



FRAGMENTATION PREDICTOR

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INTRODUCTION

The action or process of breaking something into small parts is known as fragmentation.

In fragmentation, an object continuously breaks into an increasing number of smaller pieces by external driving. Fragmentation is ubiquitous in nature. At geological scales, fragmentation is responsible for sand grains on beaches and for boulder fields. At the molecular level, chemical bond breaking underlies polymer degradation and the consumption of material in combustion.

When an explosive charge, confined within a blast hole is initiated, reactions take place resulting in production of large amount of gases at very high temperature and pressure in a very short time. An important characteristic of high explosive is the production of very large amount of energy per unit of time. The gas pressure acts on the walls of the hole and thus subjects the media beyond the hole to vast stresses and strains. The primary purpose of blasting is to fragment rock, and there are significant rewards for delivering a fragmentation size range that is not only well suited to the mining system it feeds but also minimizes unsalable fractions and enhances the value of what can be solid.

Drill and blast design – namely the drill-hole diameter, drill-hole spacing, blasting agent and timing – can reduce overall mining and processing costs. These variables can be controlled and adjusted to optimize fragmentation.

As we know fragmentation of rock is a fundamental to mining. It is the first preparatory stage in extraction process making loose enough to be efficiently excavated.

By optimising rock fragmentation by blasting, we can achieve significant improvements in waste productivity, fragmentation profile and waste stability

EXECUTIVE SUMMARY

Fragmentation estimation help in predictor of average fragment size & explosive energy.

Easy to Inputs the information to software such as Blast design information, Rock properties information and explosive information and based on Kuz-Ram fragmentation model and Rosin Rambler equations, this model enables to make fragmentation calculation, graph and table between Fragment size and percentage passing.

This method can predict the entire fragmentation size distribution considering intact and joints rock properties.

Help us know the type and properties of explosives and the drilling pattern used.

This type of prediction software allows blasters, to be designed according to fragmentation size requirements.

Start the Application

You can start the Fragmentation Prediction software by once logging in from the Mine Excellence Site.

Once you login from the Mine Excellence site, a dashboard will be displayed. On Click of Blasting Software link available on the left side of the dashboard you will be redirected to the list of software available in the Mine excellence as shown in fig. below

On clicking blasting software we can find software called: -Predictors. On clicking predictor, we can find fragmentation tool.

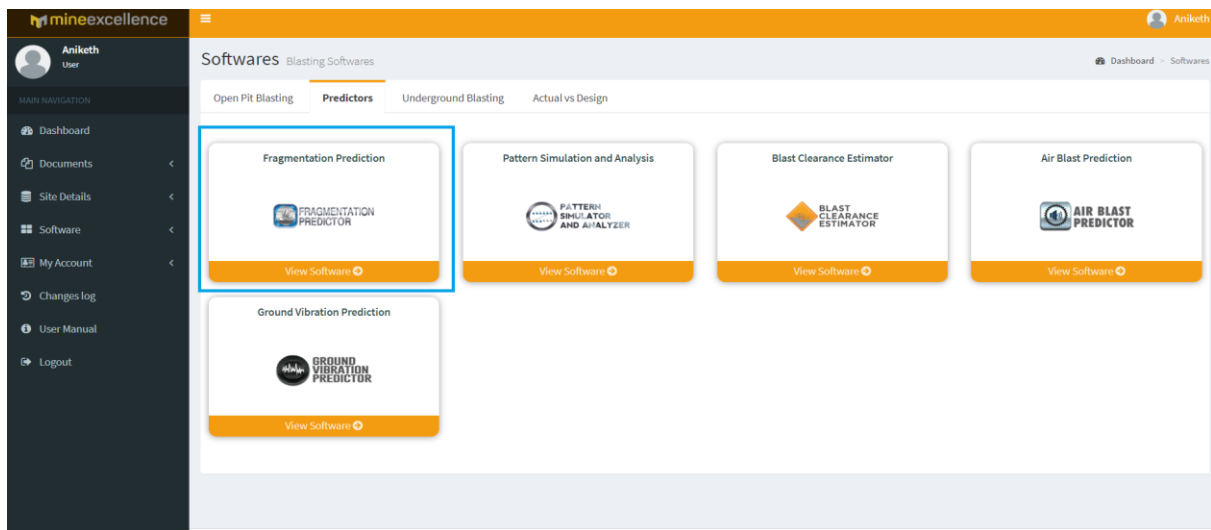


Figure 1 - Starting the application

Using the Application –

On click of Fragmentation Prediction, you will be redirected to Fragmentation Prediction Page as shown in fig. below.

