



White Horse bridge at Wembley station

Engineered to last

Many of the UK's major rail stations and much of its infrastructure are undergoing significant renovation. CHRIS LLOYD discusses the use of effective anti-corrosion and engineered protection

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The Government is committing billions of pounds to improving the rail network. As a large part of this infrastructure is over 100 years old, extensive maintenance is required to make it fit for purpose, during which disruption must be kept to a minimum. A key element in the refurbishment process is corrosion protection and the right choice of anti-corrosion products is vital. Where site access is restricted and time limited, for example, it is important to specify rapid curing products.

Protecting cast iron in London's tunnels

One interesting example is the London Road Shunt Tunnel project, which involved coating the tunnel's cast iron lining on behalf of London Underground. The tunnel is part of the London Road depot, opened in 1906 as the maintenance facility for what is now known as the Bakerloo Line.

The shunt tunnel comprises 176 bolted cast iron rings with an internal diameter of just under 4 metres, and can accommodate up to 10 trains. A survey of the tunnel had

revealed that the segments of the lining were in good condition but in need of effective, long-term protection against corrosion. The coating specified for this work was Cemprotect E942. A two component, waterborne, epoxy and cementitious modified polymer coating, E942



London Road shunt tunnel



Artist's impression of the new concourse at London Bridge station

provides years of stand-alone corrosion protection under demanding operational conditions.

Applied to a thickness of just 2mm by brush or spray, the coating requires much less surface preparation than alternative products. It can be applied to damp substrates and achieves a bond when just the surface rusting has been removed. By comparison, most alternatives require removal of all surface contaminants and corrosion by-products back to bright metal.

The water-based composition of Cemprotect E942 is another critical factor. It does not release any strong odours or hazardous solvents during application, and is non-toxic. So it can be safely applied in enclosed locations. As it is CE marked in compliance with BS EN 1504 and compliant with LU standard 1-085 Fire Safety Performance of Materials, it's also particularly useful where there are tight controls governing the use of hazardous products.

Concrete and reinforcing steel

Cementitious coatings such as this are frequently specified to increase the durability of concrete in new construction as they can be applied to freshly cast 'green' concrete without waiting for a full 28 day cure.

High performance coatings reinstate concrete cover and provide structures with additional protection against freeze/thaw cycles, de-icing salts, water and chloride ion penetration, thus ensuring that the life span of the structure is both achieved and extended.

Reinforced concrete must have an adequate thickness of concrete covering the steel reinforcement bars; the depth and quality of the concrete cover is vital, as the relatively thin layer of concrete protects the reinforcing steel from corrosion by maintaining an alkali environment and preventing the ingress of chloride ions and other fuels for corrosion.

One interesting application has been on the White

Horse Bridge, a state-of-the-art £20 million footbridge that crosses Wembley station leading up to the new Wembley Stadium. The bridge's four arches mirror the now-famous arch of the stadium itself. On event days, as many as 8,000 people an hour cross the footbridge. During construction it was found that the abutments supporting the main arch had insufficient concrete cover to the reinforcement, and a rapid method of reinstatement was required without resorting to costly recasting.

Cemprotect E942 was chosen because a coating of just 2mm would provide in excess of 100mm of effective cover, as well as a complete barrier to water under 10 bar pressure. Additionally, it would not require specialist skills or equipment to apply and would cure rapidly enabling early backfilling – an important consideration to minimise disruption.

Fast-track construction is often a key requirement for rail projects, as demonstrated by the £500 million development of King's Cross station. Newly constructed plant rooms required a permanent waterproofing system and Cementitious Coating 851, a waterborne, cementitious modified polymer coating, was specified for application to green concrete. After pouring, the concrete slab was left to cure overnight and then prepared with a stiff brush and thorough soaking. The 851 was laid to a thickness of 2mm and Cemprotect EF Grit was cast into the surface to provide a slip resistant finish. Over a period of four days the concrete was cast and waterproofed, and heavy machinery installed just a few days later.

The challenges at London Bridge station

High performance structural mortars and fairing coats have been specified to enhance the concrete finish and increase the durability of construction at London Bridge station, where the £400 million redevelopment programme includes a new concourse at street level and

improved entrances and exits. The work is said by Network Rail to be the most ambitious redevelopment of any London station in a generation, and one of the most technically demanding projects ever undertaken on the UK railway.

With a project of this scale and complexity, a high volume of fresh concrete is being cast. Rapid construction is also critical as the station will remain open throughout, to minimise disruption to passengers. To aid rapid construction an advanced, waterproof, low density, class R3 structural mortar called Monomix was specified.

Incorporating the latest proven cement chemistry, microsilica, fibre and styrene acrylic copolymer technology, Monomix is a pre-packaged, single component product that only requires the addition of clean water. This creates a mortar that can easily be applied by trowel to a thicknesses of up to 80mm. Suitable for application to vertical, horizontal and overhead surfaces, it has exceptional bond strength,

excellent tensile strength and abrasion resistance, high diffusion resistance to acid gases and chloride ions and low permeability to water even at 10 bar pressure. Its high compressive strength reaches 23.5MPa within just 24 hours, increasing to 42MPa within 28 days.

