



LOCAFI+

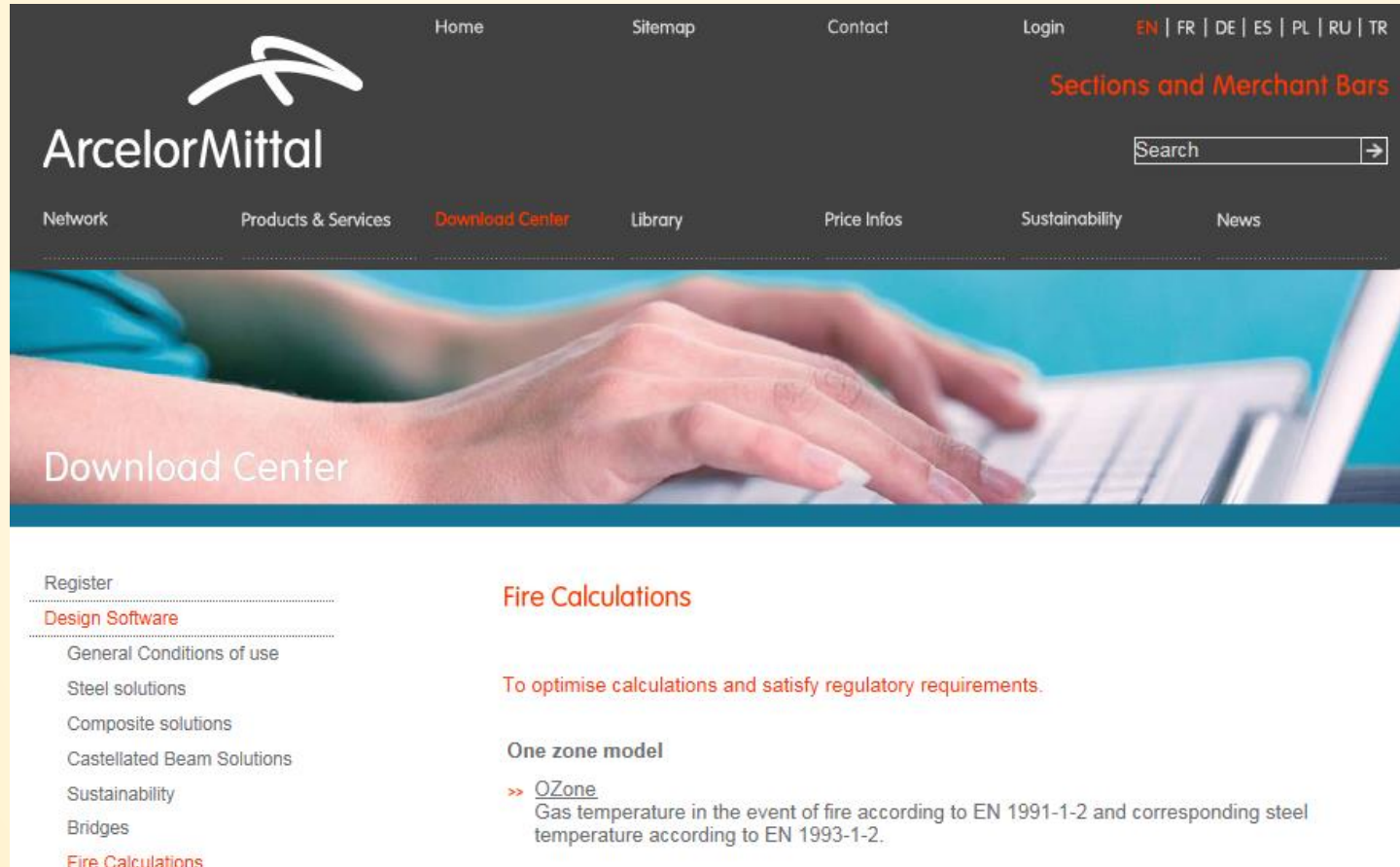
Temperature assessment of a vertical member subjected to LOCAIised FIre Dissemination

