

Požární návrhové normy po roce 2021

Zónové modely pro výpočet lokálního požáru Software OZone

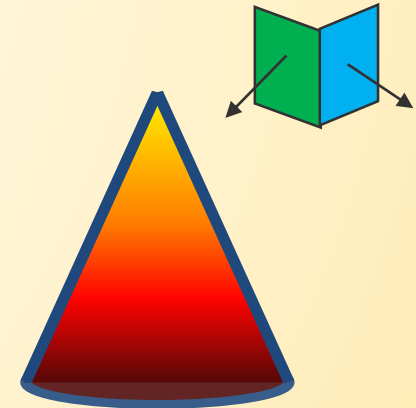


FACULTY OF CIVIL ENGINEERING
DEPARTMENT OF STEEL AND
TIMBER STRUCTURES

Zónové modely pro výpočet lokálního požáru

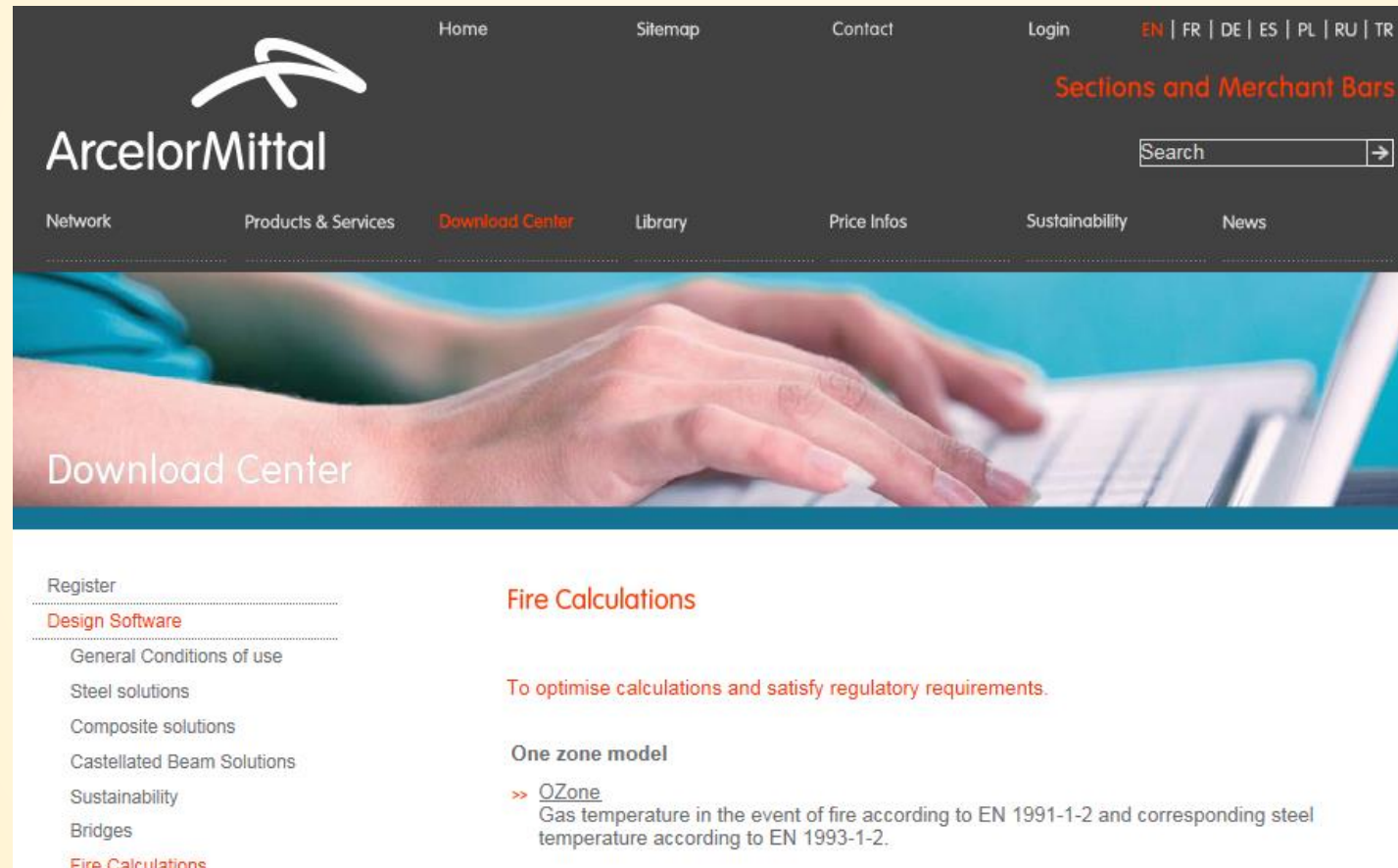
Obsah

- OZone pro výpočet lokálního požáru
- Zónové modely
- Požární úsek
- Požární zatížení _ Prostorový požár
- Požární zatížení _ Lokální požár
- Teplotní analýza ocelového prvku
- Výstupy



