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Fragmentation analysis by Wip-Frag software

Blasting is an operation which is adopted mostly in opencast mining. Now a day's India's 80% of production comes from opencast projects only. To achieve the society demand parallel production is needed, for which heavy explosives and HEMM etc., are adopted. By adopting the above-discussed things can get quick output but the fragmentation of blast is poor that results in boulder. To calculate the fragmentation of patch at every time is difficult by manually and it makes that all other works on hold. By adopting Wip-Frag software authors analyse the fragmentation of patch that results seem 95% of accuracy. Finally, this paper concludes that analysis by this software gets accurate values and within less time. That helps to extend the focus on all other works.

Keywords: *Patch; fragmentation; boulder; muck pile; Wip-Frag.*

1. Introduction

Now a day's 80% of India's production comes from opencast projects only. Based on the consideration of society demand parallel quick production is needed, for which heavy explosives and HEMM etc., are adopted. Production of mine is mainly based on the term fragmentation that means smaller pieces which are obtained from the in-situ rock mass, suitable for excavating by employed machinery.

Due to some parameters like improper charging, using heavy explosive etc., fragmentation of the blast will get fluctuated that results in boulders that was not capable to excavate or move by the respective machinery employed; to overcome these cases most of the researchers have been doing research programme on the fragmentation analysis since the beginning of the mining industry, like manual counting of oversize boulders which are obtained from the blast face and that could not be handled by adopted machinery. This can directly be found the index of over-size boulders. (Holmberg et al., 2000) [4]. The shovel loading rate, is taken into account of handled rate of blasted material by employed machinery; this is a method which can be found accurately for the blasted face (Monjezi et al., 2009) [5]. In this paper, the authors want to analyse the fragmentation of blast by the Wip-Frag; it is an image-based granular metric system that uses digital image analysis of blasted photographs to determine grain size distributions.

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2. Methodology

Wip-Frag is a recent advanced method of granular metric analysis by rock photographs to determine grain size distributions of blasted fragmentation. In this the blasted muck by explosive is thrown as a huge surface, to consider that huge surface in a single photograph is difficult to analyse, in this view blasted muck is divided into multiple partitions for good perfect photographs.

The next step is to take the two samples with a known dimension (i.e. round specimen); these are considered as references for analysis and feed those values in the reference tab of Wip-Frag. That known samples are placed at two different places on the selected partition of blasted muck; after that all the required primary adjustments should be adjusted (i.e. capture quality, white balance, focal length, point of view) to get perfection in the analysis report. Next is to take the picture with a suitable camera for the above adjustments.

Fig.1 Take the pictures of partition by two known samples

The next important step is to generate the edges that were done by automatically Edge Detecting Variables (EDV). If any image quality is poor with the help of smart edit, can manually adjust the edges by mouse.

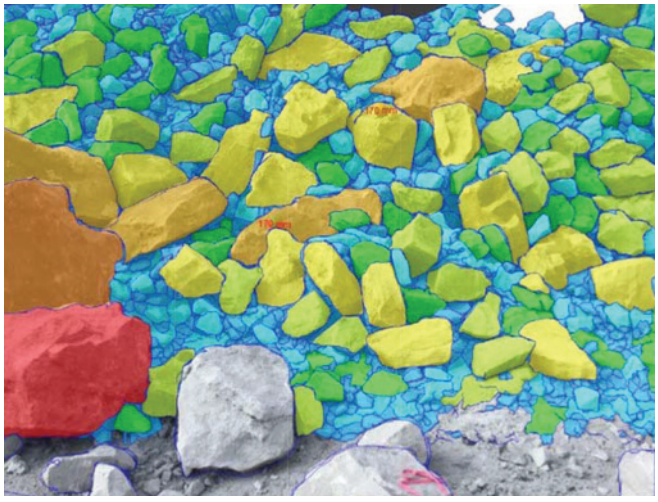

Fig.2 Preparing the edges by avoiding the surface area

After completing the entire adjustments click on the processing button that generates the analysis report in the form of graph. That shows the details of the coverage of the sample analysis, uniformity of the blasted muck, Xc-62.3% mess size and XAM-maximum boulder size in the muck. Above listed analysis has been done on the principle of "Rosin-Rammler and the Swebrec methods," it mainly explains that uniformity of the blasted material based on the research and prescribed value is developed (i.e. N=>0.75) which indicates good uniformity. The result analysis of fragmentation has displayed a graph, which shows the per cent of fragmentation passes by respective mess size. The exact per cent of material passes through particular mess size can calculate by subtracting its actual value with its next lowest value. For example, the per cent retained for the block size (2570 mm) obtained in the cumulative analyses is calculated as (100% - 99.19%) which is equivalent to 0.81%. Likewise, the per cent of different variants of blocks size can be found out with the given cumulative particle size table.

3. Case study

An experimental study has been done at a mine-X, located in the North Karanpura coalfield, latitudes/longitudes (85° 10' E to 85° 15' E and 23° 51' 30" N to 23° 55' 30" N), which having a production of 15 Mt per annum, has 5 seams with estimated reserves of 642 Mt. The location of mine in Google maps has been shown in Fig.3.

