BIOGRAPHICAL SKETCH

NAME & ADDRESS	POST HELD
Dr. Narayan K. Bhagat Rock Excavation Engineering Division CSIR-Central Institute of Mining and Fuel Research Barwa Road-Dhanbad, Jharkhand (India), 826 015 Email: nkbhagat@cimfr.nic.in/narayan_bhagat@yahoo.co.in Mobile:9430394048/7903199169	Sr. Technical Officer-2 (Gr. III-5)

EDUCATION

INSTITUTION AND LOCATION	DEGREE	FIELD
Indian Institute of Technology (ISM) Dhanbad	Ph.D. in Mining Engineering	Mining
The Institution of Engineers (I), Kolkata	Degree in Engineering	Mining
Mining Institute Dhanbad, SBTE, Patna	Dip. in Mining & Surveying	Mining

Experiences & Achievements:

- Developed Directional Controlled Blasting (DCB) technique, Expertise in Blast design for longer pull and induced caving for hard rock management in underground coal mines, Controlled blasting, Advance vibration control, Tunnel blasting for higher pull and minimum overbreak and Assessment of explosive quality.
- R&D and industries sponsored projects handled: 35 (As Principal and Co-principal Investigator, Total Project Cost-Rs.1134.62 Lakh).
- Worked in four R & D Projects (Two-Ministry of Mines & One-Ministry of Coal, Govt. of India) and one collaborative project with Satluj Jal Vidyut Nigam Limited (under an MOU with Ministry of Power, Govt. of India).
- Involvement in Industrial Sponsored Projects: 170 (Coal Mine-36, Limestone Mine-40, Civil and Hydro-electric Projects-56, Iron & Chromite Mine- 15, Stone Mine- 16 and Quality assessment of Explosives-7).
- Published 35 Research Papers as author and co-author (SCI-09, non-SCI-11, International Symposium - 05 and National Symposium - 10)

Award/Appreciation Received:

1. Certificate of Merit (SC/T-143/COM/2005-2006) for paper published in the MN Journal of Institution of Engineers (I).
2. Appreciation letters (Dated: 06.06.2006 and 01.07.2008) received from Chief Engineer, Konkan Railway Corporation Limited for stabilization of unstable slopes using controlled blasting techniques.
3. Appreciation letter (Dated:29.10.2008) received from Chief Bridge Engineer, Eastern Railway, for safe demolition of ROB No. 152 near Rampurhat using explosives.

4. Appreciation letter (Dated:08.09.2011) received from Vice President (Mines), Jaypee Himachal Cement Plant for development of systematic benches in hilly terrain of Himalaya at Baga & Bhalag Limestone Mines.
5. Appreciation letter (Dated:19.08.2013) received from Assistant Vice President (Mines), J K Cements Works for dedication and talented skillfulness in solving the environmental problems associated with blasting at four limestone mines.
6. Appreciation letter (No.154/C Dated: 29.05.2017) received from Divisional Commissioner Magadh Division Govt. of Bihar for dismantling of unstable boulder located at Brahmayoni Hills Gaya using controlled blasting techniques.
7. Appreciation letter (No.22054/ADGNW/.Drill&Blast/58/E2/Wks Dated:06.05.2020) received from Addl DGBR (NW) for CSIR Controlled blasting technique to enhance the progress of Border Roads.

Professional Membership:

- Member of the Institution of Engineers (I)
- Life Time Member of the Mining, Geological and Metallurgical Institute of India
- Life Time Member of the Mining Engineers Association of India
- Life Time Member of the Indian Mining & Engineering Journal

Peer Reviewer of International Journals:

- Artificial Intelligence Review (SCI)
- Bulletin of Engineering Geology & the Environment (SCI)
- Shocks and Vibration (SCI)
- Scientific Reports (SCI)
- Geological and Geotechnical Engineering

List of publication as Author and Co-author (Total:35)