Zónové modely pro výpočet lokálního požáru

OZone

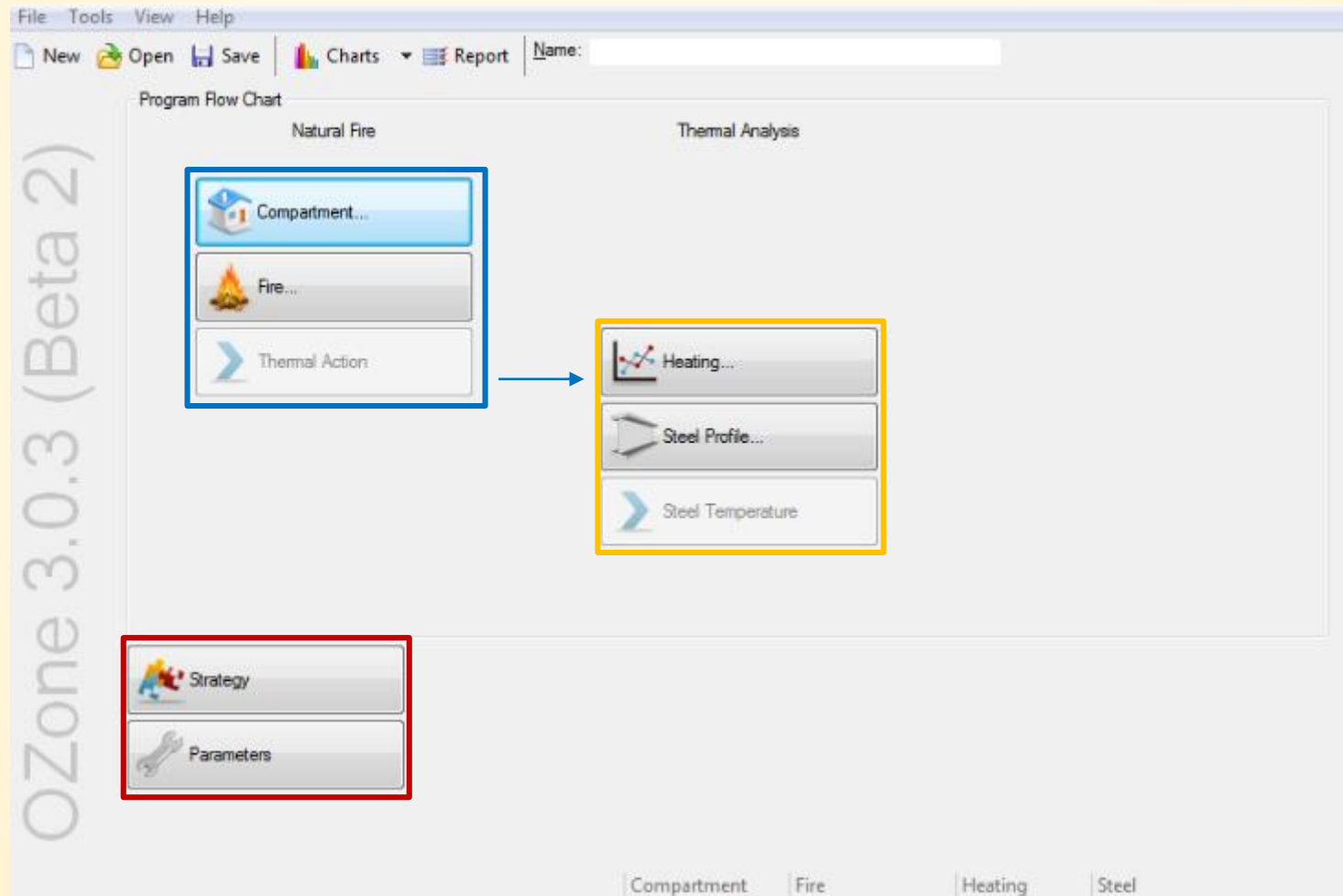


The screenshot shows the ArcelorMittal website's Download Center. The top navigation bar includes links for Home, Sitemap, Contact, Login, and language options (EN, FR, DE, ES, PL, RU, TR). The main navigation bar lists Network, Products & Services, Download Center (highlighted), Library, Price Infos, Sustainability, and News. A search bar is located on the right. Below the navigation is a banner image of hands typing on a laptop keyboard with the text "Download Center". The main content area is divided into two columns. The left column contains a "Register" link, a "Design Software" section with sub-links for General Conditions of use, Steel solutions, Composite solutions, Castellated Beam Solutions, Sustainability, and Bridges, and a "Fire Calculations" link. The right column features a "Fire Calculations" heading, a sub-heading "To optimise calculations and satisfy regulatory requirements.", and a "One zone model" section with a link to "OZone" and a description: "Gas temperature in the event of fire according to EN 1991-1-2 and corresponding steel temperature according to EN 1993-1-2."

<http://sections.arcelormittal.com/download-center/design-software/fire-calculations.html>

