Current Research of Fire Resistance of Straw Bale Structures at CTU in Prague

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Department of Building Structures

About the Project

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Research topics:

- mechanical physical properties of natural and recycled materials (shrinkage properties of clays, thermal properties of straw, mechanical properties of recycled concrete…)
- ceiling structures based on recycled and raw natural materials
- methodology development of blower door tests for large scale buildings
- **advanced structures for LE/PASS buildings based on renewable and recycled materials (includes fire resistance tests)**

Fire resistance tests

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- timber structure based on 2x4 system with wooden posts
- timber structure based on STEICO I-joists
- STEICO I-joist structure with recycled Tetra Pak boards and cellulose insulation mixed with chopped straw



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- load bearing straw bale structure




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- load bearing straw bale structure
- timber structure based on 2x4 system with thermal insulation from straw bales and cellulose insulation





Methodology of Fire Resistance Tests

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Standards:

ČSN EN 1363-1: 2000 Fire Resistance Tests: Part 1: Basic Requirements

ČSN EN 1365-1: 2000 Fire Resistance Tests for load bearing elements; Part 1: Walls

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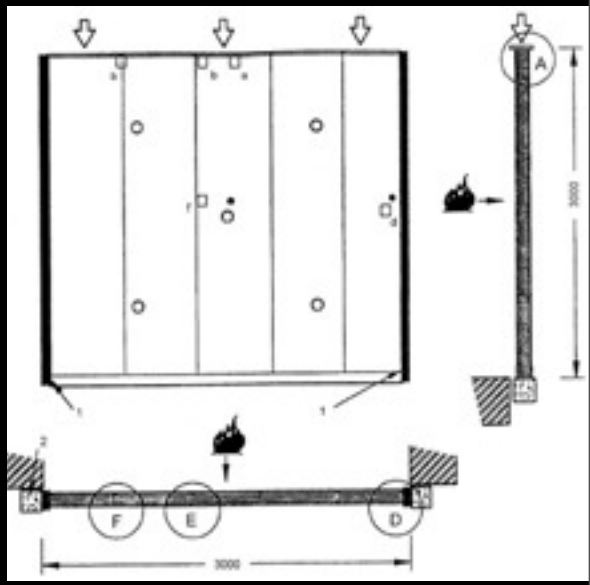
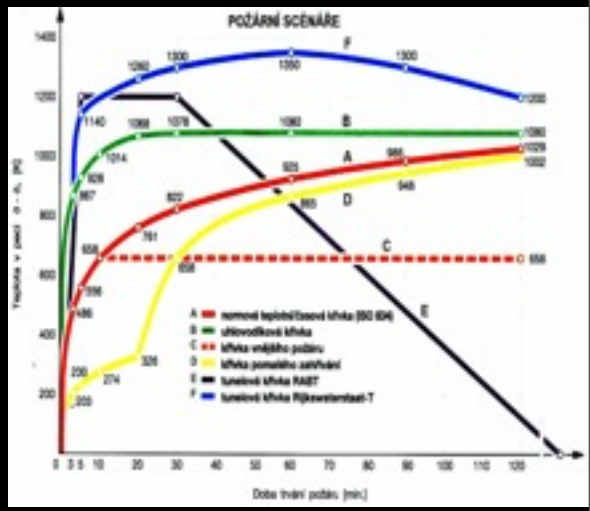
Test specimens: **3x3 m**





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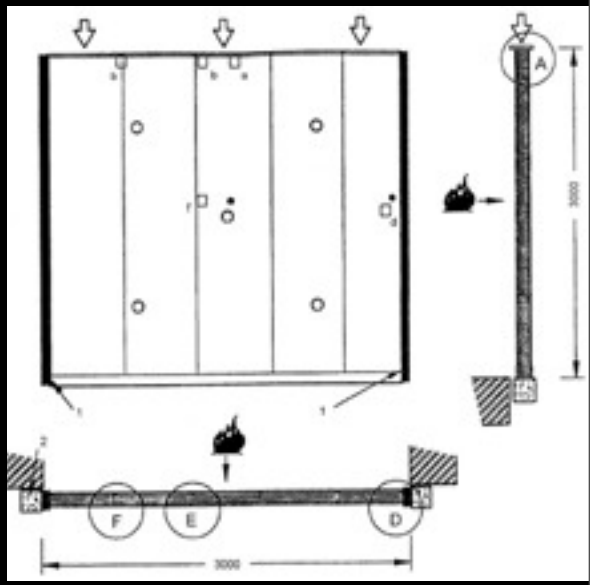

