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# LAMPIRAN

**Lampiran 1**

## Pengujian Agregat Halus dan Agregat Kasar

### A. Perhitungan Pengujian Gradasi Butiran Agregat Halus

Bahan : Pasir Merapi
Asal : Merapi, Yogyakarta
Jenis Pengujian : Gradasi Butiran Agregat Halus (Pasir)
Diperiksa :

Tabel 1. Pengujian Gradasi Butiran Agregat Halus Benda Uji 1

| Nomor Saringan | Ukuran Saringan (mm) | Berat Tertahan (g) | Persen Berat Tertahan (%) | Komulatif Tertahan (%) | Komulatif LoLos Saringan (%) |
|---|---|---|---|---|---|
| 4 | 4,8 | 0 | 0 | 0 | 100 |
| 8 | 2,4 | 14 | 1,4 | 1,4 | 98,6 |
| 16 | 1,2 | 136 | 13,6 | 15 | 85 |
| 30 | 0,6 | 251 | 25,1 | 40,1 | 59,9 |
| 50 | 0,3 | 190 | 19,0 | 59,1 | 40,9 |
| 100 | 0,15 | 283 | 28,3 | 87,4 | 12,6 |
| Pan | - | 126 | 12,6 | 100 | 0 |
| **Jumlah** | | **1000** | **100** | **303** | **397** |

1. Persen Berat Tertahan $= \frac{Berat\ Tertahan}{Jumlah}\ x\ 100\ \%$

   $= \frac{14}{1000}\ x\ 100\ \%$

   $= 1{,}4\ \%$

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2. Komulatif Tertahan= Kumulatif tertahan + Persen tertahan
   = 0 % + 1,4 %
   = 1,4 %
3. Kumulatif Lolos Saringan= Kumulatif lolos saringan – Persen berat tertahan
   = 100 % - 1,4 %
   = 98,6 %
4. Modulus Halus Butir (MHB)= $\frac{Jum \quad kumulatif\ tertahan}{jum \quad persen\ tertahan}$
   = $\frac{303}{100}$
   = 3,03 %

Tabel 2. Pengujian Gradasi Butiran Agregat Halus Benda Uji 2

| Nomor Saringan | Ukuran Saringan (mm) | Berat Tertahan (g) | Persen Berat Tertahan (%) | Komulatif Tertahan (%) | Komulatif Lolos Saringan (%) |
|---|---|---|---|---|---|
| 4 | 4,8 | 0 | 0 | 0 | 100 |
| 8 | 2,4 | 16 | 1,6 | 1,6 | 98,4 |
| 16 | 1,2 | 144 | 14,4 | 16 | 84 |
| 30 | 0,6 | 250 | 25,0 | 41 | 59 |
| 50 | 0,3 | 189 | 18,9 | 59,9 | 40,1 |
| 100 | 0,15 | 258 | 25,8 | 85,7 | 14,3 |
| Pan | - | 143 | 14,3 | 100 | 0 |
| Jumlah | | 1000 | 100 | 304,2 | 395,8 |

1. Persen Berat Tertahan=$\frac{Berat\ Tertahan}{Jumlah}$ $x$ 100 %
   = $\frac{16}{1000}$ $x$ 100 %
   = 1,6 %

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2. Komulatif Tertahan = Komulatif tertahan + Persen tertahan
   = 0 % + 1,6 %
   = 1,6 %
3. Kumulatif Lolos Tertahan= Kumulatif lolos saringan – Persen berat tertahan
   = 100 % - 1,6 %
   = 98,4 %
4. Modulus Halus Butir (MHB)= $\frac{Jum \quad kumulatif\ tertahan}{juml \quad persen\ tertahan}$
   = $\frac{304,2}{100}$
   = 3,042 %

Tabel 3. Pengujian Gradasi Butiran Agregat Halus Benda Uji 3

| Nomor Saringan | Ukuran Saringan (mm) | Berat Tertahan (g) | Persen Berat Tertahan (%) | Komulatif Tertahan (%) | Komulatif Lolos Saringan (%) |
|---|---|---|---|---|---|
| 4 | 4,8 | 0 | 0 | 0 | 100 |
| 8 | 2,4 | 13 | 1,3 | 1,3 | 98,7 |
| 16 | 1,2 | 126 | 12,6 | 13,9 | 86,1 |
| 30 | 0,6 | 244 | 24,4 | 38,3 | 61,7 |
| 50 | 0,3 | 193 | 19,3 | 57,6 | 42,4 |
| 100 | 0,15 | 288 | 28,8 | 86,4 | 13,6 |
| Pan | - | 136 | 13,6 | 100 | 0 |
| Jumlah | | 1000 | 100 | 297,5 | 402,5 |

1. Persen Berat Tertahan=$\frac{Berat\ Tertahan}{Jumlah}$ $x$ 100 %
   = $\frac{13}{1000}$ $x$ 100 %
   = 1,3 %

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2. Komulatif Tertahan= Kumulatif tertahan + Persen tertahan

   = 0 % + 1,3 %

   = 1,3 %

3. Kumulatif Lolos Tertahan= Kumulatif lolos saringan – Persen berat tertahan

   = 100 % - 1,3 %

   = 98,7 %

4. Modulus Halus Butir (MHB)= $\frac{Jum \quad kumulatif\ tertahan}{jumlah\ persen\ tertahan}$

   = $\frac{297,5}{100}$

   = 297,5 %

5. Rata –Rata Modulus Halus Butir (MHB)= $\frac{(MHB\ 1 + MHB\ 2 + MHB\ 3)}{3}$

   = $\frac{(3,03 + 3,042 + 297,5)}{3}$

   = 3,02 %

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## B. Perhitungan Pengujian Berat Jenis dan Penyerapan Air Agregat Halus (Pasir)

Bahan : Pasir Merapi
Asal : Merapi, Yogyakarta
Jenis Pengujian : Berat Jenis dan Penyerapan Air Agregat Halus (Pasir)
Diperiksa :

Tabel 4. Hasil Analisis Berat Jenis Agregat Halus

| Uraian | Sampel 1 | Sampel 2 | Sampel 3 |
|---|---|---|---|
| Berat Piknometer Berisi Pasir dan Air (Bt) | 1084 | 1074 | 1077 |
| Berat Pasir Setelah Kering (Bk) | 482 | 467 | 482 |
| Berat Piknometer Berisi Air (B) | 770 | 770 | 763 |
| Berat Pasir Keadaan Jenuh Kering Muka (SSD) | 500 | 500 | 500 |
| Analisis Hitungan | | | |
| Berat Jenis Curah (Bulk Specific Grafity) $= \frac{Bk}{B+SSD-Bt}$ | 2,55 | 2,38 | 2,59 |
| Berat Jenis Jenuh Kering Muka (Saturated Surface Dry) $= \frac{SSD}{B+SSD-Bt}$ | 2,65 | 2,55 | 2,69 |
| Berat Jenis Tampak (Apparent Specific Grafity) $= \frac{Bk}{B+Bk-Bt}$ | 2,82 | 2,87 | 2,87 |
| Penyerapan Air agregat Halus $= \frac{SSD-Bk}{Bk} \boldsymbol{x}\ \mathbf{100}\ \%$ | 3,73 | 7,07 | 3,73 |
| Rata – Rata | | | |
| Berat Jenis Curah (Bulk Specific Grafity) | | 2,51 | |
| Berat Jenis Jenuh Kering Muka (Saturated Surface Dry) | | 2,64 | |

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| | |
|---|---|
| Berat Jenis Tampak (Apparent Specific Grafity) | 2,85 |
| Penyerapan Air Agregat Halus(%) | 2,85 |

1. Berat Jenis Curah (Bulk Specific Grafity)= $\frac{Bk}{B+SSD-Bt}$

   = $\frac{\mathbf{482}}{\mathbf{770+500-1084}}$

   = 2,55

2. Berat Jenis Jenuh Kering Muka= $\frac{SSD}{B+SSD-Bt}$

   = $\frac{\mathbf{500}}{\mathbf{770+500-1084}}$

   = 2,64

3. Berat Jenis Tampak (Apparent Specific Grafity)= $\frac{Bk}{B+Bk-}$

   = $\frac{482}{770+482-1084}$

   = 2,82

4. Penyerapan Air Agregat Halus (Pasir)= $\frac{SSD-}{Bk} x$ 100 %

   = $\frac{500-4}{482} x$ 100 %

   = 3,73 %

5. Rata – Rata Berat Jenis Curah = $\frac{BJ\ 1+BJ\ 2+BJ\ 3}{3}$

   = $\frac{2,55+2,38+2,59}{3}$

   = 2,51

6. Rata – Rata Berat Jenis Jenuh Kering Muka = $\frac{BJ\ SSD\ 1+BJ\ SSD\ 2+BJ\ SSD\ 3}{3}$

   = $\frac{2,65+2,55+2,69}{3}$

   = 2,64

7. Rata – Rata Berat Jenis Tampak = $\frac{BJ\ Tampak\ 1+BJ\ Tampak\ 2+BJ\ Tampak\ 3}{3}$

   = $\frac{2,82+2,87+2,87}{3}$

   = 2,85

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8. Rata – rata penyerapan air = $\frac{3{,}73+7{,}07+3{,}73}{3}$

   = 2,85 %

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## C. Analisis Pengujian Kadar Air Agregat Halus (Pasir)

Bahan : Pasir Merapi
Asal : Merapi, Yogyakarta
Jenis Pengujian : Pengujian Kadar Air Agregat Halus (Pasir)
Diperiksa :

Tabel 5. Hasil Analisis kadar Air Agregat Halus

| Uraian | Sampel 1 | Sampel 2 | Sampel 3 |
|---|---|---|---|
| Berat Pasir Jenuh Kering Muka (gr) B! | 500 | 500 | 500 |
| Berat Cawan (gr) | 130 | 130 | 130 |
| Berat Pasir Jenuh Kering Muka + Cawan (gr) B2 | 630 | 630 | 630 |
| Berat Pasir Setelah Oven + Cawan (gr) B3 | 555 | 555 | 555 |
| Kandungan Air (gr) | 75 | 75 | 75 |
| Kadar Air (%) | 11,905 | 11,905 | 11,905 |
| Rata – Rata Kadar Air (%) | | 11,905 | |

1. Kandungan Air= B2 – B3
   = 630 – 555
   = 75 gram
2. Kadar Air= $\frac{B2-B3}{B2}\ x\ 100$
   = $\frac{630-550}{630}\ x\ 100$
   = 11,905 %
3. Kadar Air Rata – Rata= $\frac{Kadar\ Air\ 1+\ kadar\ Air\ 2+Kadar\ Air\ 3}{3}$
   = $\frac{11,905 + 11,905 + 11,905}{3}$
   = 11,905 %

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## D. Analisis Pengujian kadar Lumpur Agregat Halus (Pasir)

Bahan : Pasir Merapi

Asal : Merapi, Yogyakarta

Jenis Pengujian : Pengujian Kadar Lumpur Agregat Halus (Pasir)

Diperiksa :

Tabel 6. Hasil Analisis Kadar Lumpur Agregat Halus

| Uraian | Sampel 1 | Sampel 2 | Sampel 3 |
|---|---|---|---|
| Tinggi Air Pada Gelas Ukur (mm) A | 475 | 475 | 475 |
| Tinggi Pasir dan Tinggi Lumpur pada Gelas Ukur (mm) B | 285 | 280 | 285 |
| Tinggi Pasir pada Gelas Ukur (mm) C | 270 | 265 | 270 |
| Kadar Lumpur (%) | 5,3 | 5,4 | 5,3 |
| Rata – Rata kadar Lumpur (%) | | 5,3 | |

1. Kadar Lumpur= $\frac{(B-C)}{B}\ x100$

   = $\frac{(285-2\quad)}{270}\ x100$

   = 5,3 %

2. Rata – Rata Kadar Lumpur = $\frac{Kadar\ Lumpur\ 1+Kadar\ Lumpur\ 2+Kadar\ Lumpur\ 3}{3}$

   = $\frac{5,3\ +5,4\ +5,3}{3}$

   = 5,3 %

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## E. Analisis Pengujian Berat Satuan Agregat Halus (Pasir)

Bahan : Pasir Merapi

Asal : Merapi, Yogyakarta

Jenis Pengujian : Pengujian Berat Satuan Agregat Halus (Pasir)

Diperiksa :

Tabel 7. Hasil Analisis Berat Satuan Agregat Halus

| Uraian | Satuan | Benda UJi |
|---|---|---|
| Berat Bejana Kosong (B1) | gram | 10700 |
| Berat Bejana dan Pasir (B2) | gram | 20000 |
| Diameter Bejana | cm | 15 |
| Tinggi Bejana | cm | 30 |
| Analisis Hitungan | | |
| Volume Bejana (V) | $cm^3$ | 5301,44 |
| Berat Satuan (Bsat) | $gr/cm^3$ | 1,75 |

1. Volume Bejana (V)= $\frac{1}{4}$ $x$ 𝝅 x $D^2$ x t

   = $\frac{1}{4}$ $x$ 𝝅 x $15^2$ x 30

   = 5301,44 $cm^3$

2. Berat Satuan (Bsat)= $\frac{B2-B1}{V}$

   = $\frac{20000-10700}{5301,44}$

   = 1,75 $gr/cm^3$

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## F. Analisis Pengujian Keausan Agregat kasar (Kerikil)

Bahan : Kerikil Clereng
Asal : Clereng, Kulon Progo, Yogyakarta
Jenis Pengujian : Pengujian Keausan Agregat Kasar (Kerikil)
Diperiksa :

Tabel 8. Hasil Analisis Keausan Agregat Kasar

| Jenis Pengukuran | Berat Sampel 1 | Berat Sampel 2 | Berat Sampel 3 |
|---|---|---|---|
| Berat Sebelum Masuk Mesin *Los Angeles* (gr) | 5000 | 5000 | 5000 |
| Berat Setelah Masuk Mesin *Los Angeles* (gr) | 3780 | 3675 | 3670 |
| | Analisis Hitungan | | |
| Keausan Agregat Kasar (%) | 24,4 | 26,5 | 26,6 |
| | Rata – Rata | | |
| Keausan Rata – Rata (%) | | 25,83 | |