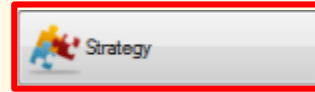
OZone

Hlavní menu



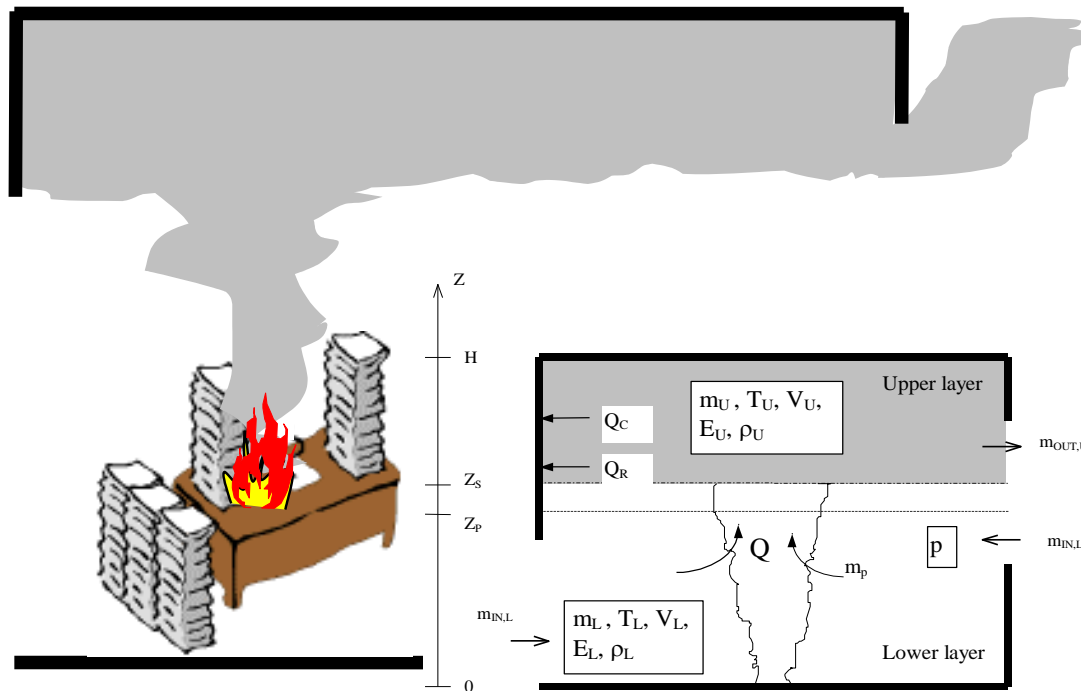
OZone

1. Zónové modely



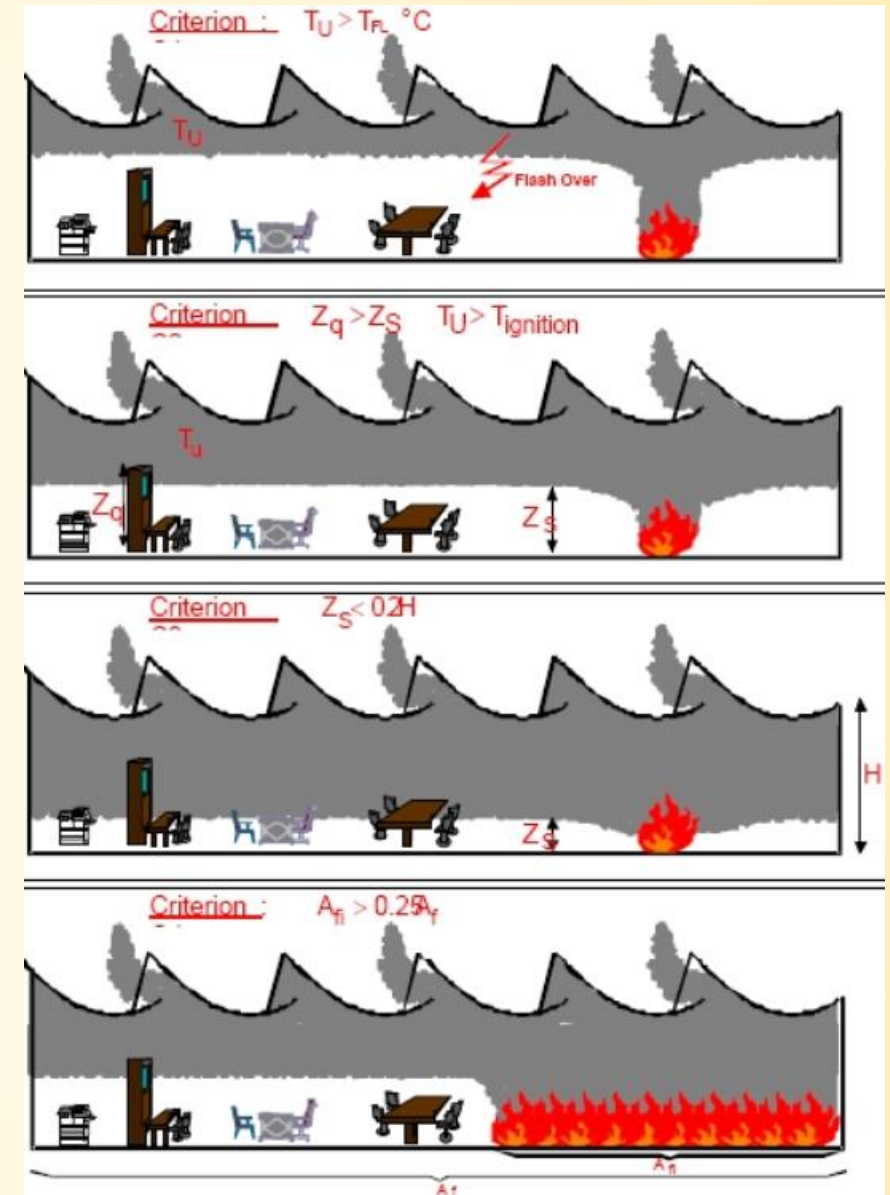
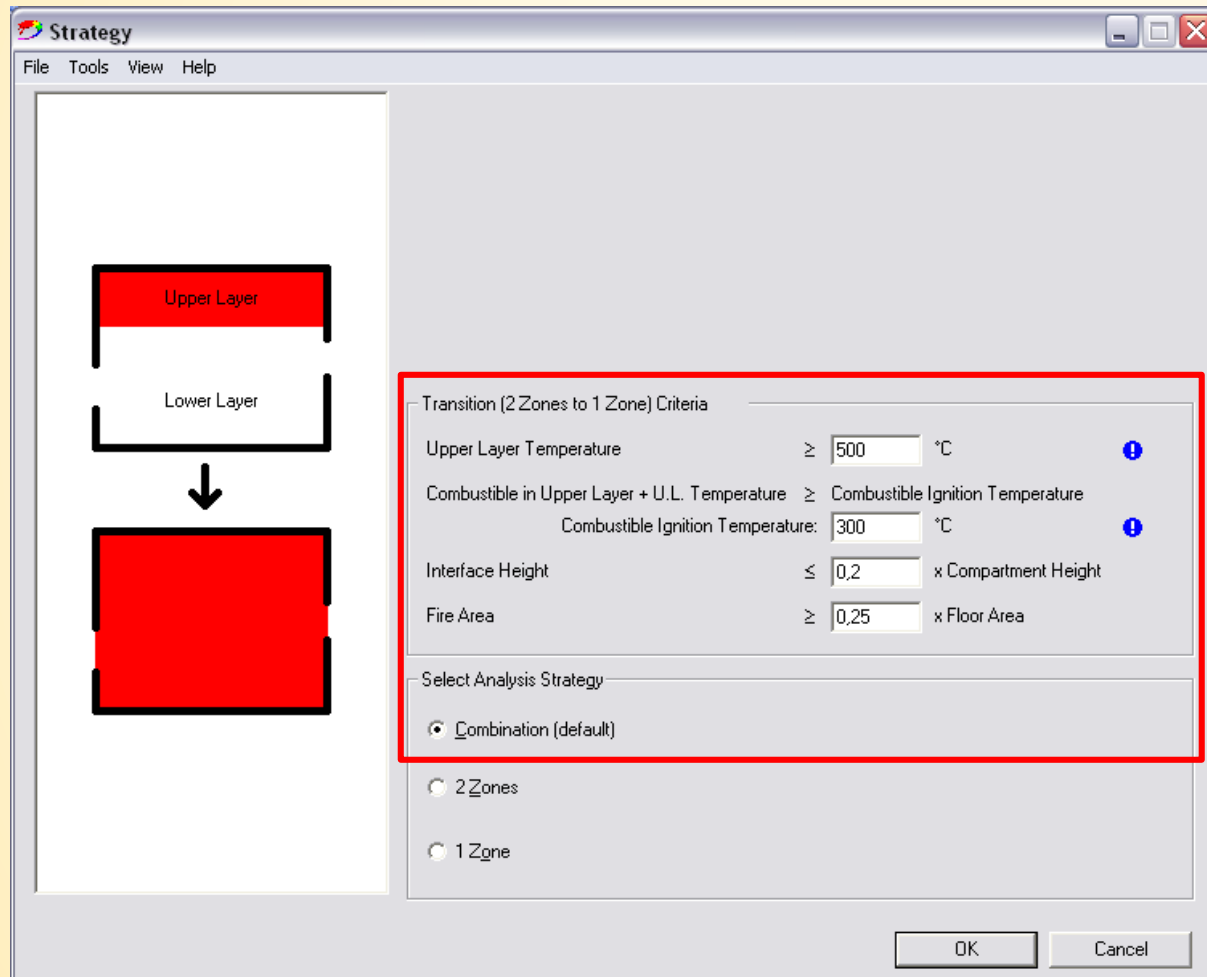
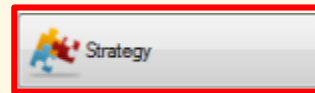
Dvouzónový model

Jednozónový model _ Plně rozvinutý požár



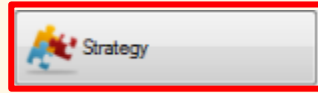
OZone

1. Zónové modely

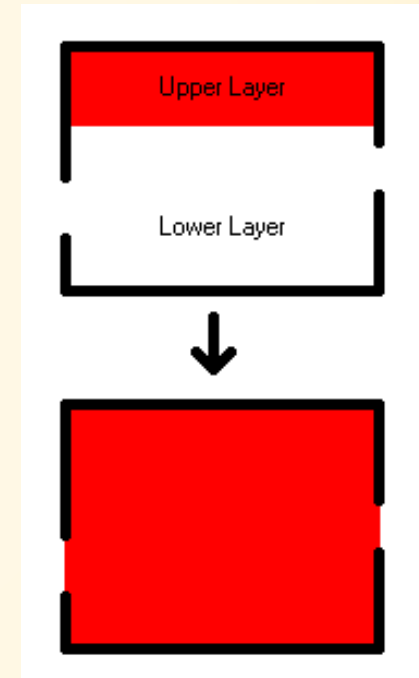
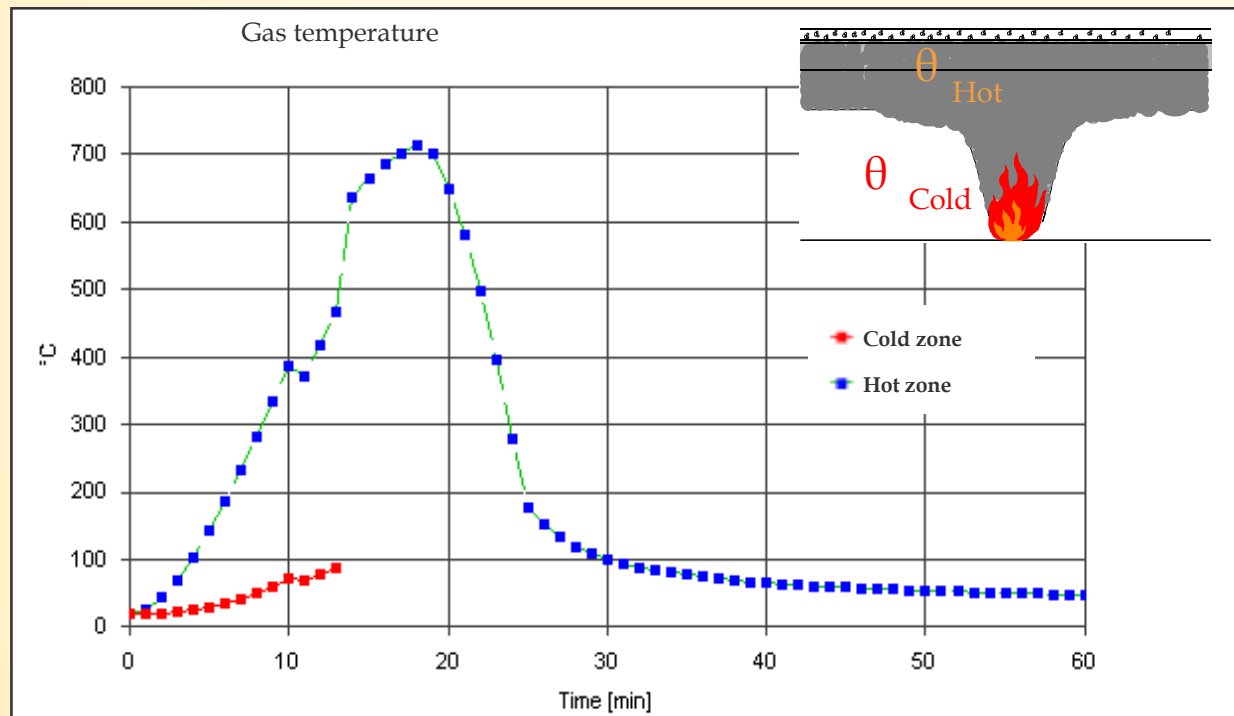


