SINTEF Building and Infrastructure

Oslo
Forskningsveien 3b, 0373 Oslo
P.O.Box 124 Blindern, 0314 Oslo
Telephone: 22 96 55 55
Telefax: 22 69 94 38

Trondheim
Høgskoleringen 7b
7465 Trondheim
Telephone: 73 59 33 90
Telefax: 73 59 33 80

E-mail: byggforsk@sintef.no
Internet: www.sintef.no/byggforsk
Enterprise No: NO 948 007 029 MVA

Client
Hunton fiber AS
Client's address
Serviceboks 2810 Gjøvik
Client's contact-person
Lars Harald Nilsen

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3D094101	05.08.2010		6	2	Restricted	Ole Morten Braathen

Project leader	Sign.	Responsible manager	Sign.	Quality assurance	Sign.
Ole Morten Braathen		Vivian Meløysund	VIM	Odd Erland Ellingsrud	

Assignment Report

Hunton Fiber - Racking strength and stiffness of soft fibreboards impregnated with bitumen

Summary

SINTEF Building and Infrastructure was contacted by Hunton Fiber AS, requested to test the racking stiffness and racking strength of soft fibreboards impregnated with bitumen. The boards are intended for use as wind barrier sheathing in timber frame construction. If the fibreboards are used as a structural material for the stability of timber frames, it is necessary to know the properties of the fibreboards subjected to this kind of loading. SINTEF Builing and Infrastructure has tested this in accordance with the test standard prEN 594 February 2010 *Timber Structures - Test methods – Racking strength and stiffness of timber frame wall panels.*

The fibreboards were mounted on a timber frame wall, and tested in the test rig to failure occurred, according to test standard prEN 594 February 2010. Specific capacities were calculated for each of the fibreboard thicknesses according to EN 14358:2006. The results are given in Table 1 and Table 2.

Address of the building			Built (year)
	Method Laboratorie-undersøkelse	Keywords Yttervegg, Vindsperre, Asfalt, Fiber, Tre, Kapasitet	Filename 3D094101 SINTEF Byggforsk rapport ENG

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1. Introduction

SINTEF Building and Infrastructure was contacted by Hunton Fiber AS, requested to test the racking stiffness and racking strength of soft fibreboards impregnated with bitumen. The boards are intended for use as wind barrier sheathing in timber frame construction. If the fibreboards are used as a structural material for the stability of timber frames, it is necessary to know the properties of the fibreboards subjected to this kind of loading. SINTEF Builing and Infrastructure has tested this in accordance with the test standard prEN 594 February 2010 *Timber Structures - Test methods – Racking strength and stiffness of timber frame wall panels*.

The test was carried out by Kjell D. Terjesen and Dag Henning Sæther.

2. Test Object

The fibreboards were mounted on a stud wall with a size of 2.4 m x 2.4 m (height x width), see Figure 1. It was used timber 48 mm x 98 mm, quality C24 sorted by EN 519. Studs were placed c / c 600 mm, and were fixed with 2 pcs. 3.4 mm x 95 mm nails through the top and bottom rail. Wood and nails have been acquired by a local building materials dealer.

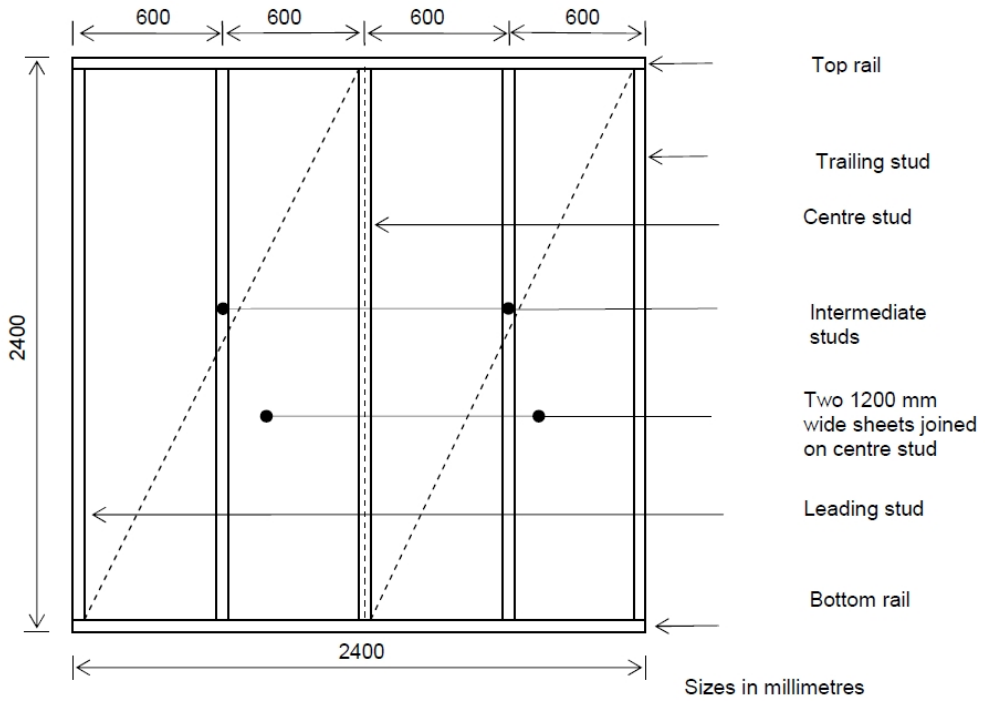


Figure 1 The trial panel of 48 mm x 98 mm, quality C24

The following fibreboard types were tested:

- Hunton Asfalt Vindtett 12 mm
- Hunton Bitroc 15 mm
- Hunton Asfalt Vindtett 25 mm

The fibreboard was delivered to the test hall by Hunton Fiber AS. SINTEF Building and Infrastructure informed Hunton Fiber AS that the fibreboards should be a representative sample in terms of production, and that, therefore, fibreboards should be chosen from different production dates.

