DIFFERENT TYPES OF PRE-STRESSED HOLLOW CORE PANELS
and their fire resistance according to Eurocodes

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Heat – exposure model

Air in hollow core
Inverse analysis was elaborated so that temperatures measured during the fire resistance testing and calculated temperatures respond together. Complex process of convection in hollow cores is defined in a simplified way through substitute coefficient of thermal conductivity.

<table>
<thead>
<tr>
<th>Type of panel</th>
<th>Echo 200 mm</th>
<th>Elematic 200 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time (min)</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>Load bearing capacity (kNm)</td>
<td>41.42</td>
<td>40.61</td>
</tr>
<tr>
<td>Fire resistance (min)</td>
<td>60</td>
<td>60</td>
</tr>
</tbody>
</table>

Structural – response model

Load bearing capacity and fire resistance
Mechanical response of pre-stressed cross-section was analysed on the basis of published dependences of concrete and pre-stressing steel mechanical characteristics on temperature. Fire resistance 40 minutes of pre-stressed panel Elematic is determined according to final version of Eurocode 2. As the thermal properties of concrete and parameters of heat transfer are more favourable according to P ENV version of Eurocode, the fire resistance according to P ENV version was stated to value 45 minutes. Laboratory testing of fire resistance was quitted for panel 1 after 65 minutes and for panel 2 after 74 minutes, fire resistance on the basis of laboratory testing was settled 45 minutes.

Decrease of pre-stressing force
Decrease of pre-stressing force during the fire influences especially deformation of particular panel. Owning to irregular decrease of pre-stressing force and reinforcement strength the bearing capacity of pre-stressing panel could be exceeded. Decrease of pre-stressing force in fire resistance calculation was considered according to Eq:

\[ P(\theta) = A_s \cdot \varepsilon_s (\theta) \cdot E_s (\theta) \]

\[ P(\theta) \] pre-stressing force versus temperature
\[ A_s \] area of reinforcement
\[ \varepsilon_s (\theta) \] specific thermal elongation of reinforcement versus temperature
\[ E_s (\theta) \] modulus of elasticity of reinforcement versus temperature

SUMMARY
In the paper the fire resistance of pre-stressed hollow core panels is analysed. Calculation of transient thermal array in cross-section is based on inverse analysis and measured and calculated temperatures confrontation. Field of temperature and final fire resistance is compared for different types of pre-stressed panel, Echo 200 mm with oval hollow core and Elematic 200 mm with circle hollow core. Calculated temperatures and final fire resistance are more favourable for panel Echo due to higher portion of concrete in cross-section. Concrete cover was also analysed. Higher concrete cover responds to mildly decrease of load bearing capacity for permanent design situation but significant increase of fire resistance. Decrease of pre-stressing force is also mentioned.