

LAMPIRAN A

DATA CURAH HUJAN

Tabel A1 Data Curah Hujan Januari 2022

A	B	C	D	E	F	G=	H
TGL	JAM HUJAN		DURASI (menit)	CURAH HUJAN (mm)	INTENSITAS (mm/menit)	KETERANGAN	
	AWAL	AKHIR					
			D=C-B	E=60*JM		G=F/E	
1	00:00:00	00:00:00	0:00:00				
2	00:00:00	00:00:00	0:00:00				
3	00:00:00	00:00:00	0:00:00				
4	00:00:00	00:00:00	0:00:00				
5	00:00:00	00:00:00	0:00:00				
6	00:00:00	00:00:00	0:00:00				
7	00:00:00	00:00:00	0:00:00				
8	20:00:00	23:55:00	3:55:00	235	60.0	0.26	DERAS
9	18:10:00	19:40:00	1:30:00	90	47.0	0.52	DERAS
10	17:10:00	22:44:00	5:34:00	334	10.0	0.03	LEMAH
11	00:00:00	00:00:00	0:00:00				
12	00:00:00	00:00:00	0:00:00				
13	00:00:00	00:00:00	0:00:00				
14	00:00:00	00:00:00	0:00:00				
15	22:20:00	23:00:00	0:40:00	40	4.0	0.10	SEDANG
16	00:00:00	00:00:00	0:00:00				
17	00:00:00	00:00:00	0:00:00				
18	07:20:00	08:40:00	1:20:00	80	4.0	0.05	LEMAH
	23:35:00	00:00:00	0:25:00	25	1.0	0.04	LEMAH
19	00:00:00	01:35:00	1:35:00	95	1.0	0.01	SANGAT LEMAH
	16:33:00	17:36:00	1:03:00	63	27.0	0.43	DERAS
20	01:00:00	04:30:00	3:30:00	210	1.0	0.00	SANGAT LEMAH
21	00:00:00	00:00:00	0:00:00				
22	00:00:00	00:00:00	0:00:00				
23	14:40:00	15:00:00	0:20:00	20	1.0	0.05	LEMAH
24	20:50:00	21:30:00	0:40:00	40	6.0	0.15	SEDANG
25	22:40:00	00:00:00	1:20:00	80	5.0	0.06	SEDANG
26	00:00:00	07:10:00	7:10:00	430	64.0	0.15	SEDANG
27	00:00:00	00:00:00	0:00:00				
28	00:00:00	00:00:00	0:00:00				
29	00:00:00	00:00:00	0:00:00				
30	00:00:00	00:00:00	0:00:00				
31	03:40:00	04:00:00	0:20:00	20	0.5	0.03	LEMAH
TOTAL				1762	232	0.13	SEDANG
RATA-RATA				125.86	16.54	0.13	SEDANG

Tabel A2 Data Curah Hujan Februari

A	B	C	D	E	F	G=	H
TGL	JAM HUJAN		DURASI (menit)	CURAH HUJAN (mm)	INTENSITAS (mm/menit)	KETERANGAN	
	AWAL	AKHIR					D=C-B
1	00:00:00	00:00:00	0:00:00				
2	00:00:00	00:00:00	0:00:00				
3	00:00:00	00:00:00	0:00:00				
4	00:00:00	00:00:00	0:00:00				
5	00:00:00	00:00:00	0:00:00				
6	00:00:00	00:00:00	0:00:00				
7	00:00:00	00:00:00	0:00:00				
8	20:00:00	23:55:00	3:55:00	235	60.0	0.26	DERAS
9	18:10:00	19:40:00	1:30:00	90	47.0	0.52	DERAS
10	17:10:00	22:44:00	5:34:00	334	10.0	0.03	LEMAH
11	00:00:00	00:00:00	0:00:00				
12	00:00:00	00:00:00	0:00:00				
13	00:00:00	00:00:00	0:00:00				
14	00:00:00	00:00:00	0:00:00				
15	22:20:00	23:00:00	0:40:00	40	4.0	0.10	SEDANG
16	00:00:00	00:00:00	0:00:00				
17	00:00:00	00:00:00	0:00:00				
18	07:20:00	08:40:00	1:20:00	80	4.0	0.05	LEMAH
	23:35:00	00:00:00	0:25:00	25	1.0	0.04	LEMAH
19	00:00:00	01:35:00	1:35:00	95	1.0	0.01	SANGAT LEMAH
	16:33:00	17:36:00	1:03:00	63	27.0	0.43	DERAS
20	01:00:00	04:30:00	3:30:00	210	1.0	0.00	SANGAT LEMAH
21	00:00:00	00:00:00	0:00:00				
22	00:00:00	00:00:00	0:00:00				
23	14:40:00	15:00:00	0:20:00	20	1.0	0.05	LEMAH
24	20:50:00	21:30:00	0:40:00	40	6.0	0.15	SEDANG
25	22:40:00	00:00:00	1:20:00	80	5.0	0.06	SEDANG
26	00:00:00	07:10:00	7:10:00	430	64.0	0.15	SEDANG
27	00:00:00	00:00:00	0:00:00				
28	00:00:00	00:00:00	0:00:00				
29	00:00:00	00:00:00	0:00:00				
30	00:00:00	00:00:00	0:00:00				
31	03:40:00	04:00:00	0:20:00	20	0.5	0.03	LEMAH
TOTAL				1762	232	0.13	SEDANG
RATA-RATA				125.86	16.54	0.13	SEDANG

Tabel A3 Data Curah Hujan Maret 2022

A	B	C	D	E	F	G	H
TGL	JAM HUJAN		DURASI (menit)	CURAH HUJAN (mm)	INTENSITAS (mm/menit)	KETERANGAN	
	AWAL	AKHIR					D=C-B
1	00:00:00	03:30:00	3:30:00	210	25.0	0.12	SEDANG
2	00:00:00	00:00:00	0:00:00				
3	00:00:00	00:00:00	0:00:00				
4	00:00:00	00:00:00	0:00:00				
5	00:00:00	00:00:00	0:00:00				
6	02:10:00	09:00:00	6:50:00	410	15.0	0.04	LEMAH
7	19:19:00	00:00:00	4:41:00	281	20.0	0.07	SEDANG
8	00:00:00	03:30:00	3:30:00	210	10.0	0.05	LEMAH
9	22:48:00	01:45:00	2:57:00	178	64.0	0.36	DERAS
	19:25:00	21:22:00	1:57:00	117	30.0	0.26	DERAS
10	00:00:00	00:00:00	0:00:00				
11	04:55:00	05:16:00	0:21:00	21	18.0	0.86	DERAS
12	00:00:00	00:00:00	0:00:00				
13	07:05:00	07:27:00	0:22:00	22	4.0	0.18	SEDANG
14	02:18:00	06:36:00	4:18:00	258	12.0	0.05	LEMAH
15	00:00:00	00:00:00	0:00:00				
16	02:13:00	04:15:00	2:02:00	122	7.0	0.06	SEDANG
17	02:10:00	02:28:00	0:18:00	18	2.0	0.11	SEDANG
	13:13:00	19:30:00	6:17:00	377	50.0	0.13	SEDANG
18	15:58:00	16:20:00	0:22:00	22	2.0	0.09	SEDANG
	20:18:00	00:00:00	3:42:00	222	10.0	0.05	SEDANG
19	00:00:00	03:00:00	3:00:00	180	10.0	0.06	SEDANG
20	02:45:00	08:00:00	5:15:00	315	3.5	0.01	LEMAH
21	00:00:00	00:00:00	0:00:00				
22	00:00:00	00:00:00	0:00:00				
23	01:30:00	02:40:00	1:10:00	70	38.0	0.54	DERAS
24	00:00:00	00:00:00	0:00:00				
25	00:00:00	00:00:00	0:00:00				
26	00:00:00	00:00:00	0:00:00				
27	00:00:00	00:00:00	0:00:00				
28	00:00:00	00:00:00	0:00:00				
29	00:00:00	00:00:00	0:00:00				
30	00:00:00	00:00:00	0:00:00				
31	00:00:00	00:00:00	0:00:00				
TOTAL				3033	321	0.11	SEDANG
RATA-RATA				178.41	18.85	0.11	SEDANG

LAMPIRAN B
SPESIFIKASI BAHAN PELEDAK, PERALATAN DAN
PERLENGKAPAN KEGIATAN PELEDAKAN

Tabel B1. Spesifikasi Bahan Peledak

Merk	DANFO
Buatan	PT. Dahana
Komposisi	NH ₄ NO ₃ + CH ₂
Bentuk	Butiran
Kecepatan Detonasi	3700 m/s
Ketahanan Terhadap Air	Buruk
<i>Density</i>	0,8 gr/cm ³

Tabel B2. Spesifikasi *Dynamite*

Merk	Dayagel
Buatan	PT. Dahana
Massa	500 gr
Size	50 mm
Panjang	200 mm
cartridges per case	40 ea

Tabel B3. Spesifikasi Furukawa HCR 1500-ED II

<i>Furukawa drilling</i>	
<i>Manufacturer</i>	FRUKAWA
<i>Model</i>	HCR 1500- ED II
<i>Rated output (HP/rpm)</i>	620/4.200
<i>Net Weigt</i>	23.636 kg
<i>Overall length (incl. Dril guide)</i>	10,14 m
<i>Overall widht</i>	2,5 m
<i>Drill travel</i>	40-180 rpm
<i>Track oscillation</i>	20°
<i>Ground clearence</i>	457 mm
<i>Width of grouses</i>	380 mm
<i>Max swing of boom (R/L 50%) lifted above horizontal</i>	45°/20°
<i>Max vertical movement of boom</i>	50°/20°
<i>Boom length</i>	3,0 m
<i>Boom extention</i>	1,2 m
<i>Max guide dump</i>	90°/20°
<i>Max guide swing (R/L)</i>	90°/20°
<i>Gaedability</i>	40% - 80%

Tabel B4. Spesifikasi *Blasting Machine*

Merk dan Type	Kobla BM200d
Sumber daya	6V Dry battery
Condenser Capacity	15uf
Output voltage	1450 V
Kapasitas detonator	200 ohm

Tabel B5. Spesifikasi *Ohm Meter*

Merk dan Type	Kolba XR III
Kapasitas	0-2000 ohm
Produsen	Korea Elektronik
Putput Voltage	0,5 V

Tabel B6. Spesifikasi *Excavator Doozan DX-500*

Type	Doosan Excavator S500 LCV
Kapasitas Bucket	3.6 m ³
Mesin	312 HP
kedalaman Penggalian Maksimum	6,28 M
Tinggi dumping Maksimum	6,590 M
Tinggi Penggalian Maksimum	9,6 m
Radius Penggalian Maksimum	9.99 M
Kecepatan maksimum	5,6 km/jam
Kecepatan Swing	9,2 rpm
Berat Keseluruhan	51100 kg

Tabel B7. Spesifikasi HINO FM 260 JD

Type	HINO FM 260 JD
Panjang	8,48 m
Lebar	2,45 m
Tinggi	2,7 m
Kecepatan Maksimum	86 km/jam
Berat Kosong	6.981 kg

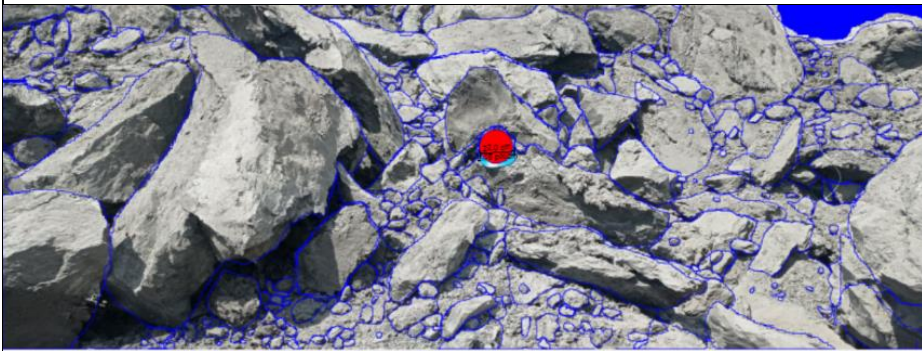
Tabel B8. Spesifikasi *Inhole Delay*

Buatan	PT. Dahana
Panjang	9 m
Waktu Tunda	3000 ms
Qty/Pack	125 pcs
Shock Tube	Kuning
J-Hook	kuning
Connector	-
Type	LP

Tabel B9. Spesifikasi *Surface Delay*

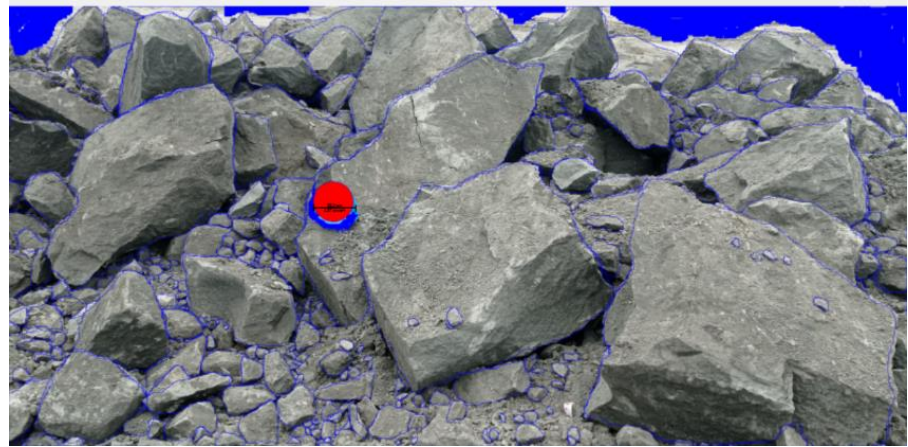
Buatan	PT. Dahana
panjang	9 m
waktu tunda	109 ms
Qty/Pack	100 pcs
Shock Tube	Biru
J-Hook	Biru
Connector	Biru
Type	SD
Buatan	PT. Dahana
panjang	9 m
waktu tunda	42 ms
Shock Tube	Putih
J-Hook	Putih
Connector	Putih
Type	SD
Buatan	PT. Dahana
panjang	9 m
waktu tunda	67 ms
Shock Tube	Orange
J-Hook	Orange
Connector	Orange
Type	SD