The fibreboards were installed in accordance with installation instructions from Hunton Fiber AS. The outer edges were nailed with a center distance of 100 mm, and the middle of the fibreboards with center distance 250 mm. It was used galvanized nails (skiferspiker) from Christiania Spigerverk, with a zinc layer thickness of 70-75 microns. For the fibreboards of 12 and 15 mm thickness it was used nail 2.8 mm x 45 mm, and for 25 mm thickness 2.8 mm x 75 mm. The head diameter of the nails was measured at an average of 9.2 mm for 5 pieces.

The plates were mounted standing with a gap distance of 3 mm.

3. Test Method

The test was done according to standard prEN 594 February 2010. Fibreboards were cut down to the height of 2400 mm, from 2440 mm. This is to adapt the tests to prEN 594, and it will also be easier to compare the test results with other kind of sheeting materials when a standard height is being used.

The bottom rail in the test frame was clamped against the test rig. Displacement sensors which measured horizontal and vertical displacements were mounted on both the top and bottom rails.

Vertical load Fv = 1 kN was applied over each stud, see Figure 2 This load was maintained throughout the test.

An increasing horizontal load was applied on the top of the test panel until failure occurred.

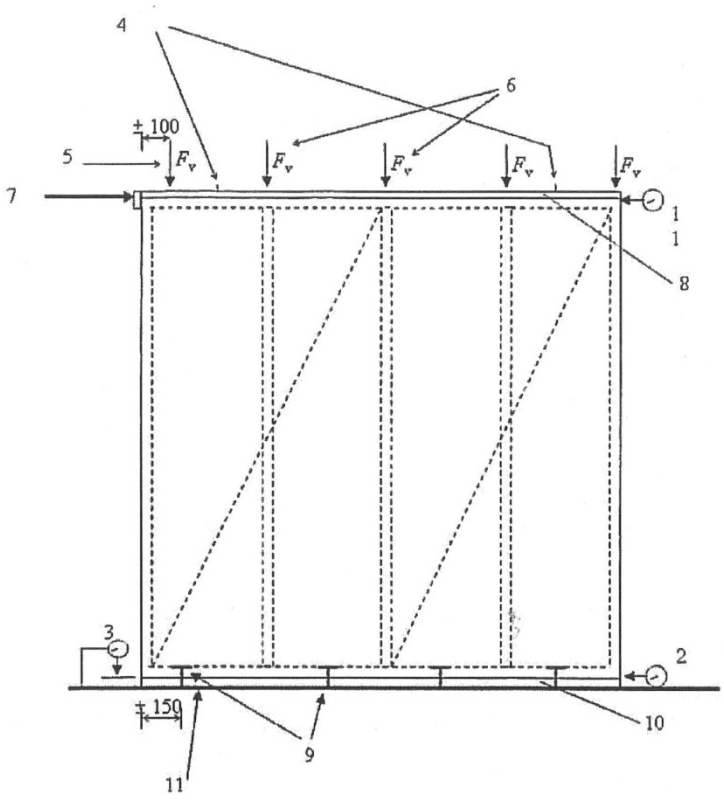


Figure 2 Location of vertical load Fv

4. Testing

The timber frame wall had during testing a moisture content of approx 9-10%. The temperature in the test hall varied between 21.0 and 22.0 ° C, and there was a relative humidity (RH) between 30.0 and 49.5% during the test.

The fibreboards were located in an air-conditioned room with temperatures of 20.0 ° C and RH of 80% before mounting to the timber frame wall.

4.1 Hunton Asfalt Vindtett 12 mm

At failure nails in the bottom sill were torn out of the fibreboard in the corner of the test panel. Sill and stud was pulled apart during the test. We also noted the displacement between the plates in the vertical joint, see photo 3.

4.2 Hunton Bitroc 15 mm

At failure nails in the bottom sill were torn out of the fibreboard in the corner of the test panel. Sill and stud was pulled apart during the test. Nails were bent along the edges. We also noted the displacement between the plates in the vertical joint.

4.3 Hunton Asfalt Vindtett 25 mm

At failure nails in the bottom sill were torn out of the fibreboard in the corner of the test panel. Sill and stud was pulled apart during the test. Nails were bent along the edges. We also noted the displacement between the plates in the vertical joint.

5 Results

Test results with calculated values according to prEN 594 February 2010, and characteristic values according to EN 14358:2006 are given in the tables below:

Table 1 Test results, calculated R, racking stiffness

	12 mm			15 mm			25 mm		
Test	12.1	12.2	12.3	15.1	15.2	15.3	25.1	25.2	25.3
F_{max} [N]	5472	5418	5551	8955	8613	9045	8623	8671	8552
F_{mean} [N]	5480			8871			8615		
$F_{0,2}$ [N]	1094	1083	1110	1791	1791	1809	1724	1734	1710
$F_{0,4}$ [N]	2188	2167	2220	3582	3445	3618	3449	3468	3420
$v_{0,2}$ [mm]	1,8	2,6	1,7	2,3	3,7	2,3	1,1	1,8	2,8
$v_{0,4}$ [mm]	4,6	6,0	4,4	6,5	8,4	7,0	6,0	7,0	8,8
R [N/mm]	390,7	318,8	411,1	426,4	351,9	384,8	351,9	333,5	285,0

Table 2 Characteristic values according to EN 14358:2006

	12 mm	15 mm	25 mm
F_{max} [N]	4681	7576	7359
R [N/mm]	243,0	285,5	228,1

6 Conclusion

The fibreboards were mounted on a timber frame wall, and tested in the test rig to failure occurred, according to test standard prEN 594 February 2010. Specific capacities were calculated for each of the fibreboard thicknesses according to EN 14358:2006. The results are given in Table 1 and Table 2.