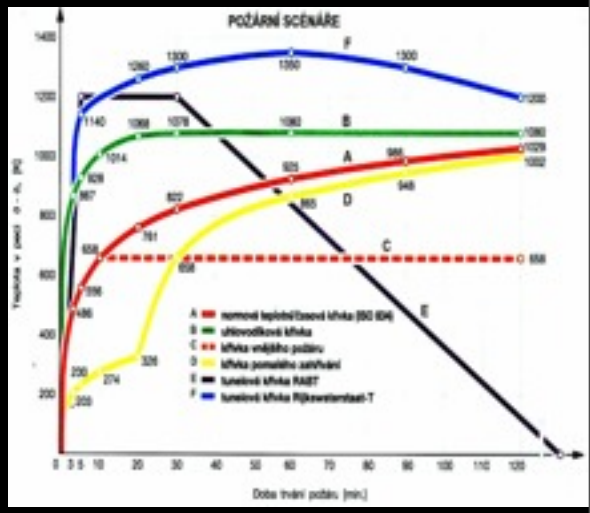

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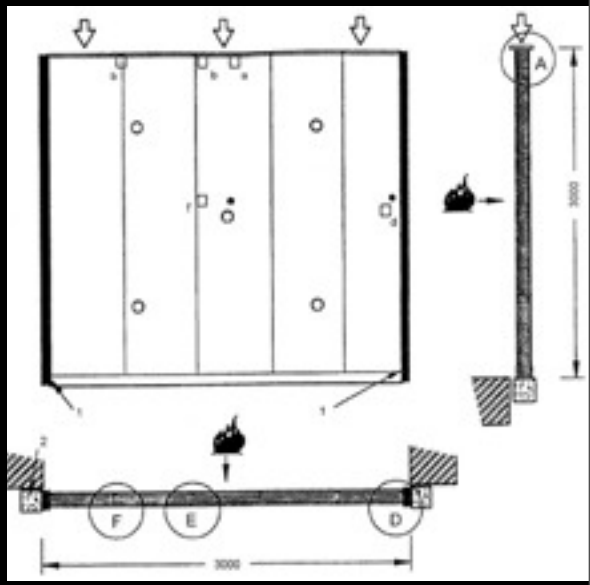

