**LAMPIRAN**

**PERHITUNGAN**

**A.1 Perhitungan Sifat Fisis Agregat**

**A.1.1 Berat jenis dan absorbsi**

Berat jenis dan absorbsi pasir pada pengujian ini dihitung berdasarkan persamaan (2.5), (2.6), dan (2.7).

Benda uji kering oven (W1) = 484 gram

Gelas ukur + air + plat kaca (W2) = 2233 gram

Gelas ukur + pasir + air + plat kaca (W3) = 2536 gram

Berat benda uji jenuh kering permukaan (W4) = 500 gram

Isi air pada suhu 28oC () = 1 gram/cm³

Berat jenis SSD = = 2,538 gram/cm³

Berat jenis OD = = 2,457 gram/cm³

Absorbsi air =x 100%= 3,306%

Untuk sampel II diperoleh berat jenis ssd pasir sebesar 2,500 gram/cm³ dengan absorbsi air sebesar 3,306%. Selengkapnya perhitungan berat jenis dan absorbsi untuk sampellainnya dengan cara yang sama diperlihatkan pada Tabel A.1.

**Tabel A.1**Berat Jenis Dan Absorbsi Agregat Halus

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| No | Berat | Notasi | Sampel | | |
| I | II | III |
| 1 | Benda Uji Kering Oven (gram) | W1 | 484 | 484 | 482,5 |
| 2 | Piknometer + Air + Plat Kaca (gram) | W2 | 2233 | 2233 | 2233 |
| 3 | Piknometer + Pasir Jenuh Kering-Permukaan + Air + Plat Kaca (gram) | W3 | 2536 | 2533 | 2534 |
|
| 4 | Volume Air Pada Suhu 28°C (gram) | ˠd | 1 | 1 | 1 |
| 5 | Benda Uji Jenuh Kering-Permukaan (gram) | W4 | 500 | 500 | 500 |
| 6 | Berat Jenis Pasir Dalam Keadaan Jenuh Kering-Permukaan |  | 2,538 | 2,500 | 2,513 |
|
| Rata-rata BJ(SSD) | | | 2,517 | | |
| 7 | Berat Jenis Pasir Dalam Keadaan Kering Oven |  | 2,457 | 2,420 | 2,425 |
|
| Rata-rata BJ(OD) | | | 2,434 | | |
| 8 | Penyerapan Air |  | 3,306 | 3,306 | 3,627 |
|
| Rata-rata (Wa) | | | 3,413 | | |

Berat jenis dan absorbsi batu pecah pada pengujian ini dihitung berdasarkan persamaan (2.5), (2.6), dan (2.8).

Benda uji kering oven (W1) = 980 gram

Benda uji jenuh kering permukaan (W2) = 1000 gram

Benda uji jenuh kering permukaandalam air (W3) =610 gram

Isi air pada suhu 28oC () = 1 gram/cm³

Berat jenis SSD = = 2,564 gram/cm³

Berat jenis OD = = 2,513 gram/cm³

Absorbsi air = x 100%= 2,041%

Untuk sampel II diperoleh berat jenis ssd batu pecah sebesar 2,624 gram/cm³ dengan absorbsi air sebesar 1,482%. Selengkapnya perhitungan berat jenis dan absorbsi untuk sampel lainnya diperlihatkan pada Tabel A.2.

**Tabel A.2**Berat Jenis dan Absorbsi Agregat Kasar

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| No. | Berat | Notasi | Sampel | | |
| I | II | III |
| 1 | Benda Uji Jenuh Kering-Permukaan Dalam Air (gram) | W3 | 610 | 612 | 611,5 |
|
| 2 | Benda Uji Kering Oven (gram) | W1 | 980 | 979 | 981 |
| 3 | Benda Uji Jenuh Kering-Permukaan (gram) | W2 | 1000 | 1000 | 1000 |
| 4 | Volume Air Pada Suhu 28°C (gram) | ˠd | 1 | 1 | 1 |
| 5 | Berat Jenis Batu Pecah Dalam Keadaan Jenuh Kering-Permukaan |  | 2,564 | 2,577 | 2,574 |
|
| Rata-rata BJ(SSD) | | | 2,572 | | |
| 6 | Berat Jenis Batu Pecah Dalam Keadaan Kering Oven |  | 2,513 | 2,523 | 2,525 |
|
| Rata-rata BJ(OD) | | | 2,520 | | |
| 7 | Penyerapan Air |  | 2,041 | 2,145 | 1,937 |
|
| Rata-rata (Wa) | | | 2,041 | | |

**A.1.2 Berat volume**

Berat volume gembur pasir pada pengujian ini dapat dihitung berdasarkan persamaan (2.8).

