ISTANBUL TECHNICAL UNIVERSITY
FACULTY OF CIVIL ENGINEERING
Civil Engineering Department

İS-KA İMALAT İNŞAAT TURİZM SAN. TİC. İTHALAT VE İHRACAT LTD ŞTİ.

Skaform Polymer Construction Mold Technical Specifications



TECHNICAL REPORT

Application Number: 1253248

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Technical Report on SKAFORM Polymer Construction Formwork Technical Specifications

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Summary

In this report, the various physical and mechanical properties of the polymer construction mold SKAFORM produced by İS-KA İMALAT İNŞAAT TURİZM SAN. TİC. İTHALAT VE İHRACAT LTD ŞTİ. are determined via experimental studies and the obtained results are presented.

On panels with 15, 18 and 21 mm nominal thickness, unit weight, specific gravity, impact strength, and at different temperatures tensile and bending strength tests were carried out.

It was determined that the mechanical properties of the panels were higher in the longitudinal direction. For this reason, it is important to consider that the panel may be inclined longitudinally between the supports and thus expose the strong section to the bending effects.

The characteristic values of elastic and strength properties obtained from tensile and bending tests performed under 15°C and 40°C sample temperature conditions are calculated and presented in a table. It is possible to calculate convenient values for temperatures between 15-40°C by interpolation. Extrapolation for temperatures other than these values should be avoided and the manufacturer's approval should be consulted for this.

The results obtained from Charpy impact tests performed on unnotched samples at 25°C ambient temperature are presented in a table.

In extraordinary applications where the concrete pressure is high, it is possible to use the panels with double layers, yet, attention should be paid using the method specified in the report and manufacturer's approval should be obtained.





Technical Report on SKAFORM Polymer Construction Formwork Technical Specifications

1. Introduction

In this report, upon the request made by the authorized person from İS-KA İmalat İnşaat Turizm San. Tic. İth. İhr. Ltd Şti. dated 19/07/2023 and numbered 1253248, various physical and mechanical properties of the polymer construction formwork product SKAFORM marketed by the said company were
determined. This report has been prepared in accordance with the Regulations of ITU Revolving Fund Enterprise.

2. Scope

The tests summarized in this report are limited to the determination of the basic physical and mechanical properties for the use of SKAFORM hollow plastic boards as construction formwork and do not include detailed characterization of every aspect of the relevant polymer material and plate. Tensile and bending tests on samples cut from plate samples were carried out at two different temperatures, 15°C and 40°C. In addition, impact tests were carried out at 25°C.

3. General Information About the Product

The product being inspected is made of polypropylene material and has a form of hollow board (Figure 1). In the product technical brochure of the prodcut, nominal thickness is given as 15, 18 and 21 mm, and standard panel dimensions are 1250x2500 mm.

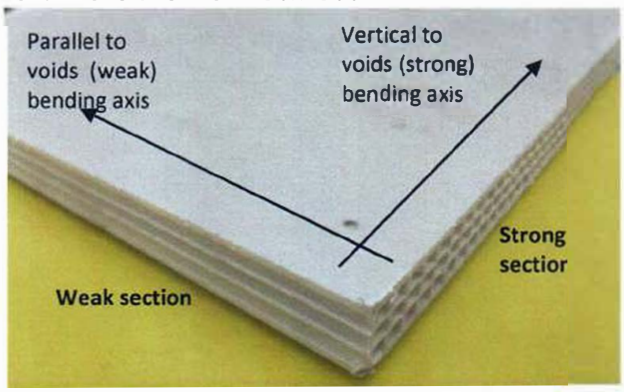


Figure 1. SKAFORM polypropylene hollow sheet sections

Developed as an alternative to traditional wooden or plywood formwork sheets in reinforced concrete building constructions, the advantages of SKAFORM sheet are lightness, strength, hardness, impact resistance and abrasion resistance, as well as its reusability, resistance to environmental conditions and chemicals, and other features that provide ease of use. The product brochure also includes some guidance on the use of the product as a formwork plate.

4. Experimental Studies

The necessary strength properties to create information about the use of SKAFORM plastic panels in concrete formwork applications were obtained from laboratory experiments. For this purpose, the following experiments were carried out.

- Square meter weight of the panel and density measurements of the panel material.
- Tensile tests at temperatures of 15°C and 40°C on the cross-section of the plate perpendicular to the voids and parallel to the void.
- Bending tests of the panel around the bending axes perpendicular to the voids and parallel to the voids at temperatures of 15°C and 40°C.
- Impact tests around the in-plane and out-of-plane strong and weak axes of the planel at 25°C.

The results from these experiments are presented in the following sections.

4.1 Density Measurements

The results obtained as a result of the measurements made on small-sized SKAFORM samples are given in table 1.

Table 1

Nominal Thickness (mm)	Square Meter Weight (kg/m^2)	Specific gravity (kg/m^3)
15	9,5	1180
18	10,3	1182
21	13,2	1210

4.2 Tensile Tests

In order to determine the elasticity modulus and tensile strength in both axes of SKAFORM boards, tensile tests were carried out at 15°C and 40°C on five samples cut parallel to both axes of the plate, as seen in Figure 2. The stress-strain graphs obtained from the performed experiments are given in Figures 3,4,5,6,7,8, and the test results are summarized in Table 2. The experiments stated to be carried out at 40°C are not carried out at 40°C ambient temperature, but are carried out under laboratory conditions after the samples were kept in a 40°C environment for 3 days and brought to the test site in insulated containers. The length of the tensile samples is 250 mm, and the average measurement length between the jaws is 140 mm. The width and thickness of each sample measured with a caliper are given in Tables 2,3,4, and calculations have been done according to these values. Modulus of elasticity has been determined on the linear parts of the curves drawn for longitudinal and transverse samples. Yield strength was calculated with the 0.2% offset method.

