

### Use of Special Chemicals to Enhance Concrete Durability

#### Specifications:

Grade	Compressive Strength (MPa)	Minimum Tensile Strength (MPa)	Minimum Split Tensile Strength (MPa)	Minimum Flexure Strength (MPa)
Grade 10	10	1.0	1.0	1.0
Grade 15	15	1.5	1.5	1.5
Grade 20	20	2.0	2.0	2.0
Grade 25	25	2.5	2.5	2.5
Grade 30	30	3.0	3.0	3.0
Grade 35	35	3.5	3.5	3.5
Grade 40	40	4.0	4.0	4.0
Grade 45	45	4.5	4.5	4.5
Grade 50	50	5.0	5.0	5.0
Grade 55	55	5.5	5.5	5.5
Grade 60	60	6.0	6.0	6.0
Grade 65	65	6.5	6.5	6.5
Grade 70	70	7.0	7.0	7.0
Grade 75	75	7.5	7.5	7.5
Grade 80	80	8.0	8.0	8.0
Grade 85	85	8.5	8.5	8.5
Grade 90	90	9.0	9.0	9.0
Grade 95	95	9.5	9.5	9.5
Grade 100	100	10.0	10.0	10.0

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In the specifications of Hong Kong, they generally involve factors such as:

- Standards for raw materials
- Minimum and/or maximum cementitious content
- Initial chloride content
- Placing temperature
- Limit on reactive alkali – i.e. Alkali-aggregate reaction (AAR) control
- Water to cementitious ratios
- .....

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### Use of Special Chemicals to Enhance Concrete Durability

Tasks of the concrete producers/designers are :

- To decide the most economical and practical combination of readily available materials.
- To produce a concrete that will meet requirements as stated in the specifications.

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### Use of Special Chemical to Enhance Concrete Durability

Grade 30 MPa

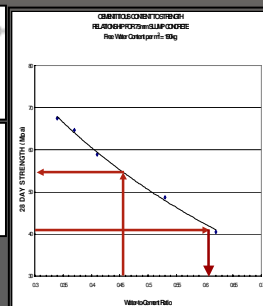
The target mean strength -  $f_{tm}$   
 = Characteristic -  $f_k$  + (Defectives -  $k$  X Standard Deviation -  $\sigma$ )  
 If  $f_k = 30$  Mpa       $\sigma_{cm}$   
 $k = 1.64$        $f_{tm} = f_k + k\sigma$   
 $\sigma = 7$        $= 30 + (1.64 \times 7)$   
 $= 41.5$  Mpa

If the target mean strength is 41.5 Mpa,  
 The cement content will be  $(190 / 0.61) = 311$  kg

If the water to cement ratio is 0.55,  
 The cement content will be  $(190 / 0.55) = 345$  kg

The difference will be  $(345 \text{ kg} - 311 \text{ kg}) = 34$  kg

Both strength (55.0 MPa vs 41.5 MPa) & cement content (345 kg vs 311 kg) are more than they should be.



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### Use of Special Chemicals to Enhance Concrete Durability

DURABLE CONCRETE

It should use:

- Low cement content
- Low free water content



- Reduce shrinkage
- Reduce heat development
- Reduce potentially cost

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### Use of Special Chemicals to Enhance Concrete Durability

- Air Entraining Admixture;
- Water-reducing Admixture;
- Accelerating Admixture;
- Waterproofing Admixture;
- High-range Water Reducing Admixture;
- Water-reducing and Retarding Admixture;
- Shrinkage-reducing Admixture;
- Corrosion Inhibitor Admixture; and
- etc .....

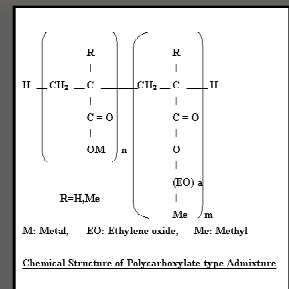


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### Use of Special Chemicals to Enhance Concrete Durability

Polycarboxylate based admixture

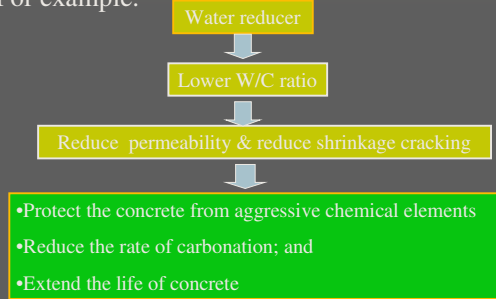
During the last few years, polycarboxylate based chemicals have become very popular to be used in concrete.



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### Use of Special Chemicals to Enhance Concrete Durability

⇒ For example:



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### Use of Special Chemicals to Enhance Concrete Durability

Lastly, I would like to say that:

- ⇒ Concrete can be very durable, if it is correctly composed.
- ⇒ Most likely, specifiers have governed the aspects of mix design process.
- ⇒ Chemical admixtures help us:
  - to enhance concrete durability; and
  - to allow concrete to be used in challenging applications never before possible.

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### Use of Special Chemicals to Enhance Concrete Durability

Following is the presentation of  
the CPA's recent study  
on the  
"Use of Special Chemical to Enhance  
Concrete Durability"  
Delivered by Mr. Jaime Yeung

Thank you

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