Grant Agreement n° 754072

5. Programa de cálculo automático

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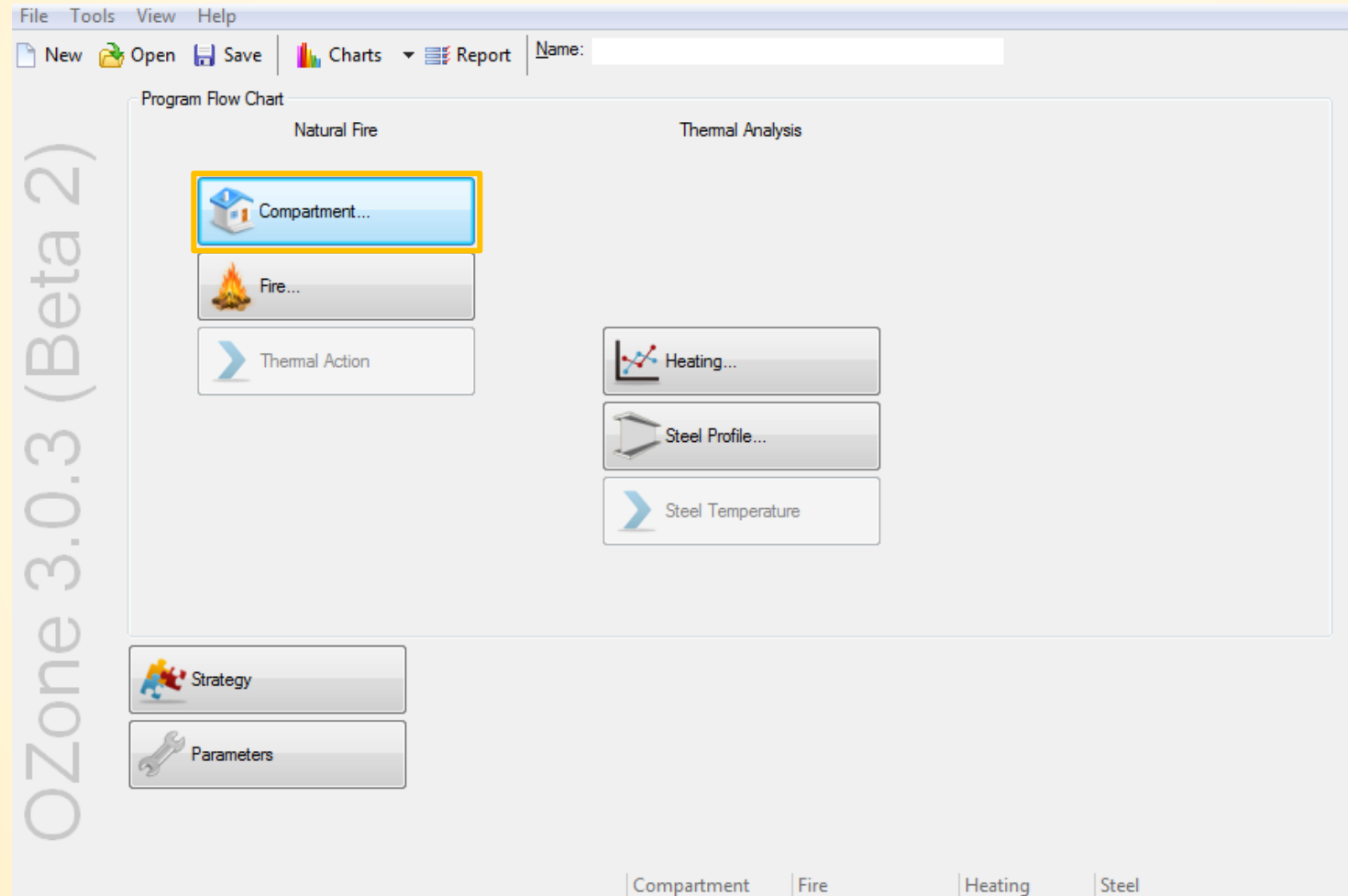
5.1. OZone Compartimento



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

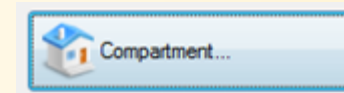
5. Programa de cálculo automático

5.1. OZone Compartimento



5. Programa de cálculo automático

5.1. OZone Compartimento



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: Define

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

Copy

☐ Copy Openings

Defined Walls:

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

Forced Ventilation

Smoke Extractors:

	Height m	Diameter m	Volume m³/sec	In/Out
Extractor 1				
Extractor 2				
Extractor 3				

OK Cancel

Geometria do
compartimento

Propriedades do
pavimento,
paredes e teto

Ventilação
forçada
(se existir)

5. Programa de cálculo automático

5.1. OZone Compartimento

File Tools View Help

Wall Length: 13 m


	Material	Thickness	Unit mass	Conductivity	Specific Heat	Rel Emissivity	Rel Emissivity
		cm	kg/m³	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