Appendix 1
Photo documentation

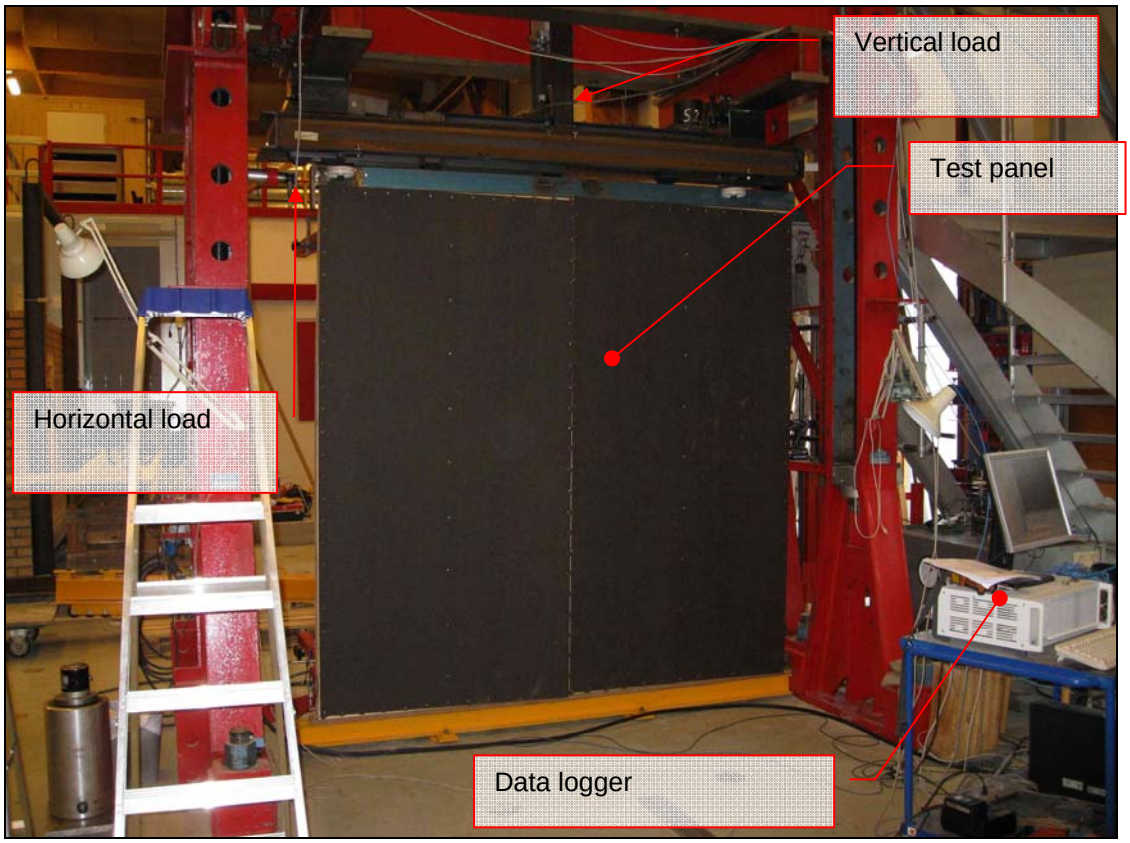


Photo 1: Hunton fiber AS. Test panel installed in test rig, front side.

Photo 2: Hunton fiber AS. Test panel installed in test rig, back side.

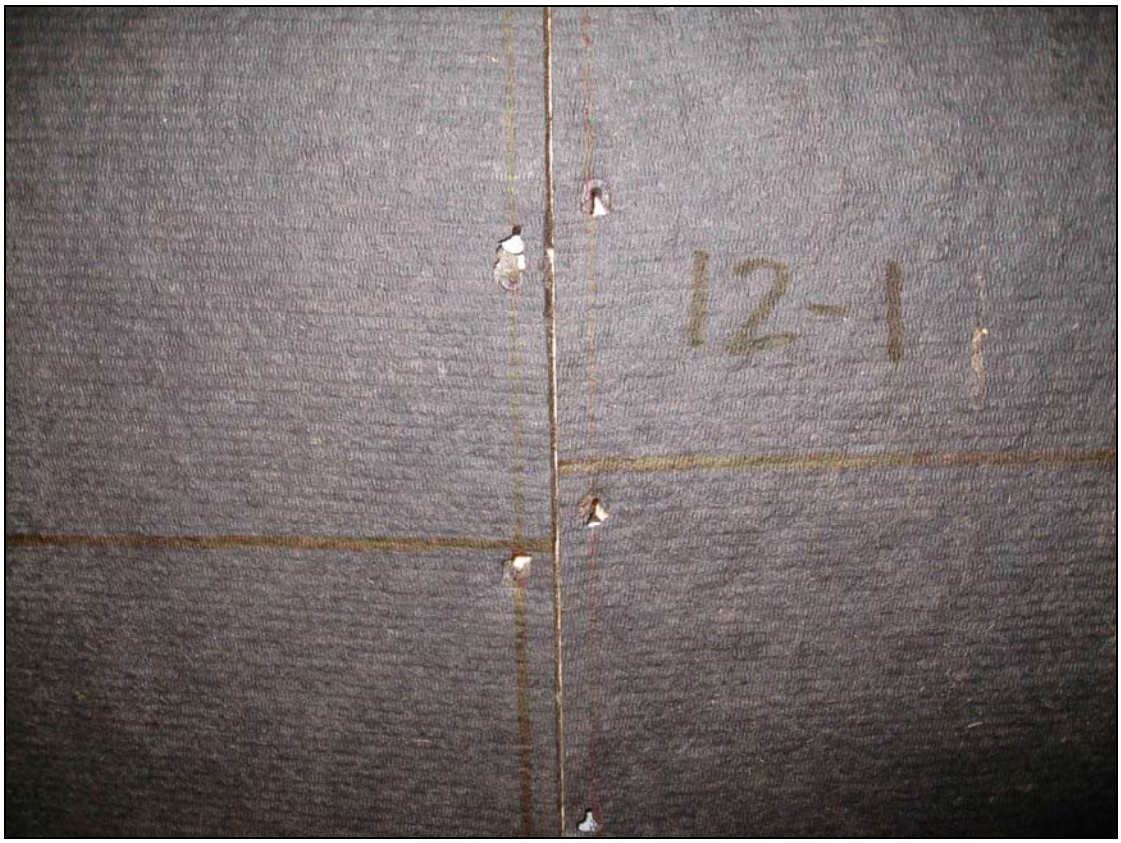


Photo 3: Hunton fiber AS. Typical displacement at the vertical joint between two fibreboards, intermediate stud.

