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PARALLEL STRAND CABLE STAYS - STATIC AND FATIGUE STRENGTH

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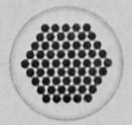
RESUME

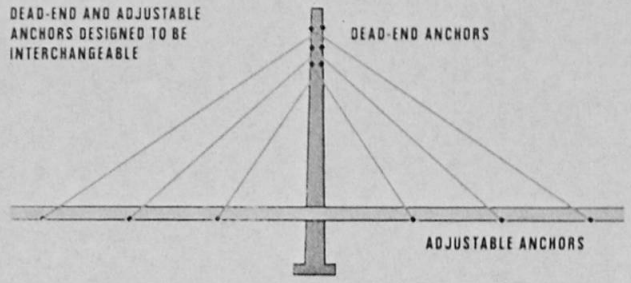
THE 7-WIRE STRAND USED IN PRESTRESSING CABLES MAY ALSO BE USED FOR CABLE STAYS PROVIDED THAT CERTAIN MEASURES ARE TAKEN TO ENSURE ADEQUATE FATIGUE STRENGTH.

THESE MEASURES HAVE BEEN TESTED IN LABORATORIES AND THE RESULTS HAVE SHOWN THAT WITH PARALLEL STRANDS, CABLE STAYS OF THIS TYPE MAY HAVE VIRTUALLY THE SAME FATIGUE STRENGTH AS THAT OF THE INDIVIDUAL STRANDS OF WHICH THEY ARE CONSTITUTED.

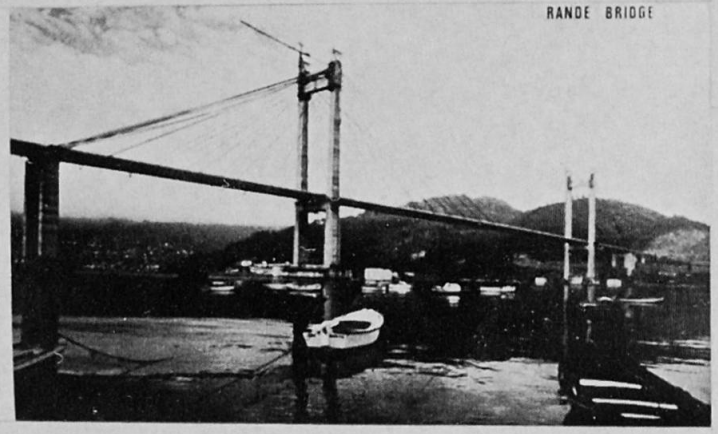
TYPE	FORCE			
	45% G.U.T.S.		100% G.U.T.S.	
	T	kN	T	kN
37H15	441	4326	980	9613
61H15	727	7132	1616	15853
91H15	1084	10634	2410	23642

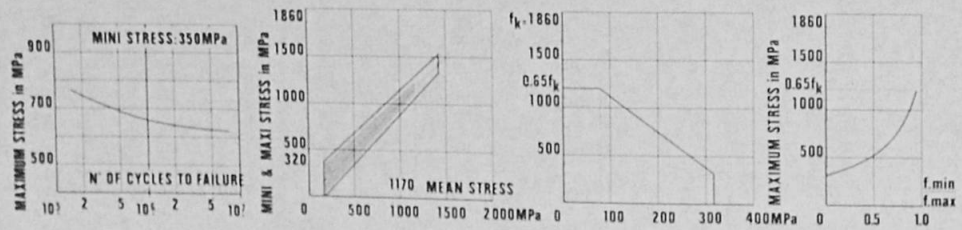
61H15 CABLE





RANDE BRIDGE

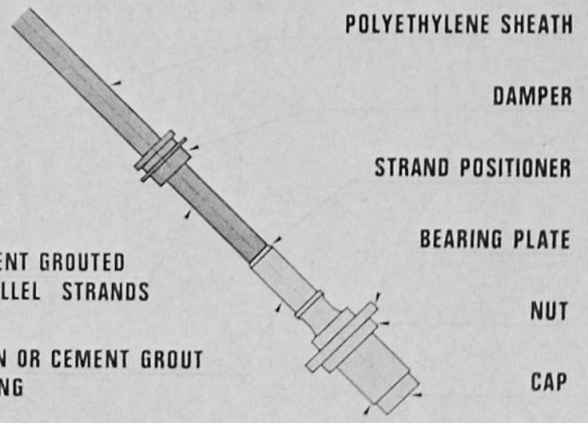




FATIGUE ENDURANCE OF A SEVEN-WIRE STRAND SPECIALLY DESIGNED FOR CABLE-STAYS

SMITH DIAGRAM AT 2.10^6 CYCLES

MAXIMUM PERMISSABLE STRESS ACCORDING TO STRESS VARIATION IN:
.ABSOLUTE VALUE .RELATIVE VALUE



POLYETHYLENE SHEATH

DAMPER

STRAND POSITIONER

BEARING PLATE

CEMENT GROUTED PARALLEL STRANDS

NUT

RESIN OR CEMENT GROUT FILLING

CAP

ANCHOR BLOCK ALLOWING INDIVIDUAL OR GLOBAL STRAND ADJUSTMENT

TAKING UP OF THE SLACK IN EACH STRAND USING SINGLE STRAND JACK

ADJUSTABLE ANCHOR

PARALLEL STRAND STAYS - STATIC AND FATIGUE STRENGTH

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A type of stay has been developed using parallel prestressing strand anchored by special stay anchor devices which comprise the following parts :

- an anchorage block, which makes it possible to anchor the strands either by 3-piece jaws and wedge action, or by swaged grips,
- a trumpet, which permits the strands to arrive to the anchor block with the right angle and spacing,
- a trumpet extension (heavy steel pipe) the length and gauge of which have been selected in order to reduce the range of stresses transmitted to the anchorage,
- a light steel pipe used to extend the stay anchor device for structural reasons.

The stay anchor devices exist both in fixed and adjustable versions. In the adjustable version part of the trumpet length is replaced by a steel tube with an outer thread which allows adjustment by turning a collar. The anchors are filled with resine after stressing.

The bundle of parallel strands is enclosed by a polyethylene pipe which after the final stressing of the stay is filled with cement grout for protection against corrosion.

Generally a neoprene damper is inserted between the light steel pipe and the structure in order to restrict wind induced oscillations in the stays.

The strands may be threaded and tensioned one by one or the whole stay may be preassembled.

The stay cable may be assembled from parallel steel stands conforming to current standards for prestressed concrete strand, but additional fatigue requirements have to be specified. Typical WOHLER-curve and SMITH diagram for good quality prestressing strand are shown on the poster.

The static and dynamic strength of the described stay type has been checked through tests of models containing up to 19 strands of 15 mm nominal diameter undertaken by official laboratoiries in various countries. Such tests have shown that a fatigue life expectancy of 2×10^6 cycles may be safely admitted within the performance band traced inside the SMITH-diagram of the individual strand.

From the performance band a linear relationship is deducted between the safe values of upper stress and stress range as shown graphically. The safe upper stress is also shown as a function of the ratio between stress range and upper stress.

The tests have further shown that the dynamic properties of a bundle of parallel strands are similar to those of a bundle of parallel wires.

Discussions around the POSTER concerned especially the dynamic strength of the stays, their durability, construction methods, damping of wind oscillations etc...

Parallel strand stays were used for such bridges as the BROTONNE bridge in FRANCE and RANDE bridge in SPAIN, both built in the late seventies.