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DYFORM WIRE ROPE TRIALS

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INTRODUCTION

Although wire rope is used extensively by all sectors of the logging industry, there have been few technological advances, or changes, in its construction.

A recent development is the production of Dyform, a compacted strand rope with higher tensile strength and greater resistance to wear and bending fatigue than conventional wire rope constructions.

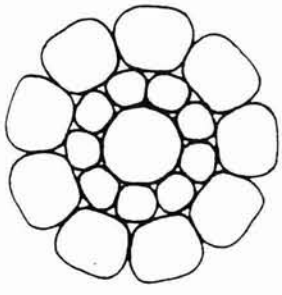
Cookes Consolidated Services Ltd. have imported 1,200 metres of a 19 mm 6 x 26 Dyform construction, for trial with the Logging Division of Waipa Sawmill. This rope construction is being evaluated with a view to manufacture in New Zealand.

ACKNOWLEDGEMENTS

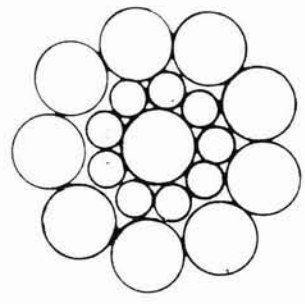
LIRA acknowledges the co-operation of the Logging Division of Waipa Sawmill, Cookes Consolidated Services Ltd., Auckland, and Steel Rope Industries, Auckland.

DYFORM ROPE

The difference between a conventional and Dyform rope construction is in the six outer strands. For a conventional rope construction, the outer strands are made to suit the nominal diameter of the finished rope. The outer strands of the Dyform rope are made to an oversize diameter initially and are then run through a die prior to the rope closing process, which compresses and reduces the strand diameter to suit the nominal diameter of the finished rope.



Dyform strand construction



Conventional round strand construction

TRIALS

Comparative workshop tests of Dyform and the conventional rope constructions have been completed and a longer term field trial is in progress.

WORKSHOP TESTS

The 6 x 26 Dyform rope was tested against the commonly used 6 x 19 and 6 x 31 rope constructions at the test facility of Steel Rope Industries, Auckland. The three rope constructions were compared in the following tests :

- tensile strength of new rope
- tensile strength of spliced rope
- accelerated wear and fatigue tests to determine differences in rope life

Construction		Test Rope Specification 6 x 19	6 x 31	6 x 26 (Dyform)
Nominal diameter	(mm)	19.00	19.00	19.00
Exact diameter	(mm)	19.12	19.10	19.36
Number of strands		6	6	6
Strand formation		(9/9/1)	(12/6+6/6/1)	(10/5+5/5/1)
Core		Independent wire rope core		
Lay		Right hand ordinary lay		
Tensile grade of wire		180	180	180

TENSILE STRENGTH TEST

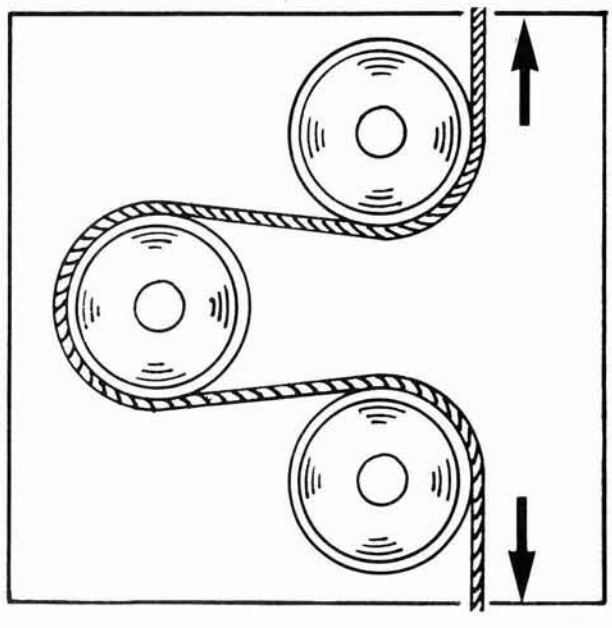
The tensile strength test is a destruction test to determine the actual breaking force of the rope.

		6 x 19	6 x 31	6 x 26 (Dyform)
Test certificate minimum breaking force	(Kgs)	23,200	23,100	26,000
Actual breaking force	(Kgs)	23,400	26,830	29,166
Butt splice		22,150	22,250	22,850
Cut splice		22,050	22,100	26,200

WEAR AND FATIGUE TESTS

For the wear and fatigue tests, a 3,500 Kg load was imposed on a fixed 20 metre test length of each rope construction. A carriage with three offset 19 mm sheaves was run up and down this rope until it broke.

A visual inspection for broken wires and a two dimensional calliper measurement of the rope diameter was taken at the same point, and number of cycles for each test sample.