Monolevel FC an engineering quality fairing coat was then used to finish the project. Applied in a thin screed to vertical and horizontal concrete, it is suitable as an exposed finish without needing further protection or coating, and was specified in white to match the colour of the freshly cast concrete.

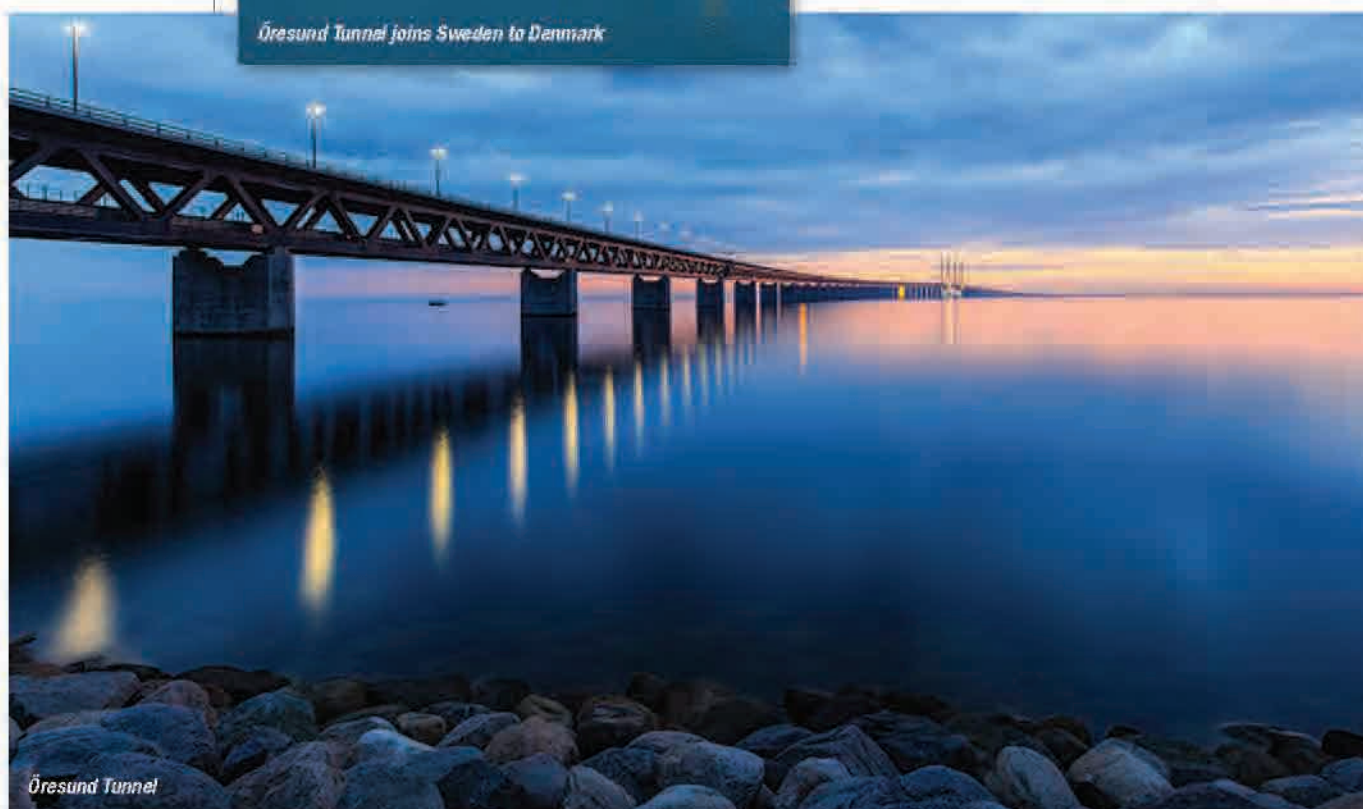
Working further afield

Flexcrete products also have a successful track record of use in international projects, one example being the Öresund Tunnel, a rail/road tunnel which connects Sweden to Denmark. Originally constructed in 2000, Cementitious Coating 851 was specified for concrete cover enhancement on segments of the tunnel at the time of construction. Some 10 years later the engineers returned to take a core sample of 851 and confirmed that the coating was still performing well, with effective protection against chloride ion penetration and cover to the steel reinforcement. Independent tests have shown that 851 combats chlorides for over 25 years.

High performance repair mortars and cementitious coatings can solve a range of complex problems associated with buildings and infrastructure in the rail sector. They meet the demands of rail refurbishment and construction projects, offering an ideal solution for fast-track construction, anti-corrosion protection, waterproofing and concrete cover reinstatement. ■



Öresund Tunnel joins Sweden to Denmark



Öresund Tunnel