

LAMPIRAN

Lampiran 1 Data hasil pengujian berat jenis tanah

a. *Clayshale*

Tabel 1 Kalibrasi Piknometer

| No | Uraian | Satuan | 1 | 2 | 3 |
|----|---------------------------------------|--------|-------|-------|-------|
| 1 | Berat piknometer (W_p) | g | 30.86 | 30.81 | 28.32 |
| 2 | Berat piknometer + air ($W_{pw,c}$) | g | 81.37 | 81.53 | 78.86 |
| 3 | Temperatur dalam piknomete (T) | C | 28.7 | 28.3 | 28.3 |
| 4 | Berat volume air ($\gamma_{w,c}$) | | 0.996 | 0.996 | 0.996 |
| 5 | Volume piknometer (V_p) | mL | 50.71 | 50.92 | 50.74 |

Tabel 2 Perhitungan Berat Jenis

| No | Uraian | Satuan | A1 | E5 | B2 |
|----|---|--------|--------|--------|--------|
| 1 | Berat piknometer (W_p) | g | 30.86 | 30.81 | 28.32 |
| 2 | Berat piknometer + tanah (W_{ps}) | g | 50.86 | 50.81 | 48.32 |
| 3 | Berat piknometer + tanah + air ($W_{pws,t}$) | g | 93.74 | 93.96 | 91.37 |
| 4 | Berat piknometer + air ($W_{pw,t}$) | g | 81.365 | 81.524 | 78.845 |
| 5 | Temperatur dalam piknometer (T) | C | 29 | 28.7 | 29.3 |
| 6 | Berat jenis $G_{s,t}$ | | 2.62 | 2.64 | 2.68 |
| 7 | Koefisien temperatur (K) | | 0,9974 | 0,9978 | 0,9976 |
| 8 | Berat jenis pada $T = 20^\circ\text{C}$, G_s | | 2.62 | 2.64 | 2.67 |
| 9 | Berat jenis rata-rata G_s | | | 2.65 | |

b. *Siltstone*

Tabel 3 Kalibrasi Piknometer

| No | Uraian | Satuan | 1 | 2 |
|----|---------------------------------------|--------|-------|-------|
| 1 | Berat piknometer (W_p) | g | 23.08 | 24.95 |
| 2 | Berat piknometer + air ($W_{pw,c}$) | g | 73.41 | 75.55 |
| 3 | Temperatur dalam piknomete (T) | C | 29.1 | 29.1 |
| 4 | Berat volume air ($\gamma_{w,c}$) | | 1 | 1 |
| 5 | Volume piknometer (V_p) | mL | 50.54 | 50.81 |

Tabel 4 Perhitungan Berat Jenis

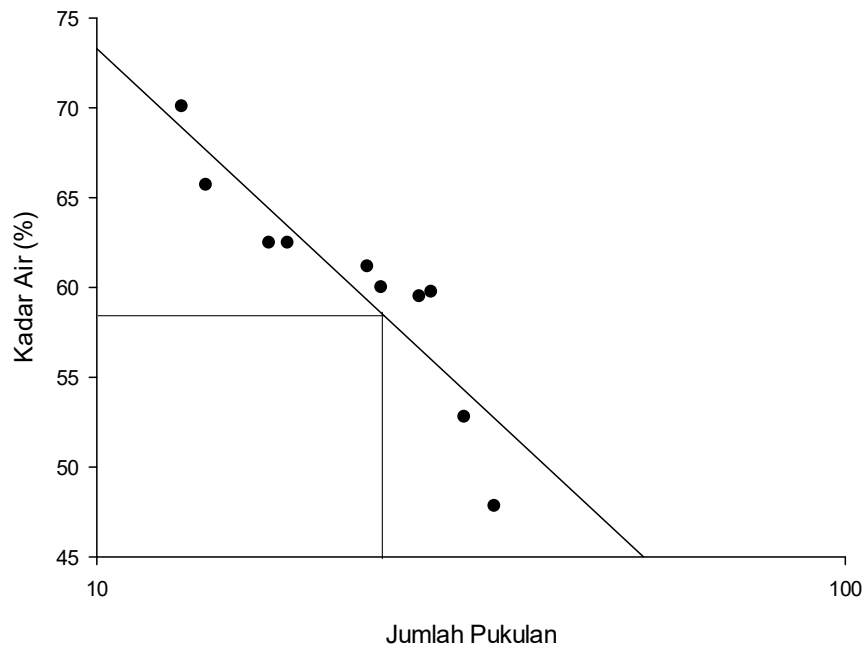
| No | Uraian | Satuan | A1 | E5 |
|----|---|--------|--------|--------|
| 1 | Berat piknometer (W_p) | g | 23.08 | 24.95 |
| 2 | Berat piknometer + tanah (W_{ps}) | g | 33.09 | 34.96 |
| 3 | Berat piknometer + tanah + air ($W_{pws,t}$) | g | 79.57 | 81.67 |
| 4 | Berat piknometer + air ($W_{pw,t}$) | g | 73.41 | 75.54 |
| 5 | Temperatur dalam piknometer (T) | C | 29.4 | 29.5 |
| 6 | Berat jenis $G_{s,t}$ | | 2.6 | 2.58 |
| 7 | Koefisien temperatur (K) | | 0.9978 | 0.9978 |
| 8 | Berat jenis pada $T = 20^\circ\text{C}$, G_s | | 2.6 | 2.57 |
| 9 | Berat jenis rata-rata G_s | | | 2.58 |

Lampiran 2 Data hasil pengujian batas-batas *Atterberg*a. *Clayshale*

1) Kadar semen 0%

Tabel 5 Pengujian Batas Cair

| No | Uraian | Satuan | 1 | 2 | 3 | 4 | 5 | | | | | |
|----|---------------------------------------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 | Jumlah pukulan | | 34 | 31 | 28 | 27 | 24 | 23 | 17 | 18 | 14 | 13 |
| 2 | Nomor cawan | | I7 | N9 | J2 | D4 | C7 | S6 | D1 | J9 | A5 | K2 |
| 3 | Berat cawan (W_1) | g | 9.14 | 9.32 | 10.41 | 9.34 | 9.13 | 9.77 | 9.24 | 9.77 | 9.26 | 9.38 |
| 4 | Berat cawan + tanah basah (W_2) | g | 29.14 | 29.32 | 30.41 | 29.34 | 29.13 | 29.77 | 29.24 | 29.77 | 29.26 | 29.38 |
| 5 | Berat cawan + tanah kering (W_3) | g | 22.67 | 22.41 | 22.93 | 21.88 | 21.63 | 22.18 | 21.55 | 22.08 | 21.33 | 21.14 |
| 6 | Berat air, $W_w = W_2 - W_3$ | g | 6.47 | 6.91 | 7.48 | 7.46 | 7.5 | 7.59 | 7.69 | 7.69 | 7.93 | 8.24 |
| 7 | Berat tanah kering, $W_s = W_3 - W_1$ | g | 13.53 | 13.09 | 12.52 | 12.54 | 12.5 | 12.41 | 12.31 | 12.31 | 12.07 | 11.76 |
| 8 | Kadar air, $W = (W_w/W_s)$ | % | 47.82 | 52.79 | 59.74 | 59.49 | 60.00 | 61.16 | 62.47 | 62.47 | 65.70 | 70.07 |
| 9 | Rata-rata kadar air, W | % | 50.30 | | 59.62 | | 60.58 | | 62.47 | | 67.88 | |
| 10 | Batas cair | % | | | | | | | 57.9 | | | |
| 11 | <i>Flow Index</i> | | | | | | | | 0.387 | | | |



Gambar 1 Hubungan Jumlah Pukulan dan Kadar Air

Tabel 6 Pengujian Batas Plastis

| No | Uraian | Satuan | D2 | J7 | X8 |
|----|---|--------|-------|-------|-------|
| 1 | Berat cawan (W_1) | g | 13.34 | 12.96 | 12.06 |
| 2 | Berat cawan+tanah basah (W_2) | g | 28.34 | 27.96 | 27.06 |
| 3 | Berat cawan+tanah kering (W_3) | g | 24.85 | 24.83 | 23.74 |
| 4 | Berat air, $W_w = W_2 - W_3$ | g | 3.49 | 3.13 | 3.32 |
| 5 | Berat tanah, $W_s = W_3 - W_1$ | g | 11.51 | 11.87 | 11.68 |
| 6 | Kadar air, $W = (W_w/W_s) \times 100\%$ | % | 30.3 | 26.4 | 28.4 |
| 7 | Kadar air rata - rata | % | | 28.4 | |

Batas cair (LL) = 57.9%

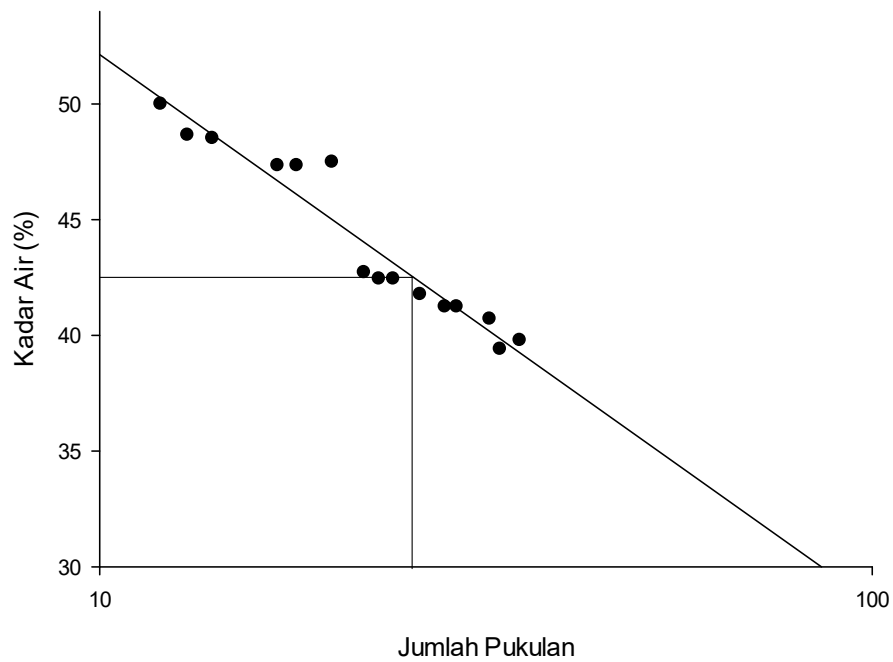
Batas plastis (PL) = 28.4%

Indeks plastisitas (PI) = 29.5%

2) Kadar semen 10%

Tabel 7 Pengujian Batas Cair

| No | Uraian | satuan | 1 | | | | | | | 2 | | | | | | | | |
|----|---------------------------------------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|
| 1 | Jumlah pukulan | | 35 | 33 | 32 | 28 | 29 | 26 | 23 | 24 | 22 | 20 | 18 | 17 | 14 | 13 | 12 | |
| 2 | Nomor cawan | | P10 | J2 | R9 | I4 | G3 | A8 | V2 | A5 | F7 | U1 | X10 | G10 | J9 | Y10 | U10 | |
| 3 | Berat cawan (W_1) | g | 8.57 | 9.24 | 9.51 | 10.29 | 9.31 | 9.27 | 9.03 | 8.79 | 9.25 | 9.41 | 9.24 | 8.59 | 9.33 | 9.98 | 9.26 | |
| 4 | Berat cawan + tanah basah (W_2) | g | 23.57 | 24.24 | 24.51 | 25.29 | 24.31 | 24.27 | 24.03 | 23.79 | 24.25 | 24.41 | 24.24 | 23.59 | 24.33 | 24.98 | 24.26 | |
| 5 | Berat cawan + tanah kering (W_3) | g | 19.3 | 20 | 20.17 | 20.91 | 19.93 | 19.85 | 19.56 | 19.32 | 19.76 | 19.58 | 19.42 | 18.77 | 19.43 | 20.07 | 19.26 | |
| 6 | Berat air, $W_w = W_2 - W_3$ | g | 4.27 | 4.24 | 4.34 | 4.38 | 4.38 | 4.42 | 4.47 | 4.47 | 4.49 | 4.83 | 4.82 | 4.82 | 4.9 | 4.91 | 5 | |
| 7 | Berat tanah kering, $W_s = W_3 - W_1$ | g | 10.73 | 10.76 | 10.66 | 10.62 | 10.62 | 10.58 | 10.53 | 10.53 | 10.51 | 10.17 | 10.18 | 10.18 | 10.1 | 10.09 | 10 | |
| 8 | Kadar air, $W = (W_w/W_s)$ | % | 39.79 | 39.41 | 40.71 | 41.24 | 41.24 | 41.78 | 42.45 | 42.45 | 42.72 | 47.49 | 47.35 | 47.35 | 48.51 | 48.66 | 50.00 | |
| 9 | Rata-rata kadar air, W | % | 39.97 | | | 41.42 | | | 42.54 | | | 47.4 | | | 49.06 | | | |
| | Batas cair | % | 42.7 | | | | | | | | | | | | | | | |
| | <i>Flow Index</i> | | 0.237 | | | | | | | | | | | | | | | |



Gambar 2 Hubungan Jumlah Pukulan dan Kadar Air

Tabel 8 Pengujian Batas Plastis

| No | Uraian | Satuan | D2 | J7 | X8 |
|----|---|--------|-------|-------|-------|
| 1 | Berat cawan (W_1) | g | 8.81 | 9.98 | 9.45 |
| 2 | Berat cawan+tanah basah (W_2) | g | 23.81 | 24.98 | 24.45 |
| 3 | Berat cawan+tanah kering (W_3) | g | 19.68 | 20.39 | 20.9 |
| 4 | Berat air, $W_w = W_2 - W_3$ | g | 4.13 | 4.59 | 3.55 |
| 5 | Berat tanah, $W_s = W_3 - W_1$ | g | 10.87 | 10.41 | 11.45 |
| 6 | Kadar air, $W = (W_w/W_s) \times 100\%$ | % | 38.0 | 44.1 | 31.0 |
| 7 | Kadar air rata - rata | % | | 37.7 | |