SCI Journals

1. **N. K. Bhagat**, A. K. Mishra, R.K. Singh, C. Sawmliana, P. K. Singh (2022) Application of logistic regression, CART and random forest techniques in prediction of blast-induced slope failure during reconstruction of railway rock-cut slopes. *Engineering Failure Analysis*, *137*, p.106230. **IF-3.634**
2. **N. K. Bhagat**, A. Rana, A. K. Mishra, M. M. Singh, Atul Singh, P. K. Singh (2021) Prediction of fly-rock during boulder blasting on infrastructure slopes using CART technique, *Geomatics, Natural Hazards and Risk.* Vol. 12(1), 1715-1740. **IF-3.528**
3. **N. K. Bhagat**, A. K. Mishra, M. M. Singh, A. Rana, P. K. Singh (2020) Innovative Directional Controlled Blasting Technique for Excavation of Unstable Slopes Along a Busy Transportation Route: A Case Study of Konkan Railway in India. *Mining, Metallurgy & Exploration*. Vol. 36(3), pp. 833-850**. IF-1.413**
4. **N. K. Bhagat**, A. K. Mishra, M. M. Singh, A. Rana, S. Tewari, P. K. Singh (2020) Blasting technique for stabilizing accident-prone slope for sustainable railway route. *Current Science.* Vol.118 (6), pp. 901-909. **IF-1.102**
5. A. Rana, S. Singh, **N. K. Bhagat**, M. M. Singh, G. P. Jadaun, P. K. Singh (2021) Evaluating the sustainability of a hydropower project in the Himalayas: A case study for resolving legal disputes in tribunals. *Renewable Energy*, *174*, pp. 894-908. **IF-8.634**

6. A. Rana, **N. K. Bhagat**, A. Singh, P. K. Singh (2022) Predicting blast-induced pull using regression tree. *Arabian Journal of Geosciences*, *15*(2), 1-10. **IF-1.827**
7. A. Rana, **N. K. Bhagat**, J. Pandey, S. K. Mandal, M. M. Singh, P. K. Singh (2021) Specific blasting technique for tunnelling in hot zone. *Current Science*, **IF-1.102**
8. A. Rana, **N. K. Bhagat**, G. P. Jadaun, S. Rukhaiyar, A. Pain, P. K. Singh (2020) Predicting Blast-Induced Ground Vibrations in Some Indian Tunnels: a Comparison of Decision Tree, Artificial Neural Network and Multivariate Regression Methods. *Mining, Metallurgy & Exploration*. Vol. 36(4), pp.1039-1053. **IF-1.413**
9. S. K. Mandal**,** M. M. Singh, **N. K. Bhagat**, S, Dasgupta (2007) Model for energy-based evaluation of blast waves to assess safety of structures. *Int. J. of Mining, Reclamation and Environment*, Vol. 21, No.2, pp. 111-125. **IF-2.956**

