LOCAFI+

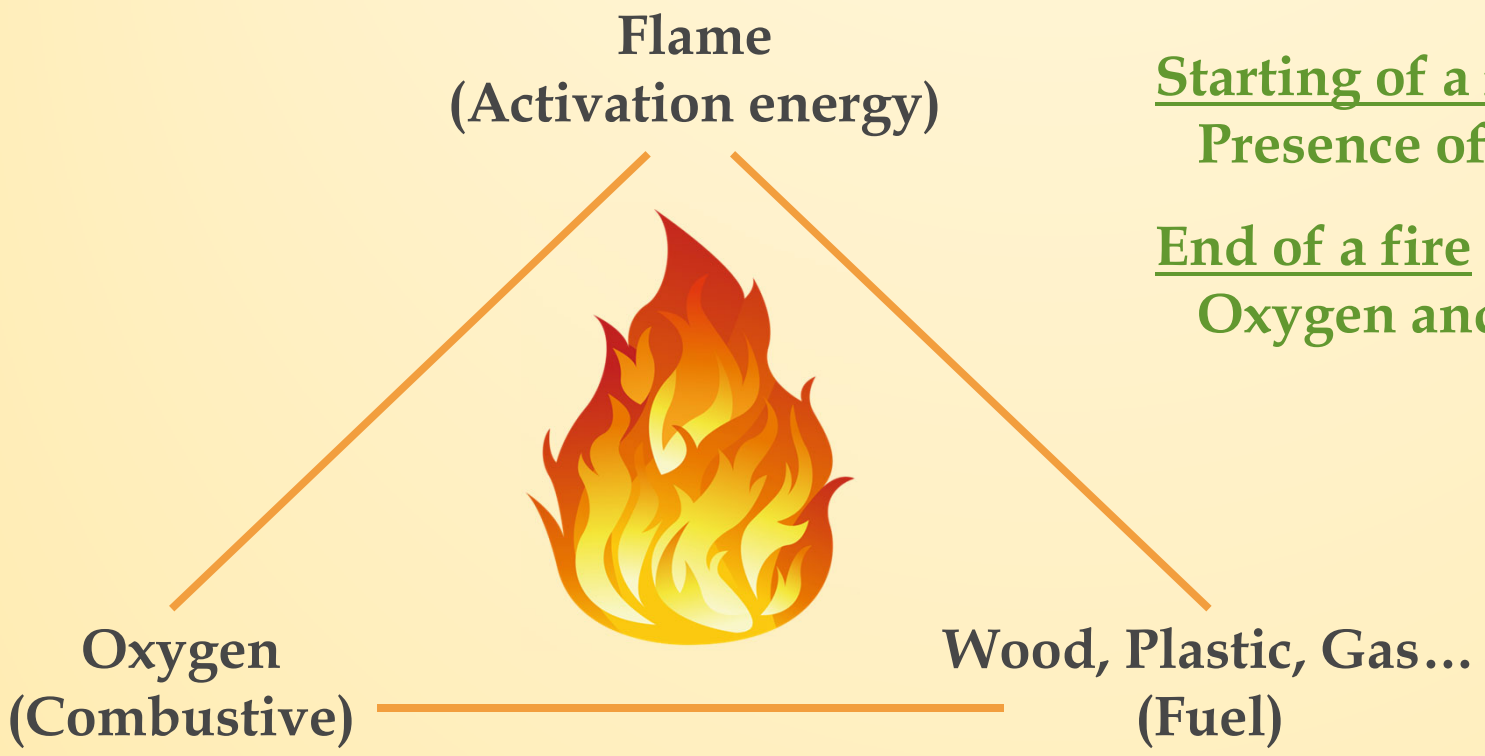
Temperature assessment of a vertical member subjected to LOCAlised Fire, Dissemination

Stanovení teploty svislých prvků vystavených lokálnímu požáru
Prezentace
Projekt č. 754072

