

# Module 1: Blending of Aggregates

Concrete Design and Placements  
(24CV404C)

# Introduction to Aggregates

- Aggregates form about 70–80% of concrete volume.
- They influence strength, durability, and economy of concrete.
- Types: Fine aggregate and Coarse aggregate.

# Difference Between CA and FA

<b>Parameter</b>	<b>Fine Aggregate</b>	<b>Coarse Aggregate</b>
<b>Defining sieve</b>	<b>4.75 mm IS sieve</b>	<b>4.75 mm IS sieve</b>
<b>Sieve criterion</b>	<b>Material passing through 4.75 mm sieve</b>	<b>Material retained on 4.75 mm sieve</b>
<b>Particle size range</b>	0.075 mm – 4.75 mm	> 4.75 mm (typically 10 mm, 20 mm, 40 mm)
<b>Examples</b>	River sand, M-sand, crushed sand	Crushed stone, gravel
<b>Role in concrete</b>	Fills voids, improves workability & finish	Provides strength & bulk

# Below is the standard arrangement of sieve sizes used for Fine Aggregates and Coarse Aggregates, as per IS 383 / IS 2386

## Sieve Sizes for Fine Aggregates(Arranged from larger to smaller sieve size)

IS Sieve Size from

- 4.75 mm
- 2.36 mm
- 1.18 mm
- 600  $\mu\text{m}$
- 300  $\mu\text{m}$
- 150  $\mu\text{m}$
- 75  $\mu\text{m}$  (optional – for silt/fines check)
- Fine aggregate = material passing 4.75 mm IS sieve.

IS Sieve Size

40 mm

20 mm

10 mm

4.75 mm

**material retained on 4.75 mm IS sieve.**

# Fine Aggregates – Functions

- Fills voids between coarse aggregates.
- Improves workability and finish.
- Contributes to strength and durability.

# Requirements of Fine Aggregate

- Clean and free from deleterious materials.
- Proper grading as per IS 383.
- Adequate strength and durability.

## Manufacturing Technique of M-Sand – Flow Chart

Mining of Raw Material  
(Granite / Basalt / Hard Rock)

Transportation to Crusher Plant

Primary Crushing  
(Jaw / Impact Crusher)

Secondary Crushing  
(Cone Crusher / VSI)

Screening  
(Material passing 4.75 mm sieve)

Washing  
(Removal of dust & clay impurities)

Grading  
(Required particle size distribution)

Storage  
(Controlled conditions)

Quality Control Testing  
(IS 383 Compliance)

Finished Product  
Manufactured Sand (M-Sand)

# Alternatives to River Sand

- M-Sand (Manufactured Sand).
- Quarry Dust.
- Crushed stone sand.

Need due to scarcity of river sand.

# Manufactured Sand (M-Sand)

- Produced by crushing hard rocks.
- Controlled grading and shape.
- Environment-friendly alternative.
- Conforms to IS 383 requirements.

# Coarse Aggregates – Importance

- Provide bulk and strength to concrete.
- Reduce shrinkage and creep.
- Economical filler material.

# Size, Shape and Texture of Coarse Aggregate

- Size: Influences strength and workability.
- Shape: Angular, rounded, flaky.
- Texture: Rough texture improves bond.

# Grading of Aggregates

- Distribution of particle sizes.
- Ensures dense packing.
- Reduces voids and cement content.

# Blending of Aggregates

- Combination of different sizes.
- Improves workability and strength.
- Achieves required grading curve.

# Testing on Aggregates

- Sieve analysis.
- Specific gravity and water absorption.
- Aggregate crushing and impact value tests.

# Recycled Aggregates

- Obtained from demolished concrete.
- Used in sustainable construction.
- Requires quality control before use.

# Self Study Component

- Collect river sand, M-sand, quarry dust.
- Observe color, texture, grain size.
- Compare suitability as per IS 383.

## IS 383: Grading Zones for Fine Aggregate

Sieve Size	Zone I	Zone II	Zone III	Zone IV
4.75 mm	90–100	90–100	90–100	95–100
2.36 mm	60–95	75–100	85–100	95–100
1.18 mm	30–70	55–90	75–100	90–100
600 $\mu\text{m}$	15–34	35–59	60–79	80–100
300 $\mu\text{m}$	5–20	8–30	12–40	15–50
150 $\mu\text{m}$	0–10	0–10	0–10	0–15

Zone	Type of Sand	Key Characteristics	Water Demand	Typical Usage
<b>Zone I</b>	Coarse sand	Coarser particles, fewer fines	Low	Mass concrete, pavements, heavy sections (use admixtures for workability)
<b>Zone II</b>	Medium sand	Well-graded, balanced size	Moderate	<b>RCC works</b> , general concrete, RMC, beams, slabs, columns
<b>Zone III</b>	Fine sand	Higher fines, smoother mix	High	Plastering, masonry, thin sections
<b>Zone IV</b>	Very fine sand	Excessive fines	Very high	Rendering/pointing only; <b>not for structural concrete</b>

Sl. No.	IS Sieve Size	Weight Retained (g)	% Weight Retained	Cumulative % Retained	% Passing
1	4.75 mm				
2	2.36 mm				
3	1.18 mm				
4	600 $\mu$ m				
5	300 $\mu$ m				
6	150 $\mu$ m				
7	Pan				
<b>Total</b>		<b>1000 g</b>	<b>100%</b>		



## Formulae Used

- % Weight Retained

$$= \frac{\textit{Weight retained on sieve}}{\textit{Total weight of sample}} \times 100$$

- Cumulative % Retained

= Sum of % retained on that sieve and all previous sieves

- % Passing

= 100 - \text{Cumulative % Retained}

The sieve analysis of fine aggregate was carried out as per IS 2386 (Part 1). The grading of fine aggregate falls under **Zone** \_\_\_ as per IS 383.

# Assignment

## Self Study: Comparison of Fine Aggregates

### River Sand:

- Rounded particles
- Better workability
- Scarcity & environmental issues

### M-Sand:

- Angular particles
- Controlled grading
- Eco-friendly alternative

### Quarry Dust:

- Very fine particles
- Lower workability
- Used with blending