Risk Assessment for Stone Quarry

Mining is among the most hazardous activities all around the world, being always accompanied with different incidents, injuries, loss of lives, and property damages. Dimension stone quarrying constitutes a big portion of mining activities. Risk assessment is all about prevention of accidents and there is a need to be aware that there is the risk of an accident before steps can be taken to prevent it happening. It may not always be obvious that a workplace task could lead to an accident. This is why risk assessments are carried out.

In risk assessment the words Hazards and Risks are often used and it is necessary to be clear what Hazards and Risks are:

- A hazard is anything that has the potential to cause harm.
- The risk is how likely it is that a hazard will cause actual harm.

Having defined the work to be undertaken risk assessment will give a clearer picture of what could go wrong and how serious an accident could be. It will depend upon following a set model which will enable the risk to be assessed.

**Five steps of risk assessment**

Step 1: Identify the hazards

Step 2: Decide who might be harmed and how

Step 3: Evaluate the risks and decide on precautions

Step 4: Record your findings and implement them

Step 5: Review your assessment and update if necessary

**Model for Risk Assessment**
This model is best understood by working through the steps listed below

1. **Identify the hazard** - How an accident might happen? Consider what or how things could go wrong when the activity is carried out.

2. **Identify who is at risk** - Who is involved in the activity? Who else could be at risk?

3. **Remove the hazard** - Can the activity be carried out in another way so as to eliminate the hazard.

4. **Evaluate the risk** - How likely is an accident to happen? How serious would the injury be if there is an accident while carrying out the activity?

5. **Decide on control measures** - look at what measures have been taken already to ensure that persons do not have an accident. For example, have suitable and sufficient guards been fitted? Decide whether anything else needs to be done. For example, it may be necessary to provide extra training in the safe use of machinery and only allow trained workers to use it.

6. **Record the assessment** - The risk assessment should be recorded.

7. **Review** - The assessment will need to be reviewed every time there are changes in the workplace, for example new members of staff, new equipment, new systems of work and new location.

**Hazard identification at Stone quarry site**

Hazard identification and risk assessment is a continual process. At mining operation following could be the main hazard:

- Blasting operation
- Drilling operation
- Health Hazard
- Accident at site/crusher
- Transportation
- Natural hazards

It is performed to identify whatever could cause injury, damage, ill-health, financial loss and loss of reputation to the organization. Hazard identification is an analysis to determine whether a risk agent under plausible conditions would cause harm to population or the environment.

Hazard identification is an analysis which is in many ways a detailed study of operations and process, epidemiology, ergonomics. Hazard identification and risk assessment (HIRA) Objectives are to,
• Identify any thing that may cause injury, damage, ill-health
• Prioritize the risks in terms of urgency of required attentions
• Discover preventive or mitigating actions that can be taken in each case
• Create awareness in all concerned in each and every factor and activity that may cause injury damage or ill health
• Enhance decision making by bringing all concerned and effected parties into the HIRA process
• Encourage employees to take ownership of their own safety in terms of recognizing and reporting hazards and participating in the discovery and implementations of the solutions that will prevent incidents or mitigate the consequence
• Build a team approach to Safety Health and Environment Management

Hazards occurrence

Drilling
Drilling is common to the winning of rock, coal and clay. The main hazards associated with drilling are:-
• Falls from the edge of a bench
• Dust created during the drilling operations
• Noise
• Entrapment in or being struck by a moving part of the drilling equipment.

Risk assessment

Falls from the edge of a bench
While the primary hazard is that of the driller falling over the edge of a working or abandoned bench the risk of minerals or materials falling onto workers at the foot of the face should not be overlooked.
A face and bench is a necessary part of a working quarry and therefore it is not possible to the highest risk will occur during the drilling of the first line of holes parallel with the working edge of the bench. Subsequent parallel lines of holes should not give rise to such a high-risk of falling off the edge of the bench.
A number of control measures can be taken and the first is to ensure that the equipment is suitable for the job and that the person in charge of the drilling machine is competent to carry out the drilling operation; part of the training should include instructions to always face
towards the open edge of the bench so that any inadvertent backward step is away from the edge.

One of the measures that can be taken to reduce the risk off the edge of the bench is to provide suitable portable rail fencing which can be erected between the drilling operations and the edge of the bench. Another is to attach a safety line to the drilling rig and provide a harness for the driller to wear.

Another is to restrict access to the area to all persons except those necessary for the drilling operation remove the hazards associated with them

**Dust from the drilling operation**

The hazard is the inhalation of dust which is created during the drilling operation.

While it is not presently possible to totally remove the hazard properly applied control measures can substantially reduce the risk.

The person primarily at risk is the drill operator.

Control measures vary from using water during the drilling operation to the provision of local exhaust ventilation which removes the dust from the head of the hole to a dust collection unit to the provision of a ventilated cabin provided for the operator. The most effective of these precautions is the provision of a control cabin on the drilling rig provided with a suitable ventilation system fitted with a dust filter to remove harmful dust and maintain the dust level within the cabin to below acceptable control levels.

Any ventilation equipment should periodically be examined to ensure that it is maintained to its design standard.

**Noise**

Drilling operations give rise to harmful levels of noise. It is created by both drilling the hole and the operation of the drill rig itself.

It is impractical to remove the hazard at the hole but new generations of drill rig should be quieter by virtue of its design. The noise created is harmful to anyone who is within a zone around the drilling machine at which the noise level is above that considered to be safe for persons to work without having to use control measures.

