

25CE301 : BUILDING MATERIALS AND CONCRETE TECHNOLOGY

Topic: Unit III: Aggregates and Admixture

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Role of Aggregates in Concrete:

- Concrete is basically a mixture of two components
- Paste (**Portland cement, water, and air**)
- Aggregate (**sand, gravel, crushed stone**)
- The aggregate occupies 70-75% of the volume of concrete, so its quality is of great importance.

- Aggregates may affect the following properties of concrete:
 - Strength
 - Durability
 - Structural Performance
 - Economy

Aggregates have 3 main functions in concrete:

- 1) To provide a mass of particles which are suitable to resist the action of applied loads & show better durability than cement paste alone.
- 2) To provide a relatively cheap filler for the cementing material.
- 3) To reduce volume changes resulting from setting & hardening process & from moisture changes during drying.

The properties of concrete are affected by the properties of aggregate:

1. The mineral character of aggregate affects the strength, durability, elasticity of concrete.
2. The surface characteristics of aggregate affects the workability of fresh mass & the bond between the aggregate & cement paste in hardened concrete. If it is rough, workability decreases & bond increases.
3. The grading of aggregate affects the workability, density & economy.

Aggregates:

- Aggregates are inert materials mixed with a binding material like cement or lime in the preparation of mortar or concrete.
- Granular material of mineral composition such as sand, gravel, shale, slag or crushed stone.



Uses of Aggregates:

- Filler material
- Dimensional Stability
 - shrinkage,
 - thermal changes
- Strength and Stiffness
- Economy
- To make the concrete denser

Heavyweight Aggregates

Magnetite (left)

Magnetite-sand
(right)



Constituents in naturally occurring Aggregates:

- **Naturally occurring concrete aggregates are a mixture of rocks and minerals**
 - **Minerals**
 - Silica (ex. Quartz)
 - Silicates (ex. Clay)
 - Carbonate (ex. Calcite, dolomite)
 - **Igneous rocks**
 - Granite
 - Basalt
 - **Sedimentary rocks**
 - Sandstone
 - Limestone
 - Shale
 - **Metamorphic rocks**
 - Marble
 - slate

PARTICLE SHAPE & SURFACE TEXTURE:

- In addition to petrological character, the external characteristics, i.e. The shape & surface texture of aggregates are of importance.

Particle Shape

- Rounded: Completely water worn & fully shaped by attrition. (River Gravel)
- Irregular: Partly shaped by attrition so it contains some rounded edges. (Land Gravel)

- Angular: Has sharp corners, show little evidence of wear. (Crushed Stone)
- Flaky: Thickness is relatively small with respect to two other dimensions. (Laminated Rocks)
- Elongated: Have lengths considerably larger than two other dimensions.



FLAT



ELONGATED



ANGULAR



ROUND

- Rounded aggregates are suitable to use in concrete because flaky & elongated particles reduce workability, increase water demand & reduce strength.
- In the case of angular particles, the bond between agg. Particles is higher due to interlocking but due to higher surface area, angular particles increase water demand & therefore reduce workability. As a result, for the same cement content & same workability rounded agg. Give higher strength.

Grading of Aggregates:

- Grading is the particle-size distribution of an aggregate as determined by a sieve analysis using wire mesh sieves with square openings.

