameters of the planned ultimate pit slope

FoS	Maximum horizontal displacement, m	Maximum shear strain rate	Maximum shear strain increment
2.06	7.5e-3	5e-9	4e-4

The Factor of Safety of 2.06, along with the maximum horizontal displacement of 7.5mm, indicates a stable slope profile. The FoS of the slope structure reduces by about 50% for the reduced bench width of 10m. However, it is still adequate enough for a satisfactory performance of the pit slope and will not cause ant functional instability.

7.0 Design of External Dump Slope

The New Umrangshu Limestone mine has planned for a 30m high external dump slope. The test data of dump material as given in Table 6(a) was used for the design of an optimally safe dump structure. Three experimental slope structures for a slope angle of 30-50° were studied to obtain the optimally safe design of the structure. The modelling showed that the FoS of the 30m dump reduced from 2.40 – 1.59 for the

increase in slope angle from 30 to 50°. The study concluded that the mine could operate the 30m high dump in a single bench, maintaining a maximum slope angle not exceeding 50°. The insignificant horizontal displacement profile of the slope also confirmed the same (Fig. 9).

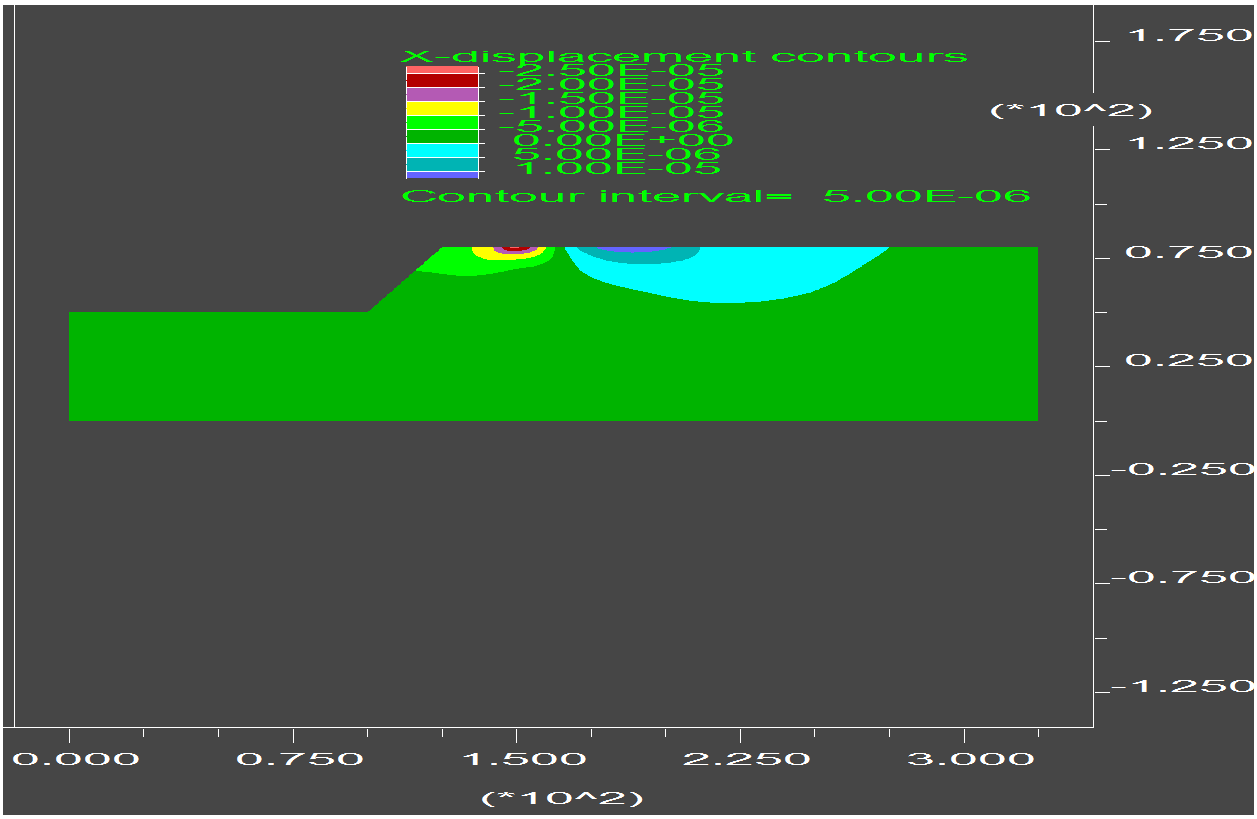


Fig. 9. Horizontal displacement profile of 30m high dump at 50° slope angle

8.0 **Effect of Blast-Induced Loading on Stability of Slopes**

The effect of near-field seismic loading induced by blasting in working benches on the open pit and dump slope has been studied for the ultimate pit as well as the external dump slope. It considers peak ground acceleration of 0.2g in horizontal directions. Accordingly, a horizontal seismic loading factor (kh) of 0.02 was initialised to calculate the resultant factor of safety. The study showed a reduced

FoS of 2.85 for the fourth and fifth years of the planned bench profile. For the planned ultimate pit slope, the FoS was reduced to 2.0 under similar loading conditions. Table 14 shows the effect of blasting-induced seismic loading on the FoS of the open-pit slope.

Table 14. Effect of dynamic loading on the stability of pit slopes

Pit condition	FoS under static loading	FoS under dynamic loading
Operating pit slope	3.03	2.85
Ultimate pit slope	2.06	2.00

9.0 **Effect of Rain on Stability of Slopes**

The presence of capillary pressure in overburden dump and high wall strata can have a big impact on the stability of its slope structure. Capillary forces hold fine particles together and can provide additional cohesion to the dump. The apparent cohesion provided by the capillary forces usually decreases as the saturation increases. While a rainfall event of low intensity and long duration may, under certain conditions, could be beneficial to the stability of the slope, a high-intensity, short-duration event may promote a buildup of saturation and induce slope failure.

The high wall section for the fourth/fifth year and the ultimate pit slopes have been studied for analysing the effect of rain fall on its stability condition. The stability of the slope has been analysed for two successive rainfall events of increasing intensity and decreasing duration. In the first stage, rain fall of 129mm/month, which is equivalent to 1579mm/year, has been considered. In the second stage, a rainfall of 438mm over three days period has been considered. These data have been arrived after analysing the last 20 years' rain fall data of the mining area. The material and fluid properties considered for this study are listed in Table 15.

Table 15. Rock and fluid properties for slope

Parameter	value
Mobility coefficient of soil, m^2/Pa-sec	1e-9
Porosity of material	0.1
Density of water, kg/m^3	1000
Density of air, kg/ m^3	0
van Genuchten parameter, *a*	0.336
van Genuchten parameter, *b*	0
van Genuchten parameter, P_0, *MPa*	0.015
Modulus of water, MPa	1e5
Non wetting fluid modulus, MPa	1
Undrained coefficient	0
Residual saturation	0
Viscosity ratio	1.0

The *modelling study has been* performed using the two-phase flow configuration in order to evaluate the effect of capillary pressures. The wetting fluid is water, and the non-wetting fluid is air. In the initial stage, the state of the slope under a constant, long-term background infiltration from precipitation has been considered. The steady-state saturation, q, for a given level of precipitation can be estimated by Eq. 4.

$$q = kK^w S_w \rho_{wg} \quad \text{...(4)}$$

Where, *k* is the mobility coefficient, K^w is the relative permeability (Eq. 5), S_w is the initial saturation, ρ_w is the density of water, and g is the acceleration due to gravity. The value of a and b are determined experimentally.

$$K^w = {S_w}^b \left[1 - \left(1 - {S_w}^{1/a}\right)^a\right]^2 \quad \text{...(5)}$$

Using Eq. (4) and (5), the value of steady state saturation, Sw can be estimated.

The negative initial pore pressure is calculated using Equation 6 from initial saturation and the atmospheric air pressure P_o. The typical values of *a* and *b* are taken as 0.336 and 0.6, respectively, based on some other studies reported elsewhere.

$$-P_w = P_0\left[{S_w}^{-1/a} - 1\right]^{1-a} \quad \text{...(6)}$$

For an infiltration rate of 129mm/month (annual rain fall of 1549mm) and the property values listed in Table 15, the steady-state saturation is evaluated as 0.58, and the initial pore pressure is 38058.

This simulation is run in three stages. First, the initial steady-state flow condition is calculated for a constant infiltration rate of 129 mm/month. Then, the first rainfall event is modelled to simulate a rainfall accumulation of 1549mm over 12 months. Finally, a second rainfall event of 465 mm over three days is simulated.

Fig. 10 shows the displacement contour of the operating slope section proposed during the 4/5th year of mine life applied to the long-term rainfall event. The plot shows that the slope receives a maximum horizontal movement of 8mm. The FoS of the slope remains 3.04 in this case. However, when it is exposed to intensive rainfall of short duration (465mm in three days), the maximum horizontal movement increases to 2.5m. Fig. 11 shows the extent of the slope undergoing horizontal movement exceeding 200mm. Large-scale failure in a number of high-wall benches is evident in the operating pit in such conditions.