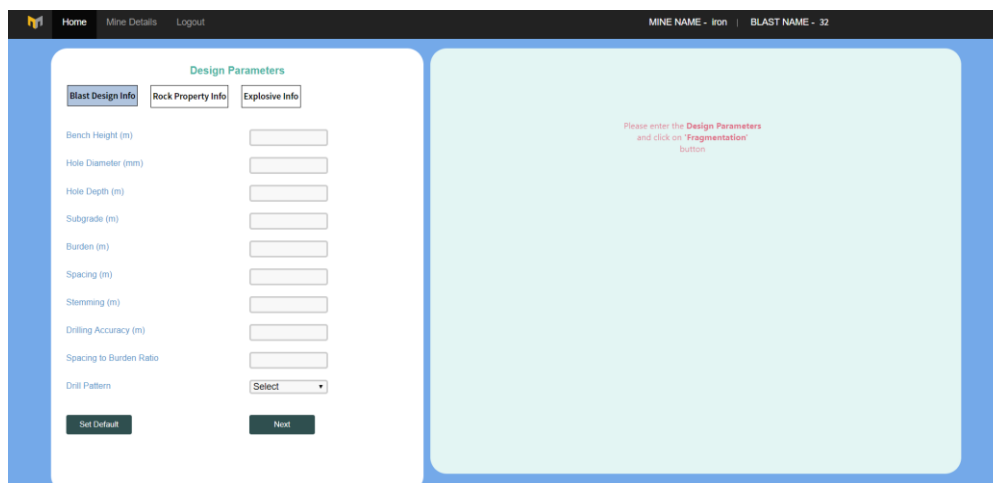


Figure 2 - Front Page

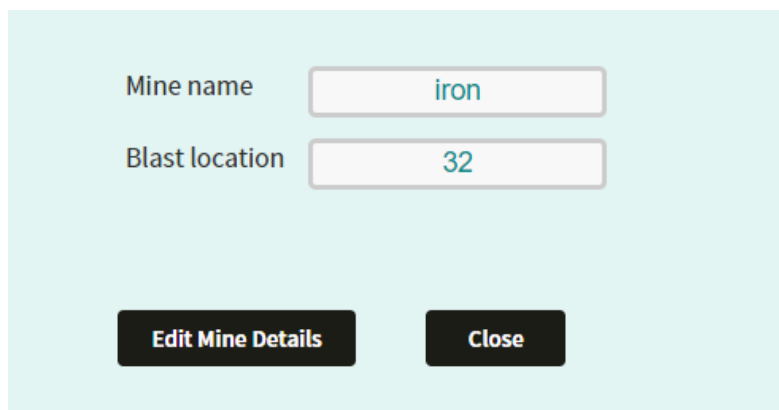
Menu Bar

This is topmost part of the screen. This bar displays menu items defining the basic functionality of the software. Following are menu items are present in the menu bar:

- **Home:** redirect user to the home page of the website
- **Mine details:** here we can edit mine name and blast location
- **Logout:** user can logout using this key
- **Mine name:** name of the mine
- **Blast name:** name of the blast

Mine Details

This function allow user to save mine details which include Mine Name and Blast Location. This information must be filled as it is needed for generating report. To save mine details, click on Edit Mine details. Once Mine Details are saved, we can close this pop up by clicking simply on Close button.



The image shows a light blue dialog box for editing mine details. It contains two input fields: 'Mine name' with the value 'iron' and 'Blast location' with the value '32'. Below the fields are two buttons: 'Edit Mine Details' and 'Close'.

Figure 3 - Mine Details

Design Parameters

Following design parameters are required to predict the fragmentation, these include:

- Bench Height
- Hole Diameter
- Hole Depth
- Sub grade
- Burden
- Spacing
- Stemming

- Drilling accuracy
- Spacing to Burden Ratio
- Drill Pattern

User can use the default parameters by clicking on **Set Default** button. It also allows user to edit these parameters as per their operational requirement.