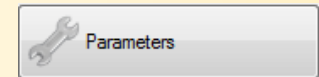


Outside

	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

Propriedades
das camadas
para cada
parede

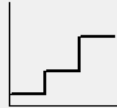


Aberturas

Temperature Dependent Openings

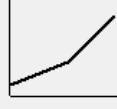
Temperature Dependent: 400 °C

Stepwise Variation



Temperature °C	% of Total Openings
20	10
400	50
500	100

Linear Variation



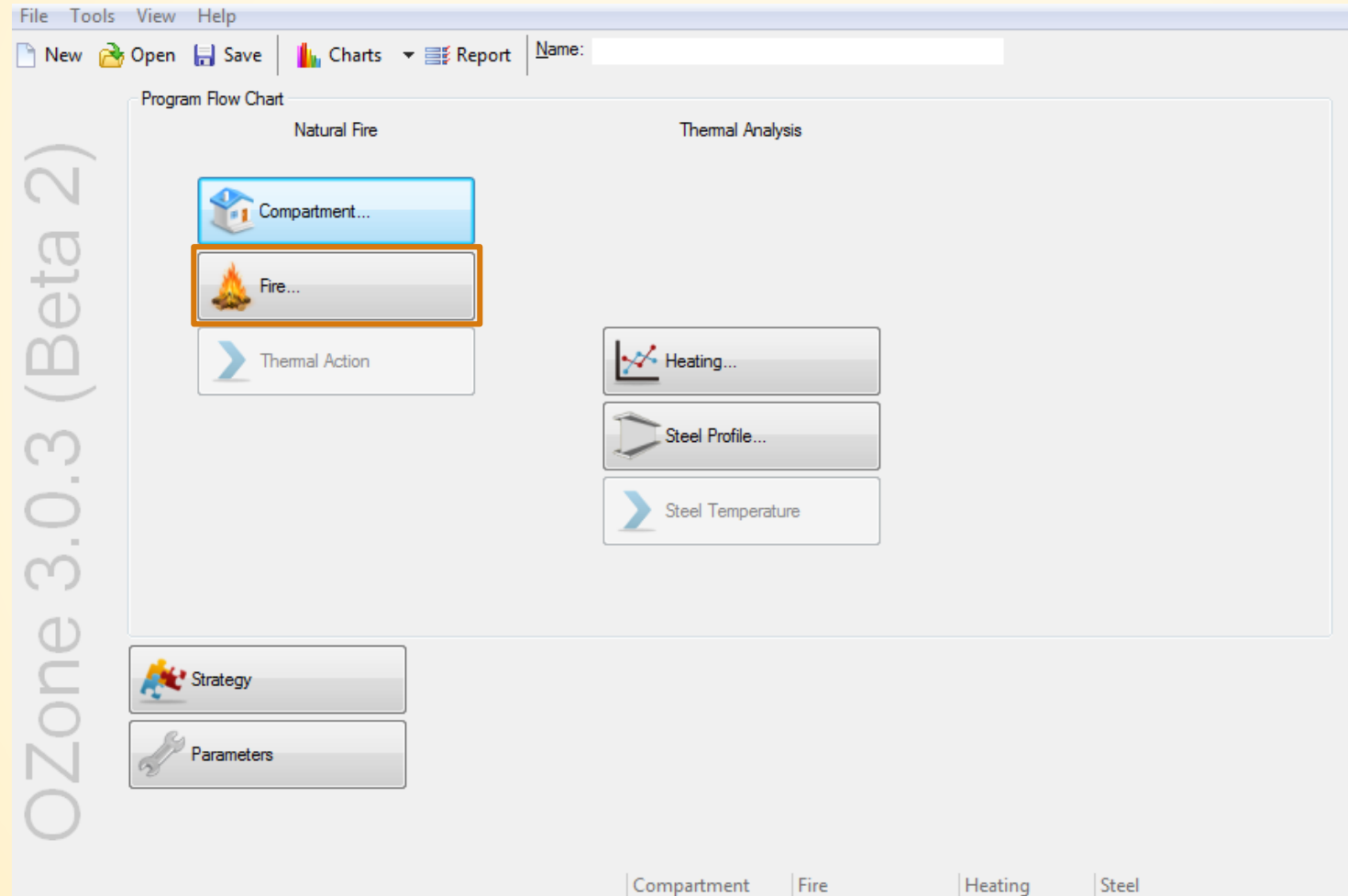
Temperature °C	% of Total Openings
20	10
400	50
500	100

