TOKYO ROPE MFG. CO., LTD.

NIHONBASHI FRONT BLDG.
6-2 NIHONBASHI 3-CHOME CHUO-KU TOKYO 103-8306 JAPAN

Structural Cable Department, Overseas Engineering Division
PHONE: +81-3-6366-7733 FAX:+81-3-6366-6870
http://www.tokyorope.co.jp/

1605-AVN

Structural Cable Systems

TOKYO ROPE MFG. CO., LTD.

Tokyo Rope is the leading company of structural cable systems.

We have manufactured PPWS since 1960's.　In 90's, we challenged to apply our technology to the world longest suspension bridge, Akashi Kaikyo Bridge.
We developed new product,　called NEW-PWS, in the 1980’ s. NEW-PWS is specialized for stay cables, main concept is fully prefabricated parallel wire cable with high fatigue strength sockets and high density polyethylene sheathing. NEW-PWS has been applied to a lot of　cable stayed bridges.

Akashi Kaikyo Bridge

Minami Bisan Seto Bridge

High Tensile Galvanized Steel Wire

Major Applications

Main cable for Suspension Bridge
- **PPWS, Aerial Spinning**

Stay Cable, Hanger Cable
- **NEW-PWS**

Property of Galvanized Wire

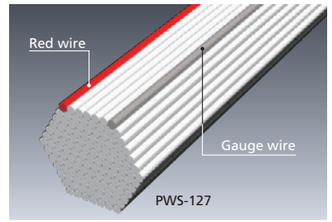
Class of G.U.T.S.		1570MPa class	1770MPa class	1960MPa class
Range of tensile strength		1570-1770	1770-1960	1960-2160
0.2% offset proof stress		75% of G.U.T.S.		
Elongation		4.0% or more		
Ductility	Torsion	5mm: Min. 14 times / 7mm: Min. 12 times		
	Winding	3d × 8 times, No fracture		
Zinc or ZnAl alloy coating	Mass	300g/m² or more		
	Adhesion	5d×2 times		

G.U.T.S.: Guaranteed Ultimate Tensile Strength

PPWS

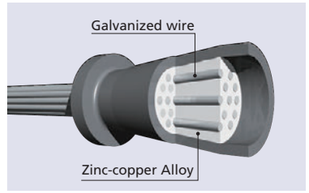
Prefabricated **P**arallel **W**ire **S**trand

PPWS consists of high tensile strength wires that are bundled in a hexagonal shape; sockets are fitted to both ends of the strand, and the strand is bound with a special plastic tape. Gauge wire measured based on the design length at stable conditions is arranged at a top of hexagonal section, and Red wire is arranged at the other top to check no twist during the erection.



Socketing

Both strand ends are socketed by zinc-cupper alloy.



Reeling

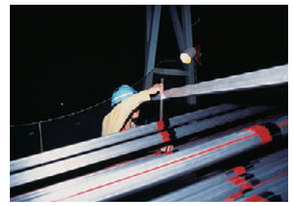
The reeling methods are two ways.

Erection of PPWS

1 The strands wound on reel are set on the unreeler.

2 The strands are drawn from unreelers, and unreeled on catwalks by hauling systems.

3 The sockets at both ends are fixed at the anchor frames. The tension and sag are adjusted by pulling socket.



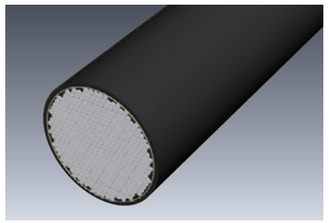
4 After all strands are in place, compaction work is carried out by squeezing machine with hydraulic jacks to be circular shape.

5 Cable bands and hanger cables are installed.

6 After erection of deck, wires are wrapped on main cable for corrosion protection.

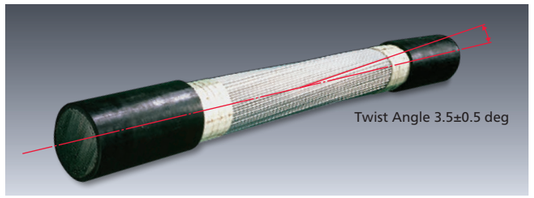
NEW-PWS

NEW-PWS possesses all the superb characteristics of PPWS, plus good handling ability, excellent corrosion proofing characteristic, and high fatigue resistance socket for stay and hanger cable.



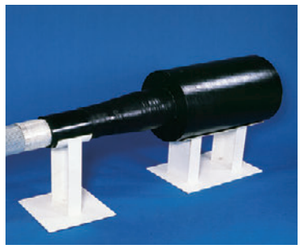
High Elastic modulus

NEW-PWS consists of parallel galvanized wires 7mm in diameter assembled while being twisted at a pitch designed to maintain optimum tensile strength and modulus of elasticity.
E=196,000N/mm^2(20,000kg/mm^2) is secured even twisting.

