

## THE DETERMINATION OF ELASTIC MODULUS FOR THE STATIC EXAMINATION OF GFRC WITH PROFILE REINFORCEMENT

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Searching for new specific utility properties of glass-fibre reinforced cement (GFRC) arouse the need for its additional reinforcement. As an example was chosen the stiff (profile) reinforcement based on the glass-fibres bonded with vinylester resin which surface roughness is adjusted by silica sand. For the static examination of GFRC with stiff reinforcement it is essential to determine the basic mechanical properties of non-reinforced GFRC. It means to settle the tensile and compressive strength, and the elastic modulus in tension and compression. With regard to this the contribution deals with the preparation of samples and the determination of elastic modulus properties.

The subject of the experimental examination was the UNICRET-MIX composite with stiff glass reinforcement to extent the application possibilities and the utility properties of GFRC.

At the beginning it was essential to set the basic material properties of the UNICRET-MIX composite such as:

- tensile strength,
- modulus of elasticity in tension,
- compressive strength,
- modulus of elasticity in compression.

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Concerning the issue, it should be mentioned that the static elastic modulus in tension and compression of the UNICRET-MIX composite has not been tested at VUSTAH yet. And because the fact that VUSTAH does not have a convenient laboratory for elastic modulus testing at its own disposal, the test was assigned to Testing and Control Building Institute (TAZUS), branch Brno. VUSTAH, however, prepared the testing samples in its technology laboratory.

Before the preparation the shape and the size of testing samples had to be specified. This specification was done on the basis of the consultation with TAZUS research workers. Thus, the size of the sample for setting the elastic modulus in compression was 100/100/400 mm (the shape of a prism), whereas the optimal shape of the sample for setting the elastic modulus in tension had to be found out. The final decision was a lamellar design with square-profile of the size 24/13/500 mm.

The testing samples for setting the elastic modulus in compression were made in steel forms. On the other hand, the production process of the samples for setting the elastic modulus in tension was more demanding. To produce the lamellar design, boards of the size 750/750/15 mm were firstly made. After the setting and hardening of boards their surface was rubbed (in Kamena, Brno) by the horizontal grinding machine to reach the unified thickness of 13 mm. Then the boards were cut into lamellas by the water jet (in AWAC Brno). However, to avoid unsuitably-directed glass fibre in cut lamellas, the cutting was done according to a computer model. Moreover, to avoid possible unwilling grinding caused by the pressure of jaws, the lamellas were fixed into special steel holders (Figure 2). So the tension force was transferred through a bonded joint.

The used testing process of both the elastic modulus in compression and in tension was based on ČSN ISO 6784 called Determination of static modulus of elasticity in compression (note: The static modulus of elasticity in tension is not the subject of the accreditation according to ČSN ISO/IEC 17025.).

## Testing process

Firstly, the produced samples of **prisms** were measured and weighted to identify their sectional areas and bulk weights. Then it was necessary to adjust some of them on their surface. During the testing process it was recorded that two samples had one-third compressive strength. This was used for testing the elastic modulus in compression. Prisms were examined on both opposite sides and its testing base was 200 mm with 0.001 mm accuracy. The lower value was 5 kN (10 kN) and the upper was one-third of the measured maximum strength.

Concerning the **lamellar samples**, they were also firstly measured and weighted to identify their sectional areas and bulk weights. Then the ends of lamellas were fixed not to be grinded during the testing. Three out of ten samples were bent to determine the tensile strength. The rest of samples showed the static modulus of elasticity in tension. For the test it was used the same method as for testing the elastic modulus in compression. Due to the greater dispersion of tensile strength values and due to the minimal deformation, the upper value was 600 N (i.e. about 50 percent of the average strength) and the lower value was 50 N.

## Results

### a) Elastic modulus in compression

The average compression on prisms	82.80 MPa
The loading force for the determination of elastic modulus	5 kN / 270 kN
The average value of elastic modulus in compression	28 500 MPa

### b) Elastic modulus in tension

The average tension on lamellas	4.00 MPa
The loading force for the determination of elastic modulus	50 N / 600 N
The average value of elastic modulus in tension	27 500 MPa

Detail results are recorded in the test certificate no. 060-027347 of 4<sup>th</sup> January 2008.

The results of the elastic modulus are incorporated into the proposal of static calculation and analysis of strain-sensing glass-fibred reinforced cement (GFRC) with the stiff reinforcement based on the glass-fibres. The theoretical examination of the capacity will be verified in an experiment. The goal of the experiment will be to examine twenty samples with different degree of stiff (profile) glass-fibre reinforcement.

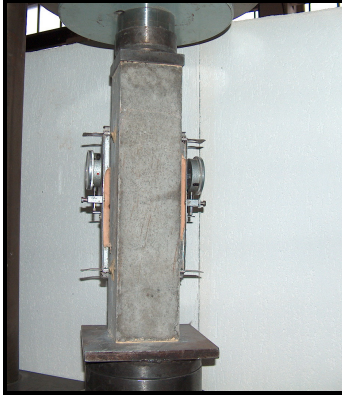


Figure 1 Test of the elastic modulus in compression (a prism shape)

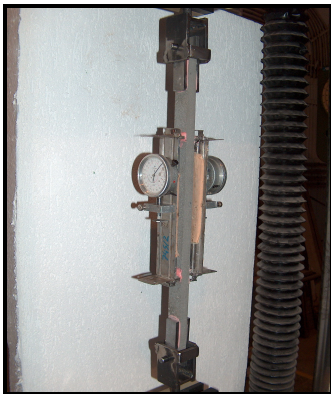


Figure 2 Test of the elastic modulus in tension (a lamellar shape)

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