4. Discussion of results

In the course of the project, samples have been collected for 5 days of using Apple i-pad by different partitions of muck pile from MINE-X. The photographs are analysed in a system

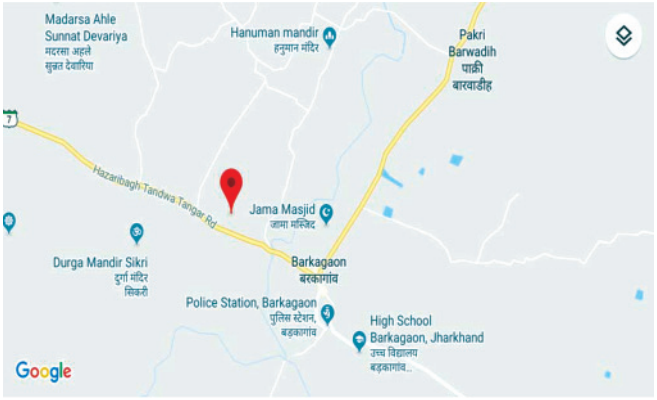

Fig.3 Location of mine in Google maps

using Wip-Frag image analysis software. The analyses of photographs are carried out using a single image and multiple image analysis techniques. Single image analysis can get cumulative size distribution of blast whereas optimum rock fragmentation can get by the help of multiple image analysis technique.

4.1. Day-1, 18 September 2018, mine-X, top bench NE

The result of this patch explains that fragmentation of the blast is good as the N value is greater than 1 (i.e. 1.78) that means uniformity of the muck pile is good and XC63.2% = 1175.00 mm mesh size and the maximum boulder size in this patch is 2200 mm

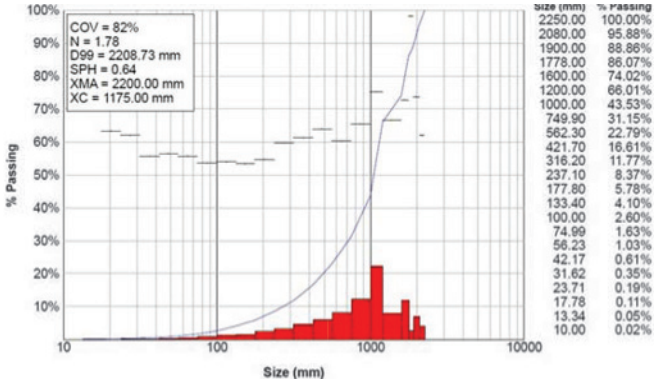

Fig.4 Cumulative analysis of day-1 patch

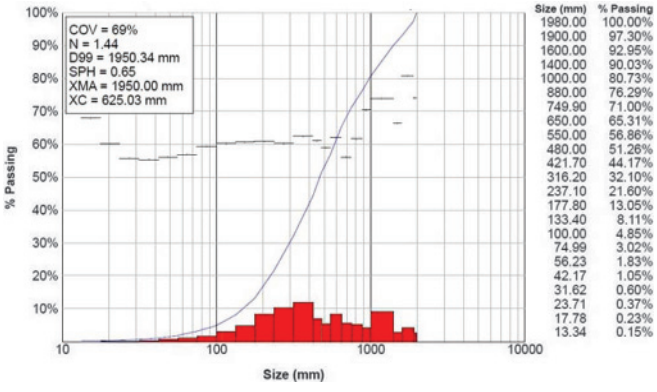

Fig.5 Cumulative analysis of day-2 patch

4.2. Day-2, 19 September 2018, Mine-X, NE second bench

The result of this patch explains that fragmentation of the blast is good as the N value is greater than 1 (i.e. 1.44) that means uniformity of the muck pile is good but by comparing the day-1 patch uniformity of patch is low (i.e. 0.34 of day-1) and XC63.2%=625.03mm mesh size and the maximum boulder size in this patch is 1950 mm.

4.3. Day-3, 20 September 2018, mine-X NE996 bench

The result of this patch explains that fragmentation of the blast is good as the N value is greater than 1 (i.e. 1.17) that means uniformity of the muck pile is good but by comparing the day-1&2 patch uniformity of patch is low (by 0.61 low to day-1 and 0.27 low to day-2) and XC63.2% = 700.73 mm mesh size and the maximum boulder size in this patch is 1460 mm.

