MITIGATING THE ENVIRONMENTAL IMPACT OF ARTISANAL QUARRYING: CONSIDERATION OF AWARENESS AND INCENTIVES

A REPORT FOR DFID/ITDG PREPARED BY DAVID UGLOW
MINING AND ENVIRONMENT RESEARCH NETWORK
UNIVERSITY OF BATH

JUNE 1999
# Table of Contents

## Introduction .................................................................................................................. 1

## Section One: The Environmental Regulatory Framework ............................................. 1

1.1 Indian Environmental Legislation and Enforcement ................................................. 1
   1.1.1 Mining Acts ........................................................................................................... 1
   1.1.2 Environmental legislation .................................................................................... 2
   1.1.3 Regulatory enforcement ....................................................................................... 4

1.2 Kenyan Environmental Legislation and Enforcement .............................................. 4
   1.2.1 Mining Acts ........................................................................................................... 4
   1.2.2 Regulatory enforcement ....................................................................................... 5

## Section Two: Stone Quarrying and the Environment ................................................... 6

2.1 Degradation of Stone Reserves and Land ................................................................. 6
   2.1.1 Land use .............................................................................................................. 6
   2.1.2 Wasted stone ....................................................................................................... 6
   2.1.3 Land restoration .................................................................................................. 6
   2.1.4 Topsoil preservation ........................................................................................... 7

2.2 Aesthetic Pollution .................................................................................................... 7

2.3 Water Pollution ....................................................................................................... 7

2.4 Water Table and Water Course Alterations ............................................................ 7

2.5 Air Pollution .......................................................................................................... 8

2.6 Noise ....................................................................................................................... 8

2.7 Explosive Use ......................................................................................................... 8
   2.7.1 Ground vibration .................................................................................................. 9

2.8 Land Subsidence ..................................................................................................... 9

## Section Three: Environmental Recommendations ..................................................... 9

3.1 Policy and Regulatory Recommendations .................................................................. 9

3.2 Licensing Arrangements .......................................................................................... 10

3.2 Recommendations on Quarrying Methods .............................................................. 10

3.3 Environmental Management Recommendations .................................................... 11

3.4 Environmental Training and Awareness Building .................................................. 11

## Section Four: Environmental Policy Formulation and Enforcement ......................... 12

4.1 National Quarrying and Environmental Policy ......................................................... 12

## Section Five: Environmental Management Systems (EMS) ........................................ 12

5.1 Environmental Management Systems in North America and Europe ....................... 12

5.2 The 'EMS' and Small-Scale Artisanal Quarrying .................................................... 14
   5.2.1 Lessons to transfer ............................................................................................... 14
   5.2.2 Education and training ....................................................................................... 15

5.3 Public Awareness of the Environmental Effects of Small-Scale Quarrying ............... 15

5.4 Site Restoration ...................................................................................................... 16

## Section Six: Conclusion ............................................................................................. 17

## References ................................................................................................................... 18

## Appendix One ............................................................................................................. 20
INTRODUCTION

Small-scale artisanal mining has an important role to play in developing countries as it utilises often abundant available labour while requiring only limited amounts of less than abundant capital. However, enthusiasm for this sector of the economy is tempered by a variety of problems by which it is so often plagued; wasted mineral resources, poor health and safety, and environmental degradation (Noronha, 1998). The process of extracting stone by quarrying is merely physical and, consequently, this sub-sector of the mining industry is not plagued by the pollutant problems associated with chemical processing as experienced by the mining of metals and mineral. However, stone quarrying does have numerous environmental effects that are nonetheless serious. In the area around Nairobi in Kenya small-scale quarrying there is 'a blatant disregard for the environment'; Savery (1997). The unregulated destruction of the natural environment is not compatible with sustainable development. However, a process of lessening the environmental impact of small-scale artisanal quarrying is not easy. This paper begins by examining the environmental legislative framework in both India and Kenya. The major environmental effects of mining are then examined. The following section then examines the main recommendations drawn from the project papers. The next section has a brief examination of environmental policy before environment management systems and their applicability to small-scale artisanal stone quarrying is examined. The paper then concludes with a summary of the findings of this paper.

SECTION ONE: THE ENVIRONMENTAL REGULATORY FRAMEWORK

A key element in understanding the environmental impact of small-scale artisanal stone quarrying is an appreciation of the regulatory context within which the sector operates. This framework, and the extent to which it is adhered to, largely determines the level of the environmental impact on stone quarrying. A 1994 United Nations report on small-scale mining stated 'that a legal framework that recognises the characteristics of this type of mining is a pre-requisite for formalising the sub-sector and limiting its negative environmental impacts' (United Nations, 1994:215). The report also stated that serious efforts are needed in legislation, regulation and promotion of small-scale mining particularly in order to mitigate against amongst other factors, environmental damage. In most cases, the government is the only organised body that is able to direct activities along an efficient and sustainable route. However, this becomes difficult as the miners are often migratory and accountability is therefore a problem. In addition, the government often lacks the appropriate resources (United Nations, 1994).

The current regulations governing the quarrying sector vary from country to country and in some cases such as India, there are inter-state variations. The following section outlines the main environmental conditions and regulations as they relate to small-scale stone quarrying in both Kenya and the state of Goa, India.