Berat plat kaca (W1) = 2240gram

Berat literan (W2) = 4133gram

Berat literan + plat kaca + air (W3) = 9410gram

Berat air dalam literan (W4) = W3–(W1+W2) = 9410 – 6373 = 3028 gram

Berat literan + benda uji(W5) = 8320 gram

Jadi, berat volume gembur = = 1,383 gram/cm3

Untuk sampel I diperoleh berat volume gembur sebesar 1,383gram/cm3. Selengkapnya perhitungan berat volume gembur dan padatagregat halus dan agregat kasaruntuk sampel lainnya diperlihatkan pada Tabel A.3 dan A.4.

**Tabel A.3** Berat Volume Gembur dan Padat Agregat Halus

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| No | Berat | Volume Gembur | | | Volume Padat | | |
| I | II | III | I | II | III |
| 1 | Plat Kaca (gram) | 2224 | 2224 | 2224 | 2224 | 2224 | 2224 |
| 2 | Silinder (gram) | 4133 | 4133 | 4133 | 4133 | 4133 | 4133 |
| 3 | Silinder + Plat Kaca +Air (gram) | 9410 | 9410 | 9410 | 9410 | 9410 | 9410 |
| 4 | Volume Air (cm3) | 3030 | 3030 | 3030 | 3030 | 3030 | 3030 |
| 5 | Silinder + Benda Uji (gram) | 8320 | 8350 | 8360 | 9180 | 9120 | 9160 |
| 6 | Berat Volume (gram/cm3) | 1,383 | 1,393 | 1,394 | 1,667 | 1,648 | 1,659 |
| Berat Volume Sampel Rata-rata | | 1,390 | | | 1,658 | | |

**Tabel A.4** Berat Volume Gembur dan Padat Agregat Kasar

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| No | Berat | Volume Gembur | | | Volume Padat | | |
| I | II | III | I | II | III |
| 1 | Plat Kaca (gram) | 2224 | 2224 | 2224 | 2224 | 2224 | 2224 |
| 2 | Silinder (gram) | 4133 | 4133 | 4133 | 4133 | 4133 | 4133 |
| 3 | Silinder + Plat Kaca +Air (gram) | 9410 | 9410 | 9410 | 9410 | 9410 | 9410 |
| 4 | Volume Air (cm3) | 3030 | 3030 | 3030 | 3030 | 3030 | 3030 |
| 5 | Silinder + Benda Uji (gram) | 8780 | 8760 | 8790 | 9150 | 9130 | 9100 |
| 6 | Berat Volume (gram/cm3) | 1,533 | 1,529 | 1,538 | 1,657 | 1,649 | 1,640 |
| Berat Volume Sampel Rata-rata | | 1,53 | | | 1,649 | | |

**A.1.3 Analisa saringan**

Pemeriksaan analisa saringan agregat halus untuk melihat gradasi dan MHB agregat. Untuk masing-masing sampel, hasil perhitungan analisa saringan agregat halus diperlihatkan pada Tabel A.5 sampai dengan A.7 dan gambar A.1 sampai dengan A.4.Sedangkan perhitungan agregat kasar diperlihatkan pada Tabel A.8 sampai dengan A.10 dan gambar A.5 sampai dengan A.8.

**Tabel A.5**Analisa Saringan Agregat Halus Sampel I

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SAMPEL | No. Saringan | Berat Saringan | Berat Saringan + Agregat (gr) | Berat Tertahan | % tertahan | % tertinggal komulatif | % lolos komulatif |
| I | 9,500 | 432,0 | 432.0 | 0.0 | 0.00 | 0.00 | 100.00 |
| 4,750 | 418,5 | 418,5 | 0.0 | 0.00 | 0.00 | 100.00 |
| 2,360 | 405,5 | 622,0 | 216,5 | 21,65 | 21,65 | 78,35 |
| 1,180 | 369,0 | 636,0 | 268,0 | 26,80 | 48,45 | 51,55 |
| 0,600 | 359,0 | 622,5 | 263,5 | 26,35 | 74,80 | 25,20 |
| 0,300 | 369.5 | 517,5 | 148,0 | 14,80 | 89,60 | 10,40 |
| 0,150 | 350,0 | 429,0 | 79,0 | 7,90 | 97,50 | 2,50 |
| Sisa | 336,0 | 361,0 | 25,0 | 2,50 | 100.00 | 0.00 |
| **JUMLAH** | | | **1000** | **100** | **332,0** | **368,0** |