In drill pattern user can use two options they are: -

- Square
- Staggered

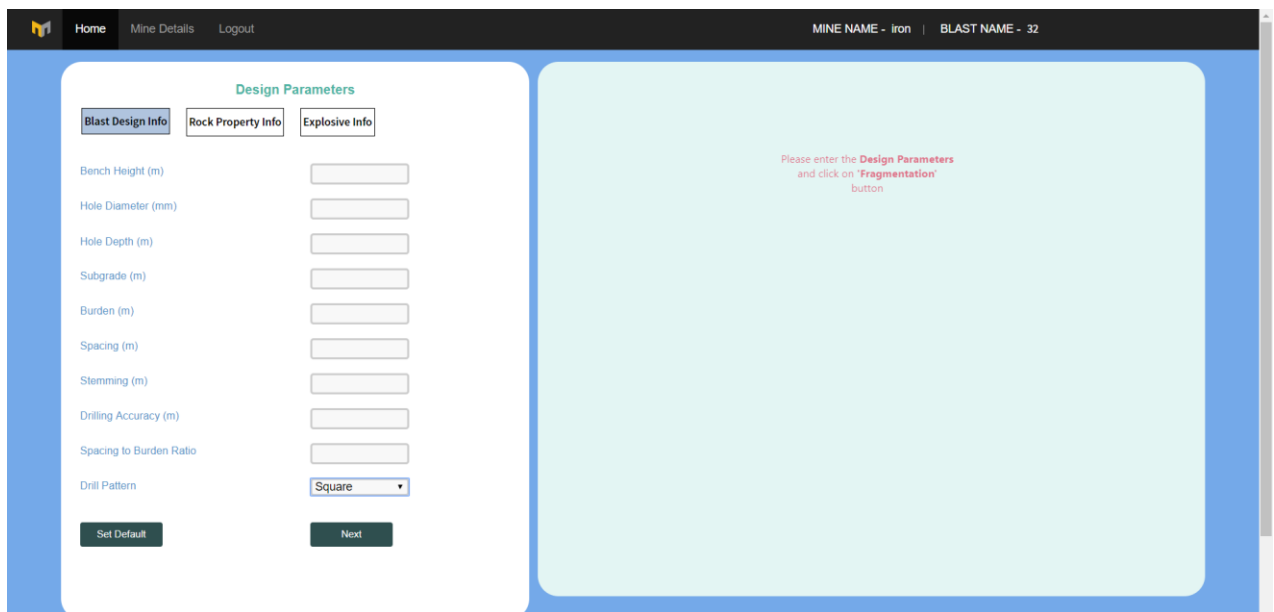


Figure 4 - Design Parameters

On clicking next option, we can fill rock property info and then explosive info as well.

Rock Property Info

- Specific Gravity
- Young's Modulus
- USC - Comprehensive Strength
- Rock Mass Description
- Vertical Joint Spacing
- Joint Plan Orientation
- Sonic Velocity