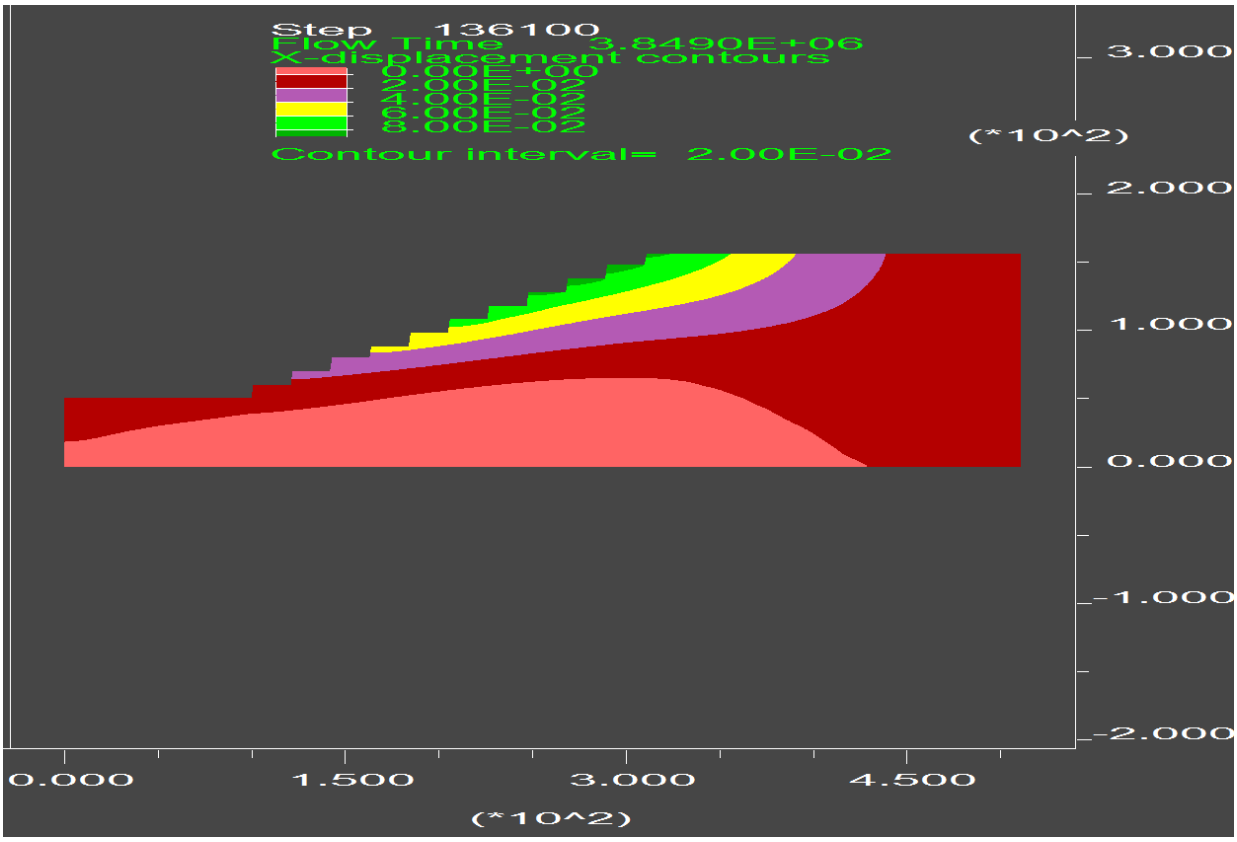
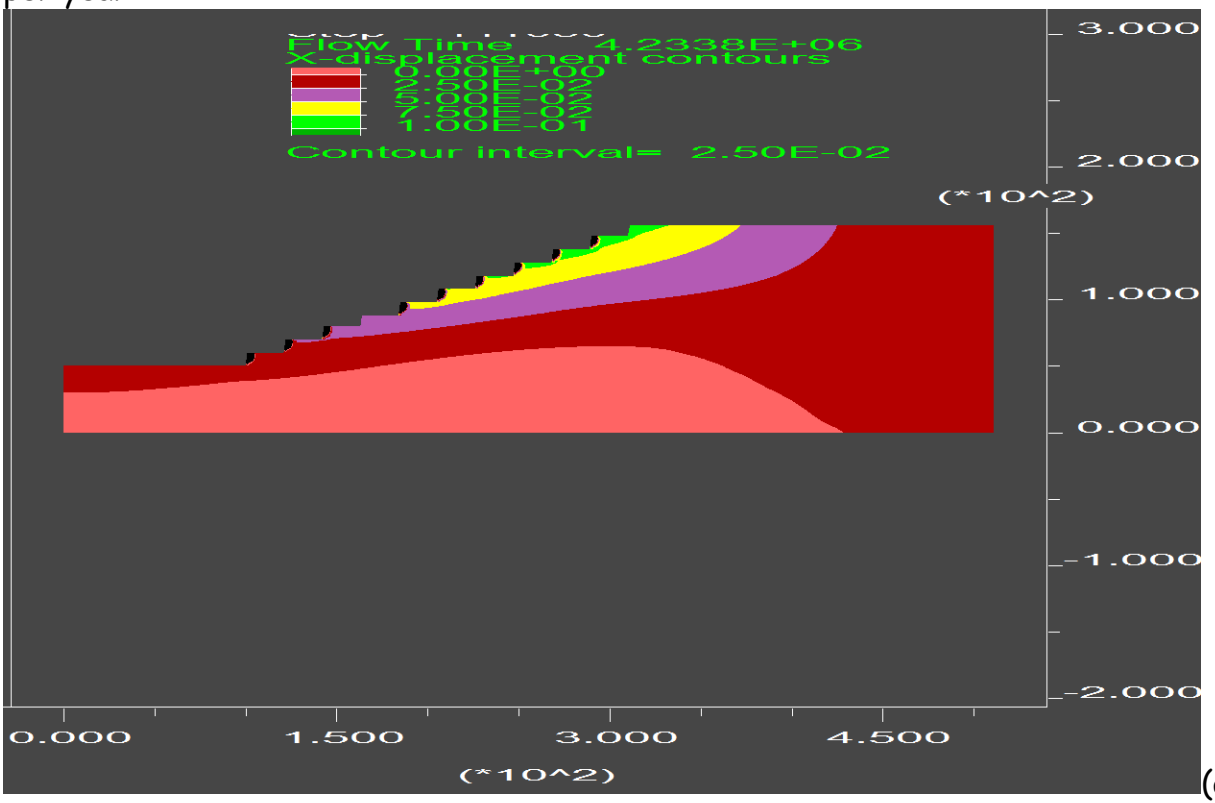
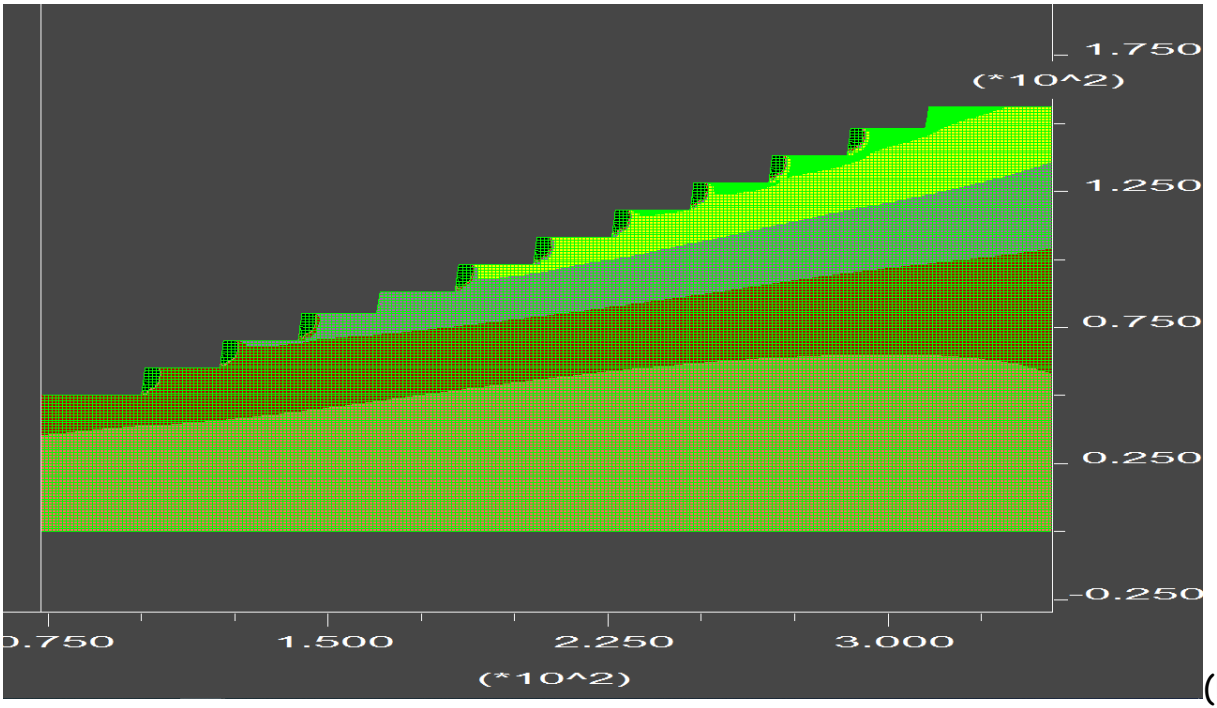


Fig. 10. Displacement contour of slope section after long term rain fall of 1549mm per year



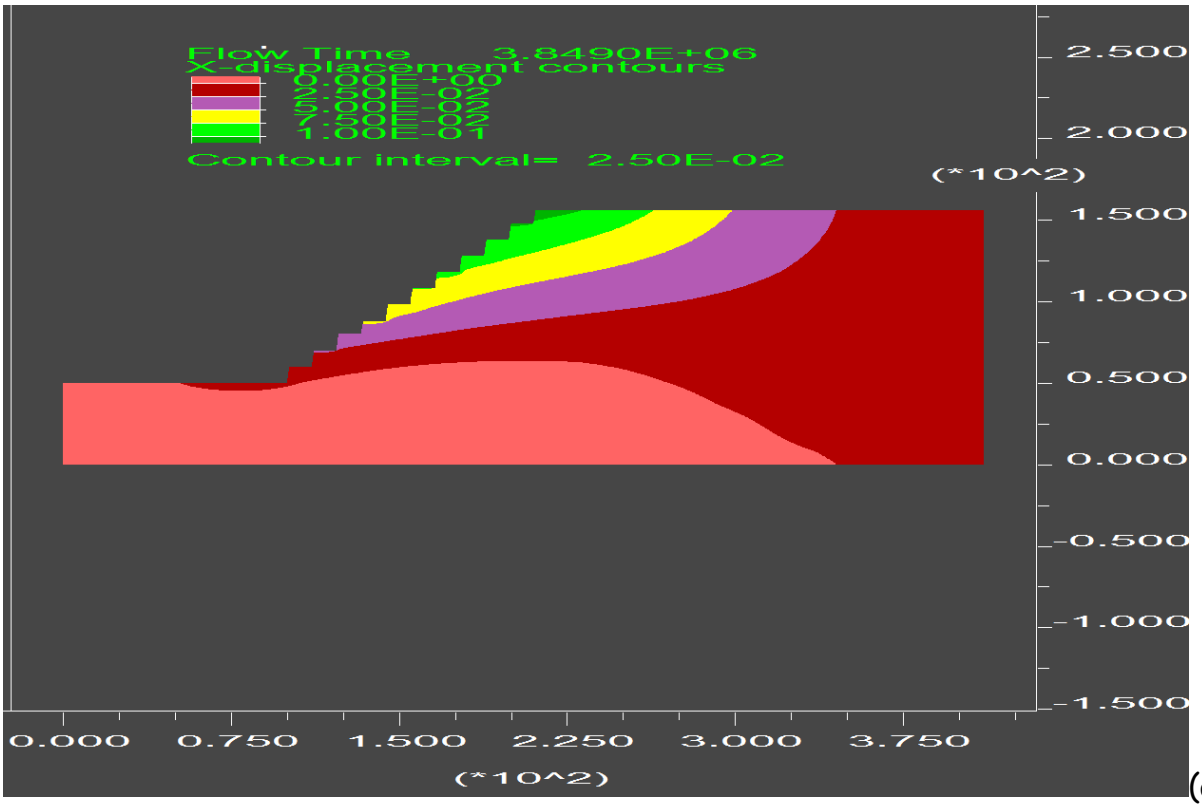
(a)

