1. Introduction

The static scheme of reinforced concrete structure of sports hall’s stands is presented in Figure 1.

![Fig. 1: The scheme of reinforced concrete structure’s frame for the sports hall’s stands](image1)

The analysis of stresses and strains in reinforced concrete structure was performed applying the finite element method, whereas the experimental part, i.e. the structure’s model testing was undertaken in the laboratory. The model for laboratory testing was developed in 1:10 scale, manufactured from 38 mm medium-density fibreboard. The model with electric tensometers for measuring strains, and supplied with inductive tensometers for measuring displacement is presented in Fig. 2. A disposition of measuring spots is shown in Fig. 3.

![Fig. 2: The model with electric tensometers and inductive tensometers prepared for testing](image2)

Mechanical characteristics of material (medium-density fibreboard) were determined prior to model testing. Material’s tensile strength was determined on the samples $l/b/h=38/3,8/3,8cm$ via bend testing and amounts $\sigma_M = 25,21MPa$. Compressive strength was tested on specimen $d/b/h=7,6/3,8/7,6cm$ and amounts $\sigma_M = 139,3MPa$.

![Fig. 3: Disposition of electric tensometers "T" and inductive tensometers "I" on the girder](image3)

Material’s elastic constants: $E$ elasticity module and $\nu$ Poisson’s coefficient are determined on prismatic samples $d/b/h=7,6/3,8/22,8cm$. Elasticity module $E = 2685MPa$, and Poisson’s coefficient $\nu = 0,26$.

2. Experimental Results

The testing of the structure’s model was conducted in four phases through gradual growth of loading. The total model loading in the fourth phase was 2190 N. The testing was shown in Fig.4.

![Fig. 4: Fourth phase of model’s testing](image4)
Measuring of strains was conducted with electric tensometers, and displacements were measured with inductive tensometers. To obtain equal stress condition on the structure’s prototype and on the model, a dimensional analysis implies that the structure’s prototype should be loaded at 219.0 kN, which is 100 time bigger than the loading on the model 2.19 kN. \( E_b = 3 \cdot 10^4 \text{ MPa} \) elasticity module was taken for concrete. Deflections on the model and on the prototype are in the ratio 10/9. The structure’s mathematical model was developed in the SAP 2000 programme package. The final elements grid with the loading scheme was shown in Fig. 5.

![Fig. 5: Grid of finite elements and loading scheme of the structure’s prototype](image)

Figures 6a, b, c show stresses diagrams in cross sections 1-1, 2-2 and 3-3 obtained via models’ testing and computation of structure’s prototype. Table 1. gives a comparison of deflections attained by testing and computation.

<table>
<thead>
<tr>
<th>Deflections [mm]</th>
<th>I1</th>
<th>I2</th>
<th>I3</th>
<th>I4</th>
</tr>
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<tr>
<td>Testing</td>
<td>0.435</td>
<td>1.1</td>
<td>0.544</td>
<td>0.546</td>
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<tr>
<td>Computation</td>
<td>0.398</td>
<td>0.993</td>
<td>0.47</td>
<td>0.6</td>
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<tr>
<td>Difference</td>
<td>9%</td>
<td>10%</td>
<td>14%</td>
<td>9%</td>
</tr>
</tbody>
</table>

3. Conclusion

The analysis and comparison of results obtained in laboratory with results obtained by calculation leads to the conclusion of good agreement between testing results for stresses and deflections.

4. References