Indicators Assessment of Social Impact Study in the Quarrying Industry: Experience at Bukit Lagong, Selangor Darul Ehsan

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ABSTRACT

This paper arises from a consultation work conducted from August to October 2007 with the Department of Minerals and GeoScience, Malaysia regarding the social impact study of the quarrying industry in the Bukit Lagong area, Selangor Darul Ehsan. The quarrying industry plays a major role in the development of the country by providing the materials needed in the foundation and construction of infrastructure such as roads, highways, commercial and residential buildings. However, the Quarry Resource Planning for the State of Selangor, Kelantan, Terengganu, Sabah and Sarawak under the Eighth Malaysia Plan pointed out some main issues affecting the quarrying industry. One of them is the need to ensure that quarrying is carried out in a safe, environmentally friendly and sustainable manner. This is in deed true for quarries operating close to urban areas such as in the case of the Bukit Lagong area. The objective of the study is to assess the perception of communities close to quarry sites with regard to the quality of environment (dust, water and noise), road safety, blasting effect, condition of roads, personal and family health. Information was gathered through a sample survey of 334 households based on questionnaire that consists of close and open-ended questions and direct observation by the research group. Analysis on the perception was done through frequency counts (percentages) and tabulation. The highest implications from each issue gathered from the respondents are: damages to roads (potholes, uneven roads, surface of roads being stripped, etc) – 90%, driving attitudes of lorry drivers – 85.2%, high risk of road accidents (related to driving attitude, heavy traffic) – 84.8% and dust / airborne particles from moving lorries and dusty roads (paved & unpaved) – 79.4%

Keywords: *Quarry operations, social impacts, social responsibilities*

Introduction

The quarrying industry has significant positive and negative impacts. Some positive impacts are its contribution to economic development of the country by providing the materials needed in the foundation and construction of infrastructure such as roads, highways, commercial and residential buildings and creating employment opportunities. The negative impacts are mostly environmental related such as air, water and noise pollution. Studies done during the Industrial Mineral Project (Quarry Resource Planning for the State of Selangor, Kelantan, Terengganu, Sabah and Sarawak) under the Eighth Malaysia Plan pointed out some main issues affecting the quarrying industry. One of them is that quarrying should be carried out in a safe, environmentally friendly and sustainable manner. The quarrying industry also has a desire to promote a 'clean and friendly' image of the industry.

The Bukit Lagong area, situated in Sungai Buloh, is under the jurisdiction of the Majlis Perbandaran Selayang and a small portion under the Majlis Bandaraya Shah Alam. It has six aggregate quarries located side by side on the hill slope of the Bukit Lagong Forest Reserve. They are currently operating with close proximity with residential areas. It is estimated that 1000 to 2000 lorries carrying loads of gravel travelled on the same roads with local residents everyday except on Sundays and public holidays. Grievances from the public have been reported in

television news and newspapers. The Department of Minerals and Geoscience initiated a social impact study under the Ninth Malaysia Plan to assess the perception of communities close to quarry sites with respect to the quality of environment (dust, water and noise), road safety, blasting effect, road condition and personal health.

The objective of the social impact survey is to provide a basis for a sustainable management policy and plans for the future development of the quarrying industry at the Bukit Lagong area. More specifically, the survey attempts to:

i. determine the level of concerns of the people with regard to environmental and social impacts from quarry operations.
ii. highlight community's expectations regarding social responsibilities of quarry operators and relevant authorities.
iii. determine the level of awareness among the residents regarding positive aspects of the quarrying industry
iv. recommend certain mitigation measures that would reduce the environmental and social impacts to within acceptable limits.

Definition of Terms

Social Impact Assessment / Study

'Social Impact Assessment/Study includes the processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions. Its primary purpose is to bring about a more sustainable and equitable biophysical and human environment'(Vanclay, 2003).

'Social Impact Assessment overlaps substantially with the current interest in monitoring and evaluation (M&E). M&E is carried out after a project or development has gone ahead, to assess impacts and to see how well its goals were met'(Wikipedia.com, 2007).

