

# Admixtures for concrete

Admixtures are substances added to concrete mixes in order to modify one or more properties of the mixes to render them suitable for specific needs or requirements. For example, if a concrete mix is to be rendered suitable for easy pouring and compacting in a structure congested with reinforcement, an admixture that enhances workability is a much better option than adding further water to the mix. Admixtures are also used in grout and similar other mixes for the same purpose as mentioned above.

Some, admixtures are capable of modifying more than one properties of the concrete or grout mix even though they are normally used to modify a single one. In other words, such an admixture used for a particular purpose can also be introduced in a mix for one or more other purposes.

For example, a water reducing admixture can also be used to enhance the workability of a concrete mix as it is capable of modifying both the properties i.e. water to cement ratio (w/c ratio) as well as workability of the mix. That means, if higher workability is to be achieved without adding additional water to the mix, ie without changing the w/c ratio of the mix, a water reducing admixture can be introduced to the mix which otherwise is used to reduce the w/c ratio without reducing workability. In the first case, workability gets increased without addition of any further water to the mix and hence it is as good as reducing water. In the second case, the admixture enables reduction of water content (or the w/c ratio) of the concrete mix without decreasing its workability. In other words, the desired workability has been kept intact and the w/c ratio too has been reduced by introducing the admixture.

Now, the same admixture can also modify a third property which is the strength of the concrete when the mix hardens. Actually, the basic aim of modifying the property called the w/c ratio is only to modify the property named strength eventually. The basic purpose of reducing the water content, and thus the w/c ratio, of a concrete mix is to increase the strength of the resulting concrete.

Interestingly, the same water reducing admixture can also be used to modify a fourth parameter of the mix – the cement content. Suppose, a concrete mix has been designed to achieve a desired characteristic strength ( $f'$ ) at a desired workability ( $W_k$ ) and w/c ratio ( $w$ ) without introducing any admixture. Now, if the aim is only to reduce the cement content of the mix without modifying other properties, then addition of a suitable dose of the same water reducing admixture can serve the purpose. That's because, due to the introduction of the admixture water content will get reduced for the same workability  $W_k$ . Since, no change in  $f'$  is wanted, the cement content now can be reduced proportionately so that the same old w/c ratio  $w$  is maintained. In this case, the same old admixture has enabled reduction of the cement content, and thus more economy, without affecting other parameters at all.

The optimum doses of admixtures are usually prescribed clearly by their manufacturers. The same should be considered during the process of designing the mix itself in order to fix the exact quantities to be introduced.

Admixtures can be classified in several categories depending on the purposes of their use. Some common among them are water reducing admixtures, accelerating admixtures, retarding admixtures, air entraining admixtures etc.

**Accelerating admixtures :** These admixtures are used in order to quicken or accelerate the setting process of concrete mixes. They are normally useful in cold weather conditions when setting of concrete takes much longer time than usual. An example of a common accelerating admixture is calcium chloride ( $\text{CaCl}_2$ ). For  $\text{CaCl}_2$ , a dosage of upto 1.5% of cement content of a mix can be introduced. However, this admixture is not recommended for prestressed concrete. There are many other accelerating admixtures such as Sigunit Powder or Sigunit LN10 etc.

**Retarding Admixtures :** These admixtures are used in order to slow or retard the setting process of concrete mixes. That means increasing the setting time of concrete. They are normally useful in hot weather condition when setting of concrete takes place much quicker than usual which is harmful to concrete. Dosage of retarders are usually limited to 0.5% of cement content of mix unless a higher value is specifically prescribed by the manufacturer. An example of a commonly available retarding admixture is sugar. Normal dosage is around 0.05% of weight of cement in the mix. A dosage of 0.2% to 1% can prevent the setting process completely. There are many other retarding admixtures such as Plastiment R etc.

**Water reducing Admixtures :** These admixtures are used in order to reduce the water content and thus the w/c ratio without reducing the workability of the concrete mix. These can also be used to increase the workability of a concrete mix without increasing the water content or the w/c ratio of the mix. As explained in Part – I, these can also be used for modifying other properties of a mix.

Water reducing admixtures are possibly the most widely used admixtures in any construction project. There are huge no of varieties available in the market from virtually all additive manufacturers. These are also commonly found as plasticisers and superplasticisers. As a thumb rule the dosages of plasticisers and superplasticisers should be restricted to 1% and 2% of weight of cement respectively unless higher values are permitted by manufacturers. It is to be noted that many water reducing admixtures also retard setting of concrete mixes by an hour or so to several hours.

**Air entraining admixtures :** These admixtures are used not only to increase workability but most importantly to increase resistance of concrete against freezing and thawing in extremely cold weather which cannot be achieved by ordinary water reducing or workability enhancing admixtures. These also help in reducing segregation and

bleeding. Resins, fats etc. are examples of these admixtures. FLOMO AEP, Sika AER etc. are few of the many names of air entraining admixtures available in market.

There are several other types of admixtures used for various other purposes. Some admixtures contain soluble chlorides & sulphates which can be harmful if present in excess quantities. While excess chlorides may cause corrosion in steel reinforcement, excess sulphates can cause disintegration of concrete in the long run. Manufacturers must specify their content in admixtures and it is necessary to ensure that the gross chlorid & sulphate content from all sources in any concrete mix donot exceed the maximum values prescribed in specifications.

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