

TEST REPORT CTS N°197517

SUBJECT :

ABOUT THE RESULTS OF THE BENDING TESTS PERFORMED ON SAMPLES TAKEN FROM N.01 COMPOSITE PANEL WITH INNER PATENTED MACROCELLULAR TRANSLUCENT POLYCARBONATE CORE PRODUCED BY BENCORE SRL – CARRARA (MS)

CTS JOB :

1602 / 17

CUSTOMER :

BENCORE SRL – Via Provinciale Nazzano, 20 – 54033 Carrara (MS)

CUSTOMER JOB:

BENCORE Composite Panel STARLIGHT Extra™

REFERENCE:

E.mail dated 30.08.2017

SAMPLING:



Done by Customer

RECEIPT DATE:

11.09.2017

ACCEPTANCE DATE:

11.09.2017

11.09.2017	0	Test Report	Tech. Christian PIOLA 	Eng. Carlo DELLABIANCIA 
<i>Date</i>	<i>Rev.</i>	<i>Description</i>	<i>Prepared</i>	<i>Checked</i> <i>Approved</i>

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Attached : [A1 ÷ A5] Load – deflection curves – flexural tests

1 – MATERIAL RECEIVED

N° 05 specimens (50 x 800 mm) taken from a composite panel with inner patented macrocellular translucent Polycarbonate core Type “STARLIGHT Extra” with nominal thickness 34 mm

The appearance of composite material is shown in the following Figs. 1 - 2.



Fig. 1 – View of a sample of composite material “STARLIGHT Extra” type.



Fig. 2 – View of a sample of composite material through the thickness (34 mm).

2 – TESTS REQUIRED AND REFERENCE STANDARDS

The following tests on the received specimens

N°05 Bending strength determination according to UNI EN 310 : 1994;

N°05 Bending modulus of elasticity determination according to UNI EN 310 : 1994.

3 – INSTRUMENTS AND EQUIPMENTS EMPLOYED

Instruments and equipments listed in Table A below have been used for testing the composite samples in subject.

N°	Description	Trade Mark	Model	Serial Number
1	Digital Caliper	MITUTOYO	DIG 0 – 150	08231678 [A38]
1	Test Machine	INSTRON	5581	1001 [A53]

Tab. A - Instruments and equipments.

4 – TESTS PERFORMED AND RESULTS

4.1 Bending strenght determination

The typical arrangement for bending test is shown in the Figs. 3 - 4.



Fig. 3 – Typical arrangement for bending test (UNI EN 310).



Fig. 4 – Typical arrangement for bending test (UNI EN 310) – Lateral view.

The test load was applied with a constant rate $V = 10 \text{ mm / min}$, so that maximum load can be reached within $60 \pm 30 \text{ s}$.

The bending strength R_f (MPa) of each specimens was reckoned with the following equation:

$$R_f = (3 F_{\max} l_1) / (2 b t^2)$$

where:

R_f = bending strength;
 F_{\max} = breaking load;
 l_1 = span length;
 b = specimen width;
 t = specimen thickness

The results obtained are summarized in the following Table B, the symbol F_u indicates the deflection reached at break point.

SPECIMEN N.	DIMENSIONS			BREAKING LOAD Fmax (N)	BENDING STRENGTH Rf (MPa)	Fu (mm)
	l ₁ (mm)	b (mm)	t (mm)			
FS1	700	50,1	33,8	1649	30,3	81,6
FS2	700	50,1	33,9	1552	28,3	76,8
FS3	700	50,2	33,7	1610	29,7	79,9
FS4	700	50,3	33,9	1694	30,8	87,4
FS5	700	50,5	33,8	1671	30,4	81,1
MEAN VALUE [FS]					29,9	
Standard deviation					<i>0,97</i>	

Tab. B - Bending strength results.

The typical failure of test specimens happened for the fracture of the external layer subjected to compression stress, see Figs. 5 – 8 .



Figs. 5 – 6 Typical specimen failure happened on external layer of composite panel [Specimen FS1].



Figs. 7 – 8 Typical specimen failure happened on external layer of composite panel [Specimen FS4].

4.2 Bending modulus of elasticity determination

For the determination of the bending modulus of elasticity was employed the load – deflection curve for each specimens.

The load – deflection curves are reported in ATT. 1 – 5

The bending modulus of elasticity was calculated by the following equation:

$$E_F = l_1^3 (\Delta P / \Delta h) / (4 b t^3)$$

where:

E_F = bending modulus of elasticity;

l_1 = span length;

ΔF = increment of load on the straight line portion of the load – deflection curve;

Δh = increment of deflection at the mid – length of the specimen;

b = specimen width;

t = thickness width.