Batas cair (LL) = 42.7%

Batas plastis (PL) = 37.7%

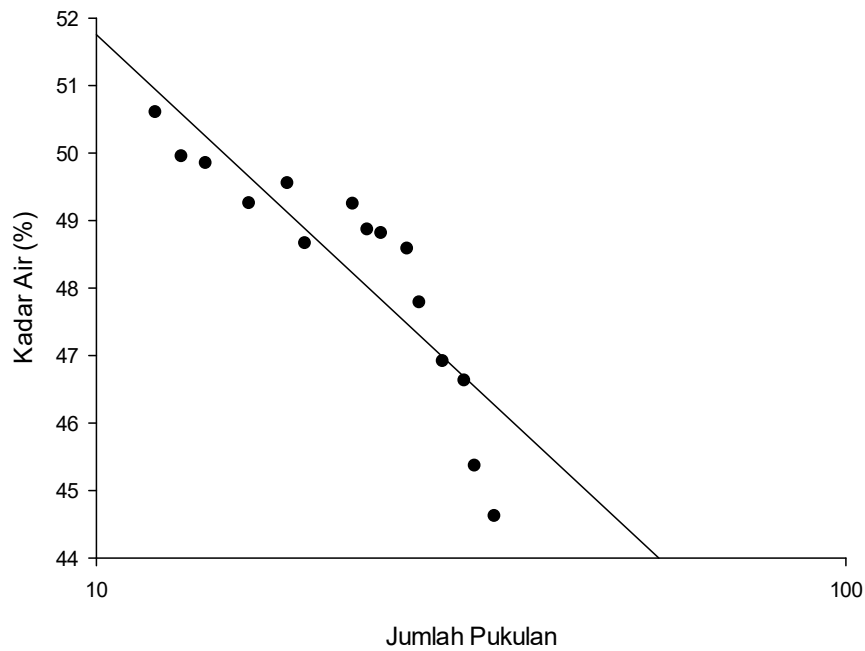
Indeks plastisitas (PI) = 5,0%

b. *Siltstone*

1) Kadar semen 0%

Tabel 9 Pengujian Batas Cair

| No | Uraian | satuan | 1 | | | | | | | 2 | | | | | | | | | | | | |
|----|---------------------------------------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|-------|--|--|--|
| | | | 14 | 12 | 13 | 18 | 19 | 16 | 24 | 23 | 22 | 26 | 29 | 27 | 34 | 32 | 31 | | | | | |
| 1 | Jumlah pukulan | | 14 | 12 | 13 | 18 | 19 | 16 | 24 | 23 | 22 | 26 | 29 | 27 | 34 | 32 | 31 | | | | | |
| 2 | Nomor cawan | | S5 | Y4 | E9 | P4 | K8 | X9 | Q1 | PR21 | P3 | Z1 | W8 | C1 | K4 | H5 | L1 | | | | | |
| 3 | Berat cawan (W_1) | g | 9.83 | 9.36 | 9.21 | 9.63 | 9.36 | 13.01 | 8.64 | 9.42 | 10.02 | 9.94 | 9.07 | 10.68 | 9.81 | 9.8 | 9.57 | | | | | |
| 4 | Berat cawan + tanah basah (W_2) | g | 24.83 | 24.36 | 23.5 | 24.63 | 24.36 | 28.01 | 23.64 | 21.88 | 23.87 | 23.03 | 24.07 | 25.68 | 24.72 | 21.56 | 24.57 | | | | | |
| 5 | Berat cawan + tanah kering (W_3) | g | 19.84 | 19.32 | 18.74 | 19.66 | 19.45 | 23.06 | 18.72 | 17.79 | 19.3 | 18.75 | 19.28 | 20.83 | 20.12 | 17.89 | 19.8 | | | | | |
| 6 | Berat air, $W_w = W_2 - W_3$ | g | 4.99 | 5.04 | 4.76 | 4.97 | 4.91 | 4.95 | 4.92 | 4.09 | 4.57 | 4.28 | 4.79 | 4.85 | 4.6 | 3.67 | 4.77 | | | | | |
| 7 | Berat tanah kering, $W_s = W_3 - W_1$ | g | 10.01 | 9.96 | 9.53 | 10.03 | 10.09 | 10.05 | 10.08 | 8.37 | 9.28 | 8.81 | 10.21 | 10.15 | 10.31 | 8.09 | 10.23 | | | | | |
| 8 | Kadar air, $W = (W_w/W_s)$ | % | 49.85 | 50.60 | 49.95 | 49.55 | 48.66 | 49.25 | 48.81 | 48.86 | 49.25 | 48.58 | 46.91 | 47.78 | 44.62 | 45.36 | 46.63 | | | | | |
| 9 | Rata-rata kadar air, W | % | 50.13 | | | | 49.16 | | | | 48.97 | | | | 47.67 | | | | 45.54 | | | |
| | Batas cair | % | 47.6 | | | | | | | | | | | | | | | | | | | |
| | <i>Flow Index</i> | | 0.103 | | | | | | | | | | | | | | | | | | | |



Gambar 3 Hubungan Jumlah Pukulan dan Kadar Air

Tabel 10 Pengujian Batas Plastis

| No | Uraian | Satuan | | | |
|----|---|--------|-------|-------|-------|
| 1 | Berat cawan (W_1) | g | 8.91 | 9.36 | 9.93 |
| 2 | Berat cawan+tanah basah (W_2) | g | 23.91 | 24.36 | 24.93 |
| 3 | Berat cawan+tanah kering (W_3) | g | 20.4 | 20.84 | 21.4 |
| 4 | Berat air, $W_w = W_2 - W_3$ | g | 3.51 | 3.52 | 3.53 |
| 5 | Berat tanah, $W_s = W_3 - W_1$ | g | 11.49 | 11.48 | 11.47 |
| 6 | Kadar air, $W = (W_w/W_s) \times 100\%$ | % | 30.5 | 30.7 | 30.8 |
| 7 | Kadar air rata - rata | % | | 30.7 | |

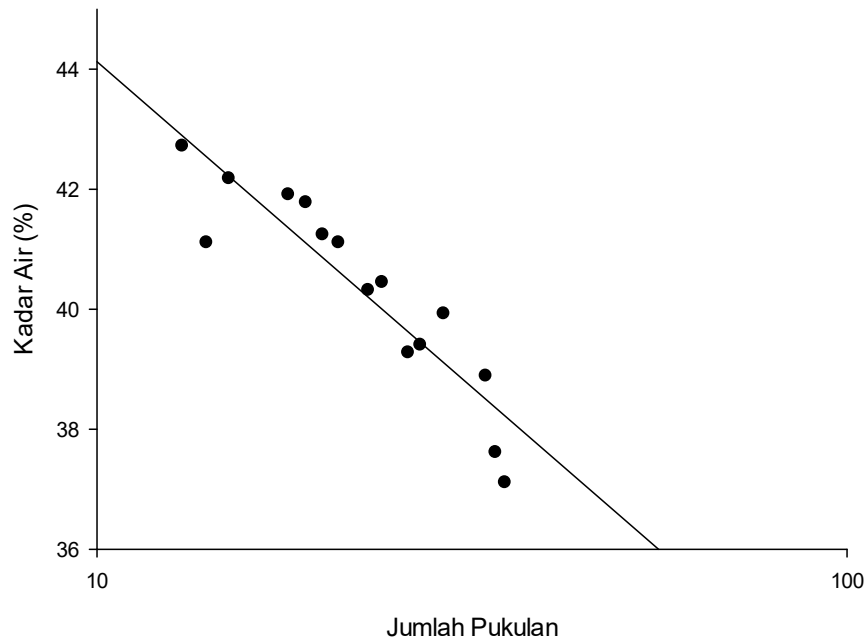
Batas cair (LL) = 47.6%

Batas plastis (PL) = 30.7%

Indeks plastisitas (PI) = 16.9%

2) Kadar semen 10%

| No | Uraian | satuan | 1 | | | | | | | 2 | | | | | | | |
|----|---------------------------------------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| | | | 35 | 34 | 33 | 29 | 27 | 26 | 21 | 23 | 24 | 19 | 20 | 18 | 15 | 13 | 14 |
| 1 | Jumlah pukulan | | G10 | T1 | L3 | Y9 | N2 | L4 | Y4 | V3 | L1 | U3 | N7 | P3 | Z8 | R2 | X7 |
| 3 | Berat cawan (W_1) | g | 8.6 | 9.65 | 9.45 | 9.18 | 9.28 | 9.24 | 9.35 | 9.6 | 12.39 | 9.19 | 9.4 | 9.99 | 8.99 | 9.31 | 8.88 |
| 4 | Berat cawan + tanah basah (W_2) | g | 23.6 | 24.65 | 24.45 | 24.18 | 24.28 | 24.24 | 24.35 | 24.6 | 27.39 | 24.19 | 24.4 | 24.99 | 23.99 | 24.31 | 23.88 |
| 5 | Berat cawan + tanah kering (W_3) | g | 19.54 | 20.55 | 20.25 | 19.9 | 20.04 | 20.01 | 19.98 | 20.29 | 23.07 | 19.77 | 20.02 | 20.56 | 19.54 | 19.82 | 19.51 |
| 6 | Berat air, $W_w = W_2 - W_3$ | g | 4.06 | 4.1 | 4.2 | 4.28 | 4.24 | 4.23 | 4.37 | 4.31 | 4.32 | 4.42 | 4.38 | 4.43 | 4.45 | 4.49 | 4.37 |
| 7 | Berat tanah kering, $W_s = W_3 - W_1$ | g | 10.94 | 10.9 | 10.8 | 10.72 | 10.76 | 10.77 | 10.63 | 10.69 | 10.68 | 10.58 | 10.62 | 10.57 | 10.55 | 10.51 | 10.63 |
| 8 | Kadar air, $W = (W_w/W_s)$ | % | 37.11 | 37.61 | 38.89 | 39.93 | 39.41 | 39.28 | 41.11 | 40.32 | 40.45 | 41.78 | 41.24 | 41.91 | 42.18 | 42.72 | 41.11 |
| 9 | Rata-rata kadar air, W | % | 37.87 | | | 39.54 | | | 40.63 | | | 41.64 | | | 42.00 | | |
| | Batas cair | % | 39.8 | | | | | | | | | | | | | | |
| | <i>Flow Index</i> | | 0.108 | | | | | | | | | | | | | | |



Gambar 4 Hubungan Jumlah Pukulan dan Kadar Air

Tabel 11 Pengujian Batas Plastis

| No | Uraian | Satuan | | | |
|----|---|--------|-------|-------|-------|
| 1 | Berat cawan (W_1) | g | 9.2 | 9.84 | 10.58 |
| 2 | Berat cawan+tanah basah (W_2) | g | 24.2 | 24.84 | 25.58 |
| 3 | Berat cawan+tanah kering (W_3) | g | 20.28 | 20.91 | 21.62 |
| 4 | Berat air, $W_w = W_2 - W_3$ | g | 3.92 | 3.93 | 3.96 |
| 5 | Berat tanah, $W_s = W_3 - W_1$ | g | 11.08 | 11.07 | 11.04 |
| 6 | Kadar air, $W = (W_w/W_s) \times 100\%$ | % | 35.4 | 35.5 | 35.9 |
| 7 | Kadar air rata - rata | % | | 35.6 | |

Batas cair (LL) = 39.8%

Batas plastis (PL) = 35.6%

Indeks plastisitas (PI) = 4.2%

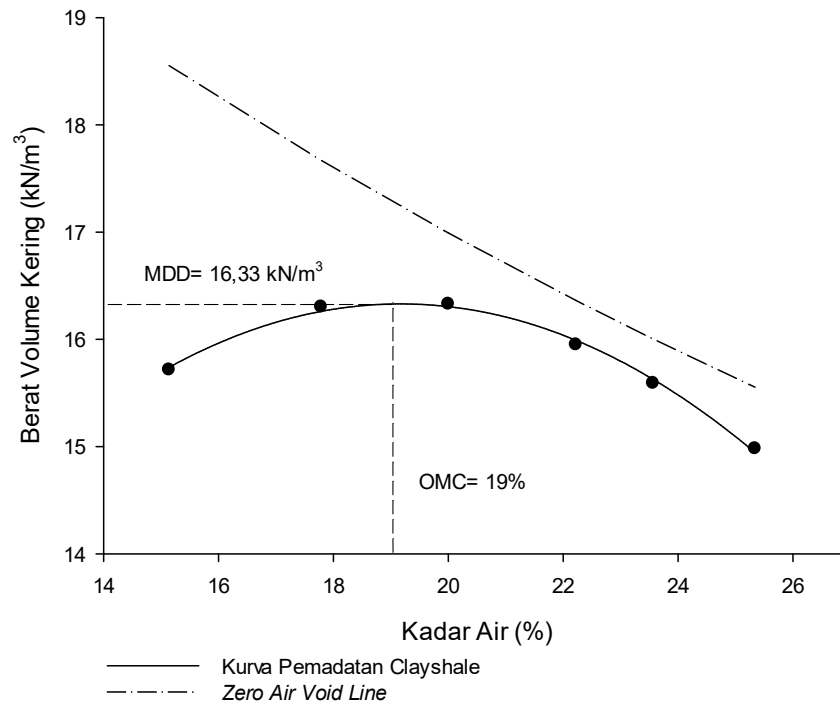
Lampiran 3 Data hasil pengujian pemadatan tanah