Social Impacts

The International Association for Impact Assessment has listed the following social impacts in their publication 'International Principles for Social Impact Assessment, 2003':

i. people's way of life – that is, how they live, work, play and interact with one another on a day-to-day basis
ii. their culture – that is, their shared beliefs, customs, values and language or dialect
iii. their community – its cohesion, stability, character, services and facilities
iv. their political systems – the extent to which people are able to participate in decisions that affect their lives, the level of democratisation that is taking place, and the resources provided for this purpose
v. their environment – the quality of the air and water people use; the availability and quality of the food they eat; the level of hazard or risk, dust and noise they are exposed to; the adequacy of sanitation, their physical safety, and their access to and control over resources
vi. their health and wellbeing – health is a state of complete physical, mental, social and spiritual wellbeing and not merely the absence of disease or infirmity
vii. their personal and property rights – particularly whether people are economically affected, or experience personal disadvantage which may include a violation of their civil liberties
viii. their fears and aspirations – their perceptions about their safety, their fears about the future of their community, and their aspirations for their future and the future of their children.

Sustainable Development

'*Sustainable development is a socio-ecological process characterised by the fulfillment of human*

needs while maintaining the quality of the natural environment indefinitely. The most often-quoted definition of sustainable development is the development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs. The field of sustainable development can be conceptually broken into three constituent parts: environmental sustainability, economic sustainability, social-political sustainability'(Wikipedia.com, 2007).

Quarry Operations

Operations at quarry sites from stripping of overburden, drilling and blasting, excavation and haulage, crushing and screening, and transporting quarry products to customers.

Research Methodology

The degree of impact from quarry operations at the residential areas is different from one another depending on their location and their closeness to quarry sites. While some residential areas are affected by air and noise pollution and vibrations from rock blasting, other residential areas are more concerned on movement of lorries, road congestion and road safety. Due to this reason, the sampling is done by selecting respondents from every residential area, thereby, making the sample to be more representative of the population. The household survey approach was employed on the basis that the impact from quarry operations will affect the household living in the same house as a single unit. The information collected from the head of the household or its representative will reflect the views and perceptions of the other family members. Since the sampling frame, that is, the list of all the residents in every neighbourhood was not possible; area sampling was used in this survey. This sampling method is suitable when the goal of the research is confined to a particular locality or area (Sekaran, 2003).

The method of data collection was by personal interviews conducted by enumerators from UiTM Pahang and information was obtained through a structured questionnaire that consists of demographic information, perceptions on quality of life with regard to the environment (air and water, the level of hazard or risk, dust and noise residents are exposed to, their physical and property safety, their health and wellbeing), perceptions on the positive contribution of quarrying industry in the nation's development, the perception on the social responsibilities that have been implemented by quarry operators and related agencies and the avenues on dissemination of complains regarding quarry operations. Data analysis to close-ended and Likert scale questions was done by frequency counts to determine the percentage of respondents who perceived to be significantly affected by quarry operations at the Bukit Lagong area. Responses to open-ended questions were also summarised in the recommendations.

Demographic Profile

A total of 334 respondents were selected from ten residential areas and the surrounding communities according to the following proportion: Taman Matang Jaya (18.6%), Taman Impian Indah (9.6%), Kg. Matang Pagar (11.4%), Kg. Orang Asli (7.5%), Taman Sri Putra I (3.9%), Kg. Setia (11.1%), Perumahan Kos Rendah (15%), Kg. Sri Indah A (6.6%), Kg. Sri Indah B (14.7%) and Taman Desa Bukit Indah (1.8%).

The population of the residential areas is predominantly Malays. Based on this situation, the respondents selected were 86.2% Malays, 7.2% 'Orang Asli', while Chinese and Indian constitute 3.3% of the respondents. In terms of gender, 66.8% of the respondents were males and 33.2% females. The study employed the household survey approach, whereby most of the head of the household are males.

The distribution of the respondents with respect to their monthly household income were 36.8% with less than RM 1000, 32.3% earning between RM 1001 to RM 2000, 16.5% between

RM 2001 to RM 3000 and 14.5% with more than RM 3001. The survey found out that 83.8% of the respondents were living in their own house while another 16.2% of the respondents were renting. Based on this ownership factor, the percentage of residents who intend to live in the area for the rest of their live is higher (67.4%) compared to those who would transfer or uncertain about the future.

Community Perceptions and Preferences

Analysis on the degree of the negative impact of the quarry operations perceived by the community was done by determining the proportion of respondents, who agree or strongly agree that they are badly affected by certain issues arising from quarry operations. Issues with a percentage of more than 70% of the respondents who feel they are badly affected is considered to be of high concern, 40% to 70% being moderate and less than 40% being of low concern.