1.1 INDIAN ENVIRONMENTAL LEGISLATION AND ENFORCEMENT

1.1.1 MINING ACTS

In India, building stone is considered as a minor mineral. Under section 15 of the Mines and Minerals (Regulation and Development) MMRD Act 1957, the granting and renewing of mining leases for minor minerals is governed by various Minor Minerals Concessions Rules as framed by individual state governments. Within Goa, the extraction of stone is governed by the Goa Daman and Diu Minor Mineral Concession Rules (MCR) who grant 'quarrying leases' and 'quarrying
permits. Some of the restrictions placed upon the granting of these leases relate to the environment. For example, regulations stipulate the distance from certain public structures to which a quarry may operate and they regulate against the felling of trees. More seriously, quarrying operations may be suspended if they are deemed to:

- cause danger to public health or to public safety
- have an adverse effect on the environment or ecology
- interfere with the objectives of flood control or the prevention of pollution or safety to public structures including communication facilities, roads and buildings
- cause a public nuisance

Clauses for environmental protection and for ecological balance, and for the disposal and discharge of slurry and other products arising from the quarry operations may also be inserted into a quarrying lease. Consequently, the lessee may be responsible for undertaking remedial measures, for rehabilitating after quarry closure and have to give an undertaking not to pollute any streams or water sources.

1.1.2 ENVIRONMENTAL LEGISLATION

The Indian legal framework concerning the environment has three aspects to it. The first aspect relates to the laws and policies that give the governments the powers and rights to utilise the resources, such as land, forests, water and mines and minerals. The second aspect concerns the laws and policies that give the people the rights over common or private natural resources. The third aspect relates to nature itself.

Effective Indian environmental regulation has largely been implemented since the Bhopal disaster. It is based on a system of criminal sanctions with civil compensation being afforded minor importance. Economic approaches to environmental regulation are not evident. Environmental protection is clearly provided for in the Indian constitution and judicial interpretation of this mandate has been strong. In recent cases, the courts have recognised the right to a wholesome environment as being implicit in the fundamental right to life guaranteed under Article 21. Article 14, which guarantees the right to equality, is also invoked to challenge sanctions for mining where it is felt that such permission is "arbitrarily" granted without a consideration of the environmental impacts of such activity. In recent times, the courts in India, and especially, the Supreme Court, has by interpretation of the Constitution, developed principles of tortious liability instead of criminal liability. A number of public interest litigation, such as that of destructive mining in Mussoorie and Dehradun in U.P., and of the mining of marble and limestone around the Sariska Tiger Reserve in Rajasthan, point to the evolution of a new type of court-aided environmental protection in India that is becoming as significant as the statutory efforts of the Government.

Four main statutory acts regulate the environmental impacts of quarrying activity:

1. The Water Pollution Act 1974 provides for the prevention and control of water pollution, and the maintaining or restoring of the wholesomeness of water. It vests the authority in State Pollution Control Boards to establish and enforce effluent standards in mines and processing plants. Since 1988, authorities can close down an operation or withdraw infrastructural support services if it found to be transgressing.
(2) The Air Pollution Act, 1981 is similar to the water act. It provides for the prevention, control and abatement of air pollution. It lays down air pollution standards and is administered by the State Pollution Control Board. It also empowers the authorities to close down an operation or to withdraw support services if found violating the law.

At the state level, the State Pollution Control Boards enforce the Air and Water Acts. A list of functions as per these Acts that are relevant to this study is appended.

(3) The Forest (Conservation) Act, 1980 prohibits state governments from allotting any forestland or any portion thereof for any non-forest purpose without approval from the Central Government. Apart from the states of Jammu and Kashmir, this act applies to all India. Approval of the Government is necessary for a quarry lease to be granted in respect of any forest area; for the resumption of operations on the expiry of a lease; for information relating to rehabilitation of quarry sites, damage to trees, distance of the site from important ecosystems and highways, reclamation procedures. Compensatory afforestation is one of the most important conditions stipulated by the Central Government while approving proposals for dereservation and diversion of forest land. The relevant provisions of Forest (Conservation) Act, 1980 apply for diversion of any forestland for any non-forest use including mining. More recently, considerable relaxation here has been granted by the Central Government. The existing provisions affecting mining operations are appended:

Table One. The regulatory regime for environmental protection in India

<table>
<thead>
<tr>
<th>Main Elements of the Regime</th>
<th>As Applicable to the Mineral Sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>A: Laws</td>
<td>Water (Prevention &amp; Control) Act 1974; Forest Conservation Act 1980; Air (Prevention &amp; Control) Act 1984; Environmental Protection Act 1986</td>
</tr>
<tr>
<td>C: Administrative Machinery:</td>
<td>Ministry of Environment &amp; Forests at the Centre; Department of Environment at the state levels</td>
</tr>
<tr>
<td>i) Nodal governmental body</td>
<td>CPCB, NWDB, FRI, CSIR, NEERI, FSI, BSI, ICFR &amp; E, National Afforestation and Eco-development Board</td>
</tr>
<tr>
<td>ii) Other government bodies</td>
<td>Exemptions from income tax, depreciation allowance, investments allowance, exemptions from capital gains tax.</td>
</tr>
</tbody>
</table>

CPCB - Central pollution Control Board; NWDB - National Wasteland Development Board; FRI - Forest Research Institute; CSIR - Council of Scientific and Industrial Research; NEERI - National Environmental and Engineering Research Institute; FSI (Forest Survey of India); BSI (Botanical Survey of India); ICFR & E - Indian Council of Forest Research and Education

The Environment Protection Act, 1986 is applicable to the whole of India and overrules other legislation, including local laws. Under Section 5, it grants government the power to close down any industry if found violating the law. Consequent to the Act, the Environment Ministry has, among other requirements, laid down:

- Standards of emissions for the discharge of environmental pollutants
- Procedures and safeguards for the prevention of accidents
It was under Section 3 of this act, on May 7, 1992, that the government notified that no unauthorised mining could take place in the Sariska Tiger Reserve.

Many state level acts are also powerful instruments for environment management. In 1985, the Union government notified 22 types of highly polluting industries that would require environmental clearance from state governments before being granted a license or registration.