a. *Clayshale*

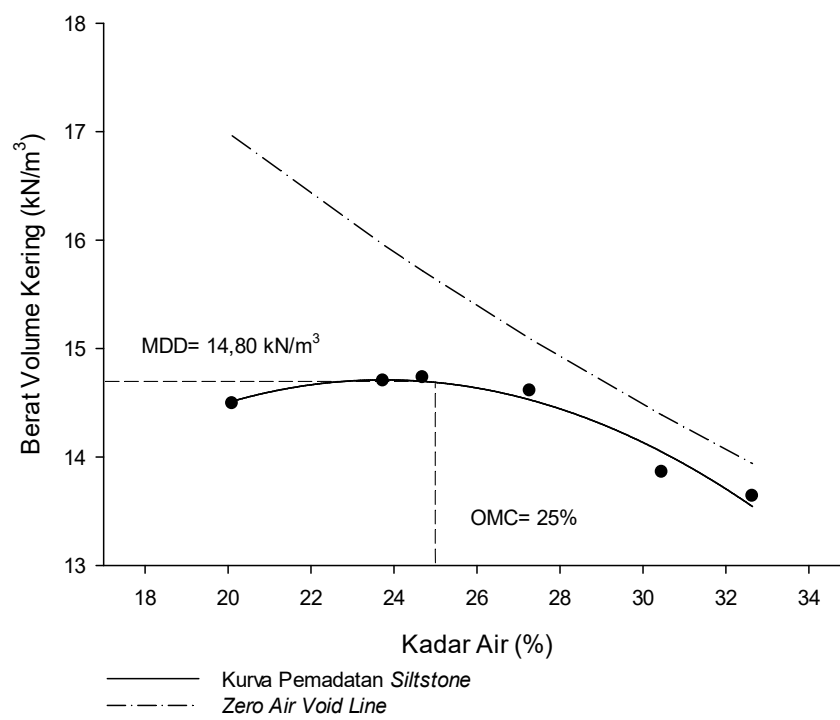
| No | Uraian | 400 | 450 | 500 | 550 | 600 | 650 | | | | | | | | | | | | |
|----|-------------------|--------|--------|--------|--------|--------|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 1 | W_1 | 1746 | 1745 | 1810 | 1810 | 1745 | 1745 | | | | | | | | | | | | |
| 2 | W_2 | 3493 | 3599 | 3739 | 3729 | 3605 | 3558 | | | | | | | | | | | | |
| 3 | W_m | 1747 | 1854 | 1929 | 1919 | 1860 | 1813 | | | | | | | | | | | | |
| 4 | D | 10 | 10.00 | 10.11 | 10.11 | 10.00 | 10.00 | | | | | | | | | | | | |
| 5 | h | 12.06 | 12.06 | 12.03 | 12.03 | 12.06 | 12.06 | | | | | | | | | | | | |
| 6 | V | 947.16 | 947.16 | 965.71 | 965.71 | 947.16 | 947.16 | | | | | | | | | | | | |
| 7 | $Y = K (W_m/V)$ | 18.09 | 19.20 | 19.60 | 19.49 | 19.26 | 18.78 | | | | | | | | | | | | |
| 8 | Pemeriksaan W | I | II | III | I | II | III | I | II | III | I | II | III | I | II | III | I | II | III |
| a | No Cawan | R6 | Z9 | E2 | K3 | D9 | F2 | D7 | L6 | A9 | D3 | Y8 | Z1 | E5 | M6 | G5 | M8 | G9 | F2 |
| b | W_o | 9.13 | 9.15 | 9.38 | 9.13 | 8.66 | 9.67 | 10.25 | 8.69 | 9.27 | 9.17 | 9.20 | 9.38 | 10.33 | 9.24 | 11.95 | 9.21 | 9.10 | 9.22 |
| c | W_b | 29.13 | 29.15 | 29.38 | 29.13 | 28.66 | 29.67 | 30.25 | 28.69 | 29.27 | 29.17 | 29.20 | 29.38 | 30.33 | 29.24 | 31.95 | 29.21 | 29.10 | 29.22 |
| d | W_d | 26.52 | 26.49 | 26.76 | 26.05 | 25.69 | 26.66 | 26.90 | 25.38 | 25.93 | 25.44 | 25.88 | 25.53 | 26.44 | 25.36 | 28.28 | 25.20 | 25.01 | 25.19 |
| e | $W_w = W_b - W_d$ | 2.61 | 2.66 | 2.62 | 3.08 | 2.97 | 3.01 | 3.35 | 3.31 | 3.34 | 3.73 | 3.32 | 3.85 | 3.89 | 3.88 | 3.67 | 4.01 | 4.09 | 4.03 |
| f | $W_s = W_d - W_o$ | 17.39 | 17.34 | 17.38 | 16.92 | 17.03 | 16.99 | 16.65 | 16.69 | 16.66 | 16.27 | 16.68 | 16.15 | 16.11 | 16.12 | 16.33 | 15.99 | 15.91 | 15.97 |
| g | W | 15.0 | 15.3 | 15.1 | 18.2 | 17.4 | 17.7 | 20.1 | 19.8 | 20.0 | 22.9 | 19.9 | 23.8 | 24.1 | 24.1 | 22.5 | 25.1 | 25.7 | 25.2 |
| h | W rata-rata | 15.1 | | | 17.8 | | | 20.0 | | | 22.2 | | | 23.6 | | | 25.3 | | |
| 9 | Berat V kering | 15.71 | | | 16.30 | | | 16.33 | | | 15.95 | | | 15.59 | | | 14.98 | | |
| 10 | Berat jenis | 2.70 | | | 2.70 | | | 2.70 | | | 2.70 | | | 2.70 | | | 2.70 | | |
| 11 | Y_{zav} | 18.55 | | | 17.67 | | | 16.99 | | | 16.36 | | | 16.00 | | | 15.55 | | |

b. *Siltstone*

| No | Uraian | 400 | | | 500 | | | 550 | | | 650 | | | 700 | | | 750 | | |
|----|--|--------|--------|---------|--------|--------|---------|--------|--------|---------|--------|--------|---------|--------|--------|---------|--------|--------|---------|
| 1 | W ₁ | 3357 | | | 3383 | | | 3357 | | | 3383 | | | 3357 | | | 3383 | | |
| 2 | W ₂ | 5090 | | | 5190 | | | 5186 | | | 5230 | | | 5157 | | | 5180 | | |
| 3 | W _m | 1733 | | | 1807 | | | 1829 | | | 1847 | | | 1800 | | | 1797 | | |
| 4 | D | 10.15 | | | 10.08 | | | 10.15 | | | 10.08 | | | 10.15 | | | 10.08 | | |
| 5 | h | 12.07 | | | 12.21 | | | 12.07 | | | 12.21 | | | 12.07 | | | 12.21 | | |
| 6 | V | 976.63 | | | 974.38 | | | 976.63 | | | 974.38 | | | 976.63 | | | 974.38 | | |
| 7 | Y = K (W _m /V) | 17.41 | | | 18.19 | | | 18.37 | | | 18.60 | | | 18.08 | | | 18.09 | | |
| 8 | Pemeriksaan W | I | II | III | I | II | III | I | II | III | I | II | III | I | II | III | I | II | III |
| a | No Cawan | 400 I | 400 II | 400 III | 500 I | 500 II | 500 III | 550 I | 550 II | 550 III | 650 I | 650 II | 650 III | 700 I | 700 II | 700 III | 750 I | 750 II | 750 III |
| b | W _o | 9.84 | 10.50 | 9.01 | 9.14 | 9.45 | 9.80 | 10.32 | 9.38 | 9.05 | 10.46 | 9.29 | 9.36 | 9.16 | 9.85 | 8.92 | 9.44 | 9.01 | 9.07 |
| c | W _b | 29.88 | 30.52 | 29.12 | 29.16 | 29.48 | 29.96 | 30.33 | 29.46 | 29.06 | 30.51 | 29.31 | 29.40 | 29.26 | 29.97 | 28.97 | 29.50 | 29.18 | 29.23 |
| d | W _d | 26.56 | 27.13 | 25.76 | 25.27 | 25.66 | 26.12 | 26.38 | 25.51 | 25.06 | 26.24 | 25.04 | 25.06 | 24.56 | 25.26 | 24.31 | 24.59 | 24.16 | 24.30 |
| e | W _w = W _b - W _d | 3.32 | 3.39 | 3.36 | 3.89 | 3.82 | 3.84 | 3.95 | 3.95 | 4.00 | 4.27 | 4.27 | 4.34 | 4.70 | 4.71 | 4.66 | 4.91 | 5.02 | 4.93 |
| f | W _s = W _d - W _o | 16.72 | 16.63 | 16.75 | 16.13 | 16.21 | 16.32 | 16.06 | 16.13 | 16.01 | 15.78 | 15.75 | 15.70 | 15.40 | 15.41 | 15.39 | 15.15 | 15.15 | 15.23 |
| g | W | 19.86 | 20.38 | 20.06 | 24.12 | 23.57 | 23.53 | 24.60 | 24.49 | 24.98 | 27.06 | 27.11 | 27.64 | 30.52 | 30.56 | 30.28 | 32.41 | 33.14 | 32.37 |
| h | W rata-rata | 14.49 | | | 14.70 | | | 14.73 | | | 14.61 | | | 13.86 | | | 13.64 | | |
| 9 | Berat V kering | 2.65 | | | 2.65 | | | 2.65 | | | 2.65 | | | 2.65 | | | 2.65 | | |
| 10 | Berat jenis | 16.96 | | | 15.96 | | | 15.72 | | | 15.09 | | | 14.39 | | | 13.94 | | |
| 11 | Y _{zav} | 14.49 | | | 14.70 | | | 14.73 | | | 14.61 | | | 13.86 | | | 13.64 | | |




