

Role of Management for Sustainable Development of Stone Industries in India – An Overview

Dr. Bhatu Kr. Pal

Department of Mining Engineering, National Institute of Technology, Rourkela – 769 008,,
India.

e-mail; drbkpal2007@gmail.com

After a period of widespread use of artificial materials in construction engineering, natural stone is now gaining increasing popularity, not only for relevant architecture but also for industrialized building, face and floor cladding, urban fitting, road paving, interior decoration and manufacturing of design items. India is one of the leading countries in this sector, accounting for about one-tenth of the overall production (between marble and granite) and for more than one fifth of stone processing output. Moreover, machineries and equipment made in India are exported all over the world. Stone quarrying and processing activities have recently been involved in an impressive technological progress characterized by implementation of advanced cutting technologies followed by the use of powerful material handling equipment. The development of complex stone working machinery and the application of sophisticated management tools resulting in a spectacular increase of productive parameters accompanied by a substantial improvement of material quality. At the same time pit geometry (size of faces, extension of the working areas), quarry design, plant layout and operations management had modified taking advantages of advancement of technologies, knowledge and availability of high skill manpower.

It is observed that the development of quarrying and processing activities resulted in a heavier impact on the environment whose mitigation is now one of the major problems faced by the sector. Besides the drawbacks created within the working ambient surrounding territory is also affected by a number of inconveniences such as landscape modification, damage to the naturalistic values, possible slope instability of quarry walls and of waste dumps, heavy traffic and ground water consumption due to leakage of spent oils and lubricants and release of sawmill effluents. This paper illustrates the problems and discusses the suitable measures for attenuating the nuisances with particular references to quarry fields of India which is one of the leading country in stone business.


On the management side, environmental impacts of quarrying projects are analyzed based on the commonly adopted quarrying methods and their choice. Suitable mitigation measures are studied in detail so that sustainability of this industry will not face the problem.

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Dr. B. K. Pal,
Department of Mining Engineering,
National Institute of Technology, Rourkela,
India - 769008

Introduction

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Stone quarrying and processing activities have recently been involved in an impressive technological progress, characterized by the implementation of advanced cutting methods, the use of powerful material handling equipment, the development of complex stone working machinery and the application of sophisticated management tools resulting in a spectacular increase of productive parameters, accompanied by a substantial improvement of material quality.

Environmental Problems due to Stone Industry

- * Countryside Modification of Landscape pollution
- * Groundwater pollution
- * Ecology Threatening
- * Safety and Health
- * Slope Stability

Countryside Modification of Landscape Pollution

- * Newly cut surfaces are easily discernible from distance
- * Surface remodelling and final re-vegetation are not usually followed up
- * Remnants of excavation activity may often add new interest to landscape
- * Unsafe areas and pathways needs to be eliminated
- * Waste disposal often is a critical issue

Ground water pollution

- * In mechanised operations, oil and lubrication might contaminate water
- * Inert dust can impact plant growth
- * Chemical contaminations in stone quarries

Ecology Threatening

- * Land modifications should be forbidden in zones deserving integral protection
- * Safeguarding the nature must be coped through general planning and land utilisation
- * Development of new eco-systems attracts wildlife banned from the surrounding area needs protection and suitable rehabilitation

Safety and health


- * Dust, noise and vibration is major concern in modern quarries
- * Stone processing plants disturb surrounding ambience in nearby areas
- * Noise issues are restricted by EEC, dampening is achieved by improving the technology and using insulating barriers

Slope stability

- * Rocks suitable for production of dimensional stone don't encounter the issue of landslide or rock fall
- * The only issue in these cases may be hanging pinnacles of rock, presence of fracture or defects.
- * Failures may occur at pit walls of deep excavations
- * In underground marble quarries the size of the rooms between pillars should be small for supporting burden of overlaying formations


Prevention of Environmental Problems

- * Ranking the stones into suitable scale of importance
- * Deposit of mineral substance generally belongs to the owner of land
- * Quarry shouldn't be opened without restrictions or absence of control
- * Strict regional rules deems necessary in settling conflicts and ensure rational use of resources

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- * Geological resources of interest should be identified and restriction on their exploitation should be imposed
 - * Authorization can be denied in case of issue in complying with the technical, economic and rehabilitation requirements

Environmental Assessment of Quarrying Projects

- * Detailed information providing geological reserves, quarrying method and technology adopted, production scheduling and infrastructure layout through Detailed Project Report is submitted
- * Economic aspects of the activity must be elucidated, including a market investigation and demonstration of profitability.
- * Environmental assessment is required and final rehabilitation measures described.

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- * In order to ensure fulfilment of the tasks, suitable financial guarantees are obtained, a payment of tax proportional to production is also collected for rising a fund for land rehabilitation

Operations Management Techniques in Stone Industry

- * The quarrying operation chiefly depends on efficient management
- * Leader enterprises are emerging capable of coping with different management functions such as R&D, production, purchase, sale, administration, promotion and planning etc. through integrated management structure


Commonly adopted quarrying methods and their choices

Choices depend on following factors

- * The kind of material
- * The shape and size of geological formation
- * The topography of the site
- * The overburden thickness
- * The location of quarry
- * The production level and the imposed restrictions


Commonly Adopted Quarrying Methods and their Choice

- * Caving method was popular before continuous cutting techniques emerged
- * In case of hindrance to continuous cutting, selective quarrying is adopted
- * Majority of stone quarries are now conducted according to regular bench design, using a proper combination of cutting technologies, suggested by the peculiarities of each situation

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- * In marble and granite quarries, high bench method is widely used.
 - * In case of marble quarries located in steep mountains, where the stone formation is surrounded by thick overburden, underground room and pillar methods are increasingly used


Use of advanced technologies


- * Continuous cutting technology (diamond wire & high velocity water jet)
 - * Diamond wires are now widely applied in marble quarries and has recently been introduced in granite quarries
 - * Water jet is based on erosive action of high velocity of water
- * In deep kerfing of granite rocks, stationary plain jets are used

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- * Different systems like traversing lances of special design provided with one or more nozzles are used to get slot wide enough for further cutting
 - * A suitable combination of waterjet with diamond wire can be foreseen as the winner solution for the granite quarry

Suitable Measures for Sustainable Development

- * Despite care taken against impact, it is practically impossible to avoid nuisances and drawbacks subjected to control by public authority. The key condition is always that production and rehabilitation plans are harmonized and carried out in concert.
- * Suitable paints sprayed onto freshly cut surfaces and diminishing evidence of excavation

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- * Waste disposal should have gentle slopes and well shaped heaps according to the dominant morphology of the zone
 - * Mechanical improvements can reduce water contaminations (For instance, a whole electric rock cutter provided with a diamond tipped belt has recently been developed; cooling and lubrication at the rock-tool contact points are suitably assured by water injection through a number of nozzles along the periphery of the swinging arm, thus avoiding chemical pollution of waters and soil.)

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- * Alkaline slurries discharged by granite sawing plants can be treated in appropriate sections and the water recirculated to the gangsaws in order to avoid the discharge of polluting effluents into the natural network.
 - * Reduction of nuisances within working ambient and to neighbouring area is connected with improving excavation methods (like in marble quarries, the problem has already been solved by adopting diamond based technologies).

Conclusion

Mining activity and environment protection should not be considered as incompatible, since suitable actions can be devised for minimising the inconveniences. Instances are not unfrequent where substantial improvement is even added to the area after the final rehabilitation of abandoned quarries.

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Thank you!