Community Perceptions on Air Pollution

Three sources that contribute to the deterioration of air quality are emissions of dust or airborne particles from quarry operations within the quarry sites but were blown by wind and reached the residential areas, emissions of smoke from machines within the quarry sites and emissions of dust and smoke from lorries that passed through the area daily. The results are shown in Table 1 (Residential areas in grey are perceived to be affected by five quarry operations and residential areas in blue are perceived to be affected by one quarry operation).

The study shows that in general, the most serious concern regarding negative impact to air quality is the emission of dust and smoke from lorries that passed through the area and the airborne particles from dusty and unpaved roads (70.7%). The residential areas perceived to be highly affected by this issue are Taman Impian Indah (96.9%), Taman Matang Jaya (96.8%), Taman Sri Putra I (92.3%), Kg Matang Pagar (76.3%) and Kg Setia (73%).

The overall concern for emission of dust from quarry operations at quarry sites and smoke from machines within the quarry sites are less serious (37.7% and 34.7% respectively). Nevertheless, residents from Taman Matang Jaya, the closest residential area to the quarry sites where the residents could see or hear the quarry operations, expressed high concern with the two issues that reduces the air quality (90.3% and 90.3% respectively). Wind direction plays and important role in bringing dust to their homes.

It should also be noted that two out of three residential areas situated close to only one quarry operation (Hanson Quarry), were perceived to be moderately affected by air pollution due to movement of lorries and dusty roads. (Kg. Sri Indah A – 68.2% and Taman Desa Bukit Indah – 66.7%). The other issues were of low concern to the residents.

Table 1: Proportion of Respondents Perceived to be Badly Affected by Quarry Operations with regard to Air Quality

Air Quality Issues	(Number of Respondents) / Percentage										
	Taman Matang Jaya	Taman Impian Indah	Kg Matang Pagar	Kg Orang Asli	Taman Sri Putra I	Kg Setia, Kuang	Pe-rumahan Kos Rendah	Kg Sri Indah A	Kg Sri Indah B	Tmn Desa Bukit Indah	Over-all
	n=62	n=32	n=38	n=25	n=13	n=37	n=50	n=22	n=49	n=6	334
Dust pollution from operations at quarry sites	(56) 90.3	(16) 50.1	(16) 42.1	(11) 44.0	(6) 46.2	(1) 2.7	(1) 2.0	(5) 22.7	(13) 26.5	(1) 16.7	(126) 37.7
Smoke from machines at quarry sites	(56) 90.3	(10) 31.3	(22) 57.9	(6) 24.0	(2) 15.4	(2) 5.4	(4) 8.0	(5) 22.7	(9) 18. 4	(0) 0.0	(116) 34.7
Dust pollution from lorries & dusty roads	(60) 96.8	(31) 96.9	(29) 76.3	(14) 56.0	(12) 92.3	(27) 73.0	(31) 62.0	(15) 68.2	(13) 26.5	(4) 66.7	(236) 70.7

High Concern | Moderate Concern | Low Concern

Table 2: Proportion of Respondents Perceived to be Badly Affected by Quarry Operations with regard to Noise Pollution

Noise Pollution Issues	(Number of Respondents) / Percentage										
	Taman Matang Jaya	Taman Impian Indah	Kg Ma-tang Pagar	Kg Orang Asli	Taman Sri Pu-tra I	Kg Setia, Kuang	Pe-rumaha n Kos Rendah	Kg Sri Indah A	Kg Sri Indah B	Tmn Desa Bukit Indah	Over all
	n=62	n=32	n=38	n=25	n=13	n=37	n=50	n=22	n=49	n=6	334
Noise from machines within quarry sites	(60) 96.8	(11) 34.4	(7) 18.4	(12) 48.0	(3) 23.1	(0) 0.0	(4) 8.0	(2) 9.1	(9) 18.4	(0) 0.0	(114) 34.1
Noise from blasting (explosion of rocks)	(56) 90.3	(13) 40.7	(5) 13.2	(7) 28.0	(3) 23.1	(0) 0.0	(4) 8.0	(1) 4.5	(9) 18.4	(3) 50.0	(101) 30.2
Noise from lorries	(57) 92.0	(24) 75.1	(16) 42.1	(4) 16.0	(3) 23.1	(36) 97.3	(17) 34.0	(17) 77.2	(12) 24.5	(1) 16.7	(187) 56.0

