



TEST REPORT NO. EPOD/06-05
Measurement of the Mechanical Strength of
ARAYFIX or HK HOOKS
(English version)

This test report only details the characteristics of the samples subjected to the tests and does not make any claims about the characteristics of similar products. It therefore does not constitute product certification in the meaning assigned by article L 115-27 of the consumer code and the law of 3 June 1994.

This test report may only be reproduced in full.

It contains 18 pages.

UPON THE REQUEST OF:
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38019 GRENOBLE - FRANCE

PARIS – MARNE-LA-VALLÉE – GRENOBLE – NANTES – SOPHIA ANTIPOLIS
CENTRE SCIENTIFIQUE ET TECHNIQUE DU BÂTIMENT
Sustainable Development Department

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SUBJECT

The aim of this report is to measure the strength of hooks manufactured by the company A. RAYMOND.

EXPERIMENTAL PROGRAMME / REFERENCE TEXTS

The various test methods are described in this report.

SAMPLES SUBJECTED TO THE TEST

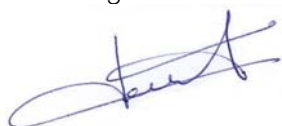
- ARAYFIX or HK hooks.

Received on: 23 May 2006.

Tests performed on: 01 June 2006 to 20 July 2006.

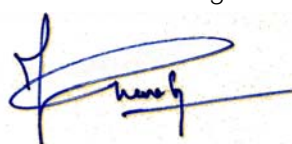
Signed in Grenoble, France on 21/07/2006

Technician
in charge of the tests



Jérôme LAURENT

Environment : Sustainable Products and Works
Division Manager



Jean-Luc CHEVALIER

1 - Experimental programme

This was drawn up by the company A RAYMOND, and relates to two types of products:

- ARAYFIX or HK hooks are steel wire pins for inserting into concrete. Their strength is measured using two types of substrate:
 - o On self-locking concrete paving blocks
 - o On 350 kg/m³ concrete (cement quantity)

The parts diagram is given in appendix 1 on page

2 - ARAYFIX or HK hook tests on concrete substrates

These hooks are tensioned by an 8 mm diameter pin.

One type of substrate has been chosen:

- 350 kg/m³ concrete substrates (cement quantity)

ARAYFIX or HK hooks are tested using:

- A 5 mm diameter smooth rod. The tension is applied:
 - o Axially



- o Parallel to the surface of the substrates in two directions of application



Direction of application 1



Direction of application 2

2-1 Method

The hooks are hammered into place in 8 and 9 mm holes drilled into the concrete substrates to a depth of 30 mm.

The tests are performed on a PC-controlled ZWICK type 1494 electromechanical machine:

- The force measuring cell is class 0.5.
- The test temperature is $23 \pm 2^\circ\text{C}$

The load is applied progressively at a speed of 20 mm/min. Using the load/distortion graph, the maximum load supported by the fixing is determined during the test. The average value is calculated over ten tests.

It should be noted that the experimental conditions are the same as those used in test report GM/94-07.

2-2 Results

The average values are given in the following tables. The full results are given on the following pages:

- axial pull-out tests on ARAYFIX or HK hooks, pages 11 - 13
- shear tests on ARAYFIX or HK hooks, pages 14 - 16

	CONCRETE SUBSTRATES 350 kg/m ³ AXIAL TENSION	
	Ø 8 mm	Ø 9 mm
NUMBER OF SAMPLES	10	10
1 st SLIP daN	90 ± 16	104 ± 47
MAX FORCE daN	344 ± 26	225 ± 31

	CONCRETE SUBSTRATES 350 kg/m ³ SHEAR Ø 8 mm	
	DIRECTION OF APPLICATION	
	1	2
NUMBER OF SAMPLES	10	10
1 st SLIP daN	205 ± 46	170 ± 33
MAX FORCE daN	408 ± 43	485 ± 98

The results of the pull-out type tests are given in the following tables.