Gambar 5 Hubungan Kadar Air dan Berat Volume Kering *Clayshale*



Gambar 6 Hubungan Kadar Air dan Berat Volume Kering *Siltstone*

Lampiran 4 Data hasil pengujian gradasi

a. *Clayshale*

|  | LABORATORIUM GEOTEKNIK JURUSAN TEKNIK SIPIL, FAKULTAS TEKNIK UNIVERSITAS MUHAMMADIYAH YOGYAKARTA JL. LINGKAR LUAR SELATAN, TAMAN TIRTO, KASIHAN BANTUL, YOGYAKARTA 55183 TELP: 0274-387856 (HUNTING) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|-----------------------|------------------------|----------------------------|----------------------------|-----------------------|--------|-----------------------|------------------------|------------------------|------------------------|-------|-----------------------|------------------------|--------|------|-------|-----------------------|------------------------|-------|------|-------|-----------------------|------------------------|-------|----|-------|-----------------------|------------------------|--------|-------|-------|-----------------------|------------------------|-------|-----|-------|-----------------------|------------------------|--------|--------|-------|----------|-------|--|----|---|---|------|-----|--------|--------|-------|-----|-------|--|-----|---|---|------|-----|--------|--------|-------|-----|-------|--|------|---|---|------|-----|--------|--------|-------|-----|------|--|
| | GRAIN SIZE ANALYSIS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Project : Tugas Akhir Location : - Test/Boring no. : 1 | Depth : - Date : 26 Maret 2019 Made by : Lab.Geoteknik | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Mass of soil, W = 52.87 gr Specific Gravity, G _s = 2.65 K ₂ = a/W x 100 : 1.891 Dispersing agent _____ | Hydrometer no. = 152 H Hydr. correction, a = 1.00 Meniscus correction, m = 1.0 Amount _____ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th>Sieve No.</th> <th>Opening (mm)</th> <th>Mass retained (gr)</th> <th>Mass passing (gr)</th> <th>% finer by mass e/W x 100%</th> </tr> </thead> <tbody> <tr> <td>4</td> <td>4.750</td> <td>d₁ = 0.00</td> <td>e₁ = 52.87</td> <td>100.00</td> </tr> <tr> <td>10</td> <td>2.000</td> <td>d₂ = 0.00</td> <td>e₂ = 52.87</td> <td>100.00</td> </tr> <tr> <td>20</td> <td>0.850</td> <td>d₃ = 1.31</td> <td>e₃ = 51.56</td> <td>97.52</td> </tr> <tr> <td>40</td> <td>0.425</td> <td>d₄ = 1.42</td> <td>e₄ = 50.14</td> <td>94.84</td> </tr> <tr> <td>60</td> <td>0.250</td> <td>d₅ = 0.39</td> <td>e₅ = 49.75</td> <td>94.10</td> </tr> <tr> <td>140</td> <td>0.106</td> <td>d₆ = 0.30</td> <td>e₆ = 49.45</td> <td>93.53</td> </tr> <tr> <td>200</td> <td>0.074</td> <td>d₇ = 0.10</td> <td>e₇ = 49.35</td> <td>93.34</td> </tr> <tr> <td></td> <td></td> <td>Σd = 3.5</td> <td></td> <td></td> </tr> </tbody> </table> | Sieve No. | Opening (mm) | Mass retained (gr) | Mass passing (gr) | % finer by mass e/W x 100% | 4 | 4.750 | d ₁ = 0.00 | e ₁ = 52.87 | 100.00 | 10 | 2.000 | d ₂ = 0.00 | e ₂ = 52.87 | 100.00 | 20 | 0.850 | d ₃ = 1.31 | e ₃ = 51.56 | 97.52 | 40 | 0.425 | d ₄ = 1.42 | e ₄ = 50.14 | 94.84 | 60 | 0.250 | d ₅ = 0.39 | e ₅ = 49.75 | 94.10 | 140 | 0.106 | d ₆ = 0.30 | e ₆ = 49.45 | 93.53 | 200 | 0.074 | d ₇ = 0.10 | e ₇ = 49.35 | 93.34 | | | Σd = 3.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Sieve No. | Opening (mm) | Mass retained (gr) | Mass passing (gr) | % finer by mass e/W x 100% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4 | 4.750 | d ₁ = 0.00 | e ₁ = 52.87 | 100.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 10 | 2.000 | d ₂ = 0.00 | e ₂ = 52.87 | 100.00 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 20 | 0.850 | d ₃ = 1.31 | e ₃ = 51.56 | 97.52 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 40 | 0.425 | d ₄ = 1.42 | e ₄ = 50.14 | 94.84 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 60 | 0.250 | d ₅ = 0.39 | e ₅ = 49.75 | 94.10 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 140 | 0.106 | d ₆ = 0.30 | e ₆ = 49.45 | 93.53 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 200 | 0.074 | d ₇ = 0.10 | e ₇ = 49.35 | 93.34 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Σd = 3.5 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <table border="1"> <thead> <tr> <th>Time</th> <th>Elapsed time min.</th> <th>R₁</th> <th>R₂</th> <th>t</th> <th>R = R₁+m</th> <th>L</th> <th>K</th> <th>D = K*L/T</th> <th>R = R₂+Cl</th> <th>P = K₂*R%</th> </tr> </thead> <tbody> <tr> <td></td> <td>2</td> <td>13</td> <td>0</td> <td>29.8</td> <td>14.0</td> <td>12.196</td> <td>0.0123</td> <td>0.03</td> <td>17.7</td> <td>33.38</td> </tr> <tr> <td></td> <td>5</td> <td>11</td> <td>0</td> <td>29.4</td> <td>12.0</td> <td>12.473</td> <td>0.0122</td> <td>0.019</td> <td>15.4</td> <td>29.03</td> </tr> <tr> <td></td> <td>30</td> <td>7</td> <td>0</td> <td>28.7</td> <td>8.0</td> <td>13.028</td> <td>0.0123</td> <td>0.008</td> <td>10.8</td> <td>20.47</td> </tr> <tr> <td></td> <td>60</td> <td>5</td> <td>0</td> <td>28.8</td> <td>6.0</td> <td>13.306</td> <td>0.0126</td> <td>0.006</td> <td>8.9</td> <td>16.83</td> </tr> <tr> <td></td> <td>250</td> <td>3</td> <td>0</td> <td>28.8</td> <td>4.0</td> <td>13.584</td> <td>0.0122</td> <td>0.003</td> <td>6.9</td> <td>13.05</td> </tr> <tr> <td></td> <td>1440</td> <td>1</td> <td>0</td> <td>28.9</td> <td>2.0</td> <td>13.861</td> <td>0.0125</td> <td>0.001</td> <td>5.0</td> <td>9.41</td> </tr> </tbody> </table> | Time | Elapsed time min. | R ₁ | R ₂ | t | R = R ₁ +m | L | K | D = K*L/T | R = R ₂ +Cl | P = K ₂ *R% | | 2 | 13 | 0 | 29.8 | 14.0 | 12.196 | 0.0123 | 0.03 | 17.7 | 33.38 | | 5 | 11 | 0 | 29.4 | 12.0 | 12.473 | 0.0122 | 0.019 | 15.4 | 29.03 | | 30 | 7 | 0 | 28.7 | 8.0 | 13.028 | 0.0123 | 0.008 | 10.8 | 20.47 | | 60 | 5 | 0 | 28.8 | 6.0 | 13.306 | 0.0126 | 0.006 | 8.9 | 16.83 | | 250 | 3 | 0 | 28.8 | 4.0 | 13.584 | 0.0122 | 0.003 | 6.9 | 13.05 | | 1440 | 1 | 0 | 28.9 | 2.0 | 13.861 | 0.0125 | 0.001 | 5.0 | 9.41 | |
| Time | Elapsed time min. | R ₁ | R ₂ | t | R = R ₁ +m | L | K | D = K*L/T | R = R ₂ +Cl | P = K ₂ *R% | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 2 | 13 | 0 | 29.8 | 14.0 | 12.196 | 0.0123 | 0.03 | 17.7 | 33.38 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 5 | 11 | 0 | 29.4 | 12.0 | 12.473 | 0.0122 | 0.019 | 15.4 | 29.03 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 30 | 7 | 0 | 28.7 | 8.0 | 13.028 | 0.0123 | 0.008 | 10.8 | 20.47 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 60 | 5 | 0 | 28.8 | 6.0 | 13.306 | 0.0126 | 0.006 | 8.9 | 16.83 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 250 | 3 | 0 | 28.8 | 4.0 | 13.584 | 0.0122 | 0.003 | 6.9 | 13.05 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | 1440 | 1 | 0 | 28.9 | 2.0 | 13.861 | 0.0125 | 0.001 | 5.0 | 9.41 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| NOTE : | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| GEOTECHNICAL LABORATORY - CIVIL ENGINEERING DEPT. -UNIVERSITAS MUHAMMADIYAH YOGYAKARTA | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |



LABORATORIUM GEOTEKNIK
 JURUSAN TEKNIK SIPIL, FAKULTAS TEKNIK
UNIVERSITAS MUHAMMADIYAH YOGYAKARTA
 JL. LINGKAR LUAR SELATAN, TAMAN TIRTO, KASIHAN BANTUL, YOGYAKARTA 55183
 TELP: 0274-387856 (HUNTING)

GRAIN SIZE ANALYSIS

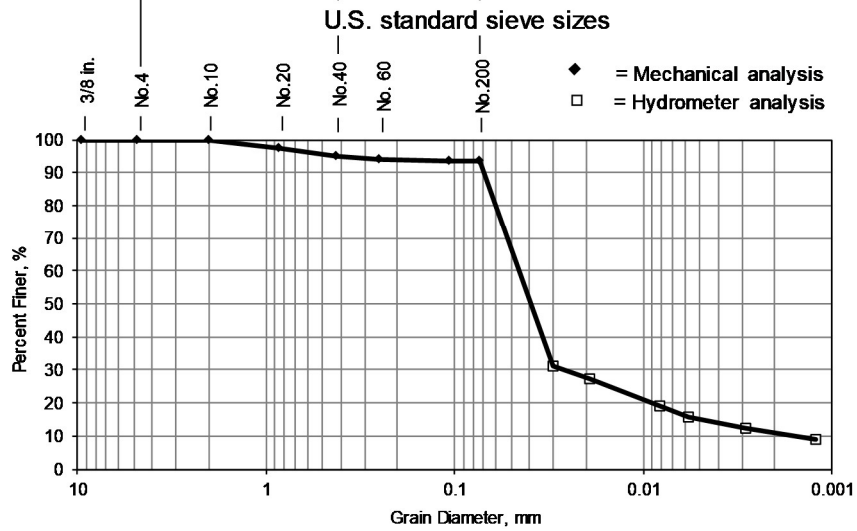
Project : Tugas Akhir
 Location : -
 No. : 1

Depth : -
 Date : 26 Maret 2019
 Made by : Lab. Geoteknik

Specific Gravity 2.65

Description of soil Clayshale

| | | | |
|--------|------------------|------|-------|
| Gravel | Sand | | Fines |
| | Coarse to medium | Fine | |



Finer # 200 = 93.34 %
 Gravel = 0.00 %
 Sand = 6.66 %
 Silt/Clay = 93.34 %

| D ₁₀ | D ₃₀ | D ₆₀ | C _u = D ₆₀ /D ₁₀ | C _c = (D ₃₀) ² / (D ₁₀ × D ₆₀) |
|-----------------|-----------------|-----------------|---|---|
| - | - | - | - | - |

b. Siltstone



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 JL. LINGKAR LUAR SELATAN, TAMAN TIRTO, KASIHAN BANTUL, YOGYAKARTA 55183
 TELP: 0274-387656 (HUNTING)

GRAIN SIZE ANALYSIS

Project : Tugas Akhir
 Location : -
 Test/Boring no. : 1
 Depth : -
 Date : 26 Maret 2019
 Made by : Lab. Geoteknik

Mass of soil, W = 65 gr
 Specific Gravity, G = 2.58
 $K_2 = a/W \times 100 = 1.560$
 Dispersing agent _____
 Hydrometer no. = 152 H
 Hydr. correction, a = 1.01
 Meniscus correction, m = 1.0
 Amount _____

| Sieve No. | Opening (mm) | Mass retained (gr) | Mass passing (gr) | % finer by mass $e/W \times 100\%$ |
|-----------|--------------|--------------------|-------------------|------------------------------------|
| 4 | 4.750 | $d_1 = 0.00$ | $e_1 = 65.00$ | 100.00 |
| 10 | 2.000 | $d_2 = 0.04$ | $e_2 = 64.96$ | 99.94 |
| 20 | 0.850 | $d_3 = 8.95$ | $e_3 = 56.01$ | 86.17 |
| 40 | 0.425 | $d_4 = 7.71$ | $e_4 = 48.30$ | 74.31 |
| 60 | 0.250 | $d_5 = 3.31$ | $e_5 = 44.99$ | 69.22 |
| 140 | 0.106 | $d_6 = 5.56$ | $e_6 = 39.43$ | 60.66 |
| 200 | 0.074 | $d_7 = 2.83$ | $e_7 = 36.60$ | 56.31 |
| | | $\sum d = 28.4$ | | |

| Time | Elapsed time min. | R_1 | R_2 | t | $R = R_1 + m$ | L | K | $D = K \cdot L / T$ | $R = R_1 - R_2 + Ct$ | $P = K_2 \cdot R \%$ |
|------|-------------------|-------|-------|------|---------------|--------|--------|---------------------|----------------------|----------------------|
| | 2 | 0 | -8 | 26.5 | 1.0 | 7.5682 | 0.0129 | 0.025 | 10.8 | 16.89 |
| | 5 | -4 | -9 | 26.4 | -3.0 | 7.0506 | 0.0129 | 0.021 | 7.8 | 12.15 |
| | 30 | -9 | -10 | 26.1 | -8.0 | 6.4036 | 0.0130 | 0.007 | 3.7 | 5.76 |
| | 60 | -9 | -8 | 29.7 | -8.0 | 6.4036 | 0.0125 | 0.004 | 3.6 | 5.58 |
| | 250 | -9 | -8 | 26 | -8.0 | 6.4036 | 0.0130 | 0.002 | 1.7 | 2.57 |
| | 1440 | -10 | -9 | 26.5 | -9.0 | 6.2742 | 0.0129 | 8E-04 | 1.8 | 2.85 |

NOTE :



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 TELP: 0274-387856 (HUNTING)

GRAIN SIZE ANALYSIS

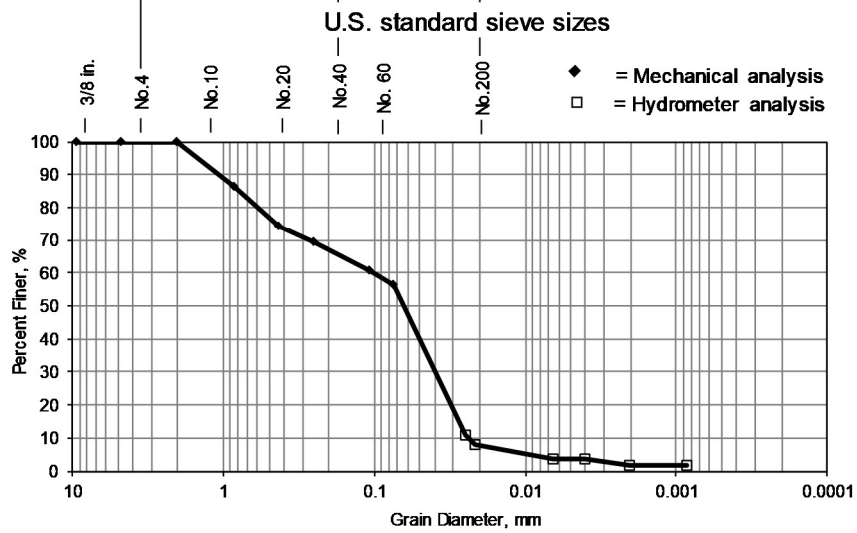
Project : Tugas Akhir
 Location : -
 No. : 1

Depth : -
 Date : 26 Maret 2019
 Made by : Lab. Geoteknik

Specific Gravity 2.58

Description of soil Siltstone

| | | | |
|--------|------------------|------|-------|
| Gravel | Sand | | Fines |
| | Coarse to medium | Fine | |



Finer # 200 = 56.31 %
 Gravel = 0.00 %
 Sand = 43.69 %
 Silt/Clay = 56.31 %

| D ₁₀ | D ₃₀ | D ₆₀ | C _u = D ₆₀ /D ₁₀ | C _c = (D ₃₀) ² / (D ₁₀ × D ₆₀) |
|-----------------|-----------------|-----------------|---|---|
| - | - | - | - | - |