High Concern | Moderate Concern | Low Concern

Community Perceptions on Noise Pollution

Noise is a nuisance factor arising from machines operating within quarry sites and plants such as hydraulic excavator, jaw and cone crusher and conveyors. Improper blasting techniques or excessive use of explosives and engine sound from lorries passing through residential areas are major contributors of sound pollution. The findings from the survey are shown in Table 2 above. The study indicates that, in general, noise pollution from the sound of lorry engines is of moderate concern to residents (56%) while noise from machines operating within quarry sites and explosion of rocks are of low concern to the residents. Nevertheless, respondents from Taman Matang Jaya, voiced very serious concerns with noise pollution from machines at quarry sites, rock blasting and sound of lorries passing through (> 90%). This is not surprising since there is no buffer zones whatsoever to separate between Taman Matang Jaya and the nearest quarry.

Noise from lorries is also a major concern to residents at Taman Impian Indah (75.1%), Kg Sri Indah A (77.2%) and Kg Setia (97.3%). There is a moderate concern on noise from quarry operations within quarry sites for the residents at Kg. Orang Asli (48%) where one of the quarries is within sight.

Community Perceptions on Hazards to Individuals and Properties

The other issue examined is the potential hazards to residents and damages to properties due to flying rocks, blasting vibrations, accidents between lorries and other pedestrians, road damages due to weight of lorries on roads, and the effect of dust on machines, furniture and appliances. Referring to Table 3, it is observed that, in general, residents at the Bukit Lagong area were highly concern with three issues, namely, high risk of accidents between lorries and other pedestrians (80.5%), the driving attitude of lorry drivers (81.4%), and lorries causing damages to roads such as potholes and uneven roads (88.9%). Other issues that were viewed moderately are dust that gets into houses that affect condition of appliances, furniture, food, personal and family health (67.7%), loads on lorries that are not adequately covered to reduce spills (46.4%), and vibrations from blasting causing cracks to houses and damages to properties (45.2%). Flying rocks from blasting and overloaded lorries seemed to be not of a serious problem.

Analysing the residential areas individually, the study shows that the most affected neighbourhood is Taman Matang Jaya. The residents interviewed were perceived to be highly and moderately affected by all the hazards except for the potential danger of flying rocks from blasting activities even though there is no buffer zone whatsoever to the nearest quarry site. All the residential areas except for Kg. Orang Asli were perceived to be highly affected with poor road conditions caused by the large number of lorries carrying weights of gravel that pass through the area daily. Seven residential areas viewed risk of road accidents, driving attitude of lorry drivers and the effect of dust to their household properties to be a major concern while the other three residential areas viewed them as moderate. Vibrations from rock blasting were perceived to be of serious concern for residents of Taman Matang Jaya (98.4%) and Kg Sri Indah A (77.3%) due to their close proximity with the quarry sites.

Table 3: Perception on the Hazards to Individuals and Properties

Hazards to Individuals and Properties	(Number of Respondents) Percentage										
	Taman Matang Jaya	Taman Impian Indah	Kg Matang Pagar	Kg Orang Asli	Taman Sri Putra I	Kg Setia, Kuang	Pe-rumahan Kos Rendah	Kg Sri Indah A	Kg Sri Indah B	Tmn Desa Bukit Indah	Over all
	n=62	n=32	n=38	n=25	n=13	n=37	n=50	n=22	n=49	n=6	334
Damages to properties / injuries due to flying rocks from blasting	(10) 16.1	(3) 9.4	(2) 5.26	(10) 40.0	(2) 15.4	(0) 0.0	(0) 0.0	(13) 59.0	(15) 30.6	(1) 16.7	(56) 16.8
Vibrations from blasting causing cracks to houses and damages to properties	(61) 98.4	(21) 65.7	(16) 42.1	(14) 56.0	(1) 7.7	(0) 0.0	(0) 0.0	(17) 77.3	(17) 34.7	(4) 66.7	(151) 45.2
High risk of accidents between lorries and other pedestrians	(61) 98.4	(28) 87	(32) 84.2	(13) 52.0	(12) 92.3	(30) 81.1	(42) 84.0	(17) 77.3	(30) 61.2	(4) 66.7	(269) 80.5
Bad driving attitude of lorry drivers	(58) 93.5	(29) 89.9	(34) 89.5	14 56.0	(12) 92.3	(34) 91.9	(38) 76.0	(16) 72.7	(33) 67.3	(4) 66.7	(272) 81.4
Lorries overloaded	(29) 46.8	(17) 53.1	(6) 15.8	(13) 52.0	(5) 38.5	(10) 27.0	(10) 20.0	(8) 36.4	(22) 44.9	(3) 50.0	(123) 36.8
Loads on lorries not adequately covered to reduce spills	(40) 64.5	(10) 31.3	(4) 10.5	(11) 44.0	(10) 76.9	(10) 27.0	(25) 50.0	(13) 59.1	(29) 59.2	(3) 50.0	(156) 46.4
Lorries causing damages to roads (potholes, uneven roads, etc)	(61) 98.4	(31) 96.9	(35) 92.1	(15) 60.0	(12) 92.3	(34) 91.9.0	(43) 86.0	(21) 95.5	(40) 81.6	(5) 83.3	(297) 88.9