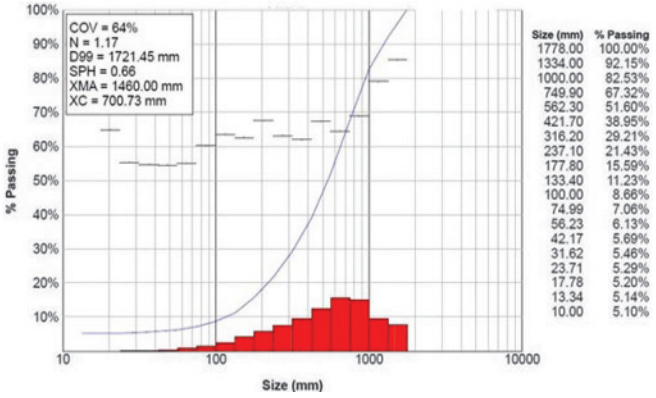

Fig.6 Cumulative analysis of day-3 patch

4.4. Day-4, 22 September 2018, mine-X NE996 second bench

The result of this patch explains that fragmentation of the blast is good as the N value is greater than 1 (i.e. 1.50) that means uniformity of the muck pile is good but by comparing the day-1 patch, uniformity of patch is low (i.e.0.28 low to day-1) and by comparing the day-2 and day-3 patch, uniformity of patch is high (i.e. 0.06 high to day-2 and 0.33 high to day-3) XC63.2% = 706.22 mm mesh size and the maximum boulder size in this patch is 1210 mm.

4.5. Day-5, 23 September, 2018, mine-X north 4th bench

The result of this patch explains that fragmentation of the blast is good as the N value is greater than 1 (i.e. 1.40) that means uniformity of the muck pile is good but by comparing the day-1, 2 and 4 patch, uniformity of patch is low (i.e. 0.38 low to day-1, 0.04 to day-2 and 0.10 low to day-4) and by

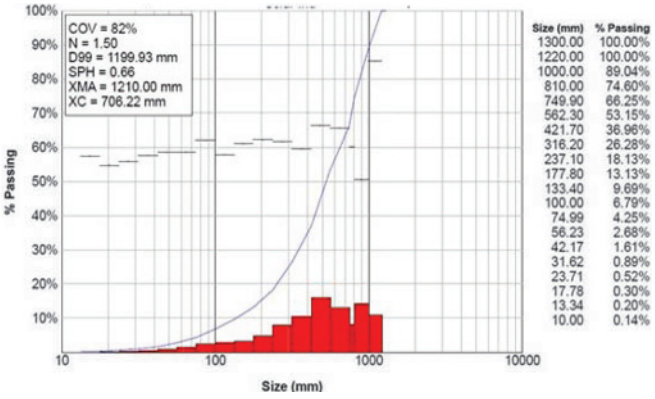

Fig.7 Cumulative analysis of day-4 patch

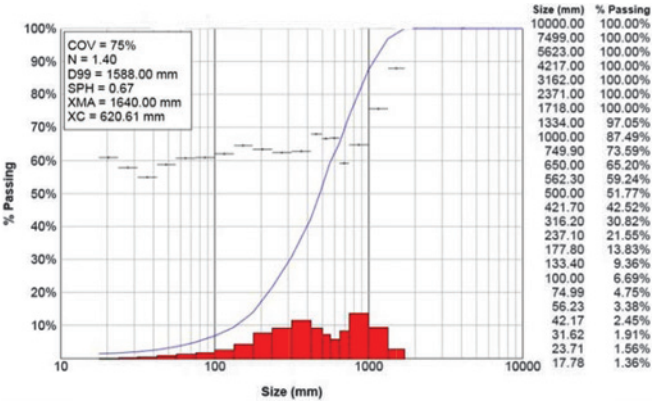

Fig.8 Cumulative analysis of day-5 patch

comparing the day-3 patch, uniformity of patch is high (i.e. 0.23 high to day-3) XC63.2% = 620.61 mm mesh size and the maximum boulder size in this patch is 1640 mm.

The Table 1 shows that the values of particular date of sample and location and the values are COV%, N. XC (mm), XAM (mm). Resultant explains that fragmentation of the blast is a little bit fluctuating but the result is good to particular employed machine and the accuracy of result is 90-95%.

5. Conclusion and suggestions

In the course of study, it is observed that the fragmentation of blast is sometimes poor and fluctuates, that result gets boulder to analyse that fragmentation is much difficult by manually that was very timetaking process and that is not possible to do it every time making all other works on hold. By adopting Wip-Frag software authors analyse the fragmentation of patch that results in 95% of accuracy.

Table 1: Cumulative list of the resultant values

Day of sample		COV (%)	N	XC (mm)	XAM (mm)
Day-1/ 18 September	Top bench NE	82	1.78	1175.00	2200.00
Day-2/ 19 September	NE Second bench	69	1.44	625.03	1950.00
Day-3/ 20 September	NE996 bench	64	1.17	700.73	1460.00
Day-4/ 22 September	NE996 second bench	82	1.50	706.22	1210.00
Day-5/ 23 September	North 4th bench	75	1.40	620.61	1640.00

During the analysis observed a few % of large size rock is generated from the backbreak of the blast. Which can more control

(a) Having a better free face of the blast

(b) Clearing the blasted muck before the blast

(c) Higher inter-hole delay may also reduce the backbrake, which is the cause of large rock size generation.

Finally, this paper concluded that analysis by this software gets accurate values in less time. That helps to extend the focus on all other works.

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