Lampiran 5 Perhitungan campuran bahan benda uji

1. *Clayshale*

a. Volume silinder (V)

$$V = \frac{1}{4} \times \pi \times d \times h$$

$$V = \frac{1}{4} \times \pi \times 3,5 \text{ cm} \times 7 \text{ cm}$$

$$V = 67,348 \text{ cm}^3$$

b. Berat total spesimen (Wtotal)

$$W_{\text{total}} = \frac{\text{MDD}}{K} \times \left(1 + \frac{\text{OMC}}{100} \right) \times V$$

$$W_{\text{total}} = \frac{16,33 \text{ kN/m}^3}{9,81 \text{ m/s}^3} \times \left(1 + \frac{19}{100} \right) \times 67,348 \text{ cm}^3$$

$$W_{\text{total}} = 133,412 \text{ gram}$$

c. Berat tanah (Wtanah)

$$W_{\text{tanah}} = \frac{W_{\text{total}}}{1 + \frac{\text{OMC}}{100}}$$

$$W_{\text{tanah}} = \frac{133,412 \text{ gram}}{1 + \frac{19}{100}}$$

$$W_{\text{tanah}} = 112,111 \text{ gram}$$

Untuk spesimen dengan kadar semen 10% maka:

$$W_{\text{tanah}_{10\%}} = \left(1 - \frac{\text{kadar semen}}{100} \right) \times W_{\text{tanah}}$$

$$W_{\text{tanah}_{10\%}} = \left(1 - \frac{10}{100} \right) \times 112,111 \text{ gram}$$

$$W_{\text{tanah}_{10\%}} = 100,9 \text{ gram}$$

d. Berat semen (Wsemen)

$$W_{\text{semen}} = W_{\text{total}} - W_{\text{tanah}_{10\%}}$$

$$W_{\text{semen}} = 112,111 \text{ gram} - 100,9 \text{ gram}$$

$$W_{\text{semen}} = 11,211 \text{ gram}$$

e. Jumlah air

$$W_{\text{air}} = W_{\text{total}} - W_{\text{tanah}}$$

$$W_{\text{air}} = 133,412 \text{ gram} - 112,111 \text{ gram}$$

$$W_{\text{air}} = 21,301 \text{ mL}$$

Untuk metode *spray mixing* digunakan nilai FAS sebesar 0,7. Maka jumlah air yang digunakan dibagi menjadi dua.

$$W_{air_{semen}} = W_{air} \times FAS$$

$$W_{air_{semen}} = 21,301 \text{ ml} \times 0,7$$

$$W_{air_{semen}} = 7,848 \text{ mL}$$

$$W_{air_{tanah}} = W_{air} - W_{air_{semen}}$$

$$W_{air_{tanah}} = 21,301 \text{ mL} - 7,848 \text{ mL}$$

$$W_{air_{tanah}} = 12,453 \text{ mL}$$

2. Siltstone

a. Volume silinder (V)

$$V = \frac{1}{4} \times \pi \times d \times h$$

$$V = \frac{1}{4} \times \pi \times 3,5 \text{ cm} \times 7 \text{ cm}$$

$$V = 67,348 \text{ cm}^3$$

b. Berat total spesimen (Wtotal)

$$W_{total} = \frac{MDD}{K} \times \left(1 + \frac{OMC}{100} \right) \times V$$

$$W_{total} = \frac{14,8 \text{ kN/m}^3}{9,81 \text{ m/s}^3} \times \left(1 + \frac{25}{100} \right) \times 67,348 \text{ cm}^3$$

$$W_{total} = 127,007 \text{ gram}$$

c. Berat tanah (Wtanah)

$$W_{tanah} = \frac{W_{total}}{1 + \frac{OMC}{100}}$$

$$W_{tanah} = \frac{127,007 \text{ gram}}{1 + \frac{25}{100}}$$

$$W_{tanah} = 101,605 \text{ gram}$$

Untuk spesimen dengan kadar semen 10% maka:

$$W_{tanah_{10\%}} = \left(1 - \frac{\text{kadar semen}}{100} \right) \times W_{tanah}$$

$$W_{tanah_{10\%}} = \left(1 - \frac{10}{100} \right) \times 101,605 \text{ gram}$$

$$W_{tanah_{10\%}} = 91,445 \text{ gram}$$

d. Berat semen (Wsemen)

$$W_{\text{semen}} = W_{\text{total}} - W_{\text{total}_{10\%}}$$

$$W_{\text{semen}} = 127,007 \text{ gram} - 91,445 \text{ gram}$$

$$W_{\text{semen}} = 10,161 \text{ gram}$$

e. Jumlah air

$$W_{\text{air}} = W_{\text{total}} - W_{\text{tanah}}$$

$$W_{\text{air}} = 127,007 \text{ gram} - 101,605 \text{ gram}$$

$$W_{\text{air}} = 25,401 \text{ mL}$$

Untuk metode *spray mixing* digunakan nilai FAS sebesar 0,7. Maka jumlah air yang digunakan dibagi menjadi dua.

$$W_{\text{air}_{\text{semen}}} = W_{\text{air}} \times \text{FAS}$$

$$W_{\text{air}_{\text{semen}}} = 25,401 \text{ mL} \times 0,7$$

$$W_{\text{air}_{\text{semen}}} = 7,112 \text{ mL}$$

$$W_{\text{air}_{\text{tanah}}} = W_{\text{air}} - W_{\text{air}_{\text{semen}}}$$

$$W_{\text{air}_{\text{tanah}}} = 25,401 \text{ mL} - 7,112 \text{ mL}$$

$$W_{\text{air}_{\text{tanah}}} = 18,289 \text{ mL}$$

Lampiran 6 Data hasil pengujian kuat tekan bebas

| Data Pengujian | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|--------------|--------------------------|-------------------------------------|------------|--------------|-----|---|-----|-----|-----|------|-----|------|------------|------|-----|------|-----|------|-----|-----|-----|-----|-----|-----|
| Kadar Semen | : | 0% | | | | | | | | | | | | | | | | | | | | | | | |
| Nomer Spesimen | : | CS I | | | | | | | | | | | | | | | | | | | | | | | |
| Berat | : | 132.4 gram | | | | | | | | | | | | | | | | | | | | | | | |
| Diameter | : | 35 mm | | | | | | | | | | | | | | | | | | | | | | | |
| Tinggi (ASTM) | : | 70 mm | s/d 87.5 mm | | | | | | | | | | | | | | | | | | | | | | |
| Tinggi Spesimen | : | 70 mm | | | | | | | | | | | | | | | | | | | | | | | |
| Luas | : | 962.1128 mm ² | | | | | | | | | | | | | | | | | | | | | | | |
| Volume | : | 67347.89 mm ³ | = 67.34789 cm ³ | | | | | | | | | | | | | | | | | | | | | | |
| Berat Volume | : | 1.966 g/cm ³ | | | | | | | | | | | | | | | | | | | | | | | |
| Kecepatan Alat (ASTM) | : | 0.35 mm/menit | s/d 1.4 mm/menit | | | | | | | | | | | | | | | | | | | | | | |
| Kecepatan Yang Digunakan | : | 0.72 mm/menit | | | | | | | | | | | | | | | | | | | | | | | |
| Batas Regangan | : | 10.5 mm | | | | | | | | | | | | | | | | | | | | | | | |
| Estimasi Runtuh | : | 14.58 menit | = 875 detik | | | | | | | | | | | | | | | | | | | | | | |
| Kadar Air | | Hasil UCS | | | | | | | | | | | | | | | | | | | | | | | |
| Z7 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Cawan | : | 9.01 gram | Kuat Tekan Bebas (qu) : 143.757 kPa | | | | | | | | | | | | | | | | | | | | | | |
| Berat Basah | : | 101.47 gram | Tegangan 50 : 71.879 kPa | | | | | | | | | | | | | | | | | | | | | | |
| Berat Kering | : | 85.78 gram | Regangan 50 : 0.675 % | | | | | | | | | | | | | | | | | | | | | | |
| Kadar Air | : | 20.4 % | Modulus Sekan (E50) : 10648.690 kPa | | | | | | | | | | | | | | | | | | | | | | |
| | | | : 10.649 MPa | | | | | | | | | | | | | | | | | | | | | | |
| | | | Jenis Keruntuhan : Brittle Failure | | | | | | | | | | | | | | | | | | | | | | |
| | | | Brittleness Index : 0.700 | | | | | | | | | | | | | | | | | | | | | | |
| Grafik Hubungan Tegangan & Regangan | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>The graph plots Stress (Tegangan) in kPa on the y-axis (0 to 1200) against Strain (Regangan) in % on the x-axis (0.0 to 6.5). The curve starts at (0,0), rises to a peak of approximately 144 kPa at a strain of about 1.7%, and then gradually declines to about 50 kPa at a strain of 6.0%.</p> <table border="1"> <caption>Key Data Points from Stress-Strain Graph</caption> <thead> <tr> <th>Strain (%)</th> <th>Stress (kPa)</th> </tr> </thead> <tbody> <tr> <td>0.0</td> <td>0</td> </tr> <tr> <td>0.5</td> <td>~50</td> </tr> <tr> <td>1.0</td> <td>~100</td> </tr> <tr> <td>1.5</td> <td>~130</td> </tr> <tr> <td>1.7 (Peak)</td> <td>~144</td> </tr> <tr> <td>2.0</td> <td>~130</td> </tr> <tr> <td>3.0</td> <td>~100</td> </tr> <tr> <td>4.0</td> <td>~70</td> </tr> <tr> <td>5.0</td> <td>~50</td> </tr> <tr> <td>6.0</td> <td>~40</td> </tr> </tbody> </table> | | | | Strain (%) | Stress (kPa) | 0.0 | 0 | 0.5 | ~50 | 1.0 | ~100 | 1.5 | ~130 | 1.7 (Peak) | ~144 | 2.0 | ~130 | 3.0 | ~100 | 4.0 | ~70 | 5.0 | ~50 | 6.0 | ~40 |
| Strain (%) | Stress (kPa) | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.5 | ~50 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.0 | ~100 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | ~130 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.7 (Peak) | ~144 | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.0 | ~130 | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.0 | ~100 | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.0 | ~70 | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.0 | ~50 | | | | | | | | | | | | | | | | | | | | | | | | |
| 6.0 | ~40 | | | | | | | | | | | | | | | | | | | | | | | | |

| Data Pengujian | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----------------|--------------------------|-------------------------------------|--------------|----------------|-----|---|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|-----|----|
| Kadar Semen | : | 0% | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nomer Spesimen | : | CS II | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat | : | 133.83 gram | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diameter | : | 35 mm | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tinggi (ASTM) | : | 70 mm | s/d 87.5 mm | | | | | | | | | | | | | | | | | | | | | | | | |
| Tinggi Spesimen | : | 70 mm | | | | | | | | | | | | | | | | | | | | | | | | | |
| Luas | : | 962.1128 mm ² | | | | | | | | | | | | | | | | | | | | | | | | | |
| Volume | : | 67347.89 mm ³ | = 67.34789 cm ³ | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Volume | : | 1.987 g/cm ³ | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kecepatan Alat (ASTM) | : | 0.35 mm/menit | s/d 1.4 mm/menit | | | | | | | | | | | | | | | | | | | | | | | | |
| Kecepatan Yang Digunakan | : | 0.72 mm/menit | | | | | | | | | | | | | | | | | | | | | | | | | |
| Batas Regangan | : | 10.5 mm | | | | | | | | | | | | | | | | | | | | | | | | | |
| Estimasi Runtuh | : | 14.58 menit | = 875 detik | | | | | | | | | | | | | | | | | | | | | | | | |
| Kadar Air | | Hasil UCS | | | | | | | | | | | | | | | | | | | | | | | | | |
| A2 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Cawan | : | 9.34 gram | Kuat Tekan Bebas (qu) : 155.305 kPa | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Basah | : | 142.51 gram | Tegangan 50 : 77.652 kPa | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Kering | : | 118.14 gram | Regangan 50 : 0.931 % | | | | | | | | | | | | | | | | | | | | | | | | |
| Kadar Air | : | 22.4 % | Modulus Sekan (E50) : 8340.744 kPa | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | : 8.341 MPa | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Jenis Keruntuhan : Brittle Failure | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Brittleness Index : 0.494 | | | | | | | | | | | | | | | | | | | | | | | | |
| Grafik Hubungan Tegangan & Regangan | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>The graph plots Stress (Tegangan) in kPa on the y-axis (0 to 1200) against Strain (Regangan) in % on the x-axis (0.0 to 6.5). The curve starts at (0,0), rises to a peak of approximately 155 kPa at 2.5% strain, and then gradually declines to about 100 kPa at 5.0% strain.</p> <table border="1"> <caption>Approximate Data Points from Stress-Strain Graph</caption> <thead> <tr> <th>Regangan (%)</th> <th>Tegangan (kPa)</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>0</td></tr> <tr><td>0.5</td><td>50</td></tr> <tr><td>1.0</td><td>100</td></tr> <tr><td>1.5</td><td>130</td></tr> <tr><td>2.0</td><td>150</td></tr> <tr><td>2.5</td><td>155</td></tr> <tr><td>3.0</td><td>140</td></tr> <tr><td>3.5</td><td>120</td></tr> <tr><td>4.0</td><td>100</td></tr> <tr><td>4.5</td><td>90</td></tr> <tr><td>5.0</td><td>80</td></tr> </tbody> </table> | | | | Regangan (%) | Tegangan (kPa) | 0.0 | 0 | 0.5 | 50 | 1.0 | 100 | 1.5 | 130 | 2.0 | 150 | 2.5 | 155 | 3.0 | 140 | 3.5 | 120 | 4.0 | 100 | 4.5 | 90 | 5.0 | 80 |
| Regangan (%) | Tegangan (kPa) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.5 | 50 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.0 | 100 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 130 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.0 | 150 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 155 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.0 | 140 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.5 | 120 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.0 | 100 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.5 | 90 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.0 | 80 | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Data Pengujian | | | | | | | | | | | | | | | | | | | |
|---|----------------|--------------------------|-------------------------------------|--------------|----------------|-----|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Kadar Semen | : | 10% | | | | | | | | | | | | | | | | | |
| Nomer Spesimen | : | CS DRY I | | | | | | | | | | | | | | | | | |
| Berat | : | 126.81 gram | | | | | | | | | | | | | | | | | |
| Diameter | : | 35 mm | | | | | | | | | | | | | | | | | |
| Tinggi (ASTM) | : | 70 mm | s/d 87.5 mm | | | | | | | | | | | | | | | | |
| Tinggi Spesimen | : | 70 mm | | | | | | | | | | | | | | | | | |
| Luas | : | 962.1128 mm ² | | | | | | | | | | | | | | | | | |
| Volume | : | 67347.89 mm ³ | = 67.34789 cm ³ | | | | | | | | | | | | | | | | |
| Berat Volume | : | 1.883 g/cm ³ | | | | | | | | | | | | | | | | | |
| Kecepatan Alat (ASTM) | : | 0.35 mm/menit | s/d 1.400 mm/menit | | | | | | | | | | | | | | | | |
| Kecepatan Yang Digunakan | : | 2.03 mm/menit | | | | | | | | | | | | | | | | | |
| Batas Regangan | : | 10.5 mm | | | | | | | | | | | | | | | | | |
| Estimasi Runtuh | : | 5.17 menit | = 310 detik | | | | | | | | | | | | | | | | |
| Kadar Air | | Hasil UCS | | | | | | | | | | | | | | | | | |
| F2 | | | | | | | | | | | | | | | | | | | |
| Berat Cawan | : | 9.15 gram | Kuat Tekan Bebas (qu) : 875.636 kPa | | | | | | | | | | | | | | | | |
| Berat Basah | : | 135.39 gram | Tegangan 50 : 437.818 kPa | | | | | | | | | | | | | | | | |
| Berat Kering | : | 117.02 gram | Regangan 50 : 0.567 % | | | | | | | | | | | | | | | | |
| Kadar Air | : | 17.0 % | Modulus Sekan (E50) : 77216.559 kPa | | | | | | | | | | | | | | | | |
| | | | : 77.217 MPa | | | | | | | | | | | | | | | | |
| | | | Jenis Keruntuhan : Brittle Failure | | | | | | | | | | | | | | | | |
| | | | Brittleness Index : 0.672 | | | | | | | | | | | | | | | | |
| Grafik Hubungan Tegangan & Regangan | | | | | | | | | | | | | | | | | | | |
| <p>The graph plots Stress (Tegangan) in kPa on the y-axis (0 to 1200) against Strain (Regangan) in % on the x-axis (0.0 to 6.5). The curve starts at the origin (0,0), rises to a peak of approximately 875 kPa at a strain of 1.5%, and then gradually declines to about 300 kPa at a strain of 3.0%.</p> <table border="1"> <caption>Approximate data points from the Stress-Strain Graph</caption> <thead> <tr> <th>Regangan (%)</th> <th>Tegangan (kPa)</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>0</td></tr> <tr><td>0.5</td><td>300</td></tr> <tr><td>1.0</td><td>600</td></tr> <tr><td>1.5</td><td>875</td></tr> <tr><td>2.0</td><td>750</td></tr> <tr><td>2.5</td><td>500</td></tr> <tr><td>3.0</td><td>300</td></tr> </tbody> </table> | | | | Regangan (%) | Tegangan (kPa) | 0.0 | 0 | 0.5 | 300 | 1.0 | 600 | 1.5 | 875 | 2.0 | 750 | 2.5 | 500 | 3.0 | 300 |
| Regangan (%) | Tegangan (kPa) | | | | | | | | | | | | | | | | | | |
| 0.0 | 0 | | | | | | | | | | | | | | | | | | |
| 0.5 | 300 | | | | | | | | | | | | | | | | | | |
| 1.0 | 600 | | | | | | | | | | | | | | | | | | |
| 1.5 | 875 | | | | | | | | | | | | | | | | | | |
| 2.0 | 750 | | | | | | | | | | | | | | | | | | |
| 2.5 | 500 | | | | | | | | | | | | | | | | | | |
| 3.0 | 300 | | | | | | | | | | | | | | | | | | |

