



**OŚRODEK BADAŃ  
ATESTACJI I CERTYFIKACJI**

**OBAC Sp. z o.o.**

**ul. Łabędzka 21,**

**44-121 Gliwice**

**Laboratorium L A B O R E x**

**ul. Aronii 4**

**44-102 Gliwice**

Gliwice, 08.01.2020

**REPORT**

from test No. LL/404/2019

**Subject: Research of glued laminated logs  
manufactured by LLC <<LES-CO>>**

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NIP: PL 631-21-53-136 z 24.04.2004 r.

REGON: 273725355

Kapitał zakładowy – 400 000,00 PLN

KRS: 0000161774 Sąd Rejonowy w Gliwicach

X Wydział Gospodarczy Krajowego Rejestru Sądowego

**1. Clients name and address:**

LLC <<LES-CO>>

2 Grushevskogo street

78267, Mateyivtsi Village, Ivano-Frankivskyj Region, Kolomyjskyj Area

Ukraine

**2. Contract/errand/order number:**

0005/OBAC/3498/19/CW/20

**3. Case identification number given by Laboratory:**

LL/404/2019

**4. Place of performing tests:**

LABOREx Laboratory

4 Aronii street

44-102 Gliwice

POLAND

**5. Date of delivery of test samples:**

26.11.2019, 05.06.2019

**6. Description, status and identification of tested subject:**

The client delivered samples as follows:

- 5 samples with length of 100 mm cut from glued laminated log 240 x 200 [mm]

- 4 samples with length of 300 mm cut from glued laminated log 240 x 200 [mm]



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- 6 samples with length of 300 mm cut from glued laminated log 280 x 200 [mm]



**7. Date(s) of performing tests:**

27.11.2019, 10.12.2019

**8. Tests range and identification of method applied:**

No.	Tested magnitude	Standards applied
1.	Examination of the adhesive strength of glued laminated log	Laboratory own method
2.	Examination of the compressive strength of glued laminated log	Laboratory own method

**9. Equipment used to perform tests:**

No.	Equipment name	Identification number
1.	Measurement probe - Hytherograph type LB701H	C/074/LL
2.	Measurement panel LB-706B with barometric module	C/073/LL
3.	Strength testing machine with instrumentation EDZ-100	A/121/LL
4.	Gauge line	A/146/LL

Apparatus was inspected prior to the tests – apparatus works correctly.

**10. Test performance and results**

The results and associated uncertainties relate only to the tested sample and may not relate to any part of product / substance / material.

Measurement uncertainty was determined according to the document EA-4/02. These uncertainties are expanded uncertainty at the 95% confidence level and coverage factor  $k = 2$ .

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- 5 samples with length of 100 mm cut from glued laminated log 280 x 200 [mm]
- 4 samples with length of 300 mm cut from glued laminated log 280 x 200 [mm]



- 6 samples with length of 300 mm cut from glued laminated log 240 x 200 [mm]

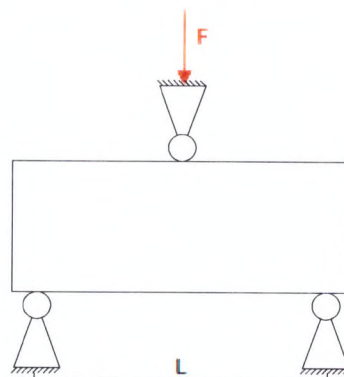


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### 10.1. Examination of the adhesive strength of glued laminated log

The tests were carried out at temperature  $(20,8 \pm 2,0)$  °C and relative humidity  $(54,3 \pm 3,0)\%$ .

The flexural strength test of a milled glued laminated logs was made, to assess the influence of glued connection on the strength of the log. The bending force applied to the sample, causes tensile stresses in the bottom part of the sample (between supports) and, as a result, the sample breaks in the weakest spot. Damage of the samples occurred during the test is shown on Pictures 1 ÷ 10.



Drawing 1. Diagram of the load applied to the samples during the test

Table 1. Test results of samples cut from glued laminated logs 240 x 200 [mm]

Sample No.	Distance between supports L [mm]	Maximum bending force $F_{max}$ [N]
LL/404/19/01	210	14 536 ±111
LL/404/19/02		19 490 ±149
LL/404/19/03		14 049 ±107
LL/404/19/04		16 323 ±125
LL/404/19/05		19 409 ±148

Table 2. Test results of samples cut from glued laminated logs 280 x 200 [mm]

Sample No.	Distance between supports L [mm]	Maximum bending force $F_{max}$ [N]
LL/404/19/06	250	10 801 ±83
LL/404/19/07		16 161 ±123
LL/404/19/08		18 434 ±141
LL/404/19/09		12 263 ±94
LL/404/19/10		12 831 ±98

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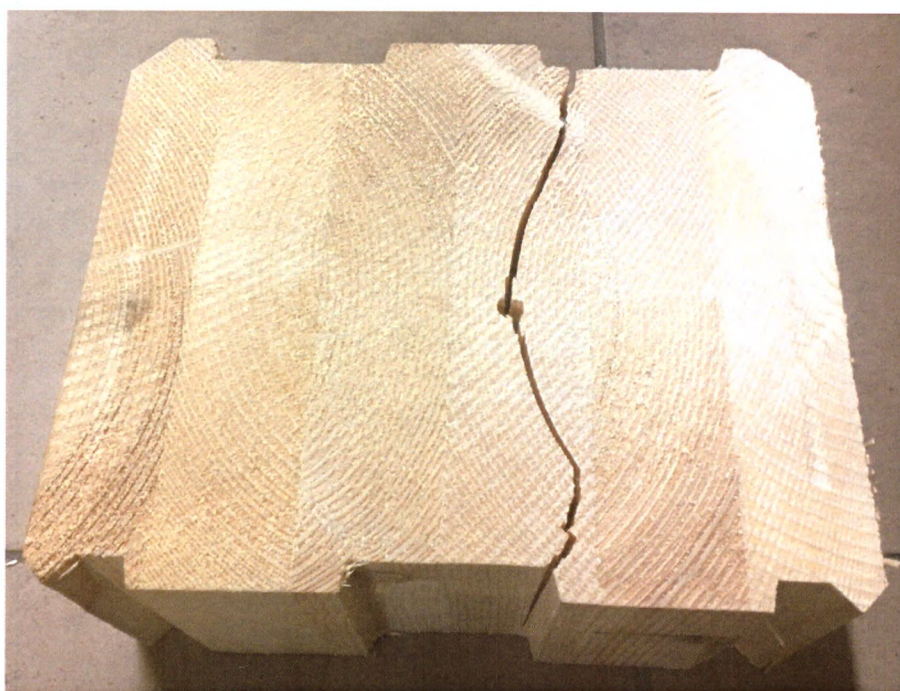
Estimation of measurement uncertainty for the testing machine EDZ-100 A/121/LL:

$$U=0,0076*w_w$$

$w_w$  – indicated value

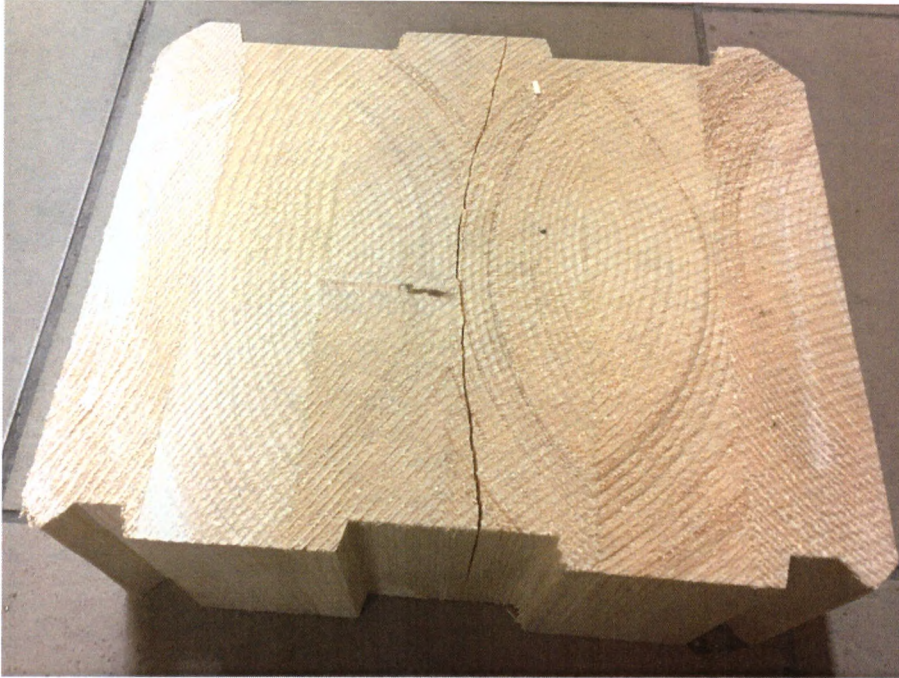


Picture 1. Damage of the sample LL/404/19/01



Picture 2. Damage of the sample LL/404/19/02

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Picture 3. Damage of the sample LL/404/19/03



Picture 4. Damage of the sample LL/404/19/04

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Picture 5. Damage of the sample LL/404/19/05



Picture 6. Damage of the sample LL/404/19/06

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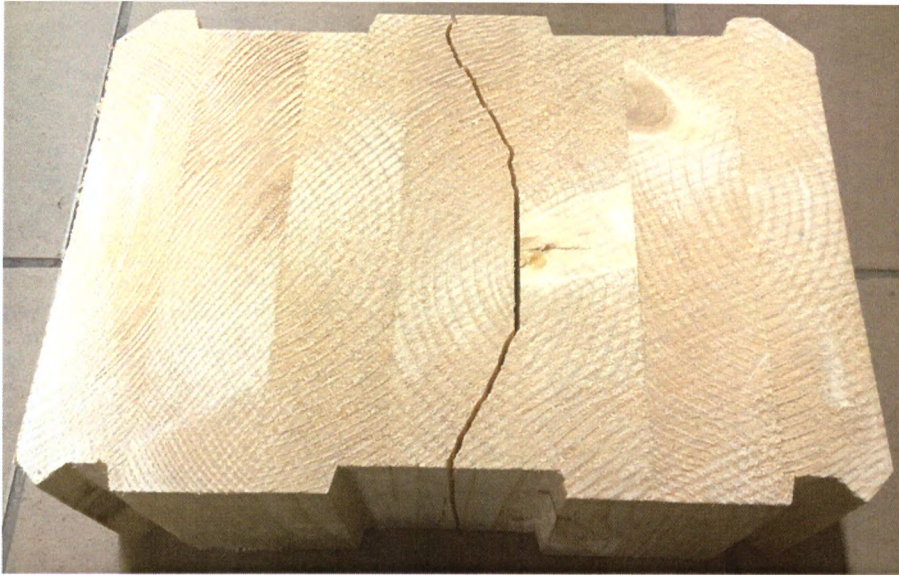


Picture 7. Damage of the sample LL/404/19/07

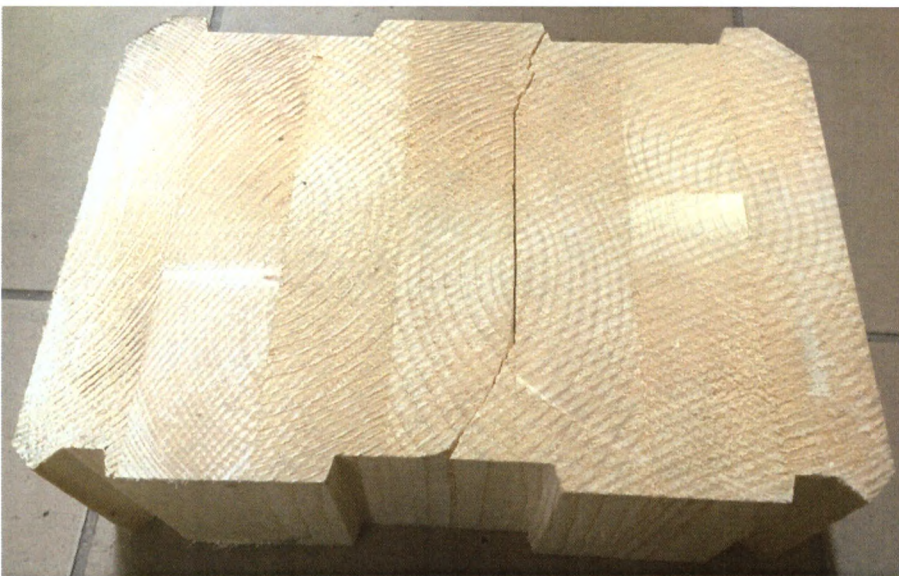


Picture 8. Damage of the sample LL/404/19/08

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Picture 9. Damage of the sample LL/404/19/09



Picture 10. Damage of the sample LL/404/19/10

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## 10.2. Examination of the compressive strength of glued laminated log

The tests were carried out at temperature  $(20,8 \pm 2,0)$  °C and relative humidity  $(54,3 \pm 3,0)\%$ .

Following samples were delivered for examination:

- samples cut from the milled glued laminated logs,
- samples cut from the not-milled glued laminated logs (not subjected to compressive strength test according to Picture 13).

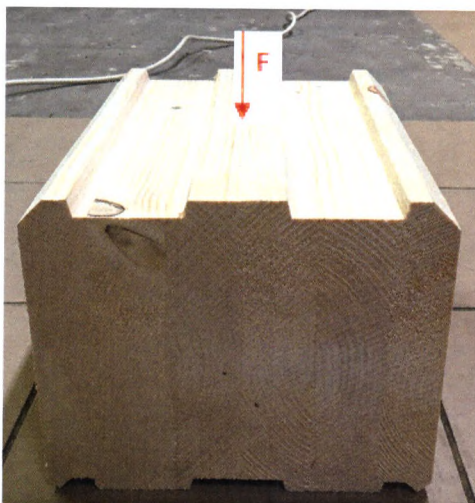
Samples with length of 300 mm cut from the glued laminated logs were subjected to the compressive force, using steel plates with surface area greater than surface of the sample. The test was continued until full destruction of the sample. Methods of loading samples:

- pressure on the side surface of the sample (Picture 11),
- pressure on the upper surface of the sample (Picture 12),
- pressure on the upper surface of two stacked samples (Picture 13).



Picture 11. Method of loading the side surface of the sample

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Picture 12. Method of loading the upper surface of the sample



Picture 13. Method of loading the upper surface of two stacked samples

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**Compressive strength of milled glued laminated logs 240 x 200 [mm] test results:**  
- load application according to Picture 11.

