BUILDING COMMON GROUND

MAX FRANK®

Expert Assessment Report

Stremaform®

Expert Assessment Report about the equal value of the product Stremaform with a fine as well as a normal mesh size

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Expert Assessment Report
about the equal value of the product Stremaform with a fine as well as a normal mesh size

Project number: 19-146

Manufacturer: Max Frank
Industriestrasse 4
96332 Pressig

Product: Stremaform

Application: Formwork elements for concreting sections

This document contains 9 pages

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Table of contents

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1 General

1.1 Task

The engineering group, Knörnschild & Kollegen, was instructed by Max Frank, Pressig, to prepare an expert's statement about the equal value of the fine and normal mesh size of the product, Stremaform. For this purpose, three component tests (slab) as well as a reference object were examined in each case.
The product is a formwork element for the realisation of concrete sections. The product, Stremaform, is described firstly. The test piece, the test setup and the test procedure are then explained and the results are presented and compared. A conclusion is then drawn based on the results.

1.2 Subject of the statement

The object of the expert report is an expanded metal mesh with a special steel mesh, which comes in two different mesh sizes ("normal-meshed" and "fine-meshed").
These expanded metal meshes are installed vertically.

Table 1: Overview of the subject of approval

Installation situation	normal-meshed	fine-meshed	Stress
Vertical installation	x	x	V
Sloped installation (60°)	x	x	V

a) Stremaform® formwork elements for joints – vertical installation (called flat material)
   - "Normal-meshed"
   - Fine-meshed

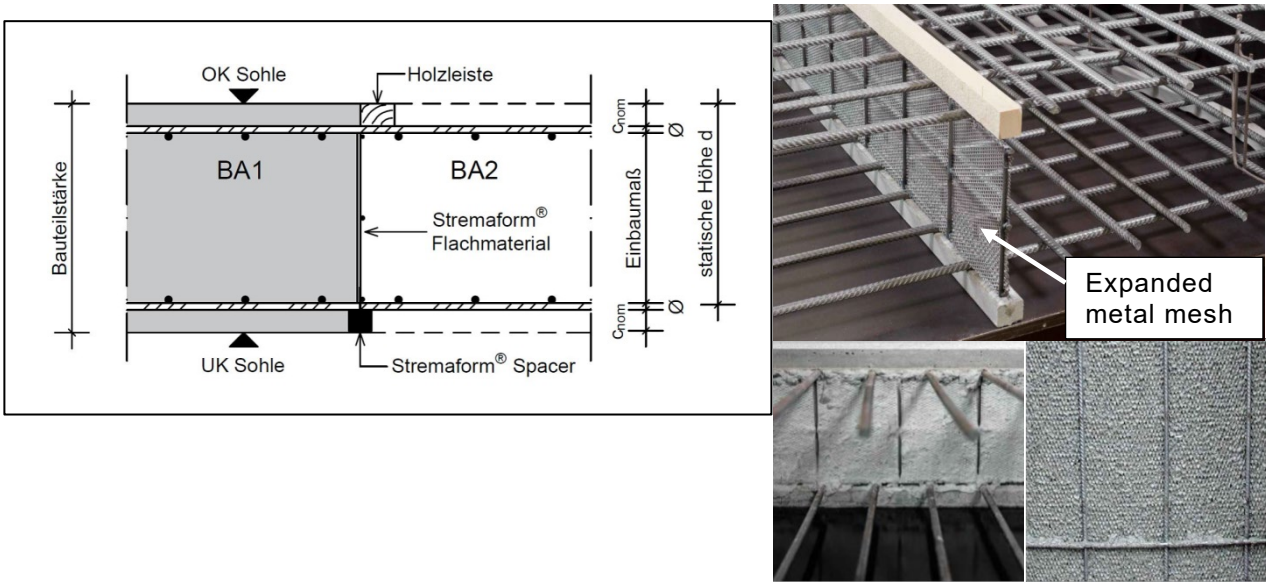

Figure 1: Stremaform installation situation
Flat material [based on Max Frank, 2018]

1.3 Field of application

The field of application is slabs and ceilings.

