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Lampiran

Hasil Pengujian

KARAKTERISTIK AGREGAT



LABORATORIUM BETON DAN ECO MATERIAL
FAKULTAS TEKNIK JURUSAN SIPIL
UNIVERSITAS HASANUDDIN

Jl. Perintis Kemerdekaan Km. 10 Makassar, 90245 Telp. 0411-587636 Fax 0411-580505

Lokasi Sampel : Batu Pecah Sungai Bii-bili
Waktu Penelitian : April - Juni 2013
Peneliti : Hartini & Andi Muhammad Hamka

REKAPITULASI HASIL PENGAMATAN
AGREGAT KASAR (BATU PECAH)

| NO. | KARAKTERISTIK AGREGAT | INTERVAL SPESIFIKASI | HASIL PENGAMATAN | KETERANGAN |
|-----|-------------------------|----------------------|------------------|-------------|
| 1 | Kadar lumpur | 0.2% - 1% | 0,67% | Memenuhi |
| 2 | Keausan | 15% - 50% | 21,09% | Memenuhi |
| 3 | Kadar air | 0.5% - 2% | 5,25% | T. Memenuhi |
| 4 | Berat volume | | | |
| | a. Kondisi lepas | 1.6 - 1.9 kg/liter | 1,50 | Memenuhi |
| | b. Kondisi padat | 1.6 - 1.9 kg/liter | 1,66 | Memenuhi |
| 5 | Absorpsi | 0.2% - 4% | 1,50% | Memenuhi |
| 6 | Berat jenis spesifik | | | |
| | a. Bj. Dasar Kering | 1.6 - 3.2 | 2,70 | Memenuhi |
| | b. Bj. Kering Permukaan | 1.6 - 3.2 | 2,74 | Memenuhi |
| | c. Bj. Nyata | 1.6 - 3.2 | 2,82 | Memenuhi |
| 7 | Modulus kehalusan | 5.5 - 8.5 | 7,82 | Memenuhi |

Makassar, 15 Mei 2013

Kepala Laboratorium Beton dan Eco Material

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UNIVERSITAS HASANUDDIN

Jl. Perintis Kemerdekaan Km. 10 Makassar, 90245 Telp. 0411-587636 Fax 0411-580505

Lokasi Sampel : Pasir Sungai Bili-bili
Waktu Penelitian : April - Juni 2013
Peneliti : Hartini & Andi Muhammad Hamka

REKAPITULASI HASIL PENGAMATAN

AGREGAT HALUS (PASIR)

| NO. | KARAKTERISTIK AGREGAT | INTERVAL SPESIFIKASI | HASIL PENGAMATAN | KETERANGAN |
|-----|-------------------------|----------------------|------------------|-------------|
| 1 | Kadar lumpur | Maks 5 % | 4,50% | Memenuhi |
| 2 | Kadar organik | < NO. 3 | No. 1 | Memenuhi |
| 3 | Kadar air | 2% - 5% | 7,05% | T. Memenuhi |
| 4 | Berat volume | | | |
| | a. Kondisi lepas | 1.4 - 1.9 kg/liter | 1,47 | Memenuhi |
| | b. Kondisi padat | 1.4 - 1.9 kg/liter | 1,61 | Memenuhi |
| 5 | Absorpsi | Maks 2% | 1,69% | Memenuhi |
| 6 | Berat jenis spesifik | | | |
| | a. Bj. Dasar Kering | 1.6 - 3.3 | 2,25 | Memenuhi |
| | b. Bj. Kering Permukaan | 1.6 - 3.3 | 2,29 | Memenuhi |
| | c. Bj. Nyata | 1.6 - 3.3 | 2,34 | Memenuhi |
| 7 | Modulus kehalusan | 2.50-3.20 | 3,39 | Memenuhi |

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Lokasi Sampel : Pasir Pantai Barombong
Waktu Penelitian : April - Juni 2013
Peneliti : Hartini & Andi Muhammad Hamka

REKAPITULASI HASIL PENGAMATAN
AGREGAT HALUS (PASIR)

| NO. | KARAKTERISTIK AGREGAT | INTERVAL SPESIFIKASI | HASIL PENGAMATAN | KETERANGAN |
|-----|-------------------------|----------------------|------------------|------------|
| 1 | Kadar lumpur | Maks 5 % | 3,16% | Memenuhi |
| 2 | Kadar organik | < NO. 3 | No. 1 | Memenuhi |
| 3 | Kadar air | 2% - 5% | 4,91% | Memenuhi |
| 4 | Berat volume | | | |
| | a. Kondisi lepas | 1.4 - 1.9 kg/liter | 1,60 | Memenuhi |
| | b. Kondisi padat | 1.4 - 1.9 kg/liter | 1,85 | Memenuhi |
| 5 | Absorpsi | Maks 2% | 1,75% | Memenuhi |
| 6 | Berat jenis spesifik | | | |
| | a. Bj. Dasar Kering | 1.6 - 3.3 | 2,43 | Memenuhi |
| | b. Bj. Kering Permukaan | 1.6 - 3.3 | 2,47 | Memenuhi |
| | c. Bj. Nyata | 1.6 - 3.3 | 2,53 | Memenuhi |
| 7 | Modulus kehalusan | 2.50-3.20 | 2,77 | Memenuhi |

Makassar, 15 Mei 2013

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Lampiran

MIX DESIGN

BETON SCC



LABORATORIUM STRUKTUR DAN BAHAN

FAKULTAS TEKNIK JURUSAN SIPIL

UNIVERSITAS HASANUDDIN

Jl. Perintis Kemerdekaan Km. 10 Makassar, 90245 Telp. 0411-587636 Fax 0411-580505

**Perencanaan Campuran (MIX DESIGN) Self Compacting Concrete (SCC)
Menggunakan Pasir Laut dan Air Laut**

Mutu Beton Rencana : 44 Mpa

Slump Flow Rencana : 65 - 75cm

DATA :

| | | | |
|------------------------------|---|--------------------------------------|--------------------|
| - Berat Jenis Semen PCC | : | 3,15 | gr/cm ³ |
| - Berat Jenis Kerikil | : | 2,74 | gr/cm ³ |
| - Berat Jenis Pasir | : | 2,47 | gr/cm ³ |
| - Berat Jenis Air Laut | : | 1,029 | gr/cm ³ |
| - Volume Silinder (15x30 cm) | : | 0,0053 | m ³ |
| - FAS | : | 0,37 | |
| - Bahan Tambah Gabungan | | | |
| Superplastisizer | : | Dosis 0,8% - 2 % dari berat semen | |
| Retarder | : | Dosis 0,15% - 0,4 % dari berat semen | |

Susunan campuran beton SCC untuk tiap meter kubik (M³) sebagai berikut :

a. Kadar Air bebas

Berdasarkan The European Guidelines for Self-Compacting Concrete, Tabel 8.2. Berbagai komposisi material pembentuk beton SCC, maka :

Digunakan air sebanyak : 210 kg/m³

b. Kadar Semen

$$\begin{aligned} \text{Kadar Semen} &= \frac{\text{Kadar Air Bebas}}{\text{FAS}} \\ &= \frac{210}{0,37} = 567,57 \text{ kg/m}^3 \end{aligned}$$

c. Volume Total Agregat (pasir&kerikil)

$$\begin{aligned} \text{Volume Total Agregat} &= 1000 - \frac{567,57}{3,15} - \frac{210}{1,029} \\ &= 615,74 \text{ Liter} \end{aligned}$$

| | | | | | | |
|--|--|----------------------------------|-------------------------------|---------------------------|--------|----------------|
| d. | Volume masing-masing Agregat | | | | | |
| | Volume Kerikil | = | 50% | x | 615,74 | = 307,87 Liter |
| | Volume Pasir | = | 50% | x | 615,74 | = 307,87 Liter |
| e. | Berat masing-masing agregat | | | | | |
| | Berat Kerikil | = | 307,87 | x | 2,74 | = 844 kg |
| | Berat Pasir | = | 307,87 | x | 2,47 | = 760 kg |
| f. | Penggunaan Bahan tambah Gabungan | | | | | |
| | Superplastisizer | : | Diambil 0,8% dari berat semen | | | |
| | | = | 0,80% | x | 567,57 | = 4,54 Kg |
| | Retarder | : | Diambil 0,2% dari berat semen | | | |
| | | = | 0,18% | x | 567,57 | = 1,02 Kg |
| Rekapitulasi Kebutuhan Campuran Beton SCC | | | | | | |
| 1. | Komposisi Mix Desain untuk 1 m ³ beton SCC | | | | | |
| | Jenis Bahan | Berat/m³ beton | | | | |
| | Semen | 567,57 | kg | | | |
| | Agregat Kasar | 843,56 | kg | | | |
| | Agregat Halus | 760,44 | kg | | | |
| | Air | 204,44 | kg | | | |
| | Superplastisizer | 4,54 | Kg | | | |
| | Retarder | 1,02 | kg | | | |
| 2. | Komposisi Mix Desain untuk Benda Uji Silinder 15x30 cm | | | | | |
| | Jenis Bahan | Berat/m³ beton | | | | |
| | | 1 Sampel Silinder | | 32 Sampel Silinder | | |
| | Semen | 3,61 | kg | 115,54 | kg | |
| | Agregat Kasar | 5,37 | kg | 171,73 | kg | |
| | Agregat Halus | 4,84 | kg | 154,81 | kg | |
| | Air | 1,30 | kg | 41,62 | kg | |
| | Superplastisizer | 0,03 | kg | 0,92 | kg | |
| | Retarder | 0,01 | kg | 0,21 | kg | |