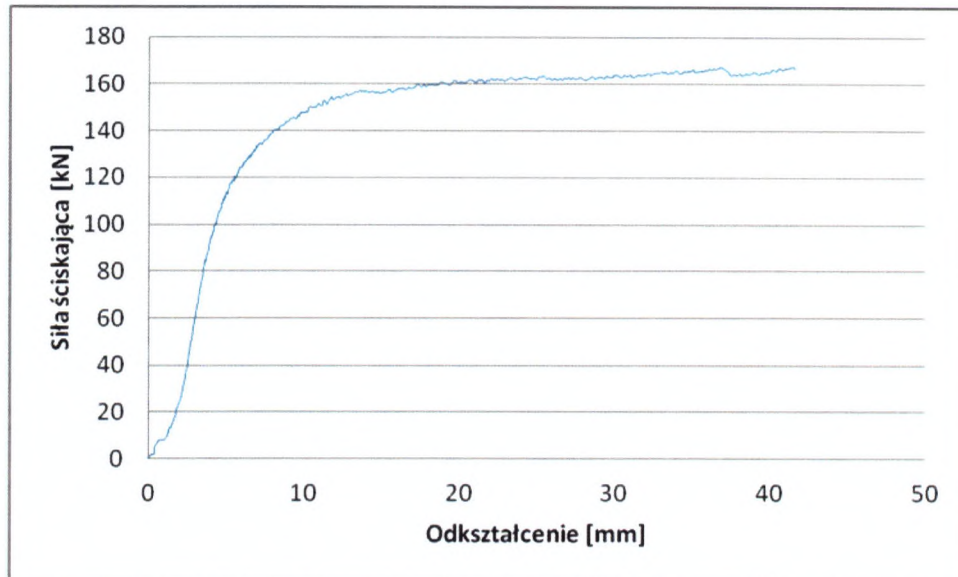


Diagram 1. Course of the test of the sample LL/404/19/11



Picture 14. Damage of the sample LL/404/19/11

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- load application according to Picture 12.

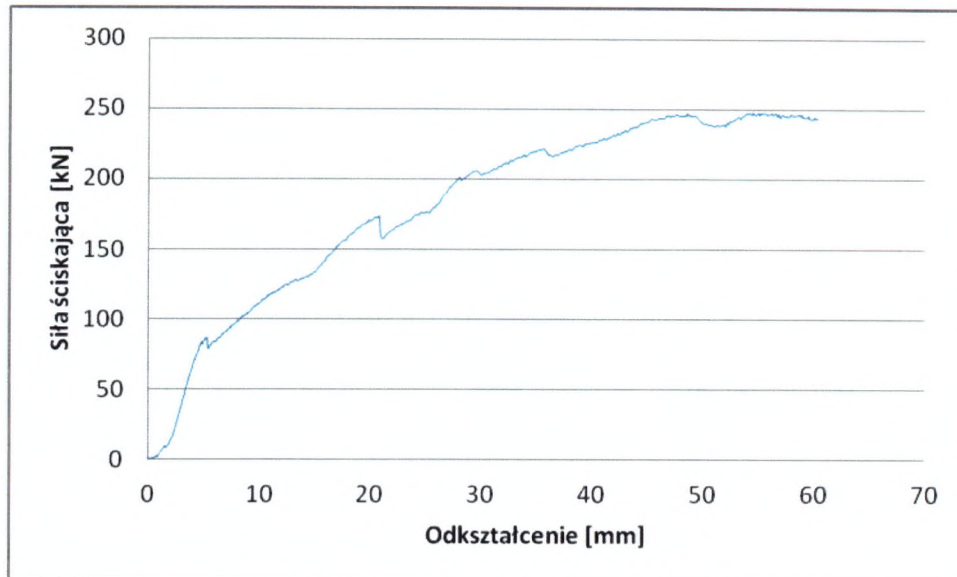


Diagram 2. Course of the test of the sample LL/404/19/12



Picture 15. Damage of the sample LL/404/19/12

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- load application according to Picture 13.

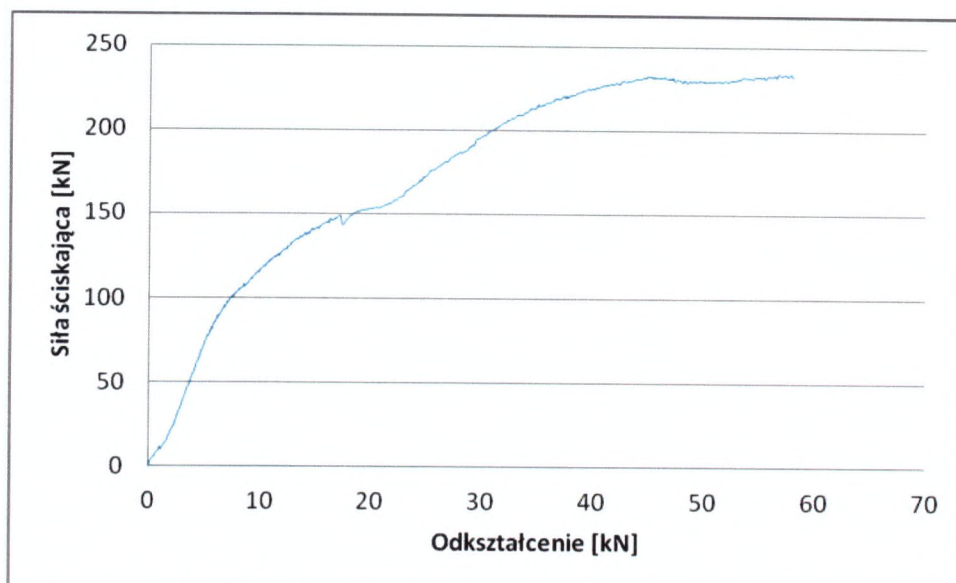


Diagram 3. Course of the test of the sample LL/404/19/13



Picture 16. Damage of the sample LL/404/19/13

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**Compressive strength of milled glued laminated logs 280 x 200 [mm] test results:**  
- load application according to Picture 11.

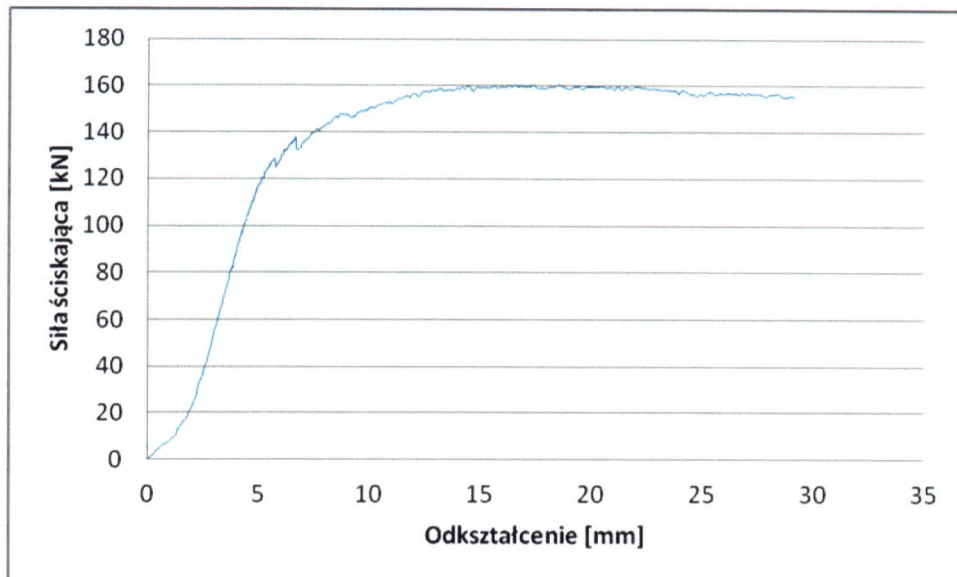


Diagram 4. Course of the test of the sample LL/404/19/14



Picture 17. Damage of the sample LL/404/19/14

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- load application according to Picture 12.