Non-SCI Journals

1. **N. K. Bhagat**, A. K. Mishra, M. M. Singh, A. Rana, P.K. Singh (2020) Directional controlled blasting technique for excavation of unstable slopes along the Konkan Railway route. *Mining Engineering.* Vol. 72(7), pp. 5-6.
2. A. Rana, **N. K. Bhagat**, G. P. Jadaun, S. Rukhaiyar, A. Pain, P. K. Singh (2020) Predicting blast-induced ground vibrations in some Indian tunnels using decision tree. *Mining Engineering.* Vol. 72(8), pp.11-12.
3. M. M. Singh, **N. K. Bhagat** (2011) Recent developments in designing of burn-cut method of blasting in tunneling for higher productivity and special emphasis on the prevention of overbreaks**,** *Journal of Mines, Metals & Fuels*, Mining Industry Annual Review, October 2011, 332-339.
4. S. K. Mandal, **N. K. Bhagat,** M. M. Singh, (2014) Magnitude of vibration triggering component determines safety of structures. *Journal of Mining & Environment, Vol.* 5(1), pp. 35-46.
5. S. K. Mandal, M. M. Singh, **N. K. Bhagat** (2013) Particle velocity of ground vibration reflected mechanism of rock breakage and damage to structures. *Journal of Civil Engineering and Science, Sept. 2013, Vol.* 2(3), pp. 178-183.
6. S. K. Mandal, M. M. Singh, **N. K. Bhagat** (2012) Simultaneous initiation of cut and production holes in trench method of blasting. *International Journal of Mining and Mineral Engineering* 4.2 (2012), pp. 139-150.
7. S. K. Mandal**,** M. M. Singh, **N. K. Bhagat**, S. Dasgupta (2008) Impact of single-hole and multi-hole blasting on vibration parameters, *Journal of Mines, Metals & Fuels*, Vol. 56, No.7 & 8, pp. 122-128.
8. R. K. Singh, S. K. Mandal, **N. K. Bhagat** (2007) Assessment of safety and stability of an unapproachable underground water dam due to blasting in nearby opencast coal mine. *Minetech*, Volume 28, No. 2 & 3, pp. 87-92.
9. S. K. Mandal**,** M. M. Singh, **N. K. Bhagat** (2006) Magnitude of Vibration vis-à-vis Charge per Delay and Total Charge. *The Institution of Engineers (India)-MN Journal*, Vol. 86, pp. 32-38.
10. P. Pal Roy, C. Sawmliana. **N. K. Bhagat**, M. Madhu (2003) Induced caving by Blasting: Innovative experiments in blasting gallery panels of underground coal mines of India, Mining technology (Trans. Inst. Min. Metall. A) U. K., Vol. 112, pp. A1-A7.

11. P. Pal Roy, Ashwani Kumar, C. Sawmliana, **N. K. Bhagat (**2002) INCAB- Induced caving by blasting: Software for blasting gallery (BG) panel of U/G mines. *Journal Mines, Metals & Fuels*, pp. 76-77.

International Symposium

1. B. M. P. Pingua, **N. K. Bhagat**, R. R. Singh (2017) Studies on properties of unwrapped explosive to improve blasting performances: A case study, *NexGen Technologies for Mining and Fuel Industries*, ISBN 978-93-85926-40.2, Feb.15-17,2017, pp.265-270.
2. M. M. Singh, **N. K. Bhagat**, S. K. Mandal (2012) Introducing specialized blasting techniques and sequences of excavation in tunneling works under critical conditions, *Tunneling in Rock by drilling and Blasting*-Spathis & Gupta (Eds), 2013 Taylor & Francis Group, London, ISBN 978-0-415-62141-0
3. C. Sawmliana, R. K. Singh, **N. K. Bhagat**, P. Pal Roy (2010) Development of an angle-cut pattern of blasting for higher productivity from underground coal mines using Pentadyne-HP explosive, Procs. *3rd Asian Mining Congress* (MGMI; ISBN: 978-81-8211069-4), January 22-25, 2010, Kolkata, India, pp. 11-23.
4. S. K. Mandal, M. M. Singh, **N. K. Bhagat**, S. Dasgupta (2006) Charge parameters and its impact on ground vibration. Proc. *1st Asian Mining Congress*, 16-18 January, 2006, The Mining Geology and Metallurgy Institute of India (MGMI), Centenary, pp. 405-412.
5. S. K. Mandal, M. M. Singh, **N. K. Bhagat**, S. Dasgupta (2005) Causes of overbreak and influence of blast parameters for smooth undamgeed wall. Proc. International Symposium on *Advances in Mining Technology and Management*, November 30 – December 02, IIT Kharagpur, India, 2005, pp. 49-58.