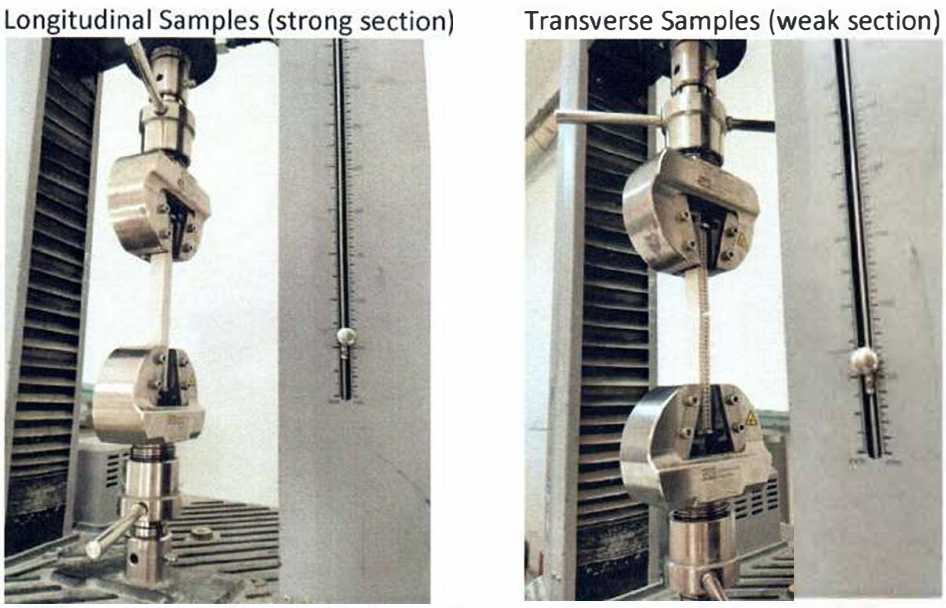


Figure 2. Transverse and longitudinal samples subjected to tensile tests at 15 °C and 40 °C

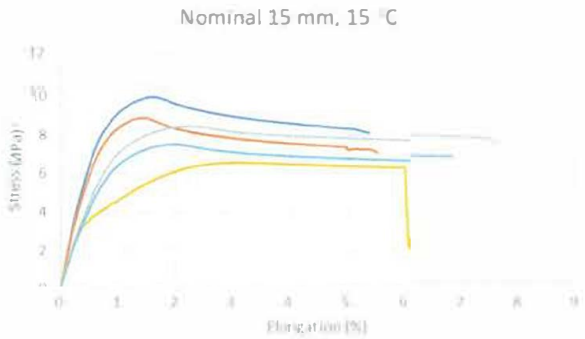


Figure 3. Stress-strain graphs obtained from tensile tests of 15 mm thick samples at 15 °C

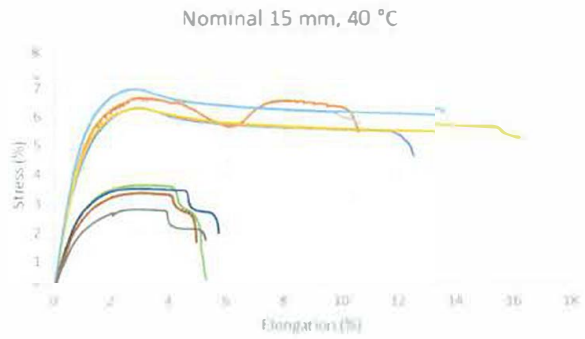


Figure 4. Stress-strain graphs obtained from tensile tests of 15 mm thick samples at 40 °C

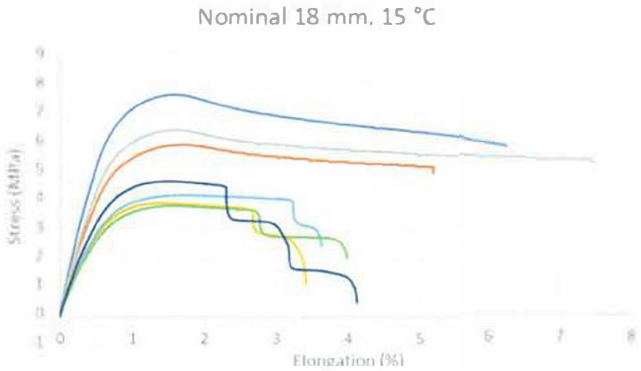


Figure 5. Stress-strain graphs obtained from tensile tests of 18 mm thick samples at 15 °C

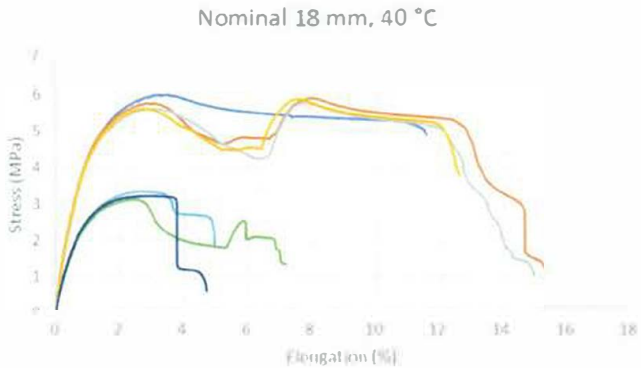


Figure 6. Stress-strain graphs obtained from tensile tests of 18 mm thick samples at 40 °C

