FIRE SAFETY ENGINEERING GROUP

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Research topics

Behavior of structures subjected to fire

Building structures, bridges and other urban infrastructures

BBC News

Kesennuma, Japan, 2011

World Trade Center, NYC, 2001

Fire development

- **Development of simple models**
- **Development of numerical tools**
- **Experimental testing**

⇒ **To improve the fire safety of the built environment**

## Some recent research projects

- LOCAFI: Temperature assessment of a vertical steel member subjected to localized fire. Theoretical and experimental studies and numerical programming in SAFIR®.
- FICEB: Fire resistance of long span Cellular Beams made of rolled profiles. Numerical studies.
- FIDESC4 : Fire design of steel members with welded or hot-rolled class 4 cross-section. Experimental, parametric and numerical studies.
- COSSFIRE : Connections of Steel and Composite Structures under Natural Fire Conditions. Experimental and numerical studies.
- Development of a multiaxial constitutive model for concrete at elevated temperatures. PhD thesis. Theoretical studies and numerical programming in SAFIR®.

Numerical Modeling: SAFIR®

Development of a computer software

- To model the behavior of structures subjected to fire
- Nonlinear finite element software
- Thermal and mechanical analyses

SAFIR® used by 190 institutions and companies worldwide

SAFIR® in the world

Non linear finite element software for structures in fire

190 licenses sold
37 countries
5 continents
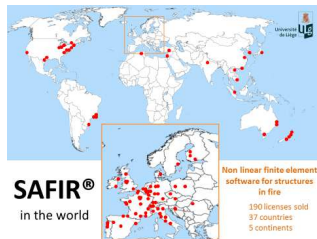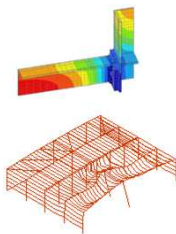
Experimental Testing: Fire Lab

Testing of structural and non-structural elements for research, commercial and educational applications

- Since 1979
- Accreditation ISO 17025, notified body under CPR
- Vertical and horizontal gas furnaces with loading capabilities
- Vertical furnace for testing of walls, columns, doors, facades, etc.
- Horizontal furnace for testing of beams, floors, roofs, stairs, etc.

Facade tested in vertical furnace

Timber floor tested in horizontal furnace
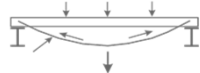
- Electrical heating system also available

Fundamental Research – Development – Implementation. Ex: Tensile Membrane Action in Composite Slabs.

Theory

- Observe from real fire events/tests
- Understand this load bearing mode
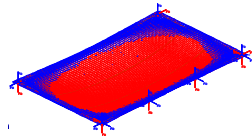- Develop theoretical models to explain
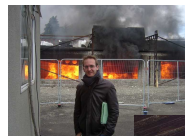

Cardington fire test, UK

Numerical studies

- Develop the numerical tools, material models, etc. to be able to represent this behavior
- Use numerical simulation for parametric studies (after validation)

Full scale testing

- Validate the models

Design in real projects

- Models can be used in design
- Cost saving and robust
- Ex: ArcelorMittal office building (Flemalle)

Protected