1. Keausan Agregat Kasar (%)= $\frac{B1-B2}{B1}$ x 100 %

   = $\frac{5000-3780}{5000}$ x 100 %

   = 24,40 %

2. Keausan Rata – Rata (%)= $\frac{Keausan\ Agrerat\ 1+Keausan\ Agregat\ 2+Keausan\ Agregat\ 3}{3}$

   = $\frac{24,40+2\ ,50+2\ ,60}{3}$

   = 25,83 %

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## G. Analisis Pengujian Berat Jenis dan Penyerapan Air Agregat Kasar (Kerikil)

Bahan : Kerikil Clereng
Asal : Clereng, Kulon Progo, Yogyakarta
Jenis Pengujian : Pengujian Berat Jenis dan Penyerapan AirAgregat Kasar (Kerikil)
Diperiksa :

Tabel 9. Hasil Analisis Berat Jenis dan Penyerapan Air Agregat Kasar (Kerikil)

| Uraian | Sampel 1 | Sampel 2 | Sampel 3 |
|---|---|---|---|
| Berat Kerikil Kering Setelah Dikeringkan (Bk) gram | 4959,1 | 1491 | 1491 |
| Berat Kerikil Didalam Air (Ba) | 3136,9 | 937,9 | 935,2 |
| Berat Kerikil Keadaan Jenuh Kering Muka (Bj) | 5031,7 | 1510,3 | 1513,7 |
| Analisis Hitungan | | | |
| Berat Jenis Curah (Bulk Specific Grafity) | 2,62 | 2,60 | 2,58 |
| Berat Jenis Jenuh Kering Muka (Saturated Surface Dry) | 2,66 | 2,64 | 2,62 |
| Berat Jenis Tampak (Apparent Specific Grafity) | 2,72 | 2,70 | 2,68 |
| Penyerapan Air Kerikil (%) | 0,01 | 0,01 | 0,02 |
| Rata – Rata | | | |
| Berat Jenis Curah (Bulk Specific Grafity) | | 2,60 | |
| Berat Jenis Jenuh Kering Muka (Saturated Surface Dry) | | 2,64 | |
| Berat Jenis Tampak (Apparent Specific Grafity) | | 2,70 | |
| Penyerapan Air Kerikil (%) | | 0,014 | |

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1. Berat Jenis Curah (*Bulk Specific Grafity*)= $\frac{Bk}{Bj-Ba}$

   = $\frac{4959,1}{5031,7-3136,9}$

   = 2,62

2. Berat Jenis Jenuh Kering Muka (*SaturatedSurface Dry*)= $\frac{Bj}{Bj-Ba}$

   = $\frac{5031,7}{5031,7-3136,9}$

   = 2,66

3. Berat Jenis Tampak (*Apparent Specific Grafity*)= $\frac{Bk}{Bk-Ba}$

   = $\frac{4959,1}{4959,1-3136,9}$

   = 2,72

4. Penyerapan Air Agregat Kasar (Kerikil)= $\frac{Bj-Bk}{Bk}$ x 100 %

   = $\frac{5031,7-4959,1}{4959,1}$ x 100 %

   = 0,01 %

5. Rata – Rata Berat Jenis Curah= $\frac{Bj\ curah\ 1+ Bj\ curah\ 2 + Bj\ curah\ 3}{3}$

   = $\frac{2,62 +2,60 +2,58}{3}$

   = 2,64

6. Rata – Rata Berat Jenis Jenuh Kering Muka = $\frac{Bj\ SSD\ 1+ Bj\ SSD\ 2 + Bj\ SSD\ 3}{3}$

   = $\frac{2,66 +2,64 +2,62}{3}$

   = 2,64

7. Rata – Rata Berat Jenis Tampak = $\frac{Bj\ Tampak\ 1+ Bj\ Tampak\ 2 + Bj\ Tampak\ 3}{3}$

   = $\frac{2,72 +2,70 +2,68}{3}$

   = 2,70

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8. Rata – Rata Penyerapan Air = $\frac{penyerapan\ Air\ 1 + Penyerpan\ Air\ 2 + Penyerapan\ Air\ 3}{3}$

   = $\frac{0{,}01 + 0{,}01 + 0{,}02}{3}$

   = 0,014

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## H. Analisis Pengujian Kadar Air Agregat Kasar (Kerikil)

Bahan : Kerikil Clereng

Asal : Clereng, Kulon Progo, Yogyakarta

Jenis Pengujian : Pengujian Kadar Air Agregat Kasar (Kerikil)

Diperiksa :

Tabel 14. Hasil Analisis Pengujian Kadar Air agregat Kasar (Kerikil)

| Uraian | Sampel 1 | Sampel 2 | Sampel 3 |
|---|---|---|---|
| Berat Agregat Kasar SSD (gr) B1 | 1000 | 1000 | 1000 |
| Berat Agregat Kasar Sesudah Dioven (gr) B2 | 985 | 980 | 1000 |
| Kandungan Air (gr) | 15 | 20 | 0 |
| Kadar Air (%) | 1,5 | 2 | 0 |
| Kadar Air Rata – Rata (%) | | 1,17 | |

1. Kandungan Air= B1 – B2
   =1000 – 985
   =15 gram
2. Kadar Air= $\frac{B1-B2}{B1}$ $x$ 100 %
   = $\frac{1000-985}{1000}$ $x$ 100 %
   = 1,5 %
3. Kadar Air Rata – Rata= $\frac{Kadar\ Air\ 1+\ Kadar\ Air\ 2\ +Kadar\ Air\ 3}{3}$
   = $\frac{1{,}5\ +\ 2\ +0}{3}$
   = 1,17 %

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## I. Analisis Pengujian Kadar Lumpur Agregat Kasar (Kerikil)

Bahan : Kerikil Clereng
Asal : Clereng, Kulon Progo, Yogyakarta
Jenis Pengujian : Pengujian Kadar LumpurAgregat Kasar (Kerikil)
Diperiksa :

Tabel 15. Hasil Analisis Kadar Lumpur Agregat Kasar (Kerikil)

| Uraian | Sampel 1 | Sampel 2 | Sampel 3 |
|---|---|---|---|
| Berat Kerikil Kering Oven Sebelum Dicuci (W1) | 5000 | 5000 | 5000 |
| Berat Kerikil Kering Oven Setelah Dicuci + Nampan (W2) | 5297,7 | 5285 | 5286,7 |
| Berat Nampan (W3) | 297,7 | 285 | 286,7 |
| Berat Kerikil Kering Oven Setelah Dicuci (W4) | 4846,9 | 4898,1 | 4877,4 |
| Analisih Hitungan | | | |
| Kadar Butiran Lolos Ayakan No 200 | 3,06% | 2,04% | 2,45% |
| Rata – Rata | | | |
| Kadar ButirLolos Ayakan No 200 Rata – Rata | | 2,52% | |

1. Kadar Lumpur= $\frac{W1-W4}{W1}\ x\ 100\ \%$
   = $\frac{5000-4846,9}{5000}\ x\ 100\ \%$
   = 3,06%
2. Rata – Rata Kadar Lumpur= $\frac{Kadar\ Lumpur\ 1-Kadar\ Lumpur\ 2+Kad\quad Lumpur\ 3}{3}$
   = $\frac{3,06+2,04+\ ,45}{3}$
   = 2,52%

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## J. Analisis Pengujian Berat Satuan Agregat Kasar

Bahan : Kerikil Clereng

Asal : Clereng, Kulon Progo, Yogyakarta

Jenis Pengujian : Pengujian Berat Satuan Agregat Kasar (Kerikil)

Diperiksa :

Tabel 16. Hasil Analisis Pengujian Berat Satuan Agregat Kasar (Kerikil)

| Uraian | Satuan | Sampel |
|---|---|---|
| Berat Silinder Kosong (B1) | Kg | 10300 |
| Berat Silinder + Agregat Kasar (Kerikil) (B2) | Kg | 17900 |
| Diameter Silinder | Cm | 15 |
| Tinggi Silinder | Cm | 30 |
| Analisis Hitungan | | |
| Volume Silinder (V) | $cm^3$ | 5301,44 |
| Berat Satuan (Bsat) | $gr/cm^3$ | 1,434 |

1. Volume Silinder= $\frac{1}{4}$ $x$ $\pi$ $x$ $D^2$ x t

   = $\frac{1}{4}$ $x$ $\pi$ $x$ $15^2$ x 30

   = 5301,44 $cm^3$

2. Berat Satuan= $\frac{B2-B1}{V}$

   = $\frac{17900-1030}{5303,44}$

   = 1,434 $gr/cm^3$

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**Mix Design (*ACI Method*)** **Lampiran 2**

## 1. Rencana

Kuat tekan beton mutu awal tinggi yang direncanakan pada umur 3 hari yaitu 40 – 82 Mpa, dengan menggunkan *superplasticizer* yang divariasi 0,8%, 1 %, 1,5%. Agregat kasar yang digunakan yaitu agregat kasar clereng dengan karateristik berat jenis sebesar 2,64. Agregat halus yang digunkan yaitu agregat halus merapi dengan karateristik berat jenis sebesar 2,63.

## 2. Proposi Campuran

a. Menetukan slump dan kuat tekan yang direncanakan

Nilai slump yang ditargetkan yaitu 1-2 inchi (25 mm-50 mm). Proporsi campuran yang akan dibuat berdasarkan campuran di laboratorium. Kuat tekan rata – rata yang direncanakan fcr' yaitu sebagai berikut :

$$fcr' = \frac{(fc+9{,}66)}{0{,}9}$$

$$= \frac{(82{,}68+9{,}66)}{0{,}9}$$

$$= 102{,}60 \text{ Mpa}$$

b. Menentukan ukuran agregat kasar maksimum

Menentukan ukuran agregat kasar dapat dilihat pada Tabel 17.

Tabel 17.*Suggested maxsimum size coarse aggregate*

| *Required concrete strength (Psi)* | *Suggested maxsimum size coarse aggregate (inchi)* |
|---|---|
| <9000 | *¾ to 1* |
| >9000 | *3/8 to ½* |

Sumber :*ACI 211 4R – 93*

Ukuran agregat kasar yang digunakan sesuai dengan kuat tekan yang direncanakan yaitu 12000 psi. Ukuran agregat yang digunakan sesuai dengan Tabel 17 kuat tekan >9000 dengan penggunaan agregat kasar

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ukuran lolos saringan 3/8 sampai dengan lolos saringan ½ (lolos 9,5 – 12,5 mm).

c. Menentukan Kadar Agregat Kasar Optimum

Menentukan kadar agregat kasar optimum ditentukan dari Tabel 18.

Tabel 18. Recommended volume of coarse aggregate per unit volume of concrete

| Nominal maxsimum size (inchi) | 3/8 | 1/2 | 3/4 | 1 |
|---|---|---|---|---|
| Fractional volume of oven dry rodded coarse aggregate | 0,65 | 0,68 | 0,72 | 0,75 |

Sumber :*ACI 211 4R – 93*

Pada Tabel 18 ukuran yang digunakan lolos saringan ½ inchi dengan volume pecahan agregat kasar (SSD) yaitu 0,68.

Ukuran agregat kasar lolos saringan ½ = VCA x Berat satuan
= 0,68 x 1434 kg/$m^3$
= 975,12 kg/$m^3$

d. Estimasi Kadar Air Pencampuran dan Kadar Udara

Menentukan estimasi kadar air pencampuran dan kadar udara dapat dilihat pada Tabel 19.

Tabel 19. *First Estimasi Of Mixing Water Requirement and Air Content Of Fresh Concrete Based On Using A Sand with 35 Percent Voids*

| Slump (inchi) | Mixing Water (lb/$yd^3$) | | | |
|---|---|---|---|---|
| | Maximum size coarse aggregate (inchi) | | | |
| | 3/8 | ½ | 3/4 | 1 |
| 1 to 2 | 310 | 295 | 285 | 280 |
| 2 to 3 | 320 | 310 | 295 | 290 |
| 3 to 4 | 330 | 320 | 305 | 300 |
| Entrapped | 3 | 2,5 | 2 | 1,5 |

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| | | | | |
|---|---|---|---|---|
| Air content | (2,5) | (2,0) | (1,5) | (1,0) |

Sumber : ACI 211 4R – 93 (ACI, 1993)

Dengan nilai slump 1 – 2 inchi, kebutuhan air 295 lb/yd$^3$ x 0,593 = 174,94 liter/m$^3$ dan kadar udara untuk beton mutu tinggi dengan superplasticizer 2 %.

