SKIN TIGHT

A hybrid system being retrofitted to protect the main cables of a bridge in Norway leaves the option of future dehumidification open. **Eric Kuhn** explains

The bridge crosses the River Glomma north of Oslo

A combination of specialist cable wrapping and cable boots is being installed on a modest bridge in Norway to protect the cables from further corrosion. But the system is also designed so that dehumidification can be added at a later date with minimum disruption, if required. The Ophus Bridge, which was built in 1955, is a suspension bridge with a span of 120m and a total length of 143m. Its style is typical of Norwegian bridges at such locations, and it has a wooden deck approximately 5m wide with a single lane of traffic.

The bridge crosses the River Glomma in the small village of Ophus, some two hours north of Oslo in the east of Norway. Each of the two main cables is made up of two parallel full locked-coil cables with a diameter of 63mm. They are set parallel in the main span, while on the back spans they splay apart, opening from 15mm separation at the saddle to a distance of 200mm apart at the anchors.

Despite the fact that they have several layers of protective paint on the cables, corrosion spots have been discovered over the years as well as discontinuities of the outer wires. Furthermore, the design of the hanger clamps prevents the use of a reliable conventional corrosion-protection system, creating a critical detail.

Conventional corrosion protection methods require extensive surface preparation measures such as sand blasting, cleaning and so on. Due to the design of the cable it would be impossible to properly prepare the cables to receive such coatings, without temporarily removing the hanger clamps and separating the cables.

The same applies to the corrosion protection. Modern approved systems consist of four or five different coatings. The requirements for application conditions are high both from the environmental and the technical perspective. In order to achieve the maximum conventional protection the cable clamps would have to be removed and reinstalled afterwards.

Owner Statens Vegvesen decided to implement a new method of corrosion protection in an effort to extend the lifetime significantly. It is possible to create a hybrid corrosion protection by combining a 'tight' corrosion protection of Atis Cableskin with active protection for the saddle area which provides ventilation.

The twin cables on each panel on the main span are being surrounded with a closed cell of foam moulding. This forms a 150mm-diameter cable which retains a channel in the centre so that a dehumidification can be accommodated at a later date if necessary. The moulding is then wrapped with Atis Cableskin.

Watertight, UV-stabilised and surface-compacted Atis Cable Boot neoprene covers were used over the hanger clamps and they were connected in to the Cableskin to create a flexible, tight but easily-inspected solution.

This type of protection provides several options for inspection and for indication of leakage. Since a tube is created by installing the moulding, it can be used for future endoscopic inspections by unfastening the watertight zippers of the Cable Boots. These special boots have already been successfully installed on the Obere Argen Bridge in Germany and on industrial applications such as large coal bunkers.

The new system is expected to last for approximately 60 years, although the neoprene boots have a shorter life expectancy and must be replaced after 20 or 30 years.

With options for inspection and the introduction of a dehumification system at a later date if required, the advantage of this solution is that the client does not have to decide immediately but can evaluate future maintenance measures over a longer period of time and then can react rapidly as necessary.

Dehumidification systems, like those which have already been fitted on some large bridges, reduce the moisture content of the air inside and around the steel cables, thus providing reliable, additional active protection.

One particularly important and sensitive section of the main cable is the point at which it is redirected into the saddle. Bending stresses are concentrated in this area of the transition from the free length of the cable to the saddle. Movements of the bridge can result in extraordinary strain being imposed on the outer wires, and this, if combined with the continuous presence of moisture between the cables and the saddle, can contribute to accelerated corrosion. All these indications were present on the bridge, and as a result a simple, removable ventilated aluminium roof was designed and installed to cover the whole saddle and extend across the overlaps where the wrapping starts on the cables on both sides of the saddle.

The back span cables on the south east side of the bridge cross a road, and from time to time, lorries pulling high-sided trailers hit the cables. To avoid any damage to the new corrosion protection, a stainless steel sheet was added on top of the new wrap in the critical area, and this was wrapped again, this time in red and white, to provide a visual warning for drivers, and a protective wearing surface.

If this protection is damaged it can be easily and very quickly repaired to the European Approval ETA 13/0171 standard by partial wrapping.

A big challenge was the fact that the go-ahead for the project was given at the end of September, which left very little time for construction. Ophus is in Hedmark county, which is known for its hard winters, and there was a high risk that the rehabilitation work could be affected by poor weather conditions. A total of 33 days was planned for

Twin cables are the main support – at the saddles there are discontinuities in the outer wires

The twin cables are being enclosed in a foam moulding and wrapped with Cableskin

the site, in order to apply the protective system to a total 280m length of cables. After 25 days, in which the first snow fell and caused a weather-related delay to the contract of 23%, the remaining work was suspended and is programmed to be completed next year, although the major part of the bridge protection has already been installed.

The rehabilitation measures were designed and installed by specialist Alpin Technik & Ingenieurservice with its Norwegian partner Betongrenovering Drift.

The corrosion protection system can be divided into four zones; the back span, saddle, main span and hanger clamps. On the back span, the cable was wrapped with Atis Cableskin according to the ETA 13/0171; although loose paint and other debris was removed by hand, no other preparation was needed.

Additional protection of the lower sections of the cables on the south east span was provided in the form of stainless steel half shells which were wrapped and marked in red and white. In the saddle area, a length of cable 200mm to each side was repainted using Sika Cable system and sealed using the casing. A removable ventilated aluminium cover was mounted on the saddle, overlapping with the Cableskin protection

The twin cables on the main span were formed into a single unit by use of a closed cell foam moulding to create a single cable of approximately 150mm diameter. A channel was retained between them to allow installation of dehumification measures in future if required. The moulding was then wrapped with Cableskin.

Hanger clamps were covered with cable boots made of UV-stabilised neoprene with a compacted, watertight surface. The cable boots each have two watertight zippers, and can be opened up for inspection. The upper end is overlapped with Cableskin

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