

TIMBER

T1) 2,8 cm softwood cubes were tested first for compression parallel to grains

Test no.	F_u (kN) ultimate force (the value of the maximum force of the force-deformation diagram)
1	23
2	27
3	28,2

Compression ultimate strength parallel to grains for specimen no. 3.:

$$f_{cu}^{\parallel} = 28,2 / 2,8^2 = 3,6 \text{ kN/cm}^2$$

T2) 2,8 cm softwood cubes were tested for compression perpendicular to grains

Test no.	F_u (kN) ultimate force
1	3,1
2	2,9

Compression ultimate strength perpendicular to grains for specimen 2:

$$f_{cu}^{\perp} = 2,9 / 2,8^2 = 0,37 \text{ kN/cm}^2$$

The compression strength perpendicular to grains was only at about 10% of the strength measured in direction parallel to grains.

T3) 320 mm long specimens with cross-section 27x13 mm were tested for compression parallel to grains

Test no.	F_u (kN) ultimate force
1	12,8
2	13
3	17

The ultimate force was reached at buckling of the specimen

For specimen no. 3. at buckling:

$$f_{cu} = 17 / (2,7 \times 1,3) = 4,84 \text{ kN/cm}^2$$

This value should have been smaller than the strength measured on cube-form specimen because due to buckling the ultimate strength reduces! Now it was not so, because the timber quality of the 320 mm long specimens was better.

LIMESAND BRICK

Limestone brick cubes of side length 68 mm were tested in compression

Test no.	F_u (kN) ultimate force
1	17

...2

Rupture of the specimen occurred by development of cracks parallel to the compression force, due tension developing in the transverse direction

$$f_{cu} = 17/6,8^2 = 0,37 \text{ kN/cm}^2$$

STEEL

Testing of $\Phi 8$ mm reinforcing steel bars subjected to tension force.

Cross-section: $A = 0,8^2\pi/4 = 0,5 \text{ cm}^2$

Test no.	F_u (kN) ultimate force
1	32,4

...2

Rupture of the specimen occurred after transverse contraction along diagonal cross-section due to shear. The tensile stress at rupture (the calculated ultimate tensile strength) of the 1st specimen was:

$$f_t = 32,4/0,5 = 64,8 \text{ kN/cm}^2 = 648 \text{ N/mm}^2$$

Let us compare the test results measured for the different structural materials! If we consider the greatest strength value ($64,8 \text{ kN/cm}^2$) of the steel bar being 100%, the relationship of the strengths measured for the other materials can be seen below:

- reinforcing steel ultimate tensile strength: 100%
- timber ultimate compr. strength parallel to grains: $100 \cdot 3,6/64,8 = 5,5\%$ that is ≈ 18 times smaller
- limesand brick ultimate compression strength: $100 \cdot 0,37/64,8 = 0,57\%$ that is ≈ 175 times smaller

Final conclusion: the measured steel strength was almost 20 times greater than that of soft timber parallel to grains, and was almost 200 times greater than the compression strength of limesand brick.