Department of Mechanics, Materials and Structures
Fundamentals of Structures
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TESTING OF THE MOST IMPORTANT STRUCTURAL MATERIALS

1- **TIMBER (tests performed in an earlier year)**
   a) **Compression test parallel to grains of 3,5x3,5x10 cm timber specimens**

	Cross-section 3,2x3,2 cm	The maximum resistant force (ultimate force) measured	Ultimate strength
test no.	A (cm^2)	F_u (kN)	$f_u = F_u/A$ (kN/cm^2)
1	3,2 x 3,2	35,0	3,418
2	3,2 x 3,2	31,2	3,047
3	3,2 x 3,2	28,4	2,773
4	3,2 x 3,2	37,5	3,662
5	3,2 x 3,2	34,8	3,398
6	3,2 x 3,2	33,4	3,262
7	3,2 x 3,2	37,2	3,633
8	3,2 x 3,2	29,4	2,871
9	3,2 x 3,2	33,7	3,291
10	3,2 x 3,2	34,0	3,320

Mean strength: 3,267 kN/cm^2

Observations, conclusions:

-The measured ultimate force is varying between 28,4 and 37,5 kN demonstrating that the quality of the specimens is not uniform, depending from local imperfections of the material.

   b) **Compression test perpendicular to grains of 3,5x3,5x3,5 cm timber specimens (cubes)**

	The maximum resistant force (ultimate force) measured F_u (kN)	ultimate strength $f_{u\vdash}$ (kN/cm^2)
test no. 1	3,85	0,31
2	3,40	0,27
3	3,50	0,28

Observations, conclusions:

-The compression strength of timber perpendicular to grains is significantly smaller than in direction parallel to grains.

-The rate of strength parallel and perpendicular to grains is approximately:

$f_{u,mean,parallel}/f_{u,mean,perpendicular} \approx 11$

that is at about by an order of magnitude smaller.

2. STEEL

Tension test of ø8 mm diameter reinforcing steel bar

cross-section area: A= $ø^2\pi/4 = 0,8^2 \cdot 3,1415/4 = 0,501$ cm^2

	The maximum resistent force (ultimate force) measured F_u (kN)	ultimate strength $f_u = F_u/A$ (kN/cm^2) (kN/cm^2)
test no. 1	32	32/0,501= 63,87
2	32,4	32,4/0,501= 64,67
3	32	63,87

Observations, conclusions:

-After a linear part of the force-elongation diagram, great, so called plastic deformation occurred (without increment of the applied tensile force), before rupture. Near the section of rupture transverse contraction of the steel bar occurred: this resulted in tension failure of the contracted (reduced) cross-section.

-Test results are almost the same, which proves that quality of steel material is much more reliable

-Compare the mean strength of steel specimens to that of timber in compression parallel to grains:

$f_{u,steel,mean}/f_{u,timber,mean}$ = 64,14/

3. CONCRETE

Compression test of 105 mm diameter concrete cylinders

A=$ø^2\pi/4$= 10,5$^2\pi/4$= 10,5$^2\pi/4$=86,6 cm^2

	The maximum resistant force (ultimate force) measured F_u (kN)	ultimate strength $f_U = F_u/A$ (kN/cm^2)

test no. 1 135   135/86,6= 1,56

    2

    3

Because of limited time only one concrete cylinder was tested in compression, but from experience we can state that test results should have been at a higher extent different than either for steel or for timber specimens.

Observations and conclusions

-way of failure: deformations perpendicular to the applied force showed extension of the specimen in transverse direction, giving rise to tension. The tensile strength of concrete is approximately only 10 % of the compression strength, which caused cracking of the concrete: a series of vertical cracks could be observed along the perimeter of the cylinder. Independent slender vertical columns suffered rapid buckling failure.

-mean strength rates: steel to concrete: 64,14/1,56= 41,1

         concrete to timber: 1,56/3,267≈0,5

The concrete specimen – this time - was rather weak. In practice values of the above rates lie at about 20 and 1 approximately, but may naturally somewhat different depending from the quality of the materials.

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