Journal of the Textile Institute Transactions
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/jtit20

59-Tensile Tests for Cotton Yarns the Rate of Loading (Addendum)

Version of record first published: 22 Jan 2013.

To cite this article: (1926): 59-Tensile Tests for Cotton Yarns the Rate of Loading (Addendum), Journal of the Textile Institute Transactions, 17:12, T661-T662

To link to this article: http://dx.doi.org/10.1080/19447027.1926.10600026

59—TENSILE TESTS FOR COTTON YARNS
THE RATE OF LOADING (*ADDENDUM*)

By Edward Midgley, B.Sc. and Frederick Thomas Peirce, B.Sc., F.Inst.P.

(British Cotton Industry Research Association)

In the paper recently published under the above title,[3] the need arose for data on the effect of rate of loading in testing fabrics, for comparison with that found in testing hairs and yarn. Those quoted appeared the best available, but did not allow a critically quantitative comparison. Another publication has since been found in which the question is explicitly dealt with, the effect also being expressed against the logarithm of the time of break, namely,[1] "The Effect of Rate of Loading on the Apparent Strength of Cotton Balloon Fabrics," by Dr. Guy Barr, to whom the writers owe an apology for the oversight.

A number of fabrics were tested on the Avery machine over a wide range of speeds, the time of break T varying from 13 sec. to 2½ hours, and the relations obtained were expressed linearly against log. T. Writing the breaking load F, when T is 10 sec. F_1, the slopes of the lines are given in the Table I.

Table I.

Fabric	Weight gm/m²	$-dF/d.\log.T$	Remarks
Cotton "C"	80 ...	0·059 F_1 ...	Both warp and weft.
Linen	— ...	0·086 ...	Technical Report, 1914–15.
2-ply Rubbered cotton	— ...	0·096 ...	Warp way of straight ply.
Cotton "D"	65 ...	0·103 ...	Light airship material.
Canvas	210 ...	0·111 ...	Heavy balloon cotton fabric.
Mean	— ...	0·091 F_1 ...	—

Barr tentatively explains the effect by supposing the fibres to slip less in rapid breaks, the fibre strength remaining invariant. It will be seen, however, that the rate of change of apparent strength of fabrics is the same as that found in hairs and yarn, and that no indication of greater slippage could be found in the latter after a slow break. The effect in all three seems to be accounted for quantitatively by the elastic imperfection of the cellulose of the ultimate fibre. This difference of interpretation is by no means of merely academic and theoretical importance, as the effect is involved not only in reconciling the results of different testers and in standardising testing conditions, but also in industrial application, viz., the slow yielding under a steady load, the loss of tautness of driving bands or aircraft fabric. In attempting to control or avoid these time-effects, an entirely different manner of attack is called for if the cause lies in the cellulose itself than if it be structural and influenced by sizing or weave.

In this connection, the variations of slope of the logarithmic relation should be considered. For single hairs,[2] the slopes are not defined exactly enough to indicate or disprove specific differences between cottons, though the mercerised cotton may be rather more susceptible. For variations among yarns there are available only the parallel results of standard, Moscrop, and ballistic tests, the ratios between which vary irregularly, in the absence of sampling for the purpose, about those given by the yarn thoroughly tested from this point of view.[3] Effects of cotton, spinning, sizing, and humidity, are involved in the comparison of the ballistic and dead-weight tests made in the work on the effect of humidity.[4] Assuming a linear relation between load and extension, and that the final extension is independent of speed, a comparative figure of the slope $100/F_s \cdot \times dF/d.\ \log.\ T$ is given in Table II., where F_s is the breaking load in the slow test. The similar figure from the mean results at 70 R.H. of the ballistic and dead-weight tests given in the paper[3] on the rate of loading is 13.

Table II.

Slopes of Rate of Loading Effect on Warp Yarns

Unsized							Sized						
R.H.	50s	32s	Sa	Sb	Mean		R.H.	50s	32s	Sa	Sb	Mean	Mean.
50	15	13	19	19	16	...	53	23	14	19	15	18	17
70	14	12	14	12	13	...	69	20	12	14	13	15	14
85	12	12	16	10	13	...	85	19	16	15	15	16	15
92	15	15	24	15	17	...	94	15	13	14	14	14	16
Mean	14	13	18	14	15	...	—	19	14	16	14	16	15

There appears in this table no significant influence of cotton, counts, combing, sizing, or even humidity. Returning to Table I., the last three slopes are not significantly different and no influence can be ascribed to the large differences of weight and of reinforcement. The only distinct variation is that shown by Fabric "C," which is the same as the single ply of the rubbered material, and the only feature to which this may be ascribed is the greater possibility of inter-fibral slipping. During the slow application of tension, excessive tensions will be released and the load more evenly distributed between the fibres, the structure will be made more compact by readjustment under compression, and the fabric strengthened so as to counteract the natural time effect in the cellulose.

REFERENCES

[1] Barr. Aeronautical Research Committee, Report No. 757, Dec. 1920.
[2] Mann and Peirce. Shirley Inst. Mem., 1926, **5**, 7; or J. Text. Inst., 1926, **17**, T82.
[3] Midgley and Peirce. Shirley Inst. Mem., 1926, **5**, 102; or J. Text. Inst., 1926, **17**, T330.
[4] Peirce and Stephenson. Preceding Memoir.

Shirley Institute
Didsbury

Received for publication, 17th September 1926.