The noise levels around drilling equipment should be measured and the risk assessed. Unless control measures are in place no-one, except those necessary for the work in hand, should be allowed inside the designated noisy area.

In most cases this will be the drill operator.

The risk is highest at older machines. Newer large drilling machines are provided with sound insulated operating cabins which control the noise level within the cabins to acceptable levels.
Other control measures will include training operators and providing them with ear protection, although the latter should only be seen as an interim precaution until a permanent solution can be found.

The risk is very high when no control measures are provided. However if full measures are provided the risk will be low.

**Entrapment in or being struck by a moving and revolving part of the drilling equipment.**
There may be a number of hazards, principally those of moving the drilling rig around the site, traps between reciprocating and fixed parts of the rig and revolving parts such as the drill rods and bit.

The primary hazards associated with the movement of equipment on site and dangerous parts of the drilling rig are an integral part of operating a mine.
Those most at risk will be persons having need to move and operate the drilling rig.
The risk of an accident occurring will be low if the dangerous parts of the equipment are properly guarded, operators are well trained and supervised and only those essential to the work are involved in the activities.

However, the risk of an accident will be high if the dangerous parts are exposed and the operators poorly trained and supervised.

**Explosives**
Explosives by virtue of their nature have the potential for the most serious and catastrophic accidents in the mining industry yet the way they are used is an excellent example of how risk assessment is properly applied. For example no one would allow any person to use explosives without first having been properly trained in its handling and use.

Increasingly use of explosives is specialist work. Planning for a round of shots is necessary to ensure that the face is properly surveyed, holes correctly drilled, direction logged, the weight of explosive suitable for good fragmentation and the continuity of the initiator are but a few of the steps necessary to ensure its safe use.

Poorly designed shots can result in misfires, early ignition and flying rock.

The more sophisticated type of explosive demands properly trained persons to carry out the blast design, charge and fire a round of explosives.
If within a company there is no competent person to do this work competent contractors should be engaged to carry it out.

**Face stability**
Face instability gives rise to rock falls or slides.
Face instability can arise because of adverse geological faulting or poor work methods.
Those at greatest risk will be face workers engaged in loading material and driving vehicles.

**Loading**

The main hazard associated with loading is rock falling on to the driver, plant toppling over due to uneven ground, failure of hydraulic systems, fires and falls while gaining access to operating cabins. Electrocution, and failure of wire ropes are added hazards with some dragline equipment.

Good access must be provided to operators cabins which should be of suitable strength to protect the driver in the event of rock falling against the cab or if the vehicle rolls over.

**Transporting**

Transporting may be categorised as any means of moving the raw product from the working face to the process plant.

The usual method of transporting minerals from the working face is by truck. Large earth moving plant belt conveying systems are the norm for transporting mineral from the primary crusher and from the loaders used in sand and gravel pits. Additionally hydraulic conveying is often used in sand and gravel and clay mining.

This volume will deal with hazards associated with the equipment used.

**Crushing**

The hazards are blockages, tramp metal, high noise and dust levels and vibration.

At risk are the machine operators, maintenance and cleaning staff.

The preventative measures include the use of hydraulic hammers to break up blockages and providing noise insulated control cabins which also have mechanical ventilation systems designed to remove any harmful dust. The cabins should also be provided with vibration damping devices to isolate them from any harmful vibration.

Careful attention must be paid to guarding dangerous parts of the equipment and handling heavy components during maintenance work.

**Mitigation measures**

**DRILLING:**

1. Drilling machine shall be fitted with dust suppression, collection and disposal arrangement.
2. Deep wetting of drilling zones shall be done by water sprinkling before starting drilling.
3. During the drilling operations the efforts shall be made to reduce dust generation by taking appropriate measures
BLASTING

1. Proper blasting whole geometry shall be designed.
2. Blast site shall be wetted before and after blasting operations are completed.
3. Only optimum quantity of permissible explosives shall be used so that the vibrations do not damage the structures/houses if the quarrying operations are close to human habitation. 4) Blasting shall be conducted only during favorable weather conditions and only during the day time and permissible hours.
4. The blasting operations shall be given publicity in the local area through Announcement and other available media so that local people become aware of the blasting activities being undertaken in the area.
5. The vibrations should be monitored periodically in consultation with the local Mining authorities.
6. The storage of the explosives and its transfer to and from the quarry area shall be strictly in accordance with the conditions listed in the permission granted by Explosives Department

Heavy Earth moving Machinery (HEMM):

1. The operator/ transporter shall carry out regular maintenance of the machinery and vehicles.
2. The speed limit shall be adhered to.
3. Operator's cabin of the HEMMs should preferably be air conditioned at least air tight.
4. The smoke emission should conform to the standards notified in Motor Vehicle Act.
5. The trucks carrying the mined products shall be covered with tarpaulin so that there are no fugitive emissions during transportation.
6. The transportation should not through the busy roads in the city/towns/villages if by pass roads are available

HAUL ROADS:

1. All the haul and service roads shall be mettled and well maintained.
2. Unmettled haul roads shall be free of ruts and pot holes.
3. All haul roads and surface roads shall be regularly sprayed with water.
4. Plantation alongside haul roads (avenue plantation) shall be carried out done.
5. Mined material receiving pits are shall be located close to the quarry to reduce the haul length of the dumper
OVERBURDEN:

1. Non-operative dumps shall be subjected to technical and biological reclamation.

2. Plantation over and around over burden dumps shall be carried out to ensure stability of slopes, prevention of dust by wind action and soil erosion during the run off. Wetting of surface of O. B. dump shall be regularly practiced.