

A RESEARCH FRAMEWORK FOR ENVIRONMENTAL QUARRY SYSTEM

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ABSTRACT

Environment is the surroundings in which an organization functions, including air, water, land, natural resources, flora, fauna, humans, and their interrelation. Surroundings in this context extend from within an organization to the global system [1]. The aim of this study is present conceptual framework design for environmental quarry components which are particles, Vibration and Noise (PVN) object. The framework may be useful for environment quarry and practically environmental quarry system in Malaysia.

Keywords: environmental quarry; noise; vibration; particles and dust

1.0 INTRODUCTION

Mining comprises several technologies applied for searching and developing mineral capitals in the beneficial shape for their additional use. Apart from clearly related with mining subversive mining enterprises (hard coal, lignite, metalores, chemical resources), the substances running mining actions likewise contain: open cast mines (hard coal, lignite, metal ores, sulphur, chemical resources), quarries and bore-hole mines (water, mineral waters, natural gas, oil, salt, sulphur). Mining or quarrying of stone and metals was implemented from the pre-historic eras and has been considered important for the improvement of each society, though, continuous removal of the raw material has extensive influences on the setting [2]. Each applied mining technology for slighter or superior grade influences the environment. The scale and type of this influence relies on several conditions namely, geological possessions of the deposit, technical solutions, scale of exploitation, occurrence of issues transporting or limiting the effect and possessions of environmental constituents receptors of that influence. It should be noted apart from strictly mining technologies, in likewise techniques not associated with mining exploitation are applied in mining industry: associated to the enrichment of the presented capitals, their purification, transportation and storage [3]. During the past decade, administrations, universities and investigation components out of several areas that contain fields like biology, medicine, chemistry and geology, have observed an exponential development in digital data existing for knowledge, observing and allocation of the experiences. Additionally, according to review papers, investigators did not inspect PVN as an integrated model. Consequently, the improvement of PVN outline and repository scheme is supposed to be one of the appropriate clarifications that might be considered beneficial regarding the environmental quarry scheme.

I.

2.0 COMPONENT OF ENVIRONMENTAL QUARRY

Dust and Particles

Dust is a generic term applied for describing the fine elements which are suspended in the atmosphere. A variety of clarifications might be found in the previous works, which distinguish several dust features [4]. Based on the International Standardization Organisation (ISO) and British Standard Institute [1], dust considered as small solid units, conservatively under 75µm in diameter, that settle out below their own mass but that might stay suspended for some time. Based on the arrangement of aerosols, dust considered as a solid particle aerosol shaped by the mechanical

breakdown of a parent material, such as started by crushing or grinding. Dust related with mining doings typically happens as a consequence of the disturbance of fine particles resultant from soil or rock. Mine dust is completely dissimilar to related kinds of dusts. In an urban environment, dust derives out of industry, transportation, land clearing and wood burn [5]. The particle dimension is a very significant element as several dust possessions relies it. A dust emissions inventory for quarrying are identified as follow:

- **Drilling:** Drilling operation is usually the case which the drill string passes over an upper unit of the bore, that is cased, and a lower and more lately drilled bore unit that is uncased. While drilling, it is not rare for the bore to intersect developments that cause problems regarding the drilling operator, counting: unstable developments that collapse into the bore; swelling developments that restrict the bore and might trap the drill string in the bore; porous formations that outcome in damage of returning drilling fluid; and fluid-containing foundations that result in uncontrolled movement of gas or liquid into the bore [11]. Blast holes are drilled into the overburden and the mined mineral through applying the drill rigs. In dry circumstances, this drilling process might create noteworthy dust [6].
- **Blasting operations:** Blasting considered as an important component of surface mining; it aids as the leading character in breaking the overburden and revealing limestone and related mineral deposits [7]. Extreme amounts of structural vibration produced by ground vibration out of blasting might cause in injury to, or failure of, assemblies. People can notice vibration at levels much inferior than those needed for making even superficial injury to the most susceptible constructions. Ground vibrations, air blasts and flying rocks are considered as the side effects resultant out of an unsuitably planned blasting operation. Emissions could be made both from the mechanical of the rock pile and from windblown instruments [8].
Handling of Limestone: When the mineral mass was fragmented and released through blasting, it would be loaded into haulage trucks. Frequently haulage trucks of up to 100 tonne volume are applied to remove the mined mineral out of the open pit to the downstream dispensation plant [9]. These processes will cause dust emissions throughout loading, unloading and throughout the transportation of the component out of the pit (from agitation of the road exterior). Material on the bed of the dumper will create dust, over mechanical attrition and windblown act [10].
- **Mineral Processing:** The crushing and screening of the mineral into slighter dimension portions causes dust emissions. A loader and gyratory crusher are frequently applied for the initial crushing of the mineral. Now mechanical act will create the manufacture of a dust and fines.