OZone

1. Zónové modely

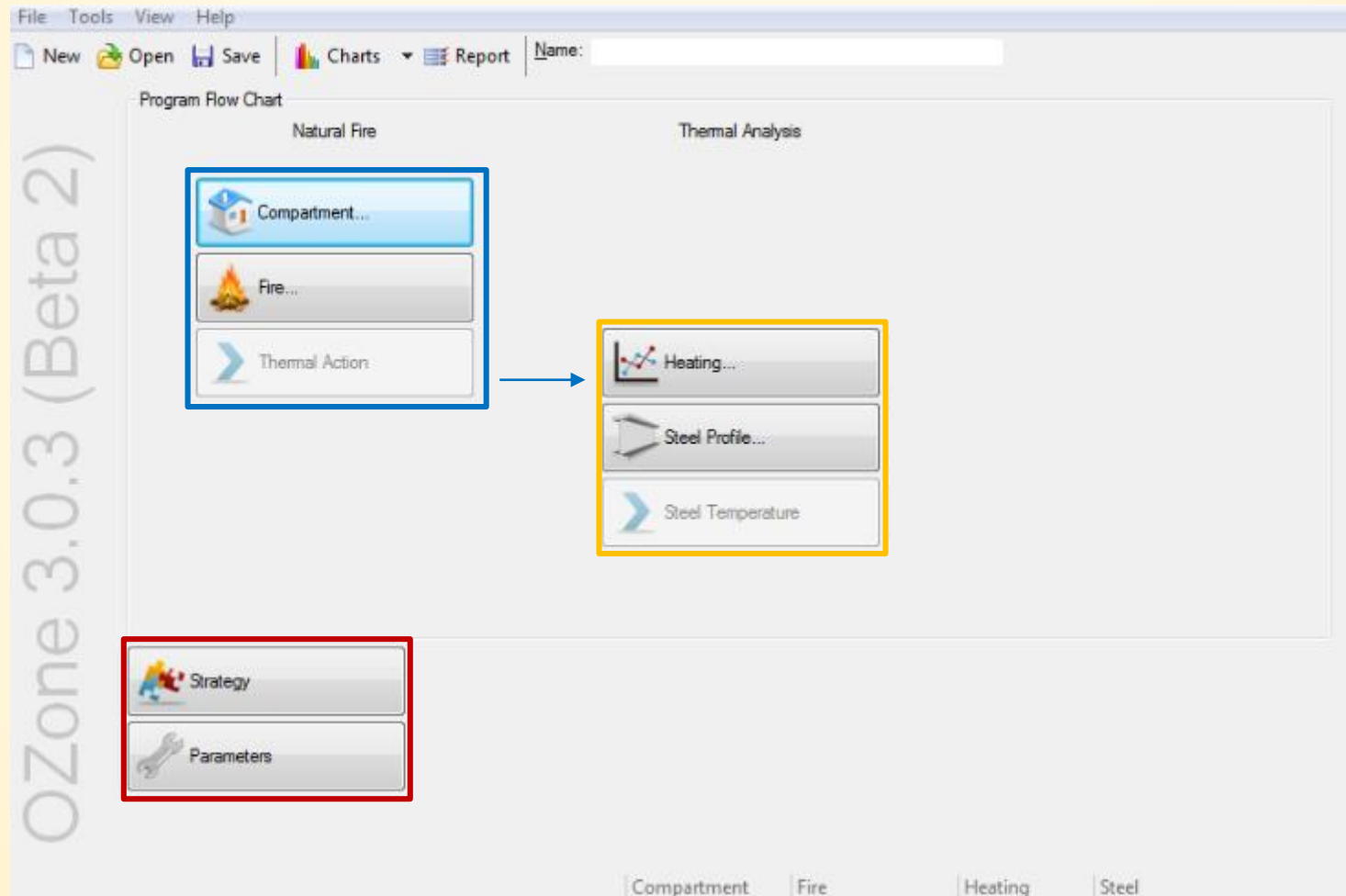


Po 13 minutách teplota horké zóny dosahuje 500 °C → Přepnutí z 2 zónového na 1 zónový model



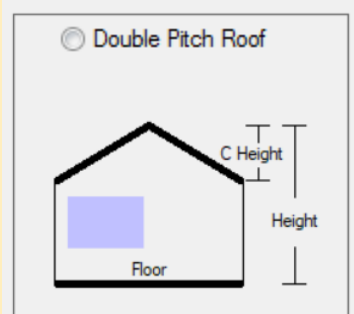
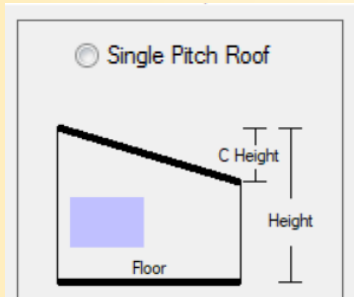
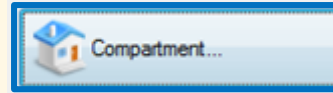
OZone

Hlavní menu



OZone

2. Požární úsek



File Tools View Help

Form of Compartment

Rectangular Floor
 Flat Roof
 Single Pitch Roof
 Double Pitch Roof
 Any Compartment

Height: m
Depth: m
Length: m

Define Layers and Openings

Select Wall:

Select Walls to Copy to:

Copy Openings

Defined Walls:

Wall	Type	Openings	Length
Floor			
Ceiling			
Wall 1			
Wall 2			
Wall 3			
Wall 4			

Forced Ventilation

Smoke Extractors:

	Height	Diameter	Volume	In/Out
	m	m	m ³ /sec	
Extractor 1				
Extractor 2				
Extractor 3				

Geometrie
prostoru

Vlastnosti
podlahy, stěn a
stropu

Nucené větrání
(pokud je použito)

2. Požární úsek

Select Wall:
 Floor Define

Select Walls to Copy to:
 Ceiling
 Wall 1
 Wall 2
 Wall 3
 Wall 4
 Copy Openings Copy

File Tools View Help

Wall Length: 13 m

	Material	Thickness	Unit mass	Conductivity	Specific Heat	Rel Emissivity	Rel Emissivity
		cm	kg/m ³	W/mK	J/kgK	Hot Surface	Cold Surface
Layer 1	Steel [EN1994-1-2]	0.1	7850	45	600	0.8	0.8
Layer 2	Glass wool_Rock wool	6	60	0.037	1030	0.8	0.8
Layer 3	Steel [EN1994-1-2]	0.1	7850	45	600	0.8	0.8
Layer 4							

Enter each layer on a single row in the table above (up to four layers). Just click in a cell and edit it's value. If not found in the list of materials you can define your own material, by filling in the appropriate cells. Define your layers starting from Layer 1 (Inside).

Define your openings if any (up to three openings in a single wall). Click in the desired cell and input your values. Start from Opening 1.

To delete or insert a row, right click on a row header and select the appropriate command from the popup menu.

