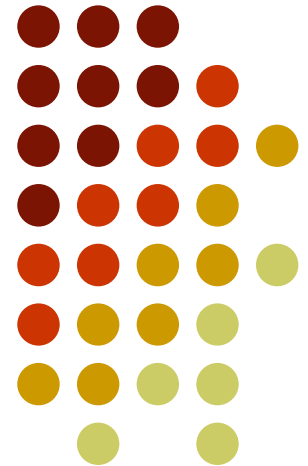


Plain & Reinforced Concrete-1

Sixth Term
Civil Engineering

CE-314

Sieve Analysis



SIEVE ANALYSIS ON AGGREGATES

Sieve analysis is performed on fine and coarse aggregates in order to check their gradation.



Sieves are placed one above the other, starting from the larger size at the top and then gradually reducing the size.

The minimum sieving time must be two minutes and the sample is usually of 2 kg weight.

The sieve shaking must include four types of motion, i.e., forward-backward motion, left-right motion, clockwise and counterclockwise motion and frequent vertical jolting.

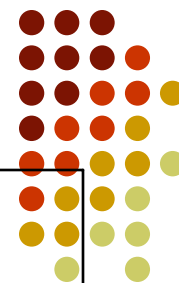


A standard set of sieves consists of a 75mm sieve and all subsequent sieves are obtained by approximately reducing the size of the upper sieve to half.

Sometimes, certain non-standard sieves are also introduced in-between the standard set to more clearly capture the gradation.

The set of sieves used for coarse aggregate is given in Table 22.4.

Table 22.4. Sieves Used For Coarse Aggregates.



| Sieve Size (mm) | Comments |
|---------------------------|--------------------|
| 75 | |
| 63 | Non-standard sieve |
| 50 | Non-standard sieve |
| 37.5 | |
| 25 | Non-standard sieve |
| 19 | |
| 12.5 | Non-standard sieve |
| 9.5 | |
| 4.75 | |
| 2.38 | |
| Pan | |

- The coarse aggregate size is specified in terms of maximum size particles present in it.
- For example, a 19 mm down aggregate is that for which majority of the particles pass the 19mm sieve but are partially retained on next smaller size sieve.
- The biggest sieve used for the sieve analysis of coarse aggregates is usually one size larger than the size of the aggregate.
- This means that the sieves of sizes 75mm, 63mm and 50mm may be omitted for the sieve analysis of a 25mm size aggregate.





Table 22.5. Sieves Used For Fine Aggregates.

| Sieve Size (mm or mic) | Comments |
|----------------------------------|-----------------|
| 4.75 | Standard sieves |
| 2.38 | -do- |
| 1.18 | -do- |
| 600 mic | -do- |
| 300 mic | -do- |
| 150 mic | -do- |
| Pan | -do- |

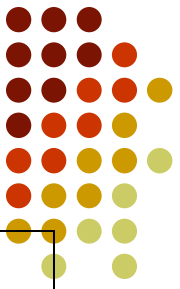


Table 22.6. Standard Sieve Analysis Table.

| Sieve Size (mm) | Mass Retained (g) | Percentage Retained | Cumulative Percentage Passing | Cumulative Percentage Retained |
|--------------------|-------------------------|------------------------|-------------------------------------|--|
| C1 | C2 | C3 | C4 | C5 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | Total = m_t | | | Total under the given conditions |



- The first two columns are directly filled from the observations during the test.
- The total mass of the second column (m_t) must be close to the originally taken mass of the sample.
- The values in the third column (C3) are filled by using the following expression but up to one decimal place only:

$$C3 = C2 / m_t \times 100, \text{ where}$$

C2 is the corresponding value in the 2nd column



- The values in the fourth column (C4) are filled by using the following expression and are reported in whole numbers:

$C4_i = (C4_{i-1} - C3_i)$, where i is the row number and $C4_{i-1}$ for the calculation of first row is taken equal to 100.

- The last column readings are found by subtracting the previous column readings from 100, as shown below:

$$C5 = 100 - C4$$



- The total of cumulative percentages passing given in the last column is made subjected to the following conditions:
 - a) The value for each sieve below 150 mic is not included in the total.
 - b) The values for the non-standard sieves are not included in the total.
 - c) Values for missing standard sieves above 150 mic should be considered equal to the next higher sieves values and should be considered in making the total.
 - d) Values for missing standard sieves above the aggregate size automatically get zero value by using the procedure of third condition. So, these values may be omitted.

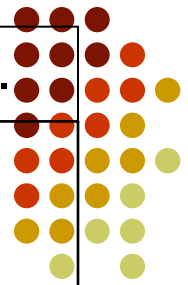
ASTM Grading Requirements



Table 22.7. ASTM Grading Requirements For Fine Aggregates.

| Sieve Size (mm or mic) | Percentage Passing | |
|----------------------------------|---------------------------|----------------|
| | Minimum | Maximum |
| 9.5 | 100 | 100 |
| 4.75 | 95 | 100 |
| 2.38 | 80 | 100 |
| 1.18 | 50 | 85 |
| 600 | 25 | 60 |
| 300 | 10 | 30 |
| 150 | 2 | 10 |

Table 22.8. ASTM Grading Requirements For Coarse Aggregates.



| Percentage Passing | | | | | | |
|---------------------------|------------------------------|------|------------------------------|------|------------------------------|------|
| Sieve Size | 37.5mm Down Aggregate | | 19.0mm Down Aggregate | | 12.5mm Down Aggregate | |
| | Min. | Max. | Min. | Max. | Min. | Max. |
| mm or mic | | | | | | |
| 50 | 100 | 100 | – | – | – | – |
| 37.5 | 95 | 100 | – | – | – | – |
| 25 | – | – | 100 | 100 | – | – |
| 19 | 35 | 70 | 90 | 100 | 100 | 100 |
| 12.5 | – | – | – | – | 90 | 100 |
| 9.5 | 10 | 30 | 20 | 55 | 40 | 70 |
| 4.75 | 0 | 5 | 0 | 10 | 0 | 15 |
| 2.38 | – | – | 0 | 5 | 0 | 5 |