LAMPIRAN C
HASIL *SPLIT DESKTOP*



Gambar. C1 Fragmentasi Data 1

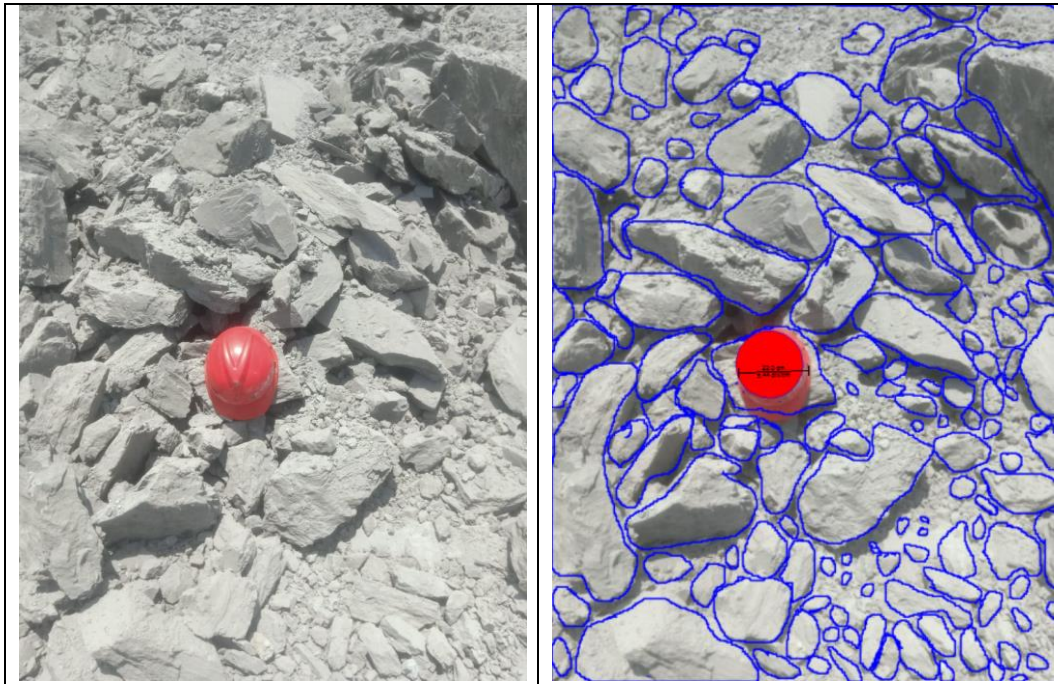




Gambar. C2 Fragmentasi Data 2

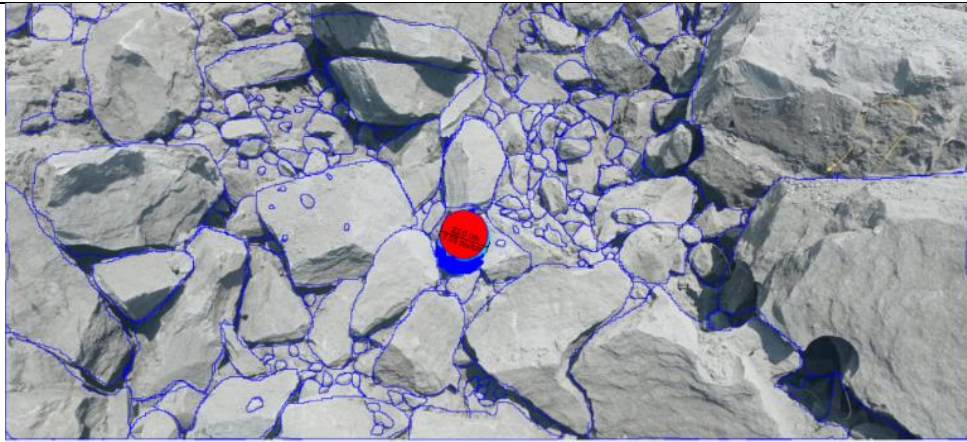


Gambar. C3 Fragmentasi Data 3

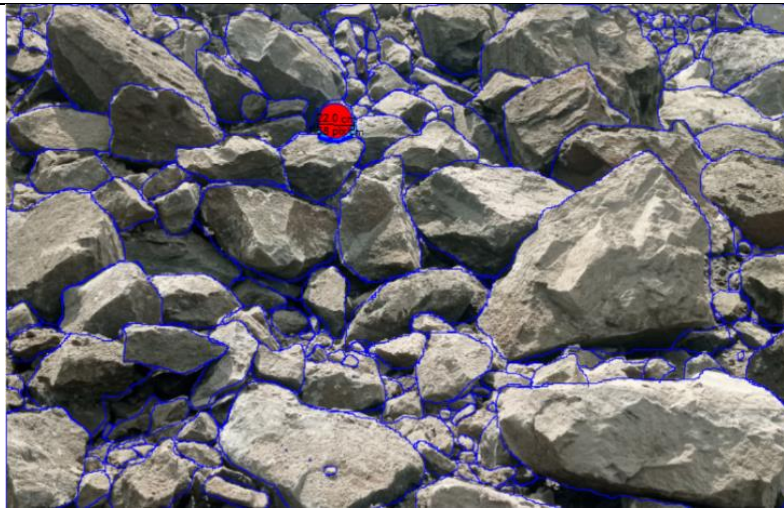


Gambar. C4 Fragmentasi Data 4

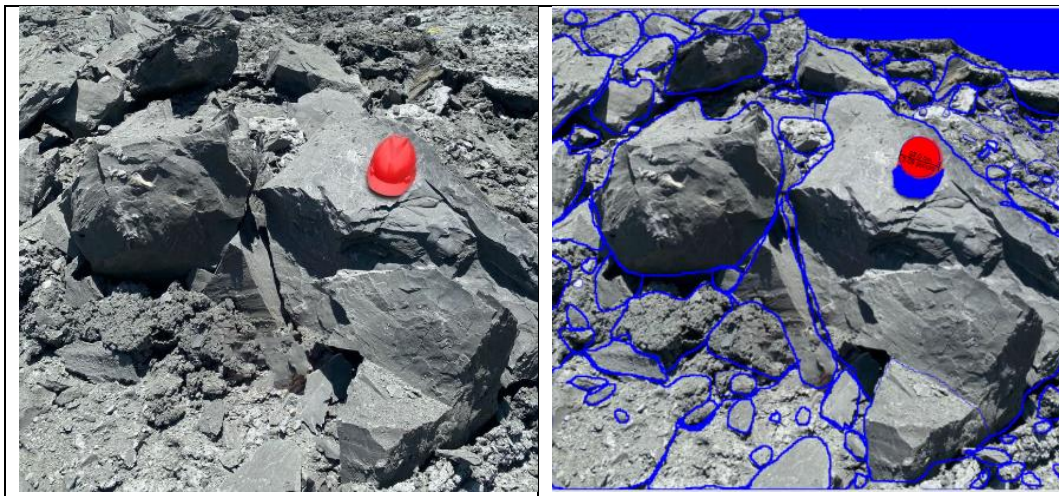




Gambar. C5 Fragmentasi Data 5



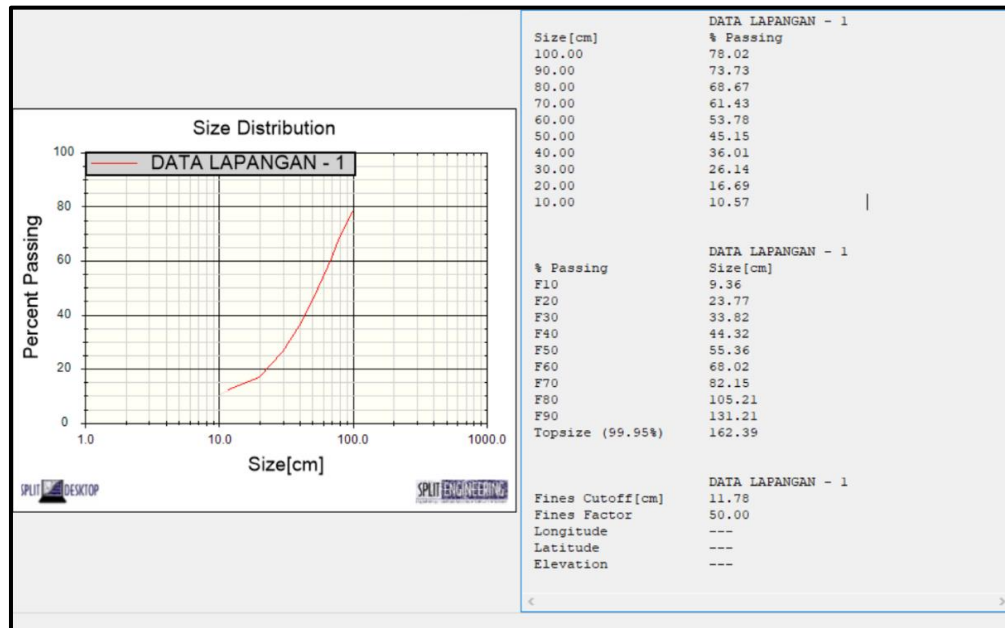
Gambar. C6 Fragmentasi Data 6



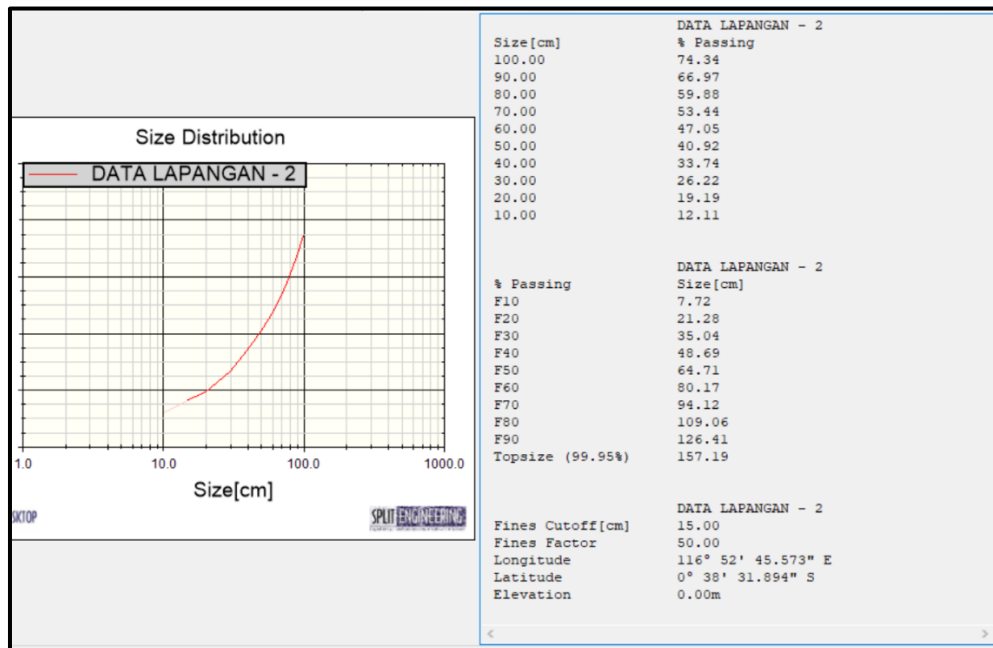
Gambar. C7 Fragmentasi Data 7

LAMPIRAN D

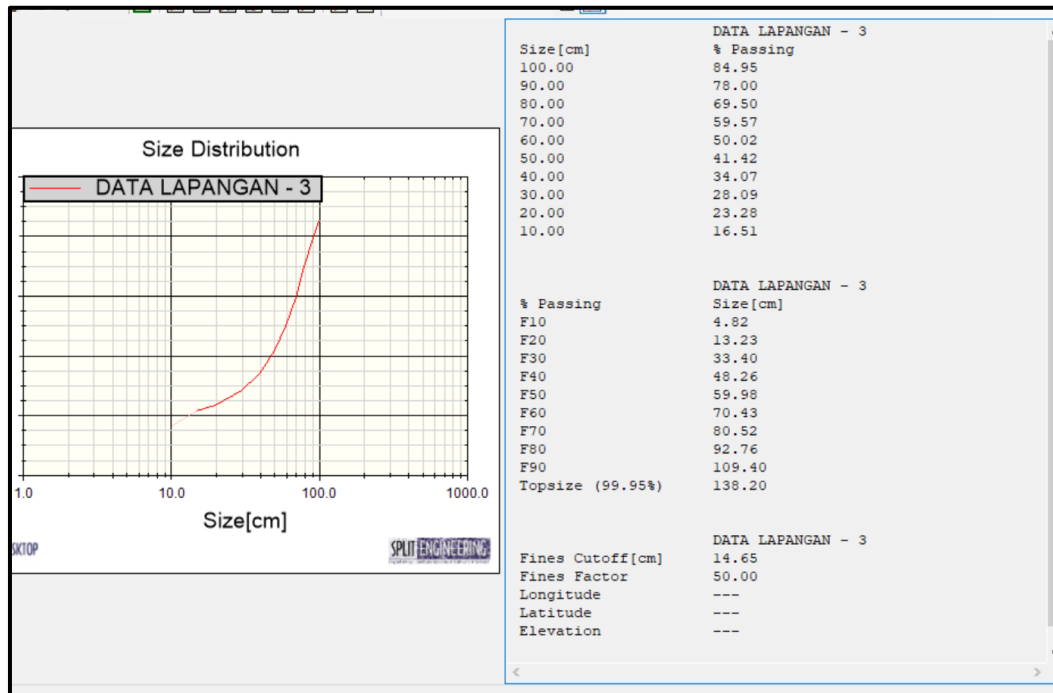
GRAFIK *SPLIT DESKTOP*



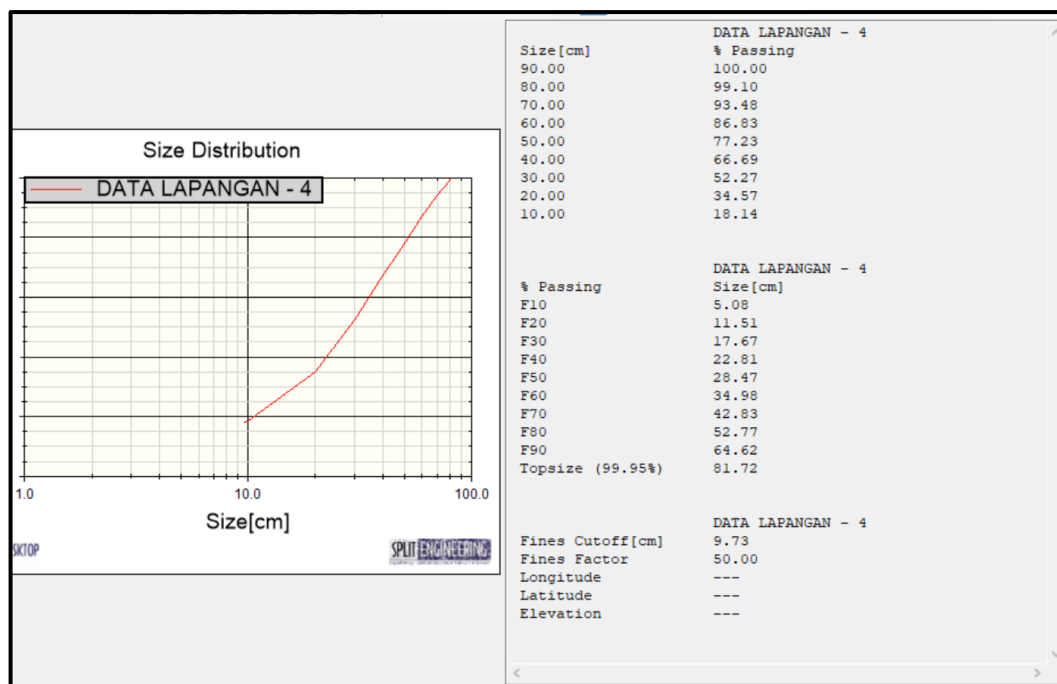
Gambar D1. Distribusi Fragmentasi Data 1



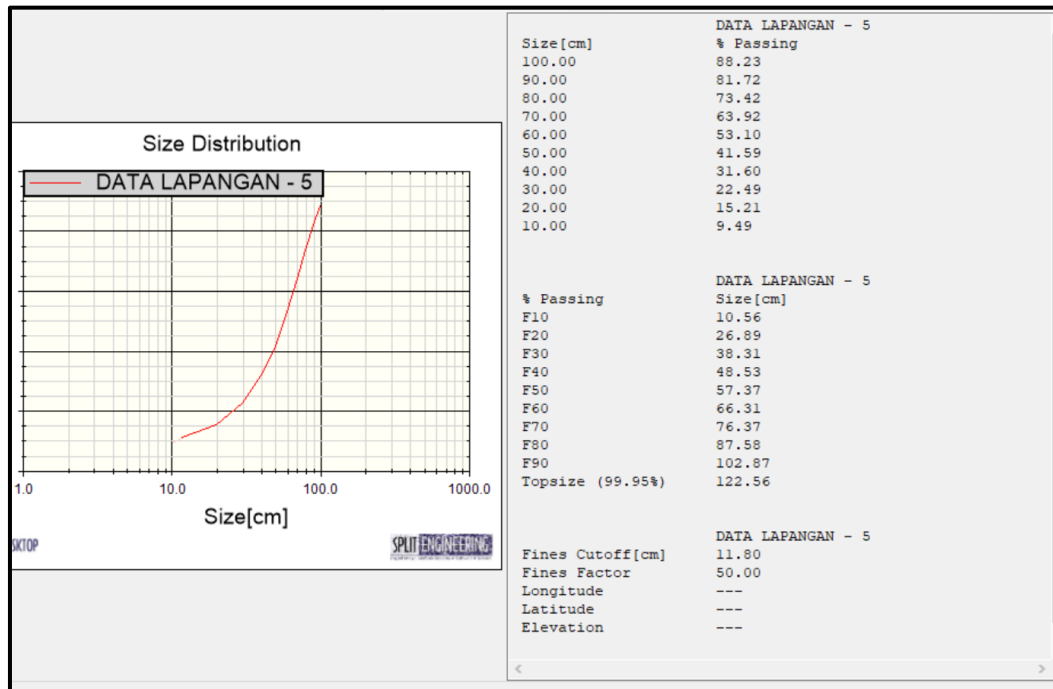
Gambar D2. Distribusi Fragmentasi Data 2



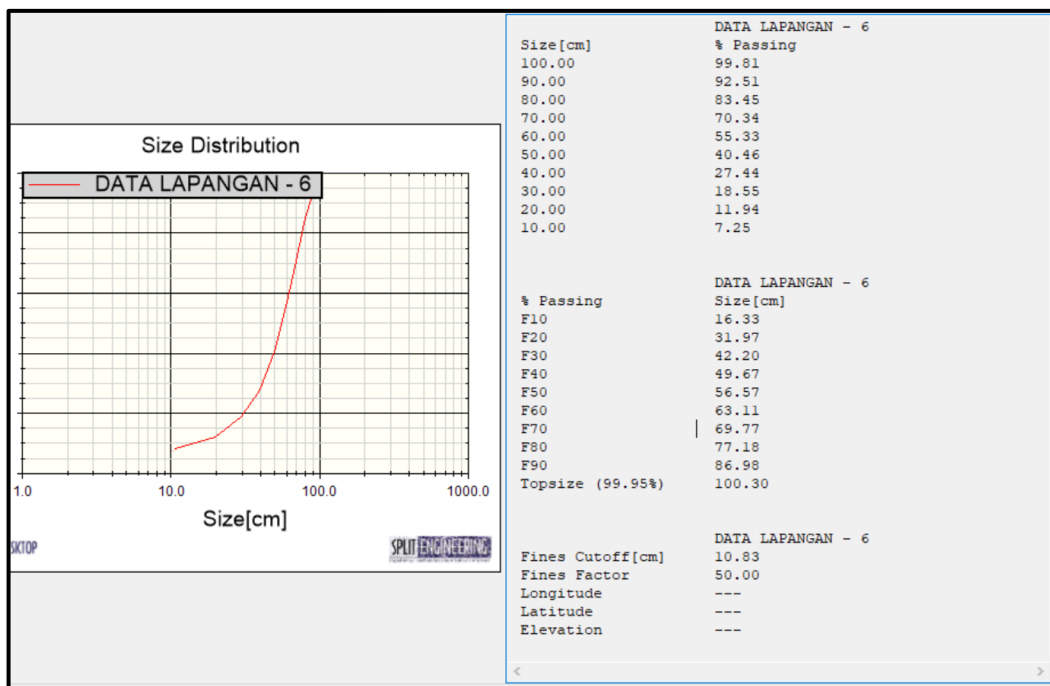
Gambar D3. Distribusi Fragmentasi Data 3



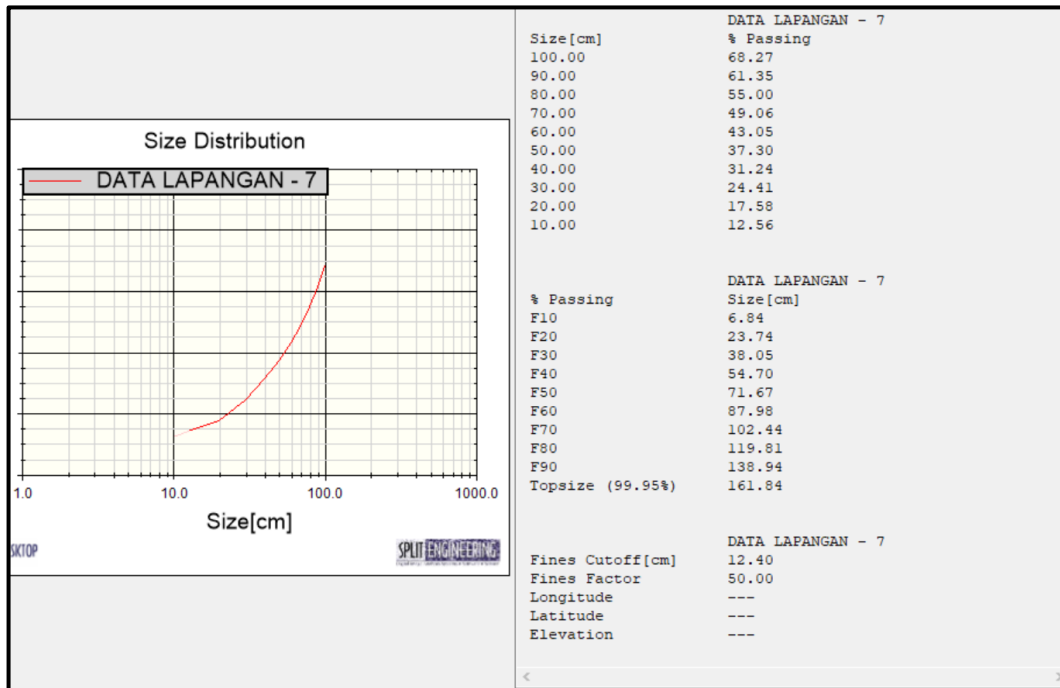
Gambar D4. Distribusi Fragmentasi Data 4



Gambar D5. Distribusi Fragmentasi Data 5



Gambar D6. Distribusi Fragmentasi Data 6



Gambar D7. Distribusi Fragmentasi Data 7

LAMPIRAN E
PERHITUNGAN TEORITIS GEOMETRI USULAN DAN
AKTUAL MENURUT TEORI R.L. ASH

Dalam perhitungan secara teori, didasarkan pada pemenuhan target produksi, dengan menggunakan metode R.L. Ash sebagai berikut :

Geometri peledakan usulan berdasarkan teori R.L. Ash dengan material batupasir (*hardsanstone*)

$$D \text{ material} = 2,232 \text{ ton/m}^3 = 167,72 \text{ lb/ft}^3$$

$$D \text{ Std} = 160 \text{ lb/ft}^3 = 2,56 \text{ ton/m}^3$$