| Data Pengujian | | | | | | | | | | | | | | | | | |
|---|---|-----------------------|-------------------|-----|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Kadar Semen | : 10% | | | | | | | | | | | | | | | | |
| Nomer Spesimen | : CS DRY II | | | | | | | | | | | | | | | | |
| Berat | : 127.52 gram | | | | | | | | | | | | | | | | |
| Diameter | : 35 mm | | | | | | | | | | | | | | | | |
| Tinggi (ASTM) | : 70 mm s/d 87.5 mm | | | | | | | | | | | | | | | | |
| Tinggi Spesimen | : 70 mm | | | | | | | | | | | | | | | | |
| Luas | : 962.1128 mm ² | | | | | | | | | | | | | | | | |
| Volume | : 67347.89 mm ³ = 67.34789 cm ³ | | | | | | | | | | | | | | | | |
| Berat Volume | : 1.893 g/cm ³ | | | | | | | | | | | | | | | | |
| Kecepatan Alat (ASTM) | : 0.35 mm/menit s/d 1.400 mm/menit | | | | | | | | | | | | | | | | |
| Kecepatan Yang Digunakan | : 2.03 mm/menit | | | | | | | | | | | | | | | | |
| Batas Regangan | : 10.5 mm | | | | | | | | | | | | | | | | |
| Estimasi Runtuh | : 5.17 menit = 310 detik | | | | | | | | | | | | | | | | |
| Kadar Air | Hasil UCS | | | | | | | | | | | | | | | | |
| C1 | | | | | | | | | | | | | | | | | |
| Berat Cawan | : 10.63 gram | Kuat Tekan Bebas (qu) | : 924.613 kPa | | | | | | | | | | | | | | |
| Berat Basah | : 124.4 gram | Tegangan 50 | : 462.306 kPa | | | | | | | | | | | | | | |
| Berat Kering | : 105.59 gram | Regangan 50 | : 0.607 % | | | | | | | | | | | | | | |
| Kadar Air | : 19.8 % | Modulus Sekan (E50) | : 76162.508 kPa | | | | | | | | | | | | | | |
| | | | : 76.163 MPa | | | | | | | | | | | | | | |
| | | Jenis Keruntuhan | : Brittle Failure | | | | | | | | | | | | | | |
| | | Brittleness Index | : 0.517 | | | | | | | | | | | | | | |
| Grafik Hubungan Tegangan & Regangan | | | | | | | | | | | | | | | | | |
| <p>The graph plots Stress (Tegangan) in kPa on the y-axis (0 to 1200) against Strain (Regangan) in % on the x-axis (0.0 to 6.5). The curve starts at the origin, rises to a peak of approximately 925 kPa at a strain of about 1.3%, and then gradually declines to about 450 kPa at a strain of 2.5%.</p> <table border="1"> <caption>Approximate data points from the Stress-Strain Graph</caption> <thead> <tr> <th>Regangan (%)</th> <th>Tegangan (kPa)</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>0</td></tr> <tr><td>0.5</td><td>300</td></tr> <tr><td>1.0</td><td>750</td></tr> <tr><td>1.3</td><td>925</td></tr> <tr><td>1.5</td><td>850</td></tr> <tr><td>2.0</td><td>700</td></tr> <tr><td>2.5</td><td>450</td></tr> </tbody> </table> | | Regangan (%) | Tegangan (kPa) | 0.0 | 0 | 0.5 | 300 | 1.0 | 750 | 1.3 | 925 | 1.5 | 850 | 2.0 | 700 | 2.5 | 450 |
| Regangan (%) | Tegangan (kPa) | | | | | | | | | | | | | | | | |
| 0.0 | 0 | | | | | | | | | | | | | | | | |
| 0.5 | 300 | | | | | | | | | | | | | | | | |
| 1.0 | 750 | | | | | | | | | | | | | | | | |
| 1.3 | 925 | | | | | | | | | | | | | | | | |
| 1.5 | 850 | | | | | | | | | | | | | | | | |
| 2.0 | 700 | | | | | | | | | | | | | | | | |
| 2.5 | 450 | | | | | | | | | | | | | | | | |

| Data Pengujian | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|-----------------------|-------------------|-----|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Kadar Semen | : 10% | | | | | | | | | | | | | | | | | | | | | | | | |
| Nomer Spesimen | : CS SPRAY I | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat | : 127.89 gram | | | | | | | | | | | | | | | | | | | | | | | | |
| Diameter | : 35 mm | | | | | | | | | | | | | | | | | | | | | | | | |
| Tinggi (ASTM) | : 70 mm s/d 87.5 mm | | | | | | | | | | | | | | | | | | | | | | | | |
| Tinggi Spesimen | : 70 mm | | | | | | | | | | | | | | | | | | | | | | | | |
| Luas | : 962.1128 mm ² | | | | | | | | | | | | | | | | | | | | | | | | |
| Volume | : 67347.89 mm ³ = 67.34789 cm ³ | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Volume | : 1.899 g/cm ³ | | | | | | | | | | | | | | | | | | | | | | | | |
| Kecepatan Alat (ASTM) | : 0.350 mm/menit s/d 1.400 mm/menit | | | | | | | | | | | | | | | | | | | | | | | | |
| Kecepatan Yang Digunakan | : 2.03 mm/menit | | | | | | | | | | | | | | | | | | | | | | | | |
| Batas Regangan | : 10.5 mm | | | | | | | | | | | | | | | | | | | | | | | | |
| Estimasi Runtuh | : 5.17 menit = 310 detik | | | | | | | | | | | | | | | | | | | | | | | | |
| Kadar Air | Hasil UCS | | | | | | | | | | | | | | | | | | | | | | | | |
| J8 | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Cawan | : 8.76 gram | Kuat Tekan Bebas (qu) | : 958.943 kPa | | | | | | | | | | | | | | | | | | | | | | |
| Berat Basah | : 123.63 gram | Tegangan 50 | : 479.472 kPa | | | | | | | | | | | | | | | | | | | | | | |
| Berat Kering | : 104.71 gram | Regangan 50 | : 1.285 % | | | | | | | | | | | | | | | | | | | | | | |
| Kadar Air | : 19.7 % | Modulus Sekan (E50) | : 37312.968 kPa | | | | | | | | | | | | | | | | | | | | | | |
| | | | : 37.313 MPa | | | | | | | | | | | | | | | | | | | | | | |
| | | Jenis Keruntuhan | : Brittle Failure | | | | | | | | | | | | | | | | | | | | | | |
| | | Brittleness Index | : 0.642 | | | | | | | | | | | | | | | | | | | | | | |
| Grafik Hubungan Tegangan & Regangan | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>The graph plots Stress (Tegangan) in kPa on the y-axis (0 to 1200) against Strain (Regangan) in % on the x-axis (0.0 to 6.5). The curve starts at the origin, rises to a peak of approximately 959 kPa at a strain of about 2.3%, and then gradually declines to about 350 kPa at a strain of 4.5%.</p> <table border="1"> <caption>Approximate data points from the Stress-Strain graph</caption> <thead> <tr> <th>Regangan (%)</th> <th>Tegangan (kPa)</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>0</td></tr> <tr><td>0.5</td><td>100</td></tr> <tr><td>1.0</td><td>250</td></tr> <tr><td>1.5</td><td>500</td></tr> <tr><td>2.0</td><td>800</td></tr> <tr><td>2.3</td><td>959 (Peak)</td></tr> <tr><td>2.5</td><td>900</td></tr> <tr><td>3.0</td><td>600</td></tr> <tr><td>3.5</td><td>450</td></tr> <tr><td>4.0</td><td>380</td></tr> <tr><td>4.5</td><td>350</td></tr> </tbody> </table> | | Regangan (%) | Tegangan (kPa) | 0.0 | 0 | 0.5 | 100 | 1.0 | 250 | 1.5 | 500 | 2.0 | 800 | 2.3 | 959 (Peak) | 2.5 | 900 | 3.0 | 600 | 3.5 | 450 | 4.0 | 380 | 4.5 | 350 |
| Regangan (%) | Tegangan (kPa) | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.5 | 100 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.0 | 250 | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 500 | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.0 | 800 | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.3 | 959 (Peak) | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 900 | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.0 | 600 | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.5 | 450 | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.0 | 380 | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.5 | 350 | | | | | | | | | | | | | | | | | | | | | | | | |