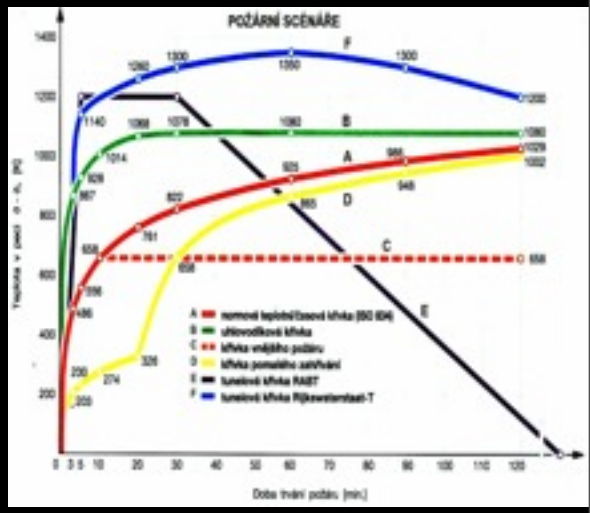

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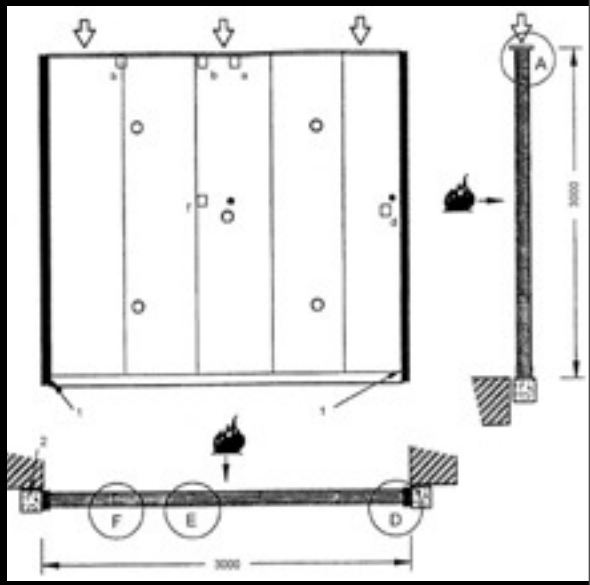
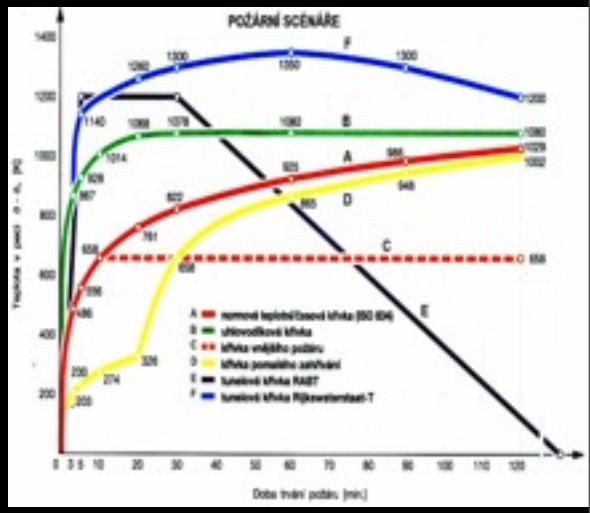
Laboratory: PAVUS, officially fire test laboratory





Requirements on Fire Resistance of Load Bearing Walls in the Czech Republic

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1 story family house	**15 min**
2 story family house	**30 min (ground floor)**
	15 min (1. floor)
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	15 min (2. floor)

Limit states:

- **R** (load-bearing capacity and structural stability) – maximal vertical deformation 1%
- **E** (surface integrity) – no flames or smoke, no ignition of specific piece of cotton
- **I** (thermal insulation of the surface on the opposite side of the fire) – max 140°C

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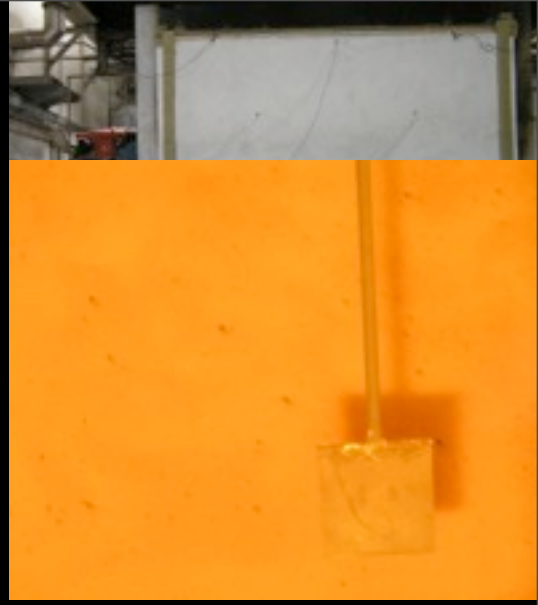

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145. min: the test has been stopped due to vertical deformation (more than limits), visible cracks in the lime plaster, dark blends on the outside side

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Final result: fire resistance **REI 120 min** (2 hours 26 minutes)

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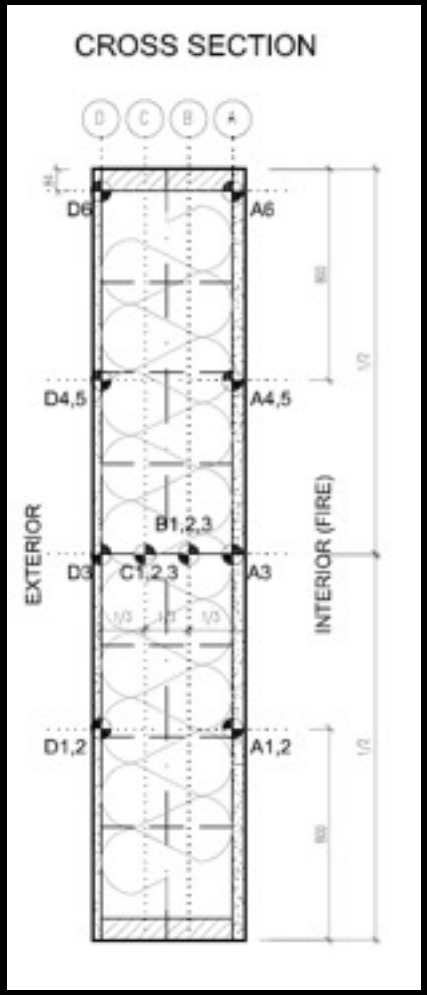