1) Kadar rongga udara

V = 1 - $\frac{berat\ satuan\ agregat\ kasar}{bj\ agregat\ kasar\ x\ 1000}\ x\ 100$

= 1 - $\frac{1434}{2{,}64\ x\ 1000}\ x\ 100$ %

= 45,68 %

2) Koreksi udara= V – 35 x 4,75

= 45,68 – 35 x 4,75

= 50,74 liter/m$^3$

3) Kebutuhan air 1 m$^3$ beton= kadar air + koreksi kadar air

= 175 + 50,74

= 226 liter/m$^3$

e. Menentukan rasio W/(c + p)

Tabel 20. Rasio W/(c+p)

| Field strength (psi) | | w/c + p | | | |
|---|---|---|---|---|---|
| | | Maxsimum Size Coarse Aggregate (inchi) | | | |
| | | 3/8 | ½ | ¾ | 1 |
| 7000 | 28 day | 0,50 | 0,48 | 0,45 | 0,43 |
| | 56 day | 0,55 | 0,52 | 0,48 | 0,46 |
| 8000 | 28 day | 0,44 | 0,42 | 0,40 | 0,38 |
| | 56 day | 0,48 | 0,45 | 0,42 | 0,40 |
| 9000 | 28 day | 0,38 | 0,36 | 0,35 | 0,34 |
| | 56 day | 0,42 | 0,39 | 0,37 | 0,36 |
| 10000 | 28 day | 0,35 | 0,32 | 0,31 | 0,30 |

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| | | | | | |
|---|---|---|---|---|---|
| | 56 day | 0,37 | 0,35 | 0,33 | 0,32 |
| 11000 | 28 day | 0,30 | 0,29 | 0,27 | 0,27 |
| | 56 day | 0,33 | 0,31 | 0,29 | 0,29 |
| 12000 | 28 day | 0,27 | 0,26 | 0,25 | 0,25 |
| | 56 day | 0,30 | 0,28 | 0,27 | 0,26 |

Dari data Tabel 20 didapat hasil rasio W/(p+c) sebesar 0,26 dengan ukuran agregat lolos saringan ½ “.

f. Menentukan kadar bahan bersifat semen

Untuk membuat 1 $m^3$ beton $= \frac{Kebutuha \quad air\ 1m3}{W/(p+c)}$

$= \frac{226}{0,26}$

$= 867,98\ kg/cm^3$

g. Proporsi campuran dasar tanpa bahan bersifat semen

1) Semen $= \frac{kebutuhan\ \ 1\ m3\ beton}{Bj\ semen\ x\ 1000}$

$= \frac{867,98}{3.15\ x\ 1000}$

$= 0,2755\ m^3$

2) Agregat kasar $= \frac{kadar\ agregat\ kasar}{Bj\ kerikil\ x\ 1000}$

$= \frac{975,12}{2,64\ x\ 1000}$

$= 0,3694\ m^3$

3) Air $= \frac{kebutuha \quad air\ 1\ m3}{1000}$

$= \frac{226}{1000}$

$= 0,226\ m^3$

4) Udara $= 2\ \%$

$= 0,020\ m^3$

5) Volume bahan padat tanpa pasir= 0,2755 + 0,3694 + 0,266 + 0,020

$= 0,8906\ m^3$

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6) volume agregat halus =1 – Volume bahan padat tanpa pasir
= 1 – 0,8906
= 0,1094 $m^3$

7) Berat agregat halus = volume agregat halus x Bj pasir
= 0,1094 x 2,63
= 287,76 kg

Tabel 21 Proporsi bahan campuran dasar beton

| No | Bahan | Berat bahan | Satuan |
|---|---|---|---|
| 1 | Semen | 867,98 | $Kg/cm^3$ |
| 2 | Agregat Kasar (Clereng) | 975,12 | $Kg/cm^3$ |
| 3 | Agregat Halus (Merapi) | 287,76 | $Kg/cm^3$ |
| 4 | Air + *Admixture* | 226 | $Kg/cm^3$ |
| | Total | 2357 | $Kg/cm^3$ |

h. Proporsi campuran menggunakan semen dan *superplasticizer*

1) Jika digunakan *superplasticizer* 0,8 % + variasi *superplasticizer*

- Campuran 1 = 0,6 %
- Campuran 2 = 0,8 %
- Campuran 3 = 1 %

2) Menghitung berat semen dan superplasricizer per $m^3$

- Superplasticizer variasi 0,6 % = berat semen * 0,6 %
= 867,98 * 0,6 %
= 5,21 kg
- Superplasticizer variasi 0,8 % = berat semen * 0,8 %
= 867,98 * 0,8 %
= 6,94 kg
- Superplasticizer variasi 1 % = berat semen * 1 %
= 867,98 * 1 %
= 8,68 kg

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Tabel 22 Berat semen dan superplasticizer per $m^3$

| Jenis Campuran | Semen | Superplasticizer | Satuan |
|---|---|---|---|
| Campuran 1 | 867,98 | 5,21 | Kg |
| Campuran 2 | 867,98 | 6,94 | Kg |
| Campuran 3 | 867,98 | 8,68 | Kg |

i. Menghitung berat air dan *superplasticizer*+ *superplasticizer* 0,8 %

- Superplasticizer variasi 0,6 % = Berat Air – (Sp 0,6 % + Sp 0,8 %)
  = 226 – (5,21 + 6,94)
  = 213,52 kg
- Superplasticizer variasi 0,8 % = Berat Air – (Sp 0,8 % + Sp 0,8 %)
  = 226 – (6,94 + 6,94)
  = 211,79 kg
- Superplasticizer variasi 1 % = Berat Air – (Sp 1 % + Sp 0,8 %)
  = 226 – (8,68 + 6,94)
  = 210,05 kg

j. Hasil mix design

Tabel 23 Hasil mix design untuk 1 $m^3$

| Jenis Campuran | Semen (kg) | Agregat Kasar (kg) | Agregat Halus (kg) | Air (kg) | Superplasticizer (kg) | Superplasticizer 0,8 % (kg) |
|---|---|---|---|---|---|---|
| Campuran 1 | 867,98 | 975,12 | 975,12 | 213,52 | 5,21 | 6,94 |
| Campuran 2 | 867,98 | 975,12 | 975,12 | 211,79 | 6,94 | 6,94 |
| Campuran 3 | 867,98 | 975,12 | 975,12 | 210,05 | 8,68 | 6,94 |

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Tabel 24 Hasil mix design per silinder 15 cm x 30 cm

| Jenis Campuran | Semen (kg) | Agregat Kasar (kg) | Agregat Halus (kg) | Air (kg) | Superplasticizer (kg) | Superplasticizer 0,8 % (kg) |
|---|---|---|---|---|---|---|
| Campuran 1 | 5,25 | 5,90 | 1,74 | 1,292 | 0,0315 | 0,0420 |
| Campuran 2 | 5,25 | 5,90 | 1,74 | 1,281 | 0,0420 | 0,0420 |
| Campuran 3 | 5,25 | 5,90 | 1,74 | 1,271 | 0,0525 | 0,0420 |

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**Lampiran 3**

# Bahan Penelitian

1. Semen PPC (*Portland Pozzolan Cement*)

Gambar 1 Semen PPC (*Portland Pozzolan Cement*)

2. Agregat Kasar (Clereng)

Gambar 2 Agregat kasar (Clereng)

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3. Agregat Halus (Merapi)

Gambar 3 Agregat halus (Merapi)

4. Air

Gambar 4 Air

5. *Superplasticizer*

Gambar 5 *Besmittel* 1 liter

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Gambar 6 *Viscocrete 1003*

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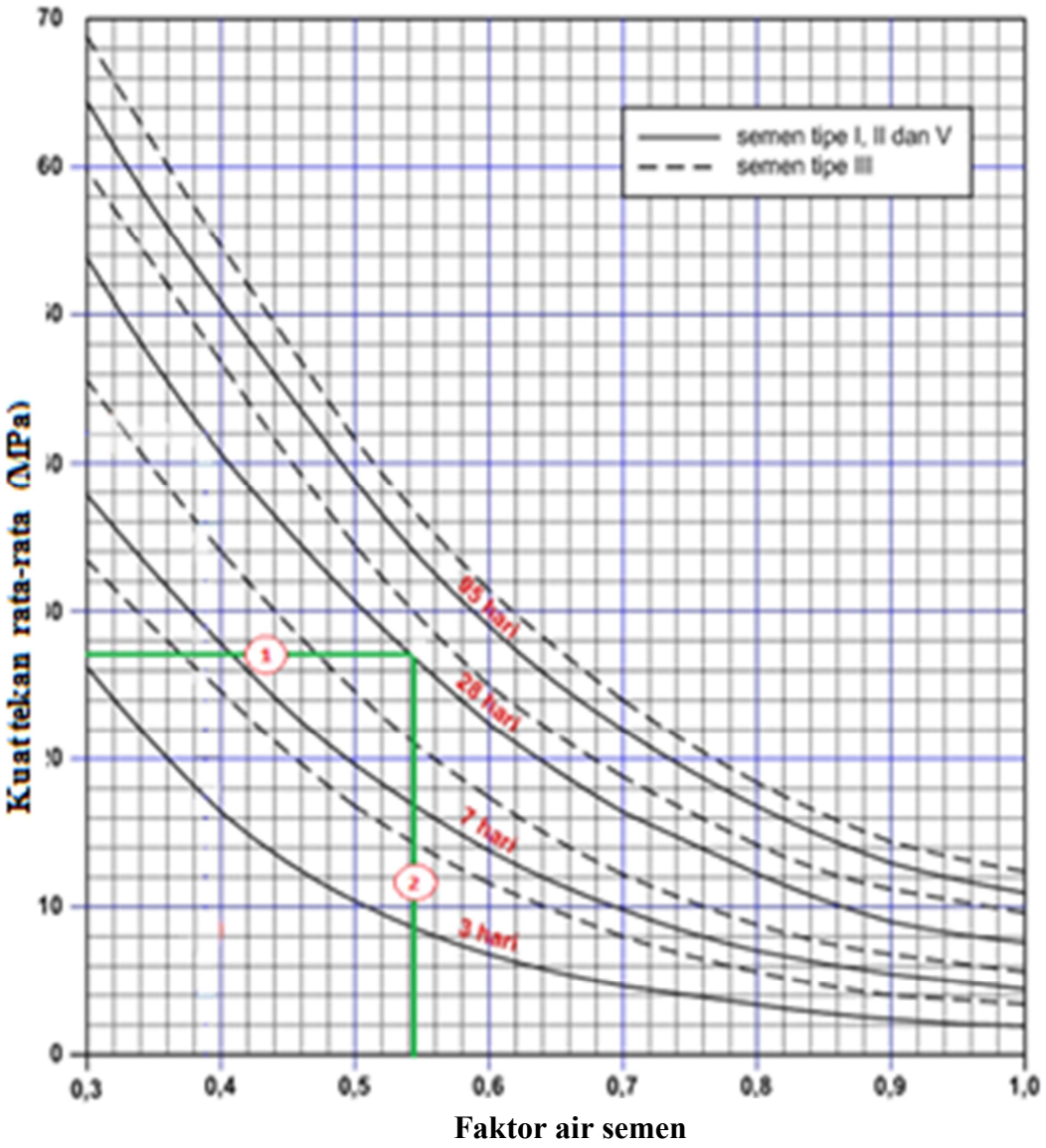
**Lampiran 4**

## Faktor Air Semen (BSN, 1993)




Gambar 4.1 Hubungan kuat tekan terhadap faktor air semen (BSN, 1993)

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## Hasil Pengujian Kuat Tekan

### a. Pengujian variasi SP 0,6%

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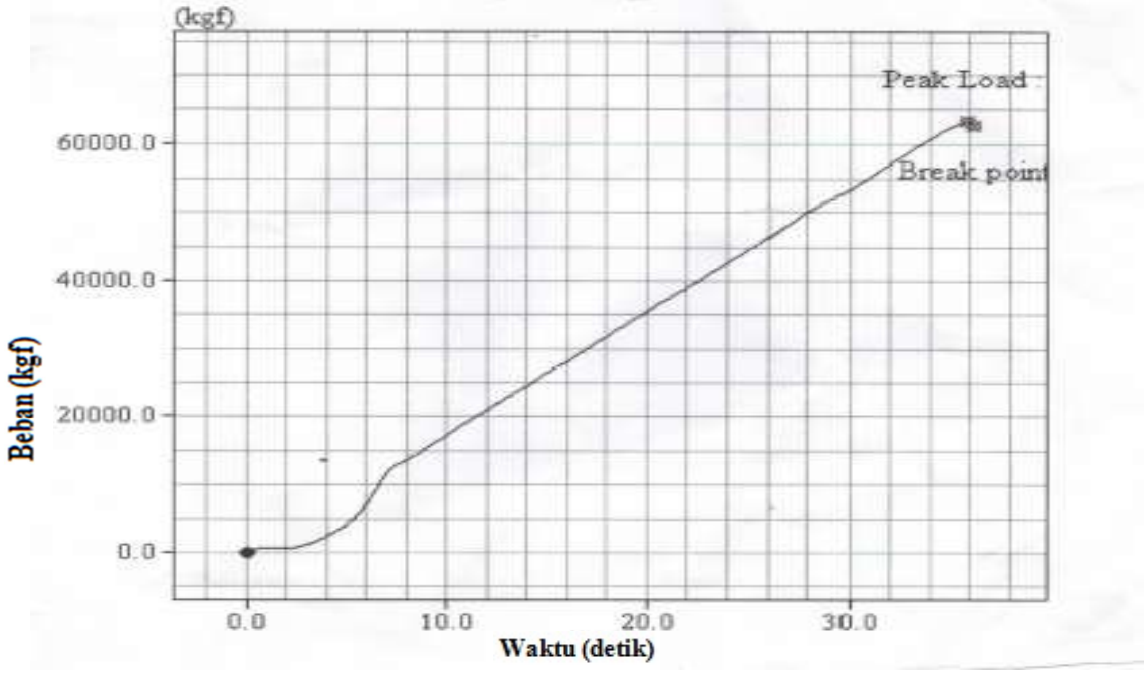
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **6/9/2018** | | | **Report No.** | | **P1. A1** | |
| **NO** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **180.98** | **63190** | **4965.9** | **348.8** | **2.0** | **300.0** | **1.0** | **3** | | |