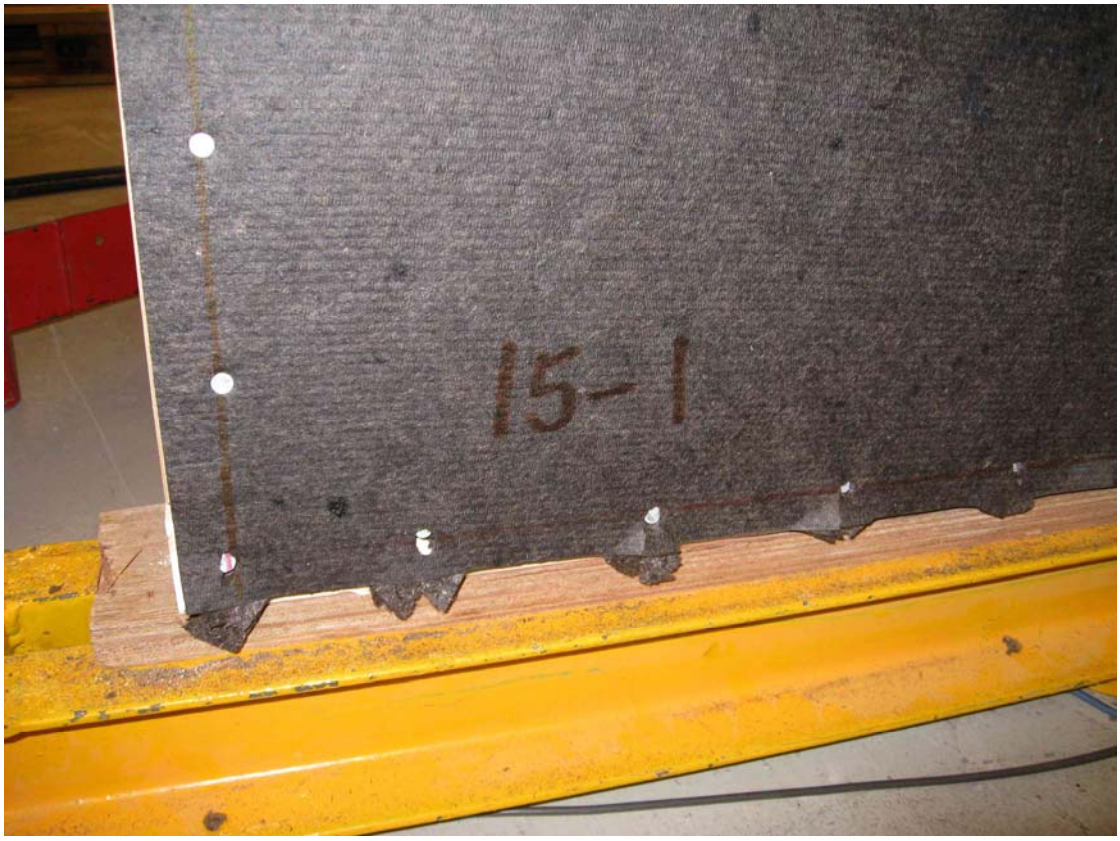
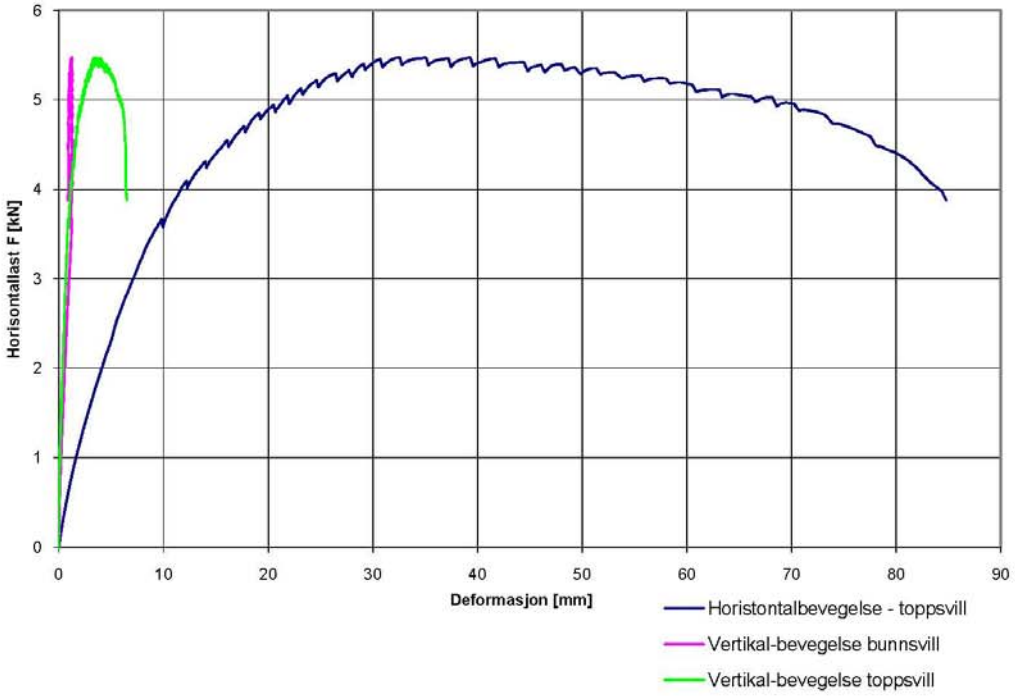


Photo 4: Hunton fiber AS. Typical tear out of nails in the corner of the bottom sill, caused by tension in the stud.