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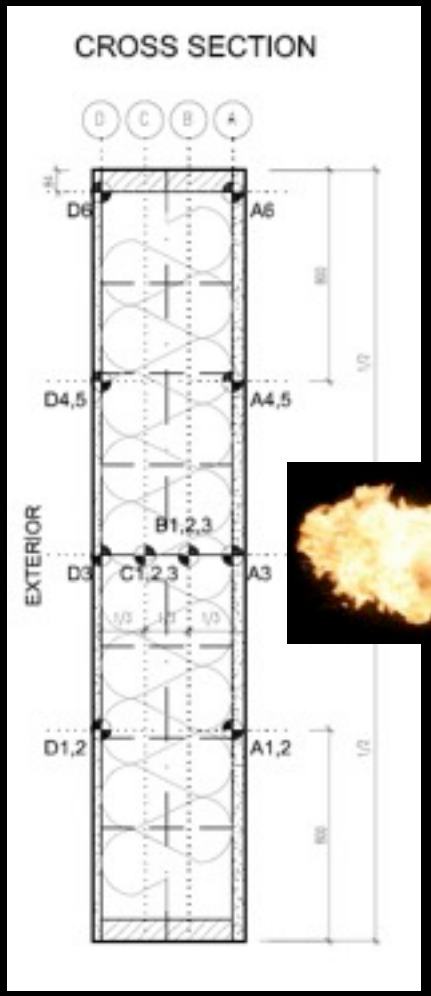

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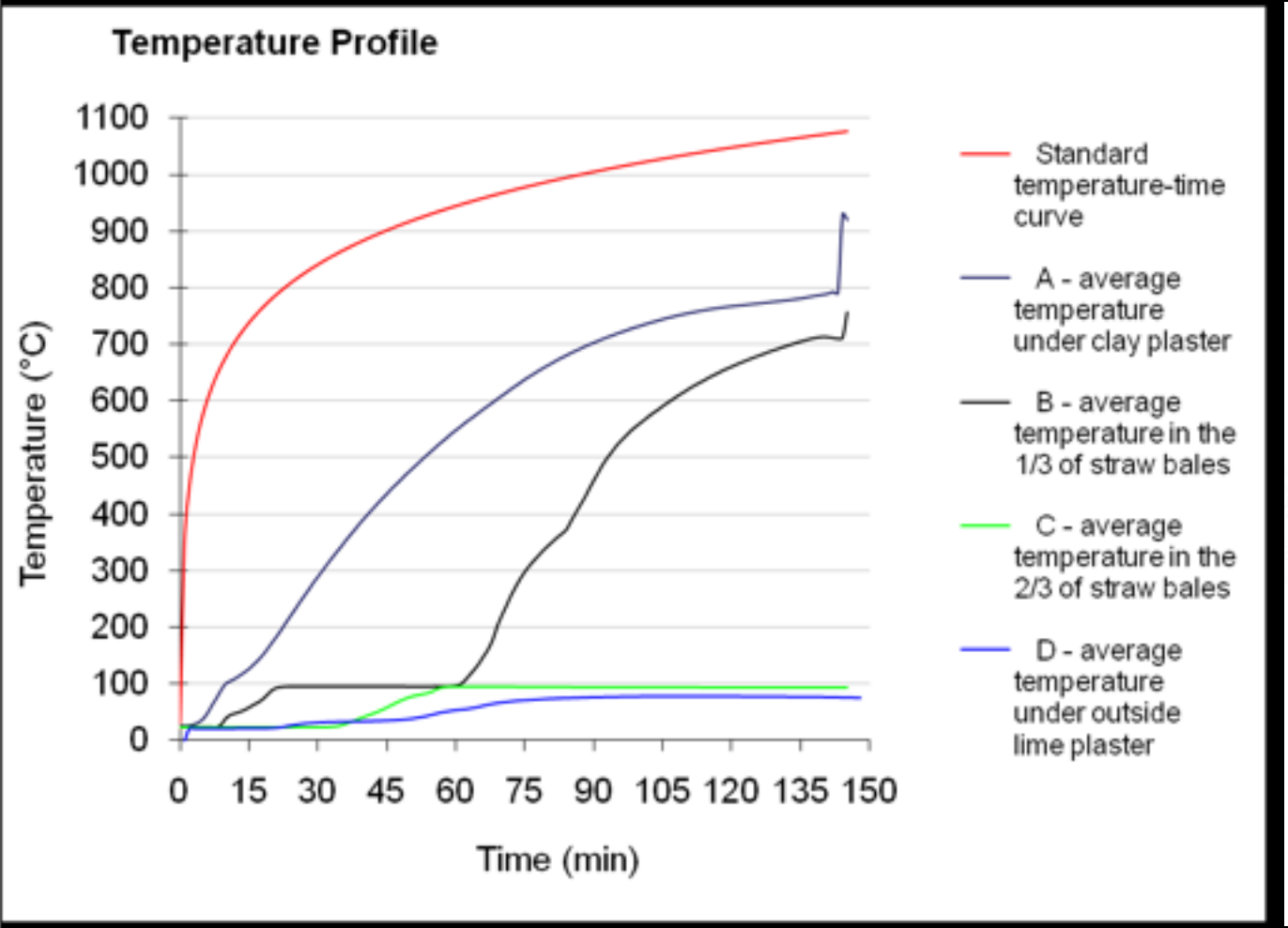