Inside

Layer 1
Layer 2
Layer 3
Layer 4

Outside

	Sill Height Hi	Soffit Height Hs	Width	Variation	Adiabatic
	m	m	m		
Opening 1	0	4	4.2	Stepwise	no
Opening 2	0	2	1	Stepwise	no
Opening 3					

OK
Cancel

Vlastnosti vrstev stěn
(pro každou stěnu samostatně)

Parameters

Temperature Dependent Openings

Temperature Dependent: °C

Stepwise Variation

Temperature	% of Total Openings
20	10
400	50
500	100

Linear Variation

Temperature	% of Total Openings
20	10
400	50
500	100

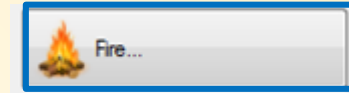
Time Dependent Openings

Time	% of Total Openings
0	5
1200	100

Otvory →

OZone

3. Požární zatížení _ Prostorový požár



Fire

File Tools View Help

Compartment Fire: Annex E (EN 1991-1-2) User Defined Fire

Localised Fire: Localised Fire

National Annex: Default

Occupancy	Fire Growth Rate	RHRI	Fire Load $q_{f,k}$	Danger of Fire Activation
School	Medium	[kW/m ²] 250	80% Fractile MJ/m ² 347	1

Active Fire Fighting Measures

- Automatic Water Extinguishing System $\delta_{n,1}=1$
- Independent Water Supplies 1 2 $\delta_{n,2}=1$
- Automatic Fire Detection by Heat $\delta_{n,3}=1$
- Automatic Fire Detection by Smoke $\delta_{n,5}=1$
- Automatic Alarm Transmission to Fire Brigade $\delta_{n,6}=1$
- Work Fire Brigade $\delta_{n,8}=1$
- Off Site Fire Brigade $\delta_{n,9}=1$
- Safe Access Routes $\delta_{n,10}=1$
- Staircases Under Overpressure in Fire Alarm
- Fire Fighting Devices $\delta_{n,9}=1$
- Smoke Exhaust System $\delta_{n,10}=1$

Fire Info

Max Fire Area: m²

Fire Elevation: m

Fuel Height: m

Design Fire Load

Fire Risk Area: m² $\delta_{q,1}=1$

Danger of Fire Activation: $\delta_{q,2}=1$

Active Measures: $\prod \delta_{n,j}=1$

$q_{f,d} = \delta_{q,1} \delta_{q,2} \prod \delta_{n,j} m q_{f,k} = 277.6 \text{ MJ/m}^2$

Combustion

Combustion Efficiency Factor: 0.8

Combustion Model: Extended fire duration

Stoichiometric Coefficient: 1.27

OK Cancel

National Annex: Czech Republic

Default

Belgium

Czech Republic

Estonia

France

Germany

Hungary

Italy

Luxembourg

Netherlands

Poland

Portugal

Romania

Slovenia

Spain

Sweden

United Kingdom

Fire Load $q_{f,k}$

80% Fractile MJ/m²

347

Danger of Fire Activation

1

Fire Risk Area: m² $\delta_{q,1}=1$

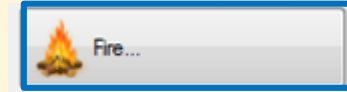
Danger of Fire Activation: $\delta_{q,2}=1$

Active Measures: $\prod \delta_{n,j}=1$

$q_{f,d} = \delta_{q,1} \delta_{q,2} \prod \delta_{n,j} m q_{f,k} = \text{MJ/m}^2$

OZone

3. Požární zatížení _ Prostorový požár



Fire

File Tools View Help

Compartment Fire: Annex E (EN 1991-1-2) User Defined Fire

Localised Fire: Localised Fire

To delete or insert a row, right click on a row header and select the appropriate command from the popup menu.

Point	Time	RHR	mf	Fire Area
	sec	MW	kg/s	m ²
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				
23				

Data Points

Save... Load...

Fire Info

Max Fire Area: m²

Fire Elevation: m

Fuel Height: m

User Defined Fire Columns

Only RHR

Only mf

RHR and mf

Fire Area

Combustion

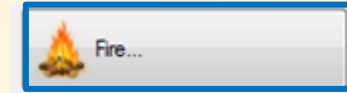
Combustion Efficiency Factor: 0.8

Combustion Model: No combustion mode

Stoichiometric Coefficient: 1.27

OK Cancel

4. Požární zatížení _ Lokální požár



OZone v3.0 - Worked Example 1c

File Tools View Help

Compartment Fire: Annex E (EN 1991-1-2) User Defined Fire

Localised Fire: Localised Fire

Number of fires: 1

Select fire: 1

Fire	Diametre [m]	Pos X [m]	Pos Y [m]
Fire 1	4	0	0
Fire 2			
Fire 3			
Fire 4			
Fire 5			

Point	Time [min]	RHR [MW]
Point 1	0	12.56
Point 2	20	12.56
Point 3		
Point 4		
Point 5		
Point 6		
Point 7		
Point 8		
Point 9		
Point 10		
Point 11		
Point 12		
Point 13		
Point 14		
Point 15		
Point 16		
Point 17		
Point 18		
Point 19		
Point 20		

Geometrical Data

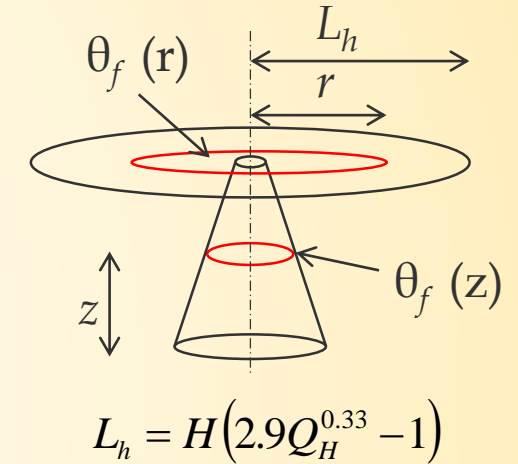
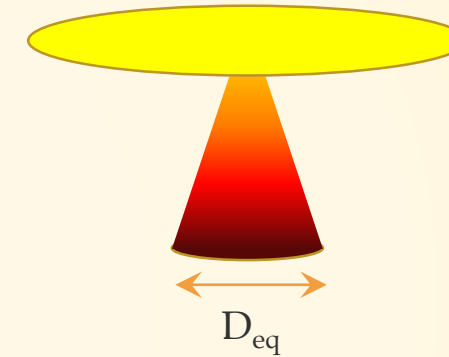
Ceiling Height: 3.5 m

Distance on Axis (x): 2.5 m

Height on Axis (z): 3.5 m

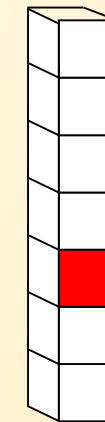
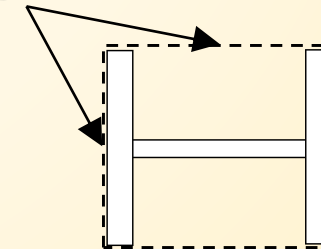
OK Cancel

Kuželový model



Pokud plamen dosahuje stropu ($L_f > H_{stropu}$)

Ekvivalentní
obdélkový
průřez

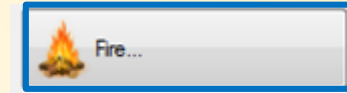


Modelování
svislých
ploch sloupu

Plocha_i

OZone

4. Požární zatížení _ Lokální požár



File Tools View Help

Compartment Fire: Annex E (EN 1991-1-2) User Defined Fire

Localised Fire: Localised Fire

Number of fires: Select fire:

Fire	Diametre [m]	Pos X [m]	Pos Y [m]
Fire 1	3	2.5	1.25
Fire 2			
Fire 3			
Fire 4			
Fire 5			

Průměr a poloha lokálního požáru(ů)

