Technical Advice Note 5

The Effects of Concrete Decay

Introduction

Concrete has been used for thousands of years. The Romans used lime-based hydraulic cements, some examples of which can still be seen today.

The biggest changes in concrete use has been over the last 100 years since the manufacture of Portland cement. Concrete has since become one of the most versatile materials in construction and used throughout the world. Under normal conditions it is a strong dense material that is hardwearing and long lasting, however there are factors which can contribute to the decay of concrete and effect the strength and longevity of the concrete and structure.

When concrete fails in extreme cases it can be catastrophic. As shown in the photograph below.

In Technical Note 3 we give a basic list of factors affecting concrete performance, in this note we show some of the effects.

Poor Design

Incorrect design criteria used, designing in too many long slender elements, incorrect loading calculations and incorrect design of reinforcement along with insufficient movement and expansion joints can all play a major part in the structural stability of the structure.

Mix Design

Incorrect cement or aggregate specified, the wrong grading or type of aggregates and incorrect water/cement ratios will affect the overall strength of the concrete when cured.

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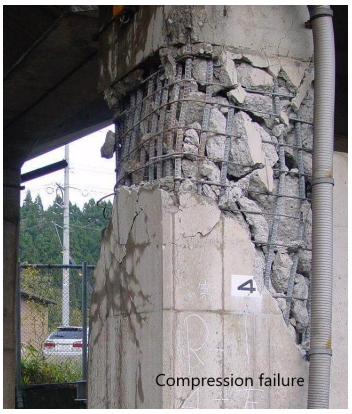
Workmanship Failure

Poor workmanship during the construction phase such as not following the design specifications, poor and inconsistent mixing of the concrete, badly fitting shuttering and formwork, allowing corrosion promoting chemical attack during the mixing and placement of the concrete and insufficient curing are all examples of bad on site workmanship and quality control.

Environmental Factors

These photos show examples where the imposed load had exceeded the design and structural capability of the supporting columns and beams. Excessive mechanical stresses and overloading along with subsidence and impact collision damage can all cause this type of failure.



Weather can also be a factor with excessive temperature changes and freeze/thaw action damaging surfaces.

Chemical attacks from Chlorides and Carbonation are the most common type of chemical attack but ASR Alkali Silica Reaction (from aggregates in the mix) and other chemicals such as acid rain, seawater (salts) chemical spillages and H_2S Hydrogen Sulphide (sewers and waste treatment areas) etc will all affect the concrete performance .

Concrete surface eroded by H_2S Hydrogen Sulphide

Concrete column damaged by saltwater