1.1.3 REGULATORY ENFORCEMENT

Due to weak institutional capacity, there is little willingness or ability to implement environmental regulations in India. Quarry operators work within a vacuum, where the bodies charged with regulatory implementation are ineffective. An example of their ineffectual nature is in the proliferation of illegal quarrying. Despite appropriate measures being in place, Noronha (1998) states that it is evident from her case study and others conducted within Goa, that the laws and regulations are not working. The reasons for this can be summarised as follows:

- There are unclear linkages between the concerned agencies and a poorly defined allocation of responsibilities. This happens when a number of institutions regulate the same activity and when a number of agencies deal with the different consequences of the same activity. Responsibility for regulation enforcement is then passed from one agency or department to the next.

- There is a lack of institutional knowledge and information about what constitutes good and bad practice.

- There is a lack of resources, financial and human, to pursue enforcement. This is the excuse most often put forward by government departments to explain their inaction.

Coupled with low capacity, there is a lack of political will. This is, in part, because the environment often has a low priority for public officials when it conflicts with economic goals. However in part, it is also because these activities are controlled by groups in society that have close links with the political leadership and the middle and low level bureaucrats, who have the actual responsibility to monitor environmental behaviour. For some of them regulations have become a means to dispense patronage and, in many cases, for self-enrichment. It is also worthy to note that in Goa, India, the stone quarrying sector operates within the shadow of a much larger iron ore mining industry. This industry has tended to attract all the attention with respect to the environmental impacts of mining. Thus, the environmental impacts of the quarrying sector have been largely overlooked.

1.2 KENYAN ENVIRONMENTAL LEGISLATION AND ENFORCEMENT

1.2.1 MINING ACTS

The Kenyan Mining Act, 1940 (last revised in 1987) does not include stone and rock. Consequently, artisanal stone quarrying has operated outside this legislation with no governing body, no overall framework governing land use planning, and no environmental control. The absolute bereft of quarrying control is illustrated by the fact that stone quarrying can commence on private land without reference to any authority. Such operations are unrecorded, unregulated and have no environmental obligations. It should be noted however that quarries operating on Government of Kenya forestry land do require a license and are required to restore the land at closure.

The Government of Kenya intends to address stone quarrying within the National Plan, 1997-2001. The intended actions are stated as:
To ensure economic exploitation of mineral resources

To present parliament with a revised Mineral Act

To complete the geological survey mapping

The question of land use is also addressed.

Two major pieces of legislation were being brought to Parliament in 1997 (Savery, 1997).

- The new Mining and Minerals Act will embrace rock, stone and aggregates. One area of change is likely to be in royalty payments. Although belonging to the Government of Kenya, it, at present, does not receive royalties on any minerals. The new proposals contain legislation whereby royalties ranging from 2 - 10 percent will be levied upon the value of the minerals.

- Environmental law will be enshrined in a new Ministry of Environment and Natural Resources. This ministry will have three departments: Mines and Geology, Forestry, and Environmental Secretariat. The Department of Mines and Geology is believed to have a code of operation, which is 'Everything should be done to the ethics of Environment' (Savery, 1997).

The Government of Kenya has also presented a National Environmental Plan (NEAP), 1994, where it states that: 'It is fully committed to policies and strategies leading to sound environmental management and development'. However, legal implementation is difficult as 'Environmental law in Kenya lacks disciplinary character and is but a pragmatic expression that helps lawyers to pigeon-hole legal material' (Ojwang in Savery, 1997:28). Ojwang also states that for environmental policies to be implemented, reforms in the Kenyan constitution will be necessary to provide an umbrella framework for integrating environmental legislation within other legislation (Savery, 1997).

Further legislation that regulates one or more aspects of quarrying activity includes the: Fire inquiry Act; Firearms Act; Explosives Act; Public Health Act; Radiation Protection Act; Local Government Act; Trust Lands Act; Mining Act; Trading in unwrought precious metal; Continental Shelf; The Forests Act; Legal Notice No. 32 of 1996; Government Lands Act, revised 1984.

1.2.2 REGULATORY ENFORCEMENT

As in India, there is little enforcement of the regulations that govern quarrying practice in Kenya. In some cases, the regulatory bodies are not empowered to act against those who flout the regulation. For example, the Soil Conservation Division of the Ministry of Agriculture does not appear to have a mandate to prosecute those who fail to backfill exposed quarry pits on Forestry Land. Its role appears advisory, giving assistance where requested by landowners on how to restore land after quarrying. The major problems facing environmental law in Kenya thus include:

- Poor or weak administrative structures
- An absence of provisions to specify standards of performance
- Inadequate deterrents and incentives
- Low levels of active or participatory awareness among the majority of the population
• A preference for short term gains at the expense of more sustainable alternatives in decision making and planning

• Gaps and overlaps in the institutional framework making enforcement of legislation difficult

• Poverty, which promotes the unsustainable use of resources

SECTION TWO: STONE QUARRYING AND THE ENVIRONMENT

The following section proceeds to describe the environmental effects of quarrying as found both in the Nairobi region of Kenya and in Goa, India.

2.1 DEGRADATION OF STONE RESERVES AND LAND

2.1.1 LAND USE

Uncontrolled and inefficient stone quarrying techniques produces a degradation of both land and stone reserves. For example, due to a deficiency of planning of resource allocation in quarrying land in the Nairobi region of Kenya, stone quarries are sited haphazardly, without professional assistance or guidance. Consequently, there is a myriad of mineral surface workings, where easy extraction occurs at shallow levels in 400 mines, that is neither good resource management nor good environmental management (Savery 1997). In India, illegal quarrying is being conducted on government and community land designated by regional plans for orchards or agriculture use, thus eliminating other planned productive pursuits. The haphazard manner in which quarries are allocated is responsible for the frequent closure and many of their inefficiencies.

