Concrete Carbonation

- Discussion of the behavior of concrete is generally based on the assumption that the ambient medium is air which does not react with hydrated cement paste.
- However, in reality, air contains CO_2 which, in the presence of moisture, reacts with hydrated cement.
- The actions of CO_2 takes place even at small concentrations such as in rural air, where the CO_2 content is about 0.03 percent by volume.
- In large cities the content may rise above 0.3 percent and, exceptionally, up to 1 percent. An example of concrete exposed to a very high concentration of CO_2 in the industrial cities
- The rate of carbonation of concrete increases with an increase in the concentration of CO_2. What else?

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- The transport of CO_2 taking place through the pore system in hardened cement paste (Porosity OR permeability?).
- In the hydrated cement paste CO_2 reacts with $Ca(OH)_2$ to product $CaCO_3$.
- Carbonation itself does not cause deterioration of concrete but it has important effects such as:
- Causing carbonation shrinkage, it would be explained later.
- Reducing pH of the pore water in hardened Portland cement paste from between 12.6 to 13.5 to a value of about 9. What is its effect on concrete durability?
- When all $Ca(OH)_2$ has become carbonated, the value of pH is reduced to 8.3.
- The highest rate of carbonation occurs at a relative humidity of between 50 and 70 percent. WHY?

Concrete Carbonation

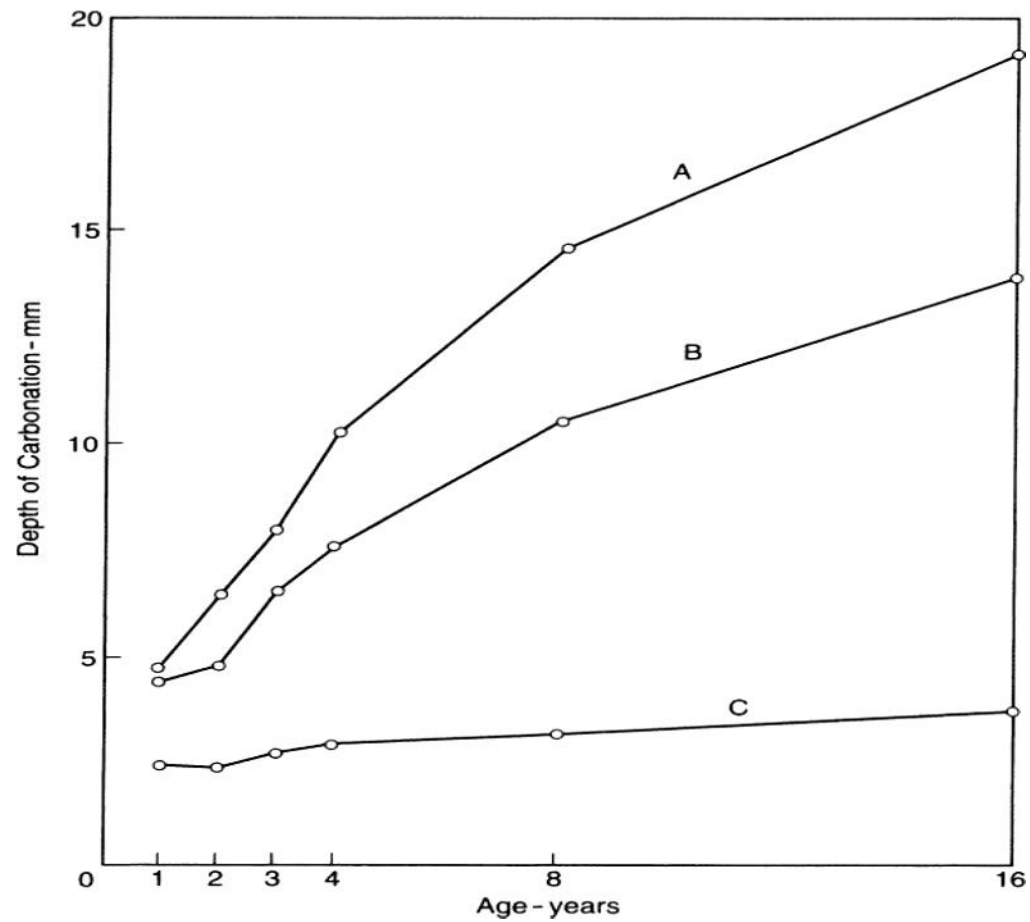
- Progress of carbonation with time of exposure under different conditions:

✓ 20°C and 65 per cent relative humidity;

✓ outdoors, protected by a roof;

✓ horizontal surface outdoors .

The values are averages for concretes with water/cement ratios of 0.45, 0.60, and 0.80, wet-cured for 7 days.



Concrete Carbonation

- The effect of curing on carbonation of concrete is substantial.
- The depth of carbonation of concretes with 28-day compressive strength can be showing in figure below.