The crushing and screening of the ore and its following transmission by belt conveyor to main stockpiles will likewise be a possible basis of dust creation [12].

Noise

Noise considered as a subjective notion and named “unfriendly, unwanted, disturbing sound”. Because of that, while the sound is considered as noise differs based on the person. However, it is clear that a high amount of noise might be doubtlessly established as noise by everybody. Industrial noise considered as that type of noise. Also, even if not being troubled through high level of sounds, it is obligatory to be measured due to several destructive physiological and even psychological effects [13, 14]. Several noise quantities in different industrial branches might be come across. However, if measured to be reached extreme noise stages throughout mining processes, in terms of being able for protecting employees’ well-being, noise levels must be completely kept underneath the limit values [15]. Noise pollution is human or machine created sound which disrupts the setting. Nearly all materials found inside a surface mine/quarry setting considers as a media for noise spread, the amount of influence being a function of which medium’s physical and chemical possessions [16]. All the distinguished noise emission bases in quarries and construction sites might be identified as follow:

- Fixed Processing Plant Equipment: Sand/gravel mechanisms include the removal of the material tracked by transportation to the loading area or fixed dispensation plant. Inside the industry, there was an overall transfer away from dredging of sands and gravel to dry working. When any top soils were removed, this merely contains using of one, or more, face shovels (wheeled loaders) removing material out of the toe of the operational face. At some sand and gravel mechanisms, a semi-mobile vibrating screen/stockpiler might be applied near to the quarry face [17].
- Mobile equipment: The commercial general liability (CGL) description of "mobile equipment" is one kind of land vehicle, counting its attached machinery and tools. Ground state considered as one of the most significant concerns to evaluate equipment performance with respect to providing enough bearing surfaces throughout the process of large mobile mining tools. With high cyclic footprint weights, stiffness of oil sand likewise meaningfully alterations with variation in ambient heat [18].
- Transportation: The transfer of aggregate from the quarry or other basis to the point of usage is vital but does extend the environmental consequence by influencing groups in the vicinity of transport routes and organization [19]. The transportation of aggregate out of a source to the point of usage considered as an important mission, but one which might make important

environmental effects. This efficiently covers the environmental consequence of the quarry by influencing communities near transport ways and substructure [20].

Vibration

Vibration considered as an unwanted and significant side products of using the explosives to loosen the rock. The level of vibrations relies on the degree of the seismic energy. To break the rock, there should be a quantity of energy that should surpass the forte of the rock and their elastic boundary [21]. Ground vibrations and air blasts are an essential share of rock blasting and inevitable. Vibrations subsequent from blast processes travel out of the source to the Receiver both over the ground (ground-borne) and air (airborne). Vibrations traveling at adequate speed might cause constructions and assemblies to shake and might even create structural injury. The intensity of vibration has a pivotal role in all kinds of opposing properties. It is very significant for controlling and measuring the shaking with a countless amount of accurateness. Once pressures are made through explosives in a borehole, pressure pulses are made in the nearby ground as the wall of the borehole enlarges and contracts. [7]. There are three key environmental influences made due to the vibration which categorized as below:

- Ground vibrations: Ground vibrations are made through seismic waves travelling over the ground and elastic disturbances that propagate away from the blast basis [22]. This is literally a wave motion which spreads outwards from the blast. These waves are quickly transferred over the solid medium that returns back to the original shape after their passage [8]. The rock mass could be measured to be an elastic medium which is composed of several separate particles [23]. Merely a fraction of explosive energy (20–30%) is applied in the real breakage and displacement of the rock mass. The rest of the energy is missed producing unwanted effects like ground vibrations, AOp, fly rocks, noises, back breaks and over breaks (Hajihassani, 2014).
- Fly rock: Fly rock considered as an individual rock fragments being thrown long distances out of the place by the force of the explosion. Of all the influences, fly rock considered as the most thoughtful concern because of the implications of rock matter being projected from a site, though this is mainly a safety subject and correct blast projects will meaningfully decrease if not totally refute the probability of a fly rock occurrence [24]. Fly rock relates to the uncontrolled dispersion of rock fragments from blast zones produced by explosive energy .There is an affective association amongst three issues, distribution of explosive energy,

mechanical strength of the rock mass, and charge confinement, and any incompatibility amongst these issues might cause fly rock [25]. Once this occurs, much of the explosive energy is applied to throw rock rather than creating disjointed rock. In surface blasting, fly rock caused in several circumstances of injury and property injury.