**Gambar A.1** Grafik Analisa Saringan Agregat Halus Sampel I

**Tabel A.6**Analisa Saringan Agregat Halus Sampel II

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SAMPEL | No. Saringan | Berat Saringan | Berat Saringan + Agregat (gr) | Berat Tertahan | % tertahan | % tertinggal komulatif | % lolos komulatif |
| II | 9,50 | 432.0 | 432.0 | 0.00 | 0.000 | 0.000 | 100.000 |
| 4,75 | 418,5 | 418,5 | 0.00 | 0.000 | 0.000 | 100.000 |
| 2,36 | 405,5 | 691,5 | 286,0 | 28,60 | 28,60 | 71,4 |
| 1,18 | 368,0 | 659,5 | 291,5 | 29,15 | 57,75 | 42,25 |
| 0,60 | 359,0 | 586,5 | 227,0 | 22,70 | 80,45 | 19,55 |
| 0,30 | 369.5 | 476,0 | 106,5 | 10,65 | 91,10 | 8,9 |
| 0,15 | 350,0 | 410,0 | 60,0 | 6,0 | 97,10 | 2,9 |
| Sisa | 336,0 | 365,0 | 29,0 | 2,9 | 100.000 | 0.000 |
| **JUMLAH** | | | **1000** | **100** | **355,0** | **345,0** |

**Gambar A.2**Grafik Analisa Saringan Agregat Halus Sampel II

**Tabel A.7**Analisa Saringan Agregat Halus Sampel III

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SAMPEL | No. Saringan | Berat Saringan | Berat Saringan + Agregat (gr) | Berat Tertahan | % tertahan | % tertinggal komulatif | % lolos komulatif |
| III | 9,50 | 432,0 | 432,0 | 0.00 | 0.000 | 0.000 | 100.000 |
| 4,75 | 418,5 | 418,5 | 0.00 | 0.000 | 0.000 | 100.000 |
| 2,36 | 405,5 | 588,0 | 182,5 | 18,25 | 18,25 | 81,75 |
| 1,18 | 368,0 | 631,0 | 263,0 | 26,30 | 44,55 | 55,45 |
| 0,60 | 359,0 | 619,0 | 260,0 | 26,00 | 70,55 | 29,45 |
| 0,30 | 369.5 | 518,0 | 148,5 | 14,85 | 85,40 | 14,60 |
| 0,15 | 350,0 | 451,0 | 101,0 | 10,10 | 95,50 | 4,5 |
| Sisa | 336,0 | 381,0 | 45,0 | 4,50 | 100.000 | 0.000 |
| **JUMLAH** | | | **1000** | **100** | **314,25** | **385,75** |
| **RATA-RATA** | | | | | | **333,75** | |
| **MODULUS KEHALUSAN BUTIR (MHB)** | | | | | | **3.338** | |

**Gambar A.3**Grafik Analisa Saringan Agregat Halus Sampel III

**Gambar A.4** Grafik Gabungan Analisa Saringan Agregat Halus

**Tabel A.9**Analisa Saringan Agregat Kasar Sampel I

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SAMPEL | No. Saringan | Berat Saringan | Berat Saringan + Agregat (gr) | Berat Tertahan | % tertahan | % tertinggal komulatif | % lolos komulatif |
| I | 38.10 | 531,000 | 531,000 | 0,0 | 0,000 | 0,000 | 100,000 |
| 19.00 | 515,000 | 516,000 | 1,0 | 0,067 | 0,067 | 99,933 |
| 12.70 | 412,500 | 1336,00 | 923,5 | 61,587 | 61,654 | 38,346 |
| 9.50 | 418,500 | 901,50 | 483,0 | 32,211 | 93,865 | 6,135 |
| 4,75 | 327,000 | 419,00 | 92,0 | 6,135 | 100,000 | 0,000 |
| sisa | 531,000 | 531,000 | 0,0 | 0,000 | 0,000 | 100,000 |
| **JUMLAH** | | | **1500** | **100** | **655,585** | **244,4** |