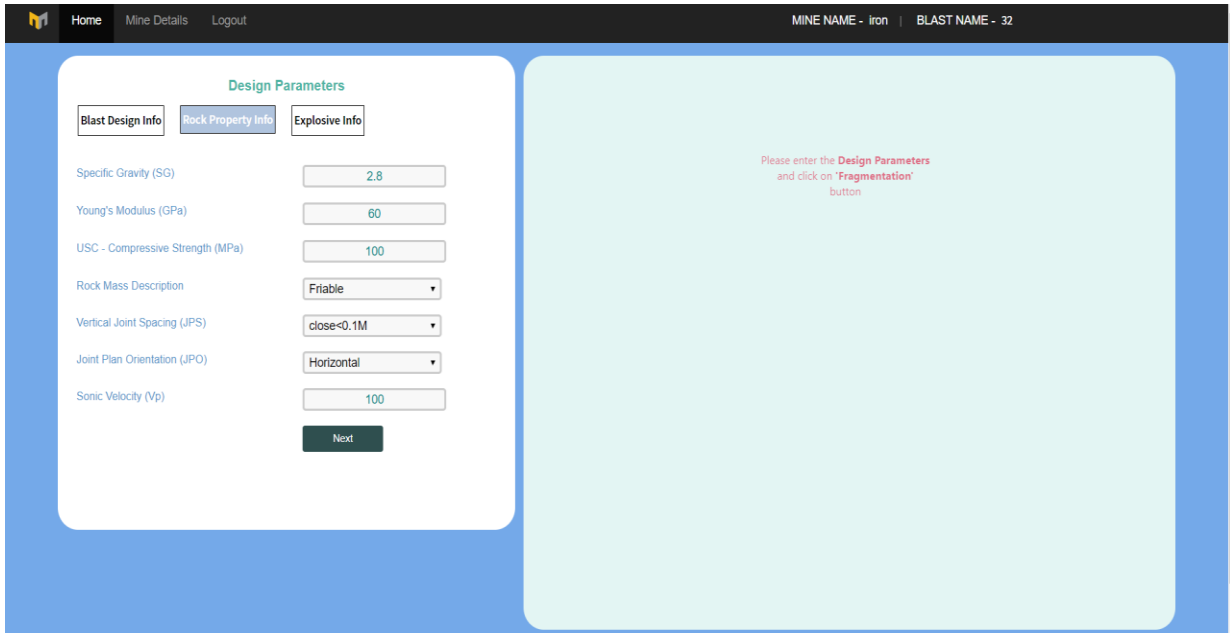


Figure 5 - Rock Properties

The user can use the default parameters by clicking on Set Default button. It also allows user to edit these parameters as per their operational requirement.

On Click of Next button user is headed to Explosive Info tab.

Explosive Info

- Explosive Diameter
- Explosive Density
- REE

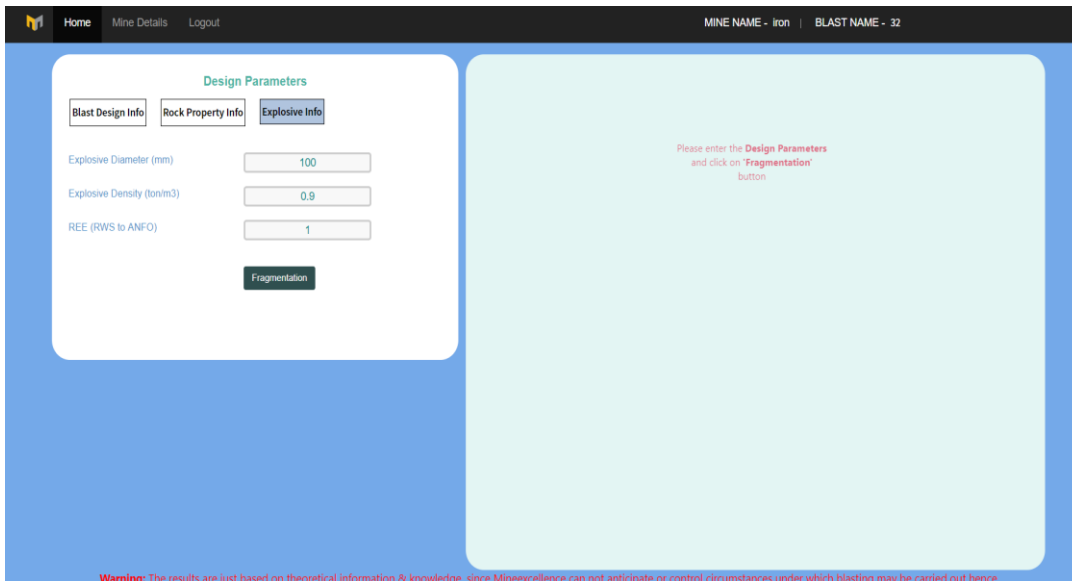
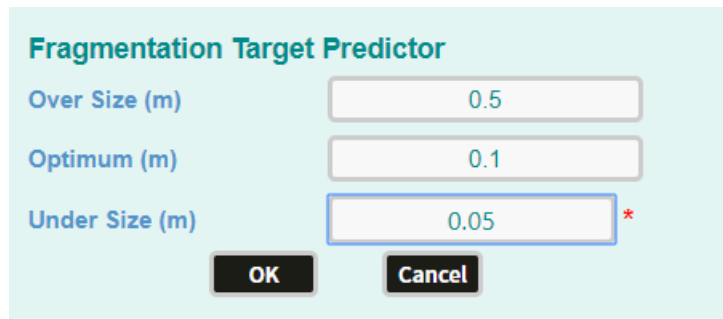


Figure 6 - Explosive Info

After clicking on Fragmentation button, a pop-up is displayed showing Fragmentation Target Predictor.