2. Shrnutí problematiky a zdůvodnění projektu

2. Shrnutí problematiky a zdůvodnění projektu

Shrnutí problematiky – rozvoj požáru

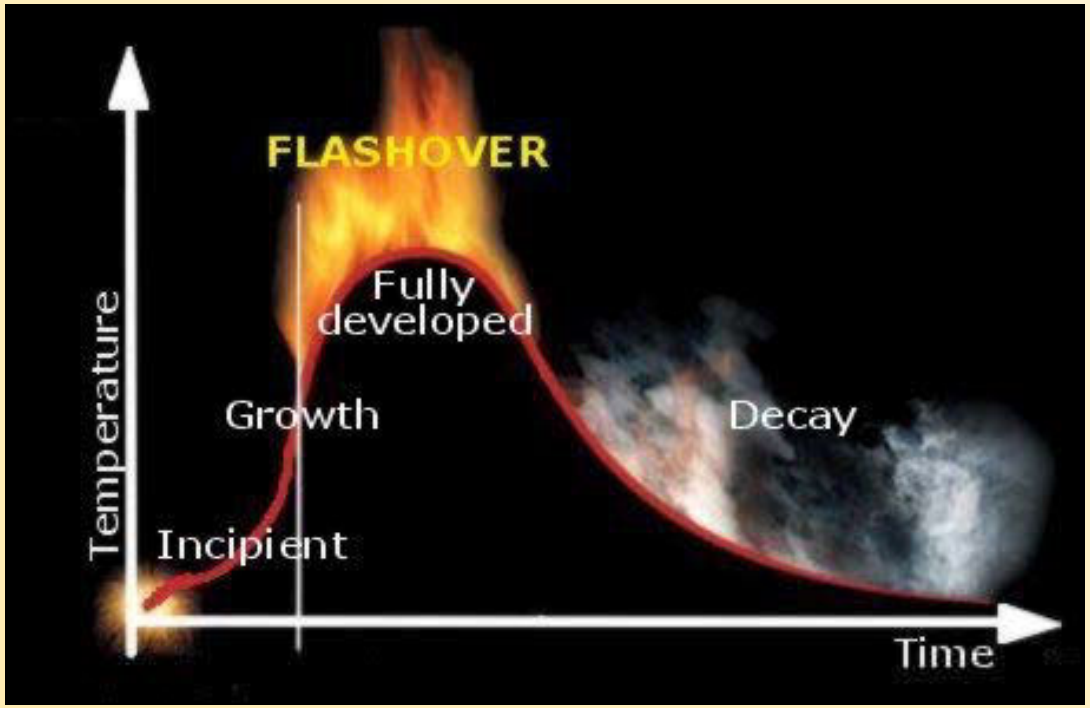


Starting of a fire :
Presence of 3 things simultaneously

End of a fire :
Oxygen and/or Fuel missing

2. Shrnutí problematiky a zdůvodnění projektu

Shrnutí problematiky – rozvoj požáru



Step 1 : Fire ignition (localised fire, action of firemen/sprinkler possible)

Step 2 : Development of the fire (depending on ventilation, fire load,…)

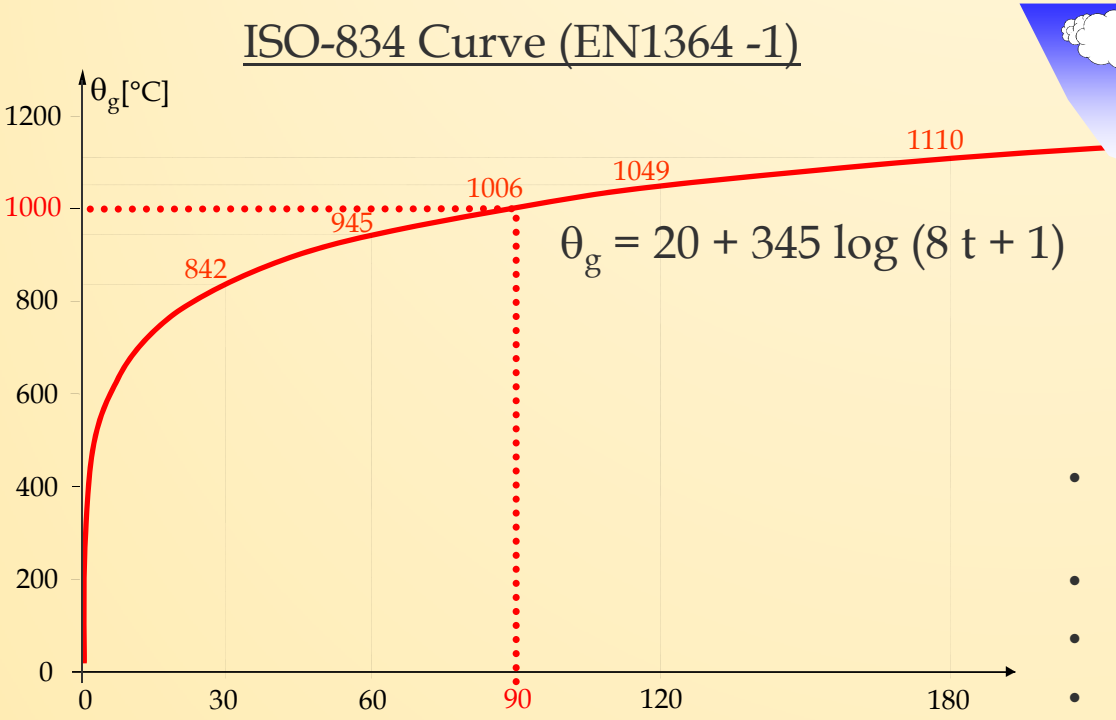
Between 2 and 3 : Flashover (from local to general)