$$Sg \text{ ANFO} = 0,8 \text{ gr/cc}$$

$$Sg \text{ Std} = 1,2$$

$$Ve \text{ ANFO} = 3.700 \text{ m/s} = 12139,29 \text{ fps}$$

$$Ve \text{ Std} = 1.2000 \text{ fps}$$

$$De = 5 \text{ inch} = 127 \text{ mm}$$

$$Kb \text{ Std} = 30$$

$$Ks = 1,4$$

$$Kt = 0,75$$

$$Kh = 1,87$$

$$L = 6 \text{ m}$$

$$Kj = 0,2 \text{ m}$$

$$de = 10,16 \text{ kg}$$

Perhitungan geometri peledakan usulan :

a. Burden

$$\begin{aligned} AF1 &= (Sg \cdot Ve^2 / Sg \text{ Std} \cdot Ve \text{ Std}^2)^{1/3} \\ &= (0,80 \times 12139,29^2 / 1,2 \times 12.000^2)^{1/3} \\ &= 0,88 \end{aligned}$$

$$\begin{aligned} AF2 &= (D \text{ std} / D) \\ &= (160 / 167,7234) \text{ lb/ft}^3 \end{aligned}$$

$$= 0,95$$

$$K_b = K_{b_{std}} \times AF1 \times AF2$$

$$= 30 \times 0,88 \times 0,95$$

$$\text{Burden} = (K_b \times D_e)/39,30 = 3 \text{ m}$$

b. Spasi

$$S = K_s \times B = 1,4 \times 3 = 4,5 \text{ m}$$

c. Stemming

$$T = K_t \times B = 0,75 \times 3 = 2,4 \text{ m}$$

d. Subdrilling

$$J = K_j \times B = 0,2 \times 3 = 0,64 \text{ m}$$

e. Kedalaman Lubang Ledak

$$H = K_h \times B = 1,87 \times 3 = 6 \text{ m}$$

f. Panjang Kolom Isian

$$PC = H - T = 6 - 2,4 = 3,6 \text{ m}$$

g. Volume Terbongkar

$$V = B \times S \times H = 3 \times 4,5 \times 6 = 86,12 \text{ m}^3$$

h. Jumlah Bahan Peledak/Lubang

$$E = d_e \times PC = 10,16 \times 3,6 = 36,46 \text{ kg}$$

i. Powder Factor

$$PF = E/V = 36,46/86,12 = 0,42 \text{ kg/m}^3$$

Geometri peledakan aktual rata-rata pengukuran di lapangan berdasarkan teori R.L.