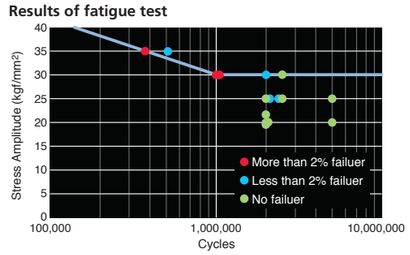


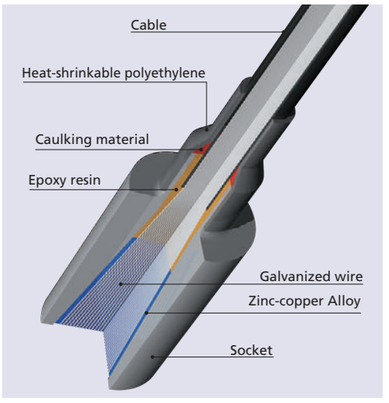
High Fatigue Strength

Sockets with high fatigue strength are developed for the stay cables. This socket called as "NS socket" is composed of zinc-cupper alloy and epoxy resin. Fixing mechanism of the NS socket consist of adhesion between wire and zinc-copper alloy and wedge effect of an integrated cone composed of wires and zinc-alloy.

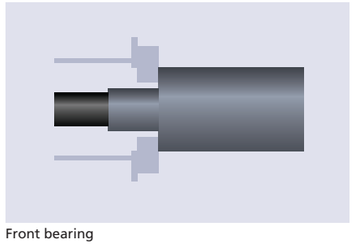


Results of fatigue test

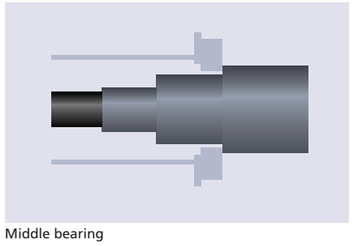




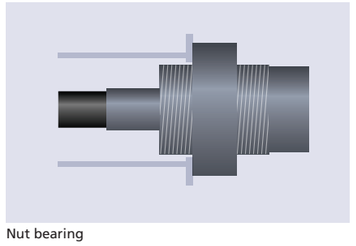
Standard Type of Socket



Front bearing



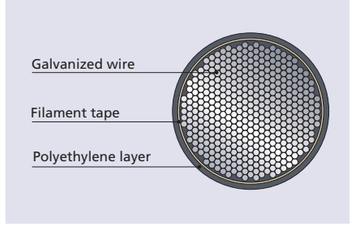
Middle bearing

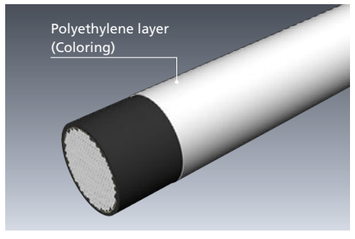


Nut bearing

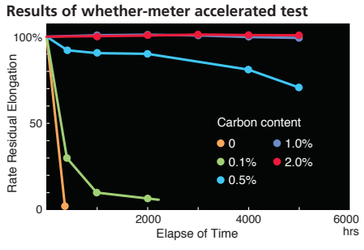
Excellent Corrosion Proofing

High density polyethylene sheath is assembled to eliminate corrosion- proofing work.
Polyethylene is resistant to acids, alkalis and other chemicals, and a carton content of about 2%ensures greater weatherability.





Results of whether-meter accelerated test

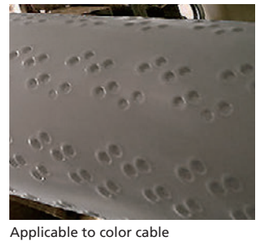



Tatara Bridge

Aerodynamic Measure for mitigating the Rain Wind Vibration

Small Drag Coefficient, even the surface treatment (Indented surface) is applied on the cable. Indented cable can achieve a counter measure without external damper against the rain wind vibration.

Indented cable: Cd≒0.7
(Cd=0.7 is the same as smooth cable)



