Zeitschrift: IABSE congress report = Rapport du congrès AIPC = IVBH Kongressbericht

Band: 13 (1988)

Artikel: Novel parallel wire/strand bundles for cable-stayed structures

Autor: Schlaich, Jörg / Bergermann, Rudolf

DOI: https://doi.org/10.5169/seals-13133

Novel Parallel Wire/Strand Bundles for Cable-Stayed Structures

Nouveaux câbles á fils parallèles/-à torons pour des constructions haubanées

Neuartige Paralleldraht/-Litzen-Bündel für Seilkonstruktionen

Jörg SCHLAICH
Prof.Dr.Ing.
Schlaich und Partner
Stuttgart, FR Germany

Rudolf BERGERMANN
Dipl.Ing.
Schlaich und Partner
Stuttgart, FR Germany

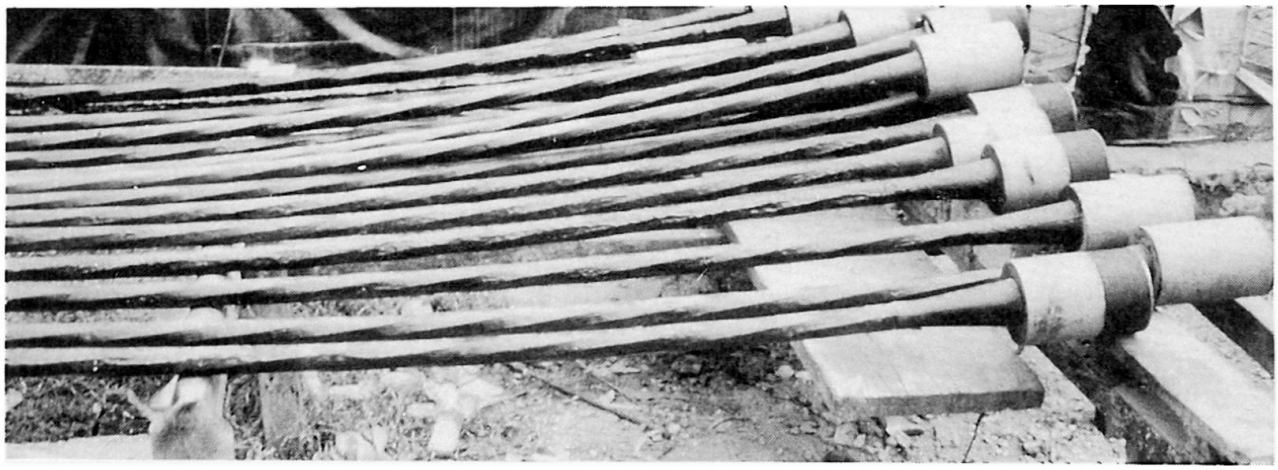

Fig. 1 Novel Parallel Wire Bundles with Long Lay Length Twist, Polyurethane Coating and Zinc Alloy Cast Socket

Bundles of parallel wires/strands, compared to spiral or locked coil ropes, offer following advantages:

- they are stiff in longitudinal direction; the elasticity modulus is very close to that of the individual steel wires, which is important because the cable stiffness dominates nearly reciprocal linearly the suspended structure bending moments.
- they have a low bending stiffness, which is as low as only the sum of its individual wires; this facilitates coiling them on reels for transport, storage and installation.
- there is no reduction in ultimate strength due to twisting.

The systems of parallel wire/strand bundles, available and in use today, still show the following disadvantages:

- for corrosion protection, they use a PE-pipe and grout; this increases the weight of the cables considerably and nevertheless presents a protection system which is not 100 % reliable due to insufficient ductility and consequent cracks in the grout and pipes.
- in order to get adequate fatigue strength, the wires are either anchored inside the socket by a sophisticated steelball-epoxy resin mix (HI-AM) or by wedges supported by an epoxy resin fill. Both schemes are very costly compared to a standard socket with a zinc alloy cast.

The new parallel wire bundle is twisted with a long lay length of about 30 d, thus avoiding any loss of stiffness and strength for the bundle. Nevertheless this twist is sufficient to keep the wires, arranged in a hexagonal shape, in a compact configuration, also during transport and installation.