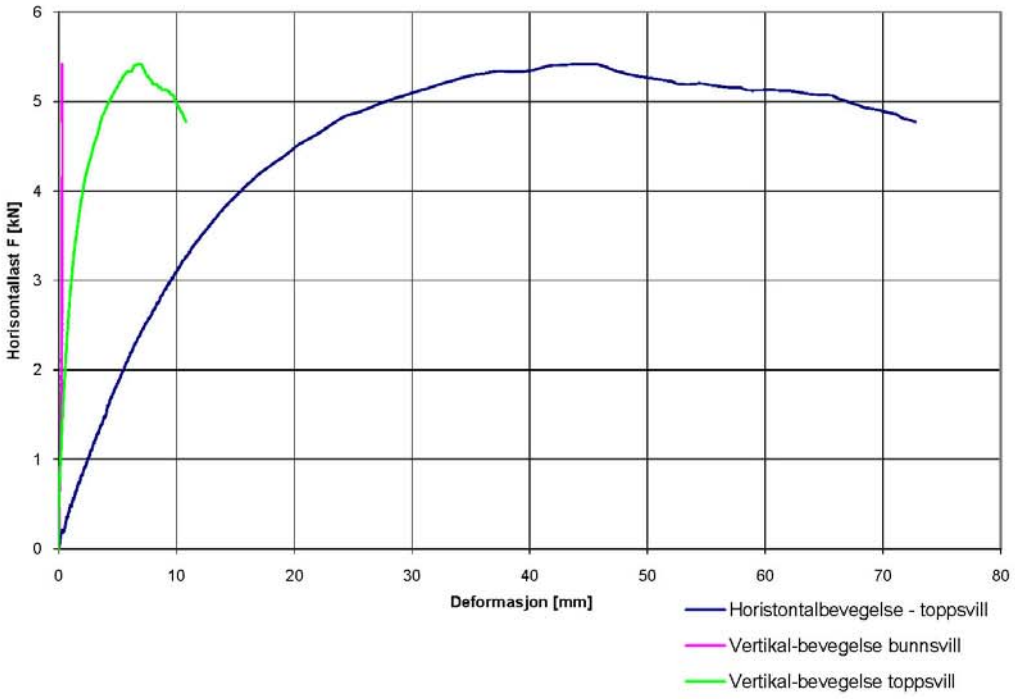
Appendix 2
Test results



Maks last (kN) **5,47**

Horisontallast (kN)	0,55	1,09	1,64	2,19	2,74	3,28	3,83	4,38	4,92	5,47
Hor.deformasjon (mm)	0,80	1,88	3,18	4,65	6,17	8,11	10,85	14,87	20,41	32,16
Vert. løft bunnsvill (mm)	0,02	0,13	0,27	0,41	0,58	0,76	1,03	1,49	2,01	3,38

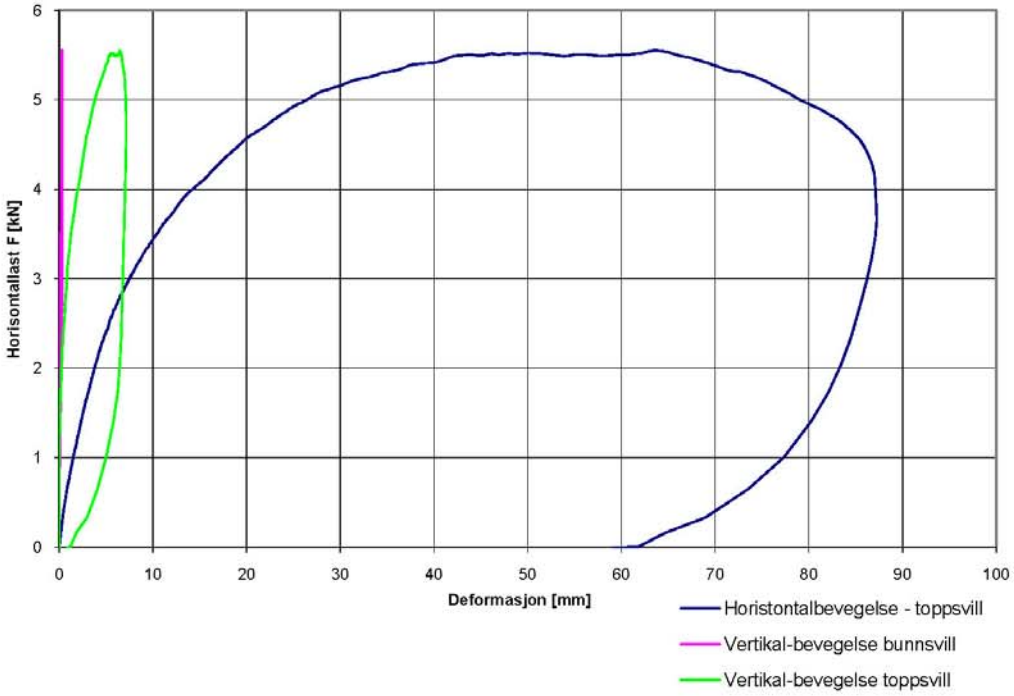
Result 12-1: Hunton fiber AS. 12 mm, 1. test



Maks last (kN) **5,42**

Horisontallast (kN)	0,54	1,08	1,63	2,17	2,71	3,25	3,79	4,33	4,88	5,42
Hor.deformasjon (mm)	1,18	2,68	4,29	6,05	8,25	10,73	13,97	18,57	25,46	43,44
Vert. løft bunnsvill (mm)	0,02	0,18	0,37	0,60	0,88	1,24	1,79	2,61	3,87	6,69

