SalierGeotechnical Limited

**Determination of Particle Size Distribution (Modified)**
Nominal Size of Aggregate 40mm or greater

Lab Test Reference

British Standard Reference: Was BS 812: Part 103: 1985 and is currently

**BS EN 933-1:1996**
**Tests for geometrical properties of aggregates**
**Part 1: Determination of particle size distribution**
**Sieving method**

**Principal Apparatus** as follows: -

Riffle Boxes, 63mm, 50mm, 40.Om, 14mm gaps should be at hand and available for use depending on the nominal size of aggregate being tested. Type as shown in **BS EN 933-2:1996 Tests for geometrical properties of aggregates - Part 2: Determination of particle size distribution: Test sieves, nominal size of apertures**

ii. A ventilated drying oven controlled to maintain a temperature of 105 ~/- 5 deg. C.

iii. Electronic Balance to weight at least 30kg to I grm.

iv. The BS Test Sieves with a yellow label will be signed out from the sieve store on request and will be selected from the following Table, depending on the type of material being tested.

Sieves to be used in Particle Size Analysis

| Nominal Aperture Size | | |
|---|---|---|
| Square Hole Perf. Plate | | Wire Cloth, |
| 450 or 300mm Diameter | | 300 or 200mm |
| mm | | mm |
| 75 | | 3.35 |
| 63 | | 2.36 |
| 50 | | 1.7 |
| 37.5 | | 1.18 |
| 28 | | |
| 20 | | um |
| 14 | | 600 |
| 10 | | 425 |
| 6.3 | | 300 |
| 5 | | 150 |
| | | 75* |

* For some applications a 63 um may be used

v. A Mechanical Sieve Shaker installed in the sound proof cupboard.

vi. Clean Square Trays sufficiently large to completely contain the sample. A stiff bristle sieve brush.

General laboratory ware.

vii. Washing Apparatus.

1. Preliminaries

1.1 A designated area will be used to perform this test and a clear area of bench must first be allotted before this test proceeds.

1.2 Ensure that the sample number and test schedule correspond.

1.3 Obtain a test worksheet from the Cabinet.

1.4 All equipment to be used in this test must first be checked.

1.5 Check the calibration status of the oven and balance.

1.6 Check the sieves as required on receipt. If any marks, dents or splits are present on the mesh, they will be taken out of service, this includes the washing sieves.

2. Standard Test Method

2.1 The aggregate used in this test will have been obtained from a bulk sample that was initially taken and prepared in the manner described in
**BS EN 932-1:1999**. **Tests for general properties of aggregates Part 1: Methods for sampling and**
**BS EN 932-2:1999**. **Tests for general properties of aggregates Part 2: Methods for reducing laboratory samples**

2.2 The test portion should have the minimum mass as shown below.

| Minimum Mass of Test Portion for Sieve Analysis | | |
|---|---|---|
| Nominal Size of Material | | Minimum Mass of Test Portion |
| mm | | kg |
| 63 | | 50 |
| 50 | | 35 |
| 40 | | 15 |
| 28 | | 5 |
| 20 | | 2 |
| BS Method must be used for these sizes | | |
| 14 | | 1 |
| 10 | | 0.5 |
| 6 | | 0.2 |
| 5 | | 0.2 |
| 3 | | 0.2 |
| <3 | | 0.1 |

2.3 The sample will be weighed to the nearest 0.1 gram and the weight recorded on the test sheet as W I in Box 1.

2.4 Dry the sample in the oven at a temperature of 105~/-5 deg.C to achieve a constant mass of 0.1%. This is usually overnight and for a period of at least sixteen hours. Record time in oven in Box 2 and the time out of oven in Box 3.

2.5 The sample shall be allowed to cool and weighed to the nearest 0.1 gram and the weight recorded on the test sheet as Ml in Box 4.

3.0 Complete Washing Method

3.1 Place a 450mm dia 20mm and a 5.0mm sieve on top of a receiver on the laboratory floor.

3.2 The whole of the sample to be washed shall now be placed on the top of these two 450mm dia. Sieves which will be shaken in order to separate the 20mm, 5mm and passing 5mm portions, incrementally if required, to prevent overloading.

