

Strengthening safety and regulatory framework in stone quarries (Minor Mineral) for Sustainable Infrastructure in India

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Abstract

Small Scale Minor mineral quarries, particularly those extracting stone, are indispensable for the development of roads, buildings, and various public infrastructures. However, these sites are increasingly characterized by unsafe mining practices, unauthorized operations, illegal use of explosives, and frequent accidents. This paper proposes a stringent safety and regulatory policy framework with coordinated actions from state and central governments to mitigate risks, prevent illegal mining, and hold leaseholders accountable. A robust policy overhaul is imperative to align minor mineral extraction with national safety, sustainability, and development goals.

Keywords: Stone mines; Unsafe mining; Minor Minerals; Illegal mining; Risk management; Safety protocols

1. Introduction

India's rapid infrastructural growth depends heavily on minor mineral resources, especially stone mines. Despite their importance, these quarries remain poorly regulated compared to major mineral operations. With the proliferation of illegal mining, unauthorized blasting, and minimal oversight, these quarries are a hotbed of safety violations, causing frequent worker injuries, fatalities, and environmental degradation. This addresses urgent need for safety reforms in the stone mining sector by investigating current practices, identifying regulatory and operational gaps, and proposing actionable, field tested comprehensive safety protocols model.

The findings underscore the need for strict regulatory enforcement, modernized safety, training and technological integration to foster a culture of proactive risk management in the stone mining sector

1.1. Objectives

- Ensure Zero tolerance for illegal and unauthorized mining practices.
- Strengthen coordination between state and central mining authorities.
- Enforce stringent safety measures across all quarry operations.
- Enforce legal accountability on leaseholders for accidents due to negligence
- Encourage scientific and environmentally sustainable mining.
- Protect the lives and rights of mine workers.
- Improve monitoring, inspection, and enforcement capacity at grassroots level

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2. Literature review

An in depth analysis of mineral policies, previous research on occupational risks in mining, reviews past studies on mining accidents, Studies by the International Labour Organization (ILO) and Directorate General of Mines Safety (DGMS) consistently show that regulatory non-compliance and informal employment practices significantly contribute to unsafe mining environments

3. Research Methodology

The research adopts a mixed method approach combining qualitative policy analysis, quantitative data elevation, DGMS Accident Reports, Times of India and other news articles and magazines, additionally stakeholder interviews, and field observations. Comparative Case studies from different regions.

The study focus on identifying the gaps for poor safety protocols and strengthening safety and regulatory framework in stone quarries.

3.1. Mineral Policy Analysis

- Each state has its own policy, especially, the minor minerals there is no uniform approach.
- Overview of mineral policy frameworks from different states in India, highlighting the strength and weakness in enforcement, coverage, and relevance to stone mining safety.
- Assessment of how regulatory inconsistencies contribute to illegal mining and poor safety enforcement.

3.2. Historical Accident Data Analysis

Comprehensive analysis of mine accident records over a span of 15 years has been conducted to systematically investigate and delineate the predominant causal factors contributing to operational hazards in stone quarrying activities like unauthorized mining, deployment of unscientific and unsafe excavation methodologies, indiscriminate and unregulated handling of explosives. This longitudinal assessment for risk profiling, hazard mapping, and the formulation of targeted safety interventions at minor mineral mining sector.

3.3. Evaluation of Current challenges in Minor Mineral Quarrying

- Safety protocols often exist only on paper
- Rampant illegal mining without valid leases or approvals



Figure 1 Illegal stone quarry located in Tirunelveli, Tamilnadu operated at unregulated work environment

- Unauthorized and unsafe use of explosives



Figure 2 Accident due to unauthorized handling of explosive west Bengal

- Exposing gaps in training, safety Gear



Figure 3 Un trained persons working at the mine without wearing safety Gadgets(PPE)

- Weak enforcement and poor coordination among regulatory authorities
- Regular Safety audits are missing

3.4. Policy framework tailored for strengthening safety and Regulation in Stone Quarries in India

We urgently need “one country one policy” uniform national safety guidelines for minor minerals for easy familiarity with rules, via DGMS Circulars or constitute a committee to go into the existing minor mineral policies state wise, amend Minor Mineral Concession rules with regard to grant of leases, period of leases and to suggest uniform procedures in the interest of the mineral development.