LABORATORIUM STRUKTUR DAN BAHAN
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Perencanaan Campuran (*MIX DESIGN*) Self Compacting Concrete (SCC)
Menggunakan Pasir Sungai dan Air Tawar

Mutu Beton Rencana : 44 Mpa

Slump Flow Rencana : 65 - 75cm

DATA :

| | | | |
|------------------------------|---|--------------------------------------|--------------------|
| - Berat Jenis Semen PCC | : | 3,15 | gr/cm ³ |
| - Berat Jenis Kerikil | : | 2,74 | gr/cm ³ |
| - Berat Jenis Pasir | : | 2,29 | gr/cm ³ |
| - Volume Silinder (15x30 cm) | : | 0,0053 | m ³ |
| - FAS | : | 0,37 | |
| - Bahan Tambah Gabungan | | | |
| Superplastisizer | : | Dosis 0,8% - 2 % dari berat semen | |
| Retarder | : | Dosis 0,15% - 0,4 % dari berat semen | |

Susunan campuran beton SCC untuk tiap meter kubik (M³) sebagai berikut :

a. Kadar Air bebas

Berdasarkan The European Guidelines for Self-Compacting Concrete, Tabel 8.2. Berbagai komposisi material pembentuk beton SCC, maka :

Digunakan air sebanyak : 210 kg/m³

b. Kadar Semen

$$\begin{aligned} \text{Kadar Semen} &= \frac{\text{Kadar Air Bebas}}{\text{FAS}} \\ &= \frac{210}{0,37} = 567,57 \text{ kg/m}^3 \end{aligned}$$

c. Volume Total Agregat (pasir&kerikil)

$$\begin{aligned} \text{Volume Total Agregat} &= 1000 - \frac{567,57}{3,15} - \frac{210}{1,00} \\ &= 609,82 \text{ Liter} \end{aligned}$$

d. Volume masing-masing Agregat

$$\text{Volume Kerikil} = 50\% \times 609,82 = 304,91 \text{ Liter}$$

$$\text{Volume Pasir} = 50\% \times 609,82 = 304,91 \text{ Liter}$$

| | | | | | |
|----|----------------------------------|---|-------------------------------|---|------------------|
| e. | Berat masing-masing agregat | | | | |
| | Berat Kerikil | = | 304,91 | x | 2,74 = 802 kg |
| | Berat Pasir | = | 304,91 | x | 2,29 = 726 kg |
| f. | Penggunaan Bahan tambah Gabungan | | | | |
| | Superplastisizer | : | Diambil 0,8% dari berat semen | | |
| | | = | 0,80% | x | 567,57 = 4,54 Kg |
| | Retarder | : | Diambil 0,2% dari berat semen | | |
| | | = | 0,18% | x | 567,57 = 1,02 Kg |

Rekapitulasi Kebutuhan Campuran Beton SCC

1. Komposisi Mix Desain untuk 1 m³ beton SCC

| Jenis Bahan | Berat/m ³ beton | |
|------------------|----------------------------|----|
| Semen | 567,57 | kg |
| Agregat Kasar | 802,04 | kg |
| Agregat Halus | 726,17 | kg |
| Air | 204,44 | kg |
| Superplastisizer | 4,54 | Kg |
| Retarder | 1,02 | kg |

2. Komposisi Mix Desain untuk Benda Uji Silinder 15x30 cm

| Jenis Bahan | Berat/m ³ beton | | | |
|------------------|----------------------------|----|--------------------|----|
| | 1 Sampel Silinder | | 32 Sampel Silinder | |
| Semen | 3,61 | kg | 115,54 | kg |
| Agregat Kasar | 5,10 | kg | 163,27 | kg |
| Agregat Halus | 4,62 | kg | 147,83 | kg |
| Air | 1,30 | kg | 41,62 | kg |
| Superplastisizer | 0,03 | kg | 0,92 | kg |
| Retarder | 0,01 | kg | 0,21 | kg |

Lampiran

Hasil Pengujian

KARAKTERISTIK BETON

**LABORATORIUM BETON DAN ECO MATERIAL****FAKULTAS TEKNIK JURUSAN SIPIL****UNIVERSITAS HASANUDDIN**

Jl. Perintis Kemerdekaan Km. 10 Makassar, 90245 Telp. 0411-587636 Fax 0411-580505

Waktu Penelitian : April - Juni 2013

Penelitian : Studi Karakteristik Beton Self Compacting Concrete (SCC)
dengan Penggunaan Air Laut

Peneliti : Hartini & Andi Muhammad Hamka

PENGUJIAN KUAT TEKAN SILINDER BETON SCC*Menggunakan Air Laut dan Pasir Laut*

| No. Sampel | Umur (hari) | Berat (kg) | Tinggi (mm) | Luas (mm ²) | Berat Isi (kg/m ³) | P maks (kN) | Kuat Tekan (Mpa) | Kuat Tekan Rata-rata (Mpa) |
|------------|-------------|------------|-------------|-------------------------|--------------------------------|-------------|------------------|----------------------------|
| 1. | 1 | 12,02 | 300 | 17662,5 | 2268,5 | 190 | 10,76 | 11,32 |
| | 1 | 12,18 | 300 | 17662,5 | 2298,7 | 200 | 11,32 | |
| | 1 | 12,35 | 300 | 17662,5 | 2330,7 | 210 | 11,89 | |
| 2. | 3 | 12,34 | 300 | 17662,5 | 2328,9 | 350 | 19,82 | 18,97 |
| | 3 | 11,98 | 300 | 17662,5 | 2260,9 | 340 | 19,25 | |
| | 3 | 12,12 | 300 | 17662,5 | 2287,3 | 315 | 17,83 | |
| 3. | 7 | 12,44 | 300 | 17662,5 | 2347,7 | 560 | 31,71 | 31,05 |
| | 7 | 11,95 | 300 | 17662,5 | 2255,2 | 530 | 30,01 | |
| | 7 | 12,22 | 300 | 17662,5 | 2306,2 | 555 | 31,42 | |
| 4. | 28 | 12,38 | 300 | 17662,5 | 2336,4 | 810 | 45,86 | 45,77 |
| | 28 | 12,42 | 300 | 17662,5 | 2343,9 | 800 | 45,29 | |
| | 28 | 12,44 | 300 | 17662,5 | 2347,7 | 815 | 46,14 | |

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| | |
|------------------|---|
| Waktu Penelitian | : April - Juni 2013 |
| Penelitian | : Studi Karakteristik Beton Self Compacting Concrete (SCC) dengan Penggunaan Air Laut |
| Peneliti | : Hartini & Andi Muhammad Hamka |

PENGUJIAN KUAT TEKAN SILINDER BETON SCC

Menggunakan Air Tawar dan Pasir Sungai

| No. Sampel | Umur (hari) | Berat (kg) | Tinggi (mm) | Luas (mm ²) | Berat Isi (kg/m ³) | P maks (kN) | Kuat Tekan (Mpa) | Kuat Tekan Rata-rata (Mpa) |
|------------|-------------|------------|-------------|-------------------------|--------------------------------|-------------|------------------|----------------------------|
| 1. | 1 | 12,06 | 300 | 17662,5 | 2276,2 | 180 | 10,19 | 10,29 |
| | 1 | 11,61 | 300 | 17662,5 | 2191,6 | 175 | 9,91 | |
| | 1 | 12,23 | 300 | 17662,5 | 2308,1 | 190 | 10,76 | |
| 2. | 3 | 11,07 | 300 | 17662,5 | 2089,2 | 310 | 17,55 | 17,74 |
| | 3 | 11,78 | 300 | 17662,5 | 2223,2 | 290 | 16,42 | |
| | 3 | 12,61 | 300 | 17662,5 | 2379,8 | 340 | 19,25 | |
| 3. | 7 | 12,13 | 300 | 17662,5 | 2289,2 | 520 | 29,44 | 30,29 |
| | 7 | 12,02 | 300 | 17662,5 | 2268,5 | 535 | 30,29 | |
| | 7 | 12,10 | 300 | 17662,5 | 2283,6 | 550 | 31,14 | |
| 4. | 28 | 12,51 | 300 | 17662,5 | 2360,9 | 800 | 45,29 | 45,01 |
| | 28 | 12,22 | 300 | 17662,5 | 2306,2 | 795 | 45,01 | |
| | 28 | 12,15 | 300 | 17662,5 | 2293,0 | 790 | 44,73 | |

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 Peneliti : Hartini & Andi Muhammad Hamka