The results are summarized in the following Table C

SPECIMEN N.	DIMENSIONS			$\Delta F / \Delta h$ (N/mm)	E_F (MPa)
	l_1 (mm)	b (mm)	t (mm)		
FS1	700	50,1	33,8	24,61	1091
FS2	700	50,1	33,9	24,13	1060
FS3	700	50,2	33,7	24,44	1091
FS4	700	50,3	33,9	24,91	1090
FS5	700	50,5	33,8	24,86	1093
MEAN VALUE [FS]					1085
<i>Standard deviation</i>					<i>1,53</i>

Tab. C - Bending Modulus of elasticity results.

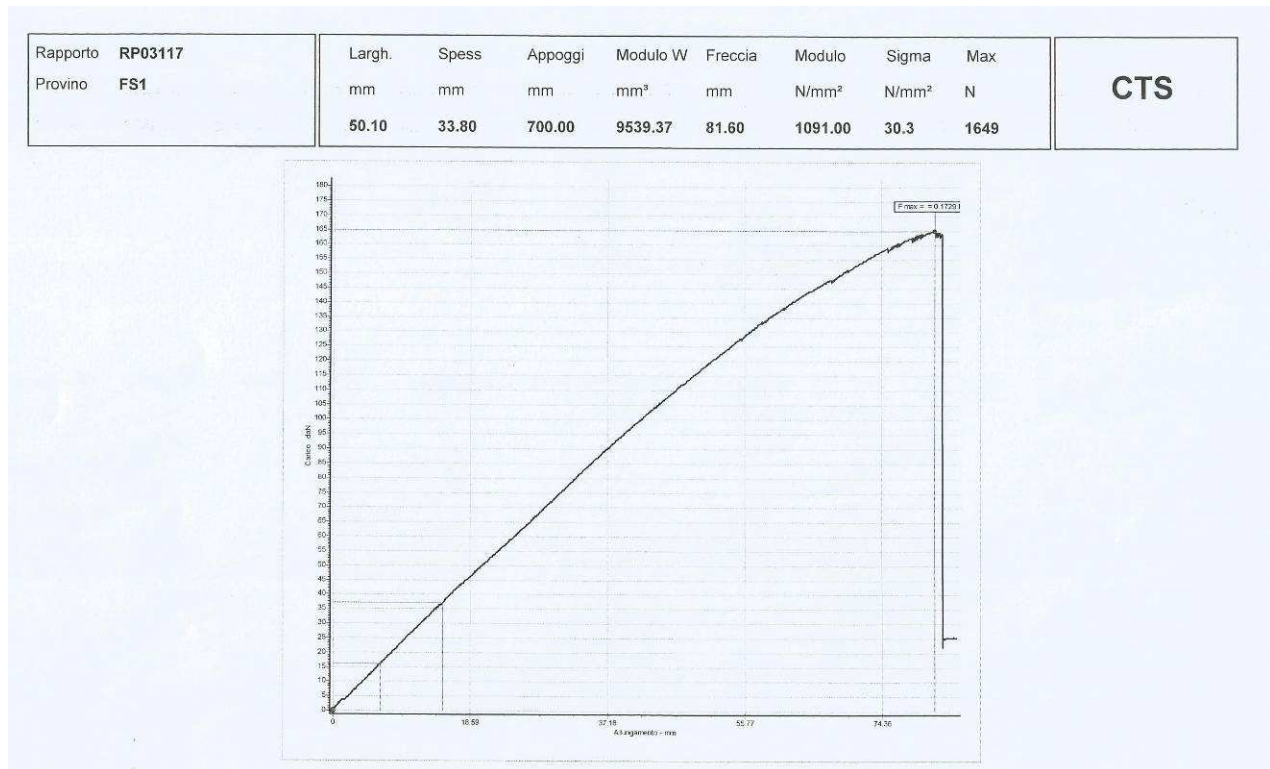
5 – CONCLUSIONS

The mean values obtained in the bending tests performed on specimens taken from a composite panel – **STARLIGTH Extra™** type nominal thickness 34 mm – BENCORE production are:

Bending strength (UNI EN 310 : 1994) = 29,9 MPa

Bending Modulus of elasticity (UNI EN 310 : 1994) = 1085 MPa

ATT.1

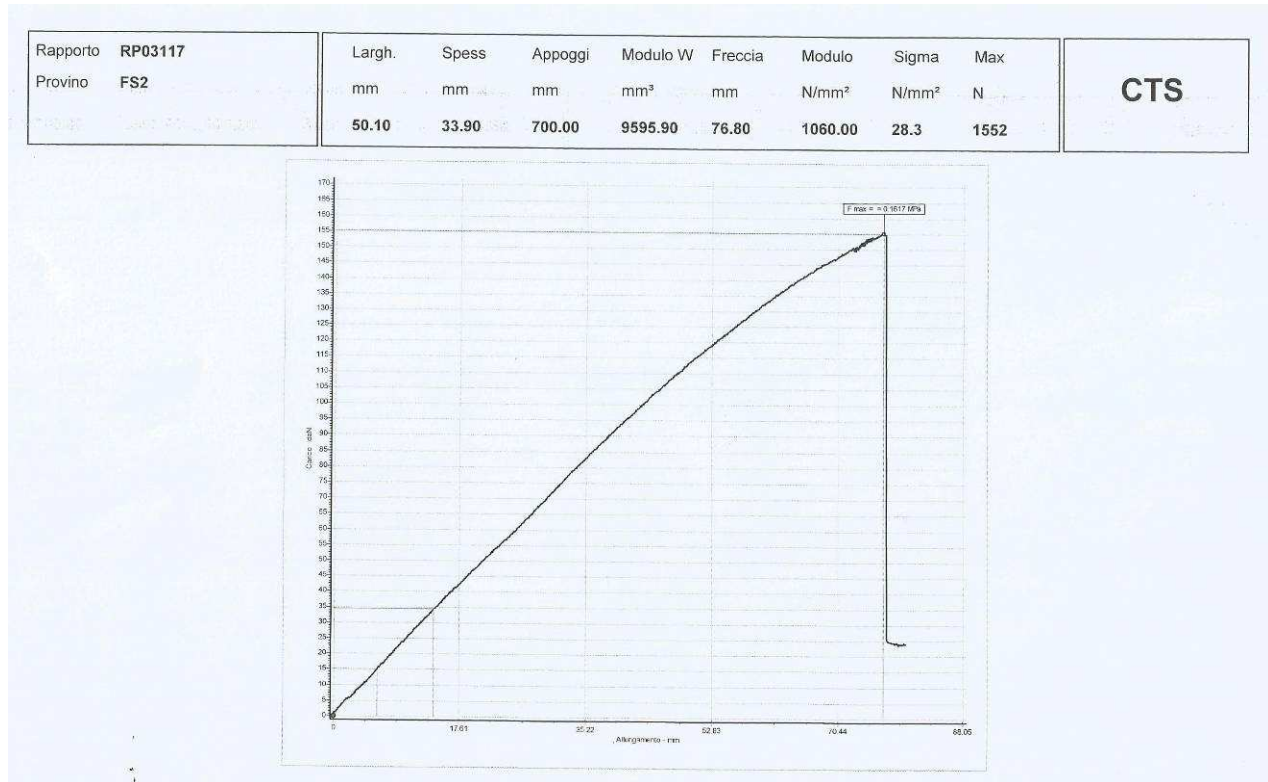


Load – deflection curve – bending test specimen FS1

ATT.2

CTS – Test Rep. N° 197517 dated 11.09.2017 – BENCORE SRL – Carrara (MS) – Bending tests