It will ask user the value of over size, optimum size and under size.



The dialog box titled "Fragmentation Target Predictor" contains three input fields: "Over Size (m)" with value 0.5, "Optimum (m)" with value 0.1, and "Under Size (m)" with value 0.05. There are "OK" and "Cancel" buttons at the bottom.

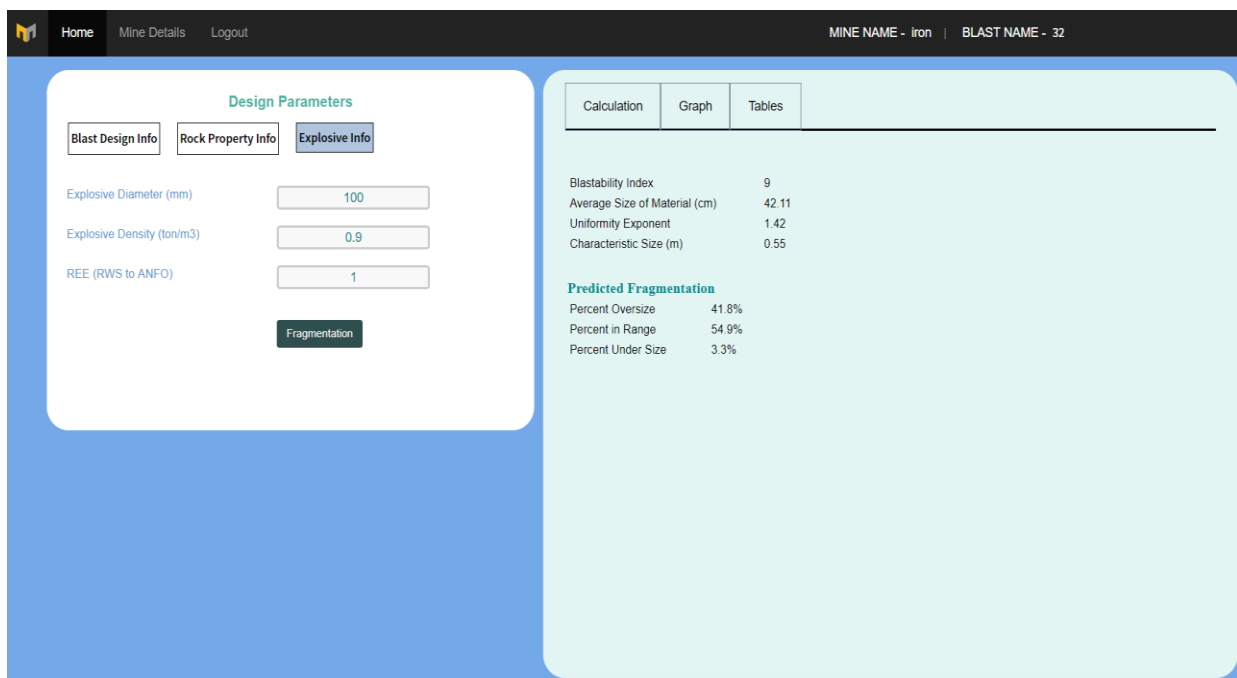
Figure 7 - Fragmentation Target Size

After clicking on ok button, will calculate and provide user the value of blast ability index, average size of material, uniformity exponent, characteristic size. It also calculates the percentage of oversize, in range and under size.

The output of fragmentation prediction is in 3 options:

Calculation

It gives the prediction results. It also calculates the blast ability index, Average size of material, Uniformity exponent and Characteristic size.



The screenshot shows a software interface with a navigation bar (Home, Mine Details, Logout) and user information (MINE NAME - Iron | BLAST NAME - 32). The main area is divided into two panels. The left panel, titled "Design Parameters", has three tabs: "Blast Design Info", "Rock Property Info", and "Explosive Info". Under "Explosive Info", there are input fields for "Explosive Diameter (mm)" (100), "Explosive Density (ton/m3)" (0.9), and "REE (RWS to ANFO)" (1). A "Fragmentation" button is at the bottom. The right panel has tabs for "Calculation", "Graph", and "Tables". It displays the following results:

Blastability Index	9
Average Size of Material (cm)	42.11
Uniformity Exponent	1.42
Characteristic Size (m)	0.55

Below this is a section titled "Predicted Fragmentation":

Percent Oversize	41.8%
Percent in Range	54.9%
Percent Under Size	3.3%

Figure 8 - Output Calculations

Graph

Result is displayed in graph format in which x-axis defines the fragment size (in meters) and y axis shows the cumulative percentage passing (in meters).