PENGUJIAN MODULUS ELASTISITAS SILINDER BETON

Menggunakan Air Laut dan Pasir Laut

| No. Sampel | Umur (Hari) | P maks (kN) | Δmax (mm) | Tinggi (mm) | Tegangan (MPa) | | Regangan | | $E = \frac{(S_2 - S_1)}{(\epsilon_2 - 0,00005)}$ | | $E = 4700 \sqrt{f'c}$ | |
|------------|-------------|-------------|-----------|-------------|----------------|----------------|----------------|----------------|--|-----------|-----------------------|-----------|
| | | | | | S ₂ | S ₁ | ε ₂ | ε ₁ | Tiap benda uji | Rata-rata | Tiap benda uji | Rata-rata |
| 1. | 1 | 190 | 0,92 | 300 | 4,529 | 0,867 | 0,000267 | 0,00005 | 16853,29 | | 15415,18 | |
| 2. | 1 | 200 | 0,93 | 300 | 4,982 | 0,732 | 0,000312 | 0,00005 | 16197,37 | 16325,49 | 15815,64 | 15812,34 |
| 3. | 1 | 210 | 0,89 | 300 | 4,303 | 0,944 | 0,000261 | 0,00005 | 15925,80 | | 16206,21 | |
| 4. | 3 | 350 | 0,690 | 300 | 7,926 | 0,849 | 0,000383 | 0,00005 | 21273,97 | | 20922,13 | |
| 5. | 3 | 340 | 0,770 | 300 | 8,153 | 0,885 | 0,00040 | 0,00005 | 20782,19 | 20964,68 | 20621,07 | 20463,89 |
| 6. | 3 | 315 | 0,710 | 300 | 7,247 | 0,965 | 0,000351 | 0,00005 | 20837,88 | | 19848,47 | |
| 7. | 7 | 560 | 1,010 | 300 | 12,682 | 1,062 | 0,000480 | 0,00005 | 27024,80 | | 26464,63 | |
| 8. | 7 | 530 | 1,020 | 300 | 12,116 | 1,117 | 0,000451 | 0,00005 | 27405,20 | 26941,55 | 25746,00 | 26185,61 |
| 9. | 7 | 555 | 0,990 | 300 | 12,456 | 1,036 | 0,000483 | 0,00005 | 26394,66 | | 26346,22 | |
| 10. | 28 | 810 | 0,740 | 300 | 18,344 | 1,287 | 0,000572 | 0,00005 | 32651,60 | | 31828,36 | |
| 11. | 28 | 800 | 0,820 | 300 | 18,117 | 1,279 | 0,000562 | 0,00005 | 32887,65 | 32647,61 | 31631,28 | 31795,36 |
| 12. | 28 | 815 | 0,740 | 300 | 18,570 | 1,276 | 0,000584 | 0,00005 | 32403,59 | | 31926,45 | |

Makassar, Juni 2013

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 Peneliti : Hartini & Andi Muhammad Hamka

PENGUJIAN MODULUS ELASTISITAS SILINDER BETON

Menggunakan Air Tawar dan Pasir Sungai

| No. Sampel | Umur (Hari) | P maks (kN) | Δmax (mm) | Tinggi (mm) | Tegangan (MPa) | | Regangan | | $E = \frac{(S_2 - S_1)}{(\epsilon_2 - 0,00005)}$ | | $E = 4700 \sqrt{f'c}$ | |
|------------|-------------|-------------|-----------|-------------|----------------|----------------|----------------|----------------|--|-----------|-----------------------|-----------|
| | | | | | S ₂ | S ₁ | ε ₂ | ε ₁ | Tiap benda uji | Rata-rata | Tiap benda uji | Rata-rata |
| 1. | 1 | 180 | 0,92 | 300 | 4,076 | 0,944 | 0,000247 | 0,00005 | 15918,77 | | 15004,03 | |
| 2. | 1 | 175 | 0,93 | 300 | 4,303 | 0,921 | 0,000273 | 0,00005 | 15158,19 | 15377,47 | 14794,18 | 15071,13 |
| 3. | 1 | 190 | 0,89 | 300 | 4,416 | 0,988 | 0,000278 | 0,00005 | 15055,45 | | 15415,18 | |
| 4. | 3 | 310 | 0,830 | 300 | 7,134 | 0,849 | 0,000353 | 0,00005 | 20718,14 | | 19690,31 | |
| 5. | 3 | 290 | 0,780 | 300 | 7,813 | 0,885 | 0,000395 | 0,00005 | 20086,55 | 19986,48 | 19044,55 | 19785,31 |
| 6. | 3 | 340 | 0,640 | 300 | 7,021 | 0,965 | 0,000366 | 0,00005 | 19154,76 | | 20621,07 | |
| 7. | 7 | 520 | 1,010 | 300 | 12,003 | 0,885 | 0,000473 | 0,00005 | 26263,44 | | 25501,95 | |
| 8. | 7 | 535 | 1,070 | 300 | 12,229 | 0,944 | 0,000476 | 0,00004 | 26151,17 | 26141,80 | 25867,15 | 25865,46 |
| 9. | 7 | 550 | 0,993 | 300 | 11,890 | 0,965 | 0,00047 | 0,00005 | 26010,79 | | 26227,27 | |
| 10. | 28 | 800 | 1,025 | 300 | 17,665 | 1,117 | 0,000567 | 0,00005 | 32010,12 | | 31631,28 | |
| 11. | 28 | 795 | 0,820 | 300 | 18,231 | 1,062 | 0,000583 | 0,00005 | 32240,51 | 31991,91 | 31532,28 | 31532,17 |
| 12. | 28 | 790 | 0,780 | 300 | 18,004 | 1,148 | 0,000581 | 0,00005 | 31725,10 | | 31432,96 | |

Makassar, Juni 2013

Kepala Laboratorium Riset Eco Material

Prof. Dr. M. Wihardi Tjaronge, S.T., M. Eng

NIP. 19680529 2002121 002



LABORATORIUM BETON DAN ECO MATERIAL
FAKULTAS TEKNIK JURUSAN SIPIL
UNIVERSITAS HASANUDDIN

Jl. Perintis Kemerdekaan Km. 10 Makassar, 90245 Telp. 0411-587636 Fax 0411-580505

| | |
|------------------|---|
| Waktu Penelitian | : April - Juni 2013 |
| Penelitian | : Studi Karakteristik Beton Self Compacting Concrete (SCC) dengan Penggunaan Air Laut |
| Peneliti | : Hartini & Andi Muhammad Hamka |

PENGUJIAN SLUMP FLOW & T₅₀ BETON SCC

Menggunakan Air Laut dan Pasir Laut

| Pengecoran | Slump Flow | | | Waktu Pengaliran | |
|------------|---------------------|---------------------|----------------|-------------------------|----------------------------|
| | Diameter Besar (cm) | Diameter Kecil (cm) | Rata-rata (cm) | T ₅₀ (detik) | T _{akhir} (detik) |
| 1 | 71 | 65 | 68 | 2,82 | 11,23 |
| 2 | 67 | 63 | 65 | 3,05 | 10,75 |
| 3 | 75 | 69 | 72 | 3,20 | 11,79 |
| 4 | 71 | 66 | 69 | 3,10 | 11,79 |
| Rata-Rata | | | 68 | 3,04 | 11,39 |

Menggunakan Air Tawar dan Pasir Sungai

| Pengecoran | Slump Flow | | | Waktu Pengaliran | |
|------------|---------------------|---------------------|----------------|-------------------------|----------------------------|
| | Diameter Besar (cm) | Diameter Kecil (cm) | Rata-rata (cm) | T ₅₀ (detik) | T _{akhir} (detik) |
| 1 | 78 | 66 | 72 | 3,62 | 13,01 |
| 2 | 72 | 68 | 70 | 3,20 | 12,55 |
| 3 | 69 | 67 | 68 | 2,65 | 10,26 |
| 4 | 73 | 68 | 71 | 3,30 | 10,26 |
| Rata-Rata | | | 70 | 3,19 | 11,52 |

Makassar, 2013
Kepala Laboratorium Beton dan Eco Material

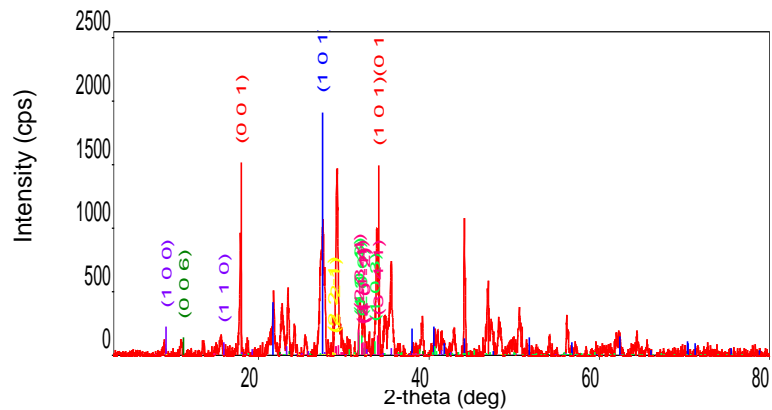
Prof. Dr. M. Wihardi Tjaronge, S.T., M. Eng
NIP. 19680529 2002121 002

Lampiran

Hasil Pengujian

MIKROSTRUKTUR BETON

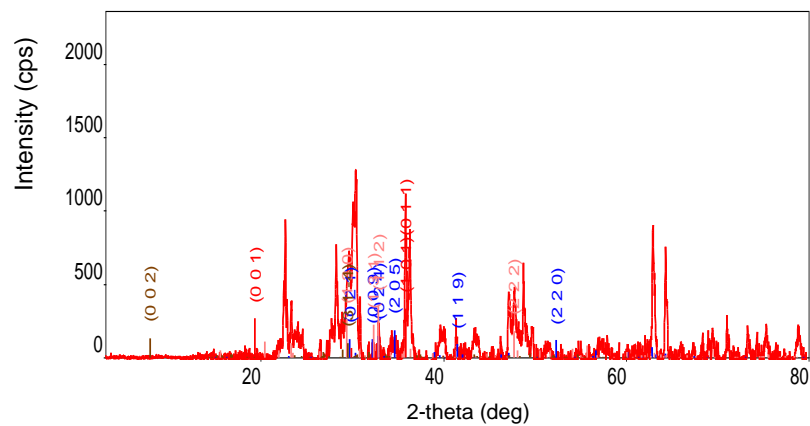
Hasil Pengujian XRD Beton Air Laut Umur 1 Hari