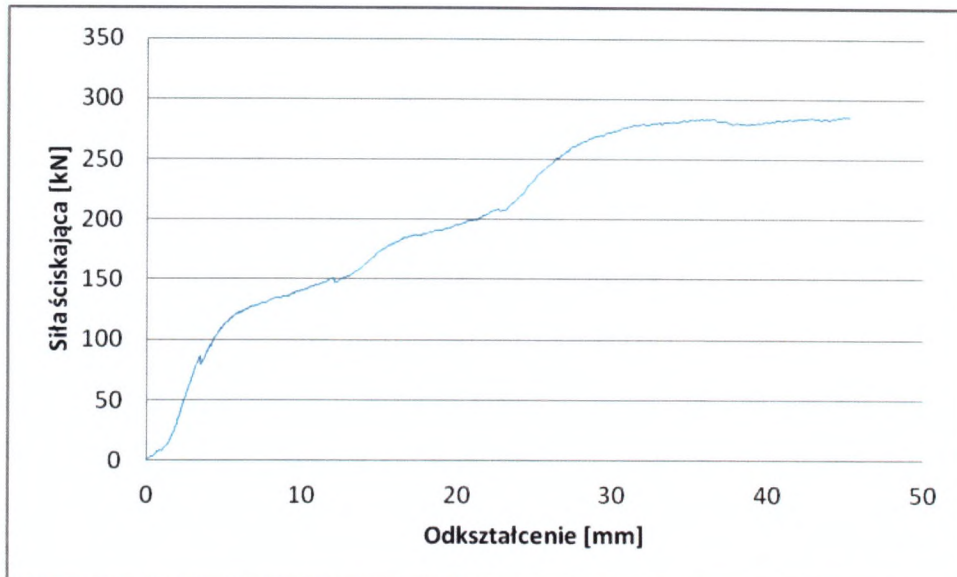


Diagram 5. Course of the test of the sample LL/404/19/15



Picture 18. Damage of the sample LL/404/19/15

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- load application according to Picture 13.

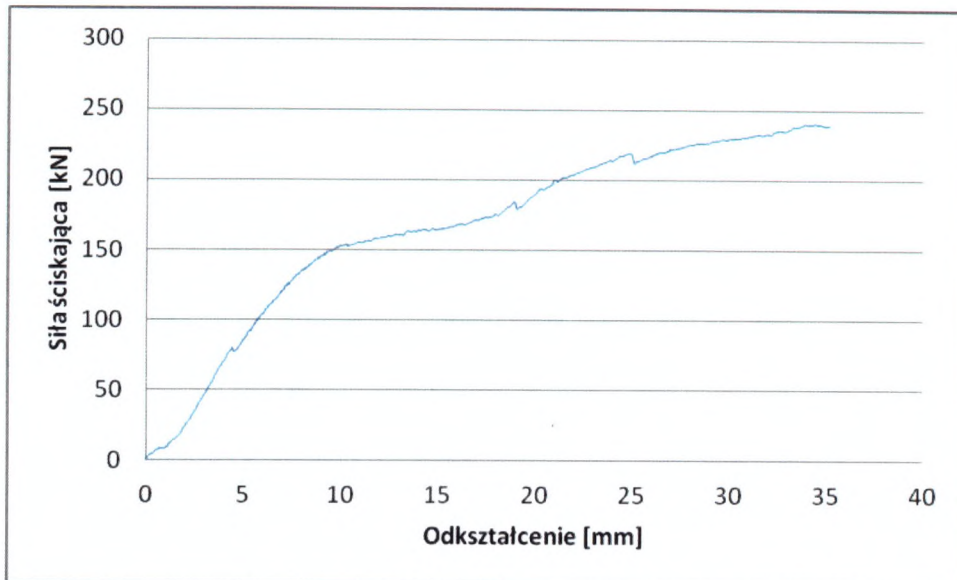


Diagram 6. Course of the test of the sample LL/404/19/16



Picture 19. Damage of the sample LL/404/19/16

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**Compressive strength of not-milled glued laminated logs 240 x 200 [mm] test results:**  
- load application according to Picture 11.

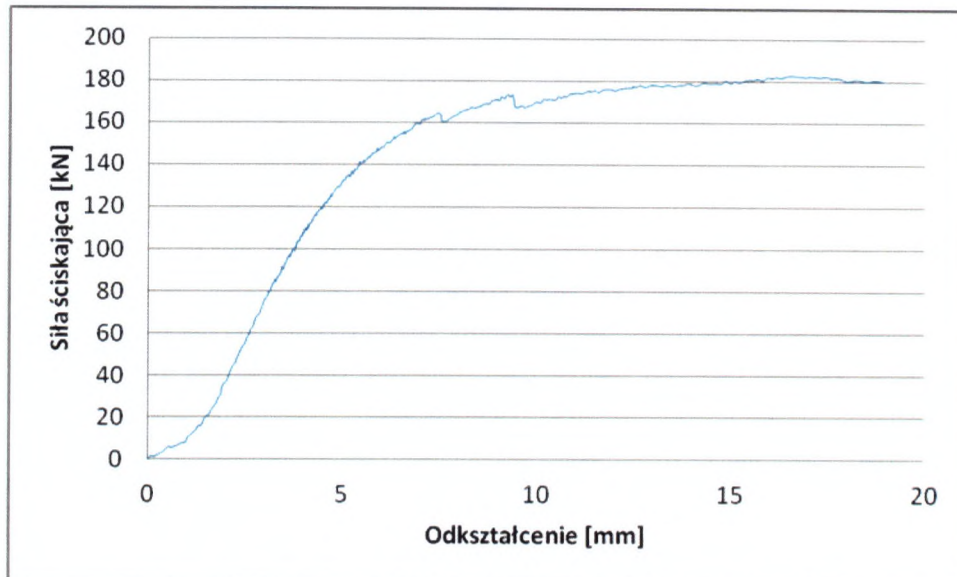
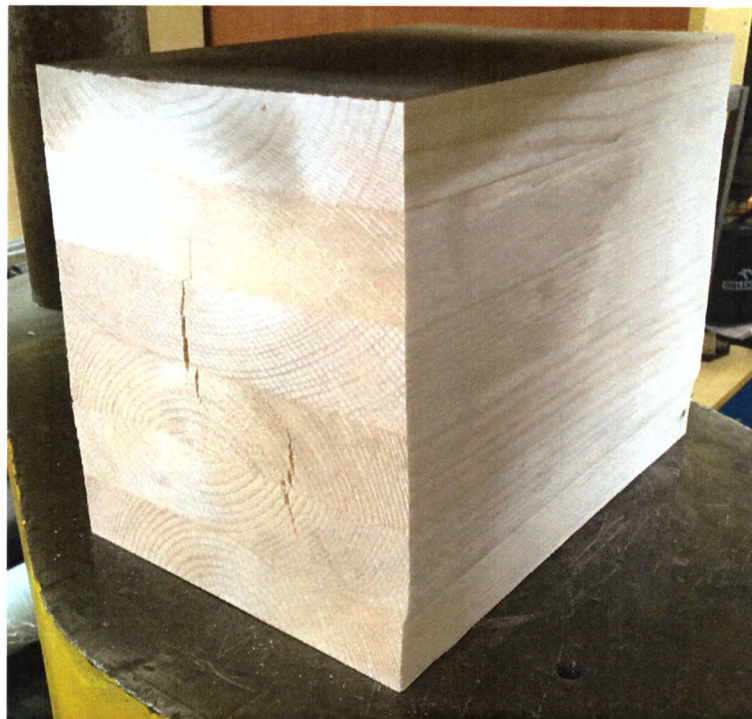