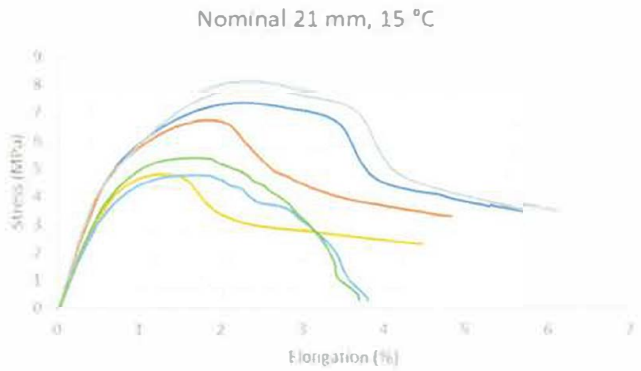


Figure 7. Stress-strain graphs obtained from tensile tests of 21 mm thick samples at 15 °C

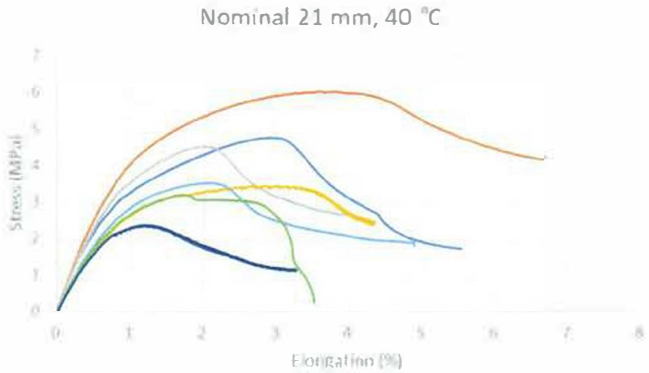


Figure 8. Stress-strain graphs obtained from tensile tests of 21 mm thick samples at 40 °C

Table 2. Results obtained from tensile tests of nominal 15 mm thick samples

Nominal Thickness (mm)	Temperature (°C)	Direction	Sample No.	Cross section (mm x mm)	Max. Load (N)	Elasticity Modulus (MPa)	Yield Strength (MPa)	Tensile Strength (MPa)	Max. Unit Elongation (%)
15	15	Longitudinal	1	24,84 x 15,10	3733	1452	8,3	10,0	5,4
			2	24,67 x 15,15	3326	1325	7,5	8,9	5,5
			3	24,81 x 15,17	3176	978	7,1	8,4	7,6
			4	24,87 x 15,19	2471	910	5,6	6,6	6,1
			5	24,93 x 15,19	2849	965	6,3	7,5	6,9
		Transverse	1	24,86 x 14,95	1637	715	4,0	4,4	2,9
			2	24,76 x 14,91	1757	743	4,4	4,8	2,8
			3	24,71 x 14,89	1873	810	4,6	5,1	2,7
			4	24,97 x 15,01	1744	756	4,3	4,7	2,8
			5	25,02 x 14,93	1681	721	4,1	4,5	2,9
	40	Longitudinal	1	24,81 x 15,20	2390	590	5,3	6,3	12,4
			2	25,10 x 15,24	2558	659	5,6	6,7	10,5
			3	25,24 x 15,20	2681	591	5,8	7,0	10,6
			4	25,01 x 15,29	2415	649	5,3	6,3	16,3
			5	25,13 x 15,30	2688	749	5,8	7,0	13,7
		Transverse	1	24,89 x 14,99	1365	417	3,1	3,7	5,2
			2	24,86 x 14,99	1317	426	3,0	3,5	5,7
			3	24,77 x 15,27	1264	389	2,9	3,3	4,9
			4	24,94 x 15,13	1013	326	2,4	2,7	5,2
			5	24,81 x 14,86	1376	429	3,1	3,7	4,7

Table 3. Results obtained from tensile tests of nominal 18 mm thick samples

Nominal Thickness (mm)	Temperature (°C)	Direction	Sample No.	Cross Section (mm x mm)	Max. Load (N)	Elasticity Modulus (MPa)	Yield Strength (MPa)	Tensile Strength (MPa)	Max. Unit Elongation (%)
18	15	Longitudinal	1	18,07 x 25,03	2657	1065	5,0	5,9	6,4
			2	18,04 x 24,97	3069	1114	5,7	6,8	7,2
			3	18,03 x 25,06	3456	1284	6,3	7,6	6,3
			4	18,07 x 25,04	2676	980	5,0	5,9	5,2
			5	18,05 x 25,01	2896	1036	5,4	6,4	7,5
		Transverse	1	18,03 x 24,75	1740	705	3,5	3,9	3,4
			2	17,88 x 24,71	1845	743	3,8	4,2	3,6
			3	17,97 x 24,91	2001	839	4,1	4,5	3,5
			4	18,08 x 24,93	1725	680	3,4	3,8	4,0
			5	18,01 x 24,87	2083	844	4,2	4,7	4,1
	40	Longitudinal	1	18,12 x 25,35	2407	516	4,4	5,2	9,6
			2	18,15 x 24,94	2714	551	5,0	6,0	11,5
			3	18,13 x 24,71	2637	595	5,0	5,9	15,3
			4	18,11 x 24,94	2601	573	4,9	5,8	14,9
			5	18,10 x 25,1	2663	605	5,0	5,9	12,6
		Transverse	1	18,13 x 24,75	1505	389	3,1	3,4	5,0
			2	18,12 x 24,83	1398	385	2,9	3,1	7,1
			3	18,06 x 25,03	1401	395	2,9	3,1	6,2
			4	18,01 x 24,95	1452	419	2,9	3,2	4,7
			5	18,03 x 25,12	1497	421	3,0	3,3	4,5

