Abstract:

In construction industries, blasting is the predominate method for fragmentation when dealing with protruded rock. The issue of fly-rock is critical to the operation of all sites that employ this method especially if it is near to highly sensitive or populated area. This paper takes a risk-based approach to identifying, analysis and managing the fly-rock hazard. The outcomes of the boulder blast should not be underestimated as the fly-rock hazard is less predictable than the primary blasting. A study in the United Kingdom mines and quarries inspectorate (2007) revealed that more than 80 percent of incidents were associated with this type of blasting. The basic cause of fly-rock generation is mismatch between the energy available and the work to be done. This mismatch can be caused by an abrupt decrease in rock resistance (geological weakness), overcharging, inappropriate blast design and inaccurate drilling. In this study, 6 cases of actual blasting operation and their effect of throw due to the amount of explosive used to break a certain volume of rock (powder factor) is examined. A range of various amount of powder factor and distance of throw from initial position of blast are presented. It can be concluded that the wild fly-rock risk can be controlled by managing the powder factor for a given blasting situation.

ABSTRAK

Dalam industri pembinaan, letupan adalah suata kaedah biasa untuk memecahkan massa batuan. Isu batu liar adalah sangat penting kerana ia sangat sensitif kepada persekitaran terutamanya di kawasan yang berdekatan penduduk. Kajian ini menggunakan pendekatan berdekatan berasaskan risiko untuk mengenalpasti, analisis dan menguruskan bahaya batu liar. Hasil dari letupan batu tidak boleh dianggap remeh kerana bahaya batu liar ini tidak dapat diramal secara tepat daripada letupan primer. Kajian di United Kingdom (2007) menunjukkan bahawa lebih daripada 80 peratus insiden dikaitkan dengan letupan primer dan sekunder. Punca utama dari kejadian batu liar adalah kerana ketidaksesuaian antara tenaga yang sedia dan beban yang harus dilakukan. Ketidakseimbargan ini disebabkan oleh penurunan mendadak dalam kelemahan geologi, jumlah bahan letupan, yang berlebihan, rekabentuk letupan yang tidak sesuai. Dalam kajian ini, 6 kes operasi peledakan dan pengaruhnya terhadap lemparan batu dikaji. Berbagai jumlah faktor peledak dan kesannya terhadap lemparan batu disajikan. Kesimpulannya, risiko batu liar dapat dikawal dengan menguruskan faktor peledak yang sesuai untuk situasi letupan yang dijalankan.

TABLE OF CONTENTS

LITERATURE REVIEW

LITERATURE REVIEW

CHAPTER 2 TITLE PAGE

LITERATURE REVIEW

CHAPTER 1

INTRODUCTION

1.1 Background

Blasting operations can be applied in various conditions such as in mining, open pit, quarries, slope works and else which require one. The main purpose of blasting operation is the rock fragmentation, and is considered to be essential to success of breaking protruded rock. This process provides appropriate material granulation that will be suitable for excavation and transportation. The blasting process, however, remains a potential source of numerous hazards. Even though blasting techniques have been improved, there are still reports indicating blast-related accidents involving people and structures. Since fly-rock and a lack of blast area security constitute the majority of all blasting area, the cause and control of these hazards and activates are discussed. Blasting of boulders is chosen as topic as we would like to focus on the impact of powder factor to fly-rock without any influence or aid of discontinuity in the breakage.

Powder factor represents the amount of explosive energy applied to each specific volume of blasted material. It can be expressed in terms of kilograms of explosive used for each cubic meter for rock. It is the indicator of consumption of explosive in a shot. Terminology relating to fly-rock in the literature is inconsistent, so it is necessary to define the terms of throw and fly-rock as used in this paper (Little, 2007).

Throw- the planned forward movement of rock fragments that form the muck-pile within the blast zone.

Fly-rock- the undesired propulsion of rock fragments through the air or along the ground beyond the blast zone by the force of the explosive that is contained within the blast clearance zone.

As the boulder blasting is concerned, the powder charge is surround by free faces, less explosive is required to break a given amount of rock then in primary blasting. Usually, this kind of blast is more violent than the primary blast.

Any fragment of rock produced by blasting that cannot be handled by the mining equipment is referred to as boulders or oversize. The sizes of these blocks depend upon each operation and during the same should be set aside for fragmentation.