2 Product description

2.1 Geometry and material

The Stremaform flat material consists of an expanded metal mesh and a special steel mesh. This carrier mat is made of profiled transverse bars and smooth longitudinal bars running vertically. The expanded metal mesh is welded on between the steel bars and thus forms a stiff material for the joint formwork. Table 2 contains the geometric and material-specific information on the special steel mesh for the formwork height of 300 mm. When produced individually according to planning specifications, the specified dimensions differ. Table 3 shows the product data for the expanded metal mesh used, made by Sorst Streckmetall GmbH.

Table 2: Details of the geometry and material of the special steel mesh

	Bar diameter ø [mm]	Bar spacing e [mm]	Tensile strength f_u [N/mm²]
Transverse bar	7.0	150	665
Longitudinal bar	5.5	148	665
Bar division of the special steel mesh (formwork height 300 mm) [Max Frank]			

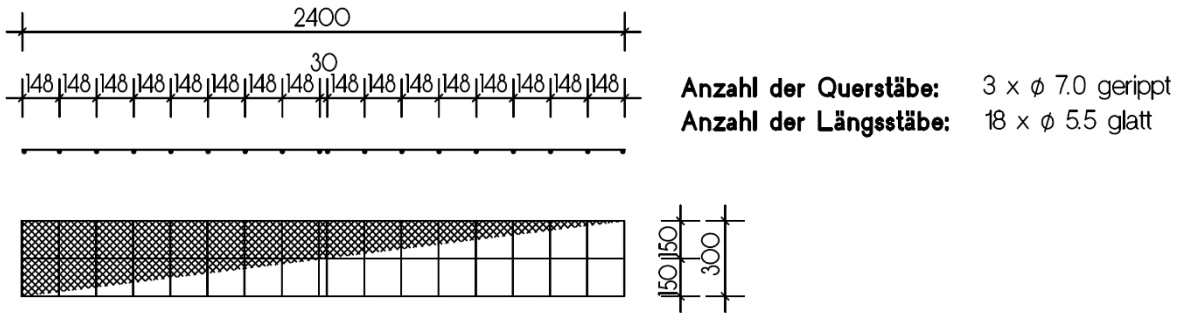

Table 3: Details of the geometry and material of the normal-meshed and fine-meshed expanded metal

	Expanded metal 16 x 6 x 1 x 1 mm – “Normal-meshed” + “Fine-meshed”						
	Mesh length (ML) [mm]	Mesh width (MB) [mm]	Bar width (SB) [mm]	Bar thickness (SD) [mm]	Steel grade	Area density [kg/m²]	Open area [%]
Normal-meshed	16.0	6.0	1.0	1.0	DC04	2.70	67.0
Fine-meshed	10.0	4.9	1.5	0.5	DC04	2.4	39.0

2.2 Installation situations

Fig. 7 shows the installation situations for the Stremaform flat material, whereby this is basically designed for the project-related installation dimensions. The formwork

element is placed on the lower reinforcement layer and then fastened onto the bars of the mesh reinforcement with binding wire. Spacers specially designed for the product are used in the area of the working joint. The Stremaform Spacer consists of a fibre concrete spacer bar, which is the formwork element in the area of the concrete cover and between the reinforcing bars. Expanded metal meshs are provided here between the bars, which are aligned parallel to the formwork element and tie into the concrete structure from the fibre concrete spacer bar. In order to ensure the required concrete cover and to form an accurate formwork edge between the concrete sections, a wooden bar is fitted on the upper reinforcement layer flush with the formwork element.