When user clicks on Graph, a drop down along with graph is opened which includes:

- a. Change Increment Size
- b. Change Percent Passing (%)
- c. Show Data Points (Check Box)
- d. Print Option

Change Increment Size: -

It gives user an option to increase Fragment Size as per their requirement.

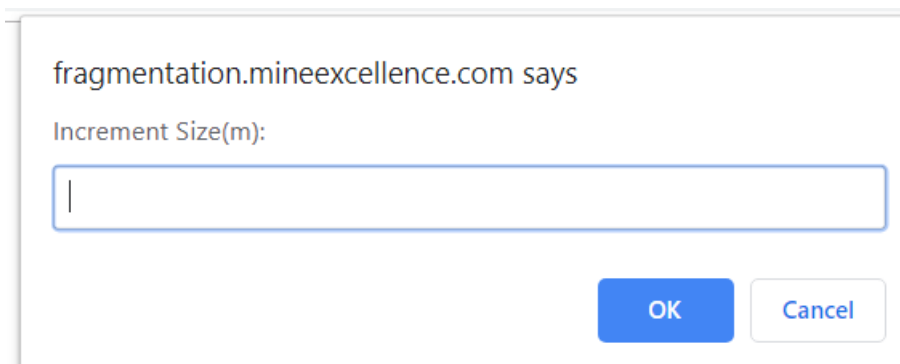


Figure 9 -Change Increment Size

Change Percent Passing: -

It gives user an option to change Percent Passing as per their requirement.

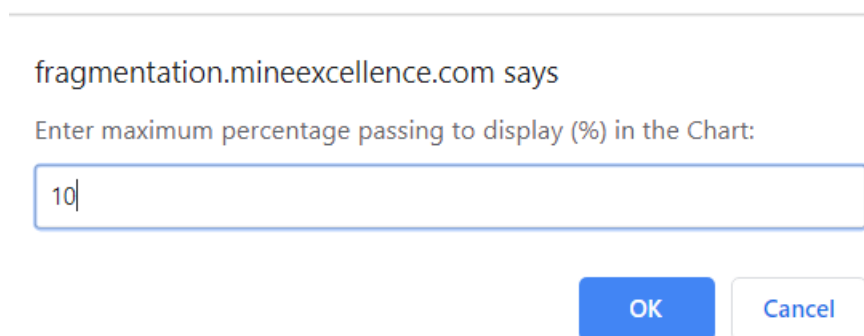
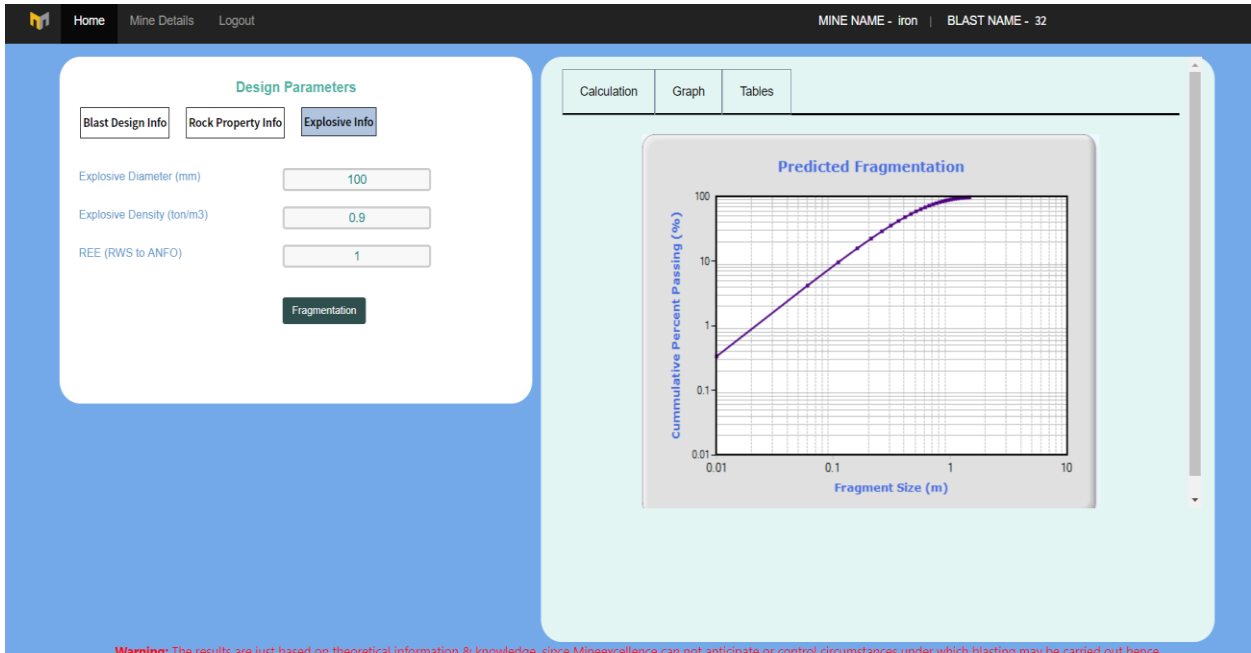