1 – Complete slip of the hook until complete pull out (example on paving block substrate)



2 – Slipping of one side of the hook, the other part remaining stuck inside the hole



3 – Pull-out of the mortar following a phase of slip



CONCRETE SUBSTRATES 350 kg/m ³ AXIAL TENSION		
TEST No.	PULL-OUT TYPE Ø 8 mm	PULL-OUT TYPE Ø 9 mm
1	1	1
2	1	1
3	2	1
4	2	1
5	1	1
6	1	1
7	2	1
8	1	1
9	2	1
10	2	1

CONCRETE SUBSTRATES 350 kg/m ³ SHEAR Ø 8 mm		
TEST No.	DIRECTION OF APPLICATION 1	DIRECTION OF APPLICATION 2
1	2	1
2	1	2
3	2	1
4	2	1
5	1	2
6	1	1
7	2	2
8	1	2
9	2	2
10	1	2

3 - ARAYFIX or HK hook tests on concrete paver substrates

These hooks are tensioned by an 8 mm diameter pin.

One type of substrate has been chosen:

- Self-locking concrete paver blocks

3-1 Experimental conditions

The hooks are hammered into place in 8 mm holes drilled into the concrete paver substrates to a depth of 30 mm.

The tests are performed on a PC-controlled ZWICK type 1494 electromechanical machine:

- The force measuring cell is class 0.5.
- The test temperature is $23 \pm 2^{\circ}\text{C}$

The load is applied progressively at a speed of 5 mm/min. Using the load/distortion graph, the maximum load supported by the fixing is determined during the test. The average value is calculated over ten tests.

It should be noted that the experimental conditions are the same as those used in test report GM/90-28.

3-2 Results

The average values are given in the following table. The full results are given on pages 17 - 18.

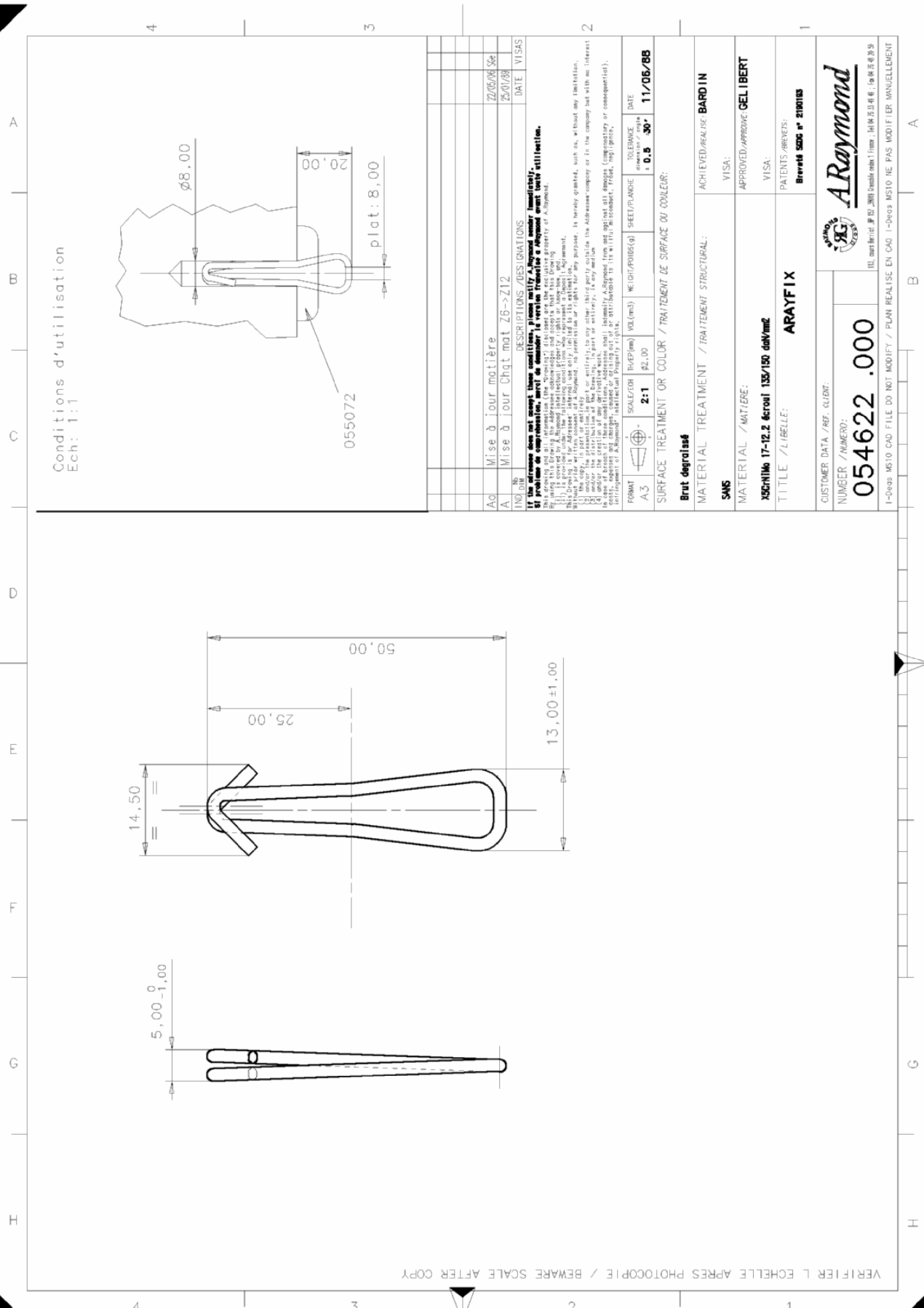
CONCRETE PAVER SUBSTRATES - AXIAL TENSION – Ø 8 mm holes	
NUMBER OF SAMPLES	10
1 st SLIP daN	73 ± 21
MAX FORCE daN	250 ± 41