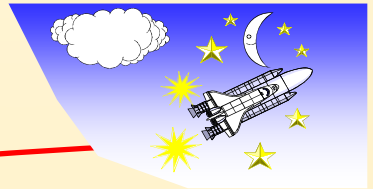
Step 3 : Fully-developped fire

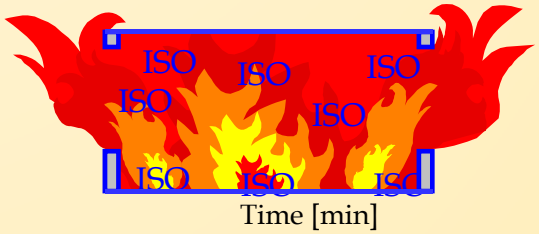
Step 4 : Decay phase (reduction of RHR due to missing fuel)

2. Shrnutí problematiky a zdůvodnění projektu

Shrnutí problematiky – nominální teplotní křivka





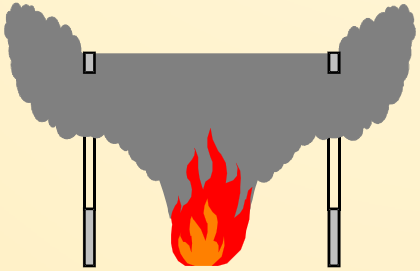


- Has to be considered in the WHOLE compartment, even if the compartment is huge
- Never goes DOWN
- Does not consider the PRE-FLASHOVER PHASE
- Does not depend on FIRE LOAD and VENTILATION CONDITIONS