High Concern | Moderate Concern | Low Concern

Generalization of the Social Impact Indicators

As shown in Figure 1, with regard to air quality issue, air pollution from lorries and dusty roads is identified to be the most concerned factor by the respondents (79.4%), while 41.6% and 39.7% of the respondents were concerned with the air pollution from quarry operations and smoke from machines at quarry sites respectively.

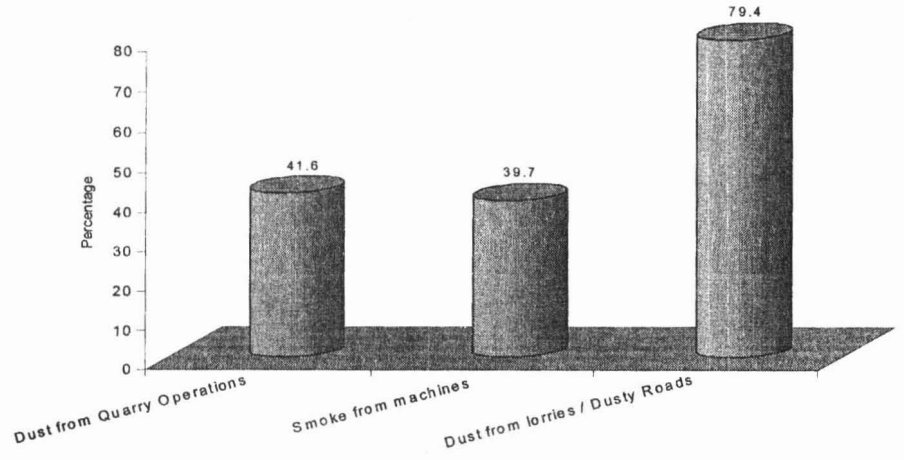

Figure 1: Percentage of Concerned Residents on Air Quality Issues

Sound of engines and movement of lorries passing through residential areas were chosen by 61% of the respondents as a major source of noise pollution. Noise from machine operating within quarry sites and noise from explosion of rocks constitute only 37.7% and 34.2% of the respondents respectively as shown in Figure 2.