Quantitative analysis results (RIR)

| Phase name | Content(%) |
|---|------------|
| Portlandite, Ca(OH) ₂ | 9.92 |
| Tobermorite, 3CaO.2SiO ₂ .3H ₂ O | 32.93 |
| Garam Friedel, 3CaO.Al ₂ O ₃ .CaCl ₂ .10H ₂ O | 0.71 |
| Ettringite, 3CaO.Al ₂ O ₃ .CaSO ₄ .32H ₂ O | 1.15 |
| Trikalsium silikat, 3CaO.SiO ₂ | 19.38 |
| Dikalsium silikat, 2CaO.SiO ₂ | 35.91 |
| Trikalsium aluminat, 3CaO.Al ₂ O ₃ | - |
| Tetrakalsium Aluminoferrit, 4CaO.Al ₂ O ₃ .Fe ₂ O ₃ | - |

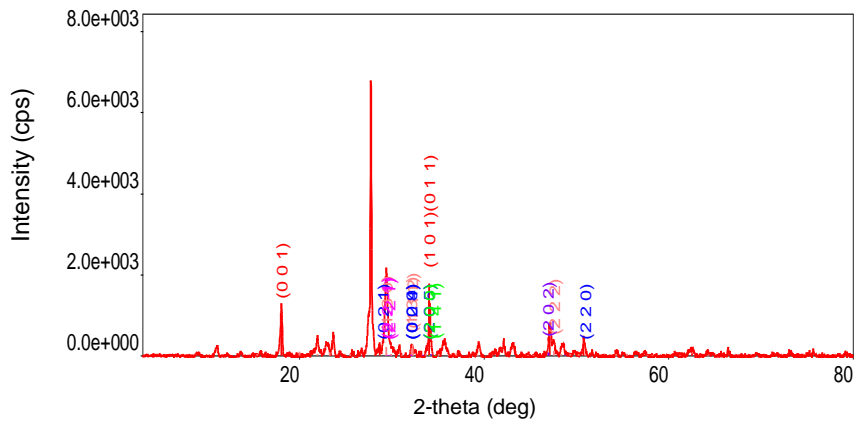
Hasil Pengujian XRD Beton Air Laut Umur 3 Hari



Quantitative analysis results (RIR)

| Phase name | Content(%) |
|---|------------|
| Portlandite, Ca(OH) ₂ | 8.10 |
| Tobermorite, 3CaO.2SiO ₂ .3H ₂ O | 35.48 |
| Garam Friedel, 3CaO.Al ₂ O ₃ .CaCl ₂ .10H ₂ O | 2.17 |
| Ettringite, 3CaO.Al ₂ O ₃ .CaSO ₄ .32H ₂ O | 4.1 |
| Trikalsium silikat, 3CaO.SiO ₂ | 16.17 |
| Dikalsium silikat, 2CaO.SiO ₂ | 33.98 |
| Trikalsium aluminat, 3CaO.Al ₂ O ₃ | - |
| Tetrakalsium Aluminoferrit, 4CaO.Al ₂ O ₃ .Fe ₂ O ₃ | - |

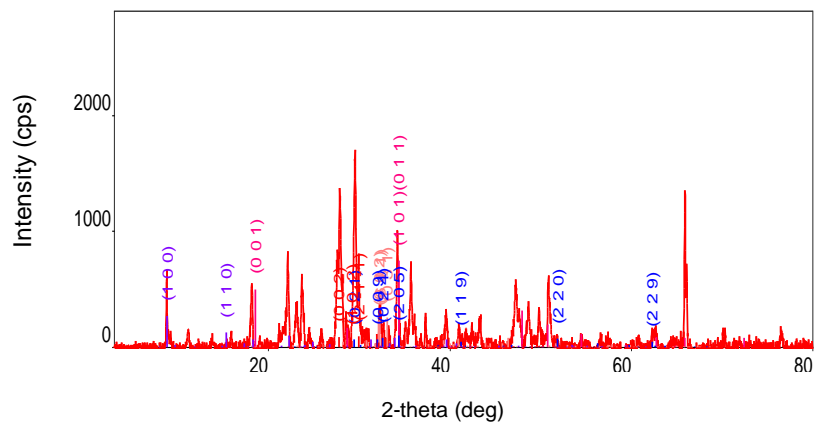
Hasil Pengujian XRD Beton Air Tawar Umur 1 Hari



Quantitative analysis results (RIR)

| Phase name | Content(%) |
|--|------------|
| Portlandite, Ca(OH) ₂ | 10.94 |
| Tobermorite, 3CaO.2SiO ₂ .3H ₂ O | 30.78 |
| Garam Friedel, 3CaO.Al ₂ O ₃ .CaCl ₂ .10H ₂ O | - |
| Ettringite, 3CaO.Al ₂ O ₃ .CaSO ₄ .32H ₂ O | - |
| Trikalsium silikat, 3CaO.SiO ₂ | 20.25 |
| Dikalsium silikat, 2CaO.SiO ₂ | 38.08 |
| Trikalsium aluminat, 3CaO.Al ₂ O ₃ | - |
| Tetrakalsium Aluminoferrit, 4CaO.Al ₂ O ₃ . Fe ₂ O ₃ | - |

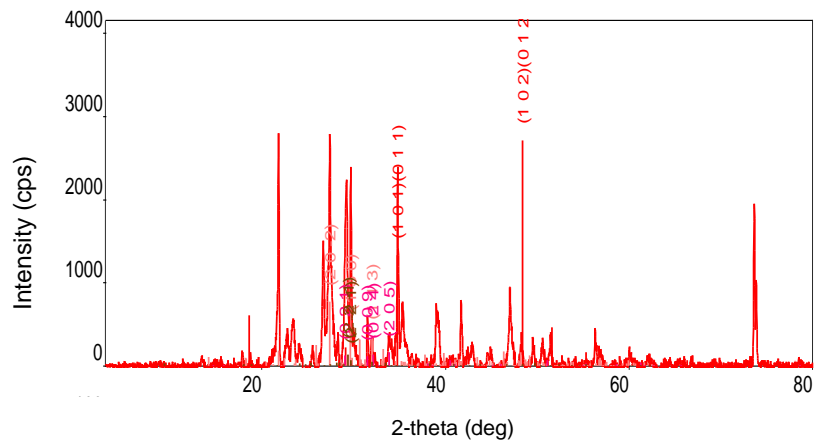
Hasil Pengujian XRD Beton Air Tawar Umur 3 Hari



Quantitative analysis results (RIR)

| Phase name | Content(%) |
|--|------------|
| Portlandite, Ca(OH) ₂ | 11.95 |
| Tobermorite, 3CaO.2SiO ₂ .3H ₂ O | 33.35 |
| Garam Friedel, 3CaO.Al ₂ O ₃ .CaCl ₂ .10H ₂ O | - |
| Ettringite, 3CaO.Al ₂ O ₃ .CaSO ₄ .32H ₂ O | - |
| Trikalsium silikat, 3CaO.SiO ₂ | 17.56 |
| Dikalsium silikat, 2CaO.SiO ₂ | 37.14 |
| Trikalsium aluminat, 3CaO.Al ₂ O ₃ | - |
| Tetrakalsium Aluminoferrit, 4CaO.Al ₂ O ₃ . Fe ₂ O ₃ | - |

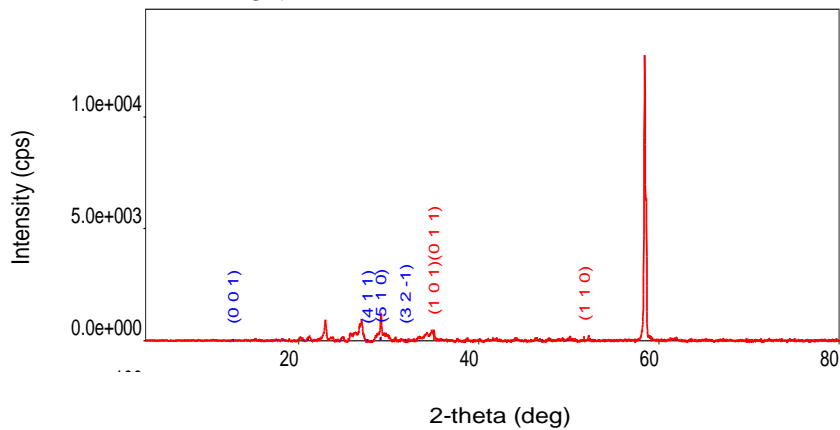
Hasil Pengujian XRD Beton Air Tawar Umur 7 Hari



Quantitative analysis results (RIR)

| Phase name | Content(%) |
|--|------------|
| Portlandite, Ca(OH) ₂ | 15.83 |
| Tobermorite, 3CaO.2SiO ₂ .3H ₂ O | 42.5 |
| Garam Friedel, 3CaO.Al ₂ O ₃ .CaCl ₂ .10H ₂ O | - |
| Ettringite, 3CaO.Al ₂ O ₃ .CaSO ₄ .32H ₂ O | - |
| Trikalsium silikat, 3CaO.SiO ₂ | 8.76 |
| Dikalsium silikat, 2CaO.SiO ₂ | 32.91 |
| Trikalsium aluminat, 3CaO.Al ₂ O ₃ | - |
| Tetrakalsium Aluminoferrit, 4CaO.Al ₂ O ₃ . Fe ₂ O ₃ | - |