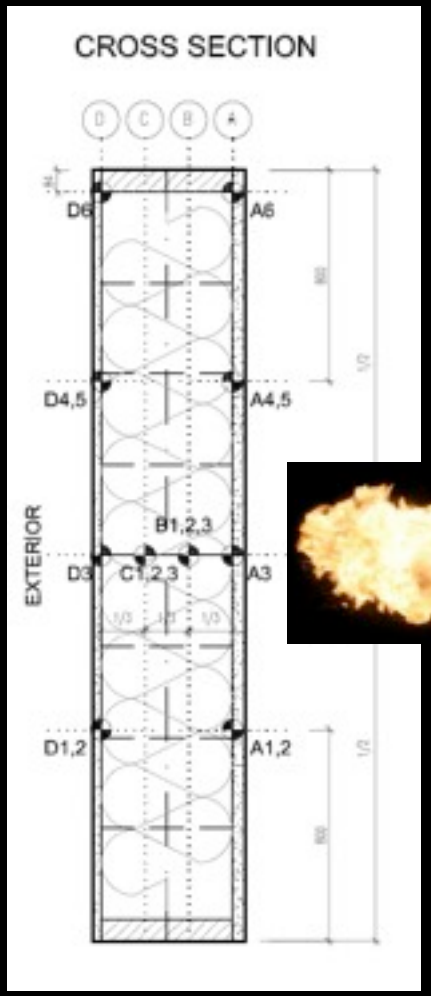

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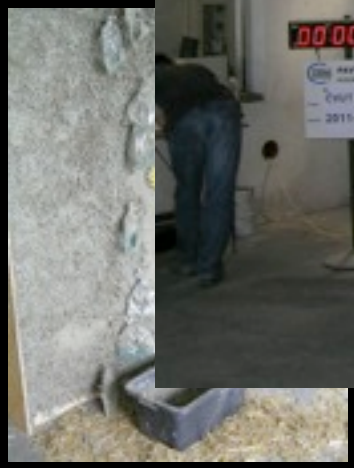


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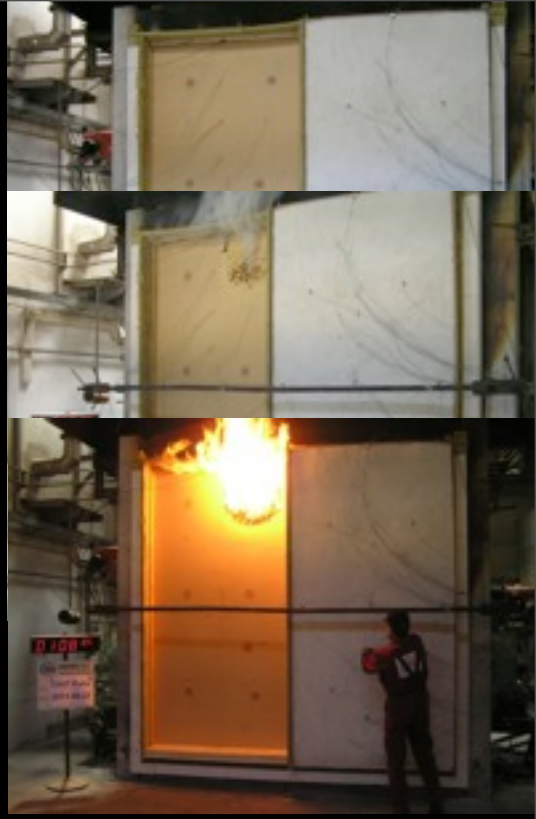