National Symposium

1. **N. K**. **Bhagat**, M. M. Singh and A. K. Mishra (2014) Stability enhancement of rock slopes using controlled blasting techniques along Konkan Railway in India-A case study, National Seminar on Surface Mining (6th NSSM), 10-11 January 2014, ISM Dhanbad. ISBN 978-93-5156-186-6
2. **N. K**. **Bhagat**, M. M. Singh, R. Kumar, A. Sulaiman (2013) Stabilization of Rock Slopes along Konkan Railway Track Using Controlled Directional Blasting Technique, Proc. of National Seminar on Explosive & Blasting Techniques for Mining, Quarrying & Infrastructures Industry (EBTMQI) Sept. 27-28, 2013 NITK Surathkal.
3. **N. K**. **Bhagat**, S. K. Mandal, M. M. Singh (2005) Damage of structures vis-à-vis Vibration, Proceedings of 3rd National Seminar on Rock Excavation Techniques, A. K. Chakarborty, G. K. Pradhan & S. K. Dutta (Eds), Nagpur, India, pp. 137-141.
4. **N. K. Bhagat**, P. Pal Roy (2003) A review on the strategic planning for mine closure with particular reference to blast-closure, Proc. National Seminar on Strategies for Mine Closure, October 11-12, 2003, Dhanbad, India, pp. 104-108.
5. M. M. Singh, **N. K**. **Bhagat**, R. S. Yadav, P. K. Singh (2018) Effective Tunnel Blast Design to Enhance Progress with Minimal Overbreak", RBT 2018 A national seminar on *Rock Blasting Techniques- Challenges and Opportunities*, November 23-24, 2018, CSIR-CIMFR Dhanbad.
6. P. Pal Roy, C. Sawmliana, R.K. Singh, R. S. Yadav, **N. K. Bhagat**, P. Hembram, S. Ghanti, A. Mazumder (2017) Demolition of Over-bridges on active railroad tracks in populated areas,

7th Asian Mining Congress, The Mining Geological and Metallurgical Institute of India (MGMI), 8-11 November, Kolkata, India.

7. M. M. Singh, **N. K. Bhagat** (2016) Short Burden Blasting (SBB)-A New Technique for Barrier Breakage in River Diversion Works, INDOROCK 2016: 6th Indian Rock Conference 17-18 June 2016, IIT Mumbai.
8. M. M. Singh, **N. K. Bhagat** (2011) A suitable blast design to minimize the magnitude of vibration with the use of existing initiation devices keeping in view of the scheduled production & productivity of the mine – a case study. Proc. of All India Seminar on "Advances in Mine Production and Safety" August 26-27, 2011, CIMFR (Dhanbad).
9. S. K. Mandal, M. M. Singh, **N. K. Bhagat** (2004) Parameters affecting blasting in Iron Ore opencast mines - Some Case study. *National Seminar on Rock Fragmentation, 23-24th January, 2004, BHU, Varanasi, pp 22-24.*
10. S. K. Mandal, M. M. Singh, **N. K. Bhagat** (2003) Fragmentation by Blasting --- Problems and Remedies. Seminar on Explosive and Blasting by National Convention of Mining Engineers, Institute of Engineers (Mining), Dhanbad Chapter. pp. 60-71.

Some of the important projects handled as Principal and Co-principal Investigator