2. Shrnutí problematiky a zdůvodnění projektu

Shrnutí problematiky – modelování požáru

LOCALISED FIRE

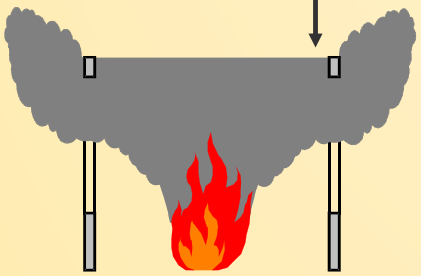


No flashover occurs

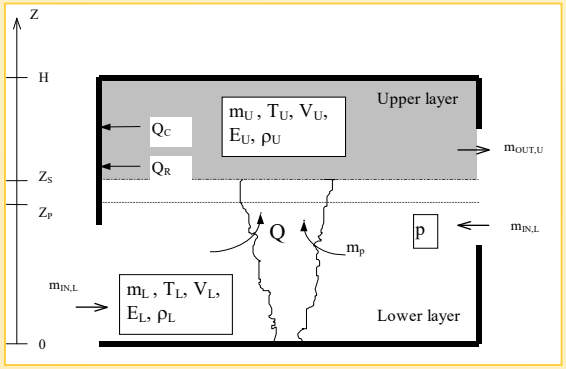
Flashover occurs

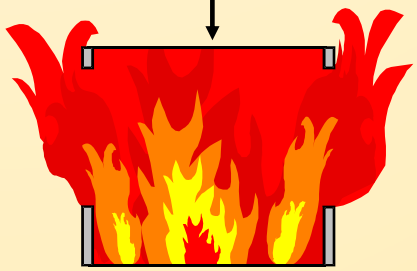
The Fire stays localised

The Fire switch to a fully engulfed fire

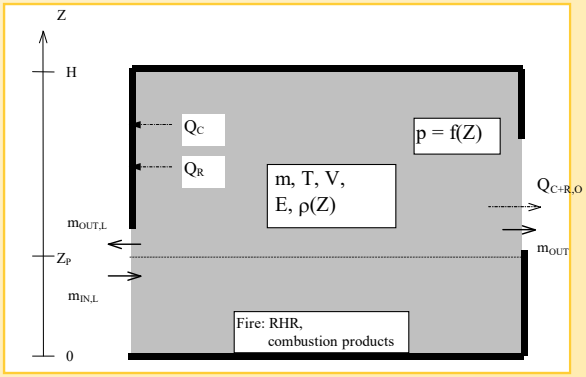


LOCALISED FIRE



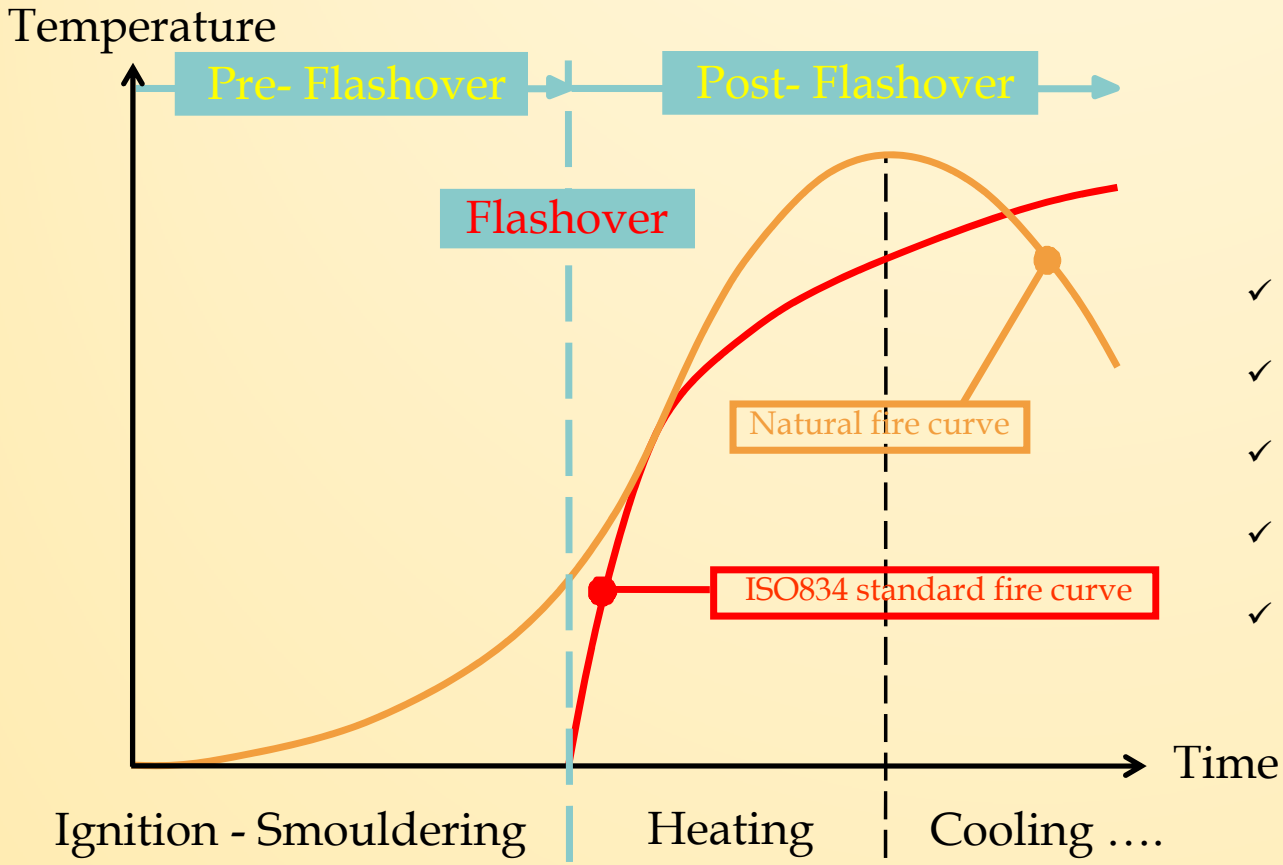


FULLY ENGULFED COMPARTMENT



2. Shrnutí problematiky a zdůvodnění projektu

Shrnutí problematiky – modelování požáru



Influencing parameters

- ✓ Boundary properties
- ✓ Ceiling height
- ✓ Opening Area

} Geometry

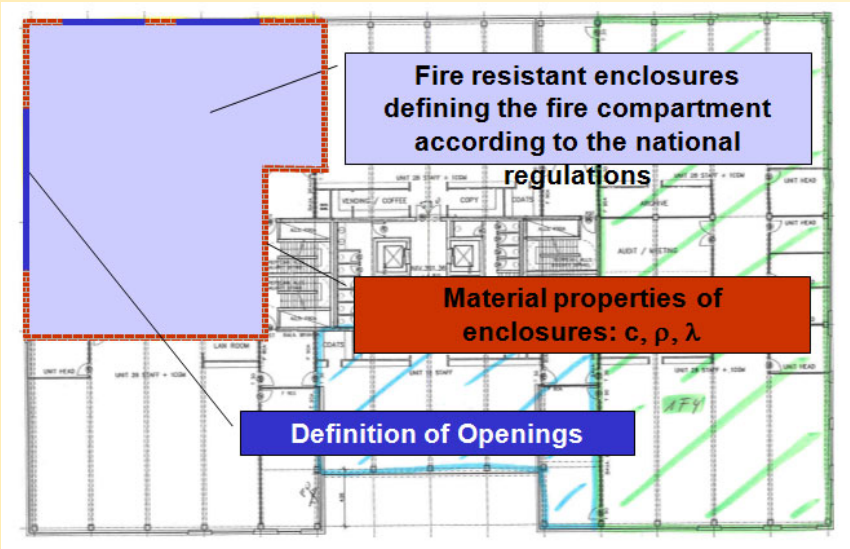
- ✓ Fire surface
- ✓ Rate of heat release

} Fire

2. Shrnutí problematiky a zdůvodnění projektu

Shrnutí problematiky – modelování požáru

Step 1 : Division of the building into compartments



Step 2 : Physical parameters linked to Occupancy

Occupancy	Fire Growth Rate	RHR_f [kW/m²]	Fire Load $q_{f,k}$ 80% fractile [MJ/m²]