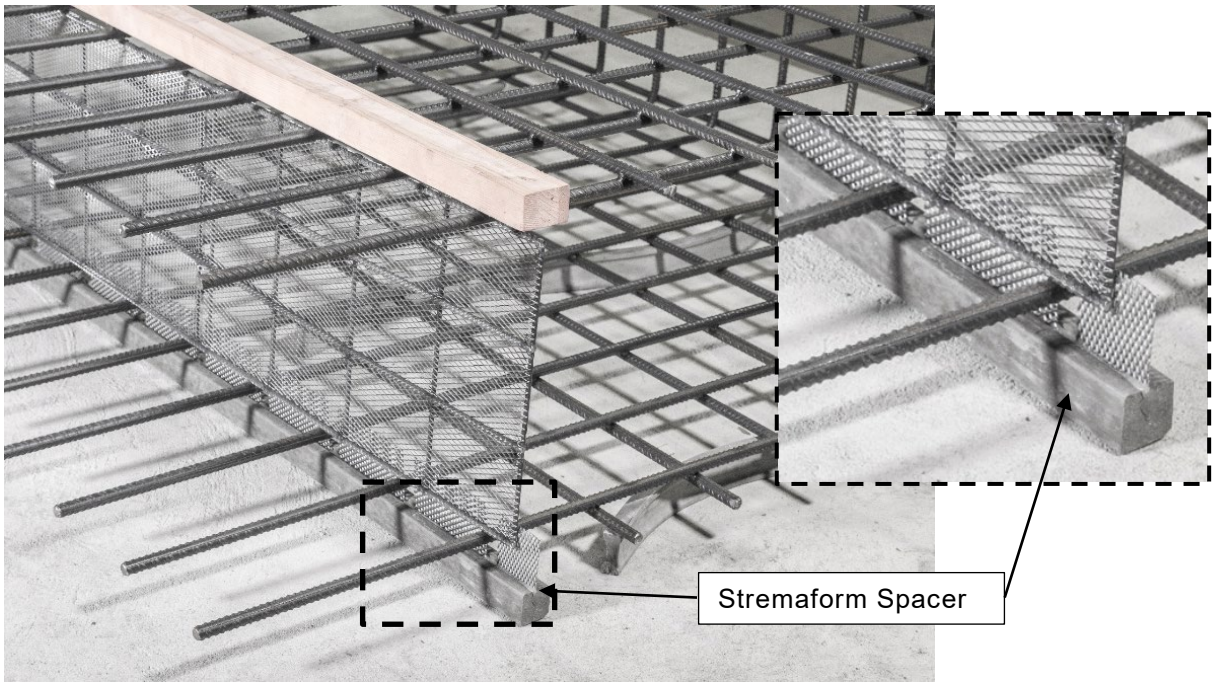

Figure 2: Stremaform flat material installation situation [Max Frank, 2018]

3 Studies carried out

3.1 Materials used

Formwork for concreting sections:

a) Stremaform vertical installation (flat material) normal-meshed
b) Stremaform vertical installation (flat material) fine-meshed

Concrete:
A C25/30 concrete according to DIN EN 206-1/DIN 1045-2 is used.

Reinforcement:
A reinforcement using steel type B 500B according to DIN 488 with; ø8, ø10, ø14, ø16 is used.