Figure 10 - Change Percent Passing

Show Data Points: -

A show data point check box is provided, when user will check this, the data points are displayed in the graph.

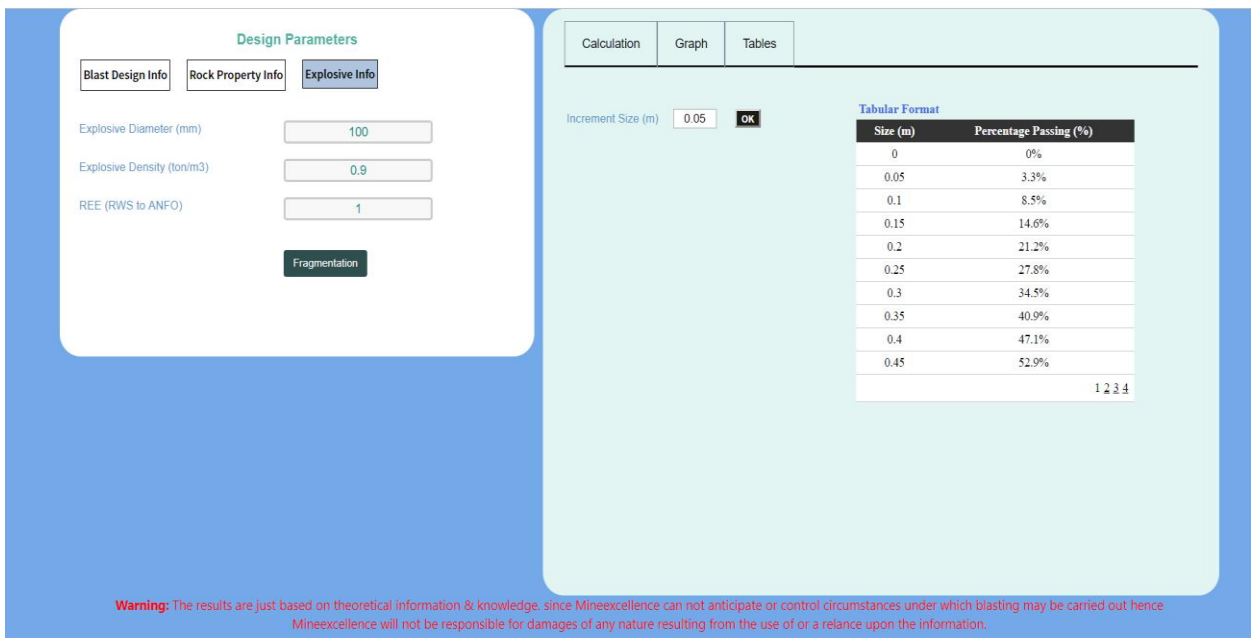


Warning: The results are just based on theoretical information & knowledge, since Mineexcellence can not anticipate or control circumstances under which blasting may be carried out hence Mineexcellence will not be responsible for damages of any nature resulting from the use of or a reliance upon the information.

Figure 11 - Fragmentation Graph

Table

This will give the prediction results, fragment size and cumulative percentage passing in tabular format.



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Figure 12 - Fragmentation Prediction

If user wants to increase or decrease the size, percentage passing will be changed according to the size. After entering the increment size, click on ok button, table will be displayed.