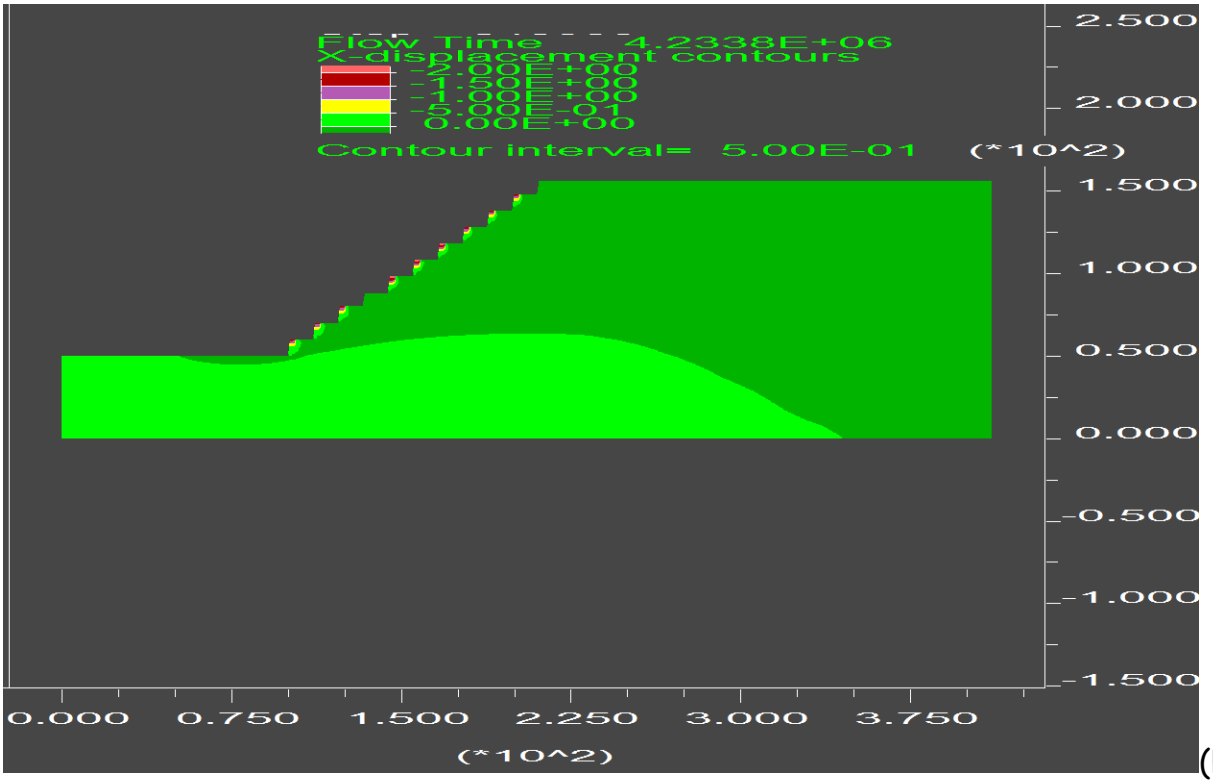


(b)

Fig. 11. Contour of X-Displacement in the different benches of the highwall slope section after 465mm of rainfall over 3 days' period, portions exceeding 200mm of displacement are shown in black colour in (b)

For the ultimate pit slope, the FoS of the slope remains almost the same, but the maximum horizontal displacement increases to 100mm for the long term precipitation of rain (Fig. 12a). For short-term heavy rain precipitation, the maximum displacement increases to 2m. The extent of bench slopes having more than 20cm of horizontal deformation is shown in Fig. 12b/c. Owing to large deformation, the solution for FoS did not converge.


Flow Time 3.8490E+06
X-displacement contours
0.00E+00
-2.50E-02
-5.00E-02
-7.50E-02
-1.00E-01
Contour interval= 2.50E-02
(*10^2)
2.500
2.000
1.500
1.000
0.500
0.000
-0.500
-1.000
-1.500
0.000
0.750
1.500
2.250
3.000
3.750
(*10^2)
(a)


Flow Time 4.2338E+06
X-displacement contours
-2.00E+00
-1.50E+00
-1.00E+00
-5.00E-01
0.00E+00
Contour interval= 5.00E-01
(*10^2)
2.500
2.000
1.500
1.000
0.500
0.000
-0.500
-1.000
-1.500
0.000
0.750
1.500
2.250
3.000
3.750
(*10^2)
(b)

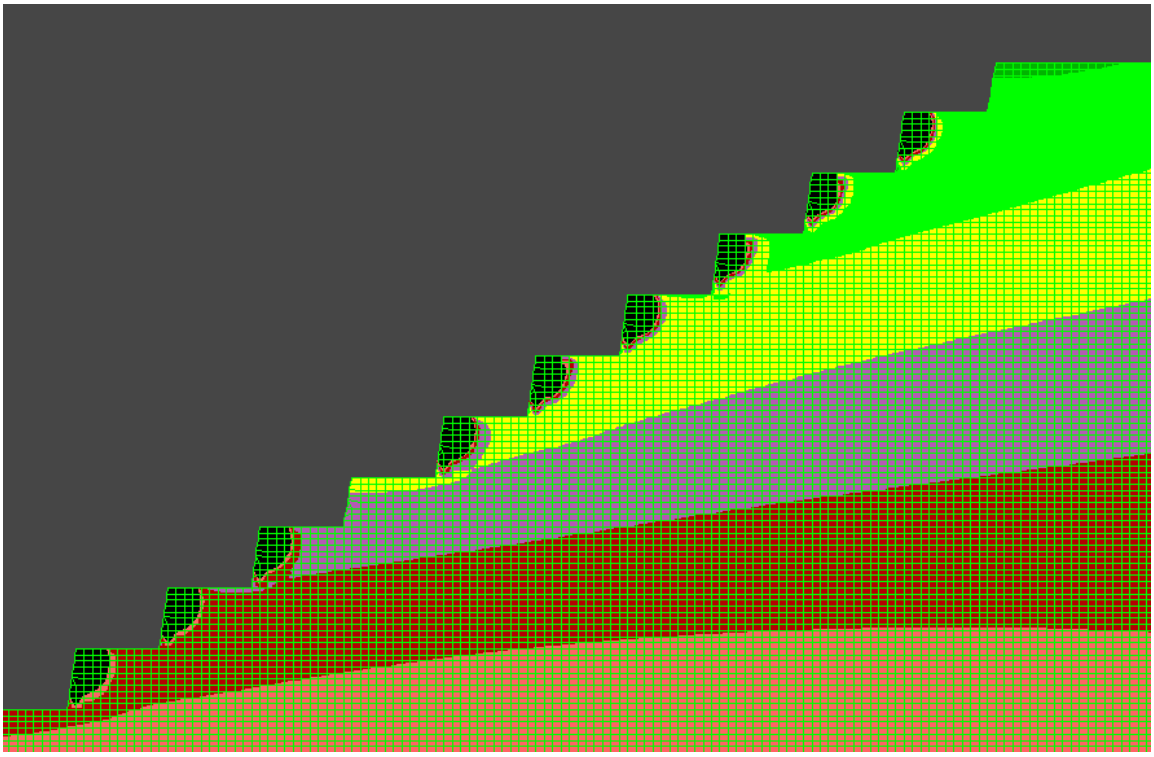


Fig. 12. Maximum horizontal displacement of ultimate pit slope after (a) long term average rain fall of 1549mm/yr, (b, c) short-term heavy rain fall of 465mm in three days

10.0 Assessment of Slope Instability Risk

The stability analysis of the various sections of open pit and dump slopes analysed in this study indicated that the planned slope sections have adequate stability with FoS of 1.59-3.42 for acceptable safety in the mine working. Hence, it has a low risk of long-term instability under dry conditions. A similar result is noted for long-term average rain fall as well. However, the slope structures are vulnerable to instability when exposed to short-term intensive rain fall. Hence, it is critically important to manage the inflow of rainwater inside the mine by adopting proper drainage and water diversion strategy to minimise the impact.

11.0 Study of the Method of Working

At present, Umrangshu mine has deployed back-hoe shovels of 3.3 m^3 bucket capacity along with 40 tonne dumpers for removal of overburden and ore. The overburden is being excavated in a series of benches. Generally, the average bench height is maintained at 8.0- 10m. The hard overburden is loosened by drilling and blasting operations for their easy handling by backhoe excavators - dumper combination.

The wagon drill machine is deployed for drilling in the overburden and limestone benches for blasting purposes having a diameter of 115mm and a depth of up to 8-12m. The backhoe type excavators are deployed for excavation and removal of blasted material and loading it into tippers having maximum cutting height up to 10.8m and dumping height up to 7.2m from the ground level. Dumpers are deployed for the handling of overburden as well as mineral. Other auxiliary types of machinery like dozers, graders and water sprinklers are also deployed in the mine, wherein its maximum width is within 4m.

The details of the machines deployed in the mine are as follows:

Excavators (Backhoe, 3.3 m^3) : Max. Cutting height - 10.8 m.

Max. Dumping height - 7.2 m.

Max. Digging depth - 6 m.

Max. Width - 3.35 m.

Dumpers/Tipper's maximum loading height from ground level - 4 m.

Max Width of Tippers -2.6 m.

Wagon drill machine maximum width - 1.5 m.

Diameter of drill hole-115 mm.

Depth of blast hole - 8 to 15 m.

Water sprinkler maximum width - 2.5 m

Maximum capacity of water carrying – 20000 litres

Maximum width of grader - 4 m.

Maximum width of Dozer - 2.5 m.

Method of working in the mechanised opencast mine

(i) The total overburden and mineral are removed by Shovel-Dumper combination having the afore-mentioned specifications.

(ii) As per the specification of backhoe excavators deployed in the mine, the maximum bench height should not be more than 10.8m.

(iii) Consideration of all the three clauses for determination of the width of benches

- Width of widest machine plus 2 meters, i.e, 4m + 2.0m = 6m
- Three times the width of dumpers/tippers ply on the benches, i.e., 3 x 2.6m = 7.8m
- Not less than the height of benches.

In Umrangshu mine, the average bench height varies from 8-10m. Hence the width of the benches should not be less than 10m in general.

(iv)The height of benches in overburden consisting of alluvial soil, clay or other similar ground should not exceed 3.0 meters, and the width thereof should not be less than three times the width of dumpers/tippers ply on the benches, i.e., 3 x 2.6m = 7.8m

(v) The average slope angle of the high wall benches in intact ground condition does not require any change. Hence, the prevailing angle may continue in future operations as well. However, no undercut should be permitted at any slope face.

(vi) If there is any change in the specification of machinery deployed in the mine, the height and width of the bench should be evaluated accordingly.

12.0 Provision of Embankment

The ultimate depth of the mine is planned as 106m, which corresponds to RL of 236m while the HFL in the Umrangshu nallah is 242m. Hence, it is important to make provision for an embankment to isolate the working of the mine from the nallah so that any chance of mine inundation during seasonal increases in water level could be ruled out. The total length of the embankment between points X –X' is 162.35m (Fig. 13a) while its width along line YY] is 60m (Fig. 13b) and the maximum height is 8.63m.