Ash

$$D_{\text{material}} = 2,232 \text{ ton/m}^3 = 167,72 \text{ lb/ft}^3$$

$$D_{\text{Std}} = 160 \text{ lb/ft}^3 = 2,56 \text{ ton/m}^3$$

$$S_g \text{ ANFO} = 0,8 \text{ gr/cc}$$

$$S_g \text{ Std} = 1,2$$

$$V_e \text{ ANFO} = 3.700 \text{ m/s} = 12139,29 \text{ fps}$$

$$V_e \text{ Std} = 1.2000 \text{ fps}$$

$$D_e = 5 \text{ inch} = 127 \text{ mm}$$

$$K_b \text{ Std} = 30$$

de	= 10,16
B	= 5 m
S	= 6 m
H	= 6,41 m
T	= 3,17 m
PC	= 3,23 m
V	= 5 x 6 x 6,41 = 192,14 m ³
E	= 10,16 x 3,23 = 32,86 kg
PF	= 32,86/192,14 = 0,17 kg/m ³

LAMPIRAN F

**PERHITUNGAN FRAGMENTASI BERDASARKAN
GEOMETRI USULAN DAN AKTUAL DENGAN METODE
KUZ-RAM**

Tabel F1. Nilai *Rock Factor* pada lokasi penelitian

PARAMETER	PEMBOBOTAN
<i>Rock Mass Description (RMD)</i>	
1. <i>Powdery / Friable</i>	10
2. <i>Blocky</i>	20
3. <i>Totally Massive</i>	50
<i>Joint Plane Spacing (JPS)</i>	
1. <i>Close (Spasi < 0,1 m)</i>	10
2. <i>Intermediate (Spasi 0,1-1m)</i>	20
3. <i>Wide (Spasi lebih dari 1)</i>	50
<i>Joint Plane Orientation (JPO)</i>	
1. <i>Horizontal</i>	10
2. <i>Dip Out of Face</i>	20
3. <i>Strike Normal to Face</i>	30
4. <i>Dip into Face</i>	40
<i>Specific Gravity Influence (SGI)</i> SGI = 25 x SG - 50	25 x 0,8 - 50 = 30
Hardness (H)	2

$$\begin{aligned}
 \text{Blastibility Index} &= 0,5 (\text{RMD} + \text{JPS} + \text{JPO} + \text{SGI} + \text{H}) \\
 &= 0,5 (50 + 20 + 20 + 30 + 2) \\
 &= 61,00
 \end{aligned}$$

$$\begin{aligned}
 \text{Rock Factor} &= \text{BI} \times 0,12 \\
 &= 61,00 \times 0,12 \\
 &= 7,32
 \end{aligned}$$

- Perhitungan fragmensi berdasarkan geometri usulan dengan metode Kuz-Ram

$$\begin{aligned}
 \text{Rata-rata ukuran fragmentasi (x)} &= A \times \left(\frac{V}{Q}\right)^{0,8} \times Q^{0,17} \times (E/115)^{-0,63} \\
 &= 7,32 \times (86,12/32,83)^{0,8} \times (32,83)^{0,17} \times (100/115)^{-0,63} \\
 &= 31,30
 \end{aligned}$$

Untuk mengetahui persentase bongkah pada hasil peledakan yang digunakan rumus indeks keseragaman (n) dan karakteristik ukuran (Xc), dengan persamaan berikut :

$$\begin{aligned} \text{Indeks keseragaman (n)} &= (2,2 - 14 \frac{B}{De}) \times (\frac{1+A'}{2}) \times (1 - \frac{W}{B}) \times (\frac{PC}{L}) \\ &= (2,2 - 14 \frac{5}{6}) \times (\frac{1+1,4}{2}) \times (1 - \frac{0}{5}) \times (\frac{3,59}{6}) \\ &= 1,44 \end{aligned}$$

$$\begin{aligned} \text{Karakteristik ukuran (Xc)} &= \frac{X}{(0,693)^{1/3}} \\ &= \frac{31,30}{(0,693)^{1/3}} = 40,37 \end{aligned}$$

Selanjutnya dapat dihitung persentase material tertahan pada ayakan (%), dengan rumus sebagai berikut :

$$R_x = e^{-\left(\frac{X}{Xc}\right)^n}$$

Dimana :

R_x = persentase material yang tertahan pada ayakan (%)

X = ukuran ayakan (cm)

n = indeks keseragaman

Xc = karakteristik ukuran (cm)

Prediksi fragmentasi hasil peledakan geometri usulan

- $R_{10} = e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{10}{40,37}\right)^{1,44}} = 87,49 \%$
Maka material lolos pada ayakan 10 cm = 100% - 87,49 % = 12,51 %
- $R_{20} = e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{20}{40,37}\right)^{1,44}} = 69,54 \%$
Maka material lolos pada ayakan 10 cm = 100% - 69,54 % = 30,46 %
- $R_{30} = e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{30}{40,37}\right)^{1,44}} = 52,11 \%$
Maka material lolos pada ayakan 10 cm = 100% - 52,11 % = 47,89 %
- $R_{40} = e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{40}{40,37}\right)^{1,44}} = 37,27 \%$
Maka material lolos pada ayakan 10 cm = 100% - 37,27 % = 62,73 %
- $R_{50} = e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{50}{40,37}\right)^{1,44}} = 25,62 \%$$

Maka material lolos pada ayakan 10 cm = 100% - 25,62 % = 74,38 %

- R60 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{60}{40,37}\right)^{1,44}} = 17,01 \%$$

Maka material lolos pada ayakan 10 cm = 100% - 17,01 % = 82,99 %

- R70 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{70}{40,37}\right)^{1,44}} = 10,95 \%$$

Maka material lolos pada ayakan 10 cm = 100% - 10,95 % = 89,05 %

- R80 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{80}{40,37}\right)^{1,44}} = 6,84 \%$$

Maka material lolos pada ayakan 10 cm = 100% - 6,84 % = 93,16 %

- R90 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{90}{40,37}\right)^{1,44}} = 4,17 \%$$

Maka material lolos pada ayakan 10 cm = 100% - 4,17 % = 95,83 %

- R100 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{100}{40,37}\right)^{1,44}} = 2,47 \%$$

Maka material lolos pada ayakan 10 cm = 100% - 2,47 % = 97,53 %

2. Perhitungan fragmensi berdasarkan geometri aktual dengan metode Kuz-Ram

Prediksi fragmentasi hasil peledakan pada tanggal 08 Maret 2022

$$\begin{aligned} \text{Rata-rata ukuran fragmentasi (x)} &= A \times \left(\frac{V}{Q}\right)^{0,8} \times Q^{0,17} \times (E/115)^{-0,63} \\ &= 7,32 \times (193,14/32,83)^{0,8} \times (32,83)^{0,17} \times (100/115)^{-0,63} \\ &= 59,73 \end{aligned}$$

Untuk mengetahui persentase bongkah pada hasil peledakan yang digunakan rumus indeks keseragaman (n) dan karakteristik ukuran (Xc), dengan persamaan berikut :

$$\begin{aligned} \text{Indeks keseragaman (n)} &= \left(2,2 - 14 \frac{B}{De}\right) \times \left(\frac{1+A'}{2}\right) \times \left(1 - \frac{W}{B}\right) \times \left(\frac{PC}{L}\right) \\ &= \left(2,2 - 14 \frac{5}{6}\right) \times \left(\frac{1+1,2}{2}\right) \times \left(1 - \frac{0}{5}\right) \times \left(\frac{3,23}{6,44}\right) \\ &= 1,05 \end{aligned}$$

$$\text{Karakteristik ukuran (Xc)} = \frac{X}{(0,693)^{1/3}}$$

$$= \frac{59,73}{(0,693)^{1/3}} = 69,49$$

Selanjutnya dapat dihitung persentase material tertahan pada ayakan (%), dengan rumus sebagai berikut :

$$R_x = e^{-\left(\frac{X}{Xc}\right)^n}$$

Dimana :

R_x = persentase material yang tertahan pada ayakan (%)

X = ukuran ayakan (cm)

n = indeks keseragaman

Xc = karakteristik ukuran (cm)

- $R_{10} = e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{10}{67,49}\right)^{1,05}} = 87,69 \%$

Maka material lolos pada ayakan 10 cm = 100% - 87,69 % = 12,31 %

- $R_{20} = e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{20}{67,49}\right)^{1,05}} = 76,22 \%$

Maka material lolos pada ayakan 20 cm = 100% - 76,22 % = 23,78 %

- $R_{30} = e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{30}{67,49}\right)^{1,05}} = 66,03 \%$

Maka material lolos pada ayakan 30 cm = 100% - 66,03 % = 33,97 %

- $R_{40} = e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{40}{67,49}\right)^{1,05}} = 57,07 \%$

Maka material lolos pada ayakan 40 cm = 100% - 57,07 % = 42,93 %

- $R_{50} = e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{50}{67,49}\right)^{1,05}} = 49,24 \%$

Maka material lolos pada ayakan 50 cm = 100% - 49,24 % = 50,76 %

- $R_{60} = e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{60}{67,49}\right)^{1,05}} = 42,42 \%$

Maka material lolos pada ayakan 60 cm = 100% - 42,42 % = 57,58 %

- $R_{70} = e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{70}{67,49}\right)^{1,05}} = 36,50 \%$$

Maka material lolos pada ayakan 70 cm = 100% - 36,50 % = 63,50 %

- R80 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{80}{67,49}\right)^{1,05}} = 31,38 \%$$

Maka material lolos pada ayakan 80 cm = 100% - 31,38 % = 68,62 %

- R90 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{90}{67,49}\right)^{1,05}} = 26,95 \%$$

Maka material lolos pada ayakan 90 cm = 100% - 26,95 % = 73,05 %

- R100 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{100}{67,49}\right)^{1,05}} = 23,13 \%$$

Maka material lolos pada ayakan 100 cm = 100% - 23,13 % = 76,87 %

Prediksi fragmentasi hasil peledakan pada tanggal 09 Maret 2022

$$\begin{aligned} \text{Rata-rata ukuran fragmentasi (x)} &= A \times \left(\frac{V}{Q}\right)^{0,8} \times Q^{0,17} \times (E/115)^{-0,63} \\ &= 7,32 \times (189,10/32,15)^{0,8} \times (32,15)^{0,17} \times (100/115)^{-0,63} \\ &= 59,51 \end{aligned}$$

$$\begin{aligned} \text{Indeks keseragaman (n)} &= \left(2,2 - 14 \frac{B}{De}\right) \times \left(\frac{1+A'}{2}\right) \times \left(1 - \frac{W}{B}\right) \times \left(\frac{PC}{L}\right) \\ &= \left(2,2 - 14 \frac{5}{6}\right) \times \left(\frac{1+1,2}{2}\right) \times \left(1 - \frac{0}{5}\right) \times \left(\frac{3,16}{6,30}\right) \\ &= 1,05 \end{aligned}$$

$$\begin{aligned} \text{Karakteristik ukuran (Xc)} &= \frac{X}{(0,693)^{1/3}} \\ &= \frac{59,51}{(0,693)^{1/3}} = 69,25 \end{aligned}$$

- R10 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{10}{69,25}\right)^{1,05}} = 87,64 \%$$

Maka material lolos pada ayakan 10 cm = 100% - 87,64 % = 12,36 %

- R20 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{20}{69,25}\right)^{1,05}} = 76,15 \%$$

Maka material lolos pada ayakan 20 cm = 100% - 76,15 % = 23,85 %

- R30 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{30}{69,25}\right)^{1,05}} = 65,93 \%$$

Maka material lolos pada ayakan 30 cm = 100% - 65,93 % = 34,07 %

- R40 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{40}{69,25}\right)^{1,05}} = 56,95 \%$$

Maka material lolos pada ayakan 40 cm = 100% - 56,95 % = 43,05 %

- R50 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{50}{69,25}\right)^{1,05}} = 49,11 \%$$

Maka material lolos pada ayakan 50 cm = 100% - 49,11 % = 50,89 %

- R60 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{60}{69,25}\right)^{1,05}} = 42,29 \%$$

Maka material lolos pada ayakan 60 cm = 100% - 42,29 % = 57,71 %

- R70 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{70}{69,25}\right)^{1,05}} = 36,37 \%$$

Maka material lolos pada ayakan 70 cm = 100% - 36,37 % = 63,63 %

- R80 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{80}{69,25}\right)^{1,05}} = 31,38 \%$$

Maka material lolos pada ayakan 80 cm = 100% - 31,38 % = 68,62 %

- R90 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{90}{69,25}\right)^{1,05}} = 26,95 \%$$

Maka material lolos pada ayakan 90 cm = 100% - 26,95 % = 73,05 %

- R100 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{100}{69,25}\right)^{1,05}} = 23,01 \%$$