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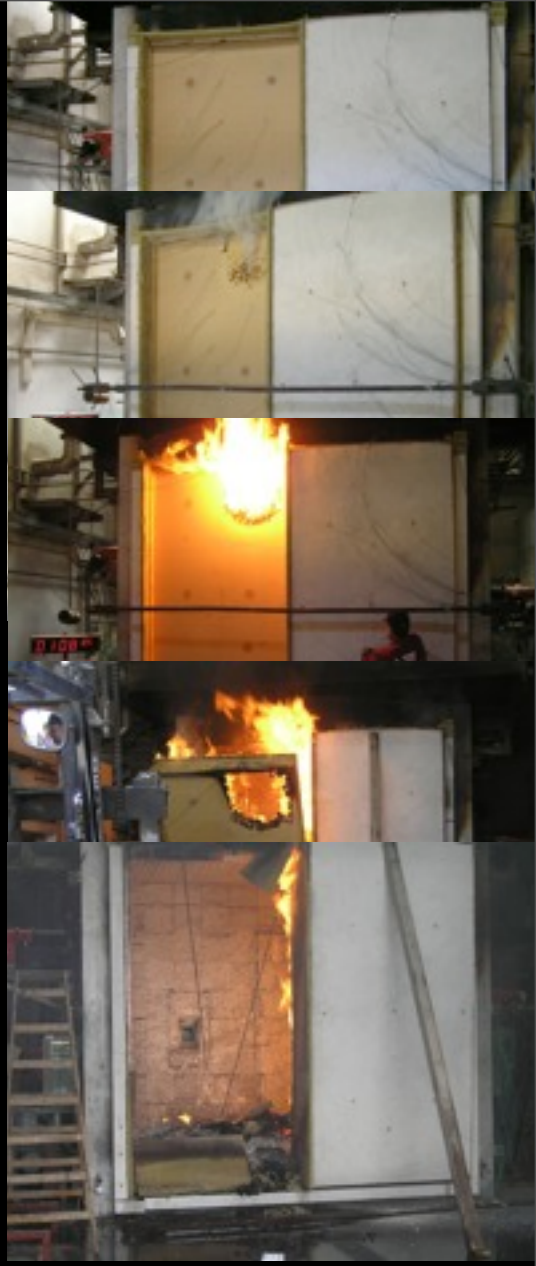

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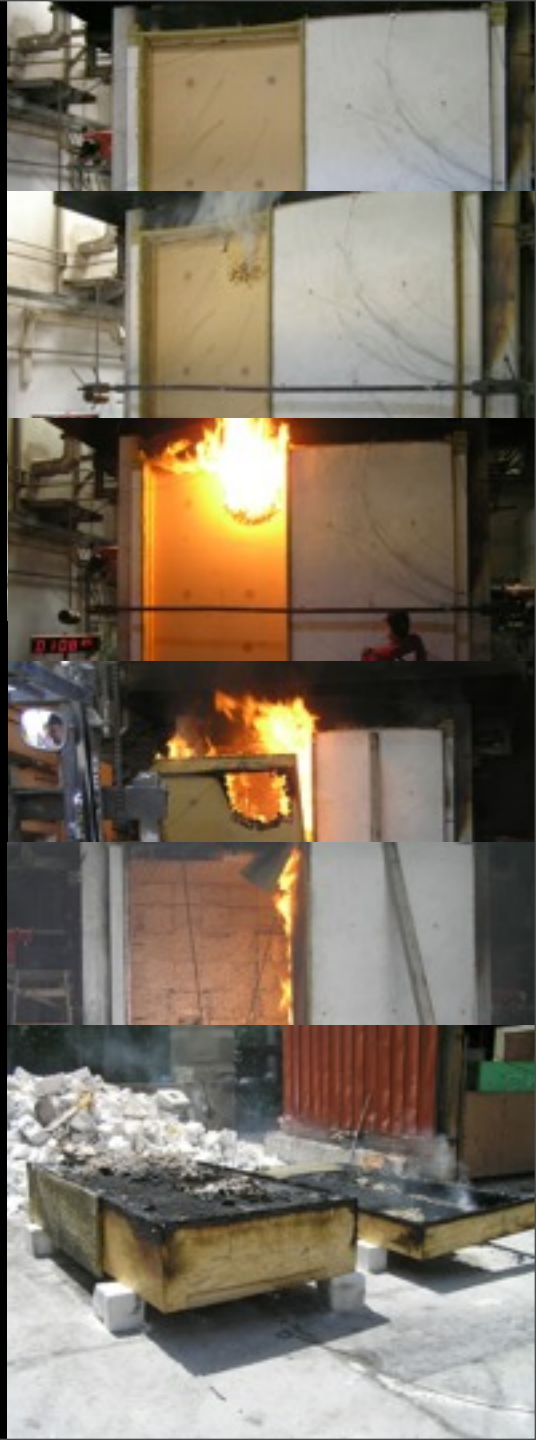