3.1.1 Internal force V tests

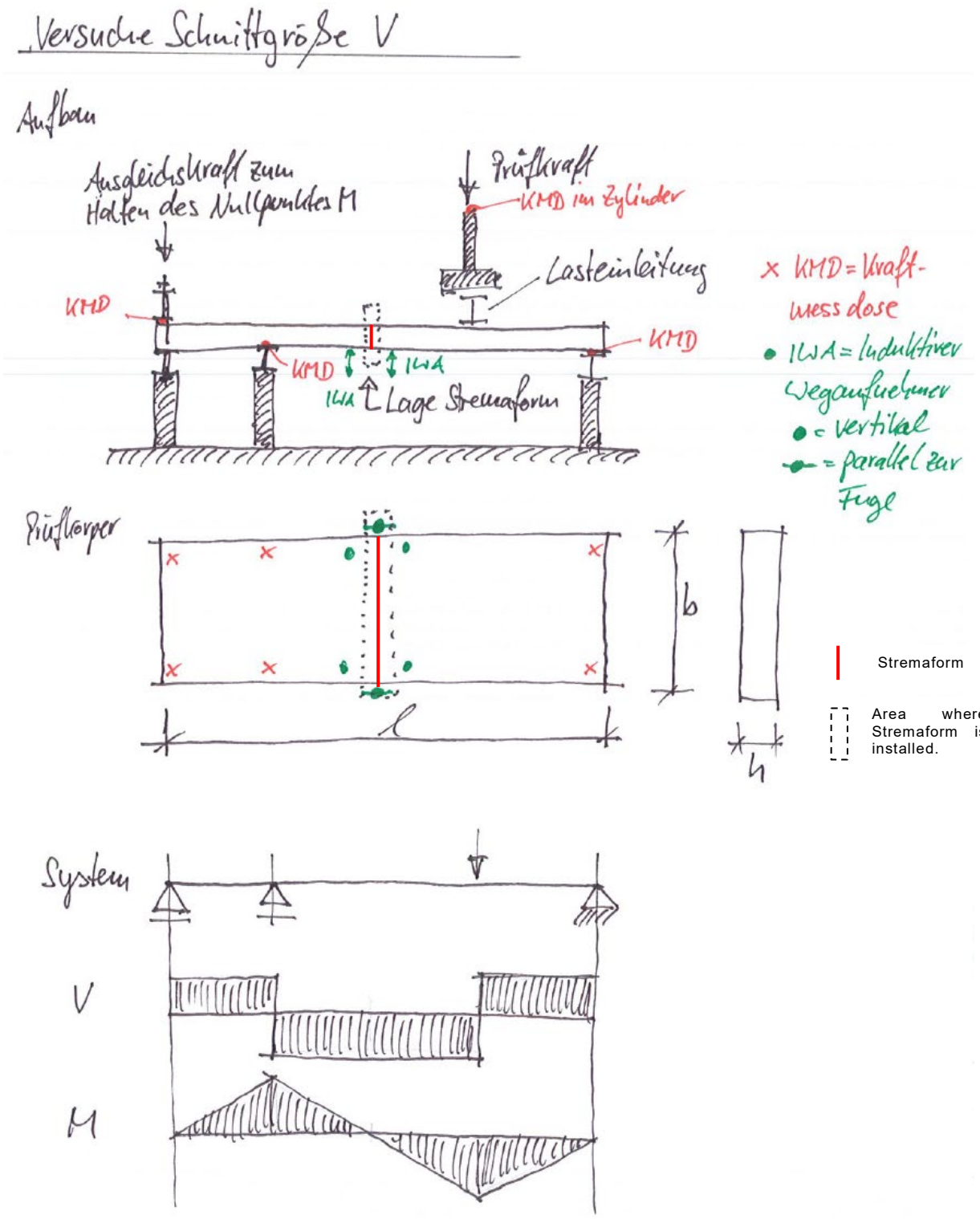

Figure 11: Internal force V tests (without dead weight)

Load type and load regime
The tests are conducted in a force-controlled manner. The load was increased in 30 kN load steps until breakage. During this process, an adjustment was made on the cantilever with the hand pump after each load step.

Type of test recording
The tests are recorded using:
- load cells up to 200 kN, 500 kN, 1000 kN; calibrated
- displacement sensors measuring range 2.5 –25 mm, calibrated

