THE NATIONAL PHYSICAL LABORATORY.

Engineering Department.

"Approved Extracts of Reports from The National Physical Laboratory, Engineering Department, on Tests for Transverse Strength, Rate of Wear, and Absorption of Water, made on Concrete Flags supplied by S. Marshall & Sons, Ltd., Southowram, Halifax.

Description of flags:- Scapplings from Hard York Natural stone paving flags (Elland Edge bed) from our own Quarries at Southowram.

Type of cement used:- Earle's, Hull

Method of moulding & pressure employed:- Hydraulically pressed, 1555 lbs. per square inch.

RESULTS OF TESTS.

1. Transverse Strength Test: Report dated 28th October, 1937.

N.P.L. Eng. Dept. Test Mark.	Dimension of Sample superficial length.	width.	thick.	Proof load lb. per ft. width.	Max. load lb. per ft. width.
KKA 2.	24"	18"	2½"	1904	3570

2. Rate of Wear: Report dated 13th July, 1937.

N.P.L. Eng. Dept. Test Mark.	Thickness of sample. inches.	Weight of sample in lb. initial	final.	Loss of weight lb.	Character of worn surface.
KEH 1 A	2½"	52.7	52.1	0.6	uniform.
KEH 2 A	2½"	54.5	53.9	0.6	uniform.

3. Absorption of Water: Report dated 28th October, 1937.

N.P.L. Eng. Dept. Test Mark.	Thickness of sample inches.	Increase in weight by absorption of water percentage after 10 minutes.	after 24 hours.
KKA 4 A	2½"	1.2	6.4

These samples do conform to the requirements of British Standard Specification No. 368 1936, Clause 11 (a), as regards transverse strength, clause 11(b) as regards rate of wear, and clause 11(c) as regards absorption of water. "

FORM M:

THE NATIONAL PHYSICAL LABORATORY

Engineering Department

REPORT

on

Testsfor Rate of Wear made on Concrete Flags supplied by

Messrs. S. Marshall & Sons Ltd.,
Cromwell Quarries & Artificial Paving Works,
Southowram,
Halifax, Yorks.

Ministry of Transport Requisition No:- F.48

N.P.L. Eng.Dept.Test Mark:- KEH

Senders' Marks: None

1. Senders' Description of Flags:

Description and source of the aggregate used in the manufacture:

Scapplings from Hard York Natural Stone Paving Flags (Elland Edge Bed) from our own Quarries at Southowram, passing $\frac{1}{4}$ in.

Type of Cement used in the manufacture:

Earle's Robson Brand.

Method of Moulding and Pressure employed:

Hydraulically pressed, 1555 lb.per square inch.

2. Method of Test:

Three samples each 2 ft. x 1 ft. x $2\frac{1}{2}$ in. were tested by means of the apparatus described in British Standard Specification No.368-1936, appendix B.

The samples, after being dried to a constant weight* at a temperature not exceeding 100°F. and finally weighed, were secured in position with their wearing faces inwards and covering openings in the sides of the container. One thousand hard steel balls, $\frac{1}{2}$" diameter, were placed in the container and after all openings had been closed, the complete assembly was revolved for 24 hours at a speed of 60 revolutions per minute in one direction and then for 24 hours at the same speed in the reverse direction. At the end of the first period of 24 hours the dust was removed from the machine.

Upon removal of the samples from the container, the faces were brushed clean of all dust, the samples again dried to a constant weight* and the loss in weight determined.

3. Results /

* A sample was considered as having been dried to a constant weight when it lost no more than 0.2% of its original weight in 24 hours under the conditions specified.

3. Results of tests for Rate of Wear:

6

N.P.L. Eng. Dept. Test Mark.	Thickness of sample in.	Weight of Sample in lb.		Loss of Weight lb.	Character of worn surface.	Remarks
		Initial	Final			
KEH 1 A	$2\frac{1}{2}$	52.7	52.1	0.6	Uniform	
KEH 2 A	$2\frac{1}{2}$	54.5	53.9	0.6	Uniform	
KEH 3 A	$2\frac{1}{2}$	56.2	55.5	0.7	Uniform	

These samples do conform to the requirements of British Standard specification No. 368 - 1936, Clause 11(b) as regards rate of wear.

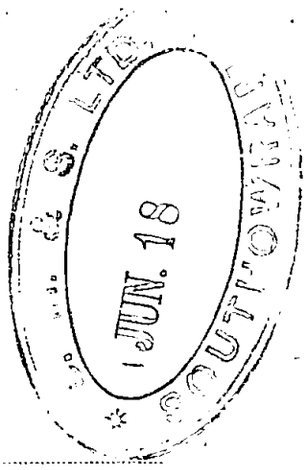
A. Bailey
for H. GOUGH
Superintendent.