Maka material lolos pada ayakan 100 cm = 100% - 23,01 % = 76,99 %

Prediksi fragmentasi hasil peledakan pada tanggal 10 Maret 2022

$$\begin{aligned} \text{Rata-rata ukuran fragmentasi (x)} &= A \times \left(\frac{V}{Q}\right)^{0,8} \times Q^{0,17} \times (E/115)^{-0,63} \\ &= 7,32 \times (184,86/32,43)^{0,8} \times (32,43)^{0,17} \times (100/115)^{-0,63} \\ &= 59,28 \end{aligned}$$

$$\text{Indeks keseragaman (n)} = \left(2,2 - 14 \frac{B}{De}\right) \times \left(\frac{1+A'}{2}\right) \times \left(1 - \frac{W}{B}\right) \times \left(\frac{PC}{L}\right)$$

$$= (2,2 - 14 \frac{5}{6}) \times (\frac{1+1,2}{2}) \times (1 - \frac{0}{5}) \times (\frac{3,09}{6,16})$$

$$= 1,05$$

$$\text{Karakteristik ukuran (Xc)} = \frac{X}{(0,693)^{1/3}}$$

$$= \frac{59,28}{(0,693)^{1/3}} = 68,99$$

- R10 = $e^{-\left(\frac{X}{Xc}\right)^n}$
- $= e^{-\left(\frac{10}{68,99}\right)^{1,05}} = 87,60 \%$

Maka material lolos pada ayakan 10 cm = 100% - 87,60 % = 12,40 %

- R20 = $e^{-\left(\frac{X}{Xc}\right)^n}$
- $= e^{-\left(\frac{20}{68,99}\right)^{1,05}} = 76,07 \%$

Maka material lolos pada ayakan 20 cm = 100% - 76,07 % = 23,93 %

- R30 = $e^{-\left(\frac{X}{Xc}\right)^n}$
- $= e^{-\left(\frac{30}{68,99}\right)^{1,05}} = 65,83 \%$

Maka material lolos pada ayakan 30 cm = 100% - 65,83 % = 34,17 %

- R40 = $e^{-\left(\frac{X}{Xc}\right)^n}$
- $= e^{-\left(\frac{40}{68,99}\right)^{1,05}} = 56,83 \%$

Maka material lolos pada ayakan 40 cm = 100% - 56,83 % = 43,17 %

- R50 = $e^{-\left(\frac{X}{Xc}\right)^n}$
- $= e^{-\left(\frac{50}{68,99}\right)^{1,05}} = 48,98 \%$

Maka material lolos pada ayakan 50 cm = 100% - 48,98 % = 51,02 %

- R60 = $e^{-\left(\frac{X}{Xc}\right)^n}$
- $= e^{-\left(\frac{60}{68,99}\right)^{1,05}} = 42,15 \%$

Maka material lolos pada ayakan 20 cm = 100% - 42,15 % = 57,85 %

- R70 = $e^{-\left(\frac{X}{Xc}\right)^n}$
- $= e^{-\left(\frac{70}{68,99}\right)^{1,05}} = 36,23 \%$

Maka material lolos pada ayakan 70 cm = 100% - 36,23 % = 63,77 %

- R80 = $e^{-\left(\frac{X}{Xc}\right)^n}$
- $= e^{-\left(\frac{80}{68,99}\right)^{1,05}} = 31,11 \%$

Maka material lolos pada ayakan 80 cm = 100% - 31,11 % = 68,89 %

- $R_{90} = e^{-\left(\frac{X}{X_c}\right)^n}$
 $= e^{-\left(\frac{90}{68,99}\right)^{1,05}} = 26,69 \%$

Maka material lolos pada ayakan 90 cm = 100% - 26,69 % = 73,31 %

- $R_{100} = e^{-\left(\frac{X}{X_c}\right)^n}$
 $= e^{-\left(\frac{100}{68,99}\right)^{1,05}} = 22,88 \%$

Maka material lolos pada ayakan 100 cm = 100% - 22,88 % = 77,12 %

Prediksi fragmentasi hasil peledakan pada tanggal 11 Maret 2022

$$\begin{aligned} \text{Rata-rata ukuran fragmentasi (x)} &= A \times \left(\frac{V}{Q}\right)^{0,8} \times Q^{0,17} \times (E/115)^{-0,63} \\ &= 7,32 \times (193,95/36,05)^{0,8} \times (36,05)^{0,17} \times (100/115)^{-0,63} \\ &= 56,36 \end{aligned}$$

$$\begin{aligned} \text{Indeks keseragaman (n)} &= \left(2,2 - 14 \frac{B}{D_e}\right) \times \left(\frac{1+A'}{2}\right) \times \left(1 - \frac{W}{B}\right) \times \left(\frac{P_C}{L}\right) \\ &= \left(2,2 - 14 \frac{5}{6}\right) \times \left(\frac{1+1,2}{2}\right) \times \left(1 - \frac{0}{5}\right) \times \left(\frac{3,55}{6,44}\right) \\ &= 1,15 \end{aligned}$$

$$\begin{aligned} \text{Karakteristik ukuran (Xc)} &= \frac{X}{(0,693)^{1/3}} \\ &= \frac{56,36}{(0,693)^{1/3}} = 44,22 \end{aligned}$$

- $R_{10} = e^{-\left(\frac{X}{X_c}\right)^n}$
 $= e^{-\left(\frac{10}{44,22}\right)^{1,15}} = 83,41 \%$

Maka material lolos pada ayakan 10 cm = 100% - 83,41 % = 16,59 %

- $R_{20} = e^{-\left(\frac{X}{X_c}\right)^n}$
 $= e^{-\left(\frac{20}{44,22}\right)^{1,15}} = 66,89 \%$

Maka material lolos pada ayakan 20 cm = 100% - 66,89 % = 33,11 %

- $R_{30} = e^{-\left(\frac{X}{X_c}\right)^n}$
 $= e^{-\left(\frac{30}{44,22}\right)^{1,15}} = 52,70 \%$

Maka material lolos pada ayakan 30 cm = 100% - 52,70 % = 47,30 %

- $R_{40} = e^{-\left(\frac{X}{X_c}\right)^n}$
 $= e^{-\left(\frac{40}{44,22}\right)^{1,15}} = 41,01 \%$

Maka material lolos pada ayakan 40 cm = 100% - 41,01 % = 58,99 %

- R50 = $e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{50}{44,22}\right)^{1,15}} = 31,61 \%$
Maka material lolos pada ayakan 50 cm = 100% - 31,61 % = 68,39 %
- R60 = $e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{60}{44,22}\right)^{1,15}} = 24,18 \%$
Maka material lolos pada ayakan 20 cm = 100% - 24,18 % = 75,82 %
- R70 = $e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{70}{44,22}\right)^{1,15}} = 18,36 \%$
Maka material lolos pada ayakan 70 cm = 100% - 18,36 % = 81,64 %
- R80 = $e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{80}{44,22}\right)^{1,15}} = 13,87 \%$
Maka material lolos pada ayakan 80 cm = 100% - 13,87 % = 86,13 %
- R90 = $e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{90}{44,22}\right)^{1,15}} = 10,42 \%$
Maka material lolos pada ayakan 90 cm = 100% - 10,42 % = 89,58 %
- R100 = $e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{100}{44,22}\right)^{1,15}} = 7,79 \%$
Maka material lolos pada ayakan 100 cm = 100% - 7,79 % = 92,21 %

Prediksi fragmentasi hasil peledakan pada tanggal 14 Maret 2022

$$\begin{aligned} \text{Rata-rata ukuran fragmentasi (x)} &= A \times \left(\frac{V}{Q}\right)^{0,8} \times Q^{0,17} \times (E/115)^{-0,63} \\ &= 7,32 \times (195,94/33,31)^{0,8} \times (33,31)^{0,17} \times (100/115)^{-0,63} \\ &= 59,87 \end{aligned}$$

$$\begin{aligned} \text{Indeks keseragaman (n)} &= \left(2,2 - 14 \frac{B}{De}\right) \times \left(\frac{1+A'}{2}\right) \times \left(1 - \frac{W}{B}\right) \times \left(\frac{PC}{L}\right) \\ &= \left(2,2 - 14 \frac{5}{6}\right) \times \left(\frac{1+1,2}{2}\right) \times \left(1 - \frac{0}{5}\right) \times \left(\frac{3,28}{6,53}\right) \\ &= 1,05 \end{aligned}$$

$$\begin{aligned} \text{Karakteristik ukuran (Xc)} &= \frac{X}{(0,693)^{1/3}} \\ &= \frac{59,87}{(0,693)^{1/3}} = 69,65 \end{aligned}$$

- R10 = $e^{-\left(\frac{X}{Xc}\right)^n}$
= $e^{-\left(\frac{10}{69,65}\right)^{1,05}}$ = 87,71 %
Maka material lolos pada ayakan 10 cm = 100% - 87,71 % = 12,29 %
- R20 = $e^{-\left(\frac{X}{Xc}\right)^n}$
= $e^{-\left(\frac{20}{69,65}\right)^{1,05}}$ = 76,27 %
Maka material lolos pada ayakan 20 cm = 100% - 76,27 % = 23,73 %
- R30 = $e^{-\left(\frac{X}{Xc}\right)^n}$
= $e^{-\left(\frac{30}{69,65}\right)^{1,05}}$ = 66,10 %
Maka material lolos pada ayakan 30 cm = 100% - 66,10 % = 33,90 %
- R40 = $e^{-\left(\frac{X}{Xc}\right)^n}$
= $e^{-\left(\frac{40}{69,65}\right)^{1,05}}$ = 57,15 %
Maka material lolos pada ayakan 40 cm = 100% - 57,15 % = 42,85 %
- R50 = $e^{-\left(\frac{X}{Xc}\right)^n}$
= $e^{-\left(\frac{50}{69,65}\right)^{1,05}}$ = 49,32 %
Maka material lolos pada ayakan 50 cm = 100% - 49,32 % = 50,68 %
- R60 = $e^{-\left(\frac{X}{Xc}\right)^n}$
= $e^{-\left(\frac{60}{69,65}\right)^{1,05}}$ = 42,51 %
Maka material lolos pada ayakan 20 cm = 100% - 42,51 % = 57,49 %
- R70 = $e^{-\left(\frac{X}{Xc}\right)^n}$
= $e^{-\left(\frac{70}{69,65}\right)^{1,05}}$ = 36,59 %
Maka material lolos pada ayakan 70 cm = 100% - 36,59 % = 63,41 %
- R80 = $e^{-\left(\frac{X}{Xc}\right)^n}$
= $e^{-\left(\frac{80}{69,65}\right)^{1,05}}$ = 31,47 %
Maka material lolos pada ayakan 80 cm = 100% - 31,47 % = 68,53 %
- R90 = $e^{-\left(\frac{X}{Xc}\right)^n}$
= $e^{-\left(\frac{90}{69,65}\right)^{1,05}}$ = 27,04 %
Maka material lolos pada ayakan 90 cm = 100% - 27,04 % = 72,96 %
- R100 = $e^{-\left(\frac{X}{Xc}\right)^n}$
= $e^{-\left(\frac{100}{69,65}\right)^{1,05}}$ = 23,22 %

Maka material lolos pada ayakan 100 cm = 100% - 23,22 % = 76,78 %

Prediksi fragmentasi hasil peledakan pada tanggal 19 Maret 2022

$$\begin{aligned} \text{Rata-rata ukuran fragmentasi (x)} &= A \times \left(\frac{V}{Q}\right)^{0,8} \times Q^{0,17} \times (E/115)^{-0,63} \\ &= 7,32 \times (200,32/34,05)^{0,8} \times (34,05)^{0,17} \times (100/115)^{-0,63} \\ &= 60,10 \end{aligned}$$

$$\begin{aligned} \text{Indeks keseragaman (n)} &= \left(2,2 - 14 \frac{B}{De}\right) \times \left(\frac{1+A'}{2}\right) \times \left(1 - \frac{W}{B}\right) \times \left(\frac{PC}{L}\right) \\ &= \left(2,2 - 14 \frac{5}{6}\right) \times \left(\frac{1+1,2}{2}\right) \times \left(1 - \frac{0}{5}\right) \times \left(\frac{3,35}{6,68}\right) \\ &= 1,05 \end{aligned}$$

$$\begin{aligned} \text{Karakteristik ukuran (Xc)} &= \frac{X}{(0,693)^{1/3}} \\ &= \frac{60,10}{(0,693)^{1/3}} = 69,90 \end{aligned}$$

- R10 = $e^{-\left(\frac{X}{Xc}\right)^n}$
= $e^{-\left(\frac{10}{69,90}\right)^{1,05}} = 87,76 \%$

Maka material lolos pada ayakan 10 cm = 100% - 87,76 % = 12,24 %

- R20 = $e^{-\left(\frac{X}{Xc}\right)^n}$
= $e^{-\left(\frac{20}{69,90}\right)^{1,05}} = 76,35 \%$

Maka material lolos pada ayakan 20 cm = 100% - 76,35 % = 23,65 %

- R30 = $e^{-\left(\frac{X}{Xc}\right)^n}$
= $e^{-\left(\frac{30}{69,90}\right)^{1,05}} = 66,20 \%$

Maka material lolos pada ayakan 30 cm = 100% - 66,20 % = 33,80

- R40 = $e^{-\left(\frac{X}{Xc}\right)^n}$
= $e^{-\left(\frac{40}{69,90}\right)^{1,05}} = 57,27 \%$

Maka material lolos pada ayakan 40 cm = 100% - 57,27 % = 42,73 %

- R50 = $e^{-\left(\frac{X}{Xc}\right)^n}$
= $e^{-\left(\frac{50}{69,90}\right)^{1,05}} = 49,45 \%$

Maka material lolos pada ayakan 50 cm = 100% - 49,45 % = 50,55 %

- R60 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{60}{69,90}\right)^{1,05}} = 42,64 \%$$

Maka material lolos pada ayakan 20 cm = 100% - 42,64 % = 57,36 %

- R70 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{70}{69,90}\right)^{1,05}} = 36,73 \%$$