**Gambar A.5**Grafik Analisa Saringan Agregat Kasar Sampel I

**Tabel A.9**Analisa Saringan Agregat Kasar Sampel II

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SAMPEL | No. Saringan | Berat Saringan | Berat Saringan + Agregat (gr) | Berat Tertahan | % tertahan | % tertinggal komulatif | % lolos komulatif |
| II | 38.10 | 531,000 | 531,000 | 0,000 | 0,000 | 0,000 | 100,000 |
| 19.00 | 515,000 | 516,000 | 1,000 | 0,067 | 0,067 | 99,933 |
| 12.70 | 412,500 | 1130,00 | 717,500 | 47,833 | 47,900 | 52,100 |
| 9.50 | 418,500 | 1043,00 | 624,500 | 41,633 | 89,533 | 10,467 |
| 4,75 | 327,000 | 484,00 | 157,000 | 10,467 | 100,000 | 0,000 |
| sisa | 531,000 | 531,000 | 0,000 | 0,000 | 0,000 | 100,000 |
| **JUMLAH** | | | **1500** | **100** | **637,500** | **262,500** |

**Gambar A.6**Grafik Analisa Saringan Agregat Kasar Sampel II

**Tabel A.10**Analisa Saringan Agregat Kasar Sampel III

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| SAMPEL | No. Saringan | Berat Saringan | Berat Saringan + Agregat (gr) | Berat Tertahan | % tertahan | % tertinggal komulatif | % lolos komulatif |
| III | 38.10 | 531,000 | 531,000 | 0,0 | 0,000 | 0,000 | 100,000 |
| 19.00 | 515,000 | 520,000 | 5,0 | 0,333 | 0,333 | 99,667 |
| 12.70 | 412,500 | 1261,00 | 848,5 | 56,567 | 56,900 | 43,100 |
| 9.50 | 418,500 | 974,50 | 556,0 | 37,067 | 93,967 | 6,033 |
| 4,75 | 327,000 | 417,50 | 90,5 | 6,033 | 100,000 | 0,000 |
| sisa | 531,000 | 531,000 | 0,0 | 0,000 | 0,000 | 100,000 |
| **JUMLAH** | | | **1500** | **100** | **651,200** | **248,800** |
| **RATA - RATA** | | | | | | **648,095** | |
| **MODULUS KEHALUSAN BUTIR (MHB)** | | | | | | **6,481** | |

**Gambar A.7**Grafik Analisa Saringan Agregat Kasar Sampel III

**Gambar A.8** Grafik Gabungan Analisa Saringan Agregat Kasar

**A.1.4 Kadar kelembaban**

Kadar kelembaban agregat halus pada pengujian ini dihitung berdasarkan persamaan (2.4).

Berat cawan (W1) = 78,5 gram

Berat cawan+ benda uji (W2) = 578,5 gram

Berat cawan+ benda uji kering oven (W3) = 573,5 gram

Jadi, kadar air pasir =x 100% = 1,010%

Untuk sampel I diperoleh kadar air sebesar 1,010%. Data selengkapnya perhitungan kadar kelembabanagregat halus dan kasar untuk sampel lainnya diperlihatkan pada Tabel A.11 dan A.12.

**Tabel A.11** Kadar Air Agregat Halus

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| No. | Berat | Notasi | Sampel | | | |
| I | II | | III |
| 1 | Berat Cawan (gram) | W1 | 78,5 | 113,0 | | 116,0 |
| 2 | Berat Cawan + Agregat (gram) | W2 | 578,5 | 613,0 | | 616,0 |
| 3 | Berat Cawan + Agregat Kering Oven (gram) | W3 | 573,5 | 609 | | 609 |
| 4 | Kadar Air (%) |  | 1,010 | 0,806 | | 1,420 |
|
| Kadar Air Rata-rata | | | 1,079 | | | |
| **Tabel A.12** Kadar Air Agregat Kasar | | | | | | |
| No. | Berat | Notasi | Sampel | | | |
| I | | II | III |
| 1 | Berat Cawan (gram) | W1 | 244,5 | | 284,0 | 118,0 |
| 2 | Berat Cawan + Agregat (gram) | W2 | 5244,5 | | 5284,0 | 5118,0 |
| 3 | Berat Cawan + Agregat Kering Oven (gram) | W3 | 5179,5 | | 5198 | 5050 |
| 4 | Kadar Air (%) |  | 0,013 | | 0,018 | 0,014 |
|
| Kadar Air Rata-rata | | | 0,015 | | | |