13th July 1937
ER.

Notice: Attention is drawn to the following clause from the Laboratory regulations:- A Laboratory Certificate, Statement or Report may not be published except in full, unless permission for the publication of an approved abstract has been obtained, in writing, from the Director.

E 1795—2000 (115)

TECHNICAL COLLEGE BRADFORD



MATERIALS TESTING LABORATORY

REPORT on Concrete Flags tested for Rate of Wear Transverse and Absorption.

Submitted by Messrs. S. Marshall & Sons, Ltd. Southowram, Halifax.

Rate of Wear:

Test No.	Mark.	Size.	Wt. of Flag. lbs. ozs.	Wt. after test. lbs. ozs.	Loss of Wt. lbs.
C.T.413.	1	2'x1'x2½"	55. 12	55. 8	0.25
C.T.414	2	"	59. 4	59. 1	0.187

Transverse:

Test No.	Mark.	Size.	Span.	Breaking Load.
C.T.414a	1	2'x1'x2½"	18 ins.	1.23 tons = 2755 lbs. per ft. width.
C.T.415	2	"	"	1.22 " = 2732 " "

Absorption:

Test No.	Mark.	Wt. Dry. lbs. ozs.	Immersion Wt. after 10 mins. lbs. ozs.	Wt. after 24 hours. lbs. ozs.
C.T.416	-	28. 8	28.10	28.14

= 1.31%

Date 17th June, 1937.

J. B. McHay

Head of Mechanical and Civil Engineering Department.

TP 7525—2000 (130) 10/36

TECHNICAL COLLEGE BRADFORD

MATERIALS TESTING LABORATORY

REPORT on Transverse Tests on Concrete Flags.

Submitted by S. Marshall & Son Ltd. Halifax

TEST No.	MARK.	SPAN.	BREAKING LOAD.
	S.1	1' 8" SPAN	1·35 tons = 3024 lbs per ft. width.
	S 2.	1' 8" span.	1·4 " = 3136 " " "
	T 1.	"	1·02 = 2284 " " "

Date Oct 5th 57

Head of Mechanical and Civil Engineering Department

S. Marshall & Sons Ltd

CONCRETE PAVING & KERBS · MARSHALITE-TUDOR WALLING STONE
PENNINE PAVING · NATURAL YORK STONE
GLENSTONE PRODUCTS

SOUTHOWRAM
HALIFAX
Telephone: Halifax 63171 (10 lines)

HINTS ON USING MARSHALL'S WALLING.

Tudor and Marshalite Walling, Glenstone Bricks and Superscreen Walling.

FOUNDATIONS

Produce in concrete a good foundation a few inches wider than the wall and at least 4" thick. Have to hand all the necessary equipment for mixing and walling. Make sure the units are as dry as possible.

LAYING

It is essential that the correct grade of mortar is used. A proprietary brand of Brick laying mortar mix would be suitable. Alternatively, 1 part cement, 1 part lime and 6 parts sand, or 1 part masonry cement and 6 parts sand. The mix should be workable but not 'sloppy' as it is important **NOT** to allow spillage on to the face of the stone. Lay the mortar on the foundation and set a unit on it and make it level, butter the end of the unit, lay mortar for the next one, bed, make level and continue. Make sure the vertical joints are filled.

CUTTING

Using a chisel and hammer, mark the bed surface at the place required to be cut, turn the unit over and strike the face opposite the cut.

JOINTS

An attractive effect can be made by making a raked or recessed joint. This is made by scraping out approximately $\frac{3}{8}$" of mortar out of the joint before the mortar has set hard.

N.B. Do not wall with a very wet mortar or build when it is raining. After building protect with polythene until the mortar is hard.

When used as an earth retaining wall, leave drainage holes every 2/3 yards. When building long walls it is advisable to construct pillars every 12 to 15 ft.

HINTS FOR LAYING MARSHALL'S PAVING.

FOUNDATIONS

The foundation should be $2\frac{1}{2}$" of well compacted hardcore or other suitable material.

BEDDING

For a permanent fixing the paving should be bonded to the foundation either by a full bed of mortar or the five spot method. (The mortar is approximately 5 parts sand to 1 part cement and not too wet). Alternatively other methods are to lay the paving directly on to the earth or sand. With this method tilting may occur as the rain can wash away the sand or earth.

LAYING

When using mortar bedding, lay the mortar in position and tamp the paving down to the required level with a wooden trowel handle or a piece of wood, making sure the paving does not rock.

JOINTS

Pennine Paving should be butt jointed at the base (the sides are tapered). Pressed Paving can be butt jointed or a joint left between them. These joints may be left open. If required to be filled use **ONLY** a dry mortar which must be carefully brushed into the joint. Do **NOT** brush over the whole area of the paving surface and **DO NOT** apply in damp or wet weather as this can stain the surface and spoil the overall effect. Soil or dry sand can be used to fill the joints.