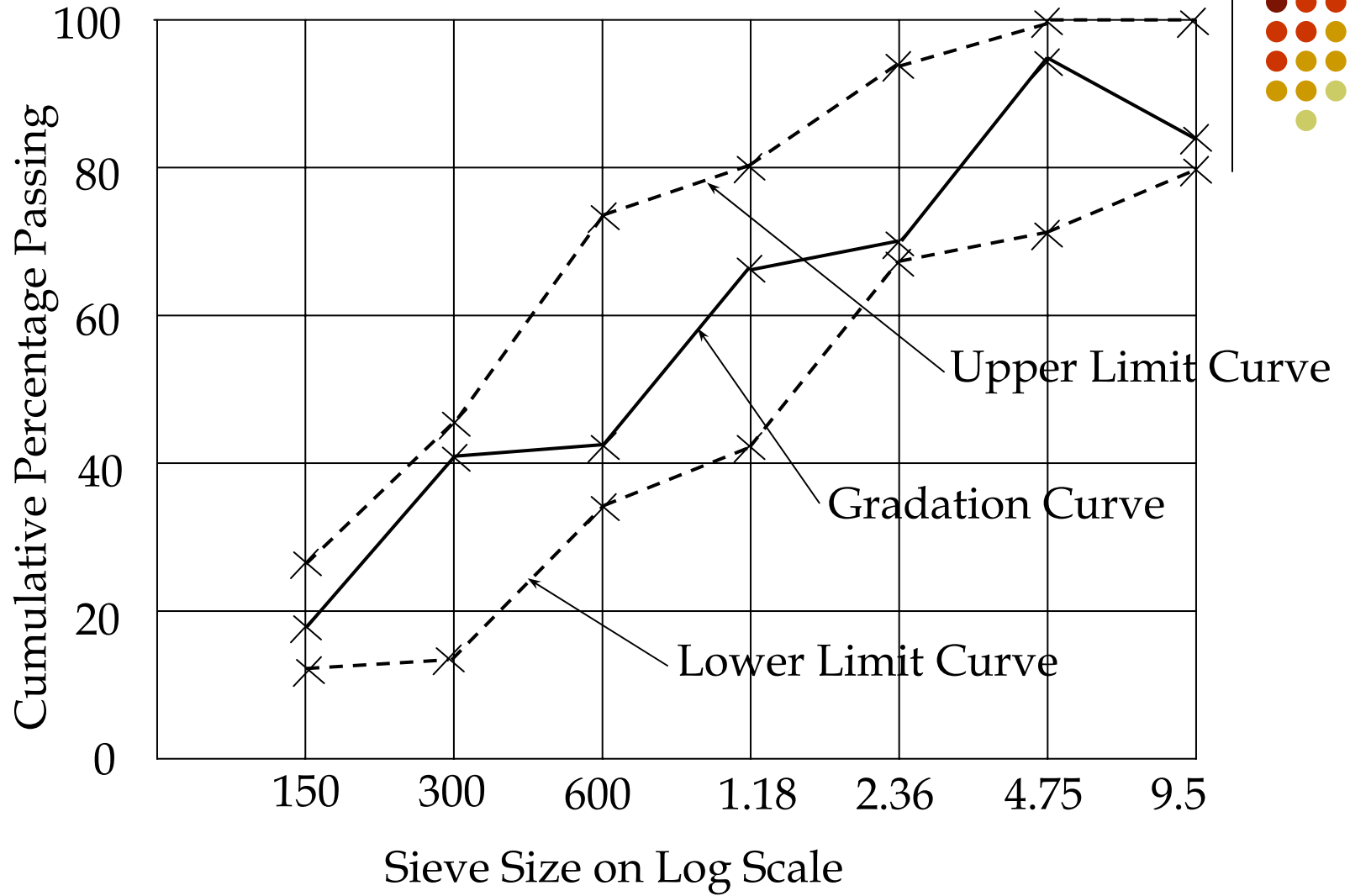
Standard Grading Curves



- In case of grading curves for the aggregates, the cumulative percentages passing are taken along the vertical axis and the sieve sizes are taken along the horizontal axis on log scale.
- However, for the standard sieves, the every time half size is equal to uniform interval for the ordinary length and hence ordinary graph paper may be used.
- The non-standard sieves may be shown between the standard sieves with some approximation.

- Every two consecutive points are joined by straight lines and smoothing of the curves is not employed.
- Besides the actual curve for the aggregate, the upper and lower limits of ASTM are also plotted using dashed lines.
- If the actual curve lies between the limiting curves for all the points, the aggregate grading is considered satisfactory.





Fineness Modulus



- Fineness modulus is an indication of the surface area.
- It is defined as the sum of the cumulative percentages retained on the sieves of the standard series, above 150 mic inclusive, divided by 100.
- It means that the sum of the last column of the gradation table under the already mentioned conditions divided by 100 will be the value of fineness modulus.
- This also approximately tells us whether a particular aggregate is well-graded or gap-graded.



- The workability of concrete depends upon the fineness modulus.
- Its value, if calculated for the coarse aggregates will be greater.
- Usually it is only calculated for the fine aggregate only and is used for classification of the fine aggregates in some standards.
- Typical values of fineness modulus for fine aggregates range from 2.3 to 3.0.