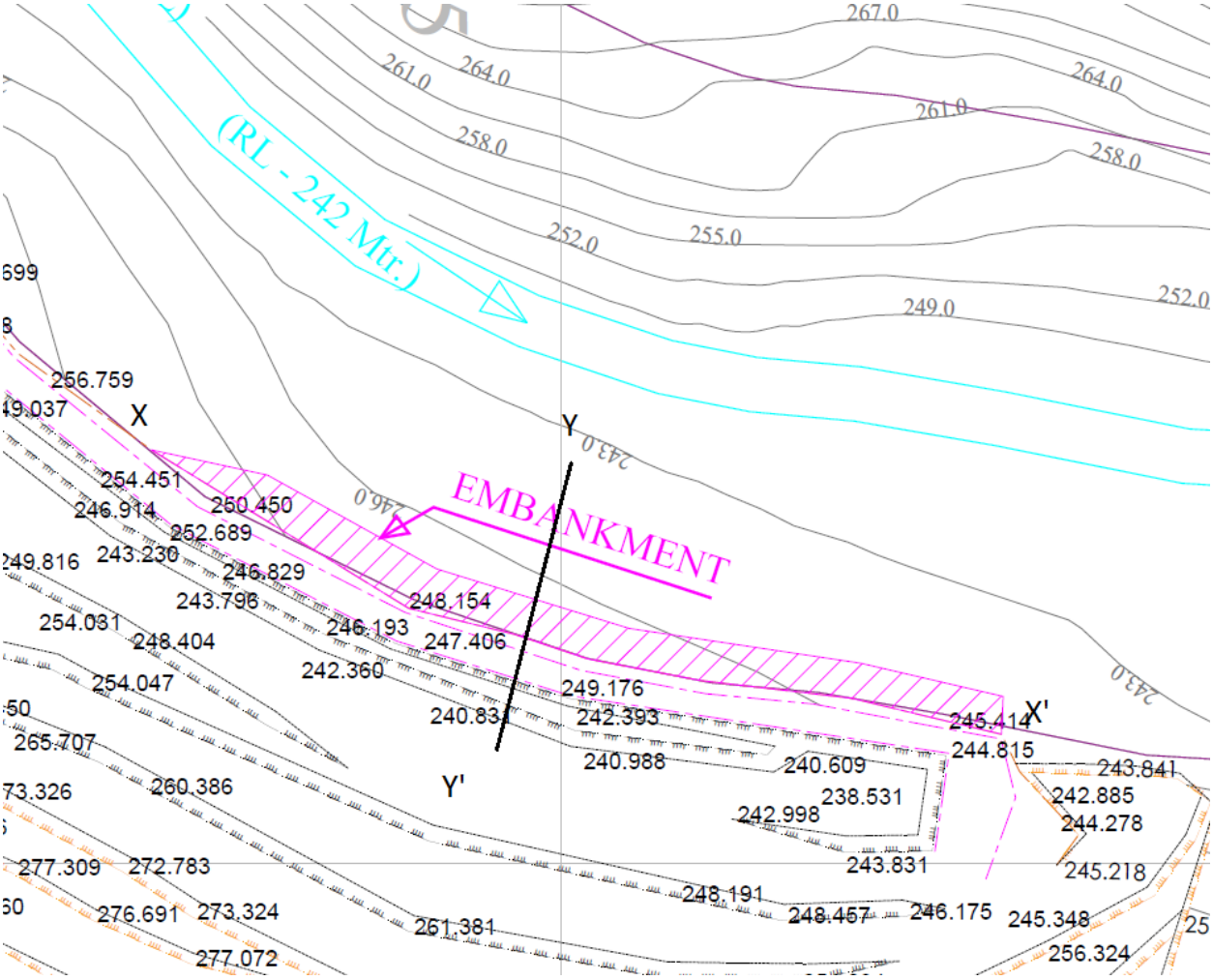
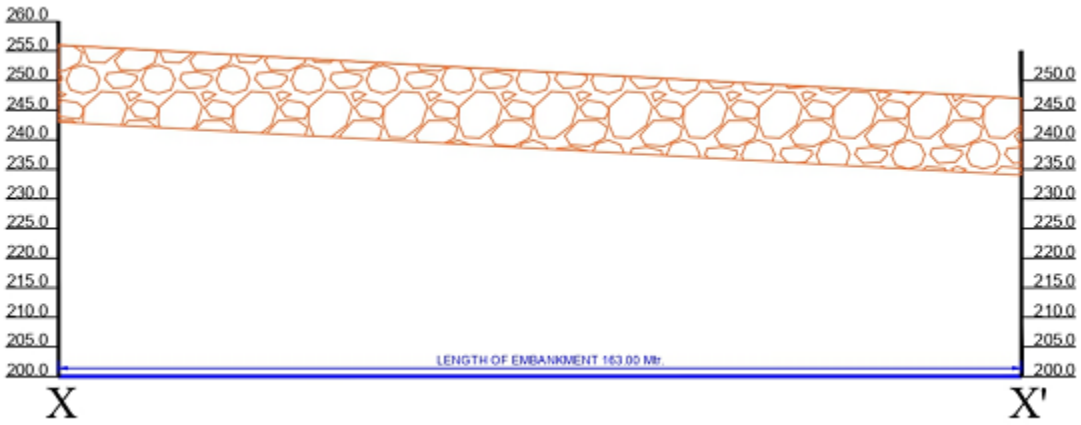
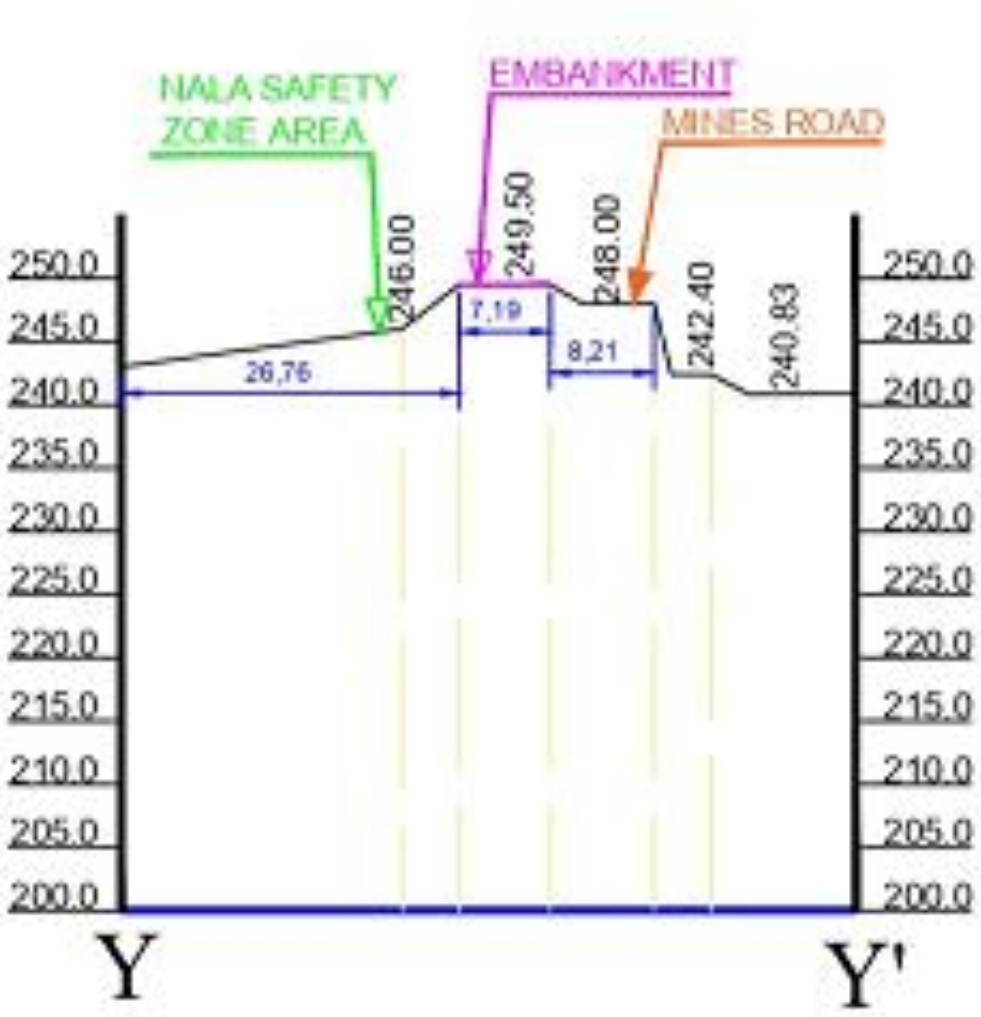


Fig. 13a Part plan of the mine plan showing location of the proposed embankment





X	N2823275.4806	X'	N2823230.3923
	E480524.9452		E480680.9090

Y	N2823275.8572	Y'	N2823217.7457
	E480602.5861		E480587.4330

Fig. 13b. Cross section along the line YY' of the proposed embankment

13.0 Suitable Method of Slope Stability Monitoring

An open pit slope structure is to be designed in a way that geometry will guarantee the safety of the structure and minimal financial cost of excavation, minimising the

rock mass volume which must be excavated. In contrast, a dump slope is to be designed for its optimal stability to ensure maximum accommodation of dump volume in the given area without compromising with a stable performance of the designed structure. In both conditions, selecting a proper factor of safety determines an optimum design of the slope. Sometimes, support and reinforcement methods may also have to be implemented to improve the rock mass strength and decrease the number of rockfalls. Despite that, failure may occur even in the most carefully designed and supported slope due to unknown geologic structures, unexpected weather patterns or a seismic shock. Therefore, it is essential to make provision for regular monitoring and examination of the slope so as to ensure quick detection of impending slope failure and reduce the associated risk of hazard.

Monitoring methods can be divided into four categories, as shown in Figure 14. A visual inspection is a primary method of slope monitoring. As a daily routine, the geo-technical engineer inspects the areas prone to slope failure, comparing the findings of the prior inspections with the last one to find visual slope changes and possible areas of instability. Mainly, the geo-technical engineer checks the slope's stability by inspecting the pit, access ways, high wall, low-walls. Not only the geo-technical engineer must do the inspection, but any other worker involved in the mine operations should also report changes in the slope face for its safe operation.

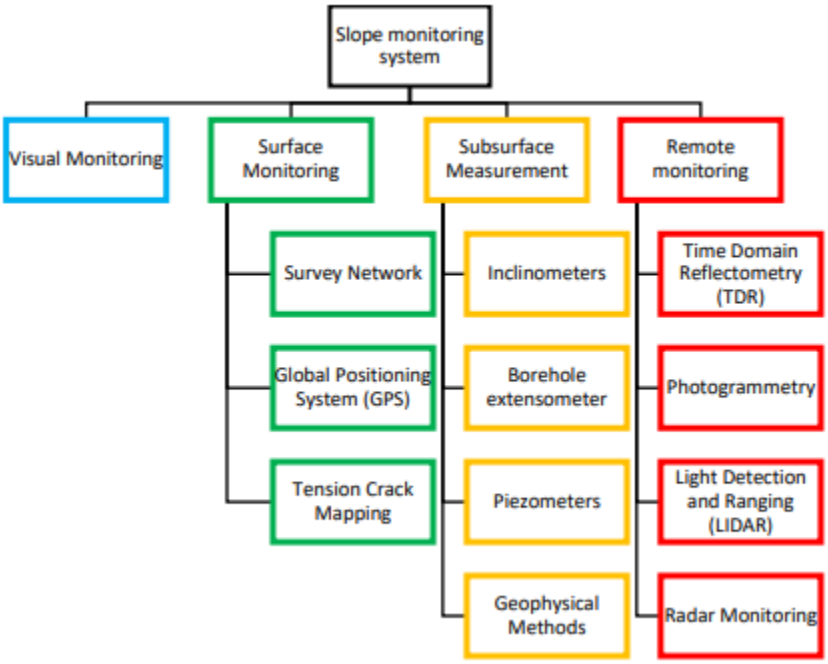


Fig. 14. Slope monitoring system

Surface monitoring includes all methods which can define surface changes of the monitor area, for example, position changes of reference points, cracks propagation and movement of Global Positioning System (GPS) antennas. The main techniques are surveying, GPS and crack monitoring. Using subsurface measurement techniques is possible to observe changes in rock conditions and parameters below the ground. It is possible to measure the type, size, and rate of the slope deformation, determine shear zones, and monitor groundwater conditions, rock electric characteristics or seismicity of the area. The main methods are inclinometers, borehole extensometers, piezometers, and geophysical methods. All remote monitoring methods observe slope movements from a certain distance. It does not require physical contact to track changes on a slope. It collects data by using advanced technology such as lasers, interferometry or photogrammetry. The most popular methods are Light Detection and Ranging (LIDAR), Interferometry of Synthetic

Aperture Radar (InSAR), Time Domain Reflectometry or Slope Stability Radar (SSR).