Dwelling	Medium	250	948
Hospital (room)	Medium	250	280
Hotel (room)	Medium	250	377
Library	Fast	500	1824
Office	Medium	250	511
School	Medium	250	347
Shopping Centre	Fast	250	730
Theatre (movie/cinema)	Fast	500	365
Transport (public space)	Slow	250	122

2. Shrnutí problematiky a zdůvodnění projektu

Shrnutí problematiky – modelování požáru

Step 3 : Danger of Fire Activation

Compartment floor area A_f [m²]	Danger of Fire Activation δ_{q1}	Examples of Occupancies	Danger of Fire Activation δ_{q2}
25	1.10	Art gallery, museum, swimming pool	0.78
250	1.50	Residence, hotel, office	1.00
2500	1.90	Manufactory for machinery & engines	1.22
5000	2.00	Chemical lab, painting workshop	1.44
10000	2.13	Manufactory of fireworks or paints	1.66

Step 4 : Active measures

Sprinkler	Independent Water Suppl. 0 | 1 | 2	Fire Detection Heat | Smoke	Alarm Transm.	Work Brigade	Off Site Brigade	Safe Road Access	Fire Fighting Devices	Smoke Exhaust System
0.61	1.0 | 0.87 | 0.7	0.87 | 0.73	0.87	0.61	0.78	0.9 | 1.0 |1.5	1.0 | 1.5	1.0 | 1.5