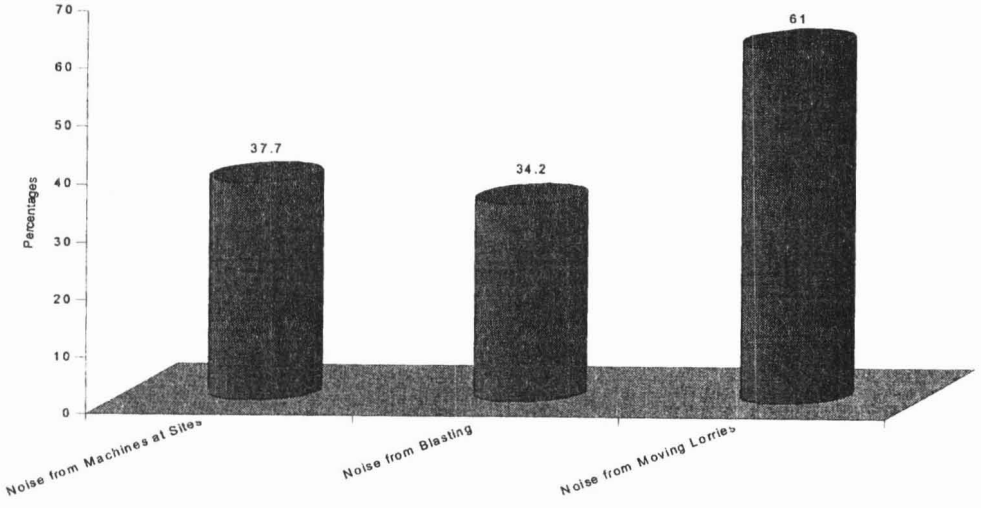

Figure 2: Percentage of Concerned Residents on Noise Pollution Issues

It is observed that more than 70% of the respondents were concerned with bad road conditions caused by lorries carrying loads of quarry aggregates (90%), the driving attitude of lorry drivers (85.2%), high risk of road accidents between lorries and other pedestrian (84.8%) and dust getting into houses thereby affecting proper functioning of appliances, getting into food stores (for example, the canteen of Sekolah Kebangsaan Tamil), and bringing up respiratory problems (72%). Proportion of respondents concerned with vibrations from blasting and causing cracks to buildings is 44% and the concern of lorry loads not adequately covered over spills is 42.8%. The concern over lorries overloaded and flying rocks from blasting are not of major concern since they only comprise 35% and 10.5% of the respondents respectively. Comparisons of the various indicators are shown in Figure 3.

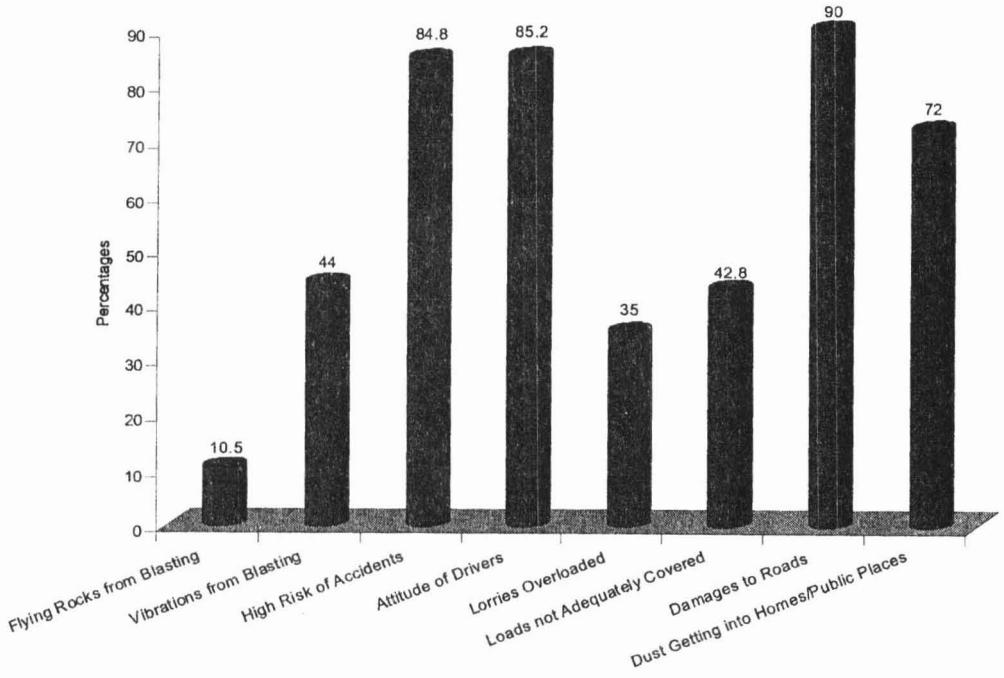

Figure 3: Percentage of Concerned Residents on Hazards to Individuals and Properties

Recommendations

The Report for the Quarry Resource Planning for the States of Selangor, Kelantan and Terengganu conducted by Osborne and Chappel Sdn. Bhd and the States of Sabah and Sarawak conducted by SBA Consultants during the 8th Malaysia suggested that quarry operators should address current problems by implementing measures as follows:

Dust Control

Control emission of dust from quarry operations within quarry sites by using water sprays in crusher plants and installing dust extractors for plant and drilling rigs and control emission of dust from lorries and roads, by wetting and cleaning lorry routes and providing tyre-cleaning facilities.