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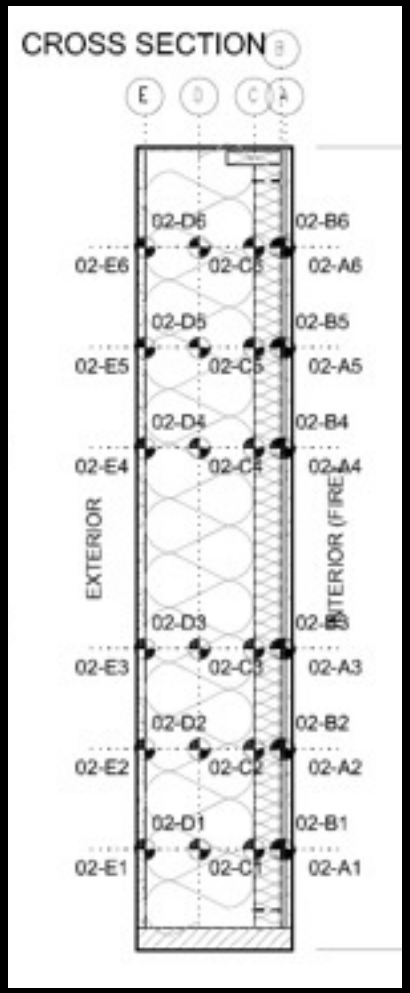

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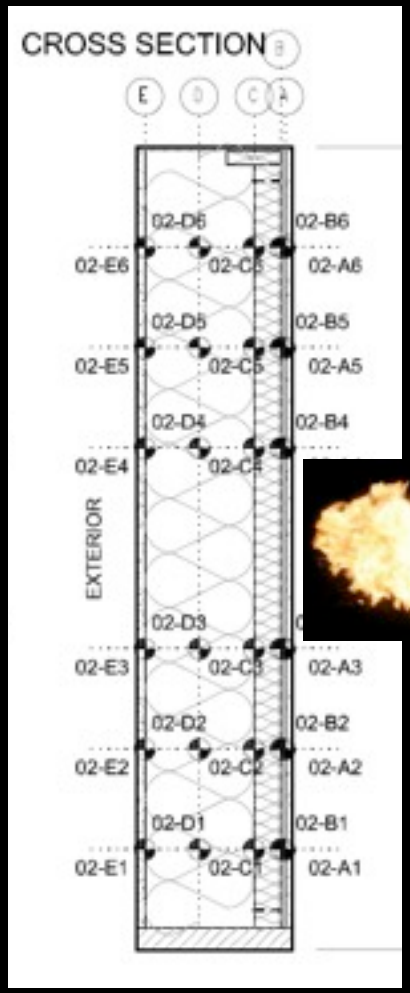