The results of the pull-out type tests are given in the following table.

- 1 – Complete slip of the hook until complete pull-out
- 2 – Slipping of one side of the hook, the other part remaining stuck inside the hole
- 3 – Pull-out of the mortar following a phase of slip

CONCRETE PAVER SUBSTRATES - AXIAL TENSION	
TEST No.	PULL-OUT TYPE
1	3
2	1
3	2
4	1
5	1
6	3
7	1
8	1
9	3
10	1

END OF REPORT



Conditions d'utilisation
Ech: 1:1

Brut dégrossi
 MATERIAL TREATMENT / TRAITEMENT STRUCTURAL: ACHIEVED/REALISE: **BARD IN**
 S&S
 VISA:
 APPROVED/APPROVE: **GELIBERT**
 MATERIAL / MATIERE: X5CrNiMo 17-12.2 écroul 135/150 daNm2
 VISA:
 PATENTS / BREVETS: **ARAYFIX**
 Brevet 506 n° 210105

CUSTOMER DATA / REF. CLIENT:
 NUMBER / NUMERO: **054622.000**
ARAYMOND
 I-0008 MS10 CAD FILE DO NOT MODIFY / PLAN REALISE EN CAD I-0008 MS10 NE PAS MODIFIER MANUELLEMENT

VERIFIER L'ECHELLE APRES PHOTOCOPIE / BEWARE SCALE AFTER COPY

PULL-OUT WITH AXIAL TENSION ON CONCRETE SUBSTRATE

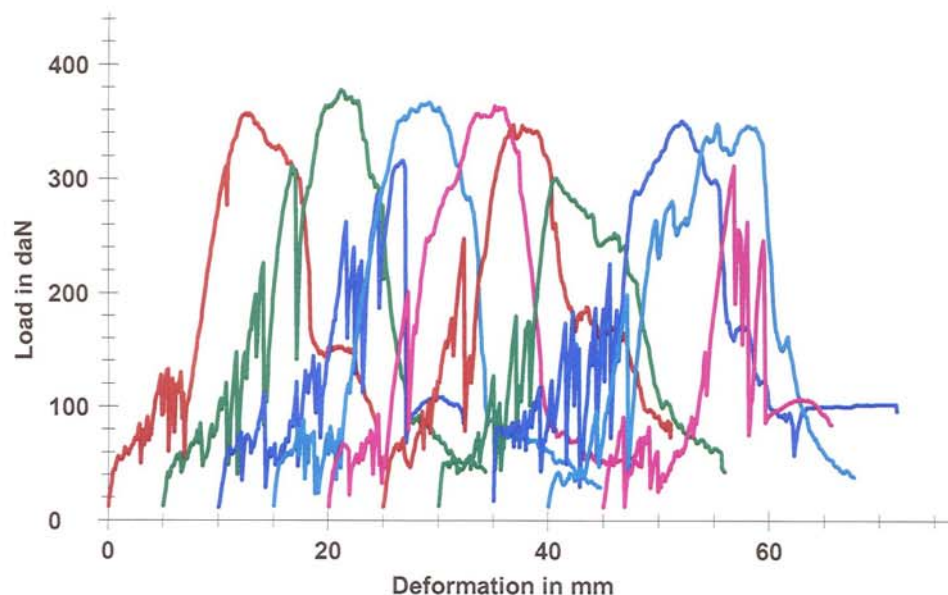

C.S.T.B. Sustainable Buildings, Products and Environment Division
Table of parameters:

Customer : A RAYMOND
 Clip Type : ARAYFIX or HK
 Support Type : Concrete 350kg/m³ - Holes 8mm

Tensile Stress: Traction
 Test Speed : 20 mm/min

Results:

Nr	1st Sliding daN	Load max. daN	Deformation mm
1	83,99	357,4	12,5
2	84,69	377,7	16,1
3	76,83	315,9	16,7
4	87,30	366,8	14,1
5	66,73	364,0	15,1
6	94,89	347,9	11,7
7	126,35	300,4	10,6
8	94,94	351,1	17,1
9	95,93	348,5	15,3
10	90,30	311,7	11,9

Graph of series:

Statistics:

Series n = 10	1st Sliding daN	Load max. daN	Deformation mm
x	90,19	344,1	14,1
s	15,60	25,9	2,3

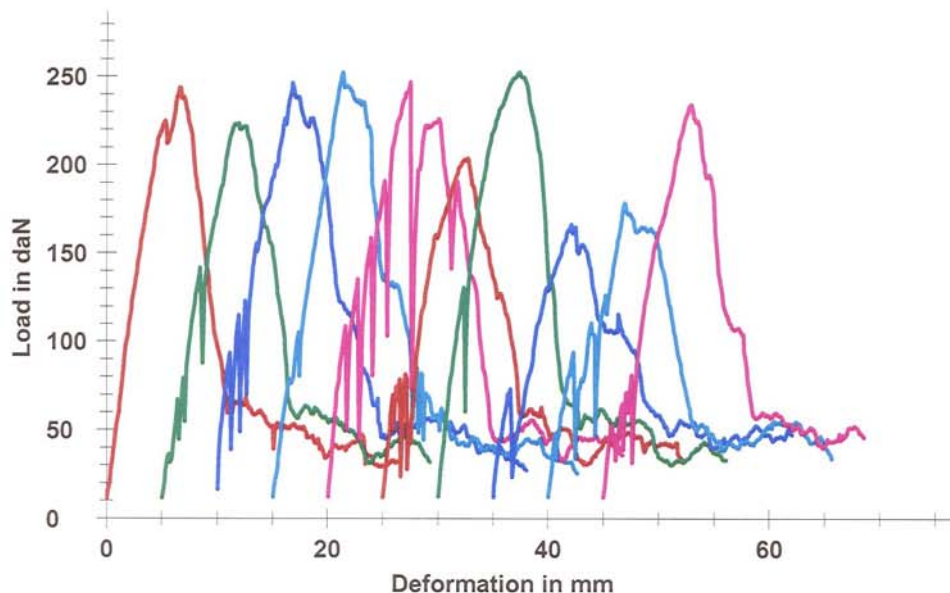

C.S.T.B. Sustainable Buildings, Products and Environment Division
Table of parameters:

Customer : A RAYMOND
 Clip Type : ARAYFIX or HK
 Support Type : Concrete 350kg/m³ - Holes 9mm

Tensile Stress: Traction
 Speed Test : 20 mm/min

Results:

Nr	1st Sliding daN	Load max. daN	Deformation mm
1	224,84	243,4	6,7
2	66,83	223,5	6,9
3	93,08	246,2	6,8
4	104,71	251,9	6,4
5	108,66	246,8	7,5
6	78,35	203,6	7,7
7	130,53	252,1	7,4
8	72,95	166,3	7,1
9	93,42	178,2	6,9
10	64,84	233,9	8,0

Graph of series:

Statistics:

Series n = 10	1st Sliding daN	Load max. daN	Deformation mm
x	103,82	224,6	7,1
s	47,25	31,4	0,5