2.1.2 WASTED STONE

A common feature of artisanal stone quarries is the very high waste to recovery ratio. For example, estimates of the amount of stone wasted in Kenya range from 50 percent up to 95 percent, while in India waste typically accounts for 10-15 percent of the stone in mechanical quarries and 20-25 percent in manual quarries. However, before partial mechanisation, the Goan Kotah stone quarries had a recovery rate of just 24 percent. The amount of stone waste is influenced by among other factors, the natural formation of the rocks and the method of extraction. Most small-scale quarries in both Kenya and India use manual mining techniques, although blasting is often used in the harder stone quarries before stone is split and then sized. Consequently, much stone is lost due to wasteful methods of quarrying and processing of stones (Agevi and Ogero, 1990).

In India, high amounts of waste can cause disposal problems. Stone waste stacks are observed in a number of working and abandoned quarries. They are particularly large in manual and illegal quarries where there are poor rates of stone recovery and no attempt to backfill at site abandonment.

2.1.3 LAND RESTORATION

Land that has been used for stone quarrying should be restored after quarrying, especially in environmentally sensitive or agricultural areas. However, in both Kenya and India, examples of quarry restoration are rare. In Kenya, quarries may be sited on private land, forestland, trust land and local authority controlled land. Those stone quarries situated on private land require no formal planning permits and, therefore, have no planning conditions that require the restoration of worked-
out quarries. Consequently, private land can end up being abandoned on cessation of mining. For example, Agevi and Ogero (1990) note that disused quarries in the Ol Kalou region of Kenya have been left to grow into bush without any organised reclamation or alternative use. Quarries on Government of Kenya forestry land require a license from the Forestry Department. A condition of the license is that quarry operators carry out compensatory tree planting on double the area of the quarry elsewhere, then restore and subsequently replant their own quarrying site after use. However, there is no obligation for the care of the site after this has been done.

During the Indian monsoon and the Kenyan rainy season, abandoned quarries can fill with water if not backfilled and restored. They then create a potential drowning hazard if not fenced off. When waterlogged, they can also become breeding grounds for malaria bearing mosquitoes. As an example, all pits in the Njiru and Kiserian quarrying areas near Nairobi were found to be left unfilled and capable of holding water for many days in the rainy season.

2.1.4 TOPSOIL PRESERVATION

To enable the effective restoration of quarry sites the topsoil needs to be separated out and stored separately from the overburden. The topsoil can then be replaced during site restoration. However, in the Kenyan quarries, overburden is treated as one commodity with no attempt being made to keep topsoil separate for subsequent restoration purposes. It is normally dumped at the shortest possible distance. At times, it even has to be double handled as the quarry face advances towards the dump.

2.2 AESTHETIC POLLUTION

The aesthetic pollution of stone quarrying can be severe if the screening of current operations and the restoration of abandoned mines is not undertaken. Savery (1997) suggests that the visual aftermath of quarrying is equal to the poor utilisation of resources as the most important environmental impact of small-scale artisanal quarrying. For example, abandoned quarry sites in the Njiru area of Kenya, although generally not visible from residential areas, are clearly visible from main highways and provide a view resembling moonscape vista. In the Ngong area, the quarries are overlooked by high standard housing development yet landscaping to reduce the visual impact of the quarries is not evident and no attempt is made to conserve trees or shrubs at the top of the quarry that could provide a visual screen. Likewise, a 1989 government report on quarrying activity in the Nyeri Forest stated that quarrying practices had led to the rapid destruction of indigenous forests and rapid soil erosion (Agevi and Ogero, 1990).

2.3 WATER POLLUTION

The Kenyan case highlighted no water pollution as sites were some distance from watercourses and the only machines at the quarry sites, were delivery vehicles. Regulations in India specify that operations should be a minimum distance from watercourses. A move to mechanisation may increase the risk of diesel and oil contaminating watercourses.

2.4 WATER TABLE AND WATER COURSE ALTERATIONS

Quarrying activities can lower the water table and result in water wells running dry, however, in the Indian quarries, operations were not found to go deep enough to affect ground water aquifers. Likewise, an alteration of drainage courses and water patterns through quarrying can lead to flooding of land during the rains. For example, a 1989 Government of Kenya government report on the quarrying activity in the Nyeri Forest cited the formation of dangerous dams at quarry sites and the diversion of watercourses (Agevi and Ogero, 1990).
2.5 Air Pollution

Artisanal small-scale stone quarries can contribute to air pollution in a number of ways. For example, the ammonium nitrate fuel mix used in blasting and engine emissions can affect quarry workers and nearby communities. Dust from the quarry or the roads leading to the quarry can affect workers and nearby communities. Both can cause discomfort, allergic reaction, chest infections and longer-term respiratory problems. Likewise, the dust and fumes from lorry traffic and dust from the blasting process may result in discharges of pollutants to the atmosphere.

Air pollution, in terms of dust, was not found a major problem in either the Kenyan or the Indian stone quarries. Where dust was a serious problem was in the transportation of the stone. The 2-km approach road to the Kenyan Ngong quarries contains little coarse rock and lorries travelling to and from the quarries create extensive dust clouds that are a danger to other road users and especially dangerous to the health of roadside communities. However, dust is not a problem on the approach road to the Njiru quarries, as the road is constructed of coarse quarry rock. In India, dust is a localised problem that affects some nearby farmers but it cannot be generalised to all quarries. In Kenya, the chemical composition of the dust is unknown. However, in India much of the stone is siliceous thus capable of causing lung or bronchial disease to those who inhale the dust (Noronha, 1998).

The use of explosives for mining is dependent on the hardness of the stone. In hard stone quarries in Kenya, blasting is a necessary and common feature of stone quarrying. Unlicensed blasters are often used to reduce costs and the blasting can create ammonium nitrate fumes and dust that when inhaled can cause serious injury. Indeed, 90 percent of quarry workers in Kenya recognise that quarry dust and fumes from explosive chemicals are a major cause of their periodic cough and chest pains (Agevi, 1997). In mechanised quarries of Goa, operators of stone cutting equipment are exposed to both dust and the hydrocarbons emitted by their cutting machines. Workers are required to wear facemasks while operating the machinery but are still exposed to gaseous pollutants.