1. Excavation and flattening of slopes at Bordave, Ukshi Yard, Agave and Shirsawane cuttings using controlled blasting under the jurisdiction of DGM/SW/RN in Ratnagiri Region, (SSP/435/2019-20, Project Cost-Rs.94.62 Lakh).
2. Methodology for Excavation, recommendations for design proof check and monitoring during excavation of three tunnels and open excavations at Panvel-Karjat Double line suburban corridor, (SSP/423/2019-20, Project Cost-Rs.390.5 Lakh).
3. Studying, modeling and evolving a new blasting technique for mine excavations near the proximity of structures (beyond 50 m) using the structural response analysis and dynamic finite element modelling (Funded by Ministry of Mines, GAP/122/2020-24, Project Cost-Rs.38.19 Lakh).
4. Scientific study and advice for carrying out controlled blasting for hard rock excavation works at Bharamtoli Hill, Ranchi for construction of 28.80 ML GSLR under Ranchi water supply scheme Phase-II, Package -A (SSP/721/2023-24, Project Cost- Rs.25.488 Lakh).
5. Scientific study for the assessment of influence zones due to blasting at stone quarries in the state of Kerala in compliance to the order of Hon'ble National Green Tribunal (NGT) passed in OA No. 304/2019 (Kerala State Pollution Control Board, SSP/714/22-23, Project Cost, 49.79 Lakh).
6. Scientific study for designing of controlled blasting at Amelia Coal Mine for safe blasting operation beyond 100 m but within 500 m of residential structures and assessment of quality of explosive and accessories. (SSP/682/2022-23, Project Cost-Rs.10.7 Lakh).
7. Scientific study for the slope excavation work using Directional Controlled Blasting (DCB) at Salal Station Yard of USBRL Project of M/s Konkan Railway Corporation Limited (KRCL), Jammu (SSP/656/2022-23, Project Cost- Rs.9.44 Lakh).
8. Scientific study for safe and economical open and underground excavation of rock using DBM at Pakal Dul Dam Project, J&K, SSP/367/2019-20 (Project Cost-Rs.49.86 Lakh).
9. Scientific study for safe blast based on the monitoring of blasts event at Gagal Limestone Mine of M/s ACC Ltd., SSP/308/2018-19 and SSP/407/19-20 (Project Cost-Rs.62.54 Lakh).

10. Study and advice on blast induced ground vibration due to excavation of Additional Adit to HRT, Sawra-Kuddu HEP, Hatkoti, HPPCL, SSP/258/17-18, (Project Cost-Rs.18.77 Lakh).
11. Designing of controlled blasting for rock excavation to set-up Wagon Tippler, Conveying Tunnels & Transfer point site at NTPC, Talcher, Odisha, (CNP/4486/2016-17 & SSP/173/2016-17, Project Cost-Rs.55.56 Lakh).
12. An advice to evolve a safe blast based on the monitoring of blasts events at ACC Gagal Limestone Mine, CNP/4527/17-18 & SSP/189/17-18, (Project Cost-Rs.25.5 Lakh).
13. Advice and monitoring of drilling and blasting work at Gagal Limestone Mine, M/s ACC Ltd. CNP-4350/2015-16 & SSP-101/2015-16 (Project Cost-Rs.25.5 Lakh).
14. Study to Identify measures for dampening of vibration effects during blasting, Satluj Jal Vidyut Nigam Limited, CLP-59/2015-16 (Project Cost-Rs.17.46 Lakh).
15. Scientific study and advice for optimisation of maximum charge per delay, total charge and blast pattern to minimise ground vibration, AOP/noise and flyrock using bulk explosive system beyond 100 m distance from the residential structures at patch-G of Kujama opencast project under Lodna Area, BCCL (CNP/5187/2023-24, Project Cost-Rs.7.67 Lakh).
16. Scientific study and advice for designing of controlled blasting at Pachhwara Central Coal Mines of DBL Pachhwara Coal Mines Private Limited (CNP/5165/2022-23, Project Cost-Rs.8.437 Lakh).
17. Scientific study and advice for designing of controlled blasting patterns for carrying out safe blasting operations at South Khliehjari Limestone Mines of M/s Meghalaya Cement Limited, East Jaintia Hills, Meghalaya (CNP/5159/2022-23, Project Cost-Rs.4.72 Lakh).
18. Scientific study and advice for the development of controlled blasting pattern at Birahuli Limestone Mine of Shri Mukund Jaiswal, Satna, MP (CNP/5155/2022-23, Project Cost-Rs.5.9 Lakh).
19. Scientific study and advice for design and development of controlled blasting nearby villages at Kashlog/Mangu Limestone Mines of M/s Ambuja Cements Limited, HP (CNP/5145/2022-23, Project Cost-Rs.10.915 Lakh).
20. Scientific study for assessment of blasting impacts on the under-construction railway line and advice for designing of controlled blasting patterns at the proposed Itoura limestone mine of M/s RCCPL Private Limited in Satna District, MP (CNP/5135/2022-23, Project Cost-Rs.7.965 Lakh).
21. Scientific study and advice on feasibility of controlled blasting for hard rock excavation works at Bharamtoli hill, Ranchi for construction of 28.80 ml GLSR under Ranchi drinking water project phase-IIA (CNP/5134/2022-23, Project Cost-Rs.5.9 Lakh).
22. Advice on directional controlled blasting to excavate hard rock for construction of second line by the side of electrified section between Jaroli - Porjanpur section of East Coast Railway (ECoR) M/s RVNL, Bhubaneswar (CNP/5059/2021-22, Project Cost-Rs.9.027 Lakh).
23. Advice on directional controlled blasting to excavate hard rock for lying 2nd line nearby existing rail track and other structures at Sanvordem Yard (Kulem-Madgaon Section of SW Railway), RVNL, Goa (CNP/5032/2020-21, Rs.5.9 Lakh).
24. Scientific study and advice on designing of controlled blasting pattern for safety of surface features at Budgauna and Majhgawan Limestone Mines of M/s UltraTech Cement Ltd. (CNP/5031/2020-21, Project Cost-Rs.14.16 Lakh).
25. Scientific study and advice for designing of deep hole-controlled blasting patterns within danger zone but beyond 100 m from the houses and buildings at Karo OCP, CCL (CNP/5027/2020-21, Project Cost-Rs.9.44 Lakh).