Maka material lolos pada ayakan 70 cm = 100% - 36,73 % = 63,27 %

- R80 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{80}{69,90}\right)^{1,05}} = 31,61 \%$$

Maka material lolos pada ayakan 80 cm = 100% - 31,61 % = 68,39 %

- R90 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{90}{69,90}\right)^{1,05}} = 27,17 \%$$

Maka material lolos pada ayakan 90 cm = 100% - 27,17 % = 72,83 %

- R100 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{100}{69,90}\right)^{1,05}} = 23,34 \%$$

Maka material lolos pada ayakan 100 cm = 100% - 23,34 % = 76,66 %

Prediksi fragmentasi hasil peledakan pada tanggal 22 Maret 2022

$$\begin{aligned} \text{Rata-rata ukuran fragmentasi (x)} &= A \times \left(\frac{V}{Q}\right)^{0,8} \times Q^{0,17} \times (E/115)^{-0,63} \\ &= 7,32 \times (188,78/30,20)^{0,8} \times (30,20)^{0,17} \times (100/115)^{-0,63} \\ &= 61,81 \end{aligned}$$

$$\begin{aligned} \text{Indeks keseragaman (n)} &= \left(2,2 - 14 \frac{B}{De}\right) \times \left(\frac{1+A'}{2}\right) \times \left(1 - \frac{W}{B}\right) \times \left(\frac{PC}{L}\right) \\ &= \left(2,2 - 14 \frac{5}{6}\right) \times \left(\frac{1+1,2}{2}\right) \times \left(1 - \frac{0}{5}\right) \times \left(\frac{2,97}{6,29}\right) \\ &= 0,99 \end{aligned}$$

$$\begin{aligned} \text{Karakteristik ukuran (Xc)} &= \frac{X}{(0,693)^{1/3}} \\ &= \frac{60,81}{(0,693)^{1/3}} = 95,89 \end{aligned}$$

- R10 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{10}{95,89}\right)^{1,05}} = 89,78 \%$$

Maka material lolos pada ayakan 10 cm = 100% - 89,78 % = 10,22 %

- R20 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{20}{95,89}\right)^{1,05}} = 80,78 \%$$

Maka material lolos pada ayakan 20 cm = 100% - 80,78 % = 19,22 %

- R30 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{30}{95,89}\right)^{1,05}} = 72,74 \%$$

Maka material lolos pada ayakan 30 cm = 100% - 72,74 % = 27,26 %

- R40 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{40}{95,89}\right)^{1,05}} = 65,54 \%$$

Maka material lolos pada ayakan 40 cm = 100% - 65,54 % = 34,46 %

- R50 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{50}{95,89}\right)^{1,05}} = 59,07 \%$$

Maka material lolos pada ayakan 50 cm = 100% - 59,07 % = 40,93 %

- R60 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{60}{95,89}\right)^{1,05}} = 53,26 \%$$

Maka material lolos pada ayakan 20 cm = 100% - 53,26 % = 46,74 %

- R70 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{70}{95,89}\right)^{1,05}} = 48,03 \%$$

Maka material lolos pada ayakan 70 cm = 100% - 48,03 % = 51,97 %

- R80 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{80}{95,89}\right)^{1,05}} = 43,32 \%$$

Maka material lolos pada ayakan 80 cm = 100% - 43,32 % = 56,68 %

- R90 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{90}{95,89}\right)^{1,05}} = 39,09 \%$$

Maka material lolos pada ayakan 90 cm = 100% - 39,09 % = 60,91 %

- R100 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{100}{95,89}\right)^{1,05}} = 35,27 \%$$

Maka material lolos pada ayakan 100 cm = 100% - 35,27 % = 64,73 %

Prediksi fragmentasi Rata-rata hasil peledakan geometri aktual

$$\text{Rata-rata ukuran fragmentasi (x)} = A \times \left(\frac{V}{Q}\right)^{0,8} \times Q^{0,17} \times (E/115)^{-0,63}$$

$$= 7,32 \times (192,21/32,86)^{0,8} \times (32,86)^{0,17} \times (100/115)^{-0,63}$$

$$= 59,52$$

Untuk mengetahui persentase bongkah pada hasil peledakan yang digunakan rumus indeks keseragaman (n) dan karakteristik ukuran (Xc), dengan persamaan berikut :

$$\text{Indeks keseragaman (n)} = (2,2 - 14 \frac{B}{De}) \times (\frac{1+A'}{2}) \times (1 - \frac{W}{B}) \times (\frac{PC}{L})$$

$$= (2,2 - 14 \frac{5}{6}) \times (\frac{1+1,2}{2}) \times (1 - \frac{0}{5}) \times (\frac{3,23}{6,41})$$

$$= 1,05$$

$$\text{Karakteristik ukuran (Xc)} = \frac{X}{(0,693)^{1/3}}$$

$$= \frac{59,52}{(0,693)^{1/3}} = 67,57$$

Selanjutnya dapat dihitung persentase material tertahan pada ayakan (%), dengan rumus sebagai berikut :

$$R_x = e^{-\left(\frac{X}{Xc}\right)^n}$$

Dimana :

R_x = persentase material yang tertahan pada ayakan (%)

X = ukuran ayakan (cm)

n = indeks keseragaman

Xc = karakteristik ukuran (cm)

- $R_{10} = e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{10}{67,57}\right)^{1,05}} = 87,37 \%$
Maka material lolos pada ayakan 10 cm = 100% - 87,69 % = 12,63 %
- $R_{20} = e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{20}{67,57}\right)^{1,05}} = 75,53 \%$
Maka material lolos pada ayakan 20 cm = 100% - 75,53 % = 24,47 %
- $R_{30} = e^{-\left(\frac{X}{Xc}\right)^n}$
 $= e^{-\left(\frac{30}{67,57}\right)^{1,05}} = 65,08 \%$
Maka material lolos pada ayakan 30 cm = 100% - 65,08 % = 34,92 %
- $R_{40} = e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{40}{67,57}\right)^{1,05}} = 55,97 \%$$

Maka material lolos pada ayakan 40 cm = 100% - 55,97 % = 44,03 %

- R50 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{50}{67,57}\right)^{1,05}} = 48,11 \%$$

Maka material lolos pada ayakan 50 cm = 100% - 48,11 % = 51,89 %

- R60 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{60}{67,57}\right)^{1,05}} = 41,35 \%$$

Maka material lolos pada ayakan 60 cm = 100% - 41,35 % = 58,65 %

- R70 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{70}{67,57}\right)^{1,05}} = 35,55 \%$$

Maka material lolos pada ayakan 70 cm = 100% - 35,55 % = 64,45 %

- R80 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{80}{67,57}\right)^{1,05}} = 30,57 \%$$

Maka material lolos pada ayakan 80 cm = 100% - 30,57 % = 69,43 %

- R90 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{90}{67,57}\right)^{1,05}} = 26,31 \%$$

Maka material lolos pada ayakan 90 cm = 100% - 26,31 % = 73,69 %

- R100 = $e^{-\left(\frac{X}{Xc}\right)^n}$

$$= e^{-\left(\frac{100}{67,57}\right)^{1,05}} = 22,66 \%$$

Maka material lolos pada ayakan 100 cm = 100% - 22,66 % = 77,34 %

LAMPIRAN G

PERHITUNGAN KOEFISIEN DETERMINASI

Berikut merupakan perhitungan *koefisien determinasi* (R^2) untuk mengetahui hubungan antar variabel (perhitungan prediksi fragmentasi dengan *split desktop* dan dengan perhitungan Kuz-Ram) yang mana semakin besar nilai R^2 maka semakin kuat hubungan antar variabel tersebut :

a. Peledakan 1 (08 Maret 2022)

Tabel G1. Selisih Analisis 1

Peledakan 1 (08/03/2022)				
Size (cm)	X	Y	(X-Y) ²	(Y- \bar{Y}) ²
	Split Desktop	Kuz-Ram	SE (%)	SE \bar{Y} (%)
20	16,69	23,78	0,50	9,11
40	36,01	42,93	0,48	1,21
60	53,78	57,58	0,14	0,13
80	68,67	68,62	0,00003	2,15
100	78,02	76,87	0,01	5,25
		\bar{Y}	$\sum SE$	$\sum SE \bar{Y}$
		53,96	0,23	3,57
		R =	0,97	
		R ² =	0,94	

$$\bar{Y} = \frac{23,78+42,93+57,58+68,62+76,87}{5} = 53,96$$

$$SE = (X-Y)^2 : 100$$

$$Size\ 20 : (16,69 - 23,78)^2 : 100 = 0,50$$

$$Size\ 40 : (36,01 - 42,93)^2 : 100 = 0,48$$

$$Size\ 60 : (53,78 - 57,58)^2 : 100 = 0,14$$

$$Size\ 80 : (68,67 - 68,62)^2 : 100 = 0,00003$$

$$Size\ 100 : (78,02 - 76,87)^2 : 100 = 0,01$$

$$\sum SE = \frac{0,5+0,48+0,14+0,00003+0,01}{5} = 0,23$$

$$SE \bar{Y} = (Y - \bar{Y})^2 : 100$$

$$Size\ 20 = (23,78 - 53,96)^2 : 100 = 9,11$$

$$Size\ 40 = (42,93 - 53,96)^2 : 100 = 1,21$$

$$\begin{aligned}
 \text{Size 60} &= (57,58 - 53,96)^2 : 100 = 0,13 \\
 \text{Size 80} &= (68,62 - 53,96)^2 : 100 = 2,15 \\
 \text{Size 100} &= (78,02 - 53,96)^2 : 100 = 5,25 \\
 \sum \text{SE } \bar{Y} &= \frac{9,11+1,21+0,13+2,15+5,25}{5} = 3,57 \\
 R^2 &= 1 - \frac{\sum \text{SE}}{\sum \text{SE } \bar{Y}} = 0,94 \\
 R &= \sqrt{R^2} = 0,97
 \end{aligned}$$

b. Peledakan 2 (09 Maret 2022)

Tabel G2. Selisih Analisis 2

Peledakan 2 (09/03/2022)				
Size (cm)	X	Y	(X-Y) ²	(Y- \bar{Y}) ²
	Split Desktop	Kuz-Ram	SE (%)	SE \bar{Y} (%)
20	19,19	23,85	0,22	9,13
40	33,74	43,05	0,87	1,21
60	47,05	57,71	1,14	0,13
80	59,88	68,75	0,79	2,15
100	74,34	76,99	0,07	5,25
		\bar{Y}	$\sum \text{SE}$	$\sum \text{SE } \bar{Y}$
		54,07	0,62	3,58
		R =	0,91	
		R ² =	0,83	

$$\bar{Y} = \frac{23,85+43,05+57,71+68,75+76,99}{5} = 54,07$$

$$\text{SE} = (X-Y)^2 : 100$$

$$\text{Size 20} : (19,19 - 23,85)^2 : 100 = 0,22$$

$$\text{Size 40} : (33,74 - 43,05)^2 : 100 = 0,87$$

$$\text{Size 60} : (47,05 - 57,71)^2 : 100 = 1,14$$

$$\text{Size 80} : (59,88 - 68,75)^2 : 100 = 0,79$$

$$\text{Size 100} : (74,34 - 76,99)^2 : 100 = 0,07$$

$$\sum \text{SE} = \frac{0,22+0,87+1,14+0,79+0,07}{5} = 0,62$$

$$\text{SE } \bar{Y} = (Y - \bar{Y})^2 : 100$$

$$\text{Size 20} = (23,85 - 54,07)^2 : 100 = 9,13$$

$$\text{Size 40} = (42,93 - 54,07)^2 : 100 = 1,21$$

$$\text{Size 60} = (57,71 - 54,07)^2 : 100 = 0,13$$

$$\text{Size 80} = (68,75 - 54,07)^2 : 100 = 2,15$$

$$\text{Size 100} = (76,99 - 53,96)^2 : 100 = 5,25$$

$$\sum \text{SE } \bar{Y} = \frac{9,11+1,21+0,13+2,15+5,25}{5} = 3,55$$

$$R^2 = 1 - \frac{\sum \text{SE}}{\sum \text{SE } \bar{Y}} = 0,83$$

$$R = \sqrt{R^2} = 0,91$$

c. Peledakan 3 (10 Maret 2022)

Tabel G3. Selisih Analisis 3

Peledakan 3 (10/03/2022)				
Size (cm)	X	Y	(X-Y) ²	(Y- \bar{Y}) ²
	Split Desktop	Kuz-Ram	SE (%)	SE \bar{Y} (%)
20	23,28	23,93	0,0042	9,16
40	34,07	43,17	0,83	1,21
60	50,02	57,85	0,61	0,13
80	69,5	68,89	0,004	2,16
100	84,95	77,12	0,61	5,26
		\bar{Y}	$\sum \text{SE}$	$\sum \text{SE } \bar{Y}$
		54,19	0,41	3,58
		R =	0,94	
		R ² =	0,88	

$$\bar{Y} = \frac{23,93+43,93+57,85+68,89+77,12}{5} = 54,19$$

$$\text{SE} = (X-Y)^2 : 100$$

$$\text{Size 20} : (23,28 - 23,93)^2 : 100 = 0,0042$$

$$\text{Size 40} : (34,07 - 43,17)^2 : 100 = 0,83$$

$$\text{Size 60} : (50,02 - 57,85)^2 : 100 = 0,61$$

$$\text{Size 80} : (69,5 - 68,89)^2 : 100 = 0,004$$

$$\text{Size 100} : (84,95 - 77,12)^2 : 100 = 0,61$$

$$\sum \text{SE} = \frac{0,0042+0,83+0,61+0,004+0,61}{5} = 0,41$$

$$\text{SE } \bar{Y} = (Y - \bar{Y})^2 : 100$$

$$\text{Size 20} = (23,28 - 54,19)^2 : 100 = 9,16$$

$$\text{Size 40} = (34,07 - 54,19)^2 : 100 = 1,21$$

$$\begin{aligned}
\text{Size 60} &= (50,02 - 54,19)^2 : 100 = 0,13 \\
\text{Size 80} &= (69,5 - 54,19)^2 : 100 = 2,16 \\
\text{Size 100} &= (84,95 - 54,19)^2 : 100 = 5,26 \\
\sum SE \bar{Y} &= \frac{9,16+1,21+0,13+2,16+5,26}{5} = 3,58 \\
R^2 &= 1 - \frac{\sum SE}{\sum SE \bar{Y}} = 0,88 \\
R &= \sqrt{R^2} = 0,94
\end{aligned}$$

d. Peledakan 4 (11 Maret 2022)