Gambar 1 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P1. A1

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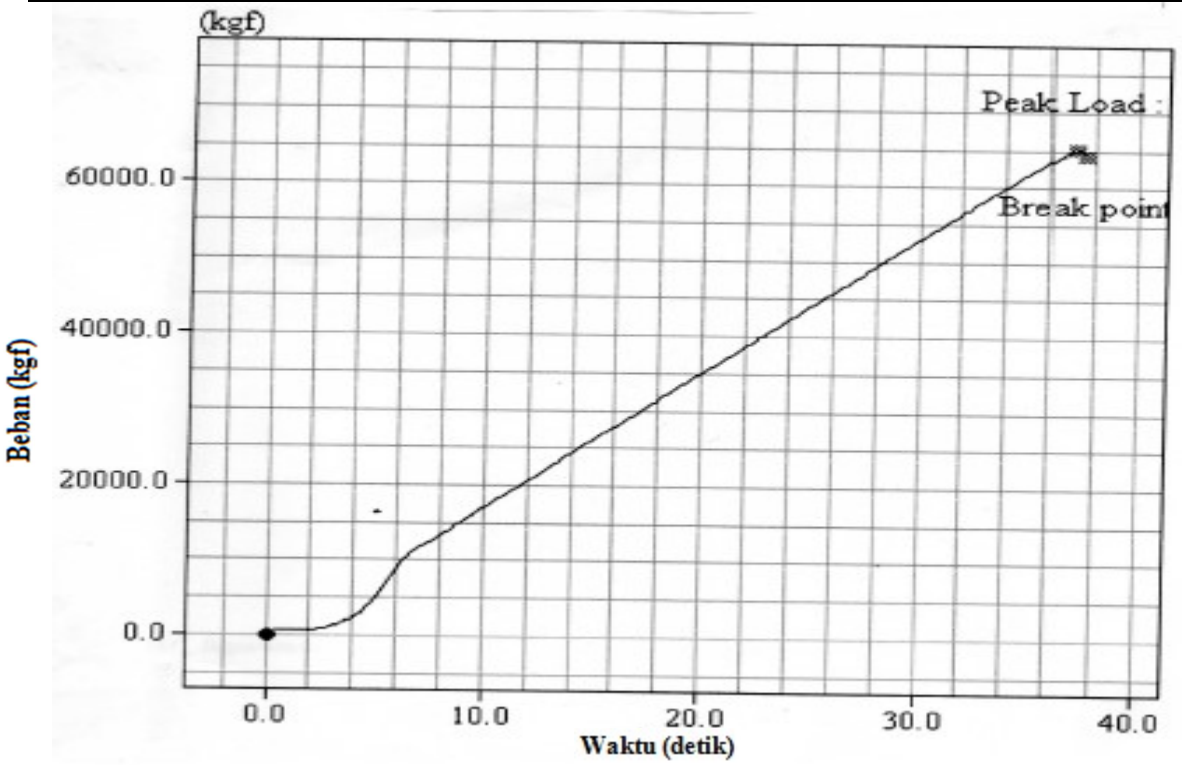
**Concrete Testing**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **6/9/2018** | | | **Report No.** | | **P1. A2** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **179.08** | **65040** | **5165.6** | **362.8** | **2.0** | **300.0** | **1.0** | **3** | | |




Gambar 2 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P1. A2

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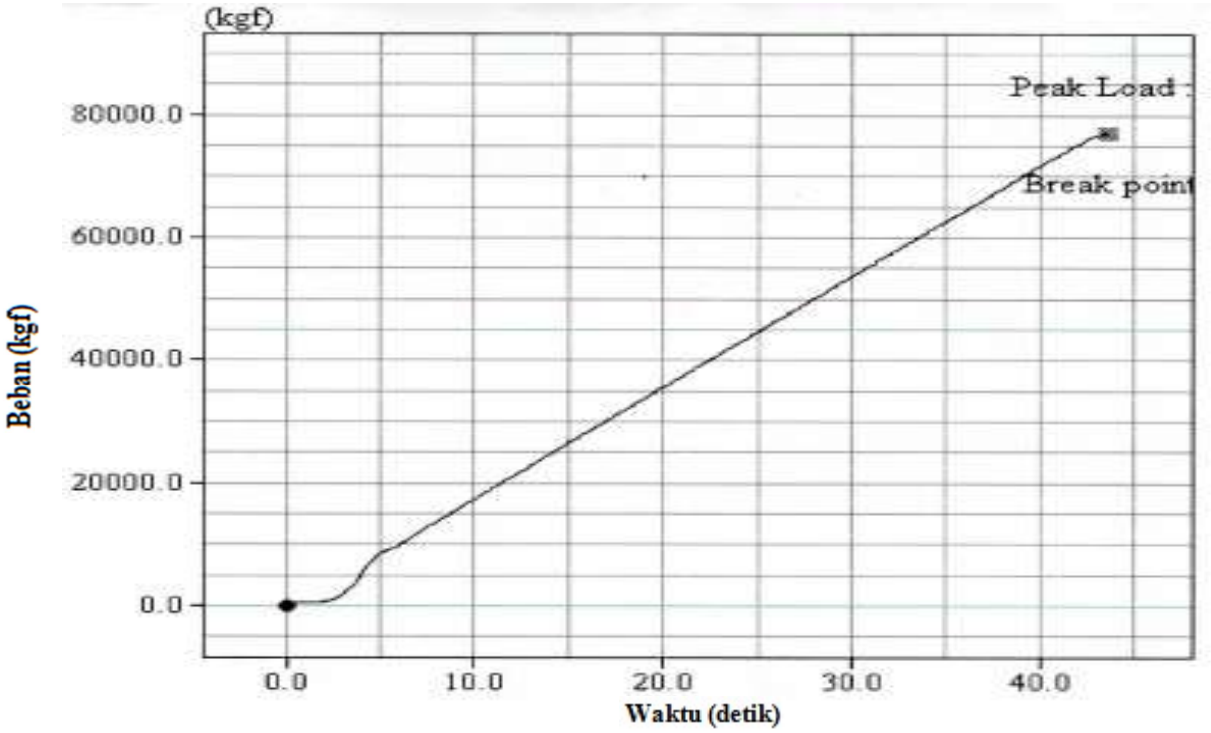
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **5/30/2018** | | | **Report No.** | | **P2. A1** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **181.46** | **77120** | **6044.7** | **424.2** | **2.0** | **300.0** | **1.0** | **7** | | |




Gambar 3 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P2. A1

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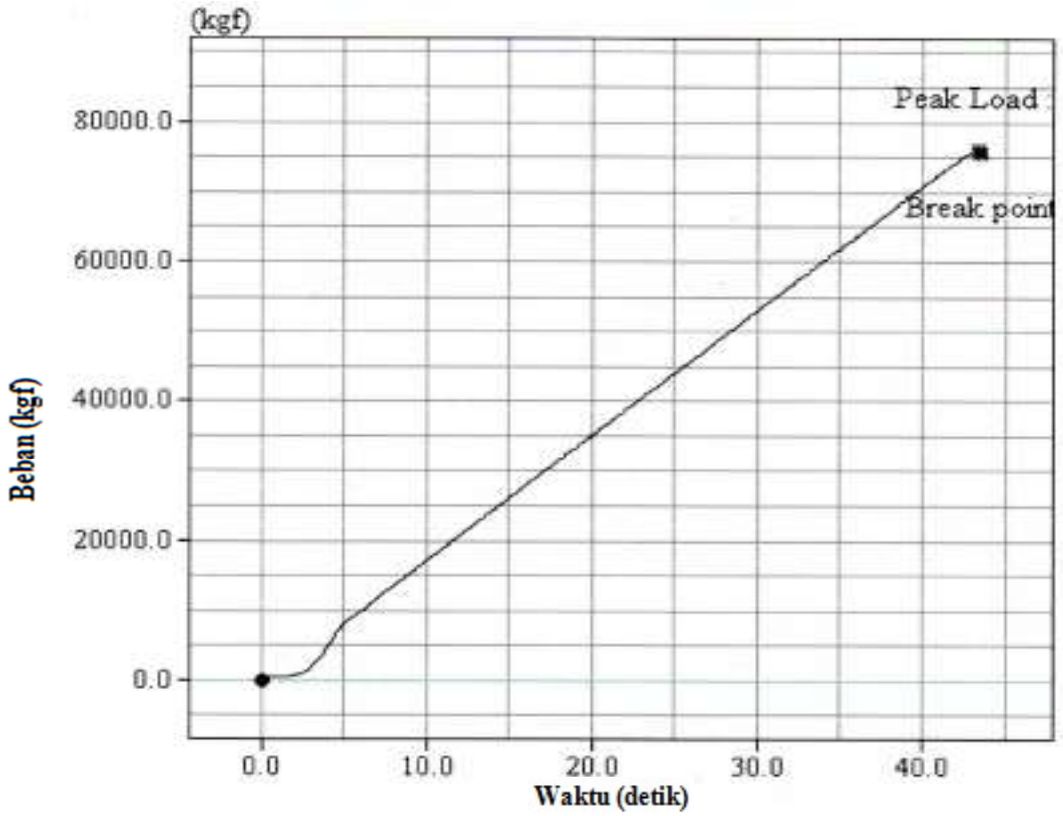
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **5/30/2018** | | | **Report No.** | | **P2. A2** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **178.84** | **76040** | **6047.2** | **424.2** | **2.0** | **300.0** | **1.0** | **7** | | |




Gambar 4 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P2. A2

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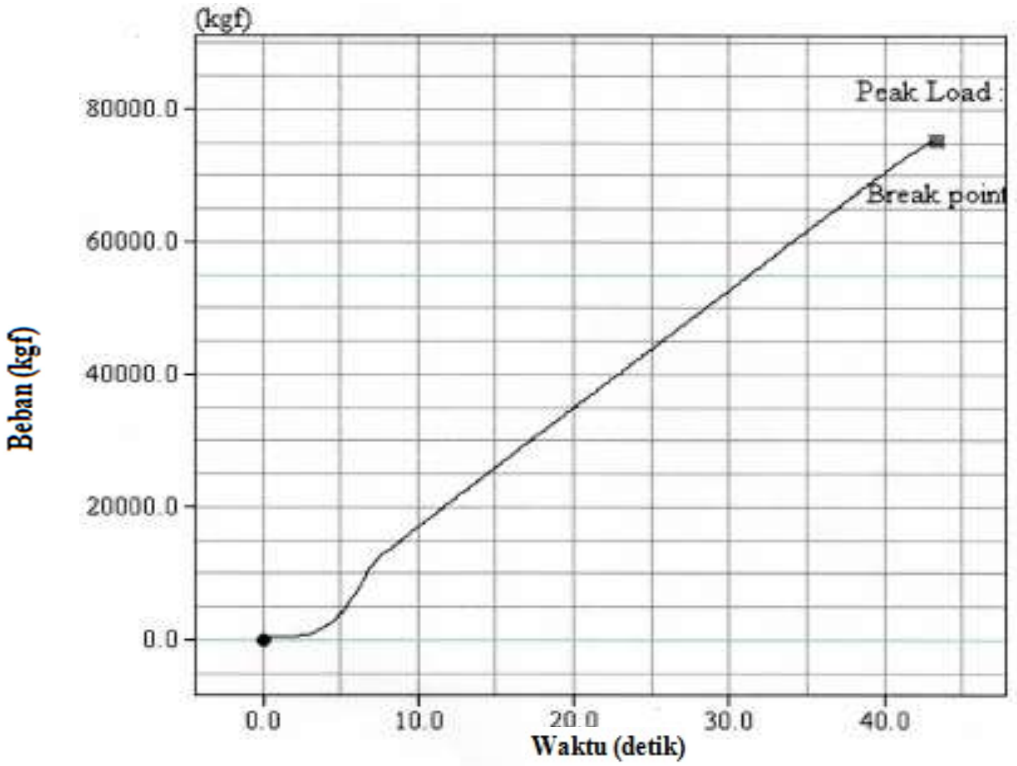
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **7/11/2018** | | | **Report No.** | | **P3. A1** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **177.89** | **75360** | **6025** | **423.2** | **2.0** | **300.0** | **1.0** | **28** | | |




Gambar 5 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P3. A1

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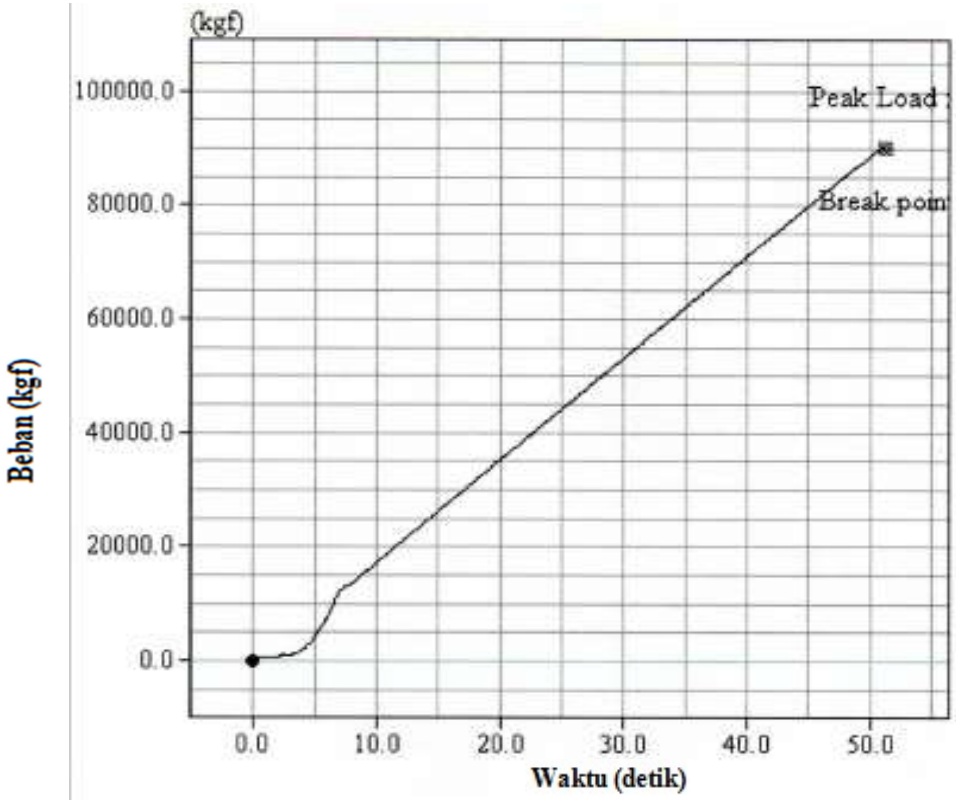
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **7/11/2018** | | | **Report No.** | | **P3. A2** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **179.08** | **90240** | **7167** | **503.4** | **2.0** | **300.0** | **1.0** | **28** | | |