| Data Pengujian | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|---|-------------------------|-----------------|-----|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Kadar Semen | : 10% | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nomer Spesimen | : S SPRAY II | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat | : 137.14 gram | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diameter | : 35 mm | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tinggi (ASTM) | : 70 mm s/d 87.5 mm | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tinggi Spesimen | : 70 mm | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Luas | : 962.1128 mm ² | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Volume | : 67347.89 mm ³ = 67.34789 cm ³ | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Volume | : 2.036 g/cm ³ | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kecepatan Alat (ASTM) | : 0.35 mm/menit s/d 1.400 mm/menit | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kecepatan Yang Digunakan | : 2.03 mm/menit | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Batas Regangan | : 10.5 mm | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Estimasi Runtuh | : 5.17 menit = 310 detik | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kadar Air | Hasil UCS | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| K9 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Cawan | : 9.16 gram | Kuat Tekan Bebas (qu) : | 955.364 kPa | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Basah | : 139.39 gram | Tegangan 50 : | 477.682 kPa | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Kering | : 117.38 gram | Regangan 50 : | 1.172 % | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kadar Air | : 20.3 % | Modulus Sekan (E50) : | 40757.84 kPa | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | : 40.758 MPa | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Jenis Keruntuhan : | Brittle Failure | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | Brittleness Index : | 0.773 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Grafik Hubungan Tegangan & Regangan | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>The graph plots Stress (Tegangan) in kPa on the y-axis (0 to 1200) against Strain (Regangan) in % on the x-axis (0.0 to 6.5). The curve starts at the origin (0,0), rises to a peak of approximately 955 kPa at a strain of about 2.2%, and then gradually declines to about 200 kPa at a strain of 5.5%.</p> <table border="1"> <caption>Approximate data points from the Stress-Strain Graph</caption> <thead> <tr> <th>Regangan (%)</th> <th>Tegangan (kPa)</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>0</td></tr> <tr><td>0.5</td><td>150</td></tr> <tr><td>1.0</td><td>350</td></tr> <tr><td>1.5</td><td>600</td></tr> <tr><td>2.0</td><td>900</td></tr> <tr><td>2.2</td><td>955 (Peak)</td></tr> <tr><td>2.5</td><td>950</td></tr> <tr><td>3.0</td><td>800</td></tr> <tr><td>3.5</td><td>600</td></tr> <tr><td>4.0</td><td>500</td></tr> <tr><td>4.5</td><td>400</td></tr> <tr><td>5.0</td><td>300</td></tr> <tr><td>5.5</td><td>200</td></tr> </tbody> </table> | | Regangan (%) | Tegangan (kPa) | 0.0 | 0 | 0.5 | 150 | 1.0 | 350 | 1.5 | 600 | 2.0 | 900 | 2.2 | 955 (Peak) | 2.5 | 950 | 3.0 | 800 | 3.5 | 600 | 4.0 | 500 | 4.5 | 400 | 5.0 | 300 | 5.5 | 200 |
| Regangan (%) | Tegangan (kPa) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.5 | 150 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.0 | 350 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 600 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.0 | 900 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.2 | 955 (Peak) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 950 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.0 | 800 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.5 | 600 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.0 | 500 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.5 | 400 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.0 | 300 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.5 | 200 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Data Pengujian | | | | | | | | | | | | | |
|--|--------------|--------------------------|------------------------------------|------------|--------------|---|---|-------|--------|-----|--------|-----|---|
| Kadar Semen | : | 0% | | | | | | | | | | | |
| Nomer Spesimen | : | SS I | | | | | | | | | | | |
| Berat | : | 123.48 gram | | | | | | | | | | | |
| Diameter | : | 35 mm | | | | | | | | | | | |
| Tinggi (ASTM) | : | 70 mm | s/d 87.5 mm | | | | | | | | | | |
| Tinggi Spesimen | : | 70 mm | | | | | | | | | | | |
| Luas | : | 962.1128 mm ² | | | | | | | | | | | |
| Volume | : | 67347.89 mm ³ | = 67.34789 cm ³ | | | | | | | | | | |
| Berat Volume | : | 1.833 g/cm ³ | | | | | | | | | | | |
| Kecepatan Alat (ASTM) | : | 0.350 mm/menit | s/d 1.400 mm/menit | | | | | | | | | | |
| Kecepatan Yang Digunakan | : | 0.72 mm/menit | | | | | | | | | | | |
| Batas Regangan | : | 10.5 mm | | | | | | | | | | | |
| Estimasi Runtuh | : | 14.58 menit | = 875 detik | | | | | | | | | | |
| Kadar Air | | Hasil UCS | | | | | | | | | | | |
| I8 | | | | | | | | | | | | | |
| Berat Cawan | : | 9.26 gram | Kuat Tekan Bebas (qu) : 72.471 kPa | | | | | | | | | | |
| Berat Basah | : | 63.41 gram | Tegangan 50 : 36.236 kPa | | | | | | | | | | |
| Berat Kering | : | 52.11 gram | Regangan 50 : 0.969 % | | | | | | | | | | |
| Kadar Air | : | 26.4 % | Modulus Sekan (E50) : 3739.481 kPa | | | | | | | | | | |
| | | | : 3.739 MPa | | | | | | | | | | |
| | | | Jenis Keruntuhan : Brittle Failure | | | | | | | | | | |
| | | | Brittleness Index : 0.490 | | | | | | | | | | |
| Grafik Hubungan Tegangan & Regangan | | | | | | | | | | | | | |
| <p>The graph plots Stress (Tegangan) in kPa on the y-axis (0 to 1200) against Strain (Regangan) in % on the x-axis (0 to 6.5). The curve shows a linear elastic region up to approximately 2.2% strain, where the stress reaches its maximum value of 72.471 kPa. After this peak, the stress drops sharply, indicating a brittle failure mode.</p> <table border="1"> <caption>Key Data Points from Stress-Strain Graph</caption> <thead> <tr> <th>Strain (%)</th> <th>Stress (kPa)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> </tr> <tr> <td>0.969</td> <td>36.236</td> </tr> <tr> <td>2.2</td> <td>72.471</td> </tr> <tr> <td>4.5</td> <td>0</td> </tr> </tbody> </table> | | | | Strain (%) | Stress (kPa) | 0 | 0 | 0.969 | 36.236 | 2.2 | 72.471 | 4.5 | 0 |
| Strain (%) | Stress (kPa) | | | | | | | | | | | | |
| 0 | 0 | | | | | | | | | | | | |
| 0.969 | 36.236 | | | | | | | | | | | | |
| 2.2 | 72.471 | | | | | | | | | | | | |
| 4.5 | 0 | | | | | | | | | | | | |

| Data Pengujian | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|----------------|--------------------------|-------------------------------------|------------|--------------|-----|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|----------------|-----|------|-----|-----|-----|-----|-----|-----|-----|-------------|
| Kadar Semen | : | 0% | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nomer Spesimen | : | SS II | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat | : | 132.36 gram | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diameter | : | 35 mm | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tinggi (ASTM) | : | 70 mm | s/d 87.5 mm | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tinggi Spesimen | : | 70 mm | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Luas | : | 962.1128 mm ² | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Volume | : | 67347.89 mm ³ | = 67.34789 cm ³ | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Volume | : | 1.965 g/cm ³ | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kecepatan Alat (ASTM) | : | 0.35 mm/menit | s/d 1.4 mm/menit | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kecepatan Yang Digunakan | : | 0.72 mm/menit | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Batas Regangan | : | 10.5 mm | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Estimasi Runtuh | : | 14.58 menit | = 875 detik | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kadar Air | | Hasil UCS | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| B7 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Cawan | : | 9.41 gram | Kuat Tekan Bebas (qu) : 108.069 kPa | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Basah | : | 110.2 gram | Tegangan 50 : 54.035 kPa | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Kering | : | 88.15 gram | Regangan 50 : 1.443 % | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kadar Air | : | 28.0 % | Modulus Sekan (E50) : 3744.604 kPa | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | : 3.745 MPa | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Jenis Keruntuhan : Brittle Failure | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Brittleness Index : 0.465 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Grafik Hubungan Tegangan & Regangan | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>The graph plots Stress (Tegangan) in kPa on the y-axis (0 to 1200) against Strain (Regangan) in % on the x-axis (0.0 to 6.5). The curve shows a linear elastic region up to approximately 2.8% strain, where the stress reaches a peak of 108.069 kPa. After this peak, the stress drops sharply, indicating a brittle failure. The failure occurs at a strain of approximately 5.0%.</p> <table border="1"> <caption>Key Data Points from Stress-Strain Graph</caption> <thead> <tr> <th>Strain (%)</th> <th>Stress (kPa)</th> </tr> </thead> <tbody> <tr> <td>0.0</td> <td>0</td> </tr> <tr> <td>0.5</td> <td>~20</td> </tr> <tr> <td>1.0</td> <td>~40</td> </tr> <tr> <td>1.5</td> <td>~60</td> </tr> <tr> <td>2.0</td> <td>~80</td> </tr> <tr> <td>2.5</td> <td>~100</td> </tr> <tr> <td>2.8</td> <td>108.069 (Peak)</td> </tr> <tr> <td>3.0</td> <td>~100</td> </tr> <tr> <td>3.5</td> <td>~80</td> </tr> <tr> <td>4.0</td> <td>~60</td> </tr> <tr> <td>4.5</td> <td>~40</td> </tr> <tr> <td>5.0</td> <td>0 (Failure)</td> </tr> </tbody> </table> | | | | Strain (%) | Stress (kPa) | 0.0 | 0 | 0.5 | ~20 | 1.0 | ~40 | 1.5 | ~60 | 2.0 | ~80 | 2.5 | ~100 | 2.8 | 108.069 (Peak) | 3.0 | ~100 | 3.5 | ~80 | 4.0 | ~60 | 4.5 | ~40 | 5.0 | 0 (Failure) |
| Strain (%) | Stress (kPa) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.5 | ~20 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.0 | ~40 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | ~60 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.0 | ~80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | ~100 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.8 | 108.069 (Peak) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.0 | ~100 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.5 | ~80 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.0 | ~60 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.5 | ~40 | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.0 | 0 (Failure) | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Data Pengujian | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|--------------|--------------------------|--------------------------------------|------------|--------------|-----|---|-----|------|-----|------|-----|------|-----|------|-----|-------|------------|--------|-----|-------|-----|------|-----|------|-----|------|
| Kadar Semen | : | 10% | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nomer Spesimen | : | SS DRY I | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat | : | 123.77 gram | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diameter | : | 35 mm | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tinggi (ASTM) | : | 70 mm | s/d 87.5 mm | | | | | | | | | | | | | | | | | | | | | | | | |
| Tinggi Spesimen | : | 70 mm | | | | | | | | | | | | | | | | | | | | | | | | | |
| Luas | : | 962.1128 mm ² | | | | | | | | | | | | | | | | | | | | | | | | | |
| Volume | : | 67347.89 mm ³ | = 67.34789 cm ³ | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Volume | : | 1.838 g/cm ³ | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kecepatan Alat (ASTM) | : | 0.350 mm/menit | s/d 1.400 mm/menit | | | | | | | | | | | | | | | | | | | | | | | | |
| Kecepatan Yang Digunakan | : | 2.03 mm/menit | | | | | | | | | | | | | | | | | | | | | | | | | |
| Batas Regangan | : | 10.5 mm | | | | | | | | | | | | | | | | | | | | | | | | | |
| Estimasi Runtuh | : | 5.17 menit | = 310 detik | | | | | | | | | | | | | | | | | | | | | | | | |
| Kadar Air | | Hasil UCS | | | | | | | | | | | | | | | | | | | | | | | | | |
| F1 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Cawan | : | 10.49 gram | Kuat Tekan Bebas (qu) : 1227.400 kPa | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Basah | : | 102.4 gram | Tegangan 50 : 613.700 kPa | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Kering | : | 80.32 gram | Regangan 50 : 1.443 % | | | | | | | | | | | | | | | | | | | | | | | | |
| Kadar Air | : | 31.6 % | Modulus Sekan (E50) : 42529.463 kPa | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | : 42.529 MPa | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Jenis Keruntuhan : Brittle Failure | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Brittleness Index : 0.636 | | | | | | | | | | | | | | | | | | | | | | | | |
| Grafik Hubungan Tegangan & Regangan | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>The graph plots Stress (Tegangan) in kPa on the y-axis (0 to 1400) against Strain (Regangan) in % on the x-axis (0.0 to 6.5). The curve starts at the origin, rises to a peak of 1227.4 kPa at approximately 2.7% strain, and then gradually declines to about 600 kPa at 4.5% strain.</p> <table border="1"> <caption>Key Data Points from Stress-Strain Graph</caption> <thead> <tr> <th>Strain (%)</th> <th>Stress (kPa)</th> </tr> </thead> <tbody> <tr> <td>0.0</td> <td>0</td> </tr> <tr> <td>0.5</td> <td>~100</td> </tr> <tr> <td>1.0</td> <td>~300</td> </tr> <tr> <td>1.5</td> <td>~550</td> </tr> <tr> <td>2.0</td> <td>~900</td> </tr> <tr> <td>2.5</td> <td>~1150</td> </tr> <tr> <td>2.7 (Peak)</td> <td>1227.4</td> </tr> <tr> <td>3.0</td> <td>~1150</td> </tr> <tr> <td>3.5</td> <td>~850</td> </tr> <tr> <td>4.0</td> <td>~650</td> </tr> <tr> <td>4.5</td> <td>~600</td> </tr> </tbody> </table> | | | | Strain (%) | Stress (kPa) | 0.0 | 0 | 0.5 | ~100 | 1.0 | ~300 | 1.5 | ~550 | 2.0 | ~900 | 2.5 | ~1150 | 2.7 (Peak) | 1227.4 | 3.0 | ~1150 | 3.5 | ~850 | 4.0 | ~650 | 4.5 | ~600 |
| Strain (%) | Stress (kPa) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.5 | ~100 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.0 | ~300 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | ~550 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.0 | ~900 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | ~1150 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.7 (Peak) | 1227.4 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.0 | ~1150 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.5 | ~850 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.0 | ~650 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.5 | ~600 | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Data Pengujian | | | | | | | | | | | | | | | | | | | | | |
|---|---|-----------------------|-------------------|-----|---|-----|------|-----|------|-----|------|-----|-------|-----|-----------------|-----|------|-----|------|-----|------|
| Kadar Semen | : 10% | | | | | | | | | | | | | | | | | | | | |
| Nomer Spesimen | : SS DRY II | | | | | | | | | | | | | | | | | | | | |
| Berat | : 132.74 gram | | | | | | | | | | | | | | | | | | | | |
| Diameter | : 35 mm | | | | | | | | | | | | | | | | | | | | |
| Tinggi (ASTM) | : 70 mm s/d 87.5 mm | | | | | | | | | | | | | | | | | | | | |
| Tinggi Spesimen | : 70 mm | | | | | | | | | | | | | | | | | | | | |
| Luas | : 962.1128 mm ² | | | | | | | | | | | | | | | | | | | | |
| Volume | : 67347.89 mm ³ = 67.34789 cm ³ | | | | | | | | | | | | | | | | | | | | |
| Berat Volume | : 1.971 g/cm ³ | | | | | | | | | | | | | | | | | | | | |
| Kecepatan Alat (ASTM) | : 0.350 mm/menit s/d 1.400 mm/menit | | | | | | | | | | | | | | | | | | | | |
| Kecepatan Yang Digunakan | : 2.03 mm/menit | | | | | | | | | | | | | | | | | | | | |
| Batas Regangan | : 10.5 mm | | | | | | | | | | | | | | | | | | | | |
| Estimasi Runtuh | : 5.17 menit = 310 detik | | | | | | | | | | | | | | | | | | | | |
| Kadar Air | Hasil UCS | | | | | | | | | | | | | | | | | | | | |
| Z1 | | | | | | | | | | | | | | | | | | | | | |
| Berat Cawan | : 9.93 gram | Kuat Tekan Bebas (qu) | : 1067.552 kPa | | | | | | | | | | | | | | | | | | |
| Berat Basah | : 56.72 gram | Tegangan 50 | : 533.776 kPa | | | | | | | | | | | | | | | | | | |
| Berat Kering | : 45.63 gram | Regangan 50 | : 0.945 % | | | | | | | | | | | | | | | | | | |
| Kadar Air | : 31.1 % | Modulus Sekan (E50) | : 56484.229 kPa | | | | | | | | | | | | | | | | | | |
| | | | : 56.484 MPa | | | | | | | | | | | | | | | | | | |
| | | Jenis Keruntuhan | : Brittle Failure | | | | | | | | | | | | | | | | | | |
| | | Brittleness Index | : 0.581 | | | | | | | | | | | | | | | | | | |
| Grafik Hubungan Tegangan & Regangan | | | | | | | | | | | | | | | | | | | | | |
| <p>The graph plots Stress (Tegangan) in kPa on the y-axis (0 to 1200) against Strain (Regangan) in % on the x-axis (0.0 to 6.5). The curve starts at the origin, rises to a peak of approximately 1067.552 kPa at a strain of about 2.1%, and then gradually descends to about 180 kPa at a strain of 3.5%.</p> <table border="1"> <caption>Key Data Points from Stress-Strain Graph</caption> <thead> <tr> <th>Strain (%)</th> <th>Stress (kPa)</th> </tr> </thead> <tbody> <tr> <td>0.0</td> <td>0</td> </tr> <tr> <td>0.5</td> <td>~250</td> </tr> <tr> <td>1.0</td> <td>~500</td> </tr> <tr> <td>1.5</td> <td>~750</td> </tr> <tr> <td>2.0</td> <td>~1000</td> </tr> <tr> <td>2.1</td> <td>1067.552 (Peak)</td> </tr> <tr> <td>2.5</td> <td>~750</td> </tr> <tr> <td>3.0</td> <td>~300</td> </tr> <tr> <td>3.5</td> <td>~180</td> </tr> </tbody> </table> | | Strain (%) | Stress (kPa) | 0.0 | 0 | 0.5 | ~250 | 1.0 | ~500 | 1.5 | ~750 | 2.0 | ~1000 | 2.1 | 1067.552 (Peak) | 2.5 | ~750 | 3.0 | ~300 | 3.5 | ~180 |
| Strain (%) | Stress (kPa) | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 0 | | | | | | | | | | | | | | | | | | | | |
| 0.5 | ~250 | | | | | | | | | | | | | | | | | | | | |
| 1.0 | ~500 | | | | | | | | | | | | | | | | | | | | |
| 1.5 | ~750 | | | | | | | | | | | | | | | | | | | | |
| 2.0 | ~1000 | | | | | | | | | | | | | | | | | | | | |
| 2.1 | 1067.552 (Peak) | | | | | | | | | | | | | | | | | | | | |
| 2.5 | ~750 | | | | | | | | | | | | | | | | | | | | |
| 3.0 | ~300 | | | | | | | | | | | | | | | | | | | | |
| 3.5 | ~180 | | | | | | | | | | | | | | | | | | | | |