2.6 Noise

Noise, especially from explosions, has the potential to disturb nearby communities, animals and cause hearing difficulties for quarry workers. In Kenyan study, 45 percent of quarry workers saw noise as a main environmental concern but did not seem bothered by the sporadic blasting noise. Researchers did not find the noise of blasting excessively loud and state that, as the amount of explosive required is limited, it should not present a serious intrusion to reasonably located residential properties. However, in some quarries near to Ngong town in Kenya, blasting is discouraged due the close proximity of a shopping centre and a main road (Agevi, 1997). Advocating new technology or equipment that increases productivity should be assessed for its likely noise impact when there are many small quarries close together.

2.7 Explosive Use

The use of explosives in the quarrying process is a common feature of quarries in areas of harder stone. The noise and air pollutant effects have already been covered. As has also already been stated, explosives are being used unnecessarily and in an excessively damaging way; blasting is thought to contribute to excessively high amounts of waste stone created. However, the blasting process itself can be dangerous. In Kenya, the use of explosives to blast stones results in infrequent serious injuries and death. Furthermore, the use of explosives near residential areas has started to show potential danger to both lives and property as witnessed in two instances of damage to houses from flying stone. Mjaria (1997) uncovered unconfirmed reports that vendors are engaged in the illegal importing
of explosives, smuggling and transporting them via public vehicles putting other travellers at risk of unintended explosions.

2.7.1 GROUND VIBRATION

Ground vibration from explosions in small-scale artisanal quarries can be a disturbance to nearby residential properties. However, project documentation did not highlight this as a particular problem in either Kenya or Goa.

2.8 LAND SUBSIDENCE

Stone quarrying can cause land subsidence but like ground vibration, evidence of this was not reported in the Kenyan and Goan case studies.

SECTION THREE: ENVIRONMENTAL RECOMMENDATIONS

Reports produced for this project have been damning of the environmental management at small-scale artisanal quarries in both Kenya and India. In equal measure, they also propose solutions to the current situation. This section synthesises the environmentally associated recommendations of the various reports from Kenya into four categories. The first group are policy and regulatory recommendations. The second set of guidelines relates to the licensing arrangements for small-scale stone quarries. The third set of recommendations looks quarrying methods. The fourth group address environmental management issues and the final set of recommendations feature environmental training and awareness raising.

3.1 POLICY AND REGULATORY RECOMMENDATIONS

- Extend the mining act to cover the extraction of other building materials such as sand, clay and concrete blocks to ensure sustainable quarrying (TDR workshop, 1998)
- Renew all provisions of law relating to the environment and strengthen them (TDR workshop, 1998)
- Involve all stakeholders, including local communities, in the formulation and implementation of environmental policies (TDR workshop, 1998)
- Enact appropriate environmental legislation, standards, management objectives and priorities to reflect environmental and development context in which they apply (TDR workshop, 1998)
- Build an institutional framework for the implementation of standards (TDR workshop, 1998)
- Clarify specific roles and co-ordination between different agencies to avoid conflict in enforcement of environmental laws (TDR workshop, 1998)
- Build capacities at the district levels to ensure implementation, monitoring and evaluation are realised (TDR workshop, 1998)
- Enforce the rehabilitation of quarry sites (TDR workshop, 1998)
3.2 LICENSING ARRANGEMENTS

- The number of licenses issued on one site should be limited so as to avoid congestion resulting in under exploitation of reserves (Artisanal Quarrying Stakeholders' Workshop, 1997).
- Landowners should seek approval from the District Environmental Officer before they lease their land for quarrying (Artisanal Quarrying Stakeholders' Workshop, 1997).
- Private land owners must have title deeds and produce them to verify land ownership before entering into any agreement to lease the land (Artisanal Quarrying Stakeholders' Workshop, 1997).
- Only those experienced in quarrying should receive licenses (Artisanal Quarrying Stakeholders' Workshop, 1997).
- Licensees must manage the quarry rather than be absentee licensees (Artisanal Quarrying Stakeholders' Workshop, 1997).
- The issue of rehabilitation of the land should be addressed in the lease agreement (Artisanal Quarrying Stakeholders' Workshop, 1997).
- Licensees must refill the holes after quarrying and plant trees.
- Tree seedlings should be provided by the government for quarries on government land.
- The license agreement should stipulate who provides the trees for quarries on private land.
- Where the landowner wishes to cultivate the land instead of planting trees, the tenant should only fill the hole.

3.2 RECOMMENDATIONS ON QUARRYING METHODS

- Technologies and methods should be improved so that they are user and environment friendly (TDR workshop, 1998).
- Methods that are less wasteful should be adopted. Traditional benching should be adopted and improved with a view to replace blasting to reduce waste volumes (Mjaria 1997).
- Methods of cutting stone (possibly by saw) instead of blasting should be investigated to reduce the toxicity of the explosive dust and accidents associated with blasting (Mjaria 1997).
- A further evaluation of blasting practices currently adopted should be initiated with a major explosives manufacturer. It should address the positioning of drilled holes to take account of burden and spacing, variations in rock strata / characteristics and the need to reduce fragmentation. This will influence resource utilisation and the productivity of the quarry (Savery, 1997).
- Licensees should use trained blasters only to ensure safety at mines (Artisanal Quarrying Stakeholders' Workshop, 1997).
• A database should be created on environmental issues, such as effective quarrying tools, etc. (TDR workshop, 1998)

3.3 Environmental Management Recommendations

• Environmental degradation should be minimised through the application of Environmental Impact Assessment (EIA) and EnTA on all quarry prospects (TDR workshop, 1998)

• Baseline data should be used benchmarks for assessing improvement in environmental performance (Savery, 1997)

3.4 Environmental Training and Awareness Building

• Management training seminars should be established with the emphasis on pre-planning, productivity, environmental responsibility, and the health and safety of the workforce (Savery, 1997).