Recent studies have shown that it is possible to achieve almost 100% of meaningful prediction of high wall and dump slope failures by deploying a combination of Visual observation, prism-based surveying, instrument-based crack monitoring, laser profiling along with radar. Although radar alone has a 93% success rate in detecting slope failures, it can not be deployed to scan the whole area of the slope structure at a time. As the size of the mine grows both lateral as well as vertical, the effective coverage of the mine under the limit of the radar reduces. Hence, it is important to isolate more vulnerable areas from the relatively less failure-prone areas by an active deployment of conventional monitoring tools and deploy the radar more intensively to monitor only those areas where continuous monitoring with a significantly large frequency of data retrieval and analysis is the absolute requirement. It is advisable to seek a better utilisation of the radar by implementing a combination of conventional as well as to its full potential by a gradual replacement of the prevailing practice.

13.1 Suggested Slope Monitoring Approach for New Umrangshu mine

Although the openpit and dump slopes, as planned by the mine, are expected to behave as stable structures, localised short-term instability triggered by the unfavourable orientation of joint planes, undercutting and improper blasting needs to be properly monitored for timely and effective engineering intervention for the avoidance of the impending hazard.

A multi-layer slope monitoring approach is proposed for the safe operation of high wall and dump structures in the mine. The proposed appro1ach should be implemented

and maintained by a well-structured team of trained, competent persons for slope monitoring, as already notified in DGMS Tech. Circular Dated 02/2020.

Layer 1. Visual monitoring

The Slope Monitoring/Strata Control Officer of the mine should form a team of trained, competent persons who will be assigned to undertake a visual inspection of part of the mine/the slope structure under his control at least once on a daily basis, most preferably after the scheduled tenure of blasting in the mine. These persons should also frame a communication chain with other workers of the mine who may be visiting the assigned part of the mine on a regular basis to obtain their feedback and supplement their own observations. Any counter-observation should be cross-checked by the Strata Control Officer himself on a random but regular basis.

Layer 2. Laser Profiling

Regular profiling of all active and non-stabilised slope faces should be undertaken so that the mine has a precise database of slope deformation profiles, augmenting the understanding prevailing at layer -1. This profiling should be done on a regular basis so as to cover a particular zone of the slope at least once in fifteen days to delineate sensitive zones.

Layer 3. Discontinuous monitoring using Prisms, Crack meters, Tilt meters, Piezometers, etc

Based on the outcome of Visual monitoring and laser profiling outputs, any perceived zone of slope instability should be put under active monitoring using Prism-based survey points or installing crack meters, tilt meters, or piezometers depending on their ease of accessibility, the convenience of monitoring etc. The data should be recorded at the same time period on a daily basis from all such installations.

Layer 4. TDR based monitoring

TDRs should be deployed in those isolated locations of high wall slopes, which are important for continuous monitoring and real-time warning and alarm generation.

A weekly review of the data should be made by the Slope monitoring officer for this purpose and the outcome of this study should be communicated to the higher official of the mine for their appraisal and appropriate decision-making. This approach will help in developing a more objective-oriented and focused monitoring program as the size of the mine grows to make its geo-mining condition more challenging for its safe operation.

13.2 Suggested Failure Prediction Methods

A monitoring system is used to predict the time to a failure. Data collected from slope monitoring can be presented as displacement or velocity versus time curves. After analysing those plots, it is possible to determine if there exists a trend or a trend change that can lead to slope failure. With this understanding, the data recorded by the mine should be analysed and interpreted following an SoP for meaningful decision-making in the planning and operation of mines on a day-to-day basis.

For progressive movements, the simplest method is to extrapolate the time-displacement curve for the point(s) which is moving fastest to the point where the curve will be vertical or almost vertical (Figure 15a).

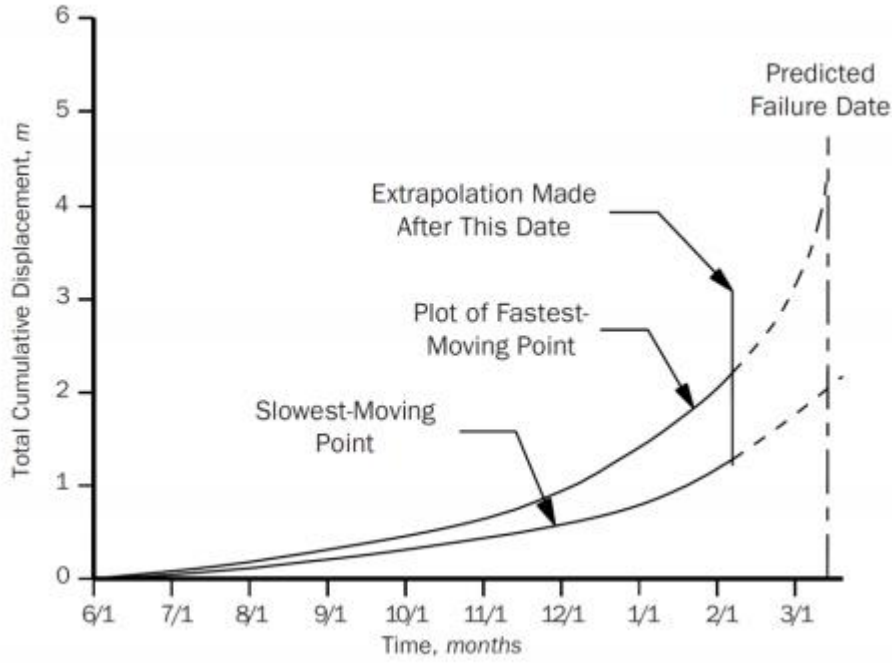


Fig. 15a. Plot of cumulative displacement against time for the fastest and slowest moving points (Kliche,2011)

Broadbent & Zavodni (1982) established a similar method to estimate the number of days prior to a failure using the predicted velocity at the point of a collapse (Figure 15b). They noticed that:

$$\frac{Vmp}{Vo} = KVmp \quad \ldots (7)$$

Where: Vmp is the velocity at the mid-point in the progressive stage, Vo is the velocity at the onset-of-failure point, and K is a constant (mean value is estimated to 7.21, and range from 4.6 to 10.4) Equation for the straight-line fit log-normal chart has a form:

$$V = Ce^{St} \quad \ldots (8)$$

Where, V-velocity, e-base of the natural logarithm, C- constant, S- the slope of the line (in days-1), t - time (in days)

Assuming that Vo=C at the onset-of-failure equation (8) takes the form:

$V = Vo\ e^{St}$ ...(9)

Using Equations 1 and 3, it is possible to determine the velocity at failure point:

$Vcol = K^2 Vo$ ...(10)

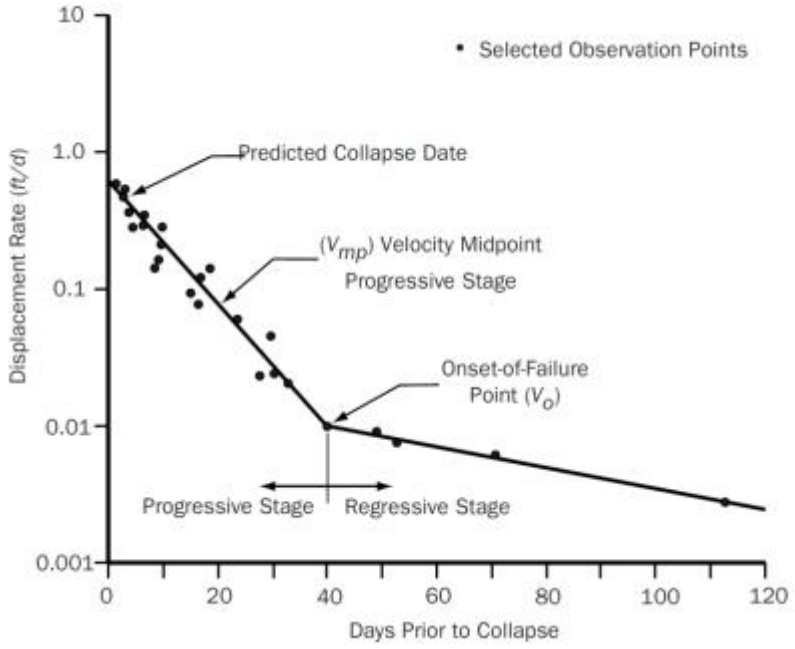


Fig. 15b. Broadbent and Zavodni (1982) failure prediction method

Another method is to use average velocity versus time graphs (Figure 15c). Velocities in the point of collapse point towards infinity. Velocities, as is presented on the graph, appear as surges, after which peaks settle down for a certain period of time. It is possible to misunderstand those surges as a point of collapse. However, it is possible to plot the velocity trend (dashed line), which can determine a point of collapse (Kliche, 2011).

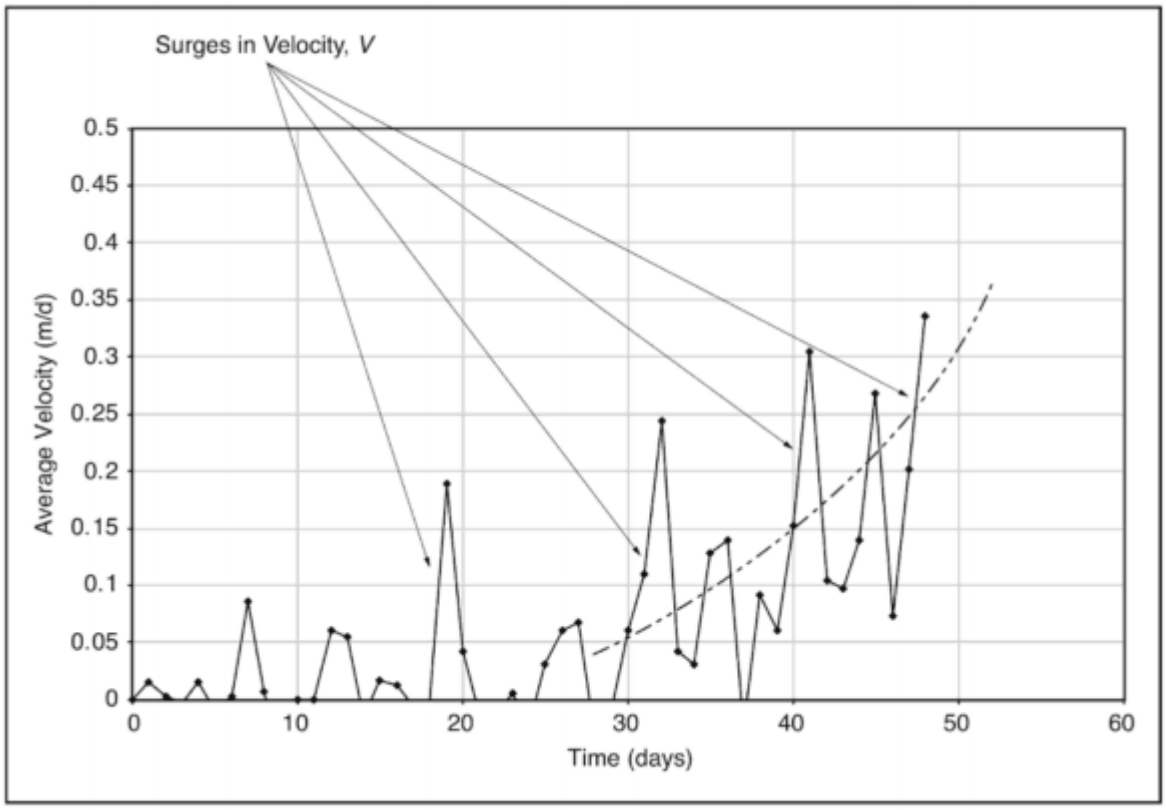


Fig. 15c. Average velocity against time graph

Fukuzono (1985) developed a better method for predicting the time of impending failure in slope structures. In this method, the inverse velocity is plotted against time (Fig. 15d). As a velocity increases towards infinity, inverse velocity values will point towards 0. It is possible to extrapolate the inverse velocities values as a straight line. Interception with the horizontal axis will give an expected time when the slope can collapse. Using Equation (11), Fukuzono obtained three curves (concave, convex and linear) which can be used for a collapse prediction.

$$1/V = [A(\alpha - 1)]^{1/(\alpha-1)} * [t_f - t]^{1/(\alpha-1)} \quad \ldots (11)$$

Where A and a are constant, t_f is a time of failure.