Gambar 6 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P3. A2

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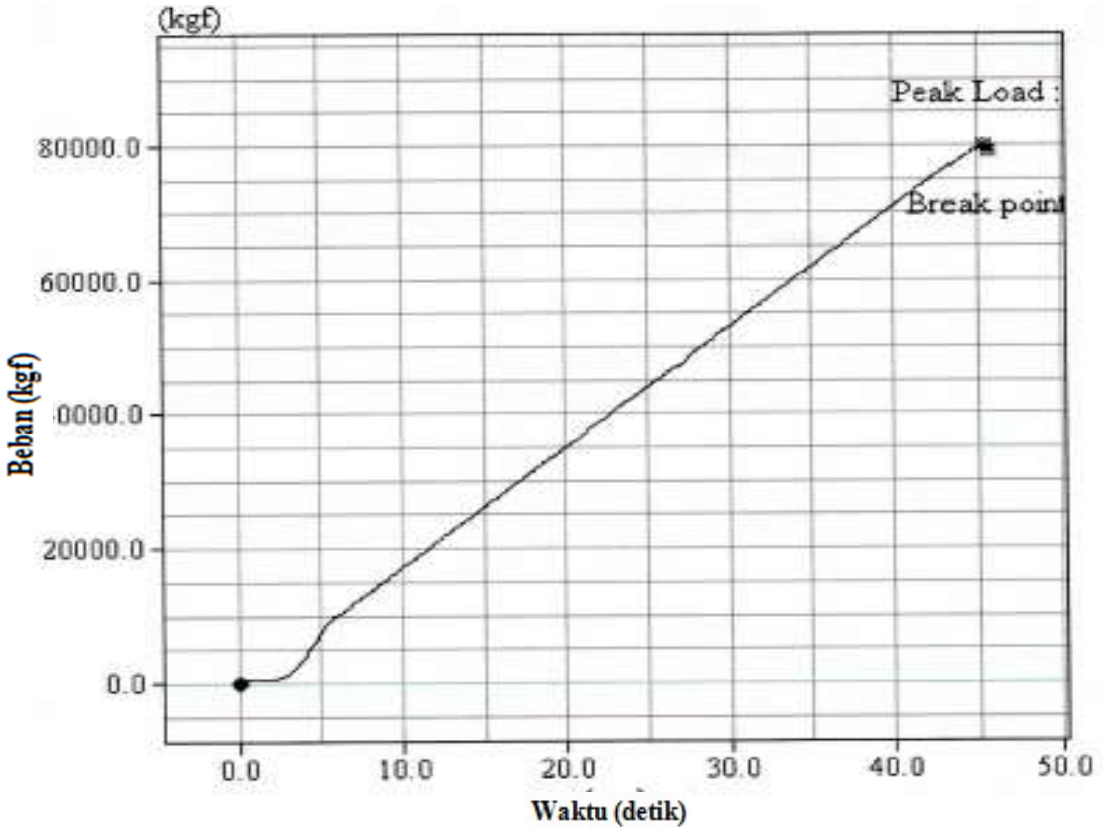
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **7/11/2018** | | | **Report No.** | | **P3. A3** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **179.08** | **79870** | **6343.4** | **446.5** | **2.0** | **300.0** | **1.0** | **28** | | |




Gambar 7 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P3. A3

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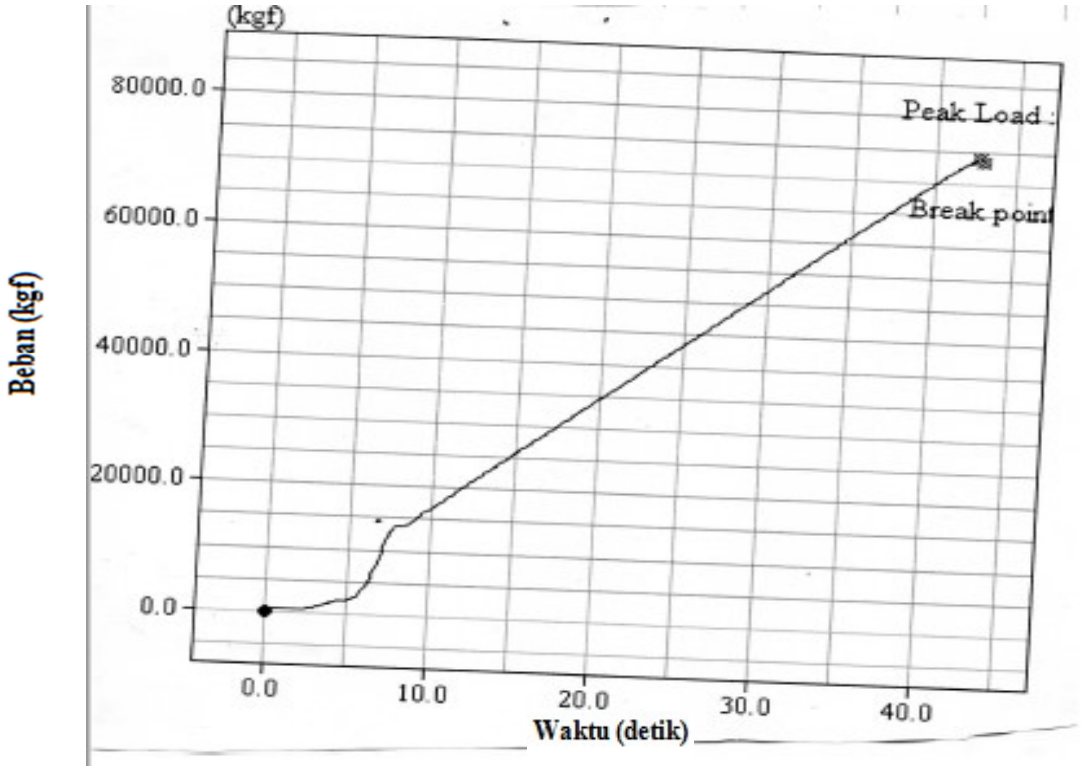
**b. Hasil pengujian variasi SP 0,8%**

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **6/4/2018** | | | **Report No.** | | **P1. B1** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **176.71** | **73740** | **5934.9** | **417.3** | **2.0** | **300.0** | **1.0** | **3** | | |




Gambar 8 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P1. B1

**UNIVERSITAS MUHAMMADIYAH YOGYAKARTA**
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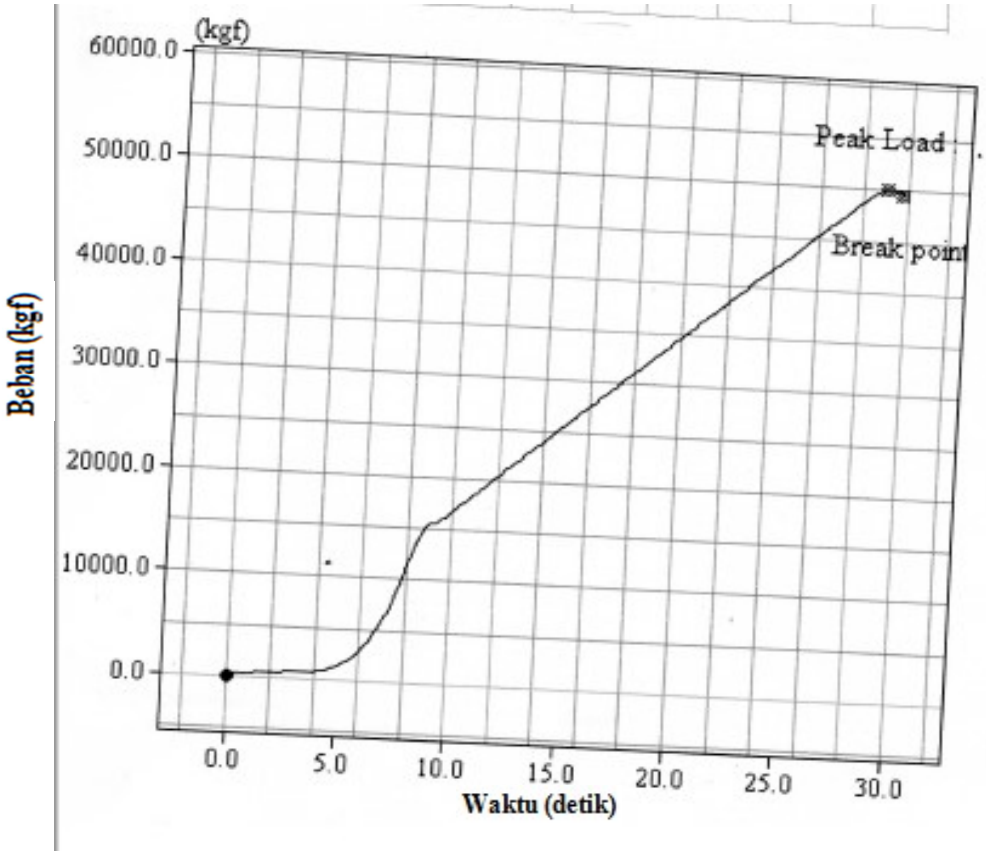
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **6/4/2018** | | | **Report No.** | | **P1. B2** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **176.71** | **50000** | **3997.5** | **281.1** | **2.0** | **300.0** | **1.0** | **3** | | |




Gambar 9 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P1. B2

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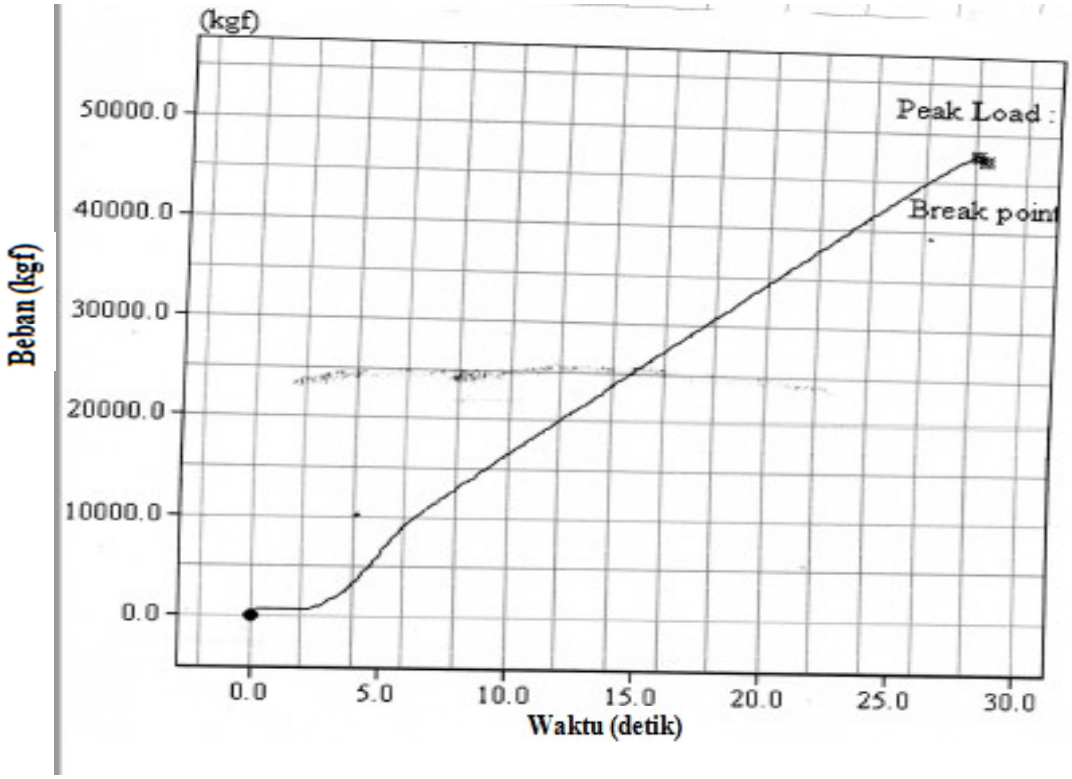
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **6/4/2018** | | | **Report No.** | | **P1. B3** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **176.71** | **47700** | **3839.1** | **269.9** | **2.0** | **300.0** | **1.0** | **3** | | |




Gambar 10 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P1. B3

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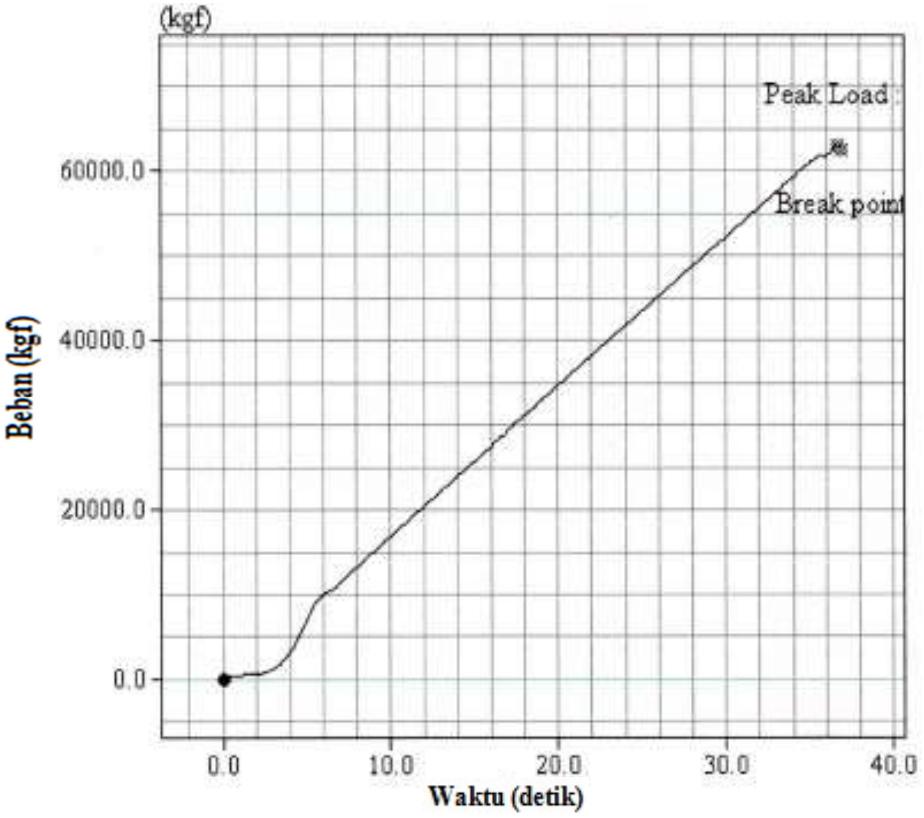
Telp, +62 – 274 – 387656 (Hunting), Fax. 0274 – 387646

