BBR HiEx CONA Strand Saddle System—Innovation Description

The Innovation

The BBR HiEx CONA saddle system is a new solution for cable-stayed and extradosed bridges with slender pylons. The saddle system was installed exclusively by certified BBR PT specialists for FCC Construccion's Transmontana highway project in Portugal. Historically the connection between cable stays on a pylon has been done with anchors. More recently though, some engineers have decided to replace the pylon anchors with a seat system such as a mono-tube or multi-tube friction, adhesive or intermediate anchoring by cutting. The cables of an extradosed bridge can be stressed to a higher level, proven by tests carried out on the BBR HiEx CONA saddle system.

What it's changed & replaced

The new seat offers several advantages over the traditional anchor connection including simplifying the pylon design by reducing its dimension. Unfortunately conventional seats, adhesions, friction and anchoring by cutting, can produce difficulties when it comes to inspection and replacement of the weight transferring elements. It can also lead to loss of stability in the face of moderate strength differences on either side of the cable. The deterioration of the cable inside the seat due to friction effects is also an issue.

The BBR HiEx CONA seat is based on a completely new concept which replaces the traditional seat with post-tensioning tendons which provide two points of connection for the anchors outside of the foundation in addition to pre-stressed concrete. The post-tensioning tendons are stressed to a higher weight than the cable stays (80% of breaking point instead of 50%), meaning the BBR HiEx CONA eliminates the problem of wear and tear due to friction and of stability loss due to different weights on either side.

Where it originated

The saddle system was used on the cable-stayed bridge over the Corgo River on the Transmontana highway, near Vila Real in Portugal, constructed by FCC Construccion. It is made up of a guided system with parallel mono-tubes arranged inside a steel pipe and wrapped inside a special highly resistant mortar. The steel cables, which have a HDPE base and wax layer inside to prevent corrosion, are inserted through a guided system and anchor themselves to both sides of the pylon by the anchor heads (see CONA CMI in figure attached).

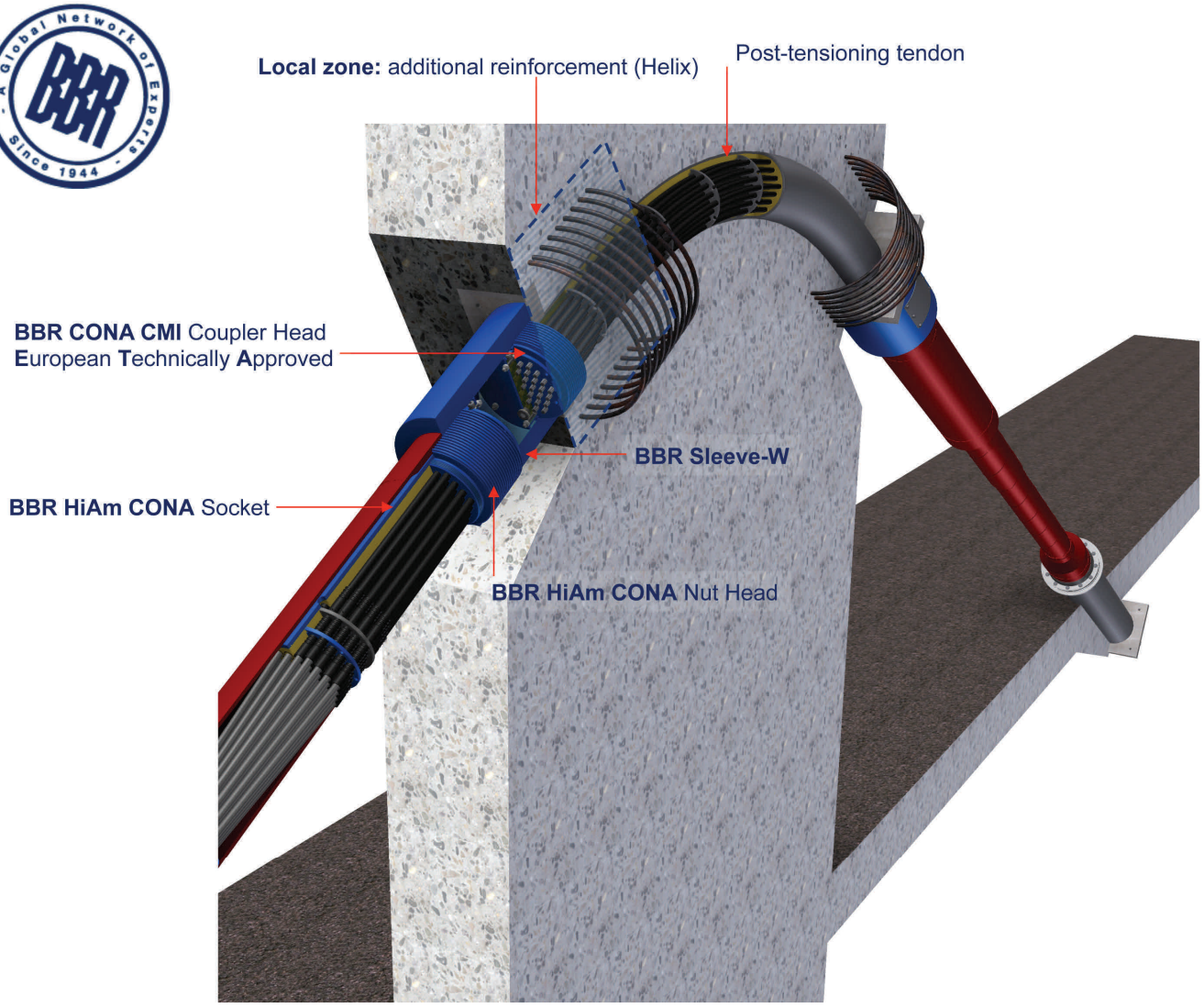
The non-adhesive guiding system ensures excellent protection against corrosion in addition to allowing the inspection and replacement of the cables at any point of the structure's life span. As such, the configuration of the guiding system (with its parallel cable arrangement without direct contact between the cables) allows tiny radius of curvature movements ($R_{min} \geq 2.0$ m). This was a special requirement of the Transmontana project due to the pylon slenderness.

The cable stay connection with the seat is done with a coupling sleeve (see *BBR HiEx CONA Sleeve-W* in figure attached) which incorporates two lateral windows to allow the installation, inspection and substitution of the anchor plate cradle. It is also possible to substitute the inside tubes of the seat on an individual basis - another technical requirement of the Transmontana project.

Specific Innovations

The BBR HiEx CONA saddle system continues to provide the primary benefit of a seat solution for pylon anchors while clearly demonstrating new innovations:

- Ensuring the stable movement of different weights to the pylon, avoiding the cable slipping
- Eliminating wear and tear caused by friction inside the seat
- Improving the seat's protection by using up to 5 layers between the outside of the seat and the cable
- Allowing the inspection, replacement and installation cable to cable; during maintenance operations only one side needs to be worked on while the other stays in tact and the operation is simplified as the cable doesn't cross the pylon.


Local zone: additional reinforcement (Helix)
Post-tensioning tendon
BBR CONA CMI Coupler Head
European **T**echnically **A**pproved
BBR Sleeve-W
BBR HiAm CONA Socket
BBR HiAm CONA Nut Head