Applicable to color cable

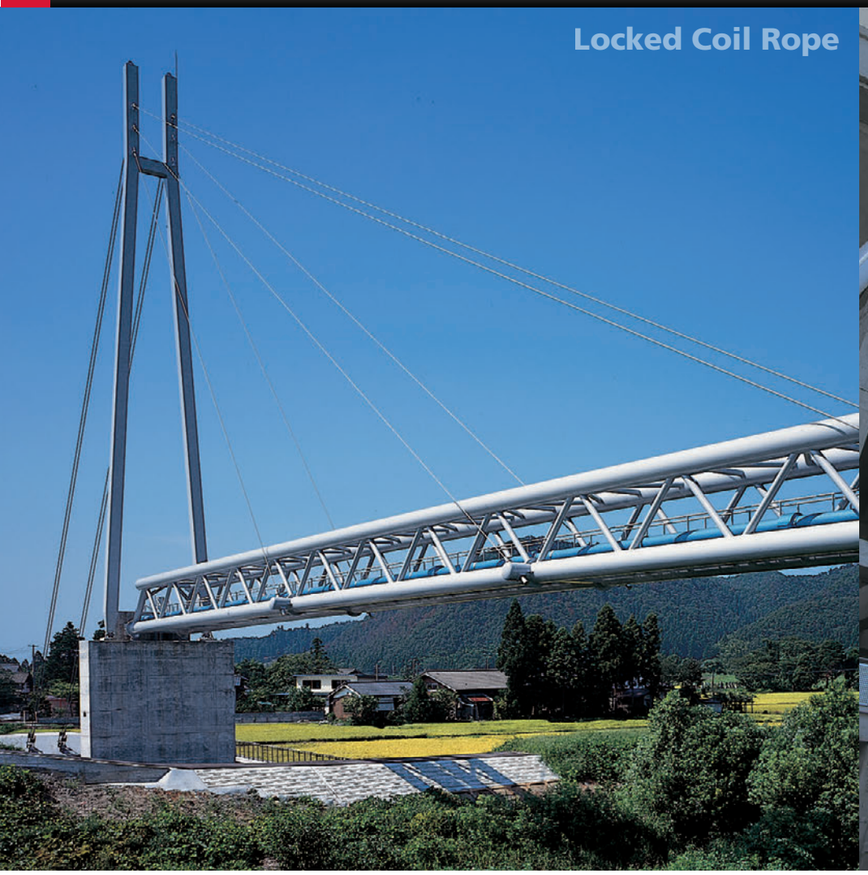
Erection of NEW-PWS

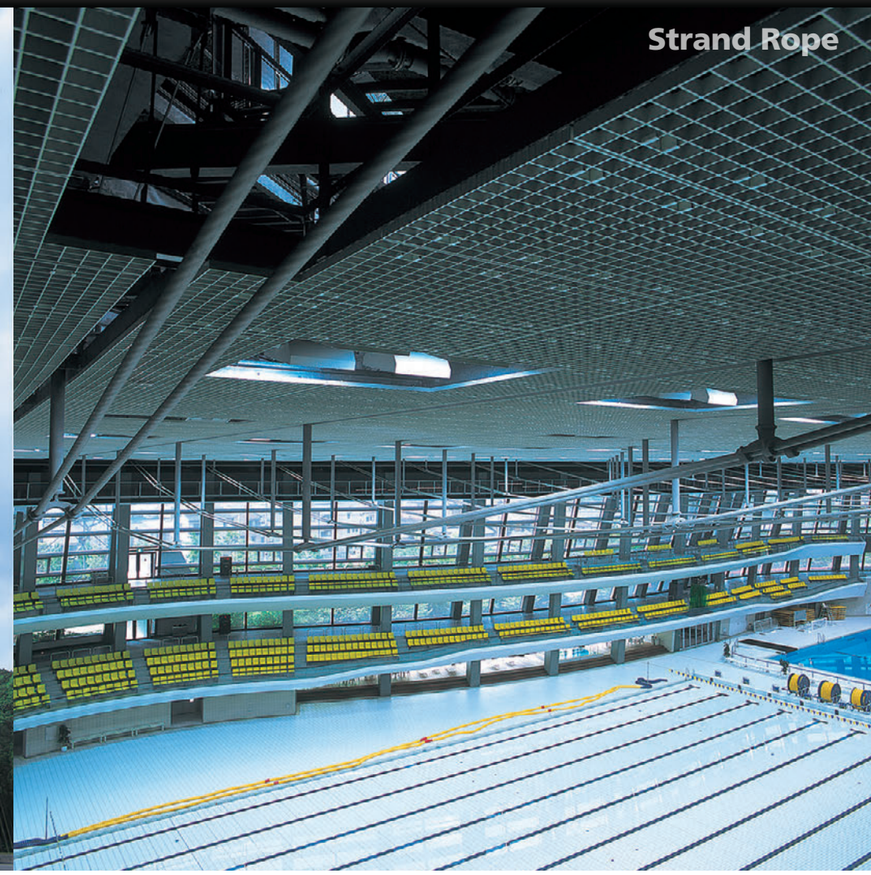
1 | Setting a cable reel on Unreeler

2 | Unreeling of cable

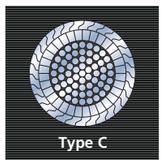
3 | Drawing & fixing of dead anchor

4 | Tensioning



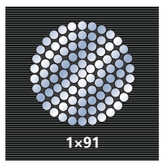


Structural Wire Rope



Locked Coil Rope

- Shaped wires (Z and T wire) are used in the outer layers.
- Rope itself has an excellent anti-corrosion performance.
- Endfitting is limited to socket type.
- Modulus of elasticity: $\geqq 1.57\times10^5 N/mm^2$
- Diameter 34～100mm