on specimens taken from a composite panel “STARLIGHT EXTRA”
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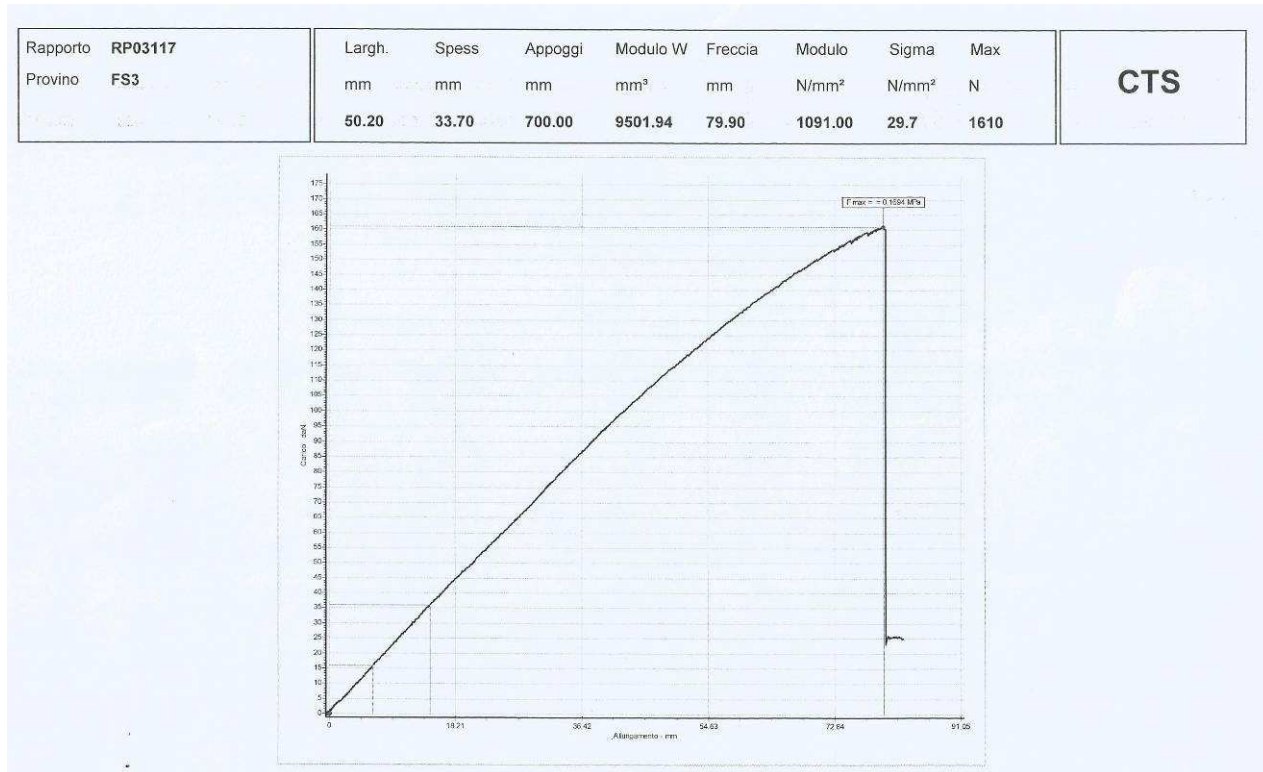


Load – deflection curve – bending test specimen FS2

ATT.3

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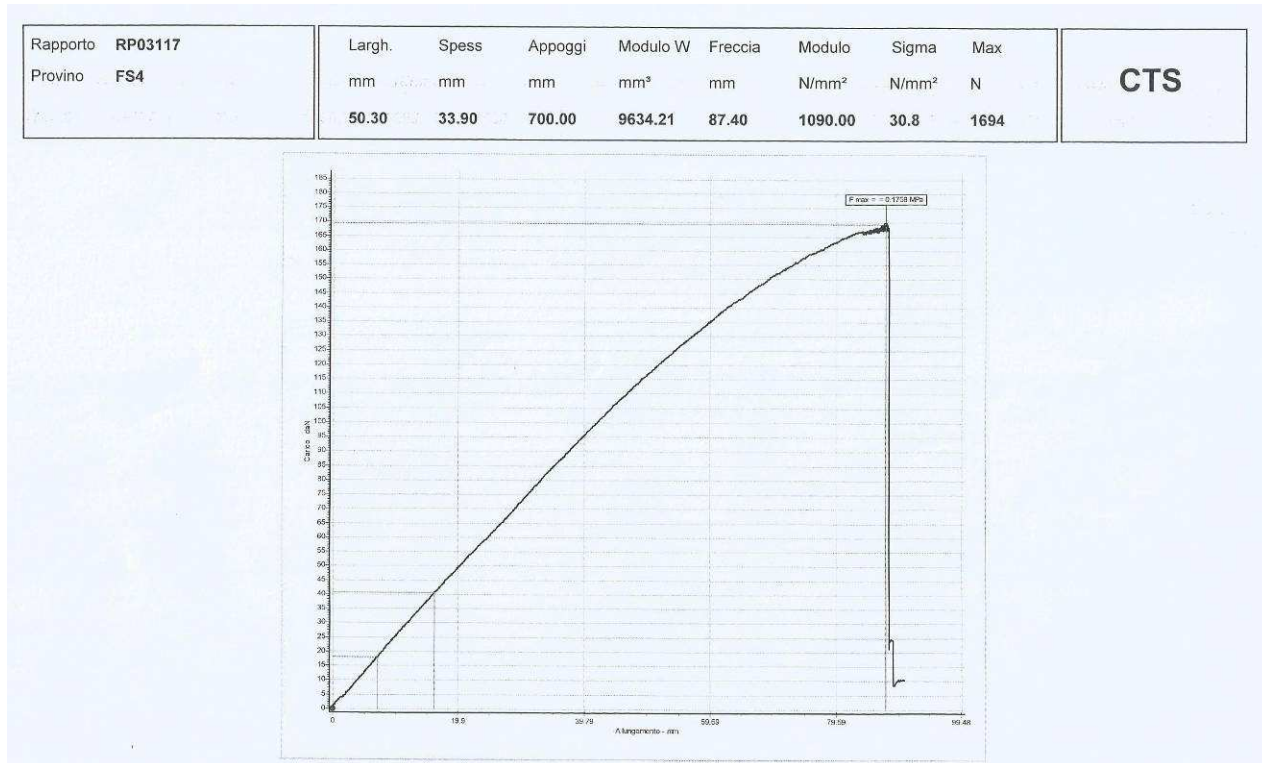


