Department of Building Egineering

EXERCISE No. 4

Construction aggregates - determination of grain composition

1.0. Determination of grain composition *(PN-EN 933-1)*

This test consists in separating the material, using a set of sieves, into several grain fractions classified according to decreasing dimensions. The number of sieves and hole dimensions are chosen according to the type of sample and the required accuracy. Determination of grain size of mineral aggregates is done by dry or wet sieving.
The principle of both methods consists in separating the aggregate into fractions by sieving (dry, wet) on a set of standardized sieve squares.
Then, determine the percentage (mass) of the individual fractions in the test sample.

- **Set of instruments**
- **weight;**
- **control sieves;**
- **shaker for mechanical sieving;**

MARKING EXERCISE

Seiving

The dried material should be poured on the set of sieves control set on the container bottom. The mounted set of sieves should be placed on a shaker.
The sieve size of 63 μm should be included in the test set of the sieves.

Then, you can proceed to the sieving aggregates. The sieving process can be considered complete when the mass of the retained material does not change by more than 1% after 1 min of sieving.

After sieving the fractions kept on each sieve should be weighed and the individual weights should be marked as R_i.
The material remaining on the bottom should also weigh and mark this mass as P.

Calculate

a) calculate the percentage of individual aggregate fractions (a_i):

$$a_i = \frac{m_i}{m} \cdot 100 \tag{4.3}$$

gdzie: m_i - total weight of the fraction separated by sieving from the analytical sample, g;
m - weight of the analytical sample, g.

b) calculate the percentage of sieving by individual sieves (b_n):

$$b_n = a_1 + a_2 + \ldots + a_{(n-1)}$$

where: $a_1 + a_2 + \ldots + a_{(n-1)}$ - the sum of the percentages all fractions of aggregate in the weight of the analytical sample n.

c) calculate the percentage of dust (f) passing through the sieve size 63 μm:

$$f = \frac{P}{M_1} \times 100 \tag{4.5}$$

gdzie: M_1 – weight of the dry analytical sample, kg;
M_2 – weight of the dry sample remaining on the sieve 63 μm, kg;
P – weight of the sieved material on the bottom, kg.

In addition, it is recommended that a graphical representation of sieve results - the curve graded aggregate.

EXAMPLE: *Calculate the grain size of the aggregate on the basis of the sieved sample of 13 040 g weight and present the curve graded aggregate.*
Output data take according to table 1.

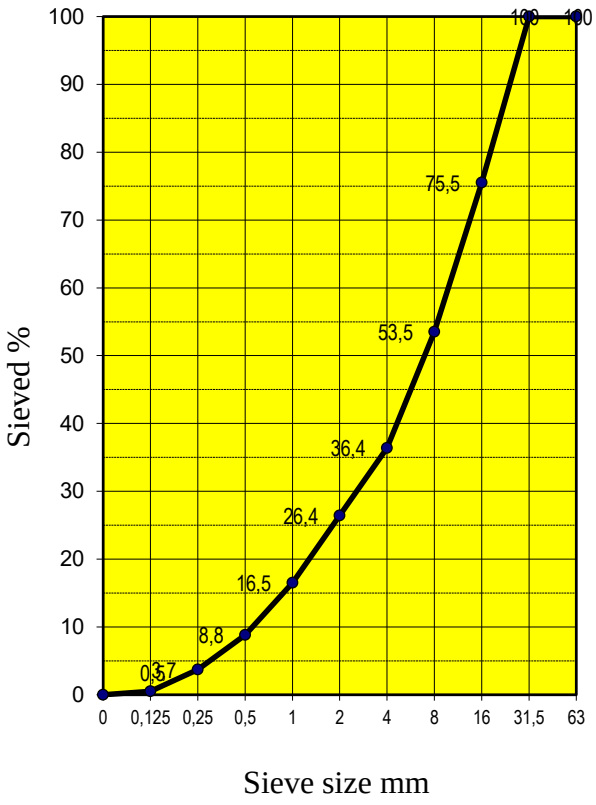
Tab1. Normal sieve sizes and weighed aggregate residues

Sieve, mm	63	31,5	16	8	4	2	1	0,5	0,25	0,125	0
Residue, g	*0*	*0*	*3200*	*2870*	*2230*	*1300*	*1290*	*1010*	*660*	*420*	*60*

The calculations were made in tabular form and are presented in Table 2, while Figure 1 is graphically presented.

Tab. 2. Tabulated test result

Sieve size D mm	Faction weight M_i g	Fraction participation a_i %	Sieved b_n %
63	0	0,0	100,0
31,5	0	0,0	100,0
16	3200	24,5	75,5
8	2870	22,0	53,5
4	2230	17,1	36,4
2	1300	10,0	26,4
1	1290	9,9	16,5
0,5	1010	7,7	8,8
0,25	660	5,1	3,7
0,125	420	3,2	0,5
0	60	0,5	0,0
	Suma :	100,0	



Rys. 1. Aggregate grading curve for this example

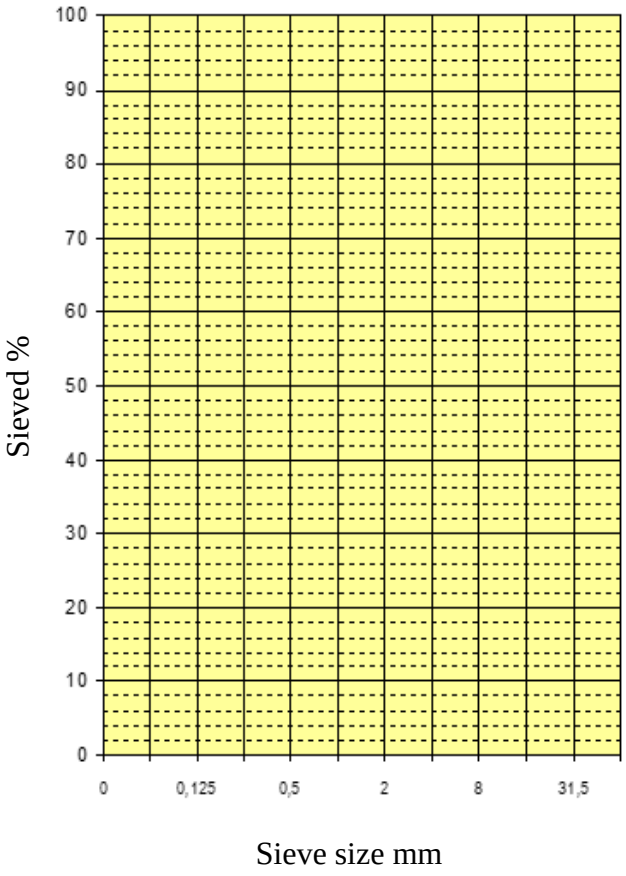
Group …… Date……

1. ……
2. ……
3. ……
4. ……

Exercise No.4

DETERMINATION OF GRAIN COMPOSITION

Total weight of dry sample before sieved M_{1s}**: …… g** **Total weight of dry sample after sieved** M_{1f}**: …… g** **Missing quantity of aggregate: …… %**			
Sieve	**Residue on the sieve**		**Sieved**
mm	g	%	%
63,0			
31,5			
16,0			
8,0			
4,0			
2,0			
1,0			
0,5			
0,25			
0,125			
0,063			
0			



The percentage of dust (f) passing through the sieve size 63 μm:

$$f = \frac{P}{M_1} \times 100 = \ldots\ldots\ldots\ldots\%$$

Final remarks: ……

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