- Air overpressure: Air overpressure considered as a problem frequently faced through the mining and quarrying industry once extracting minerals out of the exterior through blasting [26]. It is a constituent of blasting that has changed as a controlled element in which is frequently a capital of complaint from inhabitants living in the close area of the mine/quarry. The weight wave that causes air overpressure is made out of the explosion of an explosive charge that then sources the expanding gaseous response to compress the nearby air and transfers it out with a great velocity [27]. The shock wave which is made has a steep shock front that is thoroughly shadowed by a quickly declining pressure. As the nearby air delivers little confrontation to the expansion of the gaseous crops, they carry on increasing and reach pressures lower than the ambient atmospheric weight [28].

3.0 RESEARCH FRAMEWORK

After investigating the existing article of environmental quarry system, considering the main factor for environment quarry and also according to Table 1 that enlists main studies indicating main factors, Figure 1 presents the research framework as follows:

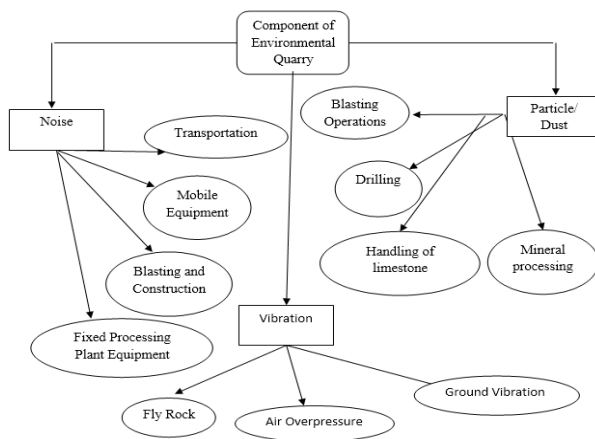


Figure 1: Conceptual framework of study

TABLE 1: CLUSTERING SORTS OF COMPONENT OF ENVIRONMENT QUARRY

Article	Noise				Vibration			Dust/ Particle			
	Transportation	Fixed Processing Plant Equipment	Mobile Equipment	Blasting and Construction	Ground Vibration	Air overpressure	Fly Rock	Drilling	Mineral processing	Handling of limestone	Blast Operations
Roy and Adhikari, 2007	x			x							x
Atakan, 2010	x	x									
Cinar, I., & Senoguz, C., 2013		x		x							x
Defra, 2007	x	x	x	x					x		x
Joseph and Weiz, 2003			x								
University of Nottingham, 2004	x	x		x	x			x	x		x
Mojezi et al, 2011					x	x	x				
Ghose, M. K. 2007								x			
Ghose, M. K. 2000								x			
Chandya et al. 2001										x	
Johnson et al. 2008										x	
Hajbassani et al. 2014				x	x	x	x				x
Khandelwal and Singh, 2005					x						
Armaghani et al. 2014				x	x	x	x				x
Rezaei et al. 2011				x	x	x	x				x
Kuru, C. 2005					x	x					
Khandelwal 2011					x	x					
Total	4	4	2	7	8	6	4	3	2	2	7

4.0 CONCLUSION

The possessions of mining and mineral processing plants on the environment contain land degradation, noise, dust, poisonous gases; pollution of water, etc. [29]. After examining the existing article of environmental quarry scheme, the consequence of this investigation is conceptual framework policy for environmental quarry based on Particles, Vibration and Noise (PVN) object. And likewise this investigation offered that noise emission sources in quarries and construction sites as being produced from; mobile equipment, fixed processing plant and equipment, transport (road and rail), blasting and building and vibration main categorized to Air Overpressure, ground vibration and fly rock and the last noise also dust emissions inventory for quarrying are Drilling, blasting, Handling of limestone, and Mineral processing had high significance dust emissions.

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