Noise and Blasting Control

Sitting plant at a judicious location; proper selection of machinery and covering or hooding of equipment would reduce noise control while adoption of controlled blasting techniques and implementing Standard Operational Procedure to improve safety and reduce vibrations controls the blasting effect

Water Pollution

Installing adequately sized silt traps and oil traps and regular maintenance of silt traps

Landscaping Work

Planting trees and having earth/rock bunds to beautify sites and reduce noise and dust pollution. Apart from the recommendations from the 'Quarrry Resource Planning Report', through our observation, discussions with local residents and analysing the open-ended questions, our additional recommendations are as follows:

Environmental Protections

i. Discuss with local authorities to create new lorry routes away from the residential areas and routing traffic away from sensitive areas.
ii. Build heavy-duty roads that need minimal maintenance
iii. Tar lorry routes to avoid dust and airborne particles
iv. Repair road damages to minimise dust and particles emission and avoid accidents.
v. Stop lorries from operating to and from quarry sites during peak hours to reduce potential congestion and safety risk. Peak hours is defined as before schools start in the morning and residents go to work, after schools end in the afternoon, and residents getting back from the workplace in the evening.
vi. Lorries should cover the loads to avoid spills.

Human Rights

i Instil safe driving programme to lorry drivers to educate them and to reduce the number of accidents.
ii Create benefits for the community - Provide job opportunities to affected residents and families. Job opportunities should not be restricted to menial or manual jobs only.
iii Establish community relationships - Dialogue/discussions with residents, organising exhibition and open days to increase public awareness of the importance of the industry and the steps taken to minimize the negative impacts of quarry operations. Identify the tools to communicate such as videos, computer presentations, pamphlets, and field trip to quarry sites.
iv Solicit feedback from the community – listen actively, take notes, ask questions, conduct satisfaction surveys to identify level of grievances and effectiveness of control measure and show true interest in the communication.
v Establishment of 600 meters wide buffer zone to separate the mining activities from the surrounding area.
vi Quarry operators should monitor and control their blasting techniques and process to reduce blasting impacts on the surrounding area even though the explosives meet global and local safety standards.

Corporate Social Responsibilities

i. Guarantee the quality and safety of services and infrastructure by educating lorry drivers in instilling safe driving programs and safe blasting to quarry workers during the operation period.

ii. Monitoring of dust and noise level, vibration during blasting and water discharge should be conducted by an independent body not appointed by quarry operators.
iii. Installing additional street lights to reduce road accidents due to potholes at night.
iv. Contribution to preservation – Reforestation, restoration and rehabilitation, including various methods of restoration that includes re cultivation, for example, planting hedges that are highly biodiversity and sowing a mixture of native shrub and tree seeds on the embankments and by implementing the environment management system.
v. Compensation formula should be devised to take into the consideration the demand from affected residents for the damaged caused by quarry operations, particularly the blasting process.
vi. Provide a positive corporate image by providing community facilities such as recreational facilities and scholarship endowments for children of the affected residents.
vii. Privatization project, for example the building of site and storage facilities could be reserved for local companies or enterprises.
viii. Residents were aware of the quarry existence before buying the house or staying in the area, nevertheless they maintain to reside in the area due to certain reasons: nearby workplace, reasonable house price and promises by the developer that quarries would be closed. However, the report on the Quarry Resource Planning for the State of Selangor suggested a 600 meters wide buffer zone surrounding all current quarry leases should be created. Hence it is recommended that there should be no development in the buffer zone area in the future.

Monitoring

i. Baseline monitoring which may be carried out over seasons or years to quantify ranges of natural variation both environmental and social systems.
ii. Compliance monitoring which aims to check that specific regulatory standards and conditions are met. Action should be taken towards quarry operators for any non-compliance.
iii. Impact and mitigation monitoring which aims to compare predicted and actual impacts and, hence, determine the effectiveness of mitigation measures.

Conclusion

Some of the respondents and non-respondents questioned of what good the survey would bring them as their grievances and complaints through TV, newspapers, politicians, resident representatives and town council for all these years have been fruitless. They acknowledged the importance of the quarrying industry and the fact that the quarries had existed before the residential areas nearby were constructed. But they also have the rights for clean air, free from dust and noise pollution, good accessible roads to their home, no worries of their children who walk or cycle to school and living a healthy life. Follow-up survey should be conducted to identify whether appropriate action has been taken in accordance to the findings and recommendations.

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