Table 4. Results obtained from tensile tests of nominal 21 mm thick samples

Nominal Thickness (mm)	Temperature (°C)	Direction	Sample No.	Cross Section (mm x mm)	Max. Load (N)	Elasticity Modulus (MPa)	Yield Strength (MPa)	Tensile Strength (MPa)	Max. Unit Elongation (%)
21	15	Longitudinal	1	21,10 x 25,17	3887	1067	6,1	7,3	8,2
			2	21,08 x 24,99	3999	1099	6,4	7,6	8,6
			3	20,98 x 24,86	3926	1081	6,3	7,5	7,9
			4	20,96 x 24,87	3641	1020	6,0	7,0	8,3
			5	21,03 x 24,86	4252	1075	6,8	8,1	8,0
		Transverse	1	20,84 x 24,84	2611	811	4,6	5,0	4,6
			2	20,94 x 24,76	2591	886	4,6	5,0	3,9
			3	20,89 x 24,98	2935	932	5,2	5,6	3,7
			4	20,95 x 25,01	2663	891	4,7	5,1	3,8
			5	20,97 x 25,05	2896	927	5,2	5,5	3,9
	40	Longitudinal	1	21,16 x 24,97	2560	554	4,1	4,8	6,0
			2	21,12 x 24,95	3100	640	5,0	5,9	7,1
			3	21,21 x 24,81	3206	565	5,2	6,1	9,3
			4	21,17 x 24,83	2962	581	4,7	5,6	7,2
			5	21,2 x 24,95	2890	542	4,6	5,5	8,0
		Transverse	1	21,08 x 25,02	1958	433	3,4	3,7	4,0
			2	21,12 x 24,90	1845	423	3,1	3,5	4,3
			3	21,04 x 24,88	1877	471	3,2	3,6	4,9
			4	21,07 x 24,93	1716	434	3,0	3,3	3,5
			5	21,07 x 24,97	2449	418	4,2	4,7	3,9

As can be seen from the graphs and tables, the elastic, strength and deformation properties of the longitudinal samples taken from the panel under investigation are quite higher than the transverse samples, as expected.

4.3 Bending Tests

Bending tests were carried out in accordance with the ASTM D790-17 standard at 15°C and 40°C on transverse and longitudinal bending samples taken from SKAFORM panels are shown in Figure 9. The bending stress- bending strain graphs obtained from the experiments are shown in Figures 10, 11, 12, 13, 14, 15, and the experimental results are summarized in Tables 5, 6, 7.

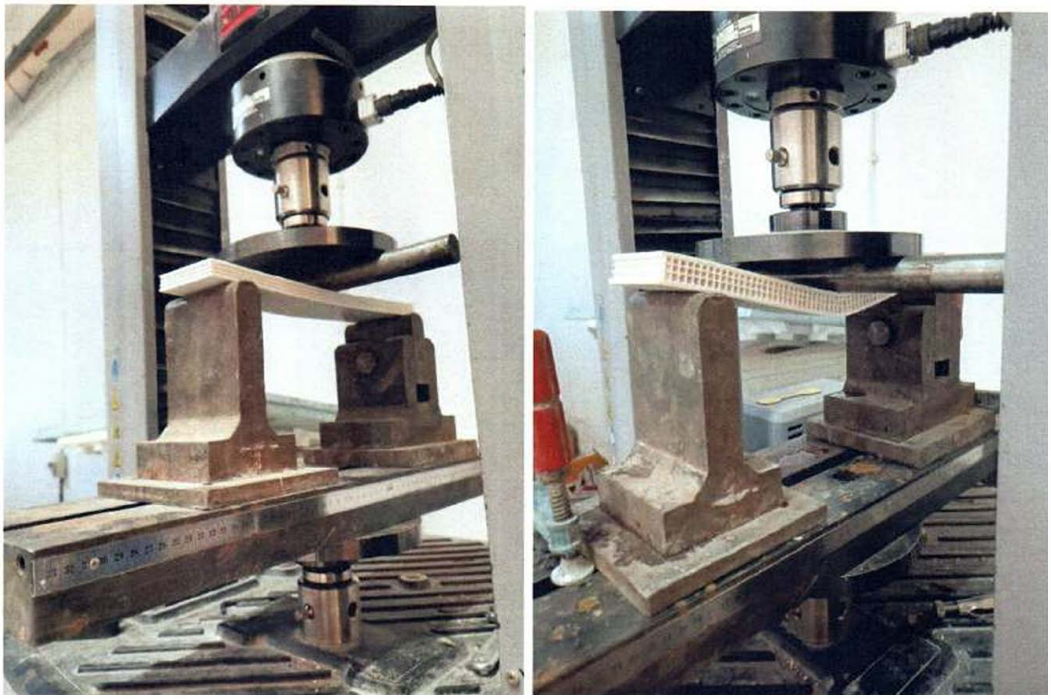


Figure 9. Bending test in longitudinal and transverse directions

In the experiments stated to be carried out at 40°C, the samples were kept at 40°C for three days and then brought to the test site in insulated containers and tested under laboratory conditions. The dimensions and bending span of the samples are given in Table 2. Due to the displacement limits of the experimental setup, the experiments were terminated at a displacement of approximately 25 mm after the longitudinal samples reached the strength value. For this reason, in Table 2, the bending elongation corresponding to the strength is given for the samples, not the breaking elongation. The bending modulus of longitudinal samples was calculated between 3 MPa and 6 MPa stresses for a temperature of 15°C, and between MPa and 4 MPa stresses for a temperature of 40°C. The tensile modulus of transverse samples was calculated between 2 MPa and 4 MPa stresses for a temperature of 15°C, and between 1 MPa and 2 MPa stresses for a temperature of 40°C. Yield strength for all samples was calculated with the 0.2% offset method.