• Environmental seminars should be held to provide employee awareness and training (Savery, 1997)

• Quarry owners should be encouraged to see the value and merit of a strong trade association (ASTA). This trade association should then be used to channel environmental initiatives within artisanal operations (Savery, 1997)

• An institutional set-up should be the facilitated (Mjaria, 1997)

• Co-operation should be sought from best practice quarries for use as blueprint models (Savery, 1997)

• Workers should be sensitised on safety at work (Mjaria, 1997)

• Workers should be encouraged to use protective clothing, hats/helmets, industrial boots and dust masks (Mjaria, 1997)

• Avenues of encouraging quarry workers to wear protective clothing should be investigated. The cost should be covered by employers, as stated in relevant laws (Mjaria, 1997)

In an analysis of the documentation, there appears to be three main elements to the environmental management of the small-scale artisanal quarrying in developing countries. The first is a policy issue and relates to the way in which small-scale stone quarrying is viewed by the state. Part of this encompasses the regulatory framework in which the industry operates, for example, licensing arrangements. However, it also encompasses the assistance or lack of assistance given by the state to the promotion of the industry. This aspect is briefly analysed here but a more thorough examination of quarrying policy can be found in an associated paper by Ruskulis (1999). The second aspect is a technical issue and relates to the tools and technologies used in the quarrying process. This issue, highlighted in the recommendations above, is explored in depth in another paper prepared for this study (Uglow, 1999) and so is not broached here. Thirdly, there are the issues of environmental management, contained within which are appropriate training and awareness measures. It is the issue that is taken up by this paper most fully.
4.1 National Quarrying and Environmental Policy

As made explicit in Section one of this paper, there are currently few or no regulations that relate to artisanal stone quarrying in Kenya. Meanwhile, India faces inappropriate mining legislation and environmental degradation (Dhar, 1997). While proposed amendments to the mining act in Kenya may herald a change, the need for national planning in relation to small-scale quarrying is apparent at every turn. In respect of the environment, some areas that a National Minerals Policy, with an integrated mining and environment plan, might address are: local level planning controls, identifying sensitive land where quarrying operations should be limited or prohibited, improving licensing arrangements, regulating against bad environmental practice at small-scale quarries and in surrounding areas, for example, road transportation. An enlightened National Minerals Policy might also put in place systems whereby money collected from leases and royalties could be partly used for environmental purposes, such as for the restoration of abandoned operations. For example, in Ghana, widely acknowledged as a leader in the promotion of small-scale mining enterprises, new laws relating to small-scale mining have allowed for the collection of mining revenues to support the institutional framework.

Unfortunately, the imposition of regulatory controls may not prove as effective as government legislators may hope, especially where institutional capacity for regulatory enforcement is low. Mjaria (1997) concludes that a framework through which safety, health and environment management regulations can be enforced is lacking. This is responsible for the laxity and the "don't care" attitude displayed by the workers and the quarry owners towards occupational health and environmental management. Quarrying enterprises that are economically vulnerable might become unviable if high level of environmental measures were imposed. However, given the current inability of the badly under-resourced and over-stretched enforcement agencies in both Kenya and India, new regulatory measures may merely lead to an increase in the level of illegal quarrying; sanctions are not easily enforced on small-scale enterprises because of their greater number and lesser visibility. Illegal quarrying is by its nature difficult to regulate and itself an obstacle to implementing positive environmental measures. Thus, improving and toughening environmental may have a counter intuitive effect. This is completely against the perceived wisdom of the United Nations who believe that artisanal mining should be legalised and formalised to promote its growth.

'A legal framework that recognises the existence and characteristics of small-scale and artisanal mining is a pre-requisite for its formalisation and for limiting negative impacts' (United Nations, 1994:223).

Insufficient capacity within regulatory agencies is also be dangerous, as local or national government officials may not have sufficient knowledge of the environmental impact assessment. This may and has resulted in quarries being closed down on environmental grounds without any true basis of assessing how much environmental damage a particular quarry is causing.

---

5.1 Environmental Management Systems in North America and Europe

North American and European firms now typically manage their environmental impact through environmental management systems. The environmental management system presents a structured and systematic way of recognising, dealing with, and minimising the environmental damage that can
result from a firm's activity. Although some companies have chosen to develop their own system of management based on an existing management framework, many have opted for compatibility with either a nationally or internationally recognised standard system, such as, BS 7750 (a British standard), the European Eco-management and Audit System (EMAS) or ISO 14001 (an international standard). Accreditation to such a standard confers credibility with the industry and beyond, for example, to suppliers, buyers, end-product customers and governments.

- Within each system, it is possible to identify the basic stages of an organisational environmental management system. These are summarised below:
  - A policy statement indicating commitment to environmental improvement and conservation and protection of natural resources.
  - A set of plans and programmes to implement policy within and outside the organisation.
  - Integration of these plans into day to day activity and into organisational culture.
  - The measurement, audit and review of the environmental management performance of the organisation against policy, plans and programmes.
  - The provision of education and training to increase the understanding of environmental issues within the organisation.
  - The publication of information on the environmental performance of the organisation (Gilbert, 1993).

Effective environmental management is concerned with continually monitoring and reviewing practices to minimise environmental impact and improve performance. It has been argued that for environmental management systems to be effective they need to be part of a stricter legislative climate (Netherwood, 1996). However, regulation is not the only determinate of success. One common factor to emerge from studies of environmental management systems in operation is that success can depend on the degree of integration of environmental management responsibility and the level of commitment. The suggestion is that environmental management is as much a philosophical exercise as a practical one. RGB Mining, as an example, cite success being dependent on a feeling of commitment, a sense of ownership and an ability to accept the principles of environmental management.