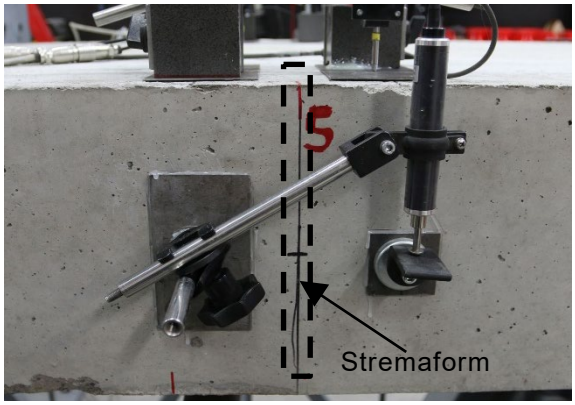

Figure 12: Measurement technology, parallel joint

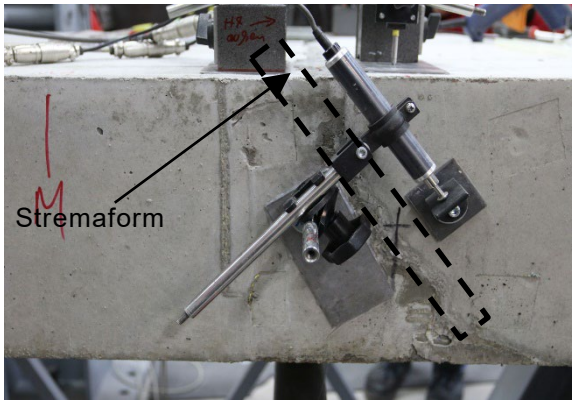

Figure 13: Measurement technology, parallel joint

- Recording of the crack patterns and crack widths
- Photo documentation
- If nec. video recording

3.2 Test program for the slab tests

Table 4: Combination of other structural element tests on slabs: Comparison of slab without shear reinforcement fine-meshed and normal-meshed

Stress on the Stremaform	Number	l/w/h [cm]	Concrete	System	Built-in component
A) Shear force	1	370/100/25	C30/37 F3	Two-span beam without shear reinforcement	None (reference)
	3				Flat material normal-meshed
B) Shear force	1	370/100/25	C30/37 F3	Two-span beam without shear reinforcement	None (reference)
	3				Flat material fine-meshed

Reinforcement density:
Bending tensile reinforcement: The bending reinforcement structurally required for the shear force (from a max. test load of 930 kN) is also fitted via the column in the field and depending on the system.

Shear reinforcement: The shear reinforcement structurally required for the associated shear force (from a max. test load of 930 kN) is fitted outside the Stremaform element.

3.3 Studies with normal-meshed flat material

Table 5: Results: (Test series 1.TV-ZFT without SB)

Designation	Breaking load [kN]	Mode of failure	Description
A1 reference	453	Shear crack in the field	
A2	422	Shear crack on the cantilever	
A3	450	Shear crack in the field + cantilever	
A4	450	Shear crack in the field + cantilever	
Mean value A1-A4	**444**		
Mean value A2-A4	**441**		
Difference to ref.	**12**		

Concrete strength:
Compressive strength 1st concrete pour 29.6 N/mm²
Compressive strength 2nd concrete pour 31.5 N/mm²
Mean value: 30.55 N/mm²

3.4 Studies with fine-meshed flat material

Table 6: Results: (Test series 3.TV-ZFT without SB)

Designation	Breaking load [kN]	Mode of failure	Description
B1 reference	420	Shear crack in the field	
B2	395	Shear crack on the cantilever	
B3	422	Shear crack on the cantilever	
B4	419	Shear crack in the field	
Mean value A1-A4	**414**		
Mean value A2-A4	**412**		
Difference to ref.	**8**		

Concrete strength class:
Compressive strength 1st concrete pour 31.1 N/mm²
Compressive strength 2nd concrete pour 31.2 N/mm²
Mean value: 31.15 N/mm²

3.5 Comparison

Table 7: Comparison of the results

Designation	Breaking load [kN]		Difference [kN]	Difference [%]
X1 reference	420	453	33	8 %
Mean value X2-X4	441	412	29	7 %

4 Statement

For the comparison of the fine-meshed and normal-meshed flat material used for the Stremaform formwork element, for each mesh width, three component tests with Stremaform and one component test without Stremaform as a reference component were examined.
The concrete strength was approximately the same, meaning that there was a common starting point regarding the strength of the concrete.
The mean value of the breaking load of the normal-meshed flat material on the reference structure was 33 kN above the reference structure of the fine-meshed Stremaform. That equates to around 8 % (453/420 = 1.079).
On the test pieces with Stremaform flat material, the difference is 29 kN or around 7 % (441/412 = 1.07).

The mode of failure is similar on both mesh widths. The shear cracks arise in the field and in the cantilever area. Sometimes these two shear cracks arise almost simultaneously, sometimes also after one another.

As the breaking loads differ both on the reference structure and on the test structure with flat material by 8 % and 7 % and the mode of failure is the same, it can be assumed that the behaviour of the fine-meshed and the coarse-meshed flat material is the same.

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