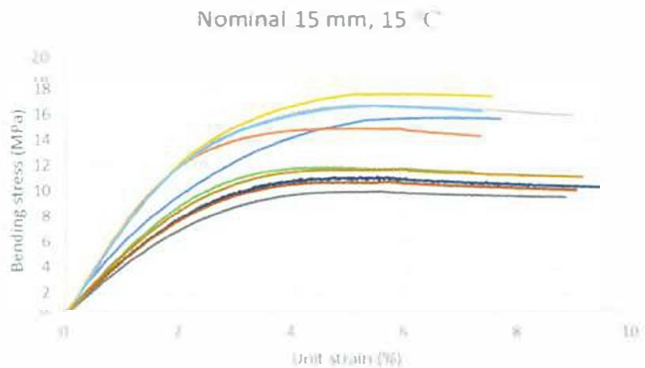


Figure 10. Stress-strain graphs obtained from bending tests of 15 mm thick samples at 15 °C

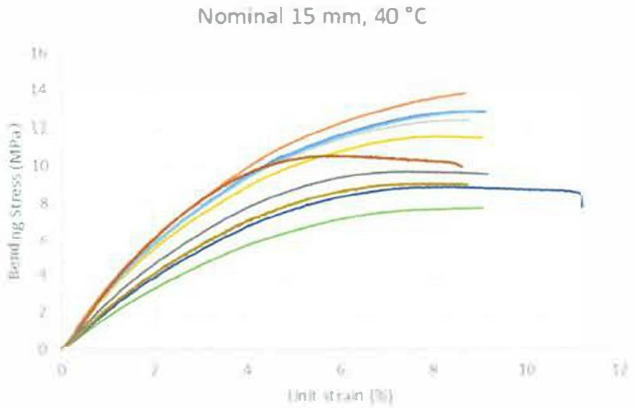


Figure 11. Stress-strain graphs obtained from bending tests of 15 mm thick samples at 40 °C

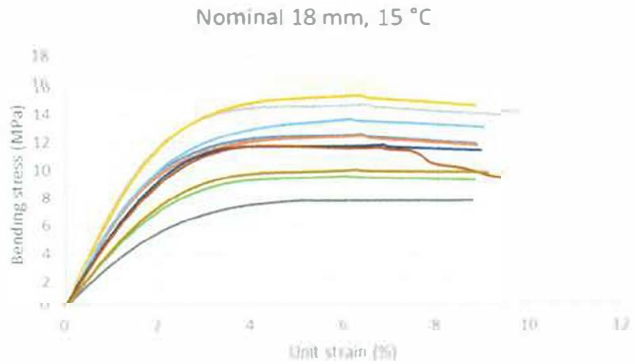


Figure 12. Stress-strain graphs obtained from bending tests of 18 mm thick samples at 40 °C

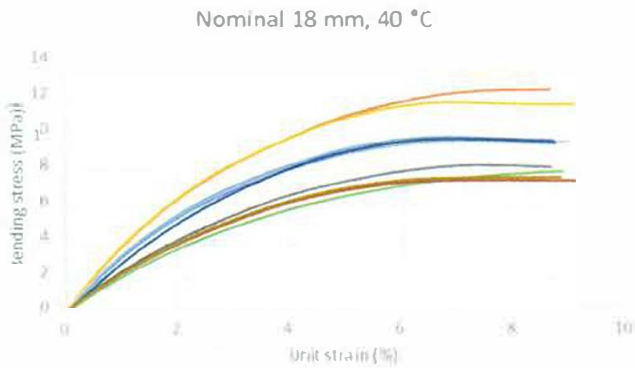


Figure 13. Stress-strain graphs obtained from bending tests of 18 mm thick samples at 40 °C

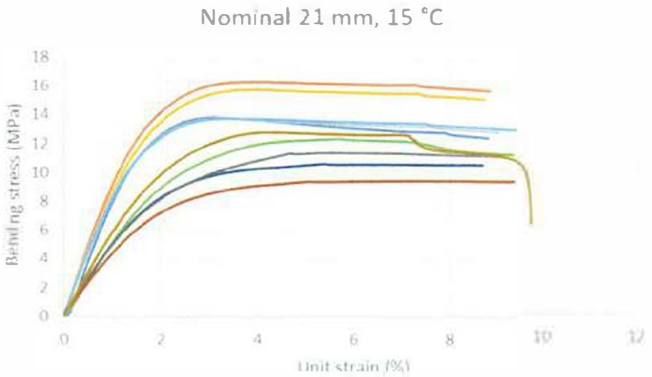


Figure 14. Stress-strain graphs obtained from bending tests of 21 mm thick samples at 15 °C

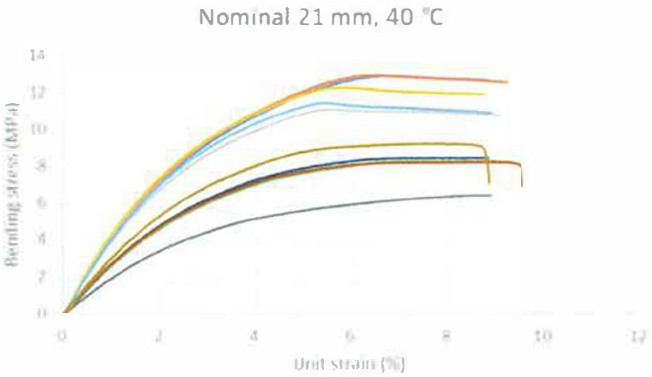


Figure 15. Stress-strain graphs obtained from bending tests of 21 mm thick samples at 40 °C