	Time [min]	RHR [MW]
Point 1	0	0
Point 2	5	1
Point 3	10	2
Point 4	15	2.5
Point 5	20	1.5
Point 6	25	0
Point 7		
Point 8		
Point 9		
Point 10		
Point 11		
Point 12		
Point 13		
Point 14		
Point 15		
Point 16		
Point 17		
Point 18		
Point 19		
Point 20		

Geometrical Data

Ceiling Height: m

Distance on Axis (x): m

Height on Axis (z): m

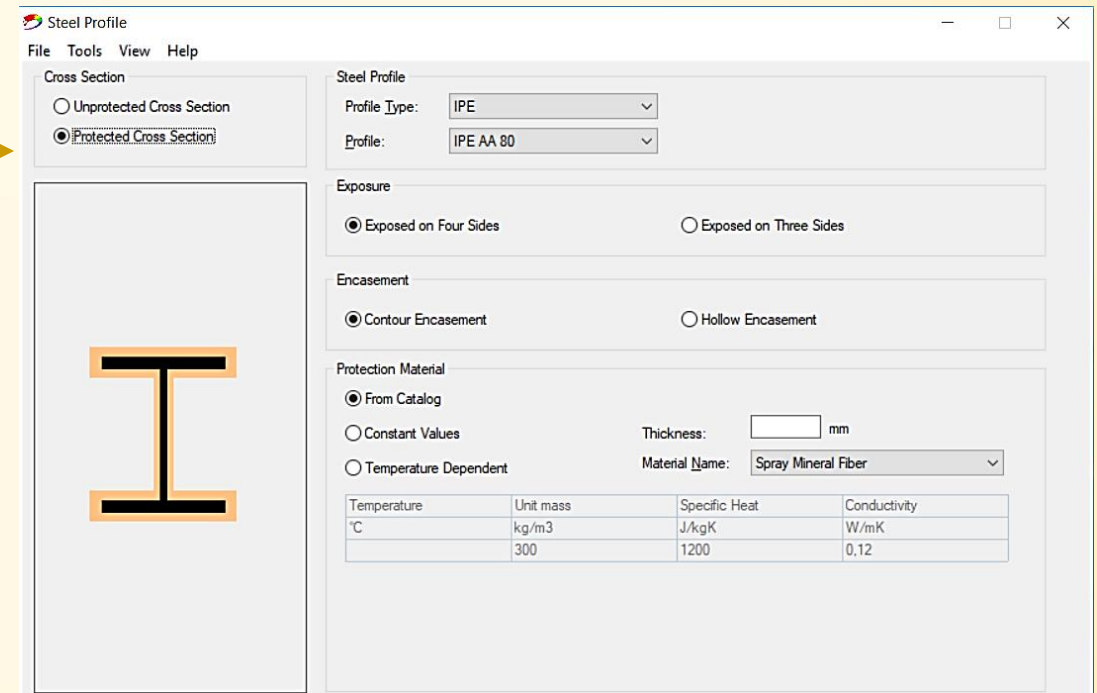
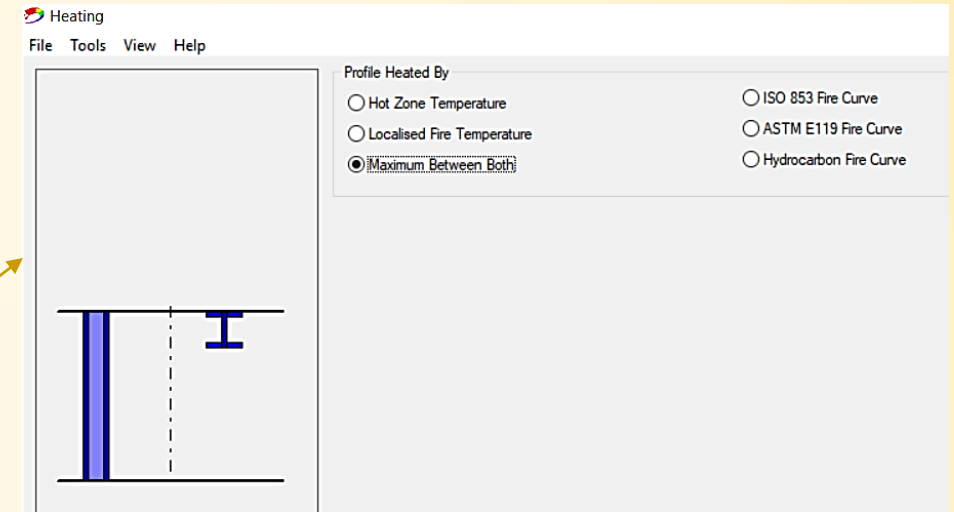
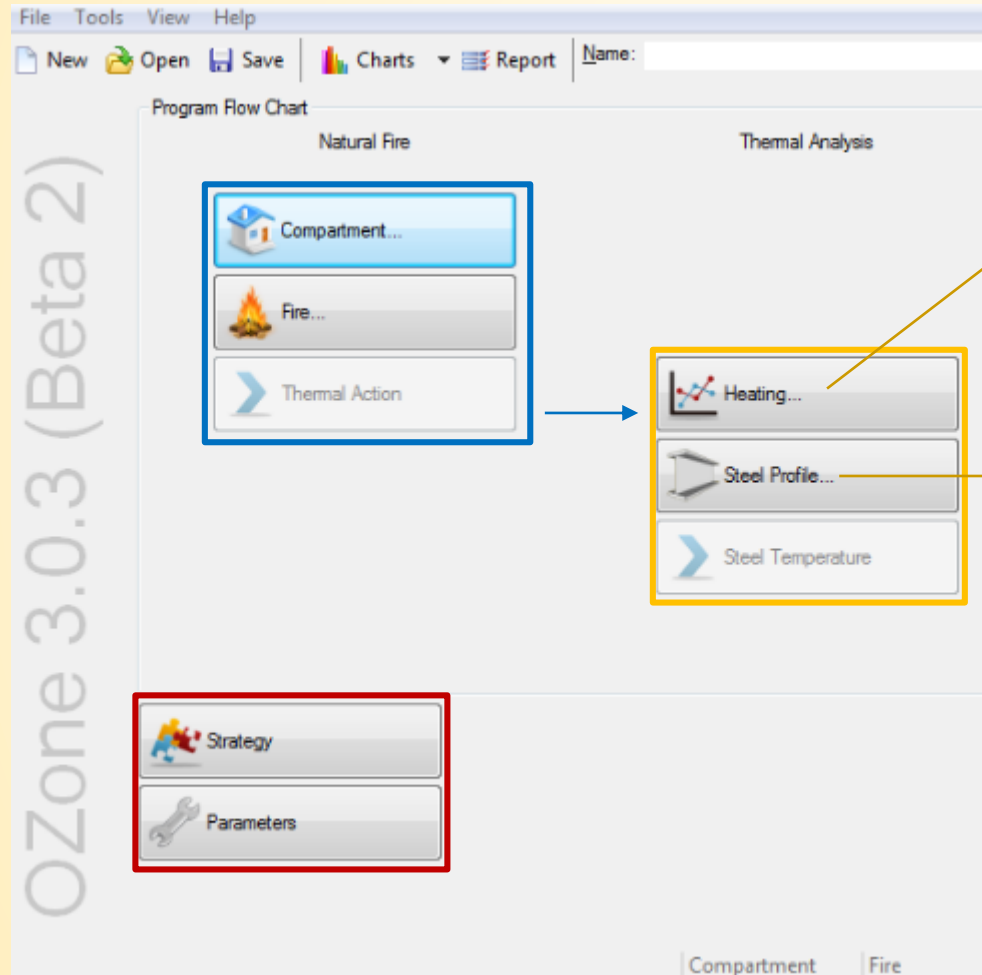
Prvek (sloup, ...) je vždy na ose y = 0. Doporučuje se nastavit na x = 0