3.3 The material retained on the 20.0mm sieve will then be weighed to the nearest 0.1 grms and the weight recorded as (RI) in Box 5.

3.4 Set-up the washing stand so that the 450mm dia 5.0mm mesh sieve rests on top of the deep 450mm dia. Reinforced 75um sieve on the stand. Place a 200mm dia. 75um sieve beneath the output of the washing stand. Wet both sides of the 7Sum sieves before use.

3.5 Place two large trays on an adjacent bench surface ready for the washed material.

3.6 Place the dry sieved material retained on the 20mm sieve on the washing stand and gently spray with water until the aggregate is completely clean, agitating the material to displace fines.

3.7 The material will then be removed from the 5mm sieve on the washing stand and will be placed in one of the clean trays on the bench.

3.8 The material retained on the 5.0mm sieve after sieving in para 3.2 will then be weighed to the nearest 0.1 grms and the weight recorded as (R2) in Box 6.

3.9 The material retained on this 5.0mm sieve will then be placed into the washing stand in increments of up to 1.5kg., each of which will be gently sprayed with water and agitated until the aggregate is clean. After washing, each of the increments will be added to the tray in which the washed 20mm material was placed.

3.10 When the whole of the material retained on the 5.0mm sieve has been washed the residue that was washed through the 5.0mm sieve and retained on the two 7Sum sieves on the washing stand will be back washed into the tray with the other aggregate, care being taken not to loose any of the material. Excess water may be decanted back through the small 7Sum sieve.

3.11 The sample will be numbered sub-number I and put to one side.

3.12 The dry material that passed the 5.0mm sieve in para 3.2 will first be weighed to the nearest 0.1 grms and the weight shall be recorded as (M2) in Box 7.

It will then be reduced through a 14mm size riffle box and a portion of not more than 0.5kg be taken. The weight of the portion will be recorded as (M3) in Box 8.

3.13 This portion will now be washed through the 75um sieve on the washing stand. Washing will continue until the water through the sieve becomes clear. Unless specifically requested the material passing the 75um sieve will be lost to waste.

3.14 The washed material will be placed in the second tray on the bench and kept separate from the previously retained aggregate. Any excess water will be gently decanted off through the 75um washing sieve. The material retained on both 75 um sieves shall be washed without loss in to the tray.

3.15 The sample will be numbered sub-number 2 and will then be placed in the drying oven with sub-sample I and dried to a constant weight usually overnight.

3.16 The samples will be removed from the oven, allowed to cool and weighed to the nearest 0.1 grm, the mass being recorded on the test sheet as (P1) and (P2) in Boxes 9 and 10 respectively.

4.0 Dry Sieving of the remaining Washed Samples

4.1 Each of the two parts, the material retained on the 5.0mm sieve and that passing the 5.0mm sieve, will be treated as separate gradings.

4.2 Some estimate will now be made of the amount of material likely to be retained on each of the 300mm diameter sieves above 5.0mm. This can be done as there is usually some history of the material being tested.

4.3 If there is any doubt that the amounts retained on any of the 300 mm dia. sieves will exceed the masses shown in the following table 3 then the sample should be reduced through the appropriate sized riffle box at this stage, or sieved in increments.

4.4 The amount taken after riffling will be recorded on the test sheet as R3 in Box 11.

Maximum Mass to be retained on a sieve at completion of Sieving

| BS Sieve Size<br><br>mm | <br><br>kg | Maximum Mass<br><br>300mm Diameter Sieve<br><br>mm<br>um | BS Sieve Size<br><br>300mm Diameter Sieve<br><br>grm | Maximum Mass<br><br>200mm Diameter Sieve<br><br>grm |
|---|---|---|---|---|
| 50.0 | 5 | 5.0 | 750 | 350 |
| 37.5 | 4 | 3.35 | 550 | 250 |
| | | 2.36 | 450 | 200 |
| 28.0* | 3 | 1.70 | 375 | 150 |
| 20.0 | 2.5 | 1.18 | 300 | 125 |
| 14.0 | 2 | | | |
| 10.0 | 1.5 | | | |
| | | 850 | 260 | 115 |
| | | 600 | 225 | 100 |
| | | 425 | 180 | 80 |
| 6.3 | I | 300 | 150 | 65 |
| 5.0 | 0.75 | 212 | 130 | 60 |
| 3.35 | 0.55 | 150 | 110 | 50 |
| | | 75 | 75 | 30 |

4.5 The remaining sample will then be placed in the nest of 300mm diameter sieves the lid fitted and sieving will take place by hand or on the shaker until the sample has been reduced into size fractions.