Table 5. Results obtained from bending tests of nominal 15 mm thick samples

Nominal Thickness (mm)	Temperature (°C)	Direction	No	Section (mm x mm)	Length (mm)	Span (mm)	Max. Load (N)	Max. Strain (mm)	Flexural Modulus of Elasticity (MPa)	Flexural Yield Strength (MPa)	Flexural Strength (MPa)	Strength in Unit Elongation (%)
15	15	Longitudinal	1	15,02 x 70,44	350	290	577	22,1	618	12,1	15,8	6,3
			2	15,18 x 69,64			551	18,1	720	12,3	14,9	5,2
			3	15,00 x 70,00			606	17,9	700	13,4	16,7	5,1
			4	14,99 x 70,49			642	21,9	714	14,3	17,6	6,3
			5	15,12 x 69,78			613	19,0	761	13,6	16,7	5,4
		Transverse	1	15,17 x 69,72	350	290	437	16,0	519	9,6	11,9	4,6
			2	15,35 x 69,93			421	19,2	446	9,0	11,1	5,5
			3	15,39 x 70,71			411	20,2	447	8,8	10,7	5,8
			4	15,36 x 70,65			383	19,4	408	8,3	10,0	5,5
			5	15,28 x 69,74			439	20,9	502	9,6	11,7	6,0
	40	Longitudinal	1	15,00 x 70,30	350	290	472	30,5	340	9,1	13,0	8,7
			2	15,11 x 70,23			512	30,1	370	9,7	13,9	8,6
			3	15,03 x 70,44			457	30,4	362	8,8	12,5	8,7
			4	15,30 x 70,23			438	27,9	333	8,2	11,6	8,0
			5	15,26 x 70,62			491	30,9	345	9,1	13,0	8,8
		Transverse	1	15,39 x 70,40	350	290	297	31,5	199	6,0	7,7	9,0
			2	15,36 x 70,04			336	29,9	226	6,5	8,9	8,6
			3	15,29 x 70,09			398	20,5	377	7,9	10,6	5,9
			4	15,26 x 70,36			367	26,2	270	6,8	9,7	7,5
			5	15,44 x 69,99			349	27,7	251	6,6	9,1	7,9

Table 6. Results obtained from bending tests of nominal 18 mm thick samples

Nominal Thickness (mm)	Temperature (°C)	Direction	No	Cross section (mm x mm)	Length (mm)	Span (mm)	Max. Load (N)	Max. strain (mm)	Flexural Modulus of Elasticity (MPa)	Flexural Yield Strength (MPa)	Flexural Strength (MPa)	Strength in Unit Elongation (%)
18	15	Longitudinal	1	18,00 x 70,81	350	290	663	22,1	675	9,4	12,6	6,3
			2	18,06 x 69,83			652	22,3	606	9,3	12,4	6,4
			3	18,01 x 69,52			761	22,3	773	10,9	14,7	6,4
			4	17,99 x 69,99			798	22,2	714	11,2	15,3	6,3
			5	18,07 x 69,69			715	21,5	637	10,3	13,7	6,1
		Transverse	1	18,02 x 69,83	350	290	497	20,9	487	7,3	9,5	6,0
			2	17,92 x 70,14			611	23,8	586	8,8	11,8	6,8
			3	18,01 x 70,29			614	15,8	568	8,8	11,7	4,5
			4	18,16 x 69,78			415	30,0	340	6,0	7,8	8,6
			5	18,05 x 69,82			522	21,9	454	7,6	10,0	6,2
	40	Longitudinal	1	18,03 x 70,17	350	290	507	25,4	356	6,5	9,6	7,2
			2	17,99 x 70,06			648	30,1	381	8,1	12,4	8,6
			3	18,05 x 70,09			509	25,2	357	6,5	9,7	7,2
			4	18,07 x 69,82			616	23,6	418	8,0	11,7	6,8
			5	18,01 x 70,45			517	23,9	353	6,6	9,8	6,8
		Transverse	1	18,09 x 70,03	350	290	416	31,0	206	5,6	7,9	8,8
			2	18,03 x 69,98			511	23,7	309	6,9	9,8	6,8
			3	18,1 x 69,88			392	26,1	224	5,1	7,4	7,5
			4	18,03 x 70,00			435	25,9	246	5,8	8,3	7,4
			5	18,05 x 69,97			399	30,7	228	6,1	8,7	7,6

Table 7. Results obtained from bending tests of nominal 21 mm thick samples

Nominal Thickness (mm)	Temperature (°C)	Direction	No	Section (mm x mm)	Length (mm)	Span (mm)	Max. Load (N)	Max. strain (mm)	Flexural Modulus of Elasticity (MPa)	Flexural Yield Strength (MPa)	Flexural Strength (MPa)	Strength in Unit Elongation (%)
21	15	Longitudinal	1	21,12 x 70,11	350	290	994	10,9	970	11,0	13,8	3,1
			2	21,05 x 70,59			1173	14,1	1019	13,0	16,3	4,0
			3	21,12 x 69,99			988	11,6	940	11,0	13,7	3,3
			4	21,21 x 69,95			1141	15,8	958	11,3	14,1	4,0
			5	21,16 x 70,05			994	12,4	920	11,0	13,8	3,6
		Transverse	1	21,03 x 69,91	350	290	879	20,0	558	11,0	12,4	5,7
			2	21,06 x 69,90			756	18,8	525	9,4	10,6	5,4
			3	21,04 x 69,78			670	27,4	452	8,3	9,4	7,8
			4	21,05 x 69,67			809	19,9	530	10,0	11,4	5,7
			5	21,01 x 70,06			911	15,7	628	11,3	12,8	4,5
	40	Longitudinal	1	21,15 x 70,08	350	290	946	23,4	459	8,6	13,1	6,7
			2	21,15 x 70,15			948	23,2	457	8,6	13,1	6,6
			3	21,21 x 70,48			822	19,8	436	7,8	11,3	5,7
			4	21,15 x 70,03			900	20,6	494	8,3	12,5	5,9
			5	21,18 x 70,54			847	19,0	472	7,9	11,6	5,4
		Transverse	1	21,05 x 70,06	350	290	609	30,5	299	6,4	8,5	8,7
			2	21,07 x 70,2			624	29,6	302	6,5	8,7	8,5
			3	21,11 x 69,96			606	31,5	296	6,3	8,5	9,0
			4	21,17 x 70,00			481	29,9	211	4,6	6,7	8,5
			5	21,11 x 70,16			681	26,9	342	7,6	9,5	7,7