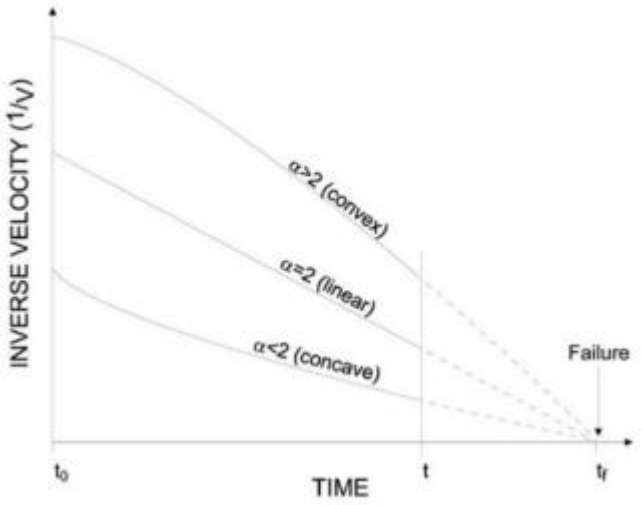


Fig. 15d. Inverse velocity against time relationship preceding slope failure

13.3 Critical Limit for Failure of Dump and Benches

Mines need to define slope movement rates that are necessary for safe operation and, in the worst case, decide about the closure of mining areas. Those movement rates are named threshold values. There are many factors that influence threshold values, such as monitoring system accuracy, knowledge about slope failure behaviour and mechanics, the possibility of implementing remedial measures and time required to install those measures, the time required for evacuation of people and equipment from a dangerous area, availability to access other mining faces.

Threshold values should be low enough to allow flexibility for the implementation of remedial measures at the right time, as well as to start monitoring dangerous areas as soon as possible changes in the slope behaviour. The threshold value should also include a safety margin in response to the slope behaviour uncertainty (Rose and Hungr, 2007). A threshold value is site-specific or even slope-specific because each slope has different rock mass parameters, unique geology, and geometry. Table 16 compiles some reference values observed in different geo-mining conditions.

Table 16. Displacement rates and threshold values in different case studies

Author	Threshold value	Description
Cruden and Masoumzadeh (1987)	6mm/hour	Initiation of acceleration stage
Martin (1993)	10-100mm/day	Progressive stage
Flores and Karzulovic (2001)	30mm/day	Cracks start to appear
	50mm/day	Potential instability if the movement continues for more than two weeks
Zavodni (2001)	<15mm/day	No failure expected within 48 hours
	<17mm/day	No failure expected within 24 hours
	>50mm/day	Collapse expected within 24 hours
	>100mm/day	Evacuate the mining area
Naismith and Wessels (2005)	2mm/day	Natural relaxation
	3.5mm/day	Alert warning level
	5mm/day	Alarm warning level
	10mm/day	Scram warning level
Little (2005)	10mm/2 hour	Red alarm
Osasan (2012)	12-48mm/day	The onset of failure in New Vaal Coal mine
	24mm/day	The onset of failure in Landau Coal mine
Saunders (2016)	48mm/day	Insufficient notification period
	24mm/day	Appropriate notification period prior to the collapse
Larsson (2018)	67mm/day	Evacuation of the area

Based on the experience of SSR-based slope stability monitoring and analysis conducted by IIT (BHU) in some highly mechanised mines, numerical modelling studies, and pertinent review of literature conducted in this study, TLV limits as given in Table 17 are recommended for Umrangshu mine.

Table 17. Recommended TLV limits

Sl No.	Level	TLV
(i)	Alert level	5mm/day for three consecutive days
(ii)	Warning Level	10mm/day
(iii)	Danger Level	20mm/day
(iv)	Evacuation level	40mm/day

14.0 Conclusion and Recommendation

Based on the findings of the field visit, analysis of data provided by the mine and the numerical modelling study conducted in the laboratory, the following conclusions may be drawn in this project:

(i) The laboratory testing results of limestone samples and overburden, as provided by the mine, are compiled in Table 5. The bulk density of the intact rock samples varies from 2460-2640 kg/m^3, while the UCS of the specimens varies from 21.42 – 32.7 MPa. The tensile strength of the rock varies from 2.05 – 3.55 MPa.

(ii) The cohesive strength of the rock varies from 6.19 – 8.58 MPa, while the shear strength varies from 9.3 – 17.8 MPa. The angle of internal friction varies from 30 - 36°. The Young's modulus of rock varies from 2.4 – 4.05 GPa while the Poisson's ratio ranges from 0.21 – 0.24. The shear modulus of the rock varies from 0.97 – 1.66 GPa.

(iii) The laboratory study of the dump sample collected from the New Umrangshu mine shows an OMC of 16.3% with a maximum dry density (MDD) of 1.74t/m^3. The cohesive strength and friction angle were 0.60MPa and 32°. The grain size analysis of the sample revealed 14% of clay, 36% of silt, 47% of sand and 3% of gravel as its representative constituent.

(iv) The petrographic and mineralogical studies of the samples provided by the mine are given in Table 9. The Lower ferruginous limestone sample contained grey-coloured fine to medium-grained minerals, slightly hard in nature. Fine-grained calcite was the major constituent. Fine to medium-grained groundmass consisted of micro and macro fossils. It also contained some amount of quartz, dolomite and opaque minerals.

(v) The Upper ferruginous limestone sample contained fine to medium-grained, grey colour and slightly hard minerals. The fossils were also visible in the hand specimen. The sample contained fine-grained calcite. Fine to medium-grained groundmass consisted of micro and macro fossils. It also had some amount of quartz and dolomite. The opaque minerals were less in comparison to lower ferruginous limestone.

(vi)The shaly limestone sample contained medium to coarse-grained, grey colour hard minerals. The sample contained fine-grained calcite. Fine to medium-grained groundmass consisted of micro and macro fossils. It also included some amount of quartz and dolomite. The opaque minerals were more in comparison to samples of Lower and Upper ferruginous limestones.

(vii) The sample of shaly Upper ferruginous limestone was medium to coarse-grained, grey in colour and hard. The fossils were also visible in the hand specimen. The sample contained fine-grained calcite. Fine to medium-grained groundmass consisted of micro and macro fossils. It also included some amount of quartz and dolomite. The opaque minerals were more in comparison to Lower and Upper ferruginous and shaly limestone samples.

(viii) The sample of cement-grade limestone was fine-grained, whitish-grey in colour and hard in nature. The fossils were visible in the hand specimen. The sample contained calcite more dominantly. Fine to medium-grained groundmass consisted of micro and macro fossils. It also contained a small amount of dolomite, quartz and opaque minerals.

(ix) The sample of 'rejects' was medium to fine-grained, grey in colour and hard in nature. The fossils were visible in the hand specimen. The sample contained calcite. Fine to medium-grained groundmass consisted of micro and

macro fossils. It also contained a small amount of dolomite, quartz and opaque minerals.

(x) The 'Rejects – red colour' sample was fine-grained, slightly brick in colour and hard in nature. It contained calcite along with dolomite, quartz and opaque minerals. The opaque minerals were more in comparison to dolomite and quartz. The fine-grained groundmass consisted of microfossils.

(xi) The Cement Grade Limestone (Old Mine) sample was fine-grained, grey in colour and hard in nature. It contained calcite as the most dominating mineral. Dolomite, quartz and opaque minerals are also observed in small amounts. The fine-grained groundmass consisted of micro and macro fossils.

(xii) The operating pit slope at a depth of 70 – 100 m and the ultimate pit slope as planned by the mine for the working depth of 70-100m have adequate stability with FoS of 2.06-3.42 for acceptable safety in the mine working. Hence, it has a low risk of long-term instability under dry conditions. A similar result is noted for long-term average rain fall as well. However, the slope structures are vulnerable to instability when exposed to short-term intensive rain fall. Hence, it is critically important to manage the inflow of rainwater inside the mine by adopting proper drainage and water diversion strategy to minimise the impact.

(xiii) An embankment of 162 m length, 60 m width and 8.67 m height is proposed to provide a physical barrier and avoid inundation due to inadvertent ingress of water from the seasonal nallah to the open pit while approaching its ultimate depth.

(xiv) The stability of the slope is extremely sensitive to undercutting at the toe of the benches and blast-induced ground vibration. Hence, suitable measures of controlled blasting need to be taken on a regular basis to ensure

that the ground vibration induced during blasting does not trigger instability of jointed rock blocks in the nearby benches due to the dynamic loading.

(xv) The modelling study confirmed that the stability of the open pit slope is highly sensitive to short-term heavy rain fall. It is recommended to adopt all possible measures for proper management of rainwater to mitigate its adverse effect on the stability of the open pit slope in the mine.

(xvi) As per the specification of HEMMs deployed in the mine, the maximum bench height should not be more than 10.8m. The width of the benches should not be less than 10m in general.

(xvii) The optimal safe design of a 30m high dump slope can be achieved by maintaining the maximum slope angle not exceeding 50°. However, the base of the dump slope should be almost flat and free from any interface to ensure that the dump does not undergo failure along its base at any point in time.

(xviii) Proper drainage arrangements should be provided along the periphery of the dump base to avoid any accumulation of rainwater.

(xix) The short-term mining plan of the mine should ensure that the movement of the face is not aligned in the direction of the true dip of the major joint sets prevailing in a given patch of the mine. Adoption of better mining practices in terms of avoidance of undercut, effective control of blasting induced ground vibration and management of rain water are also required for the safe performance of operating and ultimate pit slopes in the mine.

(xx) The instrumentation scheme as suggested in this study, should be implemented for monitoring the stability of dump and open-pit slopes in the mine. Special emphasis should be given to the targeted slope sections of the high wall and dump slopes for mitigating failure hazards.

(xxi) The mine should arrange for trend analysis of the displacement data to obtain the displacement rate (mm/hour). A code of conduct/SoP should be developed by the mine for utilising the slope monitoring results for assessing the TLV and mitigating the risk of slope instability during the actual mining operation.

(xxii) The mining operation should be so planned and executed that the geometry of the high wall and its individual benches suffer minimum deviation from their recommended design. Any significant deviation, particularly in terms of the slope angle, height and width of benches, should be rectified at the earliest possible opportunity.

Acknowledgement

The project team would like to sincerely acknowledge the cooperation received from the mine management of the New Umransu mine, especially the General Manager, the Mine Manager and the mine Survetor for taking a keen interest in the timely completion of this study. The Safety and the Survey Officers of the mine took much pain in arranging all the data that were crucially important for ensuring the meaningful completion of this work. Finally, we would also like to express our sincere thanks to M/s Calcom Cement India Limited, a subsidiary of Dalmia Cement Bharat Limited, for allowing us to provide a meaningful solution to this live problem of the industry.