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **5/30/2018** | | | **Report No.** | | **P2. B1** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **176.71** | **62900** | **5062.4** | **355.6** | **2.0** | **300.0** | **1.0** | **7** | | |




Gambar 11 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P2. B1

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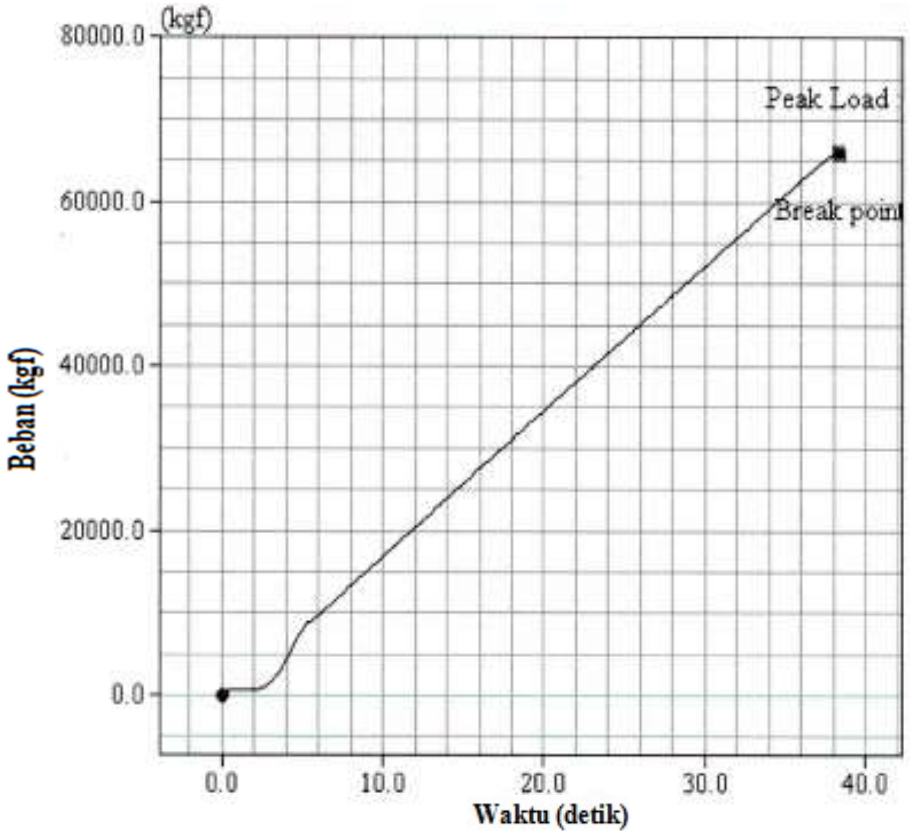
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **5/30/2018** | | | **Report No.** | | **P2. B2** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **176.71** | **66190** | **5327.2** | **373.8** | **2.0** | **300.0** | **1.0** | **7** | | |




Gambar 12 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P2. B2

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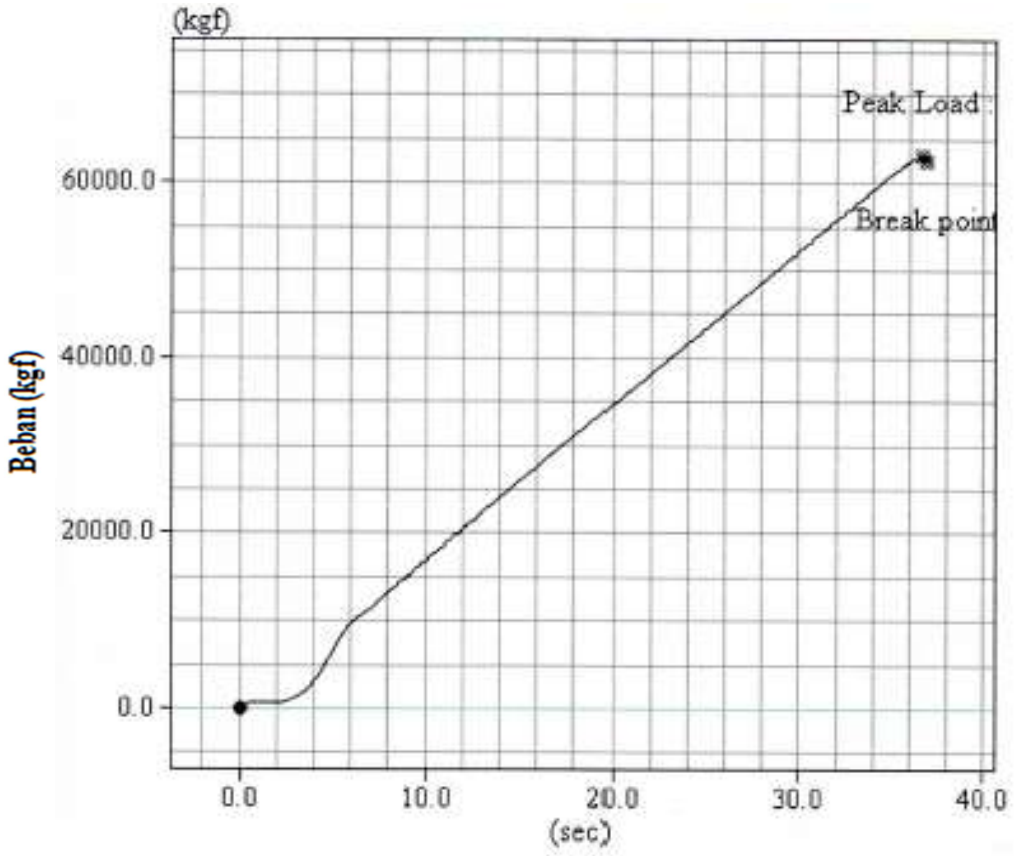
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **5/30/2018** | | | **Report No.** | | **P2. B3** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **176.71** | **63110** | **5079.3** | **356.8** | **2.0** | **300.0** | **1.0** | **7** | | |




Gambar 13 Hubungan beban (kgf) terh letik) pada benda uji beton P2. B3

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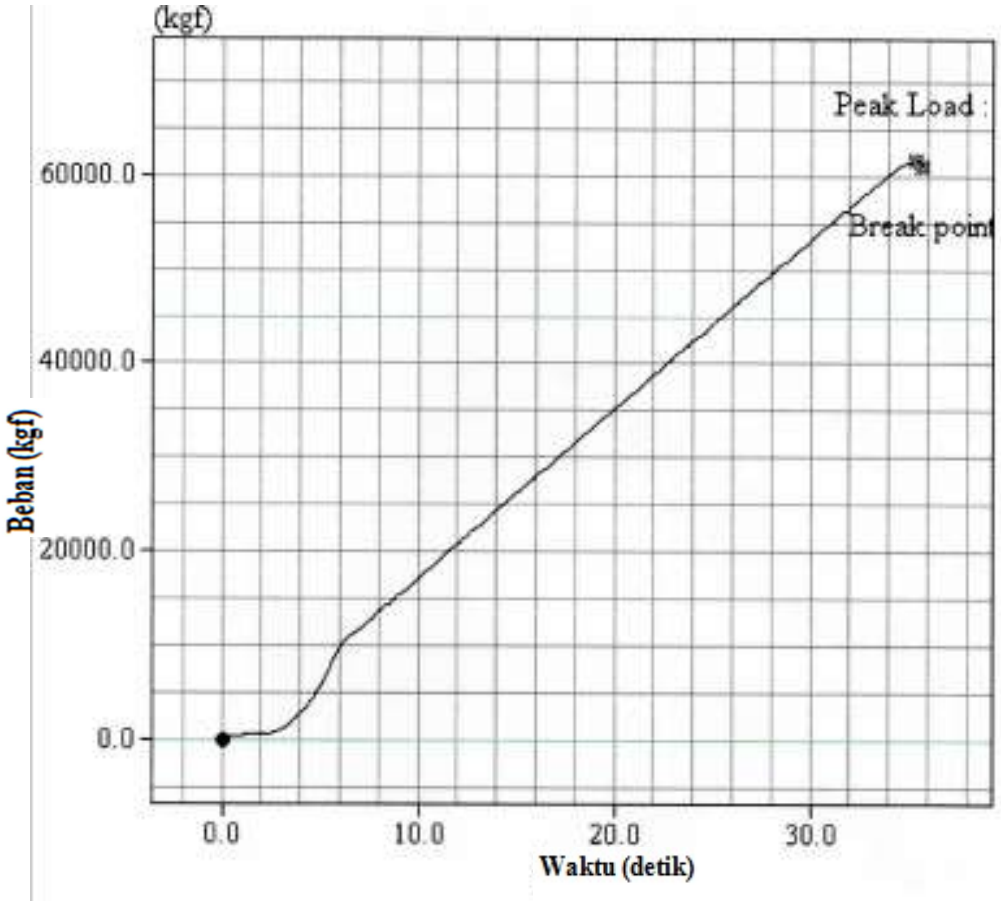
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **7/11/2018** | | | **Report No.** | | **P3. B1** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **179.55** | **61610** | **4880.2** | **343.1** | **2.0** | **300.0** | **1.0** | **28** | | |




Gambar 14 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P3. B1

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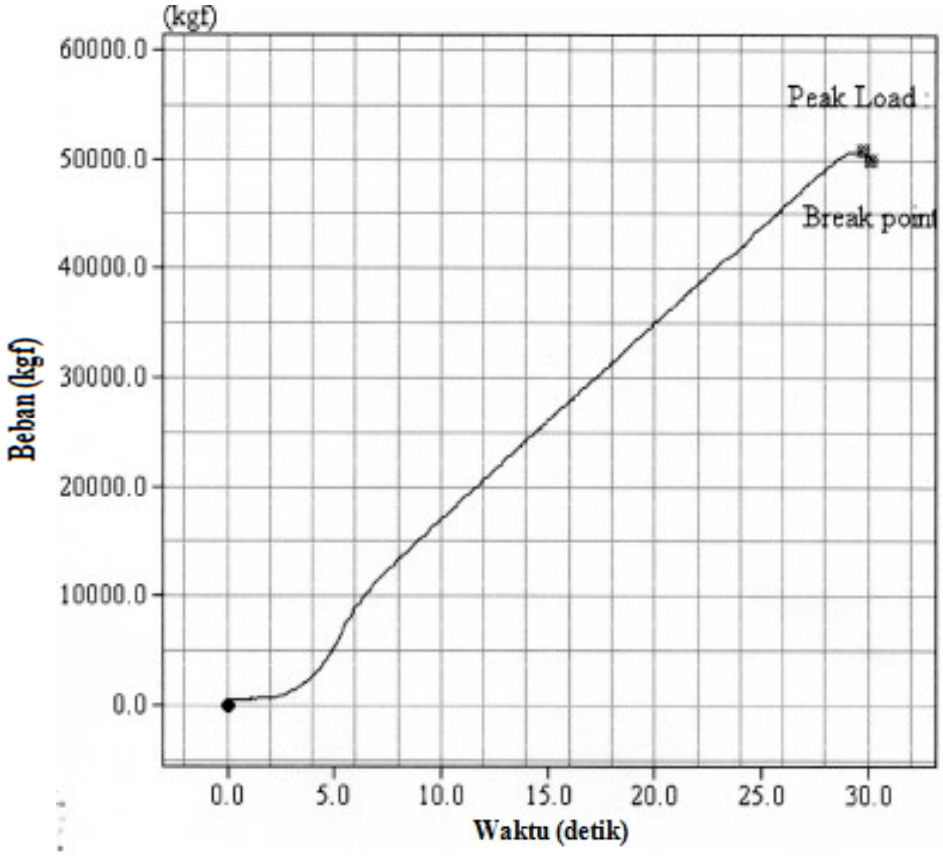
Telp, +62 – 274 – 387656 (Hunting), Fax. 0274 – 387646

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **7/11/2018** | | | **Report No.** | | **P3. B2** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **179.55** | **61610** | **4880.2** | **343.1** | **2.0** | **300.0** | **1.0** | **28** | | |




Gambar 15 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P3. B2

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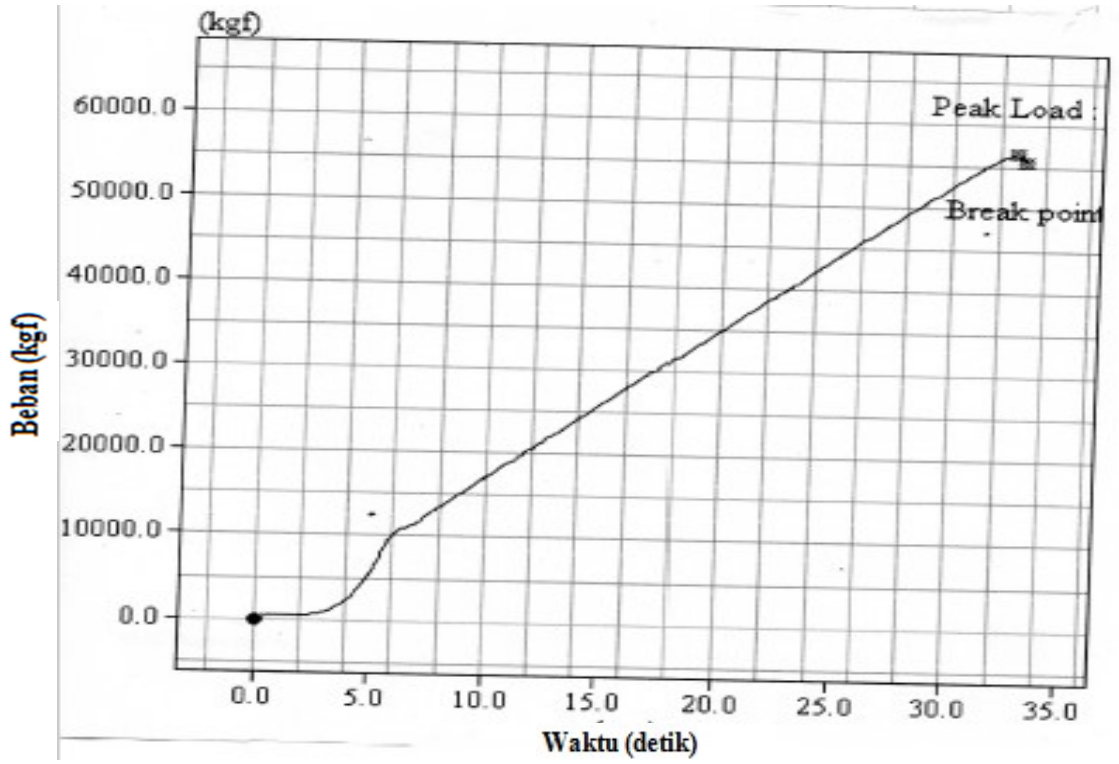
### c. Pengujian kuat tekan variasi SP 1%

