

Flyrocks Issues from Quarry Blasting



by Ir. Hj. Look Keman Sahari

ROCK blasting is an essential part of quarrying operations. It is the fragmenting of rock into sizes suitable for further crushing and screening operations and finally for use in road building, homes, bridges, airports and countless other applications. Blasting is still the cheapest and the most economical way to fragment rocks into usable product in large volumes.

However, rock blasting can have detrimental effects on the lives of people who live near the quarries. Inevitably, many residential areas have been developed near and around quarries which were once, a long distance from any human habitation. Over time, development has slowly crept nearer to quarries and this is where the problems begin. Generally there are four environmental effects of quarry blasting:

1. Fly rocks
2. Ground vibration
3. Airblast
4. Fumes



Recent fly rock incident

Of the four, flyrock is the most dangerous and records show this to be the cause of many deaths and injuries to people living near quarries as well damaged property. In one such incident recently, a factory worker was killed, others injured and the factory premises damaged.

The other three effects of blasting are more a nuisance than a danger. They are not likely to cause damage under the current minimum allowable limits imposed by the authorities. However there are usually a lot of complaints from the public who fear for their safety and who believe their houses may have sustained damage. Common complains are alleged cracking of walls, floors and ceilings. However, such damage is only possible if the houses have been subjected to regular blasting over long periods.

This article is intended to discuss the issues of flyrocks from the writer's perspective and vast experience in investigating and dealing with flyrock accidents in quarry operations and construction blasting.

Flyrock is caused by a mismatch between the explosive energy being used to break rock and the strength of the rock. This can be due to the failure of the blasting engineer or shot firer to take into consideration the difference in thickness of the burden and spacing. Depth, angle of drilling, potential drill deviation and the geology of the area are very important criteria that must be taken into account. In limestone areas, cavities – big and small – are common. If the shot firer is not careful and does not diligently observe the charging operation, he may unintentionally charge the borehole with more explosive than needed. In other types of rock there are also fractures, fissures, joints and cracks that may also result in local overcharging. Overcharging by just a few kg of explosives is enough to cause flyrocks beyond the blasting areas.



Typical Quarry Face with joints, cracks and fissures

Overcharging by hundreds of kg of explosives may cause flyrocks to rain and hit houses or structures located hundreds of metres from the blasting area. If a person is hit by flyrock, it may result in severe injuries or even death.

The use of free flow explosives such as ANFO and Bulk Emulsion is therefore inappropriate in highly fissured area as it fills the cavities and causes local overcharge, unless it is put in plastic bags before being inserted into the boreholes. The shot firer should also estimate how much explosives is needed in every borehole instead of charging up to stemming level.

As explosive manufacturers are well versed with their products, they should also inform and advise the shot firer of any deviation in the charging volume of explosives in the borehole as well as what can be done if such a case happen. Any incident of flyrock from the use of their product would also badly damage the reputation of supplier companies. Customers should be advised about the advantages and disadvantages of using bulk explosives and steps should be taken to mitigate any mistake made during charging operations.

The shot firer must also be able to change the blast design to suit the geology of the area such as changing the burden, spacing and direction of the blast. This is normally the responsibility of the blasting engineer, not the shot firer who is only taught the introductory blast design in a six-day shot firer course and so, is not expected to be well versed in complicated blast design. Many people in the quarry industry tend to overrate the capability of shot firers. With a minimum qualification of SPM, preferably in science, a shot firer cannot be expected to take the place of a blasting engineer.

It is very important that drillers and shot firers keep a comprehensive Drilling And Blasting record which includes any amendment made during the blasting process. This will make it easier for the blasting team to audit and conduct investigations in case of any unwanted incidents.

Flyrock is a safety issue closely related to the competency of the person responsible for the job. Competency is gained through experience and learning under a competent person as well as through seminars, workshops and other professional development programmes. For the time being, it is best developed under OSHA 1994 with the cooperation of the Police and Mineral and Geoscience Departments. At present, there are no blasting regulations, code of practice and guidelines for blasting at quarries and construction sites which can be taken as a reference in Malaysia. However the authorities can still use administrative procedures to control blasting operation.

Continuous training and retraining of shot firers and blasting engineers will contribute to reducing mishaps and to creating highly competent employees in the future which will, in turn, reduce our dependence on foreign expertise.

Blasting is hazardous work and requires very meticulous preparation to ensure safety, not only for the blasting team but also for the public. The authorities can help by introducing clear and easy to implement blasting regulations, codes of practice or guidelines with the help of the Industry. This will also make it easier for the industry to plan future syllabus for the training of blasting engineers and shot firers.

The new training syllabus should include blasting work for construction work, tunnelling, under water blasting, demolition and blasting in city areas. The current Shot Firer Course does not cover such specialised blasting works and no competency certificate has ever been issued by any authority in Malaysia. It is therefore, appropriate that the three Government departments mentioned above (which have the legal authority and expertise) should join forces to tackle the issue. Beside boosting confidence, any competency certificate issued is a recognition of expertise and so, is very essential for promoting and exporting our professional services abroad. ■

Ir. Hj. Look Keman Sahari graduated in 1979 in Mining Engineering from Strathclyde University, Glasgow, Scotland and M.Sc (Explosives Ordnance Engineering) from Cranfield University, England in 1991. He served as a Research Engineer specialising in slope engineering and later as Inspector of Mines serving in Perak, Selangor and Negeri Sembilan and Malacca with the former Mines Department from 1979-1996. After retirement, he works as Consulting Engineer specialising in explosives and blasting work and also rock breaking using non-explosives demolition agent.