Diagram 7. Course of the test of the sample LL/404/19/17



Picture 20. Damage of the sample LL/404/19/18

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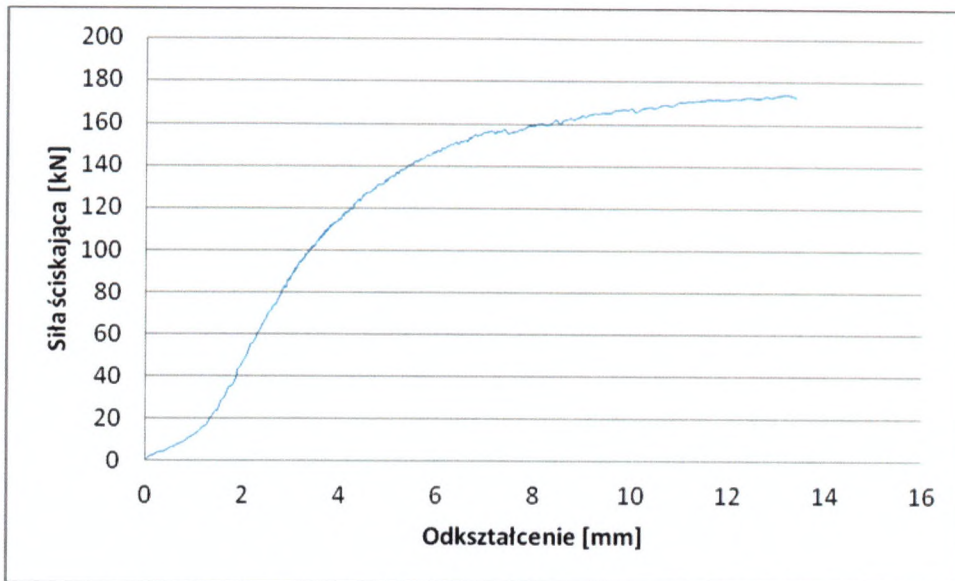
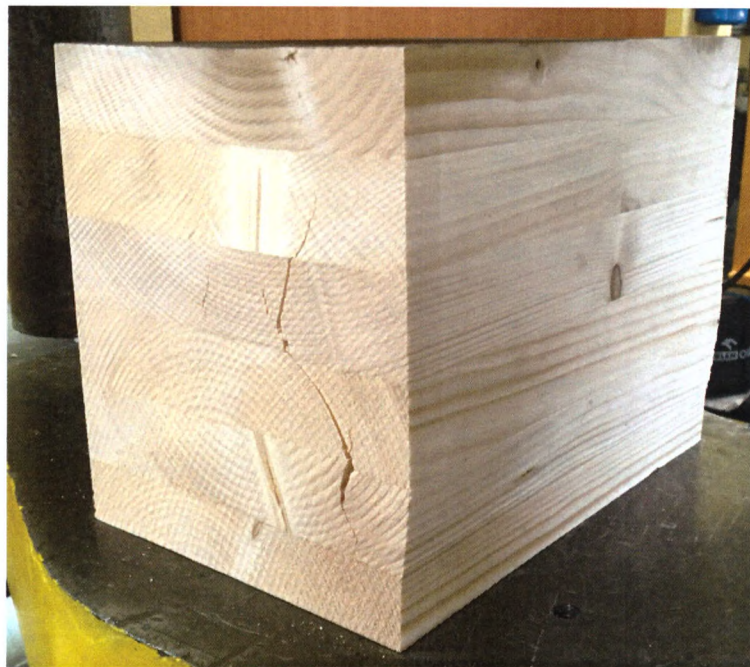


Diagram 8. Course of the test of the sample LL/404/19/18



Picture 21. Damage of the sample LL/404/19/18

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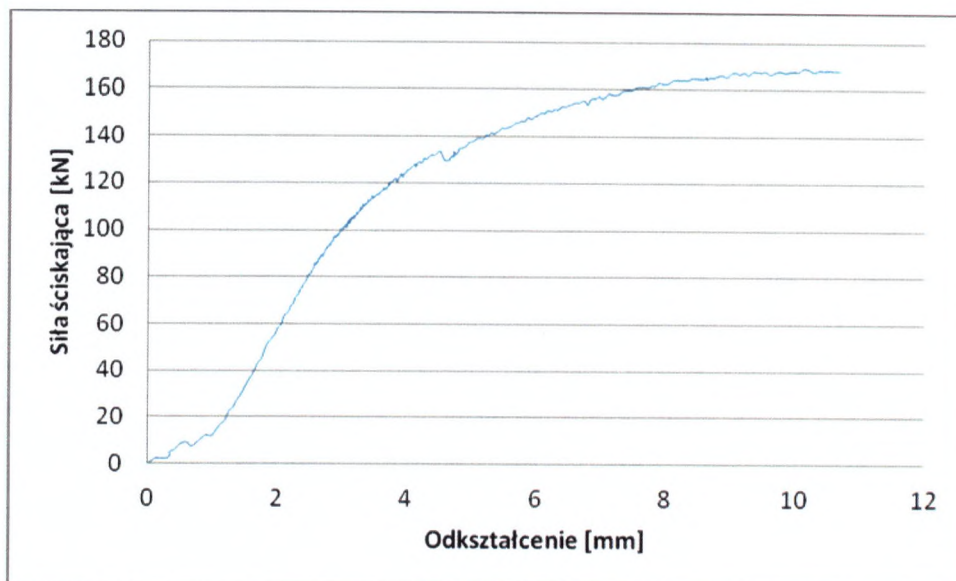
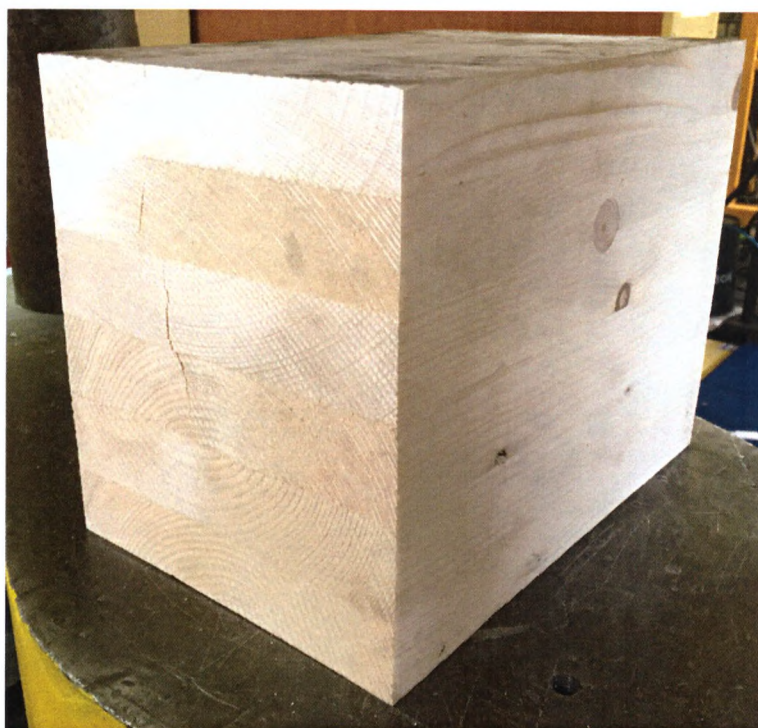


Diagram 9. Course of the test of the sample LL/404/19/19



Picture 22. Damage of the sample LL/404/19/19

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- load application according to Picture 12.