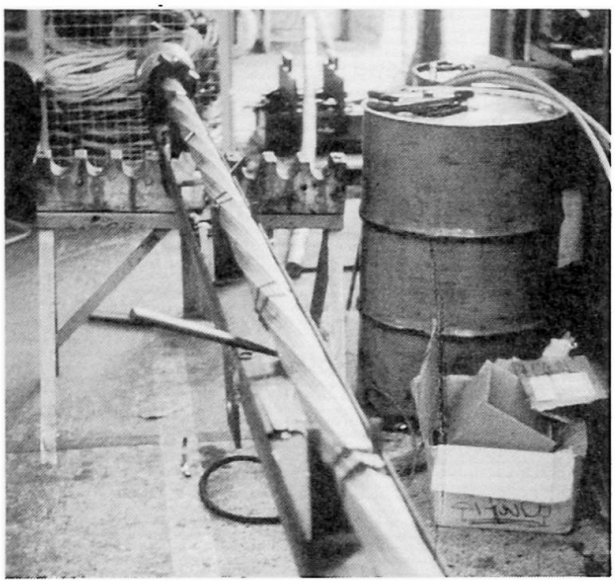

Fig. 2 Twisted Test Bundle with Long Lay Length

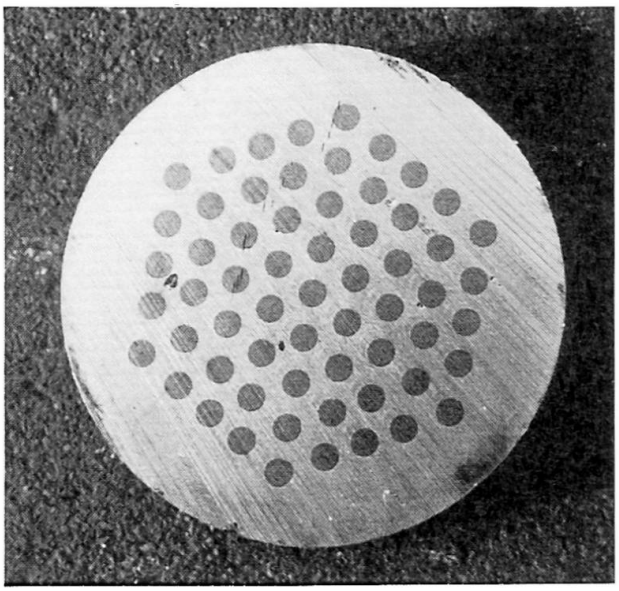

Fig. 3 Zinc Alloy Cast Cone; Section showing the uniform Wire Arrangement

Since the wires are fixed in their position relative to each other, they can be filled inside the bundle and be painted outside like the locked coil ropes. The material chosen is a two-component polyurethane, filled into all voids during assembly and applied as an outer coating of 1 to 2 mm thickness under controlled shop conditions. The material shows a strong bond to the wires of more than 2 N/mm^2, is resistant against UV-radiation and abrasion, has a breaking strength of more than 6 N/mm^2 and, most important, guarantees an elongation of minimum 400 before breaking. All bundle deformations during shipping and installation are 'bridged' by the coating without damage. So a highly effective corrosion protection system is applied which is even double-fold, where preferably hot dip galvanized wires are taken. Further the cables including their protection remain light, important especially for deeply inclined cables.

The light twist of the wire bundle yields another advantage: at the end the wires spread out conically without any bending which results in a uniform distribution in the interior socket cone, where they are anchored by ordinary zinc-alloy cast, a very economical solution. The uniform adequate space between all wires guarantees a voidless cast down to the cone base. The sockets are so shaped that they produce a well distributed high radial compression on the wires, thus allow a short bond length which minimizes the wire fretting where they leave the anchorage and results in a more flexible support for the wires; the latter fact guarantees the test-proven high fatigue strength of this type of anchorage of more than $\sigma = 200\ N/mm^2$ for 2 million load cycles.

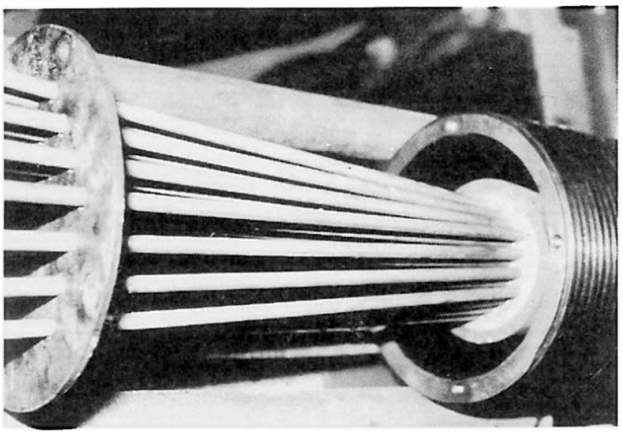

Fig. 4 Opened Bundle End before Casting

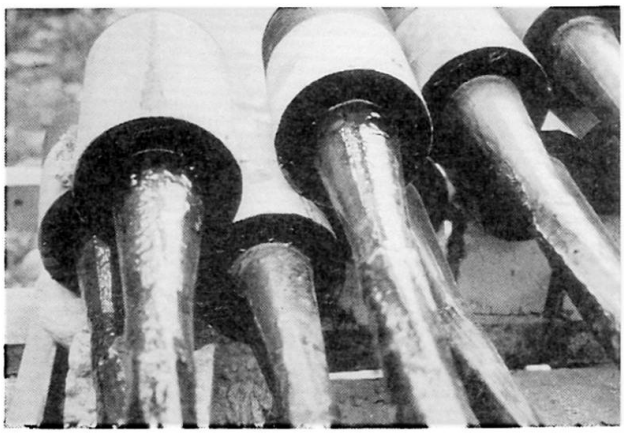

Fig. 5 Finished Sockets after Casting