AFTER CARE

To keep paving looking clean, a suggested treatment repeated every three or four months is to scrub the whole surface with a mild detergent solution using a stiff brush and wash off with plenty of clean water.

N.B. The use of salt for removal of ice and snow is not recommended.

TP 7525—2000 (130) 10/36

TECHNICAL COLLEGE BRADFORD

MATERIALS TESTING LABORATORY

REPORT on Transverse Tests of Concrete Flags

Submitted by Messrs. S. Marshall & Sons, Ltd., Southowram, Halifax.

Test No.	Mark.	Size	Span	Total Load. lbs.per ft.width.
C.T.433	S	2ft x 1 ft x 2½ ins.	18 ins.	{1.35 / 1.4 = 3080 lbs. Average of two halves.
" 434	T	"	"	1.02 = 2284 lbs.

Date 6th October, 1937.

E Meadowcroft
for Head of ~~Mechanical and~~ Civil Engineering Department

E 1795—2000 (115)

TECHNICAL COLLEGE BRADFORD

MATERIALS TESTING LABORATORY

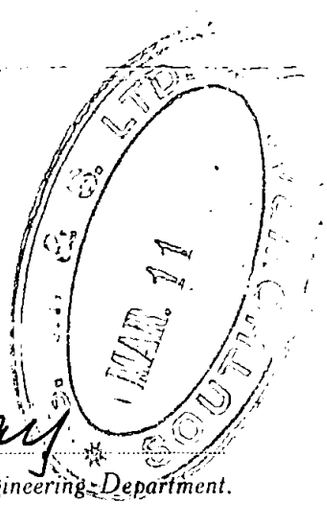
REPORT on Transverse, Rate of Wear and Absorption Tests of Concrete Flags.

Submitted by Messrs. S. Marshall & Sons, Limited. Southowram, Halifax.

Rate of Wear.	Mark.	Size.	Weight of Flag.	Weight after Test.	Loss of Weight.	
C.T.395	1	2'x 1'x2½".	59 lbs.2oz.	58 lbs.2 ozs.	16 ozs.	1½ lbs
" 396	2	"	59 " 0 "	57 " 15 "	17 "	1½ lbs
" 397	3	"	59 " 4 "	58 " 6 "	14 "	1½ lbs
" 398	4	"	58 " 12 "	57 " 13 "	15 "	1½ lbs

Absorption.	Size.	Wt. Dry.	Wt. after 48 hours.	Percentage.	
C.T.396a	4½"x4½" x 2½"	3 lbs.15 ozs.	4 lbs. 0 ozs.	1.6%	6.5 at 24 hrs

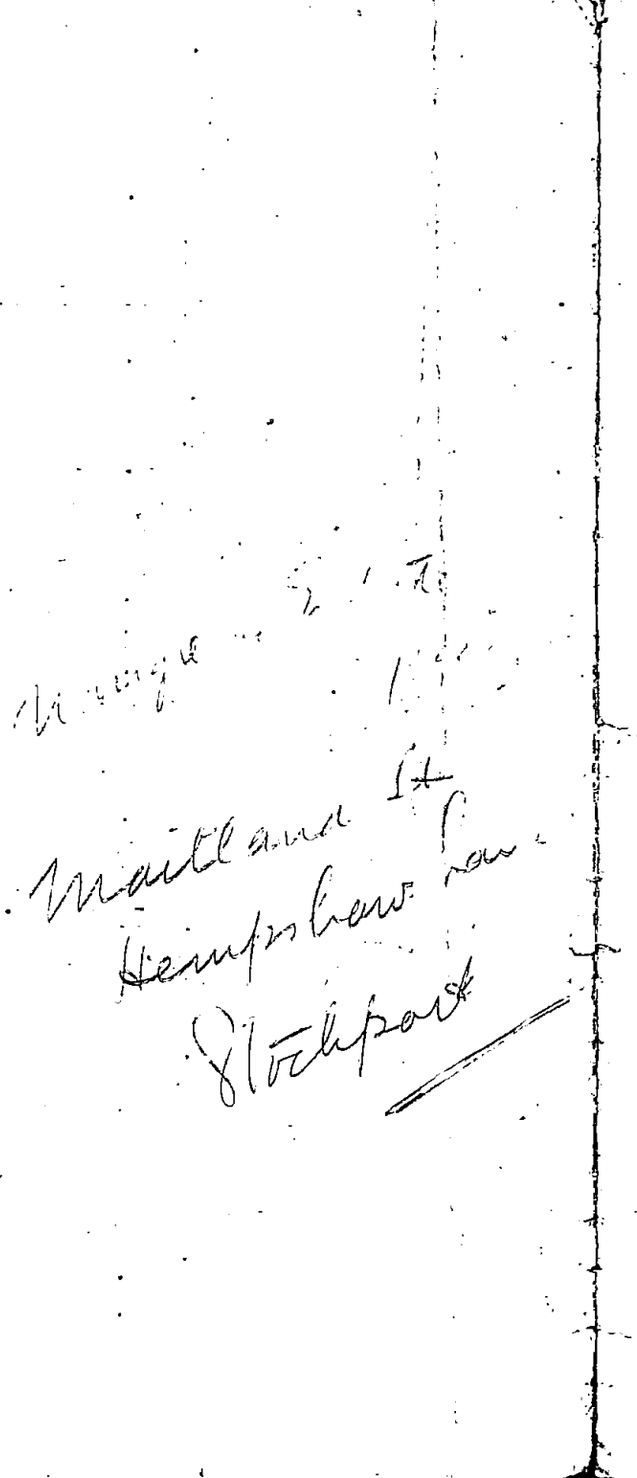
Transverse.	Size.	Span.	Breaking Load.	lbs. per ft. width.	
C.T.401	2'x2'2½"	18"	3922	1961	1404
" 402	"	"	4097	2048.	1904.



