1. INTRODUCTION:

1.1 Why protect reinforced concrete structures (ISO 1504-2)?
Carbonation and the permeability of concrete to chlorides are phenomena which can attack reinforced concrete structures.

Carbon dioxide (CO$_2$), present in the air, is absorbed by concrete when it is not adequately protected. Reaction with the calcium hydroxide in the cement produces calcium carbonate, resulting in a progressive reduction in the alkalinity of the concrete. This reaction is known as carbonation of the concrete.

The alkalinity of the concrete is frequently the only factor which affords corrosion protection to the iron framework and, therefore, reducing it will compromise this protection. Consequently, the unprotected iron initiates a process of oxidation which results in an increased volume. This contributes to the cracking of the rigid concrete which surrounds the framework.

The penetration of chloride ions is also a major cause of corrosion in iron frameworks, mainly when the concrete structures are in a maritime environment.

For these reasons and to limit the occurrence of these phenomena, it is very important to protect reinforced concrete structures with coatings capable of reducing substantially the penetration of chlorides and the absorption of CO$_2$ while offering good waterproofing and high water vapour permeability properties.

Owing to the amount of interest and work invested in recent years on the part of all the bodies associated with the protection of this type of structure, the first European Standard was produced (EN 1504-2) which specifies all the requirements which a particular coating will need to provide adequate protection for reinforced concrete structures.
1.2 Why paint tunnels?

Tunnels are specific structures within the trans-European and national road network whose characteristics require particular care to cover incidents which could occur and to facilitate access for emergency services when necessary. Painting of concrete tunnels should provide better visibility and excellent reflective values, enabling the automatic mechanisms which detect incidents and CCTV to capture undistorted images. This should allow the emergency areas to be clearly visible. Chemical resistance and resistance to the accumulation of impurities are therefore essential elements of coatings applied to tunnels.

2. SURFACE PREPARATION

Concrete and cement renders – must be completely dry, clean and free from dust and grease. It is very common for release agents or various additives such as concrete hardeners to be used. Where this occurs it is essential to remove these compounds before painting so that the adhesion of the paint is not diminished. In such cases, we recommend grit-blasting or high pressure jet washing, depending on the nature of the compounds in question.

3. PAINT SYSTEMS

3.1 INTEGRAL CONCRETE PROTECTION (EN ISO 1504-2)

All of the systems suggested below are based on products which, as well as fulfilling the requirements of Standard EN 1504-2, also carry “CE Marking”.

Solvent based systems

C-Cryl S420 HB – High film thickness acrylic eggshell coating
Apply 2-3 coats in accordance with the application process in order to obtain a final dry film thickness of 150 to 200 µm.

C-Cryl S410 HB - High film thickness acrylic medium gloss coating
Apply 2-3 coats in accordance with the application process in order to obtain a final dry film thickness of 150 to 200 µm.

If high alkalinity of the substrate is suspected (for example in the case of new concrete that has not fully cured) one coat of Betocin Sealer should be applied first to ensure colour stability of the top coat.

Water based system

C-Cryl W700 HB – High film thickness water based acrylic matt/eggshell coating (Patent nº 103563).
C-CRYYL W700 HB is certified under fire classification Bs1d0 in accordance with European Fire Reaction Standard EN 13501-1:2007.
Apply 2-3 coats in accordance with the application process in order to obtain a final dry film thickness of 150 to 190 µm.
If high alkalinity of the substrate is suspected, one coat of C-Cryl W700 HB in colour 9010 should be applied.

3.2 PAINTING OF TUNNELS
C-POX W200 HB was specially formulated to meet all the requirements for safety and clarity of image established in Decree n.º 75/2006 of 27 March, transposed through internal Directive 2004/54/CE, complying also with the recent European Fire Reaction Standard EN 13501-1:2007, with fire reaction class Bs2-d0.
C-POX W200 HB is also resistant to various liquids, organic and inorganic acids, oil and grease, oxygenating solvents and petroleum derivatives.
In addition, due to its chemical formula, it forms a barrier against water and carbon dioxide while being extremely easy to clean or repair after damage in an accident.

Water based system
C-Pox W200 HB – High film thickness epoxy medium gloss coating
First apply a primer sealant coat of C-Pox W200 HB thinned 10% with water, depending on the absorption of the substrate. The recommended film thickness is 300 µm, 250 µm being the minimum thickness in any situation.

3.3 PAINTING OF CONCRETE IN GENERAL
C-Cryl W720 HB – High film thickness acrylic water based satin coating
C-Cryl W720 HB is certified with classification Bs1 d0 in accordance with European Fire Reaction Standard EN 13501-1:2007.

Apply 2 to 3 coats in accordance with the application process.
If high alkalinity of the substrate is suspected, one coat of C-Cryl W720 HB in colour 0501 should be applied.