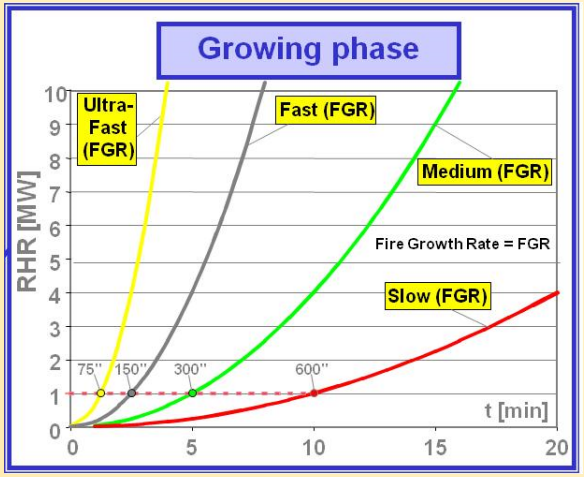
2. Shrnutí problematiky a zdůvodnění projektu

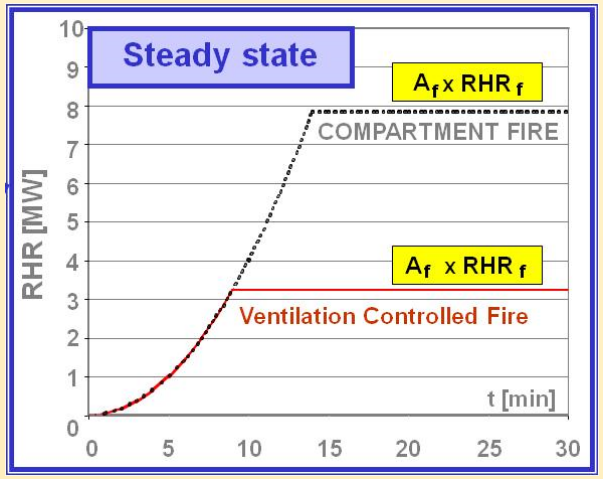
Shrnutí problematiky – modelování požáru

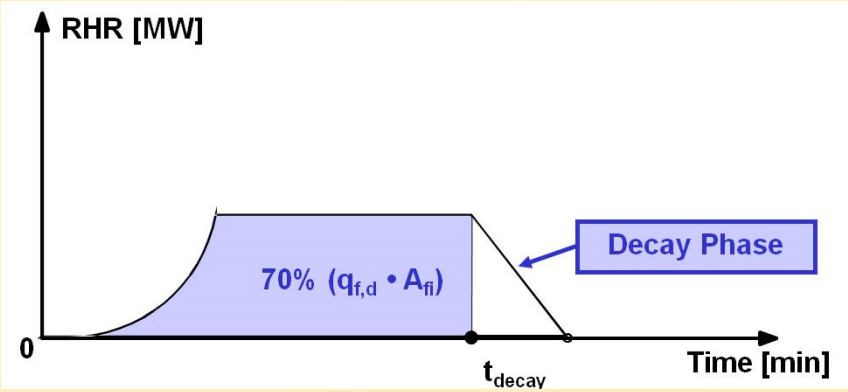
Step 5 : Design fire load

$$q_{f,d} = \delta_{q1} \cdot \delta_{q2} \cdot \prod \delta_{ni} \cdot m \cdot q_{f,k}$$