Date 8th March, 1937.

J. B. M. Hay

Head of ~~Mechanical and~~ Civil Engineering Department.


Maitland Pk
Hempshaw Lane
Stockport

FORM L:

THE NATIONAL PHYSICAL LABORATORY

Engineering Department

R E P O R T

on

Tests for Transverse Strength made on Concrete Flags supplied by

Messrs. S. Marshall & Sons Ltd.,
Southowram,
Halifax.

Ministry of Transport Requisition No:- F.53

№ Eng. Dept. Test Mark:- KKA

Senders' Marks:- SM & S Ltd.

1. Senders' Description of Flags

Description and source of the aggregate used in the manufacture:

Scapplings from Hard York Natural stone paving flags (Elland Edge bed) from our own Quarries at Southowram.

Type of Cement used in the manufacture:

Earle's Robson Brand.

Method of Moulding and pressure employed: Hydraulically pressed, 1555 lb. per square inch.

2. Method of Test:

Each of the two sample flags supplied for this test was supported upon two steel bearers, each ¼" wide on the supporting surfaces, parallel to each other and 1' 6" apart. The flag was placed upon the bearers with its wearing face uppermost and its shorter sides parallel to the bearers. The bearers were level in all directions and were arranged so as to support the flag when under test throughout its whole width. The load was applied through the medium of a hardwood fillet to a space 2" wide in the centre of the unsupported portion of the flag, and extending the whole width of the flag, parallel to the bearers. The load was applied steadily and uniformly, starting from zero, at a rate not exceeding 112 lb. per foot of width (measured parallel to the bearers) per ten seconds, up to the proof load, which was maintained for one minute. The load was then increased at the same rate as before until failure occurred.

3. Results /

R.J.

3. Results of Tests for Transverse Strength.

Date of Test: 27.10.37.

№ Eng.Dept. Test Mark.	Dimensions of sample - in. Superficial length	width	thickness	Proof Load lb.per ft. width	Max.Load lb.per ft. width	Remarks
KKA 1	24	18	2½	1904	3170	Sample marked "SM & S Ltd"
KKA 2	24	18	2½	1904	3570	Sample marked "SM & S Ltd"

These samples do conform to the requirements of British Standard Specification No.368 - 1936, Clause 11(a) as regards transverse strength.

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for A.Bailey
H.GOUGH
Superintendent.

28th October 1937
ER.
R.J.

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KERB BS 340

demarcation line, mainly between traffic and pedestrians

drainage

Section	½B	3x3	BN	SQUARE
fig	6	4	1	8
	7	5	2	
	7A		2A	
	9		3	
	urban	rural	urban	channel

aggregate
cement
pulverised fuel ash
} other contents optional

measurement limits

metric v imperial overall ± 4mm
(say 121-129 x 251-259)
individually ± 2mm

strengths

relative to age?
test based on 28 days
RW, Midland aim for strength at 14 days
Halifax slightly older because of sandstone content

When kerbs are metric

4.5m 15' unchanged

2ft - 10 ft will change to conform

standards (m) 1, 2, 3, 4½, 6, 7½, 9, 10½

FLAG BS 368

made by any process (pressed, vibrated)
pressed min 1000 lbs / □"

wet pressing needs paper to retain fines

semi dry requires only 1 man/machine but suitable only for smaller sizes

standard sizes
600 x 450 600 x 600 600 x 750
600 x 900 tolerance +0 -4 mm

work size less 2mm which then allows ± 2mm

thickness (ave of 3 flags = 12 edges)
± 3mm

bowing tolerance ± 2mm