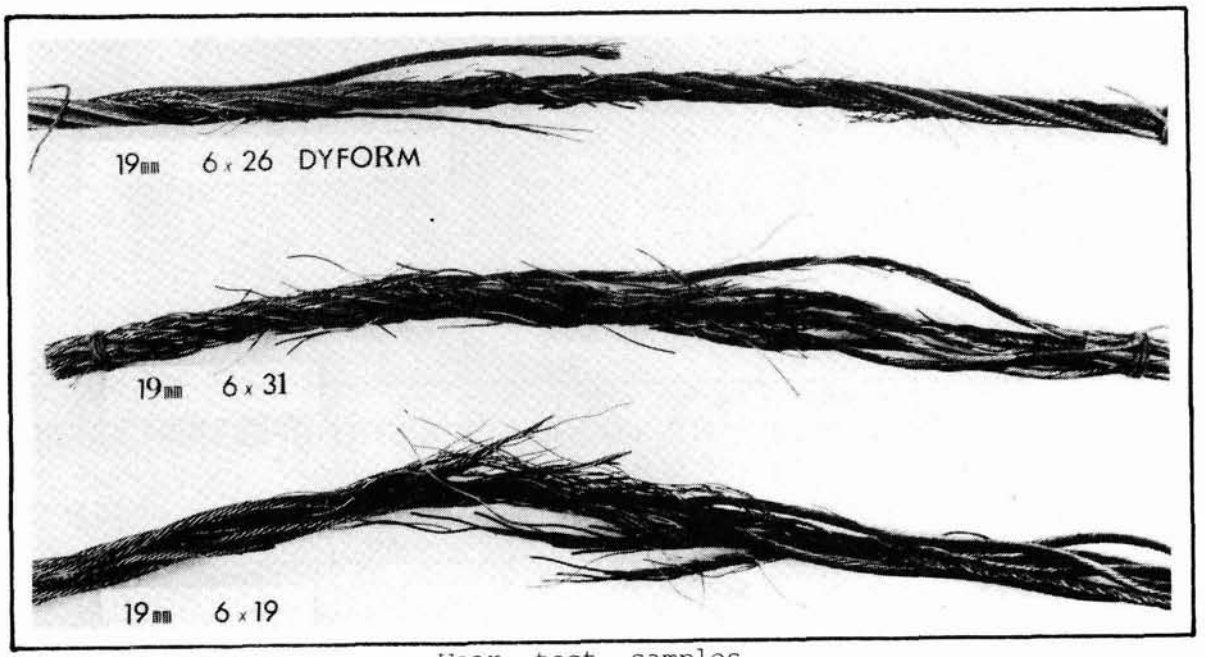
		Test Sample Specification		
		6 x 19	6 x 31	6 x 26 (Dyform)
Nominal diameter	(mm)	19.00	19.00	19.00
Off tension diameter	(mm)	19.12	20.12	19.38
3,500 Kg tension diameter	(mm)	18.62	19.88	19.02

TEST RESULT

Rope Construction	No. of Cycles	Rope Diameter (mm)	Remarks
6 x 19	880	18.64 x 18.30	Five broken wires
	1,000	18.62 x 18.26	Fourteen broken wires
	1,118	-	Four strands and the core broken
6 x 31	1,000	19.32 x 19.19	Zero broken wires
	1,102	19.30 x 19.17	One broken wire
	1,500	19.26 x 19.12	Fourteen broken wires
	2,000	19.20 x 19.08	Numerous broken wires
	2,065	-	Two strands and the core broken
6 x 26 (Dyform)	1,000	18.88 x 18.88	Zero broken wires
	1,102	18.88 x 18.88	Zero broken wires
	1,336	18.88 x 18.88	Zero broken wires
	1,980	18.84 x 18.74	Six broken wires
	2,500	18.90 x 18.61	Numerous broken wires
	3,000	18.74 x 18.56	Numerous broken wires
	3,057	-	Two strands and the core broken

The wear and fatigue tests showed that Dyform rope not only lasted significantly longer, but held its shape with less diameter distortion than both the 6 x 19 and 6 x 31 constructions. Other noticeable features were that broken wires tended to stay with the lay of the rope rather than protrude as sprags, as did the broken wires in the other constructions, and there was less elastic stretch in the Dyform rope when it was under load.

The wear and fatigue tests to destruction were repeated with no significant variation in results.



Wear test samples

DISCUSSION

The major advantages of Dyform over conventional constructions are claimed to be :-

(1) Increased strength and resistance to crushing through the increase in the amount of steel in the cross-section of the rope and the reduction in internal voids.

(2) Increased resistance to abrasion and wear through the flattened outer strand wires, which reduce the bearing pressure of the rope on sheaves and drums.

(3) An increased rope life through a combination of the above.

The workshop tests did show that the Dyform rope is significantly better than either a 6 x 19 or 6 x 31 construction, for tensile strength, resistance to crushing, diameter distortion and rope wear. Expected rope life has not yet been determined but it is reasonable to assume an increase.

As the construction of Dyform rope requires more steel for a given nominal diameter, and an extra manufacturing process, the price will be higher. As Dyform rope is not made in New Zealand as yet, a local price is not available. An indication of price, from North America, is that Dyform is approximately 40% higher than a conventional round strand construction.

Field trials are currently being held, with the Dyform rope being used as a tailrope on a Dispatch hauler. The rope will be used until it no longer meets the Labour Department Safety Code. LIRA will monitor and report on these trials.

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