Step 6 : RHR diagram



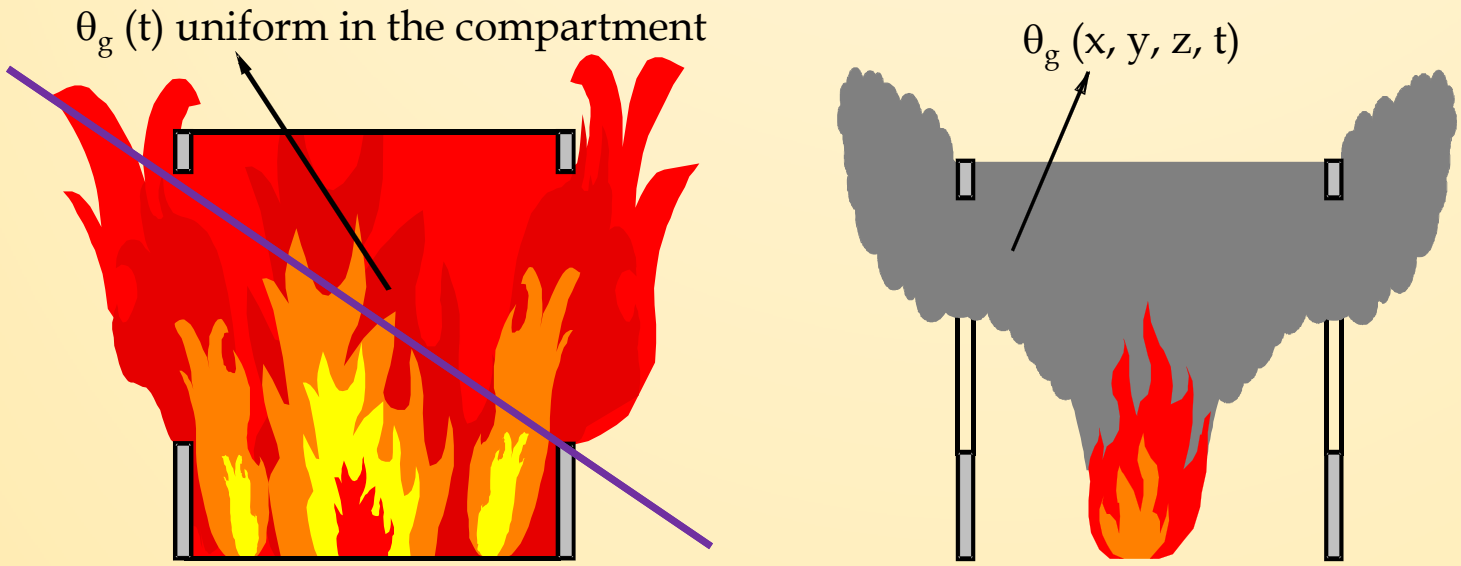




2. Shrnutí problematiky a zdůvodnění projektu

Shrnutí problematiky - lokální požár

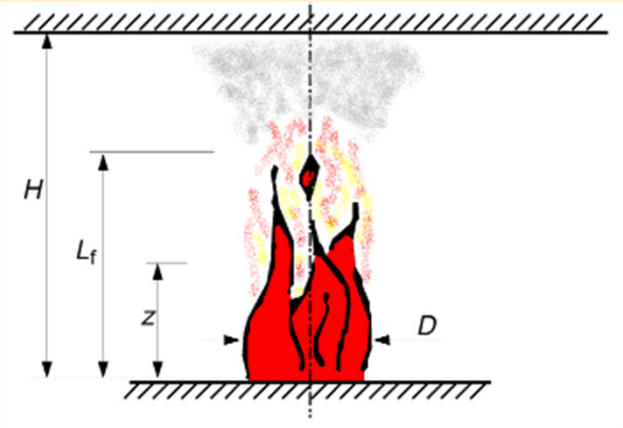
In some circumstances, the analysis of the structure under natural fire is not sufficient/realistic :
- Very large (or complex) compartment
- Ventilation controlled fire
- Fire load is localised (car park)



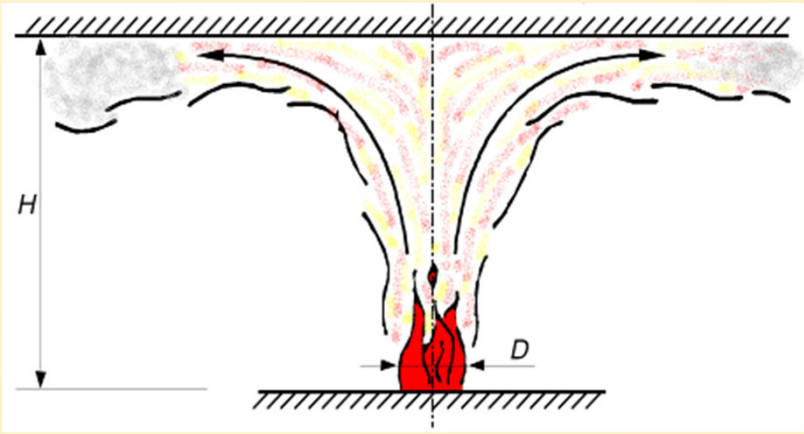
2. Shrnutí problematiky a zdůvodnění projektu