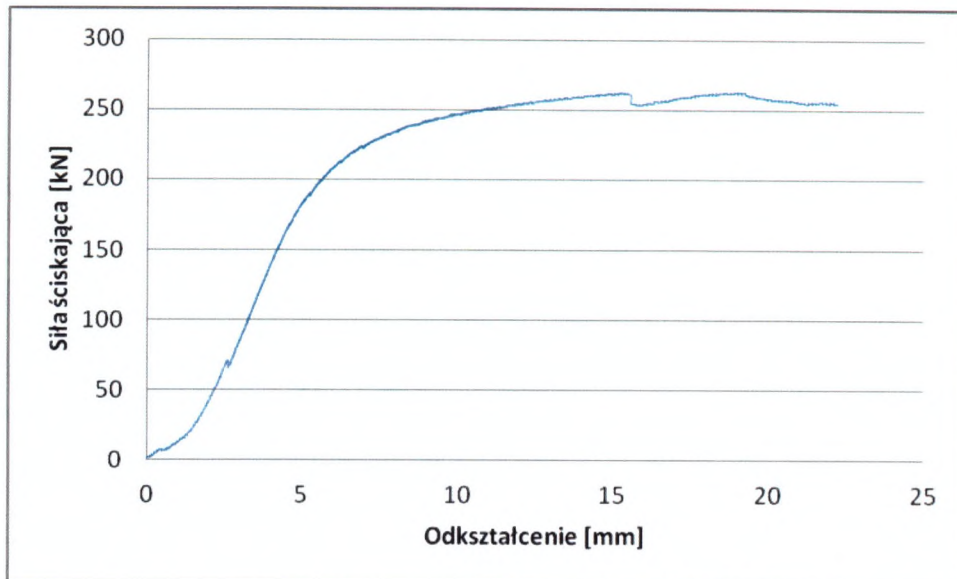


Diagram 10. Course of the test of the sample LL/404/19/20



Picture 23. Damage of the sample LL/404/19/20

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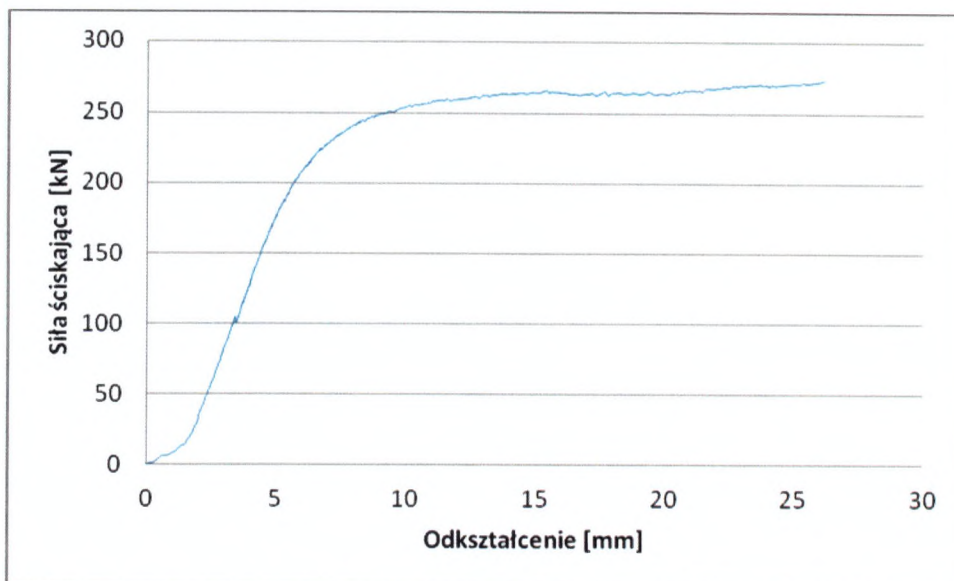
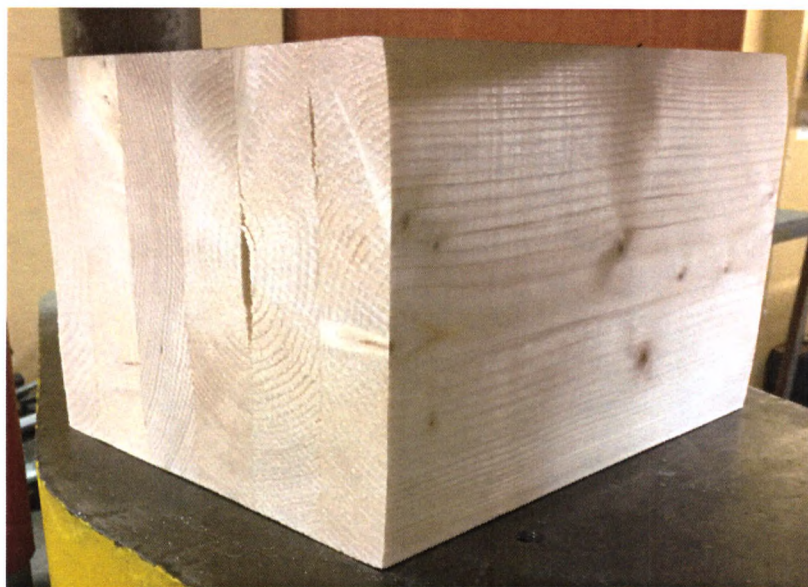


Diagram 11. Course of the test of the sample LL/404/19/21



Picture 24. Damage of the sample LL/404/19/21

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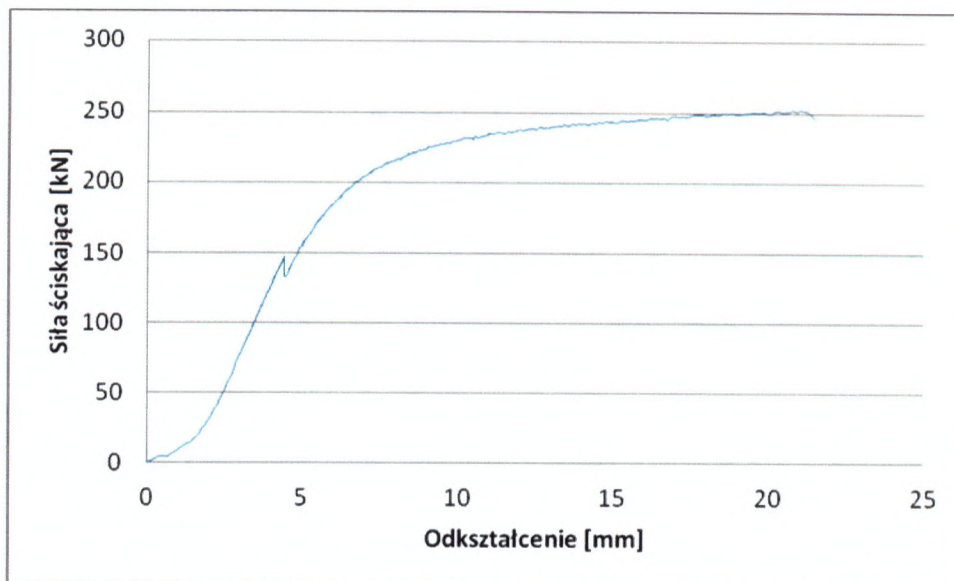


Diagram 12. Course of the test of the sample LL/404/19/22



Picture 25. Damage of the sample LL/404/19/22

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**Compressive strength of not-milled glued laminated logs 280 x 200 [mm] test results:**  
- load application according to Picture 11.