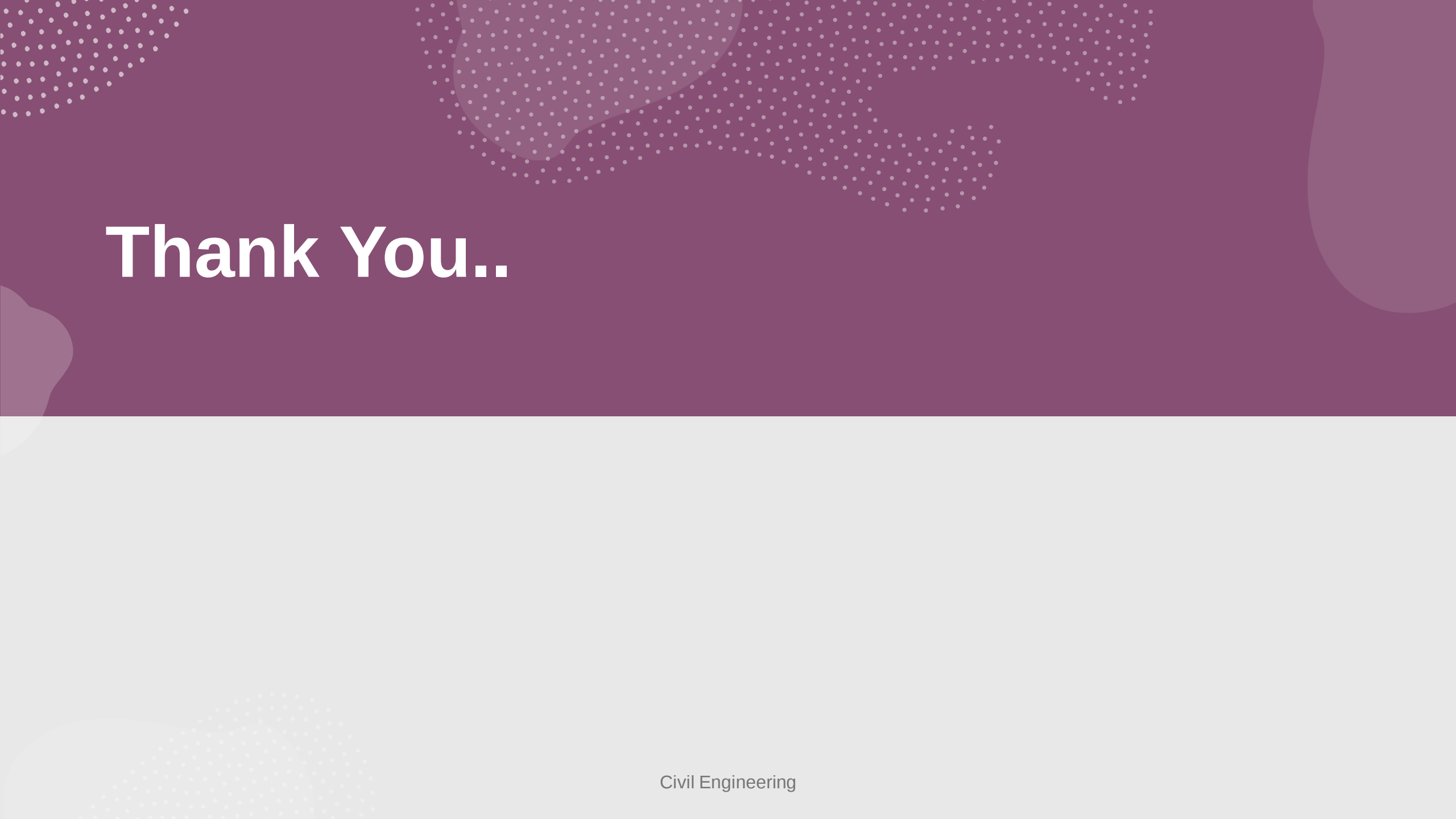
According to ASTM

Fine aggregate - 7 standard sieves with openings from 150 μm to 9.5 mm

Coarse aggregate - 13 sieves with openings from 1.18 mm to 100 mm

	IS Sieves
Sieves for Fine Aggregates	125 mm
	90 mm
	63 mm
	31.5 mm
	16 mm
	8 mm
	4 mm
	2 mm
	1 mm
	0.5 mm
	0.25 mm

	IS Sieves
Sieves for Coarse Aggregates	125 mm
	100 mm
	90 mm
	75 mm
	63 mm
	50 mm
	37.5 mm
	25 mm
	12.5 mm
	9.5 mm
	4.75 mm
	2.38 mm
	1.19 mm
	0.595 mm
	0.297 mm
	0.149 mm



Thank You..