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **6/4/2018** | | | **Report No.** | | **P1. C1** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **179.08** | **56520** | **4488.9** | **314.7** | **2.0** | **300.0** | **1.0** | **3** | | |




Gambar 16 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P1. C1

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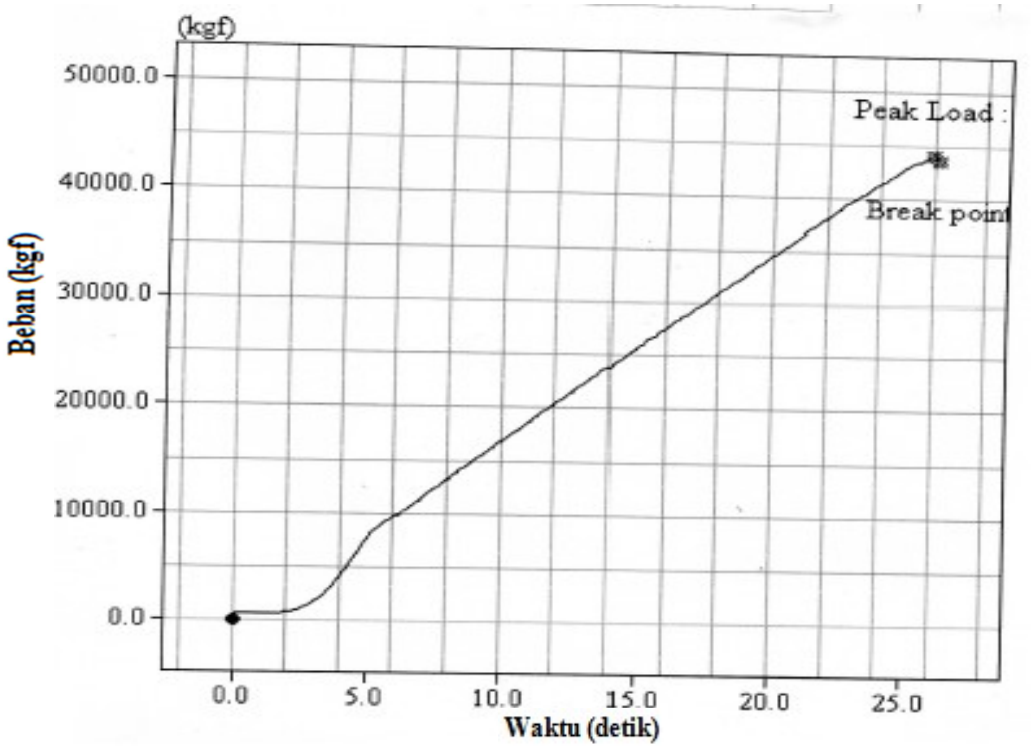
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **6/4/2018** | | | **Report No.** | | **P1. C2** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **177.89** | **43980** | **3516.2** | **247.5** | **2.0** | **300.0** | **1.0** | **3** | | |




Gambar 17 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P1. C2

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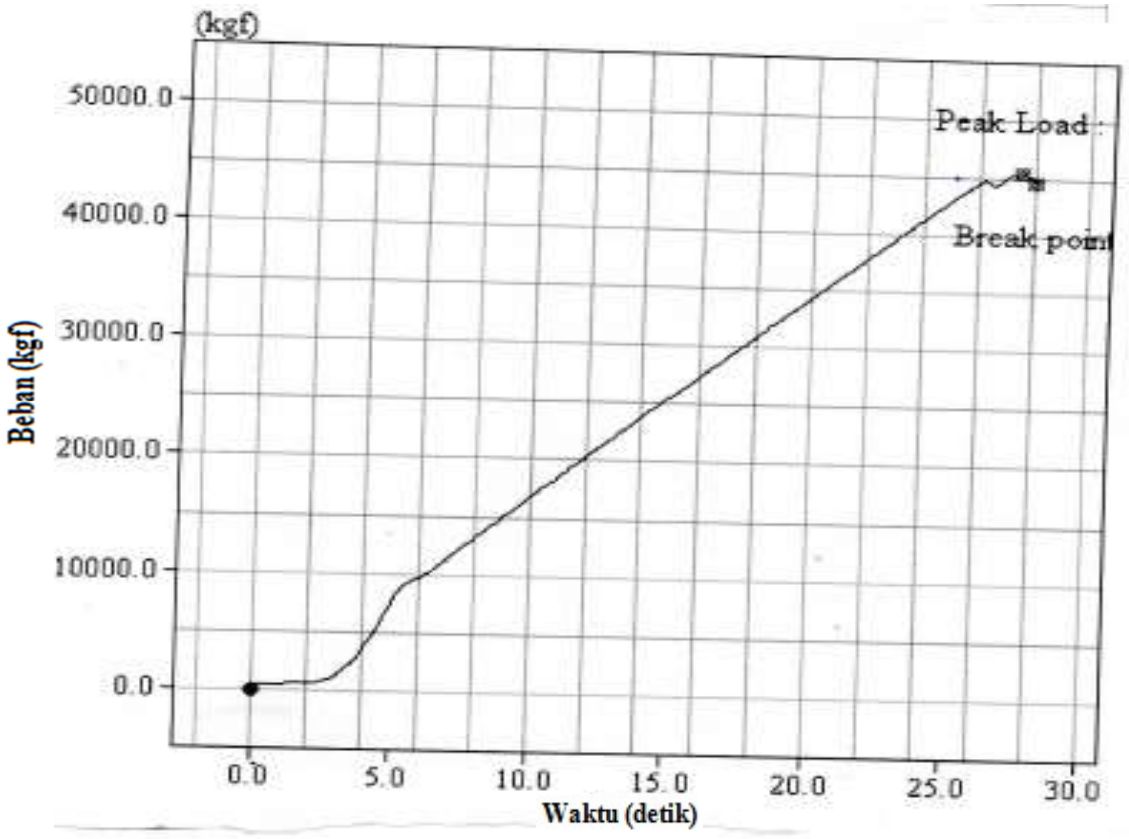
| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **6/4/2018** | | | **Report No.** | | **P1. C3** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **176.71** | **45380** | **3652.4** | **256.8** | **2.0** | **300.0** | **1.0** | **3** | | |




Gambar 18 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P1. C3

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**Laboratorium Teknologi Bahan Kontruksi**
Jalan Lingkar Selatan, Taman Tirto, Kasihan, Bantul, Daerah Istimewa Yogyakarta 55183
Telp, +62 – 274 – 387656 (Hunting), Fax. 0274 – 387646

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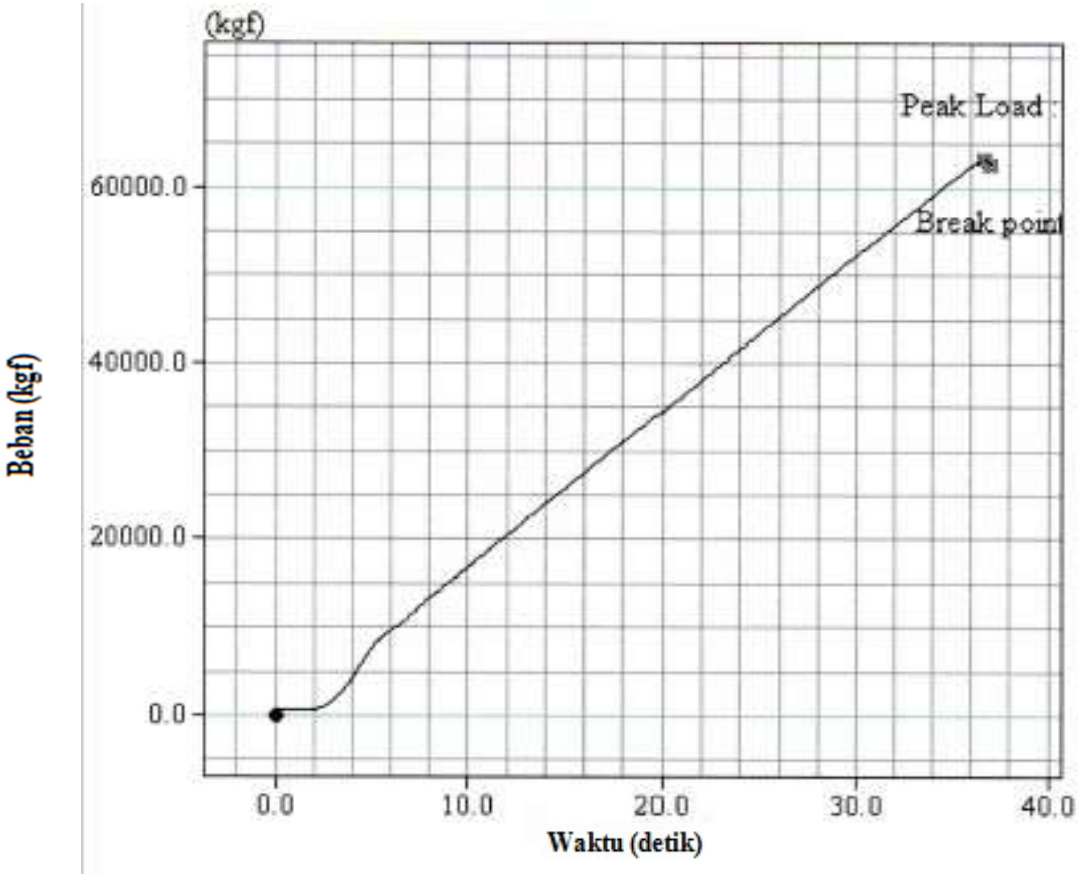
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **5/30/2018** | | | **Report No.** | | **P2. C1** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **176.71** | **63190** | **5085.8** | **356.9** | **2.0** | **300.0** | **1.0** | **7** | | |




Gambar 19 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P2. C1

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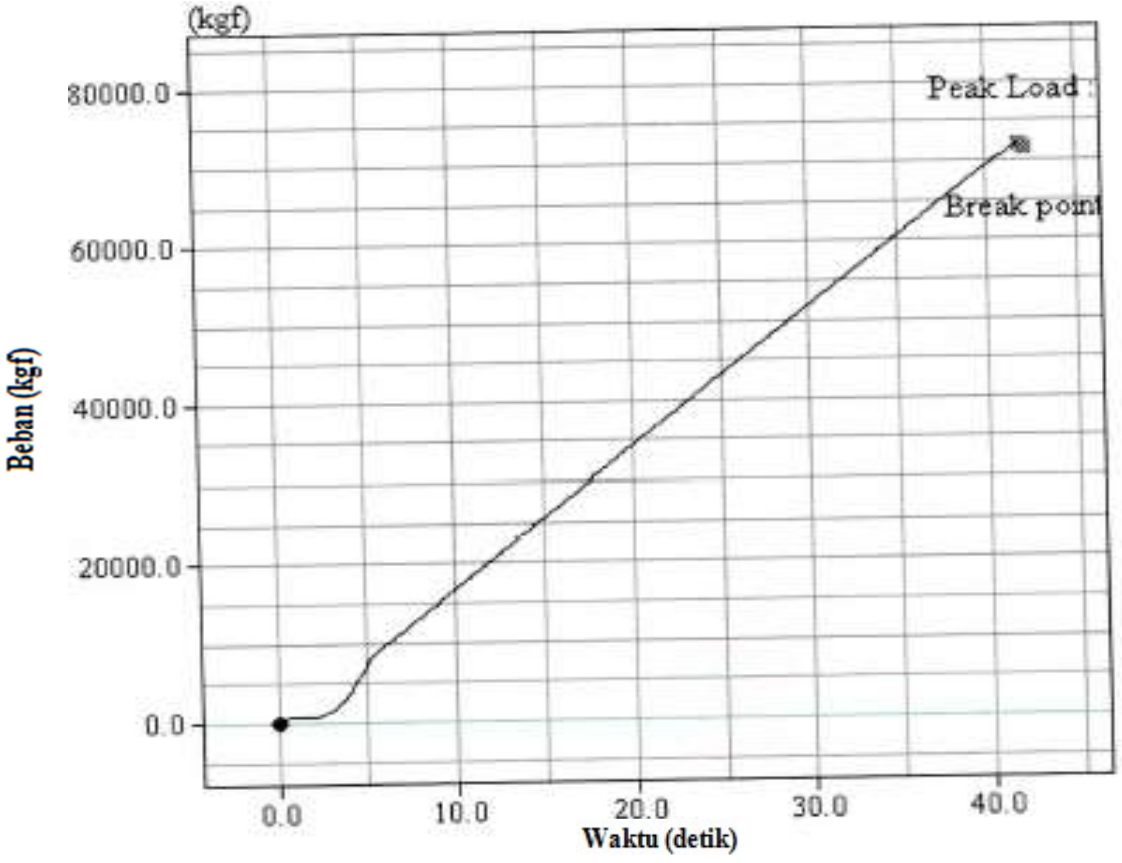
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **5/30/2018** | | | **Report No.** | | **P2. C2** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **175.54** | **71970** | **5831.2** | **410.4** | **2.0** | **300.0** | **1.0** | **7** | | |