Blasting theory is one of the most interesting, challenging, and controversial areas of the explosives engineering. It encompasses many areas in the science of chemistry, physics, thermodynamics, shock wave interactions, and rock mechanics. In broad terms, rock breakage by explosives involves the action of an explosive and the response on the surrounding rock mass within the realms of energy, time and mass.

1.2 Problem Statement

Boulders can be easily found in granitic area when performing earthwork leveling. These boulder need to be broken and handled efficiently by the loading equipment by blasting works. Although boulder employs relatively smaller amount

of charge, the potential of safety hazards must not be underestimated because the fly-rock is less predictable than primary blasting.

Although this blasting operation will help in reducing the cost and time to excavate the hard materials, the performance of the blasting operation will be affected if it is not controlled and managed well. Beside, blasting operation is a process where we need to consume explosives to break, destroy and extracting the rocks for construction. Means, this process is obviously dangerous and need extra precaution during the activity. To have a secure blasting process with less fly-rock projection, ground vibration or preventing from any bad incidents to happened, the blasters or the people involved in this industry need to have a perfect location to place the explosives. Not only that, they also need to ensure that the explosives in places correctly in the holes with the right depth and the right amount of explosives powders. So, this study is conducted to see the effectiveness of blasting depending on the powder factor and also amount of explosive that conditions affect fly-rock and throwing rock at blast process of boulder.

1.3 Research Objectives

This study is carried out in order to have a better understanding on the effect of powder factor to the boulder blasting. The objectives of the study are listed below:

1) To investigate the effect of powder factor to blasting process in granitic boulders at the project site.
2) To determine the distance of throw of the rock fragments during blasting operation.

1.4 Scope of Study

This study focus on the effect of powder factor to the throw of rock fragments in boulder blasting at Technology Park, Johor Bahru.

1.5 Significance of the Study

This study will provide a better understanding the relationship between powder factor and fly-rock on boulder blasting. This knowledge may be advantages for people that involves in the different site location with similar geological condition (granitic area) as it will shortened the time needed for consideration of the proper powder factor needed to be applied in such blast.

1.6 Site Location

This study was carried out at proposed factory site located at Technology Park Johor Bahru. The site location is shown in Figure 1.3. The purpose of the blasting work is to level down the protruded rock for construction of factory.

1.7 Geology of Site

The site consists mainly of granite rock. Granite is formed by plutonic cooling of magma. The rock material is light in colour with white and pink spotted and is regarded as coarse grained granite Photographs showing the rock material mass is shown in Figure 1.1.