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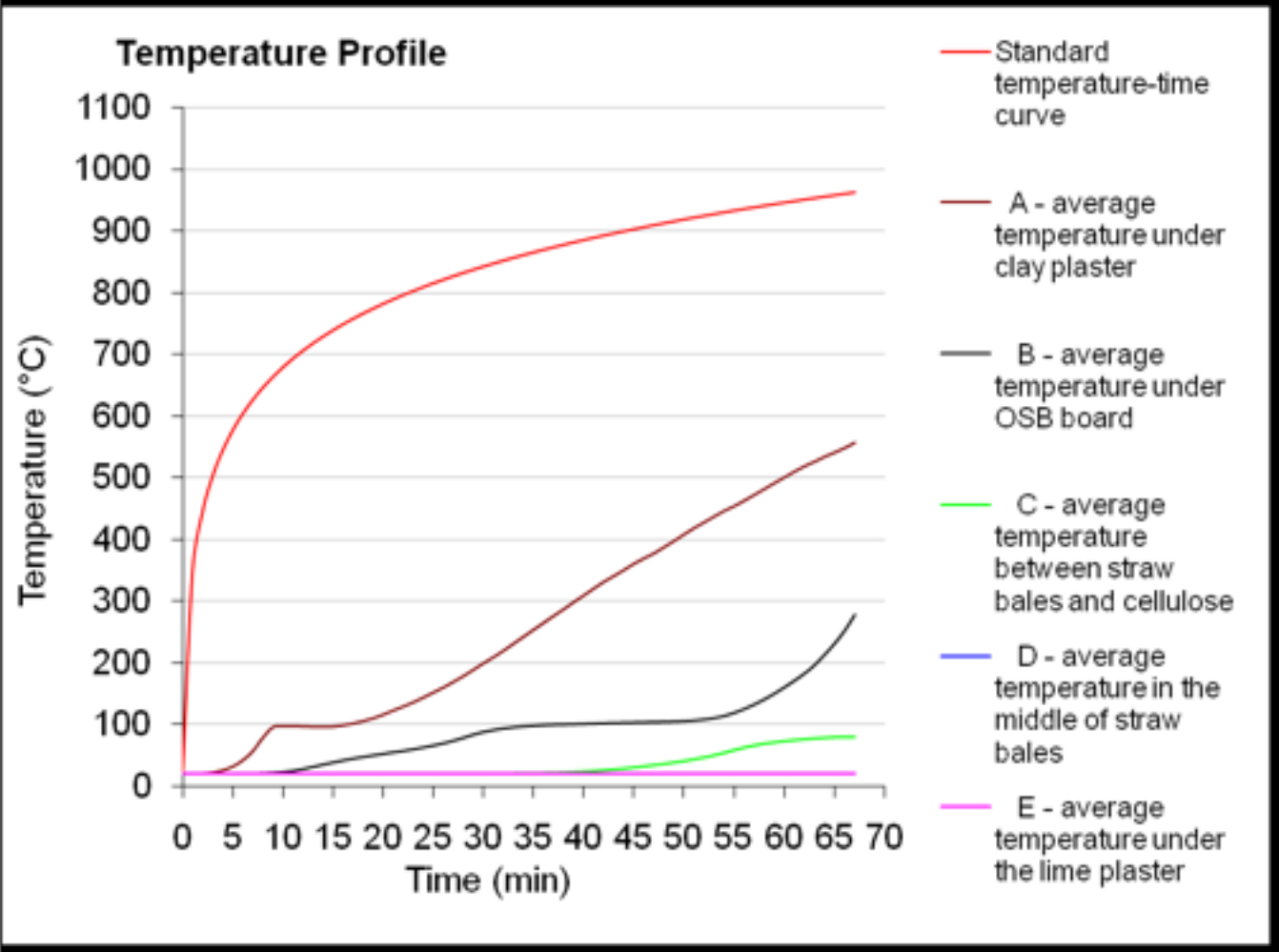

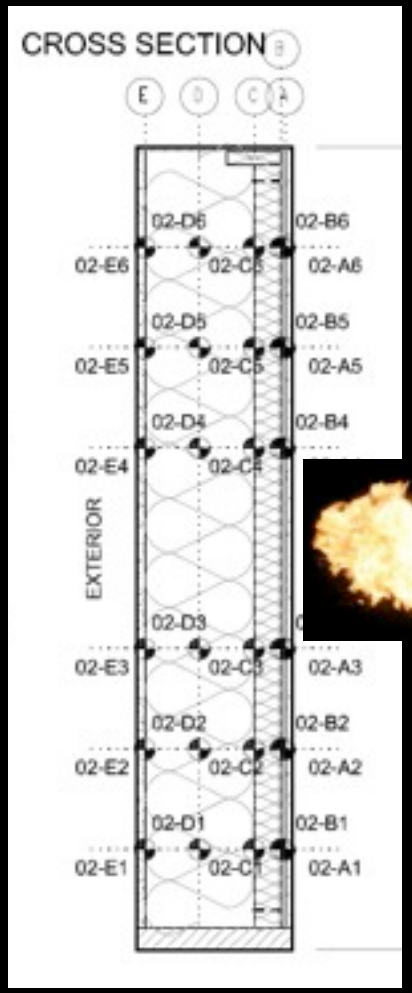

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Final reports of fire resistant tests are free available on the web site of the Project MPO Efekt: http://kps.fsv.cvut.cz/, section „Věda a výzkum“ (means „Research“)

Thank you.

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