Gambar 20 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P2. C2

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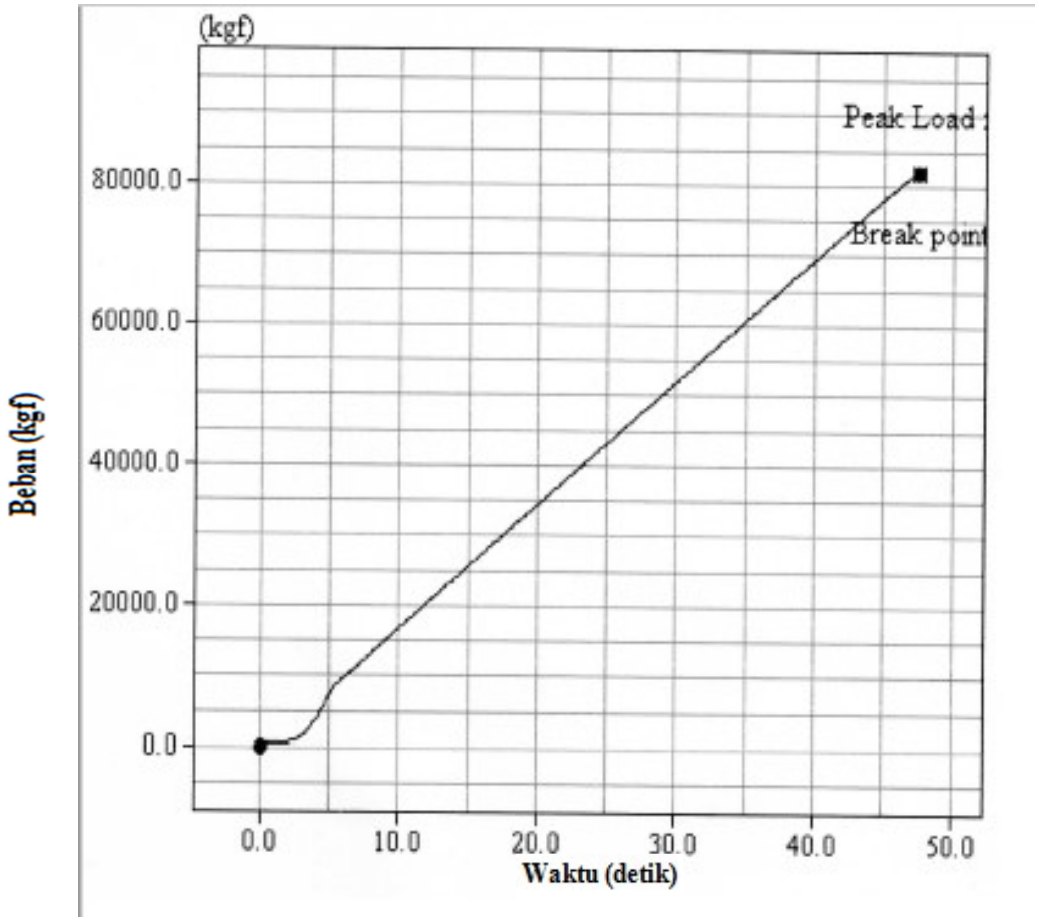
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **5/30/2018** | | | **Report No.** | | **P2. C3** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **175.54** | **81870** | **6633.4** | **465.9** | **2.0** | **300.0** | **1.0** | **7** | | |




Gambar 21 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P2. C3

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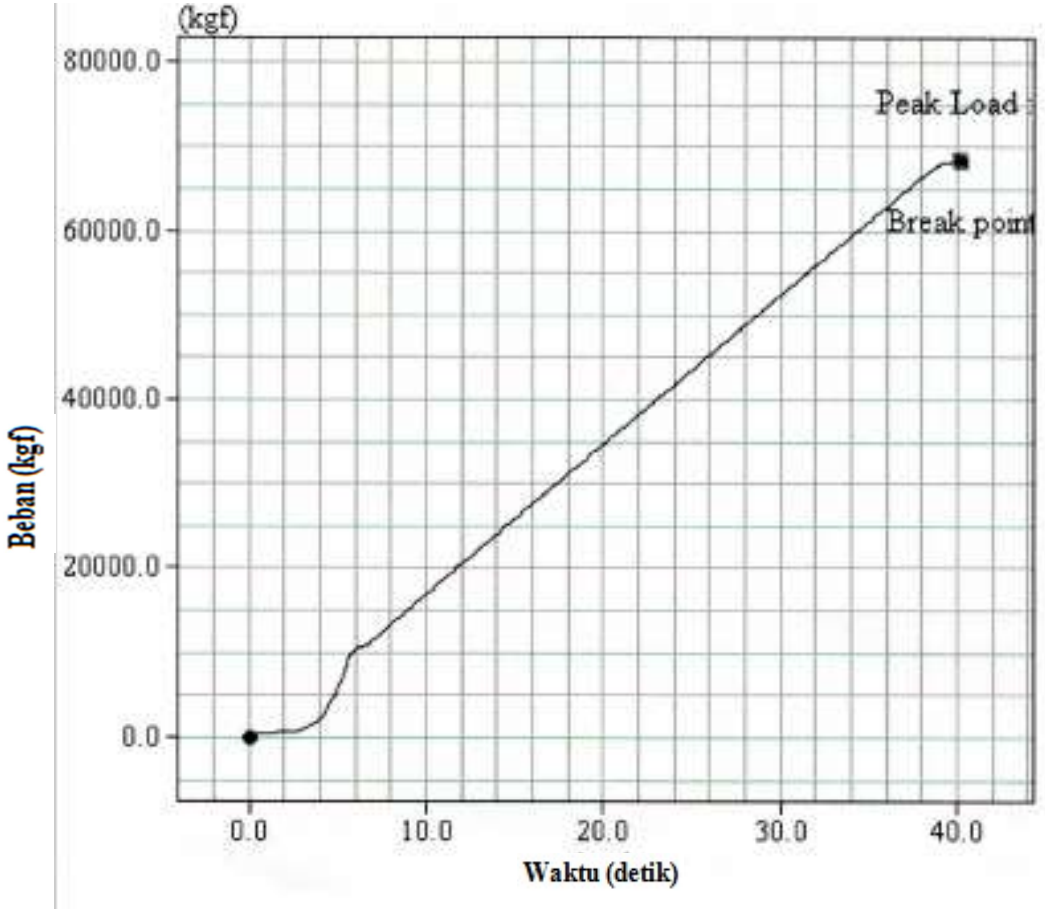
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **7/11/2018** | | | **Report No.** | | **P3. C1** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **176.71** | **68540** | **5516.4** | **387.9** | **2.0** | **300.0** | **1.0** | **28** | | |




Gambar 22 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P3. C1

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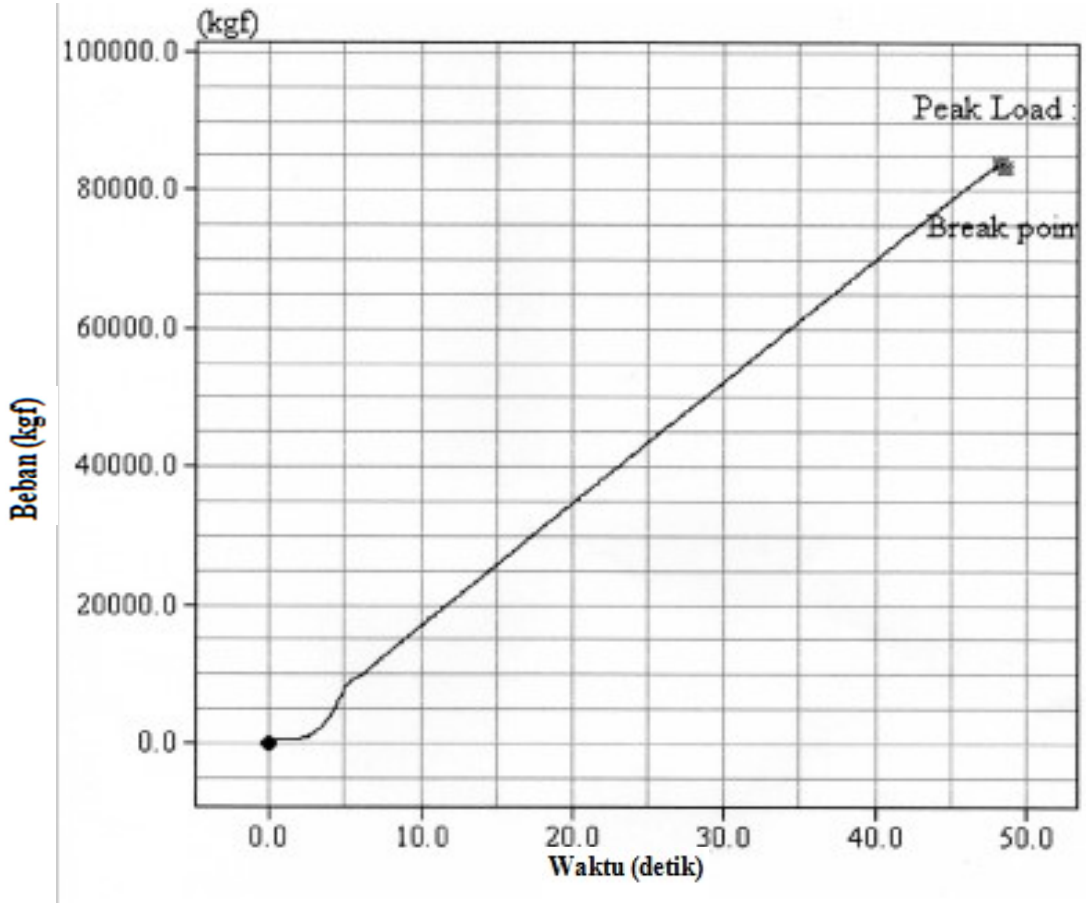
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **7/11/2018** | | | **Report No.** | | **P3. C2** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **176.71** | **83850** | **6748.6** | **473.5** | **2.0** | **300.0** | **1.0** | **28** | | |




Gambar 23 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P3. C2

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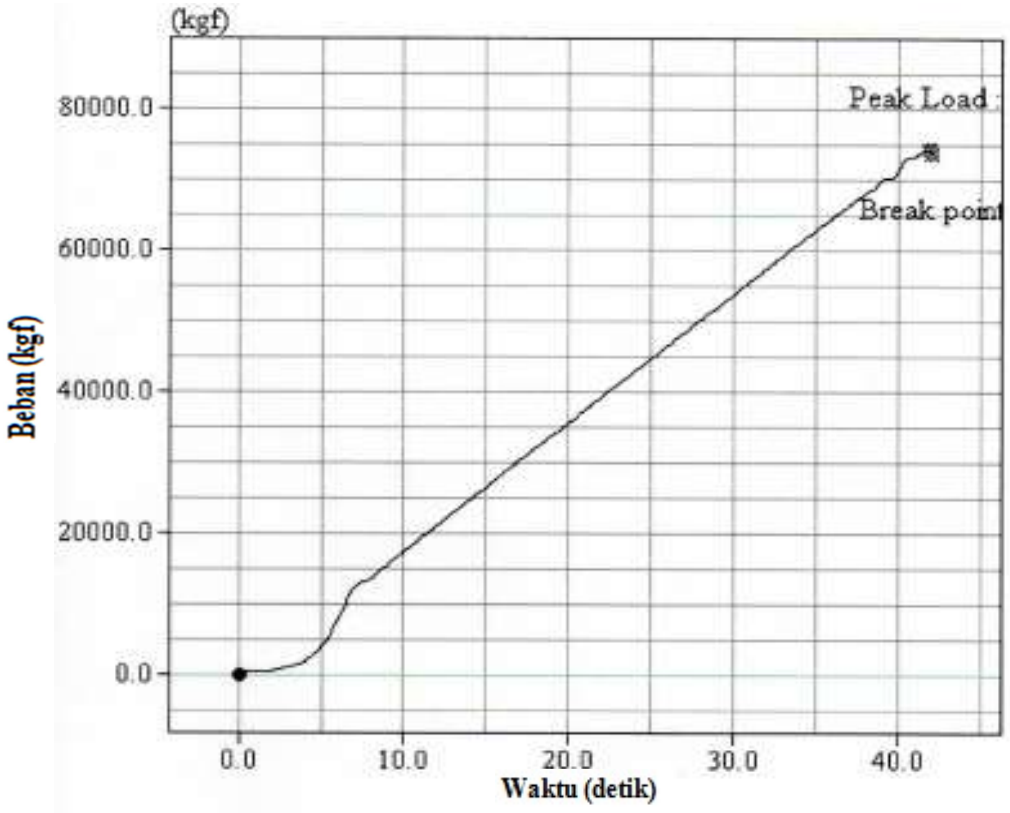
|---|---|---|---|---|---|---|---|---|---|---|
| **Construstion Name** | | | | **Silinder Beton** | | | | | | |
| **Manufacturer** | | | | **Hungta** | | | | | | |
| **Contractor** | | | | **UMY** | | | | | | |
| **Costumer** | | | | **Lab. JTS. FT. UMY** | | | | | | |
| **Test Date** | | | | **7/11/2018** | | | **Report No.** | | **P3. C3** | |
| **No** | **Area (cm^2)** | **Peak Force (kg)** | **Compression Stress (psi)** | **Adjust Stress (kgf/cm^2)** | **H/D ratio** | **Design Stress** | **Adjust Ratio** | **Life** | **Break Style** | **Remark** |
| **1** | **181.70** | **74370** | **5821.5** | **408.5** | **2.0** | **300.0** | **1.0** | **28** | | |




Gambar 24 Hubungan beban (kgf) terhadap waktu (detik) pada benda uji beton P3. C3