Load – deflection curve – bending test specimen FS3

ATT.4

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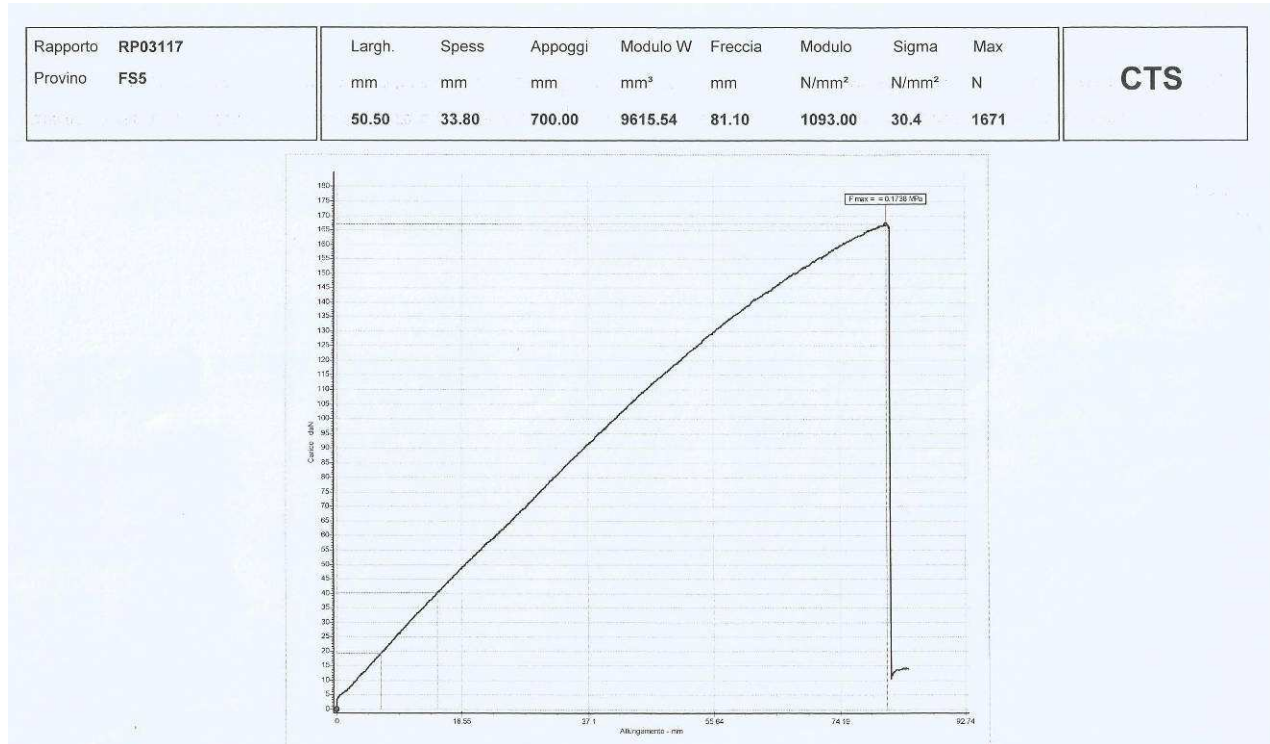


Load – deflection curve – bending test specimen FS4

ATT.5

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Load – deflection curve – bending test specimen FS5