SHEAR ON CONCRETE SUBSTRATES

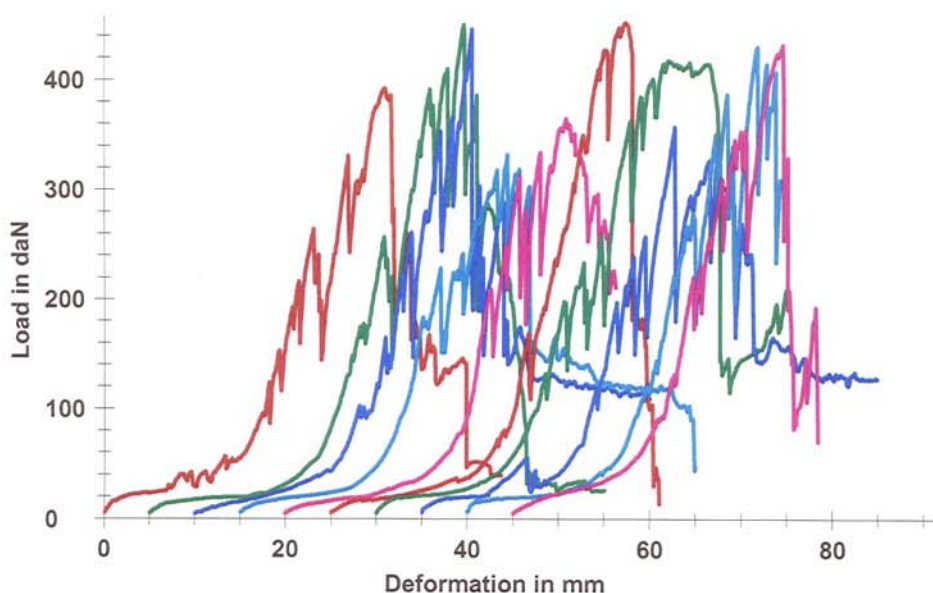

C.S.T.B. Sustainable Buildings, Products and Environment Division
Table of parameters:

Customer : A RAYMOND
 Clip Type : ARAYFIX or HK
 Support type : Concrete 350kg/m³ - Holes 8mm

Tensile Stress: Cisaillement Position 1
 Test Speed : 20 mm/min

Results:

Nr	1st Sliding daN	Load max. daN	Deformation mm
1	123,64	392,5	30,7
2	256,67	450,4	34,4
3	164,83	445,9	30,3
4	228,05	331,7	29,3
5	208,82	364,8	30,7
6	168,93	452,0	32,3
7	197,98	417,9	32,0
8	197,31	357,2	27,7
9	279,52	430,4	31,7
10	220,47	431,9	29,5

Graph of series:

Statistics:

Series n = 10	1st Sliding daN	Load max. daN	Deformation mm
\bar{x}	204,62	407,5	30,9
s	45,52	43,3	1,9



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Table of parameters:

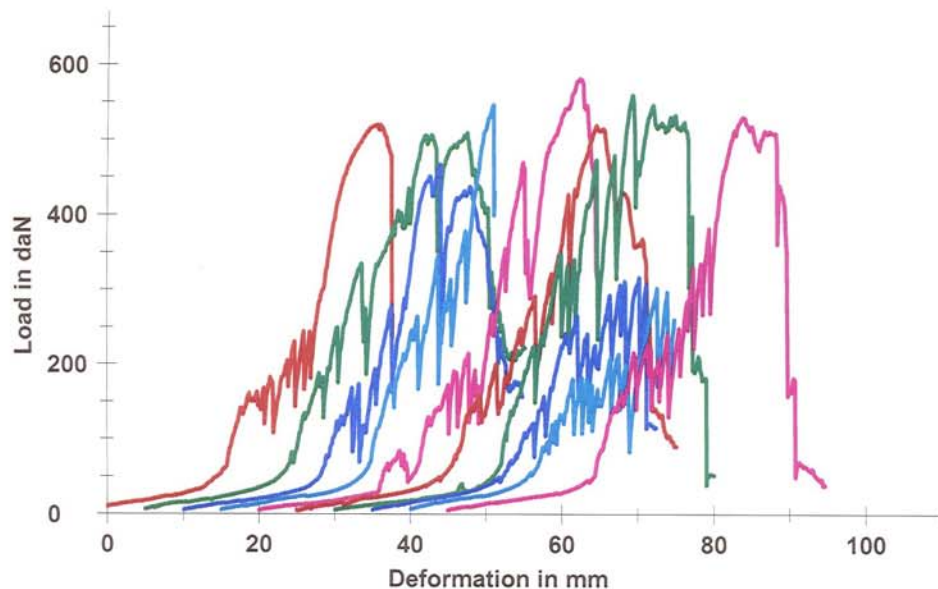
Customer : A RAYMOND
 Clip Type : ARAYFIX or HK
 Support Type : Concrete 350kg/m³ - Holes 8mm