4.4 Impact Tests

Although the impact resistance of the panels under investigation is not a direct design parameter, Charpy impact tests were carried out by preparing longitudinal and transverse samples in the in-plane and out-of-plane directions of the panel in order to give an idea about the impact resistance of the panel and to check compliance with possible specification values. The samples were tested without notches because the panel was hollow, the main resistance was provided by the panel shell, and the resolution of the test results. Transverse and longitudinal samples cut parallel and perpendicular to the panel plane with the Charpy impact test device are shown in Figure 7, and the test results are given in Table 3. As can be seen from the test results, the impact resistance of the panel is highest in the longitudinal (strong section) direction in the out-of-plane direction and lowest in the transverse (weak section) direction in the in-plane direction, as expected. Since the panels are tested without notches, it is expected that the standard deviations given in Table 3 will be higher than normal, but if the notch is opened, resolution problems similar to those seen in the 'C' set results are inevitable due to the excessive weakening of the samples.



Figure 7. Charpy impact tester and sample sets

Table 8. Impact test results

		Impact Resistance (KJoule/m²)			
		In-plane		Out of plane	
Nominal thickness (mm)	Sample no	A (Strong section)	C (Weak section)	B (Strong section)	D (Weak section)
15 mm	1	8,2	3,3	10,2	4,2
	2	7,8	3,8	10,7	4,1
	3	8,2	3,3	9,8	4,4
	4	9,4	3,1	10,1	4,3
	5	5,9	3,7	9,4	4,2
	Average	7,9	3,4	10,0	4,2
	Standard deviation	1,1	0,3	0,4	0,1
18 mm	1	9,3	3,7	10,6	4,7
	2	11,2	4,7	12,7	4,4
	3	11,0	4,8	12,6	5,0
	4	10,2	4,4	12,8	5,1
	5	9,9	4,2	12,7	4,8
	Average	10,3	4,4	12,3	4,8
	Standard deviation	0,7	0,4	0,8	0,2
21 mm	1	15,7	5,8	18,6	6,3
	2	18,3	6,1	15,6	7,5
	3	9,3	6,4	13,9	6,4
	4	10,9	8,4	12,8	8,4
	5	8,9	4,8	12,7	4,8
	Average	12,6	6,3	14,7	6,7
	Standard deviation	3,7	1,2	2,2	1,2

4.5 Characteristic Values of the Mechanical Properties

Among the test results presented in the previous sections, the characteristic values of the features that may be required in the design for the use of SKAFORM panels as concrete formwork are presented in Tables 9,10,11. The characteristic values given for 15°C and 40°C temperatures can be calculated by interpolation for intermediate temperature values. Extrapolation for temperatures outside the specified range should be avoided and the manufacturer's approval must be obtained for this.

The characteristic values given in Table 9 were calculated using the following equation for a 90% security level, using the t-distribution and taking the degree of freedom as 5, since the number of samples was 5, after calculating the mean and standard deviations of the relevant values given in Tables 1 and 2.

$$Characteristic\ value = Mean - 1.476 \times Standard\ deviation$$

Table 9. Characteristic values of SKAFORM mechanical properties with 15 mm nominal thickness

				Average	Standard deviation	Characteristic value
Longitudinal (Strong section)	Tensile	Modulus of elasticity (MPa)	15 °C	1126	219	803
			40 °C	648	58	562
		Yield strength (Mpa)	15 °C	7	0,9	5,7
			40 °C	5,6	0,2	5,3
		Strength (MPa)	15 °C	8,3	1,2	6,5
			40 °C	6,7	0,3	6,3
		Unit elongation (%)	15 °C	6,3	0,8	5,1
			40 °C	12,7	2,2	9,5
	Bend	Modulus of elasticity (MPa)	15 °C	703	46,9	634
			40 °C	350	13,8	330
		Yield strength (Mpa)	15 °C	13,1	0,8	11,9
			40 °C	9,0	0,5	8,3
		Strength (MPa)	15 °C	16,3	0,9	15,0
			40 °C	12,8	0,8	11,6
		Unit elongation (%)	15 °C	5,7	0,5	5,0
			40 °C	8,6	0,3	8,2
Transverse (Weak section)	Tensile	Modulus of elasticity (MPa)	15 °C	749	33,9	699
			40 °C	397	38,4	340
		Yield strength (Mpa)	15 °C	4,3	0,2	4,0
			40 °C	2,9	0,3	2,5
		Strength (MPa)	15 °C	4,7	0,2	4,4
			40 °C	3,4	0,4	2,8
		Unit elongation (%)	15 °C	2,8	0,1	2,7
			40 °C	5,1	0,4	4,5
	Bend	Modulus of elasticity (MPa)	15 °C	464	40,5	404
			40 °C	265	61,1	175
		Yield strength (Mpa)	15 °C	9,1	0,5	8,4
			40 °C	6,8	0,6	5,9
		Strength (MPa)	15 °C	11,1	0,7	10,1
			40 °C	9,2	1,0	7,8
		Unit elongation (%)	15 °C	5,5	0,5	4,8
			40 °C	7,8	1,1	6,2