Hasil Pengujian XRD Beton Air Tawar Umur 28 Hari

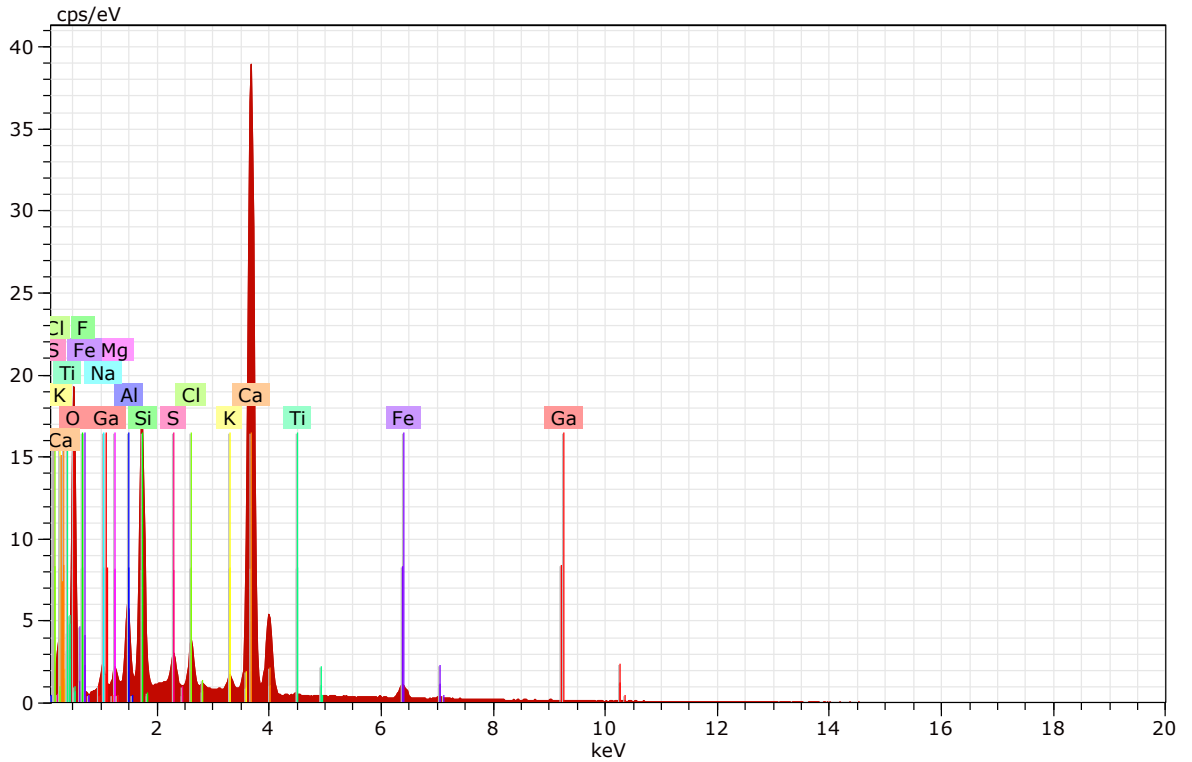


Quantitative analysis results (RIR)

| Phase name | Content(%) |
|--|------------|
| Portlandite, Ca(OH) ₂ | 21.07 |
| Tobermorite, 3CaO.2SiO ₂ .3H ₂ O | 52.66 |
| Garam Friedel, 3CaO.Al ₂ O ₃ .CaCl ₂ .10H ₂ O | - |
| Ettringite, 3CaO.Al ₂ O ₃ .CaSO ₄ .32H ₂ O | - |
| Trikalsium silikat, 3CaO.SiO ₂ | - |
| Dikalsium silikat, 2CaO.SiO ₂ | 26.27 |
| Trikalsium aluminat, 3CaO.Al ₂ O ₃ | - |
| Tetrakalsium Aluminoferrit, 4CaO.Al ₂ O ₃ . Fe ₂ O ₃ | - |

Beton SCC AL 1 H

Tescan Vega3 / Fisika_UNM

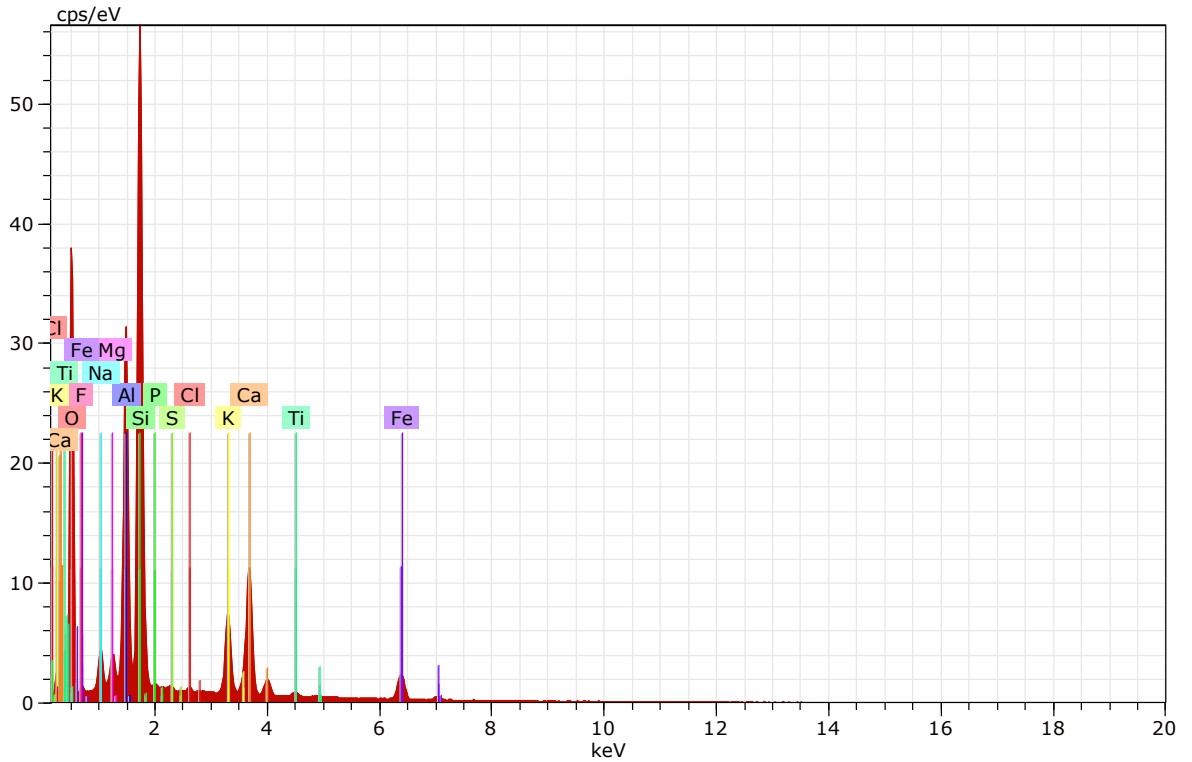


Spectrum: test

| Element | unn. C [wt.%] | norm. C [wt.%] | Atom. C [at.%] | Compound | norm. Comp. C [wt.%] | Error (3 Sigma) [wt.%] |
|-----------|---------------|----------------|----------------|----------|----------------------|------------------------|
| Oxygen | 24.87 | 34.14 | 53.63 | | 0.00 | 9.24 |
| Silicon | 6.32 | 8.68 | 7.77 | SiO2 | 18.57 | 0.90 |
| Aluminium | 2.38 | 3.27 | 3.04 | Al2O3 | 6.17 | 0.43 |
| Sodium | 1.38 | 1.89 | 2.07 | Na2O | 2.55 | 0.37 |
| Magnesium | 0.66 | 0.91 | 0.94 | MgO | 1.51 | 0.20 |
| Potassium | 0.70 | 0.96 | 0.62 | K2O | 1.16 | 0.15 |
| Calcium | 31.58 | 43.35 | 27.19 | CaO | 60.66 | 2.85 |
| Titanium | 0.07 | 0.10 | 0.05 | TiO2 | 0.17 | 0.09 |
| Iron | 1.84 | 2.53 | 1.14 | FeO | 3.25 | 0.26 |
| Sulfur | 0.87 | 1.20 | 0.94 | SO3 | 2.99 | 0.18 |
| Chlorine | 1.44 | 1.98 | 1.40 | | 1.98 | 0.23 |
| Gallium | 0.07 | 0.10 | 0.03 | | 0.10 | 0.11 |
| Fluorine | 0.65 | 0.89 | 1.18 | | 0.89 | 0.68 |
| <hr/> | | | | | | |
| Total: | 72.84 | 100.00 | 100.00 | | | |