Tensile Stress: Cisaillement Position 2
 Test Speed : 20 mm/min

Results:

Nr	1st Sliding daN	Load max. daN	Deformation mm
1	162,77	520,2	36,0
2	187,06	509,4	42,4
3	167,38	466,8	33,8
4	172,13	546,4	35,8
5	172,19	581,9	42,3
6	157,56	519,8	39,4
7	223,42	559,8	39,1
8	120,83	316,2	35,1
9	123,44	301,6	32,4
10	215,88	530,9	38,7

Graph of series:



Statistics:

Series n = 10	1st Sliding daN	Load max. daN	Deformation mm
x	170,27	485,3	37,5
s	33,43	98,0	3,4

PULL-OUT WITH AXIAL TENSION ON PAVING BLOCK SUBSTRATES

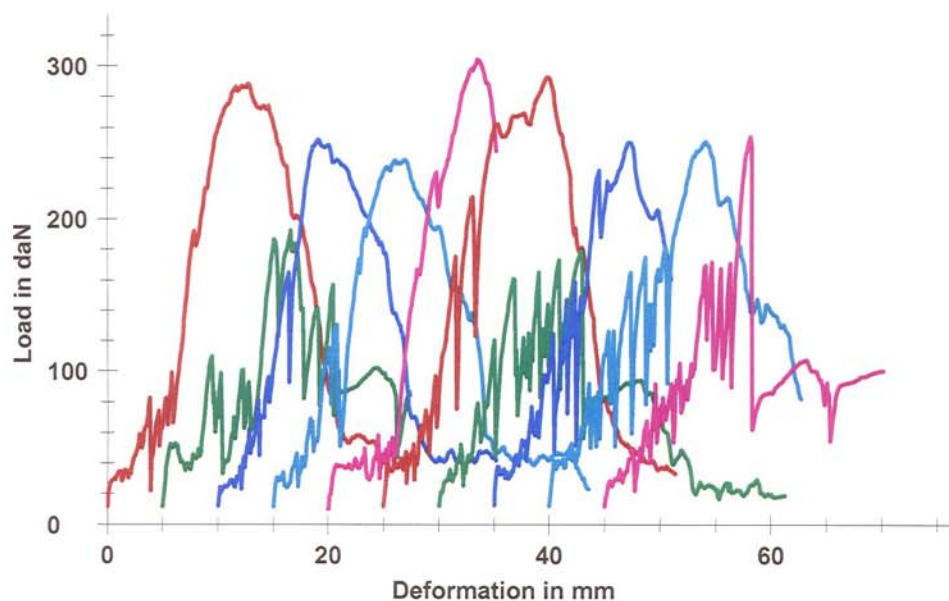

C.S.T.B. Sustainable Buildings, Products and Environment Division
Table of parameters:

Customer : A RAYMOND
 Clip Type : ARAYFIX or HK
 Support Type : Concrete Paver - Holes 8mm

Tensile Stress: Traction
 Test Speed : 5 mm/min

Results:

Nr	1st Sliding daN	Load max. daN	Deformation mm
1	82,98	288,4	12,8
2	109,74	192,3	11,5
3	81,53	251,6	9,0
4	46,55	238,8	11,9
5	58,49	304,3	13,5
6	74,54	292,6	14,8
7	52,27	179,2	12,9
8	77,02	250,1	12,3
9	92,15	250,7	14,2
10	49,82	253,9	13,2

Graph of series:

Statistics:

Series n = 10	1st Sliding daN	Load max. daN	Deformation mm
x	72,51	250,2	12,6
s	20,50	40,5	1,6