Tangible elements of success are also, however, evident. Environmental management is people specific. An effective system relies on specific personnel assuming responsibility to monitor, evaluate, report and act on designated areas. For example, specific people should be responsible for compliance with discharge contents or for the margins of deviation during blasting. This human resource is invaluable to the effective management of any system.

The second element of success within an EMS is site specificity. No two mining/quarrying sites are identical. Therefore, while generic systems can provide guiding principles, the operational detail must be determined at site level. This gives the freedom to mine managers to implement environmental management in a manner most suitable for their site. An analogy can be drawn here between the regulatory regimes of command and control and market-based incentives. Research has shown that the market-based approach, that allows firms to choose their technological and management approach, achieves the most effective reductions in pollution. By contrast, where technology is specified, innovative capacity within the firm and industry is stifled.
5.2 THE 'EMS' AND SMALL-SCALE ARTISANAL QUARRYING

5.2.1 LESSONS TO TRANSFER

The implication of European and North American studies for smaller scale operations are that the mechanisms of change are transferable. Change is as much dependent on the human resource and its familiarity with site specifics as it is with structured management systems and technological advancement. Consequently, environmental change can, in large part, be addressed through education and training. However, the current climate in which small-scale quarrying operates is not entirely conducive to education and training. If it is possible, it has to start from a very low base. Savery (1997) states that, in the Kenyan case, there is little evidence of management in the relaxed informal work environment of an artisanal quarry. It is, therefore, no surprise that the practice of environmental management appears to be practically non-existent in these quarries. This is in part because there is very little management environmental sensitivity or general environmental awareness within the industry. For example, results from the Kenyan case study indicate that 50 percent of quarry workers and 41 percent of concession holders were found to be unconcerned with environmental issues, see table two (Mjaria, 1997). The level of apathy towards environmental concerns within the quarrying sector is further illustrated by the finding that 91 percent of quarry workers and 53 percent of concession holders do not consider it their responsibility to restore the land after quarrying, although in one area, quarry owners had identified a site for putting up a tree nursery.

An environmental impact assessment during the planning and operation of a quarry has the potential to reduce environmental damage and allow potential problems to be anticipated. Some of the reports recommend that, for each site, an environmental monitoring system facilitating compliance with standards or legislation be established. In this way a detailed environmental audit could be conducted for each project intervention (Agevi, 1997). Similarly, Savery (1997) recommends that for each quarry there should be set of rules specifying safe and efficient practices expected at the site. The implementation of good environmental practice should be a component of these rules. However, quarry owners and operators have been shown to have a very low awareness of environmental issues. Without awareness of the issues, there is no sensitivity, and consequently environmental management systems, even if in place, will likely fail. Indeed, one of the conclusions of the Kenya case studies was that the artisanal stone quarry workers are characteristically conservative in attitude and are rigid to change. When combined with a complete lack of framework available for the enforcement of environmental regulations it is not surprising that workers and quarry owners display a lax and uncaring attitude towards environmental management.

Table Two. Top environmental concerns of quarrying groups

<table>
<thead>
<tr>
<th>Main concerns</th>
<th>Quarry workers</th>
<th>Concession holders</th>
<th>Land owners</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deforestation in the forest area</td>
<td>37</td>
<td>6</td>
<td>See footnote7</td>
</tr>
<tr>
<td>Land degradation</td>
<td>9</td>
<td>47</td>
<td>100</td>
</tr>
<tr>
<td>Noise from blasting</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Sun &amp; dust</td>
<td>-</td>
<td>6</td>
<td>-</td>
</tr>
<tr>
<td>Unconcerned by environmental issues</td>
<td>50</td>
<td>41</td>
<td>-</td>
</tr>
</tbody>
</table>

Source: Mjaria (1997:24)
quarries that fill with water support noxious weeds and pests such as mosquitoes. The mechanical crushing and screening in quarries creates noise and dust, which provides health hazards. Workers and those living near the quarries who suffer from allergic discomforts view dust and explosive powder as a major environmental concern in the Kenyan case. Savery (1997) found that the results of a participative study on the impacts of a road constructed in the early 1990s and its attendant quarry had made the National News. The major concerns in the study were that

- Noise pollution from quarry blasting just 15 metres from houses
- Respiratory diseases caused by excessive dust from screening and crushing activities
- Chest and skin infections from the ammonium nitrate fuel mix used in blasting
- Effects of above on livestock
- Blasting disrupting river and spring fed water sources
- Structural blast damage to houses

This case illustrated the incompatibility of noisy, dusty and dangerous development with residential areas. Had land use policies been in force, the existence of a quarry so close to a residential area would not have occurred. It also showed the short-sightedness of development without public consultation.

Public pressure can and is likely to be increasingly important factor in the development and implementation of environmental legislation in developing countries. For example, in Kenya, in 1994, the Government closed down several quarries because of complaints about blasting disturbances from nearby homeowners. Licenses were revoked and alternative sites were provided thus illustrating the power of public pressure. To respond to this pressure the artisanal quarrying industry should become pro-active in the environmental field rather than seeking change by imposition of public and regulatory control. As with the promotion of environmental training, the establishment of a trade association is seen as vital to articulate the interests of quarry owners so that they can respond proactively to government proposals on the environment.