SCC AL 3 H

Tescan Vega3 / Fisika_UNM

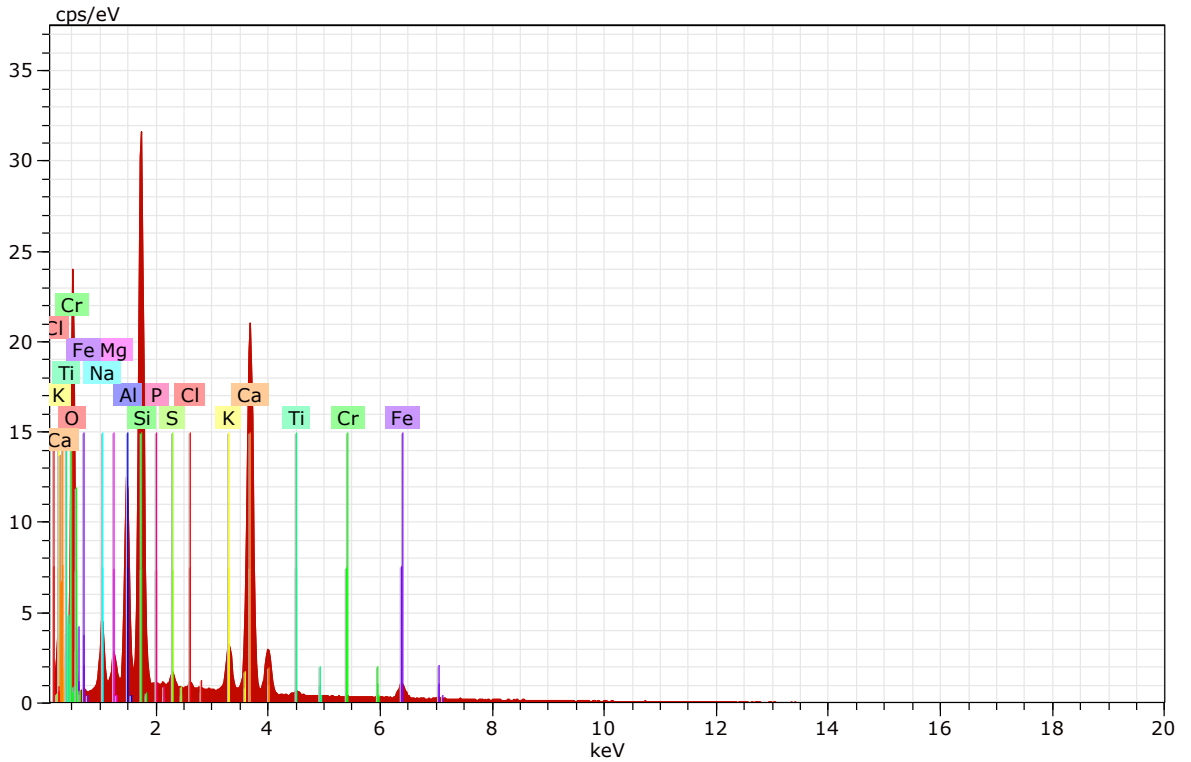


Spectrum: test

| Element | unn. C [wt.%] | norm. C [wt.%] | Atom. C [at.%] | Compound | norm. Comp. C [wt.%] | Error (3 Sigma) [wt.%] |
|------------|---------------|----------------|----------------|----------|----------------------|------------------------|
| Oxygen | 39.06 | 42.49 | 59.95 | | 0.00 | 13.67 |
| Silicon | 18.83 | 21.13 | 16.47 | SiO2 | 45.21 | 2.49 |
| Aluminium | 11.42 | 12.82 | 10.40 | Al2O3 | 24.22 | 1.72 |
| Sodium | 2.28 | 2.56 | 2.44 | Na2O | 3.46 | 0.54 |
| Magnesium | 1.33 | 1.49 | 1.34 | MgO | 2.47 | 0.31 |
| Potassium | 3.83 | 4.30 | 2.41 | K2O | 5.18 | 0.44 |
| Calcium | 7.54 | 8.46 | 4.62 | CaO | 11.84 | 0.75 |
| Titanium | 0.36 | 0.41 | 0.19 | TiO2 | 0.68 | 0.12 |
| Iron | 3.81 | 4.27 | 1.67 | FeO | 5.49 | 0.41 |
| Fluorine | 0.04 | 0.04 | 0.05 | | 0.04 | 0.15 |
| Sulfur | 0.15 | 0.17 | 0.12 | SO3 | 0.43 | 0.10 |
| Chlorine | 0.13 | 1.48 | 0.09 | | 0.14 | 0.10 |
| Phosphorus | 0.32 | 0.36 | 0.26 | P2O5 | 0.83 | 0.13 |
| <hr/> | | | | | | |
| Total: | 89.11 | 100.00 | 100.00 | | | |

SCC AL 7 H

Tescan Vega3 / Fisika_UNM

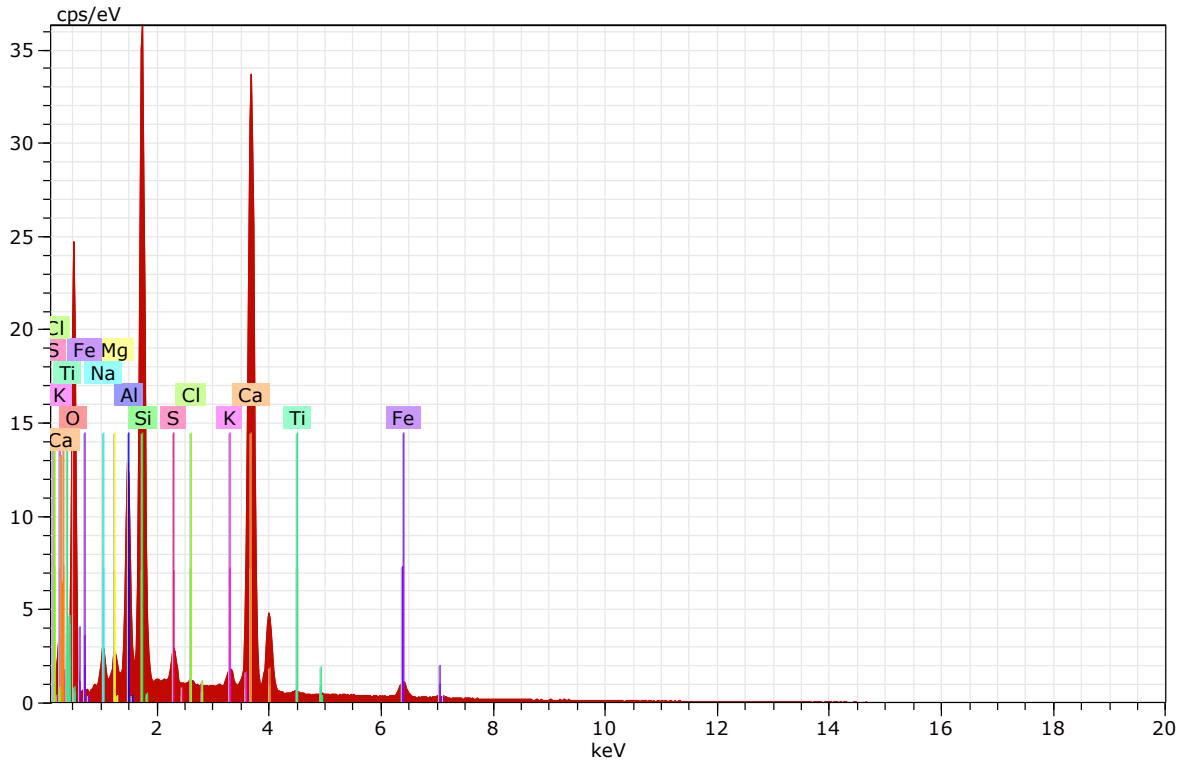


Spectrum: test

| Element | unn. C [wt.%] | norm. C [wt.%] | Atom. C [at.%] | Compound | norm. Comp. C [wt.%] | Comp. C Error (3 Sigma) [wt.%] |
|------------|---------------|----------------|----------------|----------|----------------------|--------------------------------|
| Oxygen | 34.42 | 40.23 | 57.58 | | 0.00 | 12.52 |
| Silicon | 14.33 | 16.75 | 13.66 | SiO2 | 35.84 | 1.92 |
| Aluminium | 6.37 | 7.44 | 6.32 | Al2O3 | 14.07 | 1.01 |
| Sodium | 3.71 | 4.34 | 4.32 | Na2O | 5.84 | 0.83 |
| Magnesium | 1.30 | 1.52 | 1.43 | MgO | 2.53 | 0.31 |
| Potassium | 2.09 | 2.44 | 1.43 | K2O | 2.94 | 0.28 |
| Calcium | 19.74 | 23.07 | 13.18 | CaO | 32.29 | 1.82 |
| Titanium | 0.38 | 0.44 | 0.21 | TiO2 | 0.74 | 0.13 |
| Iron | 2.15 | 2.22 | 1.03 | FeO | 3.23 | 0.29 |
| Phosphorus | 0.23 | 0.27 | 0.20 | P2O5 | 0.61 | 0.12 |
| Sulfur | 0.50 | 0.59 | 0.42 | SO3 | 1.47 | 0.14 |
| Chlorine | 0.21 | 0.54 | 0.16 | | 0.25 | 0.11 |
| Chromium | 0.12 | 0.14 | 0.06 | Cr2O3 | 0.21 | 0.10 |
| <hr/> | | | | | | |
| Total: | 85.56 | 100.00 | 100.00 | | | |