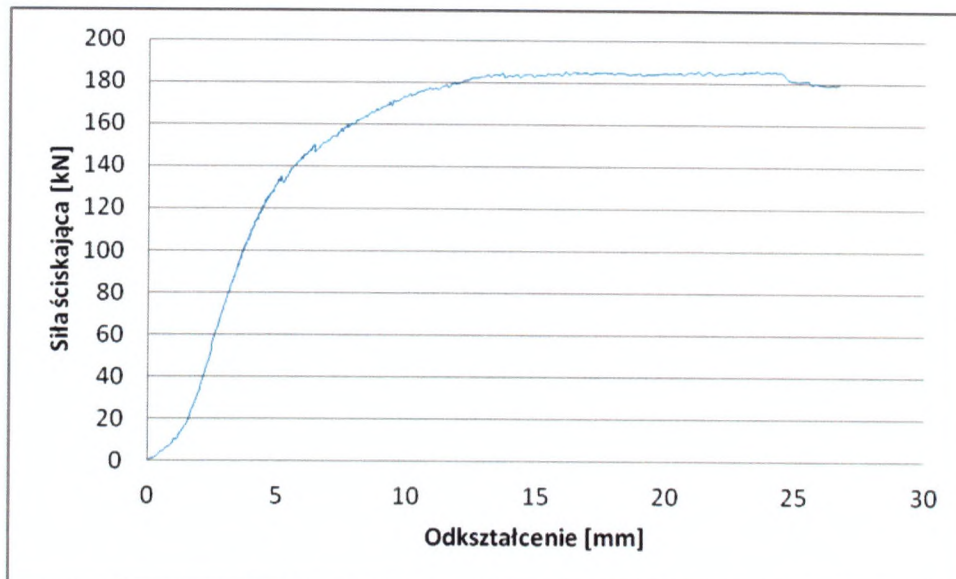


Diagram 13. Course of the test of the sample LL/404/19/23



Picture 26. Damage of the sample LL/404/19/23

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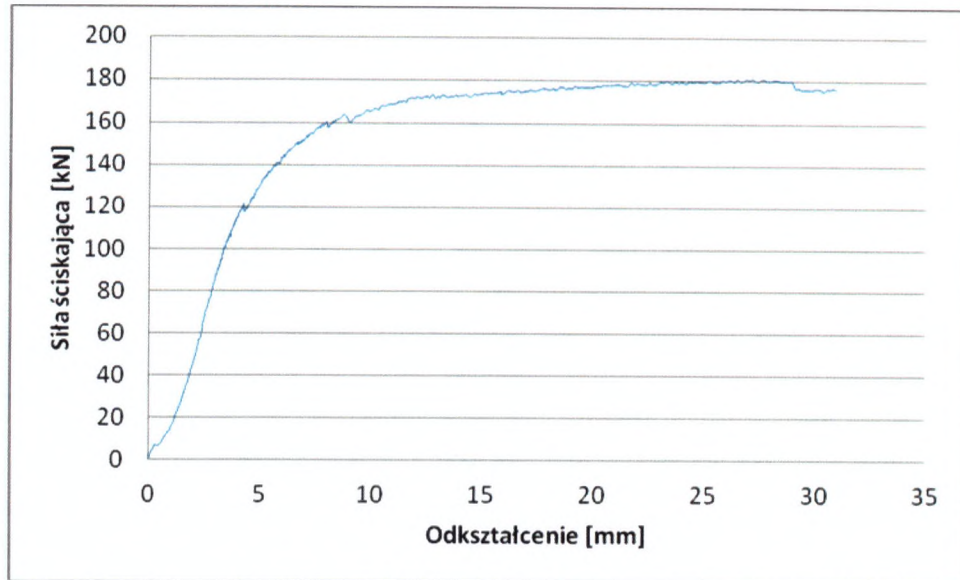


Diagram 14. Course of the test of the sample LL/404/19/24



Picture 27. Damage of the sample LL/404/19/24

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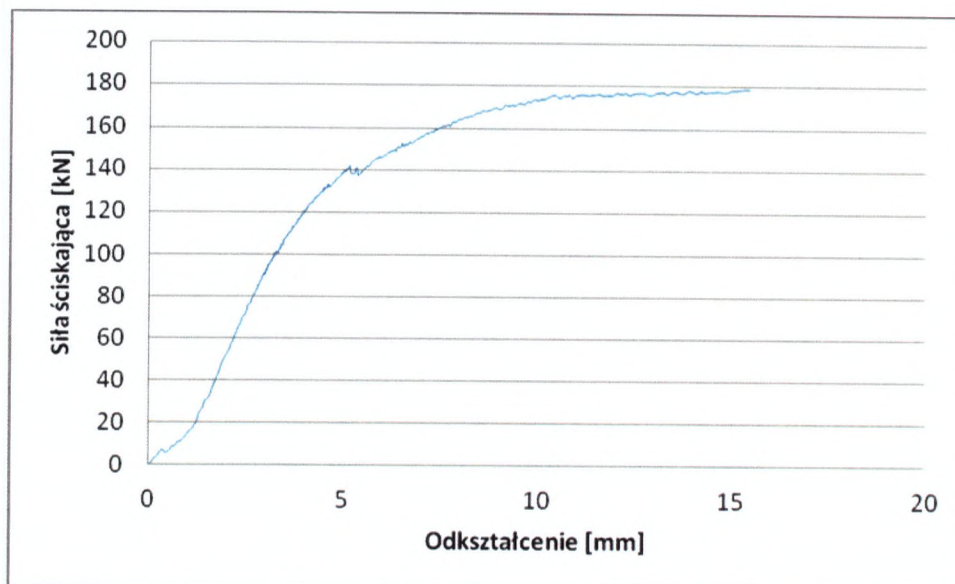


Diagram 15. Course of the test of the sample LL/404/19/25



Picture 28. Damage of the sample LL/404/19/25

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- load application according to Picture 12.