5.4 Site Restoration

One aspect of quarry management that the industry should address forthwith is the restoration of abandoned quarries. The backfilling of worked out sections of quarries during the quarry life reduces environmental damage and the scale of the recovery operation necessary on cessation of quarrying. In the Kenyan case, landowners address land degradation issues in different ways. In the Njuri quarries land owners intended to flatten the land as soon as their quarries were exhausted and sell it to housing developers. At the Ngong and Ongata private quarry, owners were in the process of refilling their quarries with quarry chippings and overburden. In one case, a landowner was not selling chippings. Instead, he was using them to reclaim the land. In another example, quarry pits were being used as a dumping ground for excavated black cotton soil from nearby construction sites. A long term Government of Kenya strategy is backfill pits to increase the quality of trees within a forest. The backfill increases the depth of the rock level, which allows for increased seepage and the deep rooting of trees. A successful pilot scheme in carried out by the Forestry department in Kenya has made license holders responsible for ensuring that they refill their quarries after operation.
Landowners and quarry operators need to agree on after care responsibility for the quarrying site. This does not stop after some immediate and remedial restoration and tree planting after cessation of quarrying. For example, as mentioned earlier, in Kenya, 53 percent of concession holders and 90 percent of workers do not consider it their responsibility to restore the land after quarrying. They feel that it is the landowner’s responsibility. For landowners, unanimously, their principle environmental concern was land degradation. Due to poor site rehabilitation measures in many areas of quarrying, in both Goa, India and Nairobi, Kenya, there is a need to initiate restoration and tree planting schemes on already disused quarries.

Box One. A Kenyan case of good site restoration

A fully rehabilitated quarry demonstrating many good environmental practices was found on private land at Ongata Rongai on the outskirts of Nairobi. The quarry, larger than average at 500 by 200 feet, was on sloping land that rose from a stream. Stone extraction by the land-owning quarry operator began in 1982. Extraction began on the lower slopes and as it progressed up the hill, the lower reaches were levelled in terraces using surplus reject stone. Soil was then replaced and crops and trees cultivated using irrigation water from the stream. The practice of this quarry owner was most admirable but circumstances suggest that this was an atypical case. Firstly, the operator owned the land, secondly, the land was purchased for farming and the owner’s intention was to revert the land back to agricultural use, and thirdly, the presence of the stream offered the potential for irrigated agricultural use and so increased the value of the land. (Wells, 1998)

This paper has examined the environmental recommendations that have emerged from project documentation in both Kenya and India. It concludes that alongside an appropriate regulatory framework and in conjunction with appropriate technology, artisanal small-scale quarries need to improve their overall environmental management. Specifically, they must respond to increasing public concern over their environmental impact. They must improve their operational practices and their site remediation measures. However, the industry needs to go further, other measures are needed for reducing dust, controlling waste stone tipping, improving the efficiency of transport, increasing the protection of water courses and screening quarry operations from populated areas besides. Environmental management systems are seen as an answer to these problems where environmental impact assessments, benchmarking, indicator development and environmental audits all have a role to play. However, the key lesson learned from similar transformation processes in North American and European environmental management systems is that environmental management is about people, their awareness, their motivations and their commitments. Given the low level of environmental awareness and poor training of most within the small-scale artisanal sector, these issues must be first addressed before the imposition of EMSs and their associated tools. The paper recommends that these issues be addressed through the provision of training by external agencies and through strengthened quarry worker and owner associations.


2 Central Act 67 of 1957.

3 For further information on Indian legislation regarding mining please see Noronha (1998).

4 This section draws exclusively on Noronha (1997).
5 See appendix one.

6 This section draws exclusively on the scoping paper of Thomas and Warhurst (1997).

7 The government forest officer does not consider quarrying to have a negative impact on forestation in the Ololua Forest. He argues that the bedrock is very close to the surface in the forest making it difficult for trees to have deep roots. Therefore, quarrying and subsequent backfilling, by breaking up the subsurface, is expected to increase seepage and improve on the health of the trees.

REFERENCES


Uglow, D. 1999. Optimising resource utilisation in artisanal stone quarrying the development and dissemination of appropriate and sustainable extraction and processing technologies. Paper prepared for ITDG/DFID small-scale quarrying project.


Provisions under the *Forest Act*, 1980 as they affect mining operations:

- Mining, including underground mining, is a non-forestry activity. Therefore, prior approval of the central Government is essential before a mining lease is granted in respect of any forest area. A renewal of an existing mining lease in a forest area also requires prior approval of the Central Government. The respective States of the Indian Union should send the proposals for renewal of mining leases at least six months before the dates of expiry of the existing leases.

- All mining projects involving diversion of more than 20 hectares of forestland shall require clearance from the environmental angle.

- All proposals involving diversion/dereservation of forest land up to 20 hectares and proposals for clearing naturally grown trees in the forest area or portion thereof shall be sent by the concerned State/Union Territory Government to that regional office of the MOEF under whose territorial jurisdiction the area falls.

- The Conservator of Forests of the concerned regional office shall be competent to clear all proposals involving diversion/dereservation of forestland up to 5 hectares except in respect of proposals for regularisation of encroachments and mining (including renewal of mining leases). Thus, all such proposals pertaining to mining need clearance from the MOEF.

- Extraction of minor minerals like boulders, stone, shell, etc. from the riverbeds shall not be permitted if the riverbed fall under national park or a wildlife sanctuary unless such extraction is for the benefit of forest or wild life.

- Extraction of minor minerals shall be from the middle of the riverbed after leaving one fourth of the riverbed or each bank untouched.

- Forest area that is required for safety zone for mining operations should not be part of the forest area proposed for diversion. However, it should be indicated separately in the proposal. Such area will have to be fenced at the cost of the project authority. Further, project authority will have to deposit funds with the Forest Department for the protection and regeneration of such safety zone area. They will also have to bear the cost of afforestation over one and half times of the safety zone area in degraded forest elsewhere.

- Compensatory afforestation is one of the most important conditions stipulated by the Central Government while approving proposals for diversion/dereservation of forest land for non-forest uses. Compensatory afforestation shall be done over equivalent area of non-forest land. However, compensatory afforestation may be raised over degraded forestland twice in extent of the forest area diverted/dereserved in a few cases including extraction of minor minerals from riverbeds.

(Noronha, 1998)