Table 10. Characteristic values of SKAFORM mechanical properties with 1 8 mm nominal thickness

				Average	Standard deviation	Characteristic value
Longitudinal (Strong section)	Tensile	Modulus of elasticity (MPa)	15 °C	1096	104,0	942
			40 °C	568	32,0	521
		Yield strength (Mpa)	15 °C	5,5	0,5	4,8
			40 °C	4,9	0,2	4,6
		Strength (MPa)	15 °C	6,5	0,6	5,6
			40 °C	5,8	0,3	5,4
		Unit elongation (%)	15 °C	6,5	0,8	5,3
			40 °C	12,8	2,1	9,7
	Bend	Modulus of elasticity (MPa)	15 °C	681	58,6	595
			40 °C	373	24,6	337
		Yield strength (Mpa)	15 °C	10,2	0,8	9,0
			40 °C	7,1	0,7	6,1
		Strength (MPa)	15 °C	13,7	1,1	12,1
			40 °C	10,6	1,2	8,8
		Unit elongation (%)	15 °C	6,3	0,1	6,2
			40 °C	7,3	0,7	6,3
Transverse (Weak section)	Tensile	Modulus of elasticity (MPa)	15 °C	762	67,8	662
			40 °C	402	15,0	380
		Yield strength (Mpa)	15 °C	3,8	0,3	3,4
			40 °C	3	0,1	2,9
		Strength (MPa)	15 °C	4,2	0,3	3,8
			40 °C	3,2	0,1	3,1
		Unit elongation (%)	15 °C	3,7	0,3	3,3
			40 °C	5,5	1,0	4,0
	Bend	Modulus of elasticity (MPa)	15 °C	487	88,4	357
			40 °C	242,6	35,6	190
		Yield strength (Mpa)	15 °C	7,7	1,0	6,2
			40 °C	5,9	0,6	5,0
		Strength (MPa)	15 °C	10,2	1,5	8,0
			40 °C	8,4	0,8	7,2
		Unit elongation (%)	15 °C	6,4	1,3	4,5
			40 °C	7,6	0,7	6,6

Tablo 11. 21 mm nominal kalınlıklıklı SKAFORM mekanik özellikleri karakteristik değerleri

				Average	Standard deviation	Characteristic value
Longitudinal (Strong section)	Tensile	Modulus of elasticity (MPa)	15 °C	1068	26,4	1029
			40 °C	576	30,3	531
		Yield strength (Mpa)	15 °C	6,3	0,3	5,9
			40 °C	4,7	0,4	4,1
		Strength (MPa)	15 °C	7,5	0,4	7,0
			40 °C	5,6	0,4	5,0
		Unit elongation (%)	15 °C	8,2	0,2	7,8
			40 °C	7,5	1,1	5,9
	Bend	Modulus of elasticity (MPa)	15 °C	961	33	912
			40 °C	464	19	435
		Yield strength (Mpa)	15 °C	11,5	0,8	10,3
			40 °C	8,2	0,3	7,7
		Strength (MPa)	15 °C	14,3	1,0	12,8
			40 °C	12,3	0,7	11,3
		Unit elongation (%)	15 °C	3,6	0,4	3,1
			40 °C	6,1	0,5	5,3
Transverse (Weak section)	Tensile	Modulus of elasticity (MPa)	15 °C	889	43	825
			40 °C	436	19	408
		Yield strength (Mpa)	15 °C	4,9	0,3	4,5
			40 °C	3,4	0,4	2,8
		Strength (MPa)	15 °C	5,2	0,3	4,9
			40 °C	3,8	0,5	3,0
		Unit elongation (%)	15 °C	4,0	0,3	3,6
			40 °C	4,1	0,5	3,4
	Bend	Modulus of elasticity (MPa)	15 °C	539	57	455
			40 °C	290	43	227
		Yield strength (Mpa)	15 °C	10	1,1	8,4
			40 °C	6,3	1,0	4,8
		Strength (MPa)	15 °C	11,3	1,2	9,5
			40 °C	8,4	0,9	7,1
		Unit elongation (%)	15 °C	5,8	1,1	4,2
			40 °C	8,5	0,4	7,9

5. Conclusion

The unit weight of panels with a nominal thickness of 15 mm is measured as 9.5 kg/m2, and the specific gravity of the panel material is 1180 kg/m³.

The unit weight of panels with a nominal thickness of 18 mm was measured as 10.3 kg/m2, and the specific gravity of the panel material was measured as 1182 kg/m³.

The unit weight of panels with a nominal thickness of 21 mm was measured as 13.2 kg/m2, and the specific gravity of the panel material was measured as 1210 kg/m³.

It has been determined that the mechanical properties of the panels are consistently higher in the longitudinal direction. For this reason, it is important to place the panel longitudinally between the supports and thus expose the strong section to bending effects.

The characteristic values of elastic and strength properties obtained from tensile and bending tests performed under 15°C ambient temperature and 40°C sample temperature conditions are calculated and presented in a table. It is possible to calculate appropriate values for temperatures between 15-40°C by interpolation. Extrapolation for temperatures other than these values should be avoided and the manufacturer's approval should be sought for this.

The results obtained from Charpy impact tests performed on unnotched samples at 25°C ambient temperature are presented in a table.

In extraordinary applications, when the concrete pressure is high, the panels may be used double layered, yet, attention should be paid and manufacturer's approval must be obtained.

This report is respectfully submitted for your information.

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