Spiral Rope

- The strength is higher than any other structural rope of the same diameter, except PPWS and NEW-PWS.
- Swaged socket is applicable up to 40mm
- Modulus of elasticity: $\geqq 1.57\times10^5 N/mm^2$
- Diameter 14～100mm

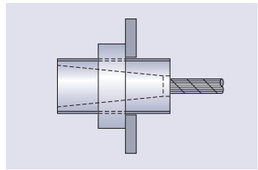
Strand Rope

- Good flexibility, Easy handling
- Swaged socket is applicable
- Modulus of elasticity: $\geqq 1.37\times10^5 N/mm^2$
- Diameter 9～71mm

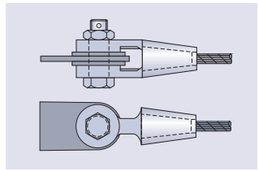
End fitting

Socket Type

Nut bearing socket

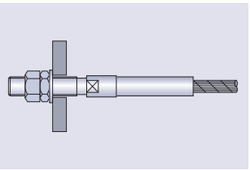


Open socket

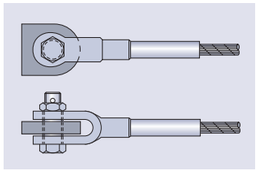


Swaging Type

Swaged socket with thread

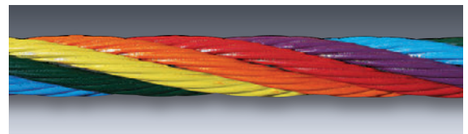


Fork end type swaged socket



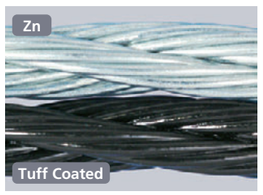
Color Coated Structural Wire Rope “Tuff Coated Rope”

Tuff Coated Rope has a high anticorrosive function due to two corrosion proofing layers, galvanizing and modified saturated polyester resin. Various color is available.



Exposure test at Mt. Aso.

At first



6 months later

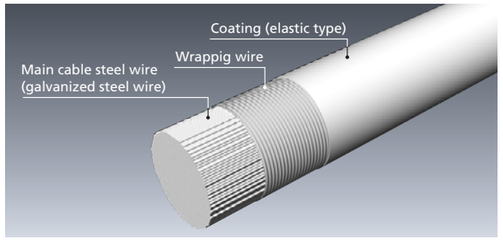
1 year later

2 years later

S-shaped Wrapping Wire

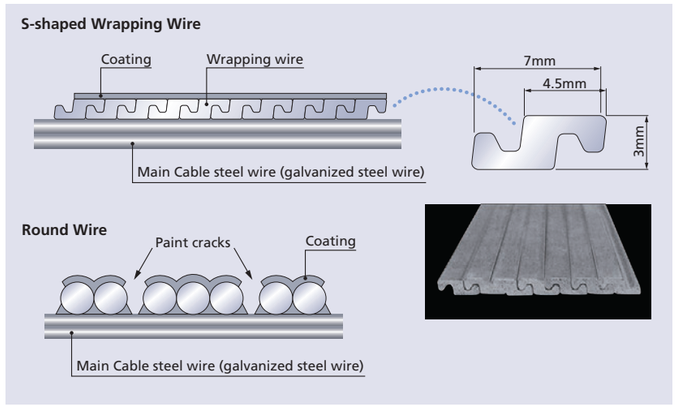
Corrosion Protection System for Main Cable

The new corrosion system that gives longer service life to the main cable, the key components of a suspension bridge, consists of Galvanized wire + Wrapping wire + Heavy-duty corrosion protection coating.

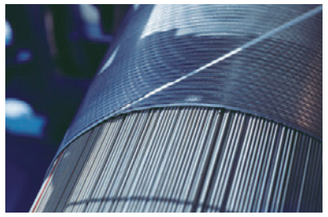


Wrapping Wire

The new wrapping wire has an S-shaped sectional configuration, and its standard size is as shown in the figure below.



This S-shaped wrapping wire prevents cracking of coating by mean of the effect of interlocking of turns. The adoption of coating agent having an excellent elongation performance prevents from cracking due to expansion of cables and at the same time prevents the infiltration of rain water and others.



Kurushima Bridge

Manufacturing Process of PPWS, NEW-PWS and Structural Rope