Shrnutí problematiky - lokální požár

Currently two models are available in the EN1991-1-2 Annex C to describe the effects of localised fire to the structure:



Heskestad model
for fire not impacting the ceiling



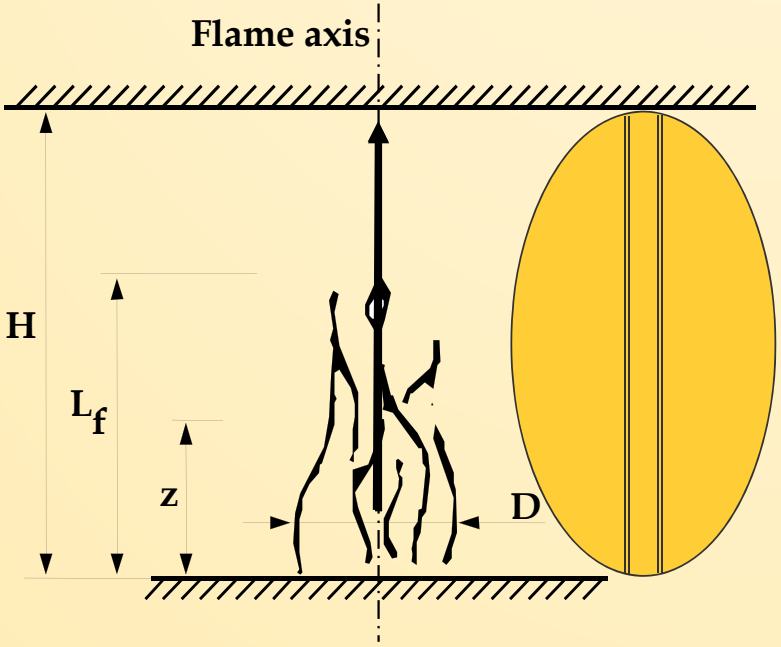
Hasemi model
for fire impacting the ceiling

For car parks structures, several experimental campaigns have been used to validate the ***Hasemi model*** as design tool able to reproduce with sufficient safety margin the temperature field in horizontal structural elements caused by burning cars.

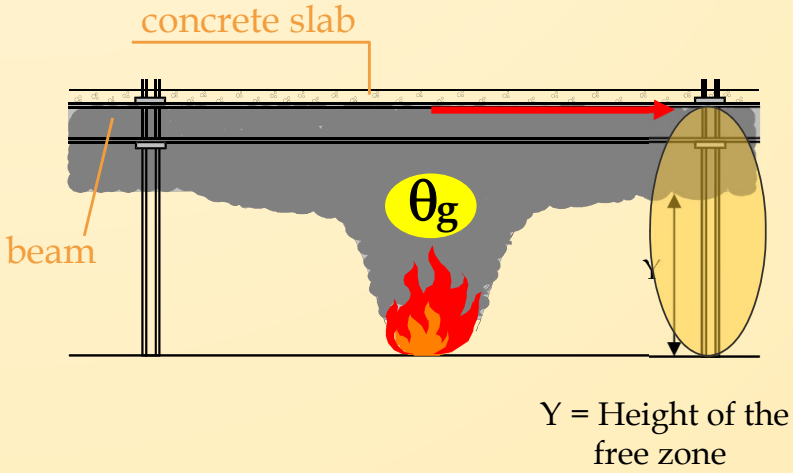
2. Shrnutí problematiky a zdůvodnění projektu

Zdůvodnění projektu

Annex C of EN 1991-1-2:
Flame not impacting the ceiling



Annex C of EN 1991-1-2:
Flame impacting the ceiling



In this situation, column temperature is mainly governed by radiative fluxes. But how to tackle this ?

2. Shrnutí problematiky a zdůvodnění projektu

Cíle projektu

- Providing scientific evidence about the thermal attack imposed on a steel column surrounded by a local fire or attacked by a local fire at a distance from the column (including verification of equations providing temperature along centreline of the source) ;
- Providing design equations that allow reproducing this thermal attack as well as temperatures induced in the column, publication of these equations and implementation in existing software (OZone, SAFIR,…) ;
- Providing rules that form the basis of the design equations in order to have them implemented in Eurocodes, which will make the models automatically accepted without any discussion by the authorities of the different Member States.