Tabel G4. Selisih Analisis 4

Peledakan 4 (11/03/2022)				
Size (cm)	X	Y	(X-Y) ²	(Y- \bar{Y}) ²
	Split Desktop	Kuz-Ram	SE (%)	SE \bar{Y} (%)
20	34,57	33,11	0,02	13,06
40	66,69	58,99	0,59	1,05
60	86,83	75,82	1,21	0,43
80	93,48	86,13	0,54	2,85
100	100	92,21	0,61	5,27
		\bar{Y}	$\sum SE$	$\sum SE \bar{Y}$
		69,25	0,59	4,53
		R =	0,93	
		R ² =	0,87	

$$\bar{Y} = \frac{33,11+58,99+75,82+86,13+92,51}{5} = 69,25$$

$$SE = (X-Y)^2 : 100$$

$$\text{Size 20} : (34,57 - 33,11)^2 : 100 = 0,02$$

$$\text{Size 40} : (66,69 - 58,99)^2 : 100 = 0,59$$

$$\text{Size 60} : (86,83 - 75,82)^2 : 100 = 1,21$$

$$\text{Size 80} : (93,48 - 86,13)^2 : 100 = 0,54$$

$$\text{Size 100} : (100 - 92,21)^2 : 100 = 0,61$$

$$\sum SE = \frac{0,02+0,59+1,21+0,54+0,61}{5} = 0,59$$

$$SE \bar{Y} = (Y - \bar{Y})^2 : 100$$

$$\text{Size 20} = (33,11 - 69,25)^2 : 100 = 13,06$$

$$\text{Size 40} = (58,99 - 69,25)^2 : 100 = 1,05$$

$$\begin{aligned}
 \text{Size 60} &= (75,82 - 69,25)^2 : 100 = 0,43 \\
 \text{Size 80} &= (86,13 - 69,25)^2 : 100 = 2,85 \\
 \text{Size 100} &= (92,21 - 69,25)^2 : 100 = 5,27 \\
 \sum SE \bar{Y} &= \frac{13,06 + 1,05 + 0,43 + 2,85 + 5,27}{5} = 4,53 \\
 R^2 &= 1 - \frac{\sum SE}{\sum SE \bar{Y}} = 0,87 \\
 R &= \sqrt{R^2} = 0,93
 \end{aligned}$$

e. Peledakan 5 (14 Maret 2022)

Tabel G5. Selisih Analisis 5

Peledakan 5 (14/03/2022)				
Size (cm)	X	Y	(X-Y) ²	(Y- \bar{Y}) ²
	Split Desktop	Kuz-Ram	SE (%)	SE \bar{Y} (%)
20	15,21	23,73	0,73	9,09
40	31,6	42,85	1,27	1,22
60	53,1	57,49	0,19	0,13
80	73,42	68,53	0,24	2,15
100	88,23	76,78	1,31	5,25
		\bar{Y}	$\sum SE$	$\sum SE \bar{Y}$
		53,88	0,75	3,57
		R =	0,89	
		R ² =	0,79	

$$\bar{Y} = \frac{23,73 + 42,85 + 57,49 + 68,53 + 76,78}{5} = 53,88$$

$$SE = (X - Y)^2 : 100$$

$$\text{Size 20} : (15,21 - 23,73)^2 : 100 = 0,73$$

$$\text{Size 40} : (31,6 - 42,85)^2 : 100 = 1,27$$

$$\text{Size 60} : (53,1 - 57,49)^2 : 100 = 0,19$$

$$\text{Size 80} : (73,42 - 68,53)^2 : 100 = 0,24$$

$$\text{Size 100} : (88,23 - 76,78)^2 : 100 = 1,31$$

$$\sum SE = \frac{0,73 + 1,27 + 0,19 + 0,24 + 1,31}{5} = 0,75$$

$$SE \bar{Y} = (Y - \bar{Y})^2 : 100$$

$$\text{Size 20} = (23,73 - 53,88)^2 : 100 = 9,09$$

$$\text{Size 40} = (42,85 - 53,88)^2 : 100 = 1,22$$

$$\text{Size 60} = (57,49 - 53,88)^2 : 100 = 0,13$$

$$\text{Size 80} = (68,53 - 53,88)^2 : 100 = 2,15$$

$$\text{Size 100} = (76,78 - 53,88)^2 : 100 = 5,25$$

$$\sum \text{SE } \bar{Y} = \frac{9,16 + 1,21 + 0,13 + 2,16 + 5,26}{5} = 3,57$$

$$R^2 = 1 - \frac{\sum \text{SE}}{\sum \text{SE } \bar{Y}} = 0,79$$

$$R = \sqrt{R^2} = 0,89$$

f. Peledakan 6 (19 Maret 2022)

Tabel G6. Selisih Analisis 6

Peledakan 6 (19/03/2022)				
Size (cm)	X	Y	(X-Y) ²	(Y- \bar{Y}) ²
	Split Desktop	Kuz-Ram	SE (%)	SE \bar{Y} (%)
20	12,67	23,65	1,21	9,07
40	30,36	42,73	1,53	1,22
60	50,58	57,36	0,46	0,13
80	68,64	68,39	0,001	2,14
100	82,59	76,66	0,35	5,24
		\bar{Y}	$\sum \text{SE}$	$\sum \text{SE } \bar{Y}$
		53,76	0,71	3,56
		R =	0,89	
		R ² =	0,80	

$$\bar{Y} = \frac{23,65 + 42,73 + 57,36 + 68,39 + 76,66}{5} = 53,76$$

$$\text{SE} = (X - Y)^2 : 100$$

$$\text{Size 20} : (12,67 - 23,65)^2 : 100 = 1,21$$

$$\text{Size 40} : (30,36 - 42,73)^2 : 100 = 1,53$$

$$\text{Size 60} : (50,58 - 57,36)^2 : 100 = 0,46$$

$$\text{Size 80} : (68,64 - 68,39)^2 : 100 = 0,001$$

$$\text{Size 100} : (82,59 - 76,66)^2 : 100 = 1,35$$

$$\sum \text{SE} = \frac{1,21 + 1,53 + 0,46 + 0,001 + 1,35}{5} = 0,71$$

$$\text{SE } \bar{Y} = (Y - \bar{Y})^2 : 100$$

$$\text{Size 20} = (23,65 - 53,76)^2 : 100 = 9,07$$

$$\text{Size 40} = (42,73 - 53,76)^2 : 100 = 1,22$$

$$\text{Size 60} = (57,36 - 53,76)^2 : 100 = 0,13$$

$$\text{Size 80} = (68,39 - 53,76)^2 : 100 = 2,14$$

$$\text{Size 100} = (76,66 - 53,76)^2 : 100 = 5,24$$

$$\sum \text{SE } \bar{Y} = \frac{9,07+1,22+0,13+2,14+5,24}{5} = 3,56$$

$$R^2 = 1 - \frac{\sum \text{SE}}{\sum \text{SE } \bar{Y}} = 0,80$$

$$R = \sqrt{R^2} = 0,89$$

g. Peledakan 7 (22 Maret 2022)

Tabel G7. Selisih Analisis 7

Peledakan 7 (22/03/2022)				
Size (cm)	X	Y	(X-Y) ²	(Y- \bar{Y}) ²
	Split Desktop	Kuz-Ram	SE (%)	SE \bar{Y} (%)
20	17,58	19,22	0,03	6,32
40	31,24	34,46	0,10	0,98
60	43,05	46,74	0,14	0,06
80	55	56,68	0,03	1,52
100	68,27	64,73	0,13	4,15
		\bar{Y}	$\sum \text{SE}$	$\sum \text{SE } \bar{Y}$
		44,37	0,08	2,61
		R =	0,98	
		R ² =	0,97	

$$\bar{Y} = \frac{19,22 + 34,46 + 46,74 + 56,68 + 64,73}{5} = 44,73$$

$$\text{SE} = (X-Y)^2 : 100$$

$$\text{Size 20} : (17,58 - 19,22)^2 : 100 = 0,03$$

$$\text{Size 40} : (31,24 - 34,46)^2 : 100 = 0,10$$

$$\text{Size 60} : (43,05 - 46,74)^2 : 100 = 0,14$$

$$\text{Size 80} : (55,00 - 56,68)^2 : 100 = 0,03$$

$$\text{Size 100} : (68,27 - 64,73)^2 : 100 = 0,13$$

$$\sum \text{SE} = \frac{0,03+0,10+0,14+0,03+0,13}{5} = 0,08$$

$$\text{SE } \bar{Y} = (Y - \bar{Y})^2 : 100$$

$$\text{Size 20} = (19,22 - 44,73)^2 : 100 = 6,32$$

$$\text{Size 40} = (34,46 - 44,73)^2 : 100 = 0,98$$

$$\text{Size 60} = (46,74 - 44,73)^2 : 100 = 0,06$$

$$\text{Size } 80 = (56,68 - 44,73)^2 : 100 = 1,52$$

$$\text{Size } 100 = (64,73 - 44,73)^2 : 100 = 4,15$$

$$\sum \text{SE } \tilde{Y} = \frac{6,32+0,98+0,06+1,52+4,15}{5} = 2,61$$

$$R^2 = 1 - \frac{\sum \text{SE}}{\sum \text{SE } \tilde{Y}} = 0,97$$

$$R = \sqrt{R^2} = 0,98$$

$$R^2 \text{ rata-rata} = \frac{0,94+0,83+0,88+0,87+0,79+0,80+0,97}{7} = 0,87 \text{ atau } 87 \%$$

LAMPIRAN H

PERHITUNGAN *ABSOLUTE VALUE OF ERROR*

Berikut merupakan perhitungan *error* antara analisis menggunakan perhitungan Kuz-Ram dan analisis dengan *Software Split Desktop*. Semakin kecil nilai *error* maka semakin baik analisis yang dilakukan

a. *Size 20 cm*

Tabel H1. *MAE Size 20 cm*

Size 20 (cm)	Data Ke -	Passing Percent (%)		Absolute Value of Error
		Kuz - Ram	Split Desktop	
	1	23,78	16,69	7,09
	2	23,85	19,19	4,66
	3	23,93	23,28	0,65
	4	33,11	34,57	1,46
	5	23,73	15,21	8,52
	6	23,65	12,67	10,98
	7	19,22	17,58	1,64
				34,99
			n	7
			MAE	5,00

Absolute Value of Error

$$\text{Data 1} = 23,78 - 16,69 = 7,09$$

$$\text{Data 2} = 23,85 - 19,19 = 4,66$$

$$\text{Data 3} = 23,93 - 23,28 = 0,65$$

$$\text{Data 4} = 34,57 - 33,11 = 1,46$$

$$\text{Data 5} = 23,73 - 15,21 = 8,52$$

$$\text{Data 6} = 23,65 - 12,67 = 10,98$$

$$\text{Data 7} = 19,22 - 17,58 = 1,64$$

$$\text{MAE} = \frac{\text{Data (1+2+3+4+5+6+7)}}{n}$$

$$\text{MAE} = \frac{7,09+4,66+0,65+1,46+8,52+10,98+1,64}{7} = 5$$

b. Size 40 cm

Tabel H2. MAE Size 40 cm

Size 40 (cm)	Data Ke -	Passing Percent (%)		Absolute Value of Error
		Kuz - Ram	Split Desktop	
	1	42,93	36,01	6,92
	2	43,05	33,74	9,31
	3	43,17	34,07	9,10
	4	58,99	66,69	7,70
	5	42,85	31,6	11,25
	6	42,73	30,36	12,37
	7	34,46	31,24	3,22
				59,88
			n	7
			MAE	8,55

Absolute Value of Error

$$\text{Data 1} = 42,93 - 36,01 = 6,92$$

$$\text{Data 2} = 43,05 - 33,74 = 9,31$$

$$\text{Data 3} = 43,17 - 34,07 = 9,10$$

$$\text{Data 4} = 66,69 - 59,99 = 7,70$$

$$\text{Data 5} = 42,85 - 31,60 = 11,25$$

$$\text{Data 6} = 42,73 - 30,36 = 12,37$$

$$\text{Data 7} = 34,46 - 31,24 = 3,22$$

$$\text{MAE} = \frac{\text{Data (1+2+3+4+5+6+7)}}{n}$$

$$\text{MAE} = \frac{6,92+9,31+9,10+7,70+11,25+12,37+3,22}{7} = 8,55$$

c. Size 60 cm

Tabel H3. MAE Size 60 cm

Size 60 (cm)	Data Ke -	Passing Percent (%)		Absolute Value of Error
		Kuz - Ram	Split Desktop	
	1	57,58	53,78	3,80
	2	57,71	47,05	10,66
	3	57,85	50,02	7,83
	4	75,82	86,83	11,01
	5	57,49	53,1	4,39
	6	57,36	50,58	6,78
	7	46,74	43,05	3,69
				48,16
			n	7
			MAE	6,88