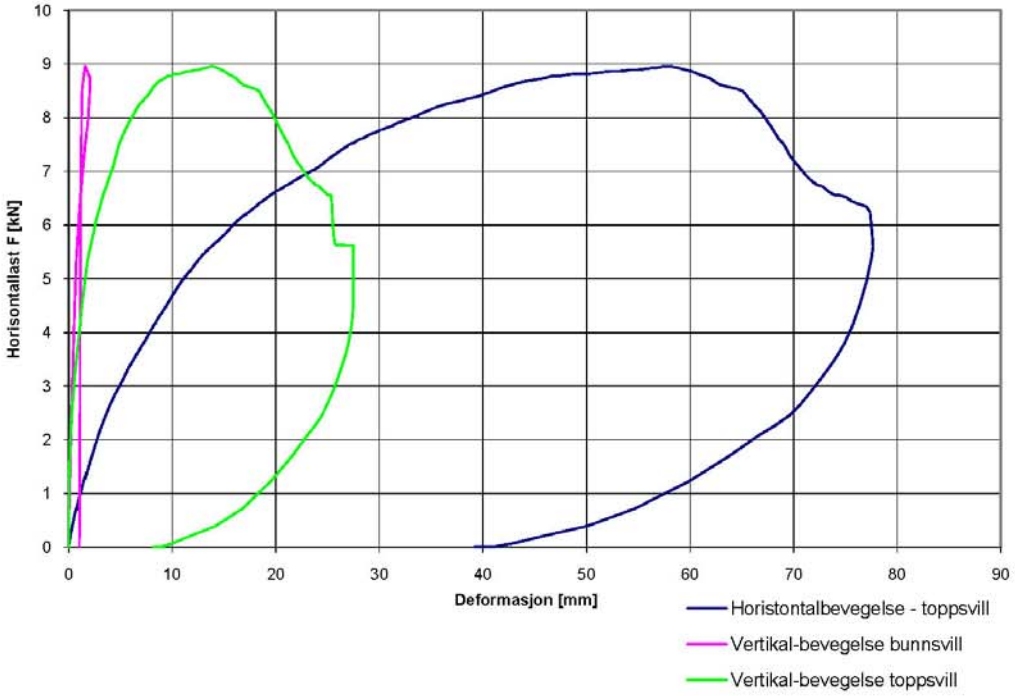
Result 12-2: Hunton fiber AS. 12 mm, 2. test



Maks last (kN) **5,55**

Horisontallast (kN)	0,56	1,11	1,67	2,22	2,78	3,33	3,89	4,44	5,00	5,55
Hor.deformasjon (mm)	0,72	1,74	2,97	4,40	6,41	9,35	13,22	18,72	26,45	63,55
Vert. løft bunnsvill (mm)	0,00	0,01	0,14	0,34	0,69	1,12	1,82	2,69	3,83	6,47

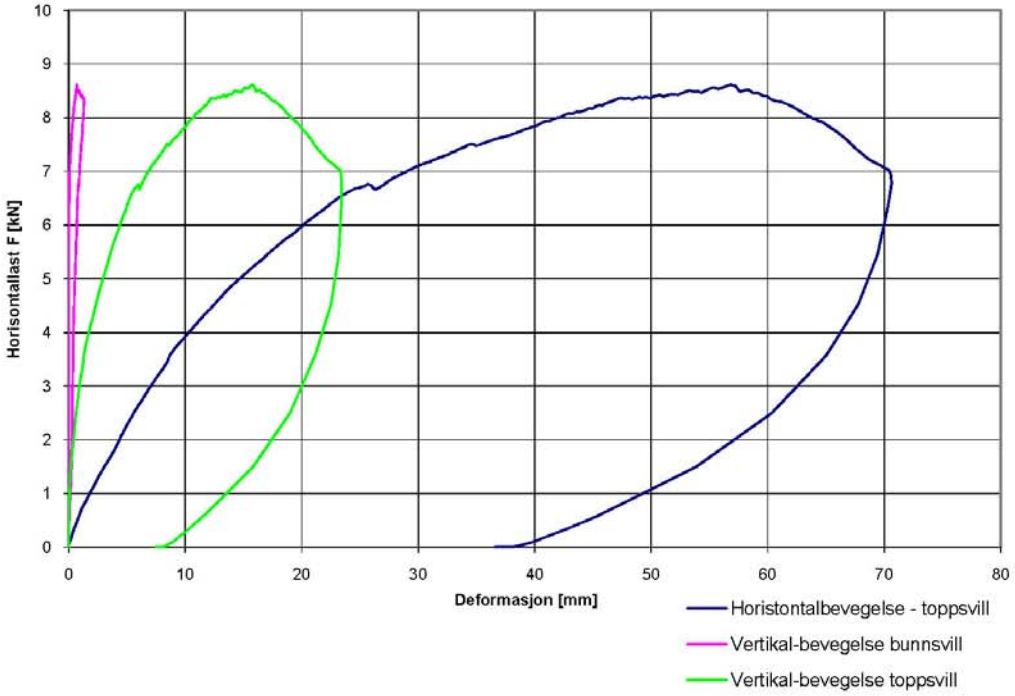
Result 12-3: Hunton fiber AS. 12 mm, 3. test



Maks last (kN) **8,96**

Horisontallast (kN)	0,90	1,79	2,69	3,58	4,48	5,37	6,27	7,16	8,06	8,96
Hor.deformasjon (mm)	1,02	2,42	4,09	6,57	9,44	12,65	17,69	24,75	34,11	57,61
Vert. løft bunnsvill (mm)	0,00	0,13	0,38	0,80	1,29	1,87	2,95	4,42	6,32	13,72