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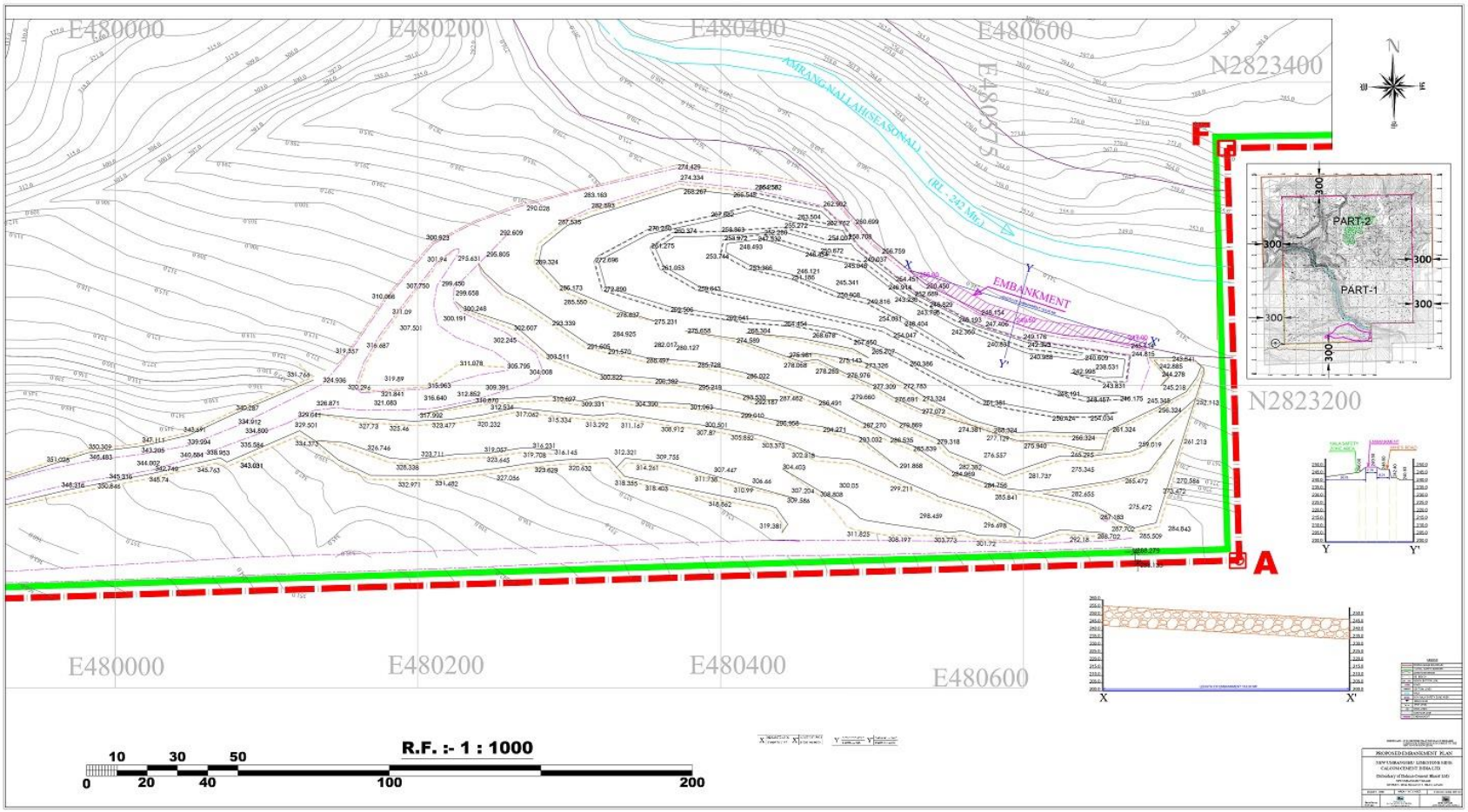
Annexure 1

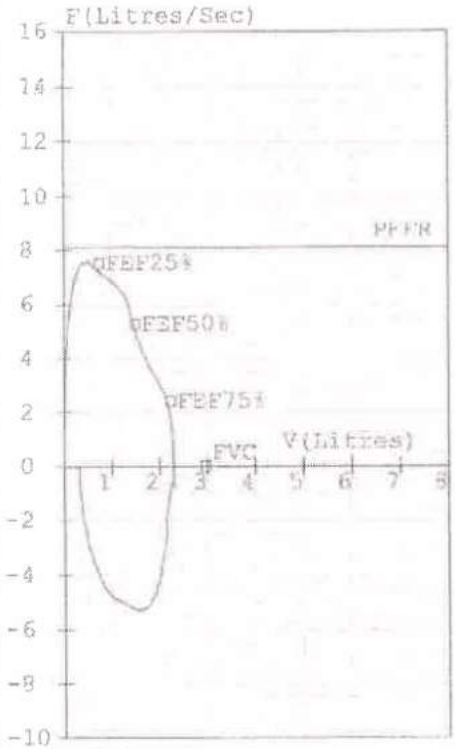
Complete mine plan of the New Umrangshu mine, showing the location of current working and the proposed embankment

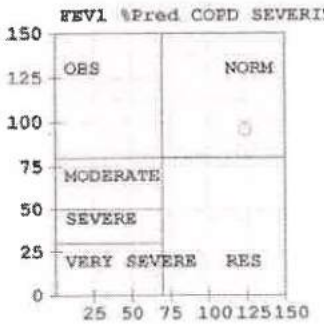


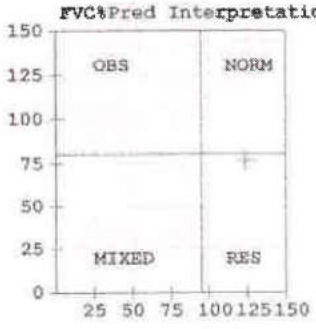
MEDICLINIC, A unit of Premier Healthcare

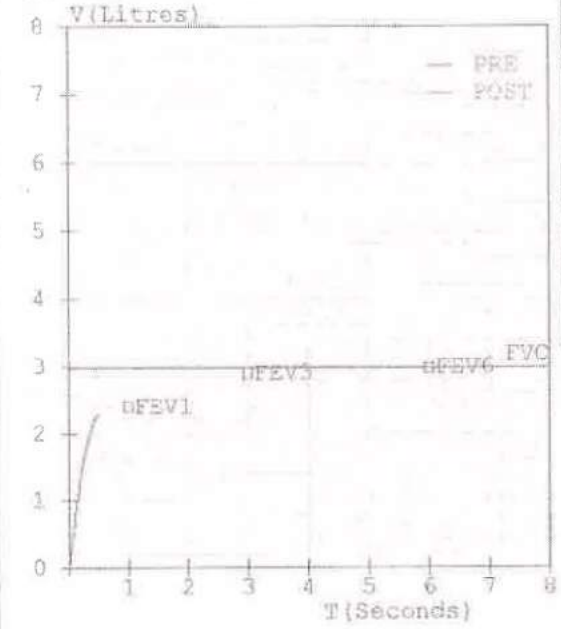
Chitrabon Enclave, 2nd Floor Opp Nexa Show Room, Zoo Road, Guwahati-03

Patient: MD JUBIR		Age	: 45 Yrs	Gender	: Male
Refd.By:		Height	: 162 Cms	Smoker	: Yes
Pred.Eqns: RECORDERS		Weight	: 55 Kgs	Eth. Corr	: 100
Date	: 16-Oct-2023 11:40 AM	ID	: DC11	Temp	:









FVC Results

Parameter		Pred	M.Pre	%Pred	M.Post	%Pred	%Imp
FVC	(L)	02.98	02.30	077	-----	---	---
FEV1	(L)	02.40	02.30	096	-----	---	---
FEV1/FVC	(%)	80.54	100.00	124	-----	---	---
FEF25-75	(L/s)	03.56	05.92	166	-----	---	---
PEFR	(L/s)	08.11	07.50	092	-----	---	---
FIVC	(L)	-----	01.98	---	-----	---	---
FEV.5	(L)	-----	02.31	---	-----	---	---
FEV3	(L)	02.89	02.30	080	-----	---	---
PIFR	(L/s)	-----	05.25	---	-----	---	---
FEF75-85	(L/s)	-----	03.33	---	-----	---	---
FEF.2-1.2	(L/s)	06.14	06.98	114	-----	---	---
FEF 25%	(L/s)	07.50	07.43	099	-----	---	---
FEF 50%	(L/s)	05.26	06.58	125	-----	---	---
FEF 75%	(L/s)	02.40	03.95	165	-----	---	---
FEV.5/FVC	(%)	-----	100.43	---	-----	---	---
FEV3/FVC	(%)	96.98	100.00	103	-----	---	---
FET	(Sec)	-----	00.50	---	-----	---	---
ExplTime	(Sec)	-----	00.05	---	-----	---	---
Lung Age	(Yrs)	045	047	104	-----	---	---
FEV6	(L)	02.98	-----	---	-----	---	---
FIF25%	(L/s)	-----	02.57	---	-----	---	---
FIF50%	(L/s)	-----	05.23	---	-----	---	---
FIF75%	(L/s)	-----	04.85	---	-----	---	---

Pre Test COPD Severity

Test within normal limits

Pre Medication Report Indicates

Mild Restriction as (FEV1/FVC)%Pred >95 and FVC%Pred <80

MediClinic

Doctors' Chambers | Diagnostics | Healthcheck

In Association With oncquest laboratories

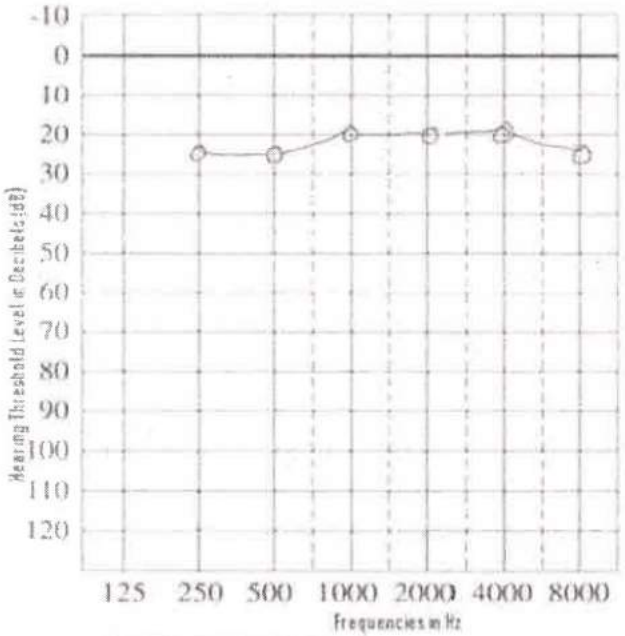
Chitrabon Enclave, Near Commerce College, Opposite NEXA, Zoo Road, Guwahati

Sl No: 11 Date: 16/10/23

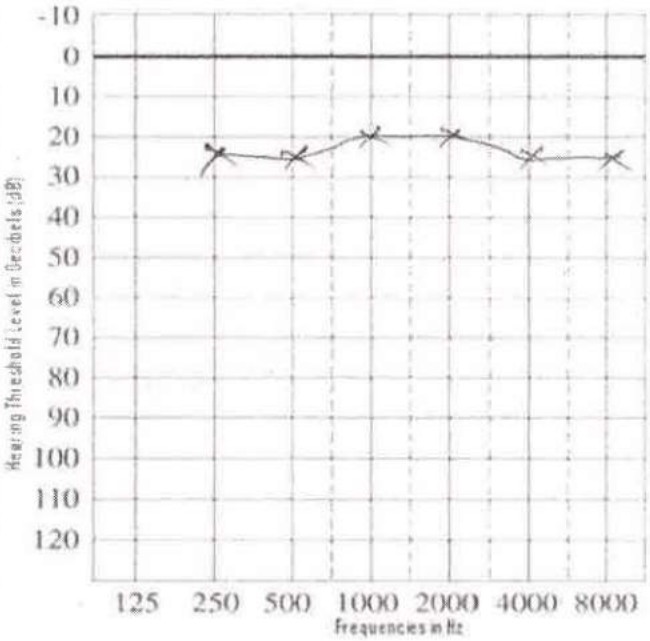
Name: MD Jubir Age / Gender: 45/M

AUDIOGRAM

RIGHT EAR



LEFT EAR



Audiogram Key

	AC Unmasked	AC Masked	BC Unmasked	BC Masked	No Response	Sound Field	Aided
Right Ear	O	Δ	[	]	↙	S	A
Left Ear	X	□	<	>	↘	^	A

SPEECH AUDIOMETRY

	SRT	SDS	UCL
Right Ear	dBHL	%	dBHL
Left Ear	dBHL	%	dBHL

TUNING FORK TEST

	Right Ear	Left Ear
WEBER		
RINNE		

IMPRESSION

Bilateral hearing sensitivity within normal limits.