Absolute Value of Error

- Data 1 = 57,58 – 53,78 = 3,80
- Data 2 = 57,71 – 47,05 = 10,66
- Data 3 = 57,85 – 50,02 = 7,83
- Data 4 = 86,83 – 75,82 = 11,01
- Data 5 = 57,49 – 53,10 = 4,39
- Data 6 = 57,36 – 50,58 = 6,78
- Data 7 = 46,74 – 43,05 = 3,69

$$MAE = \frac{Data (1+2+3+4+5+6+7)}{n}$$

$$MAE = \frac{3,80+10,66+7,83+11,01+7,83+10,66+3,80}{7} = 6,88$$

d. Size 80

Tabel H4. MAE Size 80 cm

Size 80 (cm)	Data Ke -	Passing Percent (%)		Absolute Value of Error
		Kuz - Ram	Split Desktop	
	1	68,62	68,67	0,05
	2	68,75	59,88	8,87
	3	68,89	69,5	0,61
	4	86,13	93,48	7,35
	5	68,53	73,42	4,89
	6	68,39	68,64	0,25
	7	56,68	55	1,68
				23,69
			n	7
			MAE	3,38

Absolute Value of Error

- Data 1 = 68,67 – 68,62 = 0,05
- Data 2 = 68,75 – 59,88 = 8,87
- Data 3 = 69,50 – 68,89 = 0,61
- Data 4 = 93,48 – 86,13 = 7,35
- Data 5 = 73,42 – 68,53 = 4,89
- Data 6 = 68,64 – 68,39 = 0,25
- Data 7 = 56,68 – 55,00 = 1,68

$$MAE = \frac{Data (1+2+3+4+5+6+7)}{n}$$

$$MAE = \frac{0,05+8,87 + 0,61+7,35+4,89+0,25+1,68}{7} = 3,38$$

e. *Size* 100 cm

Tabel H5. *MAE Size* 100 cm

<i>Size</i> 100 (cm)	Data Ke -	<i>Passing Percent (%)</i>		<i>Absolute Value of Error</i>
		Kuz - Ram	<i>Split Desktop</i>	
	1	76,87	78,02	1,15
	2	76,99	74,34	2,65
	3	77,12	84,95	7,83
	4	92,21	100	7,79
	5	76,78	88,23	11,45
	6	76,66	82,59	5,93
	7	64,73	68,27	3,54
				40,34
			n	7
			MAE	5,76

Absolute Value of Error

$$\text{Data 1} = 78,02 - 76,87 = 1,15$$

$$\text{Data 2} = 76,99 - 74,34 = 2,65$$

$$\text{Data 3} = 84,95 - 77,12 = 7,83$$

$$\text{Data 4} = 100,0 - 92,21 = 7,79$$

$$\text{Data 5} = 88,23 - 76,78 = 11,45$$

$$\text{Data 6} = 82,59 - 76,66 = 5,93$$

$$\text{Data 7} = 68,27 - 64,73 = 3,54$$

$$MAE = \frac{\text{Data (1+2+3+4+5+6+7)}}{n}$$

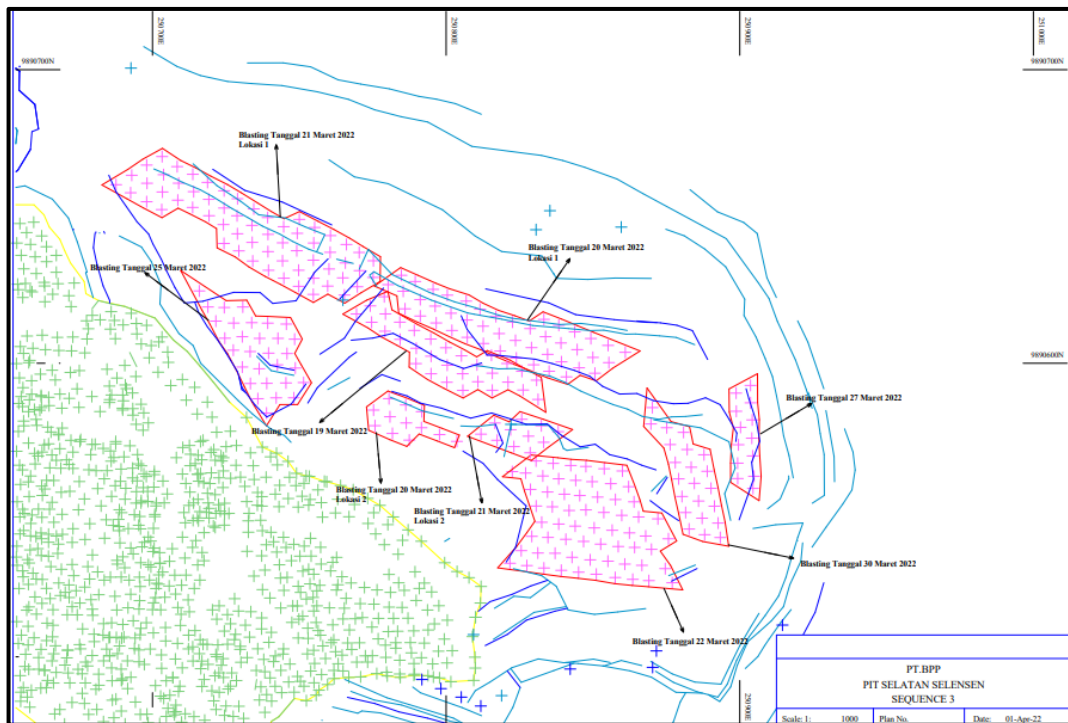
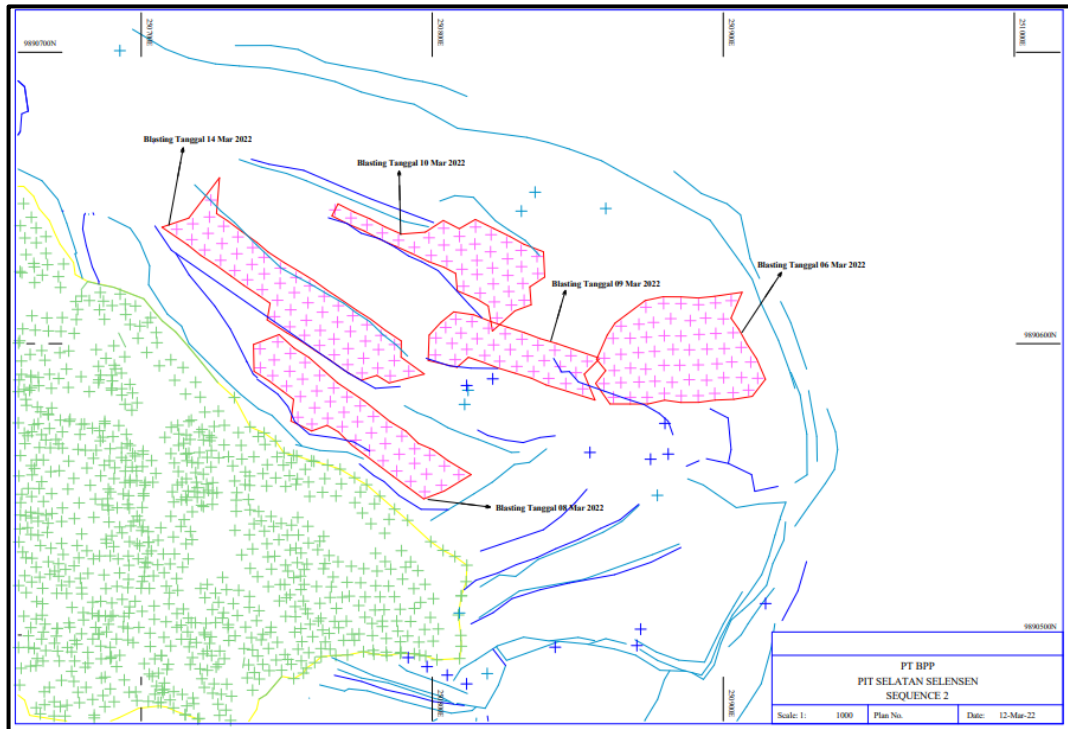
$$MAE = \frac{1,15 + 2,65 + 7,83 + 7,79 + 11,45 + 5,93 + 3,54}{7} = 5,76$$

$$MAE \text{ rata-rata} = \frac{5,00 + 8,55 + 6,88 + 3,38 + 5,76}{5} = 5,92$$

Pada hasil perhitungan dari seluruh kegiatan blasting aktual dalam berbagai ukuran *size* menunjukkan nilai rata-rata *Mean Absolute Error* adalah 5,92 yang memiliki arti bahwa nilai dari *split desktop* dan Kuz-Ram menunjukkan nilai kesalahan atau perbedaan nilai sebesar 5,92.

LAMPIRAN I

PETA PEMBORAN


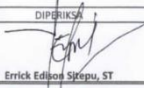



Gambar II. Peta Pemboran











LAMPIRAN J

HASIL UJI DENSITAS BATUAN

Tabel J1. Hasil Uji Laboratorium Densitas Batuan

YAYASAN PENDIDIKAN JAMBI UNIVERSITAS BATANGHARI LABORATORIUM FAKULTAS TEKNIK JL.SLAMET RIYADI, JAMBI HP. 082380090005										FIELD DENSITY TEST				Pemohon : PT. Bara Prima Pratama	
Lokasi : Selensen - Inhil					Pekerjaan : Tambang Batu Bara										
Tanggal Pemeriksaan : 07 September 2020															
No.	Location Station	Kode	Thickness				Weight In Dry gr	Weight In Water gr	Weight in SSD gr	Volume cc	Field Density gr/cc	Lab Density gr/cc	Degree Of Density %	Remark	
			T1	T2	T3	AVG									
0	1	2	3				4	5	6	7 6-5	8 4/7	9 *	10 (8/9)*100	11	
1	-	1	-	-	-	606	339	609	270,0	2,244	-	-			
2	-	2	-	-	-	397	220	400	180	2,206	-	-			
3	-	3	-	-	-	341	194	344	150	2,273	-	-			
4	-	4	-	-	-	293	165	295	130	2,254	-	-			
5	-	5	-	-	-	258	144	260	116	2,224	-	-			
6	-	6	-	-	-	220	124	224	100	2,200	-	-			
7	-	7	-	-	-	211	118	212	94	2,245	-	-			
8	-	8	-	-	-	177	101	179	78	2,269	-	-			
9	-	9	-	-	-	163	91	166	75	2,173	-	-			
Nilai Rata-rata Density										2,232					
			DIPERIKSA  Errick Edison Sirepu, ST					DIKERAJAKAN  Muhammad Sigit Taufik, ST							

LAMPIRAN K
SURAT KETERANGAN PENELITIAN

	PT. BARA PRIMA PRATAMA Job site Selensen Kecamatan Kemuning, Kabupaten Indragiri Hilir, Provinsi Riau										
<hr/> <u>SURAT KETERANGAN PENELITIAN</u> No. 008/HR/BPP-SLS/IV/2022											
<p>Yang bertanda tangan dibawah ini, menerangkan dengan sesungguhnya bahwa:</p> <table style="width: 100%;"><tr><td style="width: 30%;">Nama</td><td>: Riza Evrita</td></tr><tr><td>Ttl</td><td>: Surau gading, 27 Juli 1999</td></tr><tr><td>No. Ktp</td><td>: 1406076707990001</td></tr><tr><td>NPM/NIM</td><td>: 710018200</td></tr><tr><td>Program Studi</td><td>: S1-Teknik Petambangan</td></tr></table>		Nama	: Riza Evrita	Ttl	: Surau gading, 27 Juli 1999	No. Ktp	: 1406076707990001	NPM/NIM	: 710018200	Program Studi	: S1-Teknik Petambangan
Nama	: Riza Evrita										
Ttl	: Surau gading, 27 Juli 1999										
No. Ktp	: 1406076707990001										
NPM/NIM	: 710018200										
Program Studi	: S1-Teknik Petambangan										
<p>Benar merupakan Mahasiswa yang telah melakukan Penelitian di perusahaan kami dengan judul "Analisis Pengaruh Geometri Peledakan terhadap Fragmentasi Hasil Peledakan pada PT Bara Prima Pratama yang Dilaksanakan oleh PT. Dahana, Kec Kemuning Kab. Indragiri Hilir, Prov Riau" terhitung sejak 1 Maret 2022 sampai dengan 19 April 2022 dengan bimbingan dari Engeneer PT. Bara Prima Pratama site Selensen.</p>											
<p>Demikianlah surat keterangan ini dibuat agar dapat digunakan sebagaimana mestinya.</p>											
<p>Selensen, 20 April 2022</p> <table style="width: 100%;"><tr><td style="text-align: center;"> EDY S. ZULFINDRA HR</td><td style="text-align: center;"> TEDY PRATOMO Pembimbing PT. BARA PRIMA PRATAMA</td><td style="text-align: center;"> SUDARYONO KTT site Selensen</td></tr></table>		 EDY S. ZULFINDRA HR	 TEDY PRATOMO Pembimbing PT. BARA PRIMA PRATAMA	 SUDARYONO KTT site Selensen							
 EDY S. ZULFINDRA HR	 TEDY PRATOMO Pembimbing PT. BARA PRIMA PRATAMA	 SUDARYONO KTT site Selensen									

Gambar K1. Surat Keterangan Penelitian