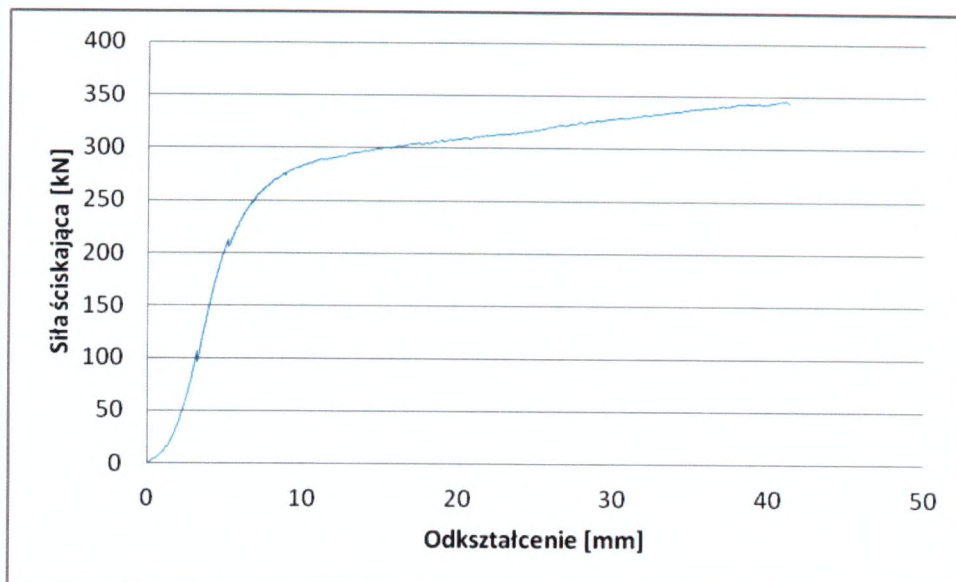


Diagram 16. Course of the test of the sample LL/404/19/26



Picture 29. Damage of the sample LL/404/19/26

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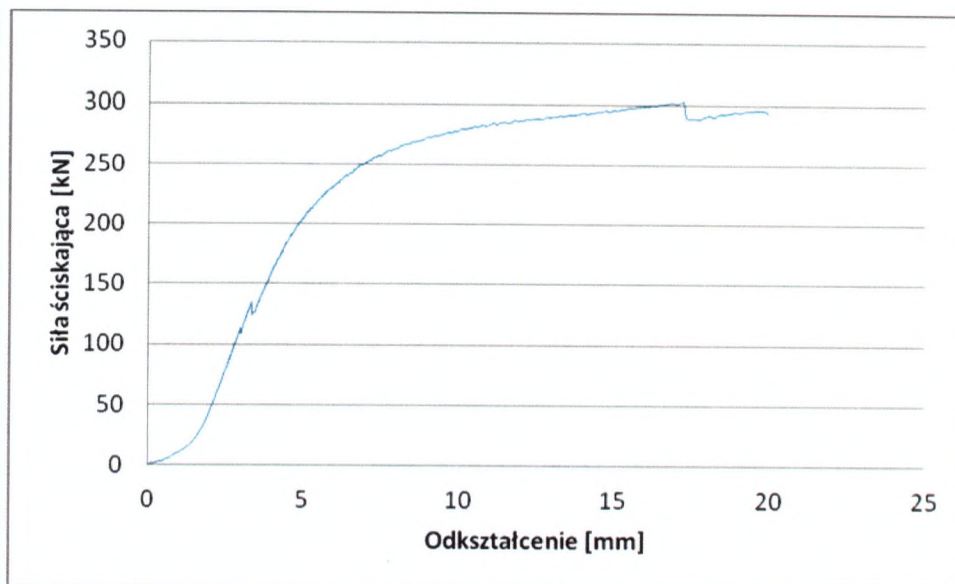
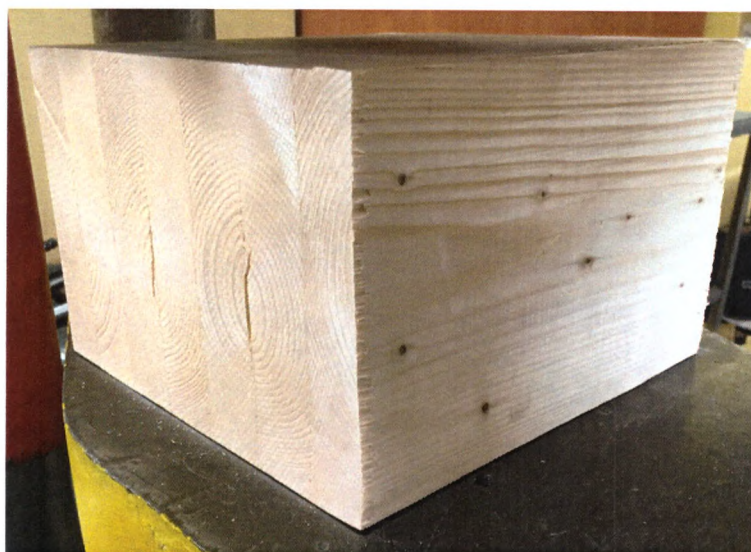


Diagram 17. Course of the test of the sample LL/404/19/27



Picture 30. Damage of the sample LL/404/19/27

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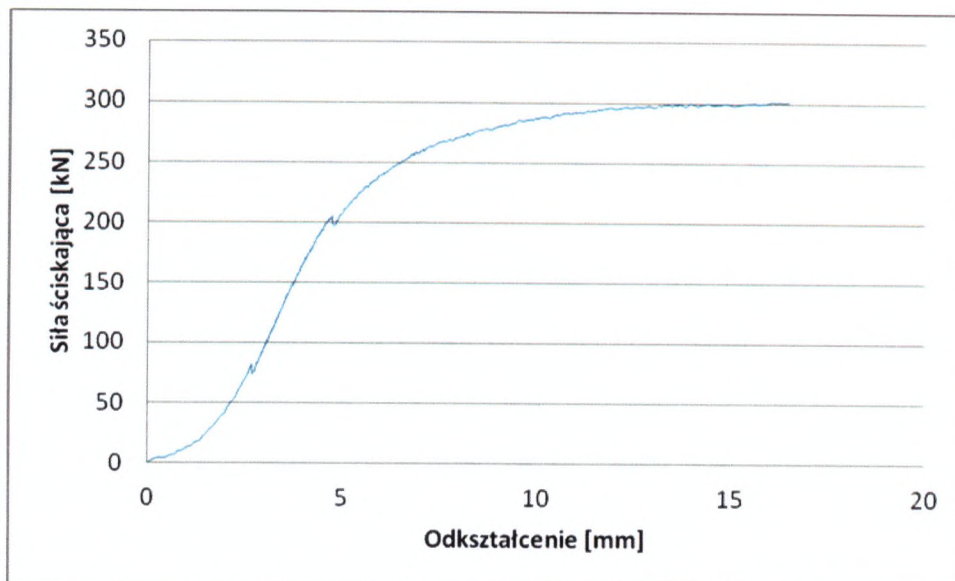
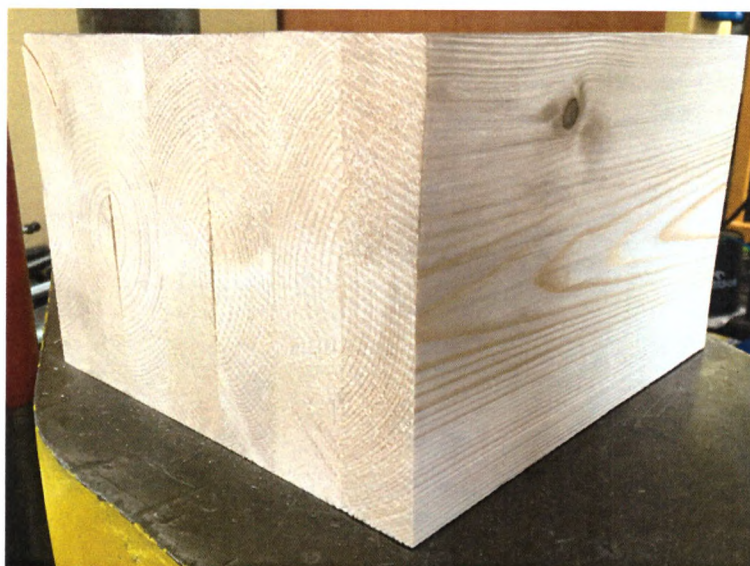


Diagram 18. Course of the test of the sample LL/404/19/28



Picture 31. Damage of the sample LL/404/19/28

**Note**

Rapid decreases in compressive force value, visible on the waveforms, occurred when the wood cracked. The first crack of the sample is shown on Diagram 19.

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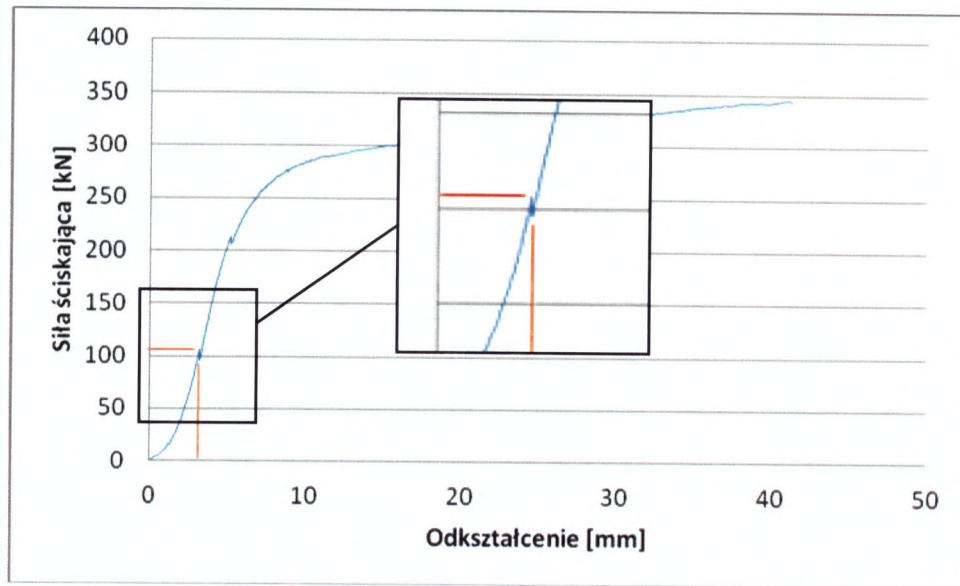


Diagram 19. Indication of the first crack of the sample during test

Tests performed by:

08.01.2020  
Date

Przemysław Małęga  
name and surname

Research Specialist  
position


  
.....  
signature

Checked and verified by:

08.01.2020  
Date

Wojciech Bobecki  
name and surname

Laboratory Manager  
position

  
.....  
signature

END OF REPORT

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