| Data Pengujian | | | | | | | | | | | | | | | | | |
|--|---|-------------------------|-----------------|-----|---|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|
| Kadar Semen | : 10% | | | | | | | | | | | | | | | | |
| Nomer Spesimen | : SS SPRAY I | | | | | | | | | | | | | | | | |
| Berat | : 132 gram | | | | | | | | | | | | | | | | |
| Diameter | : 35 mm | | | | | | | | | | | | | | | | |
| Tinggi (ASTM) | : 70 mm s/d 87.5 mm | | | | | | | | | | | | | | | | |
| Tinggi Spesimen | : 70 mm | | | | | | | | | | | | | | | | |
| Luas | : 962.1128 mm ² | | | | | | | | | | | | | | | | |
| Volume | : 67347.89 mm ³ = 67.34789 cm ³ | | | | | | | | | | | | | | | | |
| Berat Volume | : 1.960 g/cm ³ | | | | | | | | | | | | | | | | |
| Kecepatan Alat (ASTM) | : 0.350 mm/menit s/d 1.400 mm/menit | | | | | | | | | | | | | | | | |
| Kecepatan Yang Digunakan | : 2.03 mm/menit | | | | | | | | | | | | | | | | |
| Batas Regangan | : 10.5 mm | | | | | | | | | | | | | | | | |
| Estimasi Runtuh | : 5.17 menit = 310 detik | | | | | | | | | | | | | | | | |
| Kadar Air | Hasil UCS | | | | | | | | | | | | | | | | |
| U7 | | | | | | | | | | | | | | | | | |
| Berat Cawan | : 9.01 gram | Kuat Tekan Bebas (qu) : | 1099.129 kPa | | | | | | | | | | | | | | |
| Berat Basah | : 136.89 gram | Tegangan 50 : | 549.565 kPa | | | | | | | | | | | | | | |
| Berat Kering | : 117 gram | Regangan 50 : | 0.941 % | | | | | | | | | | | | | | |
| Kadar Air | : 18.4 % | Modulus Sekan (E50) : | 58402.196 kPa | | | | | | | | | | | | | | |
| | | | 58.402 MPa | | | | | | | | | | | | | | |
| | | Jenis Keruntuhan : | Brittle Failure | | | | | | | | | | | | | | |
| | | Brittleness Index : | 0.796 | | | | | | | | | | | | | | |
| Grafik Hubungan Tegangan & Regangan | | | | | | | | | | | | | | | | | |
| <p>The graph plots Stress (Tegangan) in kPa on the y-axis (0 to 1200) against Strain (Regangan) in % on the x-axis (0.0 to 6.5). The curve starts at the origin, rises to a peak of approximately 1100 kPa at a strain of about 2.5%, and then drops sharply to about 200 kPa at a strain of 3.0%.</p> <table border="1"> <caption>Approximate data points from the Stress-Strain graph</caption> <thead> <tr> <th>Regangan (%)</th> <th>Tegangan (kPa)</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>0</td></tr> <tr><td>0.5</td><td>100</td></tr> <tr><td>1.0</td><td>200</td></tr> <tr><td>1.5</td><td>350</td></tr> <tr><td>2.0</td><td>600</td></tr> <tr><td>2.5</td><td>1100</td></tr> <tr><td>3.0</td><td>200</td></tr> </tbody> </table> | | Regangan (%) | Tegangan (kPa) | 0.0 | 0 | 0.5 | 100 | 1.0 | 200 | 1.5 | 350 | 2.0 | 600 | 2.5 | 1100 | 3.0 | 200 |
| Regangan (%) | Tegangan (kPa) | | | | | | | | | | | | | | | | |
| 0.0 | 0 | | | | | | | | | | | | | | | | |
| 0.5 | 100 | | | | | | | | | | | | | | | | |
| 1.0 | 200 | | | | | | | | | | | | | | | | |
| 1.5 | 350 | | | | | | | | | | | | | | | | |
| 2.0 | 600 | | | | | | | | | | | | | | | | |
| 2.5 | 1100 | | | | | | | | | | | | | | | | |
| 3.0 | 200 | | | | | | | | | | | | | | | | |

| Data Pengujian | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|----------------|--------------------------|--------------------------------------|--------------|----------------|-----|---|-----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|
| Kadar Semen | : | 10% | | | | | | | | | | | | | | | | | | | | | | | | | |
| Nomer Spesimen | : | SS SPRAY II | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat | : | 137.14 gram | | | | | | | | | | | | | | | | | | | | | | | | | |
| Diameter | : | 35 mm | | | | | | | | | | | | | | | | | | | | | | | | | |
| Tinggi (ASTM) | : | 70 mm | s/d 87.5 mm | | | | | | | | | | | | | | | | | | | | | | | | |
| Tinggi Spesimen | : | 70 mm | | | | | | | | | | | | | | | | | | | | | | | | | |
| Luas | : | 962.1128 mm ² | | | | | | | | | | | | | | | | | | | | | | | | | |
| Volume | : | 67347.89 mm ³ | = 67.34789 cm ³ | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Volume | : | 2.036 g/cm ³ | | | | | | | | | | | | | | | | | | | | | | | | | |
| Kecepatan Alat (ASTM) | : | 0.35 mm/menit | s/d 1.400 mm/menit | | | | | | | | | | | | | | | | | | | | | | | | |
| Kecepatan Yang Digunakan | : | 2.03 mm/menit | | | | | | | | | | | | | | | | | | | | | | | | | |
| Batas Regangan | : | 10.5 mm | | | | | | | | | | | | | | | | | | | | | | | | | |
| Estimasi Runtuh | : | 5.17 menit | = 310 detik | | | | | | | | | | | | | | | | | | | | | | | | |
| Kadar Air | | Hasil UCS | | | | | | | | | | | | | | | | | | | | | | | | | |
| K9 | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Cawan | : | 9.16 gram | Kuat Tekan Bebas (qu) : 1295.851 kPa | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Basah | : | 139.39 gram | Tegangan 50 : 647.925 kPa | | | | | | | | | | | | | | | | | | | | | | | | |
| Berat Kering | : | 117.38 gram | Regangan 50 : 1.707 % | | | | | | | | | | | | | | | | | | | | | | | | |
| Kadar Air | : | 20.3 % | Modulus Sekan (E50) : 37956.96 kPa | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | : 37.957 MPa | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Jenis Keruntuhan : Brittle Failure | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Brittleness Index : 0.685 | | | | | | | | | | | | | | | | | | | | | | | | |
| Grafik Hubungan Tegangan & Regangan | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| <p>The graph plots Stress (Tegangan) in kPa on the y-axis (0 to 1400) against Strain (Regangan) in % on the x-axis (0.0 to 6.5). The curve starts at the origin, rises to a peak of approximately 1300 kPa at a strain of 4.0%, and then drops sharply to about 400 kPa at a strain of 5.0%.</p> <table border="1"> <caption>Approximate data points from the Stress-Strain Graph</caption> <thead> <tr> <th>Regangan (%)</th> <th>Tegangan (kPa)</th> </tr> </thead> <tbody> <tr><td>0.0</td><td>0</td></tr> <tr><td>0.5</td><td>50</td></tr> <tr><td>1.0</td><td>150</td></tr> <tr><td>1.5</td><td>250</td></tr> <tr><td>2.0</td><td>350</td></tr> <tr><td>2.5</td><td>450</td></tr> <tr><td>3.0</td><td>600</td></tr> <tr><td>3.5</td><td>800</td></tr> <tr><td>4.0</td><td>1300</td></tr> <tr><td>4.5</td><td>500</td></tr> <tr><td>5.0</td><td>400</td></tr> </tbody> </table> | | | | Regangan (%) | Tegangan (kPa) | 0.0 | 0 | 0.5 | 50 | 1.0 | 150 | 1.5 | 250 | 2.0 | 350 | 2.5 | 450 | 3.0 | 600 | 3.5 | 800 | 4.0 | 1300 | 4.5 | 500 | 5.0 | 400 |
| Regangan (%) | Tegangan (kPa) | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.0 | 0 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 0.5 | 50 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.0 | 150 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 1.5 | 250 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.0 | 350 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 2.5 | 450 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.0 | 600 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 3.5 | 800 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.0 | 1300 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 4.5 | 500 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 5.0 | 400 | | | | | | | | | | | | | | | | | | | | | | | | | | |

Lampiran 7 Dokumentasi pengujian kuat tekan bebas

a. *Clayshale*

1) 0% I

Gambar 7 *Clayshale* 0% I Sebelum PengujianGambar 8 *Clayshale* 0% I Sesudah Pengujian

2) 0% II

Gambar 9 *Clayshale* 0% II Sebelum PengujianGambar 10 *Clayshale* 0% II Sesudah Pengujian3) 10% *dry mix* IGambar 11 *Clayshale Dry Mix* 10% I Sebelum PengujianGambar 12 *Clayshale Dry Mix* 10% I Sesudah Pengujian

4) 10% *dry mix* IIGambar 13 *Clayshale Dry Mix* 10% II Sebelum PengujianGambar 14 *Clayshale Dry Mix* 10% II Sesudah Pengujian5) 10% *spray mix* IGambar 15 *Clayshale Spray Mix* 10% I Sebelum PengujianGambar 16 *Clayshale Spray Mix* 10% I Sesudah Pengujian6) 10% *spray mix* IIGambar 17 *Clayshale Spray Mix* 10% II Sebelum PengujianGambar 18 *Clayshale Spray Mix* 10% II Sesudah Pengujian

b. *Siltstone*

1) 0% I

Gambar 19 *Siltstone* 0% I Sebelum PengujianGambar 20 *Siltstone* 0% I Sesudah Pengujian

2) 0% II

Gambar 21 *Siltstone* 0% II Sebelum PengujianGambar 22 *Siltstone* 0% II Sesudah Pengujian3) 10% *dry mix* IGambar 23 *Siltstone Dry Mix* 10% I Sebelum PengujianGambar 24 *Siltstone Dry Mix* 10% I Sesudah Pengujian

4) 10% *dry mix* IIGambar 25 *Siltstone Dry Mix 10% II* Sebelum PengujianGambar 26 *Siltstone Dry Mix 10% II* Sesudah Pengujian5) 10% *spray mix* IGambar 27 *Siltstone Spray Mix 10% I* Sebelum PengujianGambar 28 *Siltstone Spray Mix 10% I* Sesudah Pengujian6) 10% *spray mix* IIGambar 29 *Siltstone Spray Mix 10% II* Sebelum PengujianGambar 30 *Siltstone Spray Mix 10% II* Sesudah Pengujian