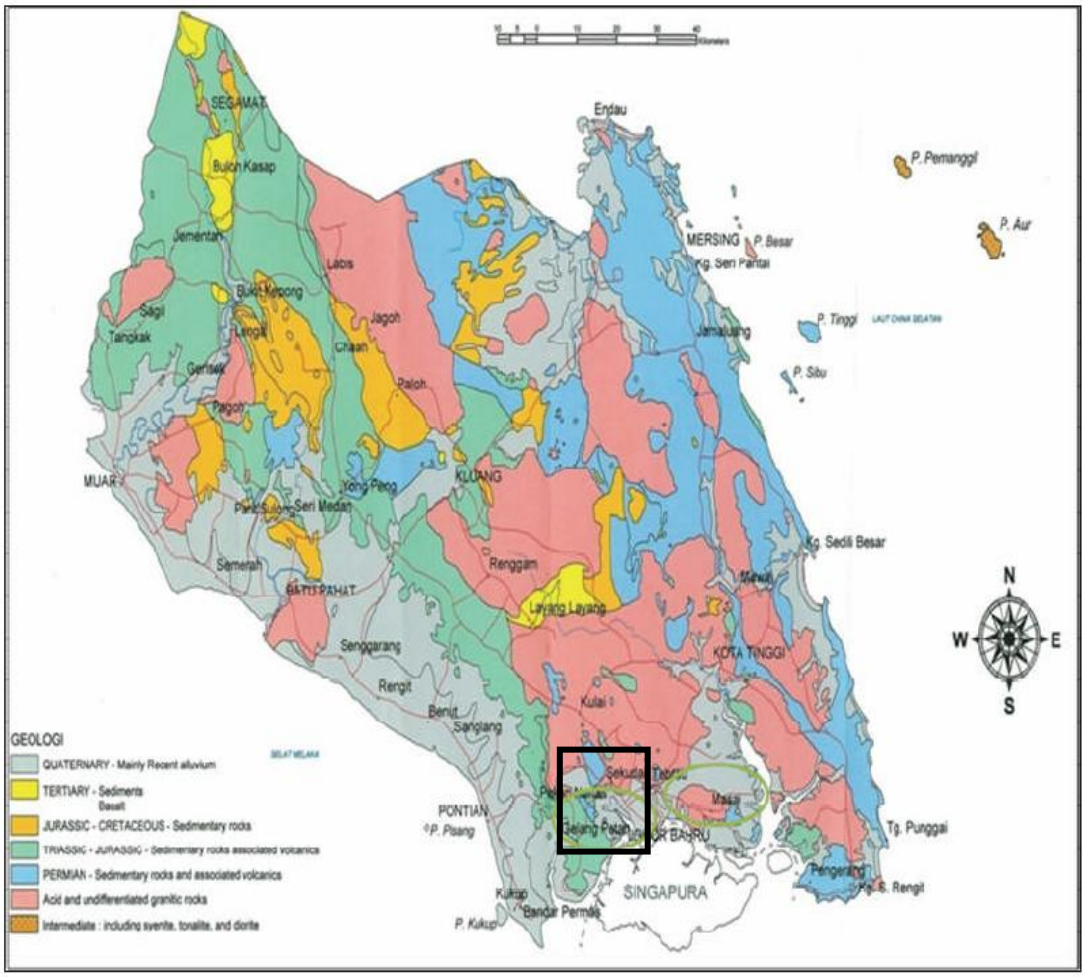

Figure 1.1. Geology Map of Site Blast Operation at Taman Teknologi Johor.

Figure 1.2. Overview of the Site.

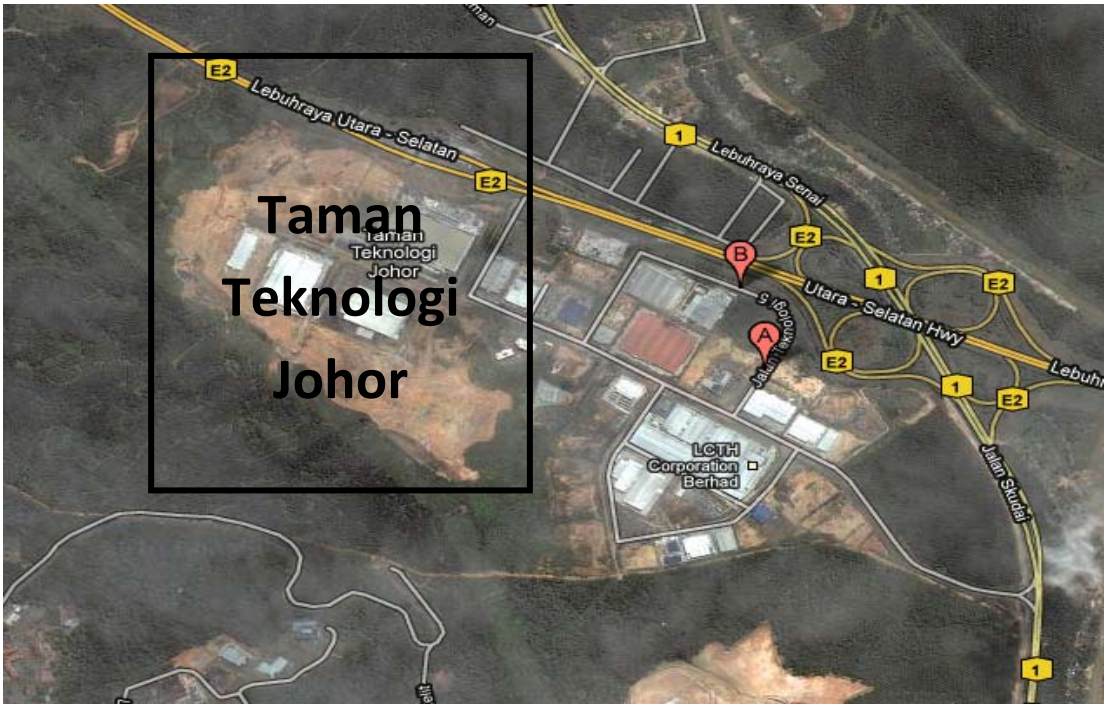

Figure 1.3. An Aerial View of the Site.