ARMCON

Choosing the right cement

– An Overview

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CERTAINTY: IN CONCRETE

CPA
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Choosing the right cement:

Top Tips

- Using the correct cement in your mix is more critical than using the correct admixtures.
- Don’t always go for the cheapest cement – it may cost you more in the long run.
- Environmental conditions, available equipment, labour force size and speed of construction should be considered when deciding on the cement type.
- Always check that if admixtures are to be used, that they are compatible with the type of cement selected.
- R usually stands for rapid set and N for normal set.

Overview

The most important constituent of any concrete is the cement; it is the binding material that allows concrete to be strong and durable. In the past Portland cement has been seen as the best or the all rounder cement. Now we have a large selection of cements to choose from that adapt perfectly to specific jobs. This is where it is tricky, and finding out the right cement for you is key.

Besides Portland cement (also known as Ordinary Portland Cement or OPC) there is Rapid Hardening, Sulphate Resistant and White Portland Cement. To cover more applications there are also combination and composite cements, these types have been made to give specific properties and solutions.

Composite cements are made during the cement production process; extra materials are ground or blended with Portland cement clinker to give the desired cement type.

So which one is right for you?

In BS 8500-2:2006, Table 1 gives a full list of cements and the derivatives that come from composites and combinations.

A table with sample designations is given below:

Typical cement designation for the UK	
CEM I	Portland cement
CEM II/B-S	Portland Slag cement with 21% to 35% ggbs
CEM II/B-V	Portland Fly Ash cement with 21% to 35% fly ash
SRPC	Sulphate Resisting Portland Cement
CIIIA	Blast-furnace Slag cement with 36% to 65% ggbs
CIIA-L	Portland Limestone cement with 6% to 20% limestone dust
CEM IV/B	Pozzolanic cement

Where the cement type has the prefix CEM it means it is factory made and where the prefix is C it means it is combination cement that is blended at the mixer.

Cement Types & Uses

Using the correct cement for the right job requires consideration of physical & chemical properties, strength gain, heat evolution, resistance to chemical attack and the final use of the concrete being produced.

Portland cement (or OPC) is by far still the most popular form of cement and accounts for high percentage of all cement sales. It is suitable for most general concretes where no there is exposure to chemical or sulphate attack and it also comes in 32,5, 42,5 and 52,5 classes with most general work recommended to use 42.5 or higher.

Rapid-hardening Portland cement (RHPC) a specialist cement which develops high early strength when compared with OPC, it can be identified by the notation of R after the cement class (e.g. 42,5***R***). RHPC is used where early strength is required and it may also be of use when concrete is being placed is colder conditions, however it should not be used in large pours or mass construction.

Sulphate-resisting Portland cement (SRPC) used for making concrete which is going to be exposed to sulphur attack during the hydration process, the effective capability of the cement also depends on water-cement ratio and permeability of the mix.

White Portland cement is a decorative cement for pre-cast concrete products, containing chalk and white clay as

opposed to iron and manganese oxide like in OPC. It usually is the 52,5 strength class, which means it will have a high early strength and allow for earlier de-mould if it is used in the pre-cast concrete industry.
Besides using Portland cement or its variants it is also possible to use composite (factory made) and combination (blended at the mixer) cements, the main materials added to the cement are fly ash, ground granulated blast-furnace slag (ggbs) and limestone fines.

All three additions will give the cement a variation on its properties, when compared with OPC and the differences are set out in the following.

Fly Ash is made from the burning of pulverised coal in power stations, it is removed from flue gases to stop atmospheric pollution. The ash is a fine powder that has 'pozzolanic' properties and will react with the lime that is a by-product of the hydration process in OPC. It is either added to cement, during manufacture or at the concrete mixing stage, in quantities from 6% to 65% depending on the type of cement required.
The effect of this addition is; that for the same water-cement ratio the concrete increases in workability, an increase in curing time, it will bleed less than OPC, it has a darker final colour, it makes lean mixes easier to finish, form-work striking time and early age strength gain suffer due to the slower curing time.

Ground Granulated Blast-furnace Slag (ggbs)

This is a by-product from the smelting of iron in a blast furnace, when ground it forms an off white powder with similar fineness to Portland cement.
As a separate material ggbs has hydration properties but is slow in its reaction, but when blended with cement it uses by products of the cement hydration to increase it's own activity but still gives the overall blended material a slower curing time than OPC.
Like Fly Ash cements ggbs is also produced as either a combination or composite cement, similarly the addition rate also varies in quantity but for ggbs it is from 6% to 95%.
The most common use of ggbs cements is for thick section or large volume concrete pours, as the low heat from the slower hydration process would ensure the problems associated with high heat hydration are avoided. Because of the properties of the ggbs it is also possible to use either the composite or combination cement in sulphate resisting concrete when the ggbs is added at level of 66 – 80%.

With so many different types of cement available it is essential for the
modern concrete producer to select the correct one for the job being undertaken. In the past OPC was thought of the general use cement but now it is not possible to do that as for most problems encountered in mixing, pouring, placing or finishing can be resolved by using the correct cement type.

This is only a guide but hopefully it will help you towards finding the cement type that suits your needs, and has made you aware that OPC is not the only option out there. Like in any situation when producing concrete, experimentation is required.