4.6 Each sieve will then be removed in turn over a large tray to ensure that none of the material is lost.

4.7 A further period of hand sieving will be carried out over another tray for at least 2 mm and though flatter pieces may be passed through the aperture by hand no effort must be used to force any of the material through the aperture. Any agglomerated material will be broken by gentle pressure with the finger against the sides of the sieve.

4.8 When it is certain that all the material has passed that aperture then the aggregate retained on that sieve will be weighed to the nearest 0.1 grms and the weight recorded on the test sheet adjacent to the appropriate sieve size as (Sn+1).

4.9 The material passing the 5.0mm sieve and retained in the receiver of the 300mm dia sieves will also be weighed and recorded on the test sheet as the portion passing the 5.0mm sieve as SP.

4.10 The above material passing the 5.0mm sieve and retained in the receiver will be placed into the nest of 200mm dia. sieves and after the lid has been fitted the sample will be sieved on the mechanical shaker in the sound proof cupboard for 5 minutes.

4.11 Remove the upper sieve over a clean tray and shake any further amount through the sieve by hand for about 1 mm. or until such time that there is very little material passing the test sieve.

4.12 Empty the material retained on the sieve into a further clean receptacle and lightly brush the remaining particles from the sieve into the container.

4.13 The aggregate will then be weighed to the nearest .1 g and the mass recorded on the test sheet adjacent to the appropriate sieve size as (SP+i).

4.14 The material will then be placed into a further clean tray where the accumulated aggregate will be retained for final check weighing.

4.15 This procedure will be repeated for each sieve in turn with any material passing the sieve after the hand sieving process being placed into the next sieve down.

4.16 After the sieving process has been completed the material collected in the check tray will be weighed and the weight recorded on the test sheet (Cl).

4.17 The check weight shall not differ from the original weight R3 by more than 0.1%.

4.18 The washed material passing the 5.0mm sieve will be treated in the manner described from 4.6 and the results recorded as a separate grading. The weights are recorded as T+i.

5. Calculations

5.1 The riffle factor will be calculated for each of the reductions and the masses passing the following sieves multiplied by the factor.

1st Riffle Fraction = R3

1St Riffle Factor = RFI = P1/R3

Amount retained on each 300mm dia Sieves TT+i = Sn+1 x RFI

2nd Riffle Portion = M2

21d Riffle Fraction = M3

2nd Riffle Factor = RF2 = M2/M3

Amount retained on each 200mm dia Sieves V+i = Tn+i x RF2

5.2 The total weights retained on each sieve will be calculated by multiplying the weights retained on each sieve by the appropriate riffle factor as above.

Each of the weights retained on the sub-sample I will be added to the equivalent weight retained on sub-sample 2 after multiplication by the riffle factors.

Total weights X+i = TT+i ~ V+i

5.4 The percentage retained on each sieve will then be calculated.

PR%(n)=(Weight retained on Sieve X+i/Mass of dry sample (MI))x100

5.5 The amount passing the 75um sieve will be added to that passing during washing (MI-(PIxRF) ~ (P2xRF2) and the total calculated as the amount passing the 75um sieve.

5.6 The percentage passing each sieve will be calculated as a cumulative percentage of the total dry sample mass.

PP%(n) = PP%(n-I) - PR%(n)

6. Test Report

6.1 The report shall indicate that this test was performed in accordance with the Nottinghamshire County Council standard test procedure.

6.2 The cumulative percentage passing each of the specified test sieves shall be reported to the nearest 0.1%.

6.3 The moisture content on delivery will be reported to the nearest 0.1%.

7. Notes

7.1 The sum total of the weight after washing may be calculated as follows:-

AW = RI ~ R2 ~ (M3 x RF)

where n is the sieve number used in sequence

i.e. n = 0 = 37.5mm sieve : n+i = I = 20mm sieve : n+ = 2 = 14mm sieve : n+3 = 3 = 10mm sieve