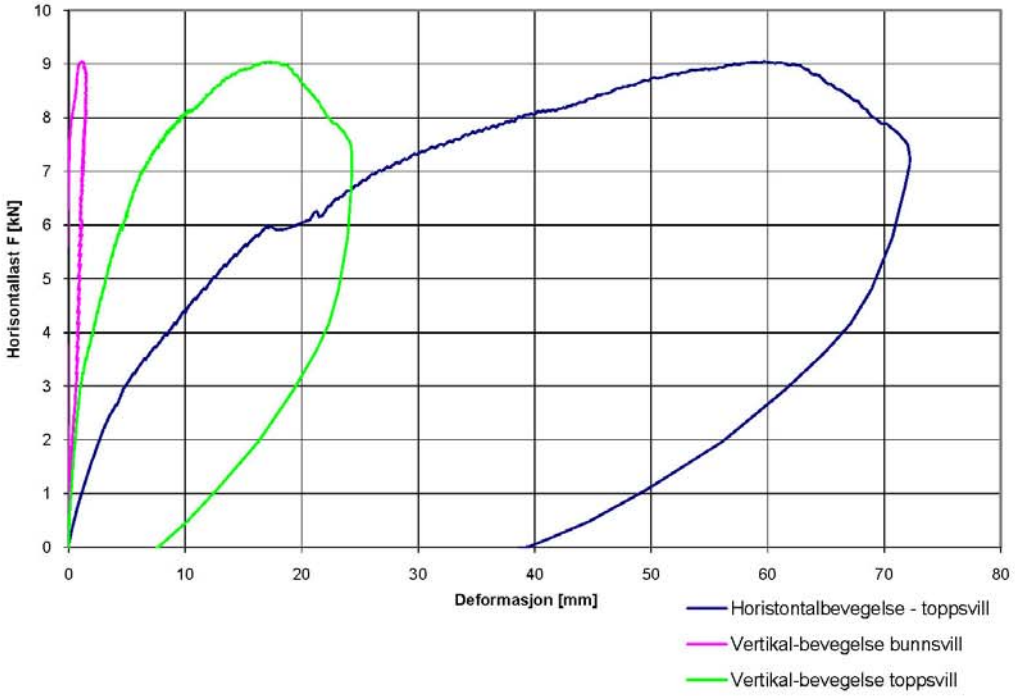
Result 15-1: Hunton fiber AS. 15 mm, 1. test



Maks last (kN) **8,61**

Horisontallast (kN)	0,86	1,72	2,58	3,45	4,31	5,17	6,03	6,89	7,75	8,61
Hor.deformasjon (mm)	1,51	3,75	5,87	8,47	11,56	15,66	20,40	28,00	38,85	56,83
Vert. løft bunnsvill (mm)	0,05	0,30	0,70	1,26	2,11	3,22	4,48	6,54	9,69	15,76

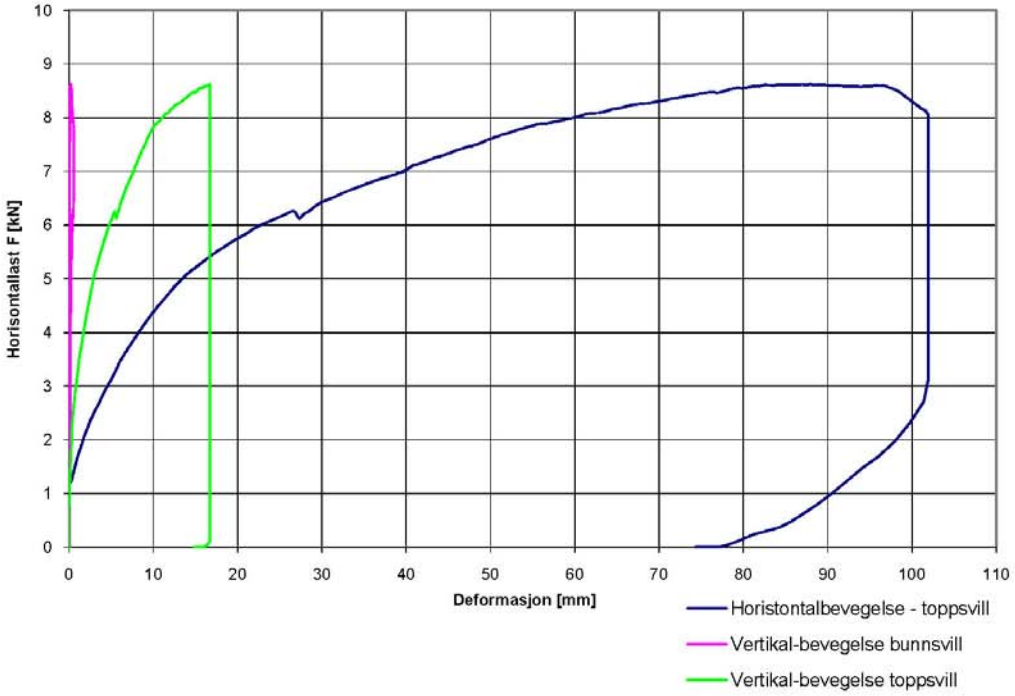
Result 15-2: Hunton fiber AS. 15 mm, 2. test



Maks last (kN) **9,05**

Horisontallast (kN)	0,90	1,81	2,71	3,62	4,52	5,43	6,33	7,24	8,14	9,05
Hor.deformasjon (mm)	0,99	2,35	4,29	7,02	10,42	14,23	22,30	28,84	41,56	58,71
Vert. løft bunnsvill (mm)	0,18	0,49	0,89	1,63	2,65	3,69	5,15	6,94	10,59	16,82