SCC AL 28 H

Tescan Vega3SB / Fisika UNM

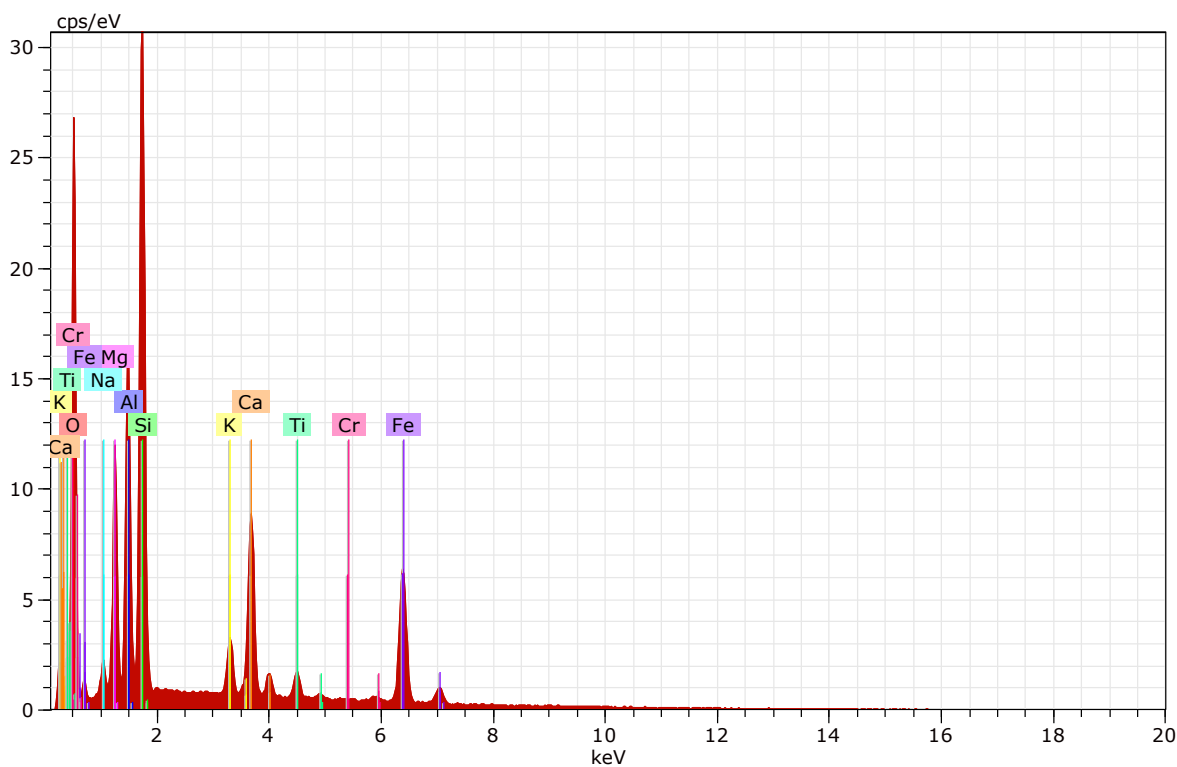


Spectrum: test

| Element | unn. C [wt.%] | norm. C [wt.%] | Atom. C [at.%] | Compound | norm. Comp. C [wt.%] | Error (3 Sigma) [wt.%] |
|---------------|---------------|----------------|----------------|----------|----------------------|------------------------|
| Oxygen | 31.68 | 39.65 | 58.00 | | 0.00 | 11.49 |
| Silicon | 12.58 | 15.75 | 13.12 | SiO2 | 33.69 | 1.69 |
| Aluminium | 4.95 | 6.19 | 5.37 | Al2O3 | 11.70 | 0.80 |
| Sodium | 1.63 | 2.04 | 2.07 | Na2O | 2.74 | 0.42 |
| Potassium | 0.73 | 0.91 | 0.54 | K2O | 1.10 | 0.15 |
| Magnesium | 0.83 | 1.04 | 1.01 | MgO | 1.73 | 0.23 |
| Calcium | 24.75 | 30.97 | 18.09 | CaO | 43.34 | 2.26 |
| Titanium | 0.10 | 0.13 | 0.06 | TiO2 | 0.22 | 0.10 |
| Iron | 1.75 | 2.19 | 0.92 | FeO | 2.81 | 0.25 |
| Sulfur | 0.82 | 1.03 | 0.75 | SO3 | 2.57 | 0.18 |
| Chlorine | 0.08 | 0.10 | 0.07 | | 0.10 | 0.09 |
| Total: | 79.90 | 100.00 | 100.00 | | | |

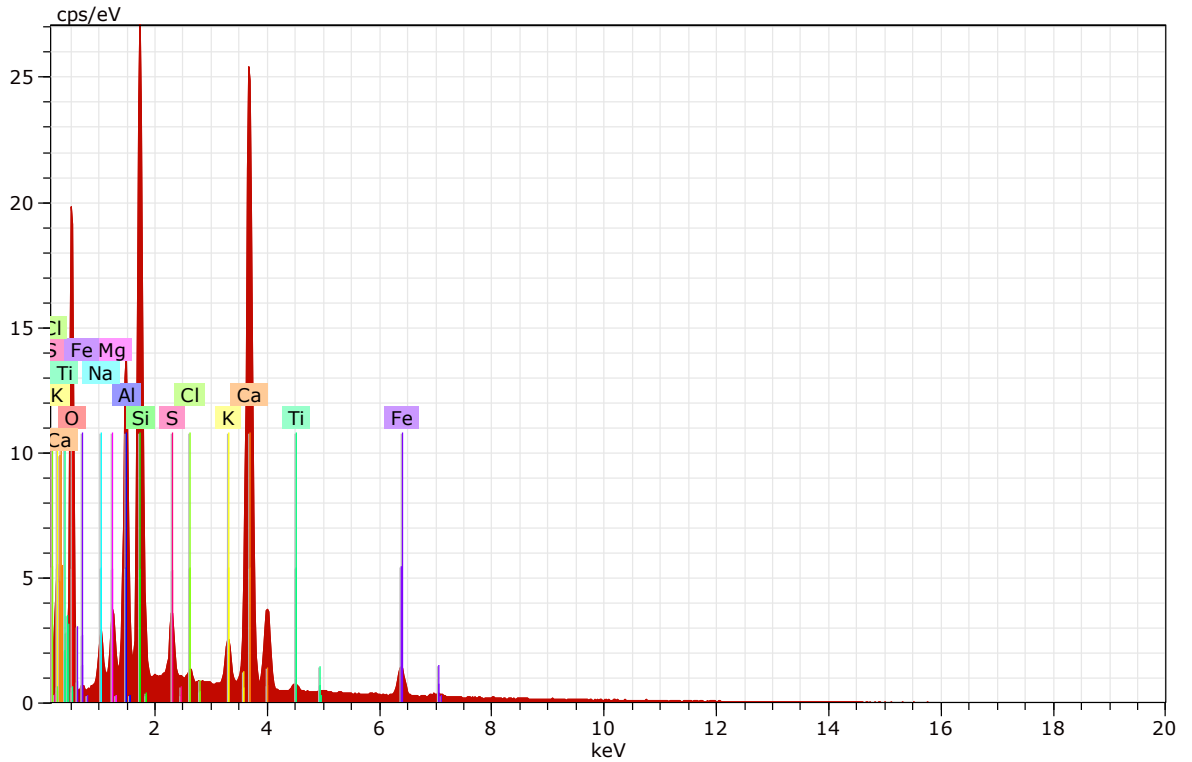
Beton SCC AT 1 H

Tescan Vega3 / Fisika_UNM



Spectrum: test

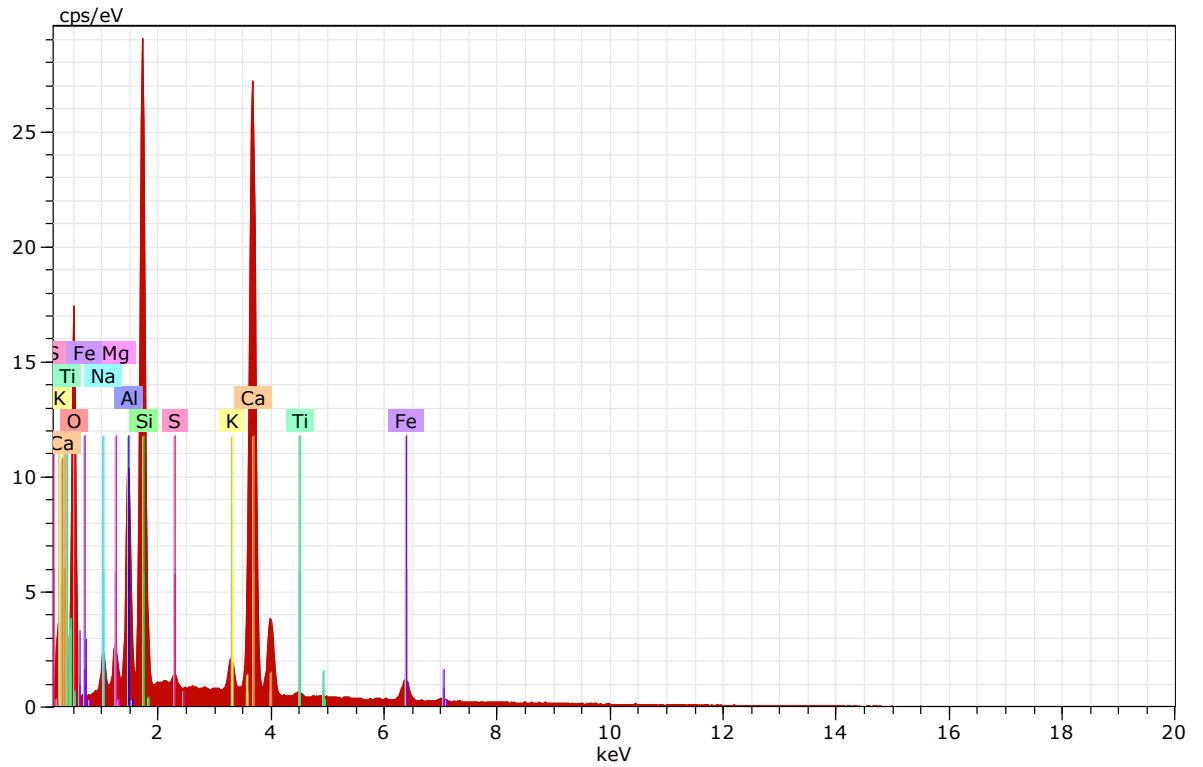
| Element | unn. C [wt.%] | norm. C [wt.%] | Atom. C [at.%] | Compound | norm. Comp. C [wt.%] | Error (3 Sigma) [wt.%] |
|-----------|---------------|----------------|----------------|----------|----------------------|------------------------|
| Oxygen | 31.40 | 39.98 | 58.13 | | 0.00 | 11.33 |
| Silicon | 12.06 | 15.36 | 12.72 | SiO2 | 32.85 | 1.63 |
| Aluminium | 7.22 | 9.19 | 7.92 | Al2O3 | 17.36 | 1.13 |
| Sodium | 1.06 | 1.35 | 1.36 | Na2O | 1.81 | 0.31 |
| Magnesium | 5.70 | 7.26 | 6.95 | MgO | 12.04 | 1.03 |
| Potassium | 1.48 | 1.89 | 1.12 | K2O | 2.27 | 0.23 |
| Calcium | 6.12 | 7.80 | 4.52 | CaO | 10.91 | 0.63 |
| Titanium | 1.27 | 1.61 | 0.78 | TiO2 | 2.69 | 0.20 |
| Iron | 12.09 | 15.40 | 6.41 | FeO | 19.81 | 1.08 |
| Chromium | 0.13 | 0.16 | 0.07 | Cr2O3 | 0.24 | 0.10 |
| Total: | 78.53 | 100.00 | 100.00 | | | |