Enforce legal accountability on lease holders, before granting of regular mining lease or temporary lease integrate lease approval with Mandatory of registration in DGMS and appointment of qualified mining engineers , blasters and obtaining necessary blasting ,heavy machinery permissions from DGMS otherwise suspension of mining lease.

Improve monitoring, inspection and enforcement capacity by DGMS coordination with state mining authorities for strengthen regulatory frame works and modernize mining practices.

Mandatory of explosive agreements for lease holders who are not having explosive Magazines from the explosive suppliers.

Explosive licensee shall made agreement with quarry lease holder after receiving all mandatory permissions and also mentioned the same in the agreement and a copy along with list of mines up to date should be sent to district collector, DGMS, State Mining Authorities and chief controller of explosives as mandatory.

Criminal Proceedings against unauthorized use of explosives shall be punished with imprisonment for term of five years and fine.

Mandatory of submission safety management plan for all quarries and Safety compliance audit every 6 months by DGMS.

Strict Penalties for unsafe Practices, un trained workers, Non Compliance of PPE and accidents due to negligence.

Penalties should be strictly for first contravention: fine and warning, second contravention: fine and suspension of lease and permits for three months, Third contravention: Fine and cancellation of mining lease and in case of continuing contravention black listing of defaulting lease holders.

Establish mining surveillance task force (Mining Regulation task force) in each state jointly operated by District Mining Authorities, Environmental Authorities, revenue authorities, police and DGMS and conduct joint inspections quarterly, to seal illegal mining and prosecute offenders. Deploy satellite surveillance, drones, GIS tools as a monitoring platform to detect illegal mining.

Establishment of Vocational training institutes in key mining belts before employment for training of quarry

Workers and specialized training certification programme in Drilling, Blasting, handling explosives and heavy earth moving machinery to mine managers, Supervisors in association with DGMS

Design a set of terms and conditions draft plan for stack holders to submit before granting of temporary mining lease as mandatory by covering all the norms of DGMS, Pollution control board, chief controller of explosives, and District mining authorities otherwise revocation of lease.

Organizing workshops, safety awareness campaigns on safety protocols for every six months by group of mines in the particular district as a training session should be develop to sensitize employees on dangerous posed by quarry activities.

Mandatory Submission of monthly reports of safety talks and quarterly mock drills to the DGMS and State mining Authorities.

Submission of report regarding periodic review and updating safety protocols in a prescribed manner to DGMS and State mining authorities.

"Develop a comprehensive online portal integrated with all requisite state government approvals, enabling real-time monitoring and rigorous scrutiny of the application process and status for granting royalty permits related to material transportation."

Culture Introducing an Annual Stone Mine Safety Week across all stone mining regions is not merely a symbolic gesture—it is a strategic imperative for transforming the safety landscape of India's mining sector. With structured implementation, strong government backing, and consistent monitoring, this initiative has the potential to reshape the operational ethos of the stone mining industry.

4. Conclusion

"Stone mining has long been a corner stone of India's economic progress and a fundamental contributor to the nation's infrastructure development these practices have not only led to a disturbing rise in workplace accidents and loss of life but have also triggered alarming environmental degradation.

A growing body of scientific and environmental literature continues to highlight the adverse impacts of poorly managed stone quarry operations, calling into question the long-term sustainability of this sector. If the prevailing neglect of safety standards and environmental protocols continues, the future of stone mining in India may be in serious jeopardy. Such a scenario would not only threaten the availability of essential construction materials but also pose a significant barrier to the country's overall developmental and infrastructural ambitions

Strengthening the safety regime like trained personnel, regular safety audits, and modern monitoring across regions and eliminating illegal practices can substantially mitigate the identified hazards and shows a path for sustainable development without endangering human life or the environment.

To enhance safety, India must formulate A well-regulated and safety-conscious mining ecosystem for miner minerals backed by action and enforcement, will not only save lives but also promote responsible resource development vital for India's long -term goals. India can transform its mining sector into a model of safety, efficiency, and environmental responsibility. Only through such integrated and resolute action can the stone mining industry continue to be a pillar of national progress while upholding the values of human dignity, ecological conservation, and lawful conduct.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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