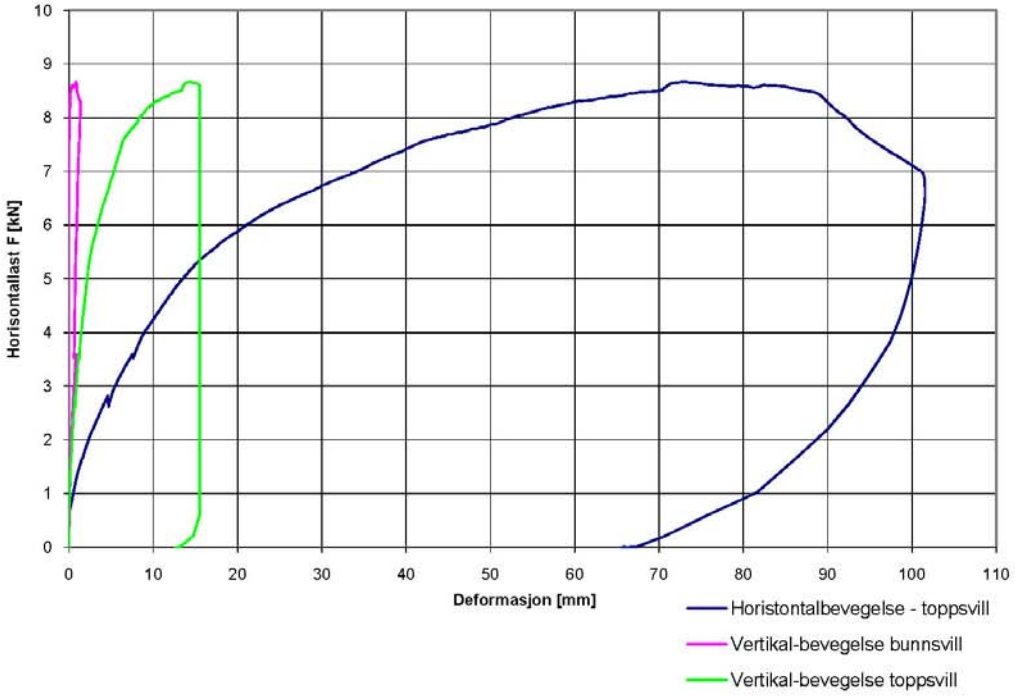
Result 15-3: Hunton fiber AS. 15 mm, 3. test



Maks last (kN) **8,62**

Horisontallast (kN)	0,86	1,72	2,59	3,45	4,31	5,17	6,04	6,90	7,76	8,62
Hor.deformasjon (mm)	0,00	1,13	3,25	6,04	9,67	14,79	23,29	37,87	53,14	84,13
Vert. løft bunnsvill (mm)	0,05	0,24	0,55	1,18	2,07	3,21	4,86	7,39	9,82	16,75

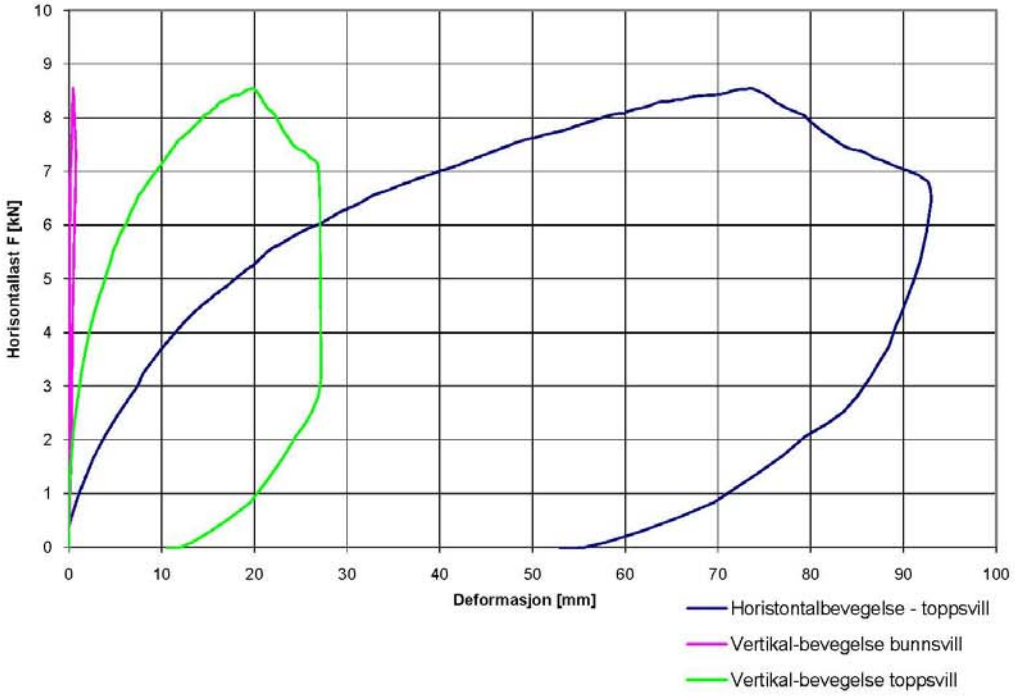
Result 25-1: Hunton fiber AS. 25 mm, 1. test



Maks last (kN) **8,67**

Horisontallast (kN)	0,87	1,73	2,60	3,47	4,34	5,20	6,07	6,94	7,80	8,67
Hor.deformasjon (mm)	0,38	1,78	3,96	7,10	10,41	14,64	21,88	33,36	48,66	73,01
Vert. løft bunnsvill (mm)	0,05	0,28	0,62	1,09	1,69	2,31	3,54	5,25	7,56	14,34

Result 25-2: Hunton fiber AS. 25 mm, 2. test



Maks last (kN) **8,55**

Horisontallast (kN)	0,86	1,71	2,57	3,42	4,28	5,13	5,99	6,84	7,70	8,55
Hor.deformasjon (mm)	0,84	2,83	5,72	8,80	12,98	18,98	26,64	37,43	51,78	73,60
Vert. løft bunnsvill (mm)	0,00	0,28	0,79	1,53	2,62	4,15	6,07	8,75	12,64	19,84

Result 25-3: Hunton fiber AS. 25 mm, 3. test