Jesif Choudhury
Consultant Audiologist

MediClinic
Doctors' Chambers | Daycare | Diagnostics

Diagnostic Partner
Premier Healthcare
Pathology | Radiology | Healthcheck
oncquest laboratories

Chitrabon Enclave, Near Commerce College, Opposite Nexa, Zoo Road, Guwahati. Tel: 7099044022

Sl No: (11)

Date: 16/10/23

Name: Md. Jubin

Age / Gender: 45/M

EYE EXAMINATION REPORT

Vision Test:

	Near	Distance	Color
Right	N8	6/6	Normal
Left	N8	6/6	Normal

Vision Correction Advice: Regular use of spectacles.

	Right Eye					Left Eye				
	SPH	CYL	AXIS	PRISM	V/A	SPH	CYL	AXIS	PRISM	VA
Distance										
Near										
Type	Bifocal / Progressive / Single Vision / Plano					Bifocal / Progressive / Single Vision / Plano				

Kuldip Mazumdar
Consultant Optometrist

Dr. Banajit Choudhury, MD,
FICC, FIAOE, FCSI
Sr. Medicine & Non-Invasive Cardiology

2023-10-16 11:35:57
Name :MD JUBIR
Sex :Male Age :45
Section: 30
RoomID:
BedID:
ID:
Operator:
Custom1:
Custom2:
Custom3:

Data for reference only:

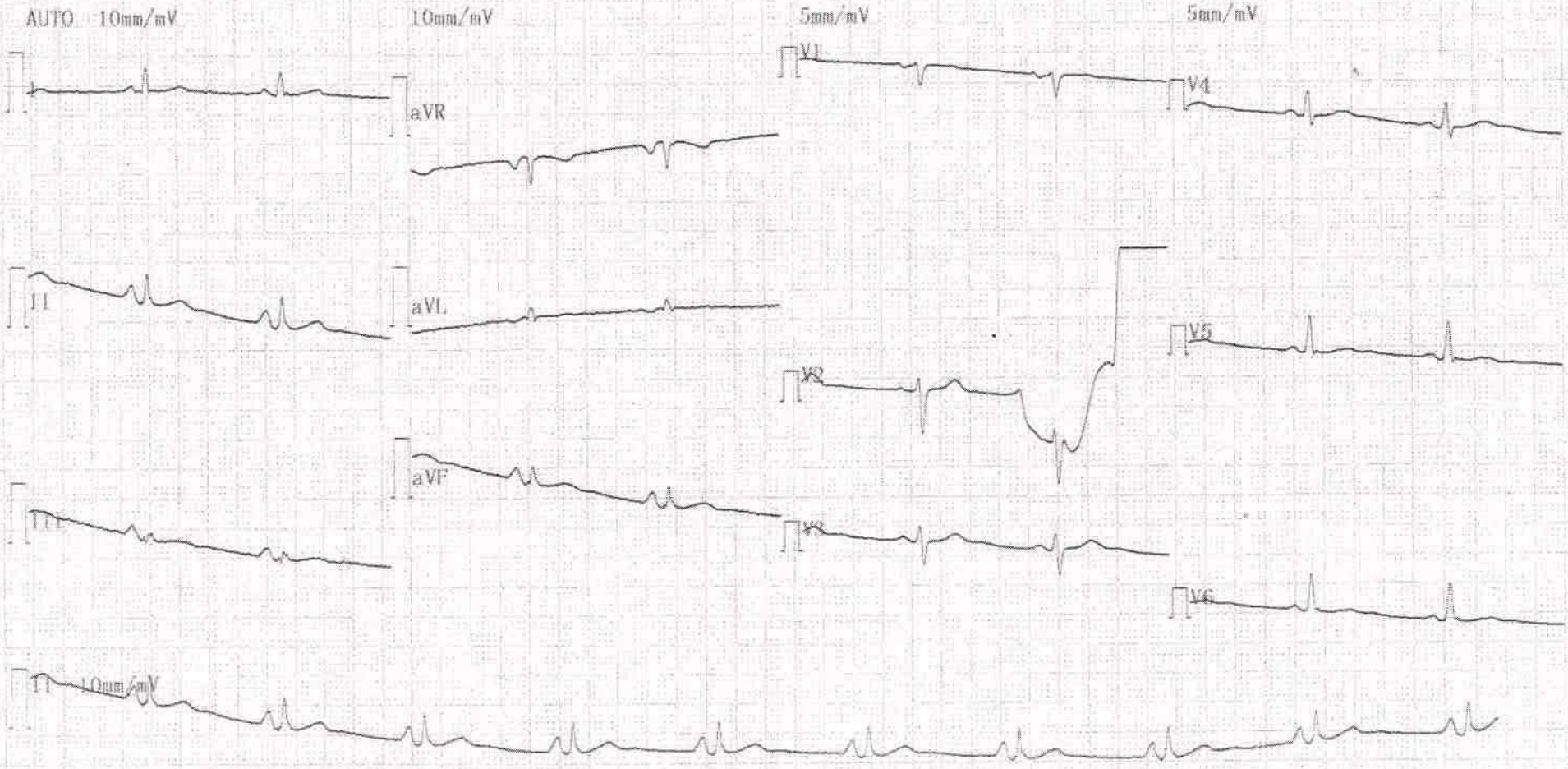
HR	bpm	:	67
PR Interval	ms	:	253
P Duration	ms	:	112
QRS Duration	ms	:	81
T Duration	ms	:	220
QT/QTc	ms	:	351/369
P/QRS/T Axis	deg	:	74.5/50.1/68.4
R(V5)/S(V1)	mV	:	0.93/0.76
R(V5)+S(V1)	mV	:	1.68

<< Conclusions >>

Cardiac electric axis normal.
1 AV block.
aVL V4 V5 V6 Abnormal T wave.

Report need physician confirm

Physician:



Report : Radiology

UHID	: 5581023115	OPD ID	: 629/1023
Name	: MD. JUBIR	Reg. Date/Time	: 28-Oct-2023/11:34 AM
Age/Gender	: 45 Years / Male	Printing Date/Time	: 30-Oct-2023/5:12 PM
Address	:		
Ref. By	: Dr. Self ,		

CHEST PA VIEW

Clinical note :
Check up.

Findings :
Lung fields do not reveal any active parenchymal lesion.
Pleural angles are clear and domes of the diaphragm are of normal contour.
Cardio-thoracic ratio is within normal limits.
Hilar shadows are normal.
Bony thorax is intact.
Soft tissue shadows are normal.

Impression :
RADIOLOGICAL FEATURES ARE ESSENTIALLY WITHIN NORMAL LIMITS.

DR UPASANA SARMA
MBBS, MD
Consultant Radiologist

DR. SHANTANU KUMAR BARUA
MBBS,DMRD(Dib)
Consultant Radiologist

Name	: Mr.MD. ZUBIR	Centre Details	:MEDICLINIC C/O PREMIER HEALTHCARE
Age	: 45 Yrs Sex: Male	Accession.ID	:GUW2310170073
Collection Date	: 18/Oct/2023 11:41AM	Referred By	:SELF
Received Date	: 18/Oct/2023 12:20PM	Report Date	:19/Oct/2023 03:50PM
Registration Date	: 17/Oct/2023	Ref. No./TRF No.	: /

DEPARTMENT OF CLINICAL PATHOLOGY

Test Name	Result	Unit	Bio. Ref. Range
Urine Examination (Routine)			
Urine			
Physical Examination			
Volume *Visual Examination*	25.00	mL	
Colour *Visual Examination*	PALE YELLOW		PALE YELLOW
Appearance *Visual Examination*	CLEAR		CLEAR
pH Urine *Double indicators test*	6.0		4.6-8.0
Specific Gravity *Strip Test*	1.015		1.001-1.030
Chemical Examination			
Blood *Strip Test*	NIL		NEGATIVE
Urine Protein *Strip Test*	NIL		NIL
Urine Glucose *Strip Test*	NIL		NIL
Bilirubin *Dichlorobenzene diazonium reaction*	NEGATIVE		NIL
Microscopic Examination			
Red Blood Cells *Microscopic Examination*	NIL	/HPF	NIL
Pus Cells (WBC) *Microscopic Examination*	2-3	/HPF	0-5

Dr. Bidhan Ch. Das
M.D. Pathology
Reg. No. -20667

Name	: Mr.MD. ZUBIR	Centre Details	:MEDICLINIC C/O PREMIER HEALTHCARE
Age	: 45 Yrs Sex: Male	Accession.ID	:GUW2310170073
Collection Date	: 18/Oct/2023 11:41AM	Referred By	:SELF
Received Date	: 18/Oct/2023 12:19PM	Report Date	:19/Oct/2023 12:32PM
Registration Date	: 17/Oct/2023	Ref. No./TRF No.	: /

DEPARTMENT OF BIOCHEMISTRY AND IMMUNOASSAY

Test Name	Result	Unit	Bio. Ref. Range
Lipid Profile (Basic)			
Serum			
Total Cholesterol *Spectrophotometry*	181	mg/dL	140-250
Triglycerides *Spectrophotometry*	**235**	mg/dL	35.00-170.00
HDL Cholesterol *Spectrophotometry*	46	mg/dL	Moderate risk: 35-55 mg/dl High risk: < 35 mg/dl
LDL Cholesterol *Calculated*	88	mg/dL	Optimal:<100 Borderline high:130-160 High:161-190 Very high:>_190
VLDL Cholesterol *Calculated*	47	mg/dL	30-70
Total / HDL Cholesterol Ratio *Calculated*	3.93		Low risk:3.3-4.4 Average risk 4.4-7.1 Moderate risk 7.1-11.0 High risk >11.0
Non HDL Cholesterol *Calculated*	135	mg/dl	Adult Optimal <130 Above optimal 130-159 Borderline High 160-189 High 190-219 Very High >=220
LDL / HDL Cholesterol Ratio	2	()	0-4

Dr. Bidhan Ch. Das
M.D. Pathology
Reg. No. -20667