OK Cancel

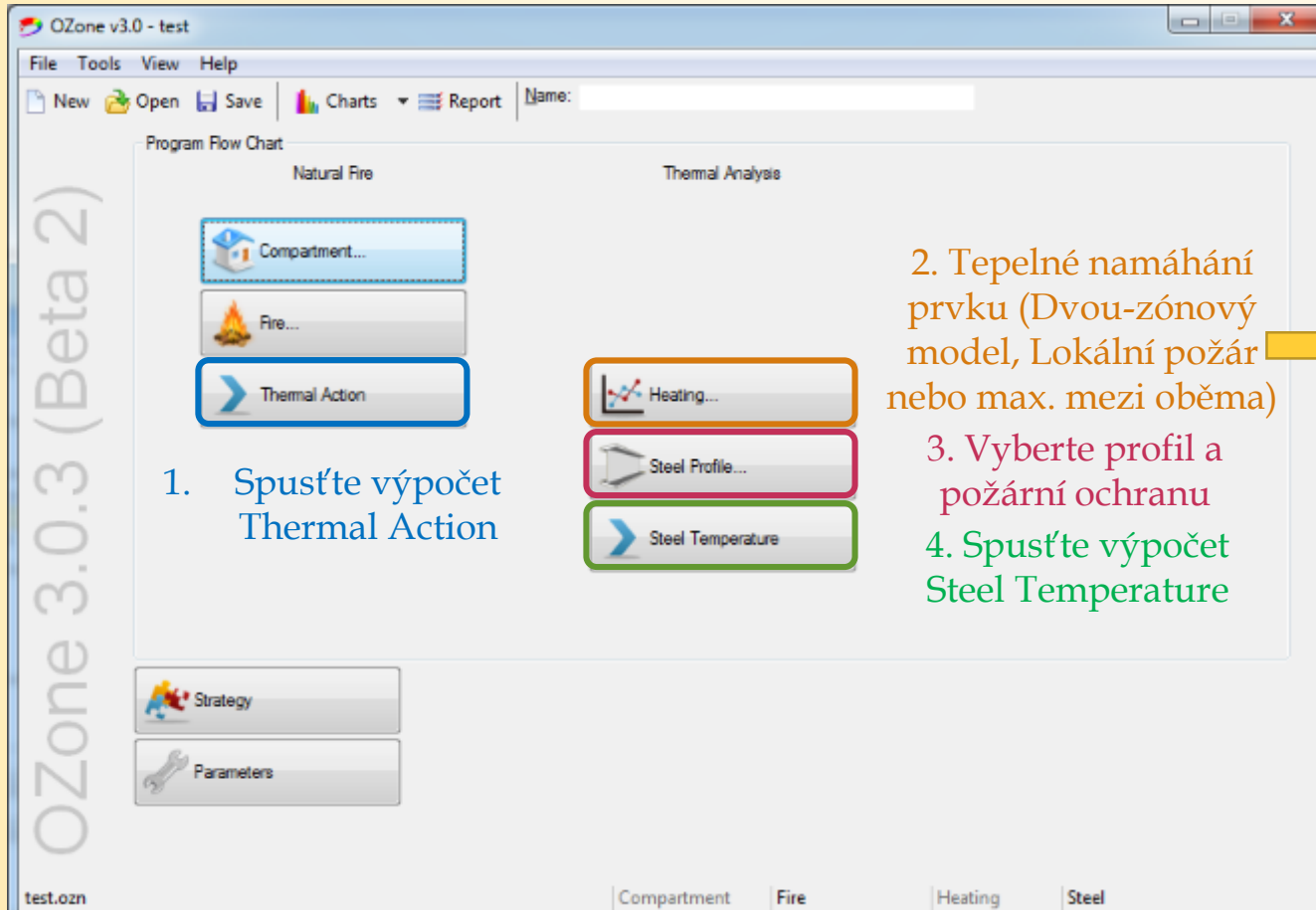
Vývoj RHR

OZone

Hlavní menu



5. Teplotní analýza ocelového prvku



OZone v3.0 - test

File Tools View Help

New Open Save Charts Report Name:

Program Flow Chart

Natural Fire Thermal Analysis

Compartment... Fire... Thermal Action Heating... Steel Profile... Steel Temperature

Strategy Parameters

test.ozn | Compartment | Fire | Heating | Steel

1. Spusťte výpočet Thermal Action

2. Tepelné namáhání prvku (Dvou-zónový model, Lokální požár nebo max. mezi oběma)

3. Vyberte profil a požární ochranu

4. Spusťte výpočet Steel Temperature

Pro výpočet teplotního pole prvku může být použito tepelné zatížení získané kombinací maximálních hodnot výsledků z dvou-zónového modelu a lokálního požáru.