Spectrum: test

| Element | unn. C [wt.%] | norm. C [wt.%] | Atom. C [at.%] | Compound | norm. Comp. C [wt.%] | Error (3 Sigma) [wt.%] |
|-----------|---------------|----------------|----------------|----------|----------------------|------------------------|
| Oxygen | 29.09 | 39.73 | 57.91 | | 0.00 | 10.73 |
| Silicon | 10.07 | 13.76 | 11.42 | SiO2 | 29.43 | 1.37 |
| Aluminium | 5.82 | 7.95 | 6.87 | Al2O3 | 15.01 | 0.92 |
| Sodium | 1.56 | 2.12 | 2.15 | Na2O | 2.86 | 0.40 |
| Magnesium | 1.43 | 1.95 | 1.87 | MgO | 3.23 | 0.33 |
| Potassium | 1.20 | 1.63 | 0.97 | K2O | 1.97 | 0.20 |
| Calcium | 19.99 | 27.50 | 15.89 | CaO | 38.20 | 1.84 |
| Titanium | 0.31 | 0.42 | 0.20 | TiO2 | 0.70 | 0.12 |
| Iron | 2.38 | 3.25 | 1.36 | FeO | 4.18 | 0.31 |
| Sulfur | 1.23 | 1.69 | 1.23 | SO3 | 4.21 | 0.22 |
| Total: | 73.23 | 100.00 | 100.00 | | | |

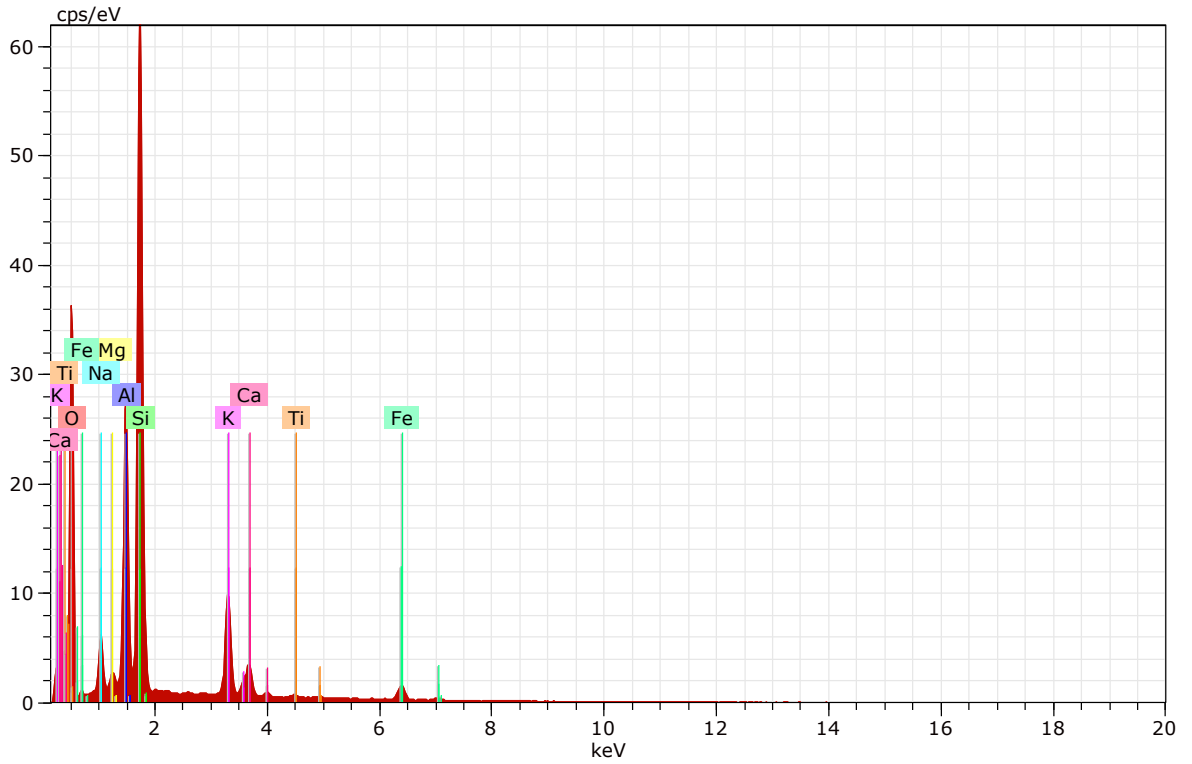
SCC AT 7 Hari - EDS
Tescan Vega3SB / Fisika UNM



Spectrum: test

| Element | unn. C [wt.%] | norm. C [wt.%] | Atom. C [at.%] | Compound | norm. Comp. C [wt.%] | Error (3 Sigma) [wt.%] |
|---------------|---------------|----------------|----------------|----------|----------------------|------------------------|
| Oxygen | 26.59 | 38.99 | 57.54 | | 0.00 | 9.97 |
| Silicon | 10.64 | 15.61 | 13.12 | SiO2 | 33.39 | 1.45 |
| Aluminium | 4.34 | 6.36 | 5.56 | Al2O3 | 12.01 | 0.71 |
| Sodium | 1.18 | 1.73 | 1.77 | Na2O | 2.33 | 0.33 |
| Magnesium | 0.85 | 1.24 | 1.21 | MgO | 2.06 | 0.23 |
| Potassium | 0.89 | 1.31 | 0.79 | K2O | 1.57 | 0.17 |
| Calcium | 21.41 | 31.40 | 18.50 | CaO | 43.93 | 1.97 |
| Titanium | 0.15 | 0.23 | 0.11 | TiO2 | 0.38 | 0.10 |
| Iron | 1.98 | 2.91 | 1.23 | FeO | 3.74 | 0.27 |
| Sulfur | 0.16 | 0.23 | 0.17 | SO3 | 0.59 | 0.10 |
| Total: | 68.20 | 100.00 | 100.00 | | | |

SCC AT 28 H
Tescan Vega3SB / Fisika UNM



Spectrum: test

| Element | unn. C [wt.%] | norm. C [wt.%] | Atom. C [at.%] | Compound | norm. Comp. C [wt.%] | Error (3 Sigma) [wt.%] |
|-----------|---------------|----------------|----------------|----------|----------------------|------------------------|
| Oxygen | 36.34 | 45.36 | 60.50 | | 0.00 | 12.78 |
| Silicon | 20.70 | 25.84 | 19.63 | SiO2 | 55.27 | 2.73 |
| Aluminium | 9.69 | 12.10 | 9.57 | Al2O3 | 22.85 | 1.47 |
| Sodium | 2.96 | 3.69 | 3.43 | Na2O | 4.98 | 0.67 |
| Potassium | 5.30 | 6.62 | 3.61 | K2O | 7.97 | 0.57 |
| Magnesium | 0.70 | 0.87 | 0.76 | MgO | 1.44 | 0.20 |
| Titanium | 0.20 | 0.25 | 0.11 | TiO2 | 0.42 | 0.11 |
| Iron | 2.31 | 2.88 | 1.10 | FeO | 3.70 | 0.29 |
| Calcium | 1.92 | 2.40 | 1.28 | CaO | 3.36 | 0.26 |
| <hr/> | | | | | | |
| Total: | 80.12 | 100.00 | 100.00 | | | |



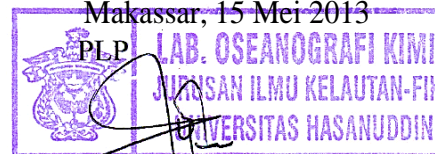
LABORATORIUM OSEANOGRAFI KIMIA
JURUSAN ILMU KELAUTAN
FAKULTAS ILMU KELAUTAN DAN PERIKANAN
UNIVERSITAS HASANUDDIN MAKASSAR
Jl. Perintis Kemerdekaan Km. 10 Kampus Unhas Tamalanrea Makassar 90245

LAPORAN HASIL UJI
No. 02/LOK/V/2013

Jenis Contoh : Air Laut
Asal Contoh : Perairan Kota Makassar
Jumlah Contoh : 01 Botol
Tanggal Analisi : 13 Mei 2013

| No | Parameter Uji | Satuan | Hasil Analisis |
|----|-----------------------------|--------------------|----------------|
| 1 | Salinitas | ‰ | 18 |
| 2 | Berat Jenis | gr/cm ³ | 1,029 |
| 3 | pH | - | 8,53 |
| 4 | Sulfat (SO ₄) | mg/l | 134 |
| 5 | Karbonat (CO ₃) | mg/l | 576,576 |
| 6 | Klorida (Cl) | mg/l | 5.303,70 |
| 7 | Kesadahan Kalsium (Ca) | mg/l | 348,348 |
| 8 | Kesadahan Magnesium (Mg) | mg/l | 1973,492 |
| 9 | Natrium (Na) | mg/l | 2.085,22 |

Makassar, 15 Mei 2013



Isyanita, S.TP., M.M

Nip. 19760122 199703 2 001

Lampiran

Dokumentasi Pengujian

1. Persiapan Bahan



2. Pengecoran dan Pengujian *Slump Flow*



3. Pengujian Kuat Tekan



4. Pengujian Elastisitas Beton

