

# CHAPTER 6

## Materials



# MATERIALS

## Aggregate

Aggregates can be defined as any granular material used as the main constituent of concrete, mortar, or plaster. Aggregate is described by its size - as coarse, fine; or all-in; or its source.

19mm stone and riversand are the most commonly used aggregates in manufacturing normal concrete.

Aggregates are used to reduce the cost per cubic metre of concrete and reduce shrinkage and other deformations.

Aggregate in concrete may be classified in two groups:

- Dense – Sand and stone, and
- Low density – vermiculite (light weight concrete)

### Shape of aggregate

In order to get strong concrete, the aggregate should be well placed and packed closely together to avoid any voids 'honeycomb'. The shape of the crushed aggregates ranges from rounded; angular; flaky; and elongated. Flaky and elongated aggregates should be avoided in concrete mixes.

### Types of aggregate

#### Coarse aggregate (Stone)

Coarse aggregate is used in concrete for bulk and because it is cheaper than cement, making the mix more economical. If the stone size is increased, less water is needed to give the required slump, therefore less cement is necessary to maintain the same water:cement ratio and strength.

There are a number of different sizes of stone, the four commonly used nominal sizes are; 26.5mm; 19mm, 13.2mm and 9.5mm. Stone is sorted by using a sieve or screens with the relevant size holes in order that the stone to be sized.

#### Fine aggregate (Sand)

Fine aggregate is used as a void filler. It fills up spaces between the stone and cement. It also affects the amount of water needed in the mix and as described above the shape of the particles is also important as it affects the amount of water required and the slump. Sand also reduces the paste content and makes the concrete more stable.

Sands lacking fine fractions (fines) – passing through a 300µm sieve -produce harsh concrete that bleeds and has a tendency to segregate.

An essential requirement is that sand should be free of organic matter such as roots, twigs, humus, clay etc.

## Cement

Cementitious materials for concrete are fine mineral powders. When these materials are mixed with water, they react chemically to form a strong rigid mass that binds aggregate particles together to make concrete.

For the purpose of this publication, we deal with ordinary Portland cement only. It has a medium setting period and is obtainable from your local hardware store or building supply merchants.

When sealed in airtight drums, cement remains the same in strength for up to 3 years.

When packed in sacks, even under good conditions, deterioration in the strength of the cement will occur, with a prolonged shelf life, for example:

- 20% loss after 3 months
- 30% loss after 6 months
- 40% loss after 1 year
- 50% loss after 2 years

The arrangements for storing or stocking cement should be such that batches are used in the same order in which they were received. First in - first out.



#### IMPORTANT NOTE:

It is illegal to sell cement in South Africa if it does not have the SABS mark indicating its compliance with the requirements of the standard. Portland cement extenders

- SANS 1491: Part 1 - Ground granulated blast- furnace slag
- SANS 1491: Part 2 - Fly ash
- SANS 1491: Part 3 - Silica fume

## Lime

The addition of lime to mortars is recommended but is no longer common practice.