26. Scientific study and advice on designing of controlled blasting pattern for safety of surface features at Argat Limestone Mine of Sidhi Cement Works (CNP/5004/2020-21, Project Cost-Rs.7.67 Lakh).
27. Scientific study and advice on blast-induced ground vibration, flyrock and AOP at Chormari and Degarhat Limestone mines, Jaypee Rewa Plant, CNP/4984/2020-21, (Project Cost-Rs.9.44 Lakh).
28. Scientific study and advice for safe blast design to minimize Fly-rock, Ground vibration, AOP, Throw at Rajanka Limited Mines (F-South area), CNP/4911/2019-20, (Project Cost-Rs.5.9 Lakh).
29. Scientific study to conduct controlled deep hole blasting at Barjora North Coal Mine and advice thereof, CNP/4783/2018-19, (Project Cost-Rs.5.9 Lakh).
30. Consultancy services on evaluation of explosives and blasting accessories to improve its quality and suggestions at Jhamarkotra Mines, RSMML, CNP/4773/2018-19, (Project Cost-Rs.46.42 Lakh).
31. Scientific advice and designing of controlled blasting pattern for safety of surface features at Budgauna Limestone Mine of Sidhi Cement Works, CNP/4723/2018-19, (Project Cost-Rs.7.67 Lakh).
32. Advice on assessment of the effect of vibration due to blasting on nearby villages surrounding Bhanora West Opencast, Sripur area, ECL, CNP/4728/2018-19, (Project Cost-Rs.4.72 Lakh).
33. Advice on deep hole blasting in an area beyond the danger zone along with blast design parameters in Godhur Patch "A", (CNP/4225/2015-16, Project Cost-Rs.3.65 Lakh).
34. Study and advice for safe control blasting technique for excavation and flattening of slopes under the jurisdiction of Regional Engineer/Ratnagiri section of Konkan Railway (CNP/3390/12-13, Project Cost -Rs.76.79 Lakh).
35. Scientific study for optimisation of maximum charge per delay, total charge and blasting pattern to minimise ground vibration, noise and flyrock using Bulk Explosive system beyond 100 m from residential structures at Kujama Opencast Project, BCCL (CNP/2700/2010-11, Project Cost-Rs.2.508 Lakh).

Date: 02.05.2023

Place: CSIR-CIMFR Dhanbad (Dr. Narayan Kumar Bhagat)