Profile Heated By

Hot Zone Temperature

Localised Fire Temperature

Maximum Between Both

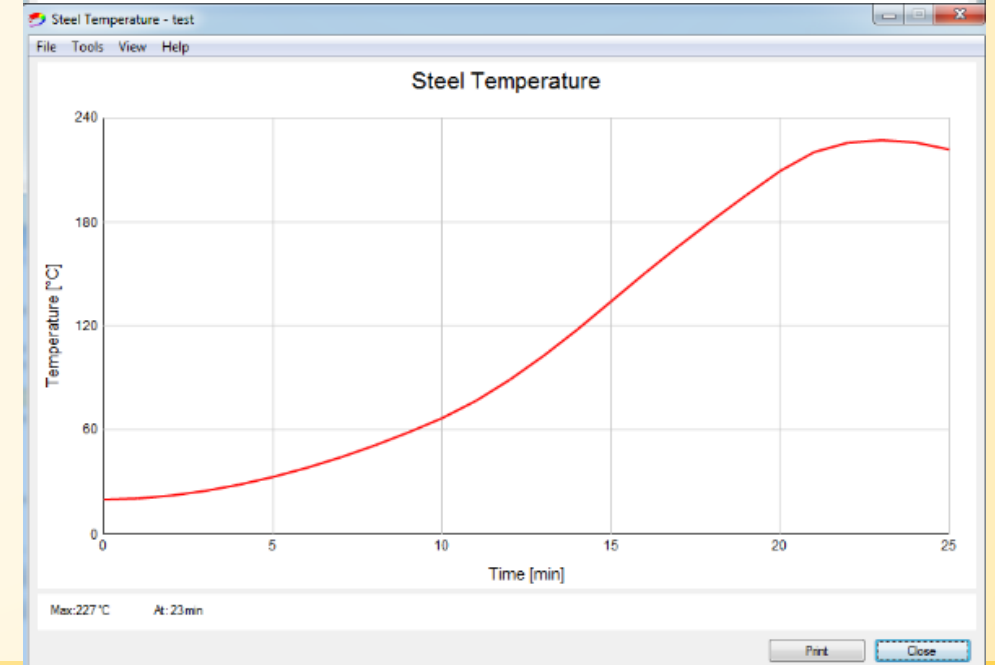
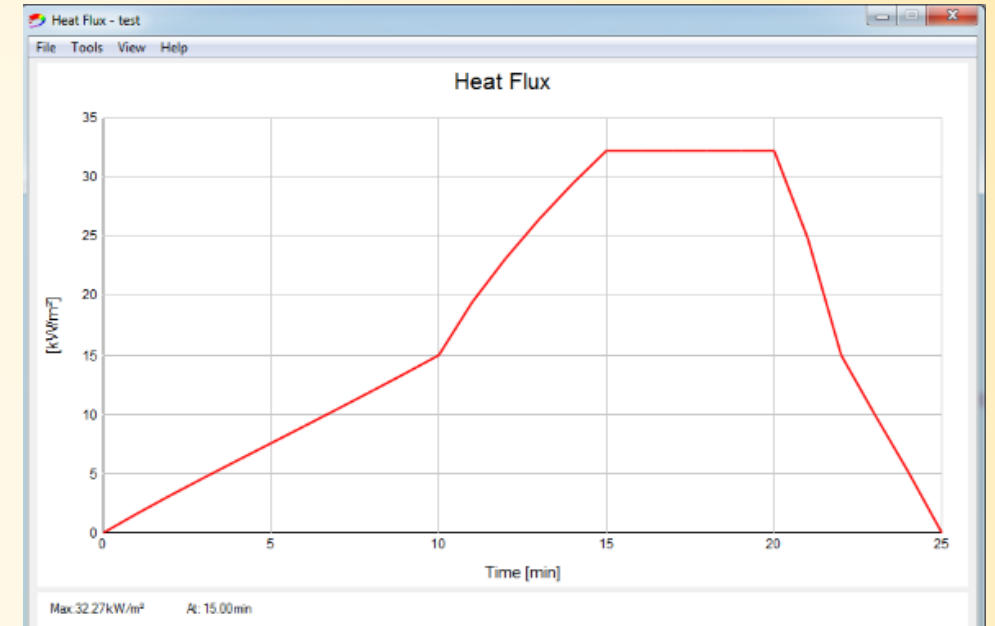
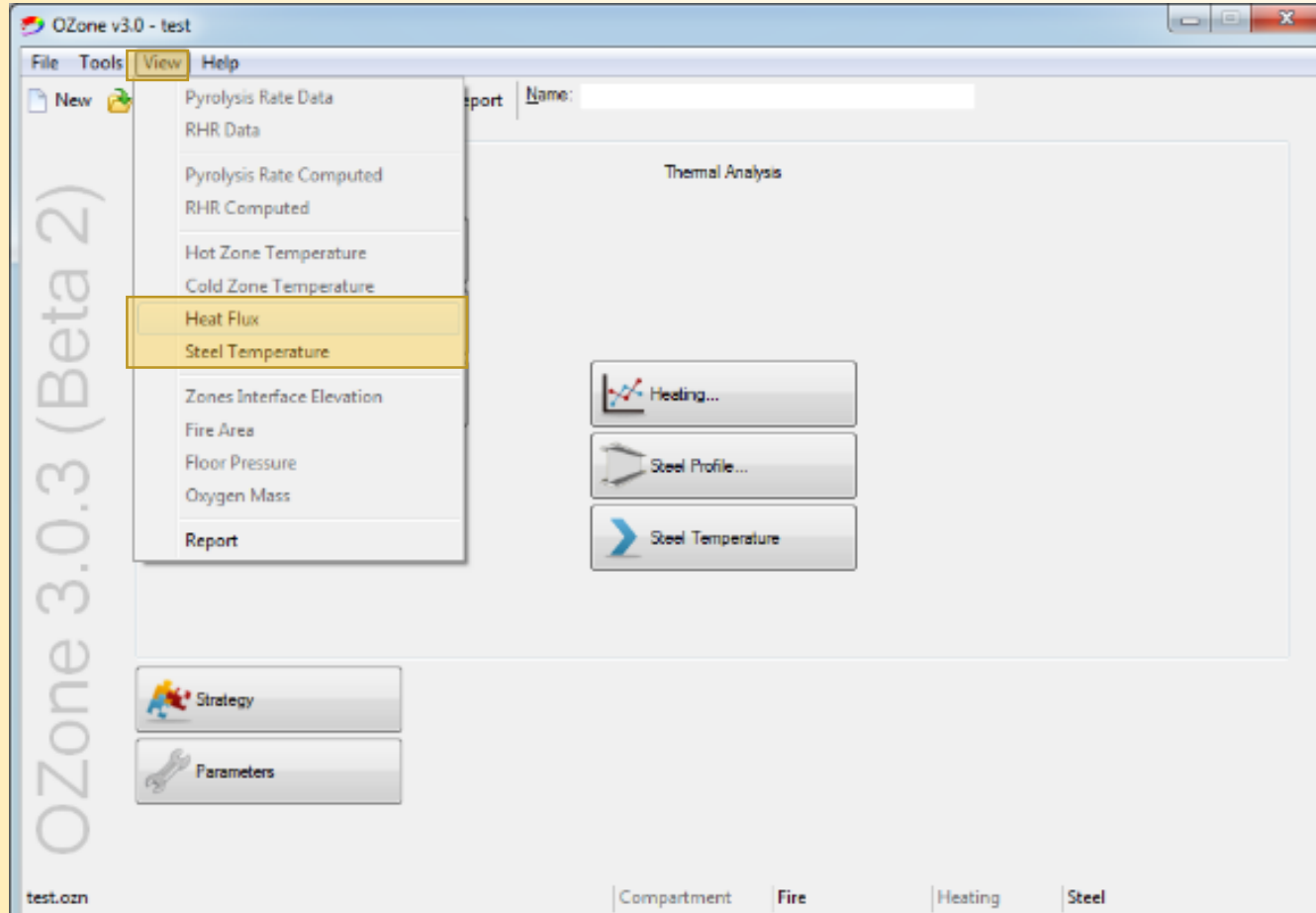
ISO 853 Fire Curve

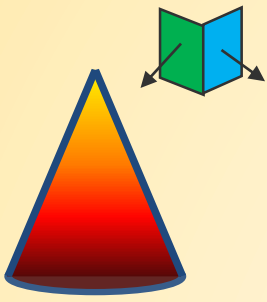
ASTM E119 Fire Curve

Hydrocarbon Fire Curve



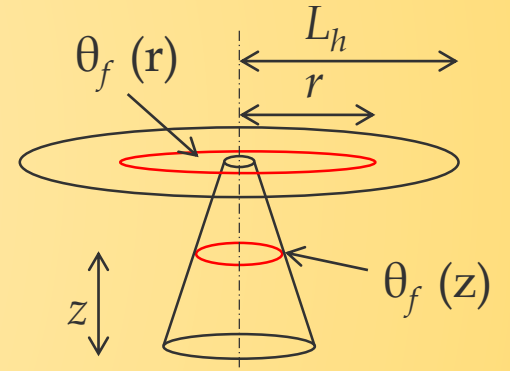
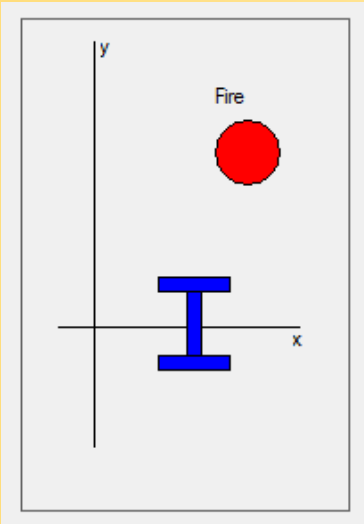
6. Výstupy





DĚKUJI ZA POZORNOST

Nikola Lišková



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DEPARTMENT OF STEEL AND
TIMBER STRUCTURES

Softwary pro podrobnější výpočet

MKP

Pokud je potřeba přesnějšího výpočtu, lze použít MKP modelování pomocí softwarů, jako např. SAFIR®, ABAQUS nebo ANSYS®.

Výhody těchto výpočtů jsou:

- přesnější tvar kužele pro aproximaci virtuálního plamene,
- skutečný tvar sloupu, včetně zastínění,
- samostatný výpočet součinitele radiace pro jednotlivé povrchy,
- v průřezu lze uvažovat s nerovnoměrným ohřátím,
- lze spojit teplotní a mechanický výpočet a uvažovat s teplotní deformací sloupu.