Time Dependent Openings

Time sec	% of Total Openings
0	5
1200	100

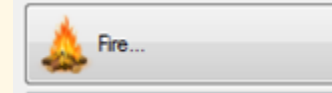
5. Programa de cálculo automático

5.1. OZone Compartimento



5. Programa de cálculo automático

5.1. OZone Compartimento



Fire

File Tools View Help

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

Localised Fire: ☐ Localised Fire

National Annex:

Occupancy	Fire Growth Rate	RHRf	Fire Load $q_{f,k}$	Danger of Fire Activation
		[kW/m ²]	80% Fractile MJ/m ²	
School	Medium	250	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 $\delta_{n,9}=1$

☒ Fire Fighting Devices $\delta_{n,10}=1$

☒ 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: $\prod \delta_{n,i}=1$

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

Combustion

Combustion Efficiency Factor:

Combustion Model:

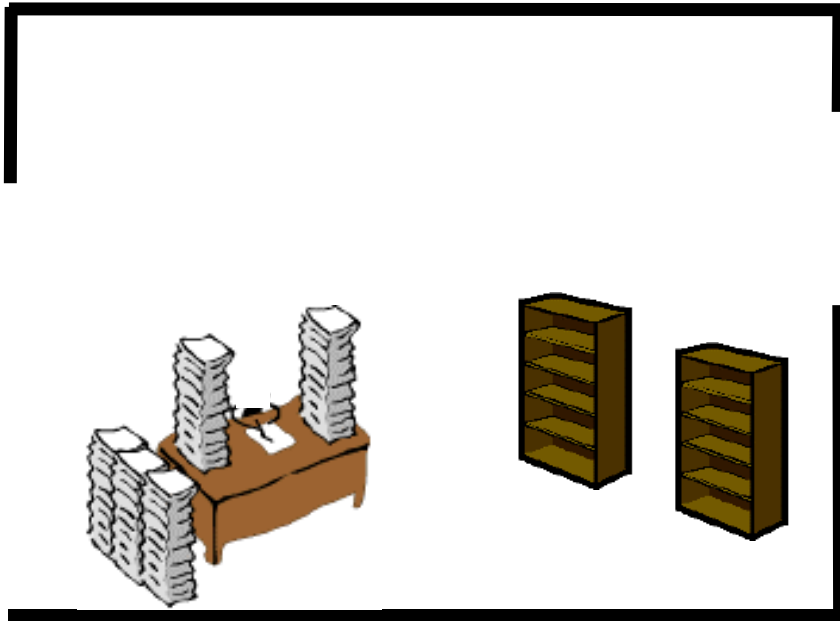
Stoichiometric Coefficient:

OK Cancel

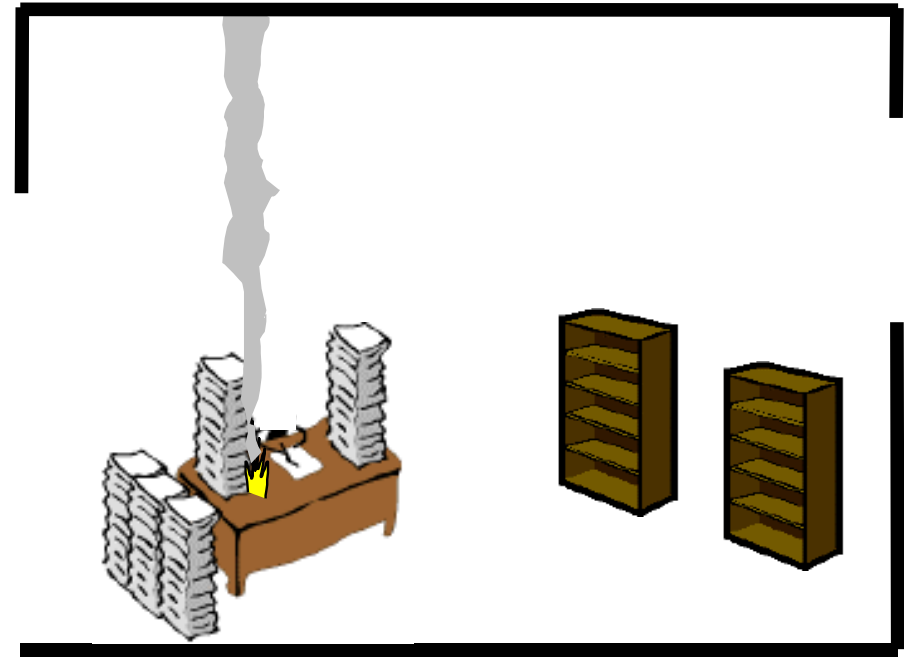
5. Programa de cálculo automático

5.1. OZone Compartimento

Antes do incêndio



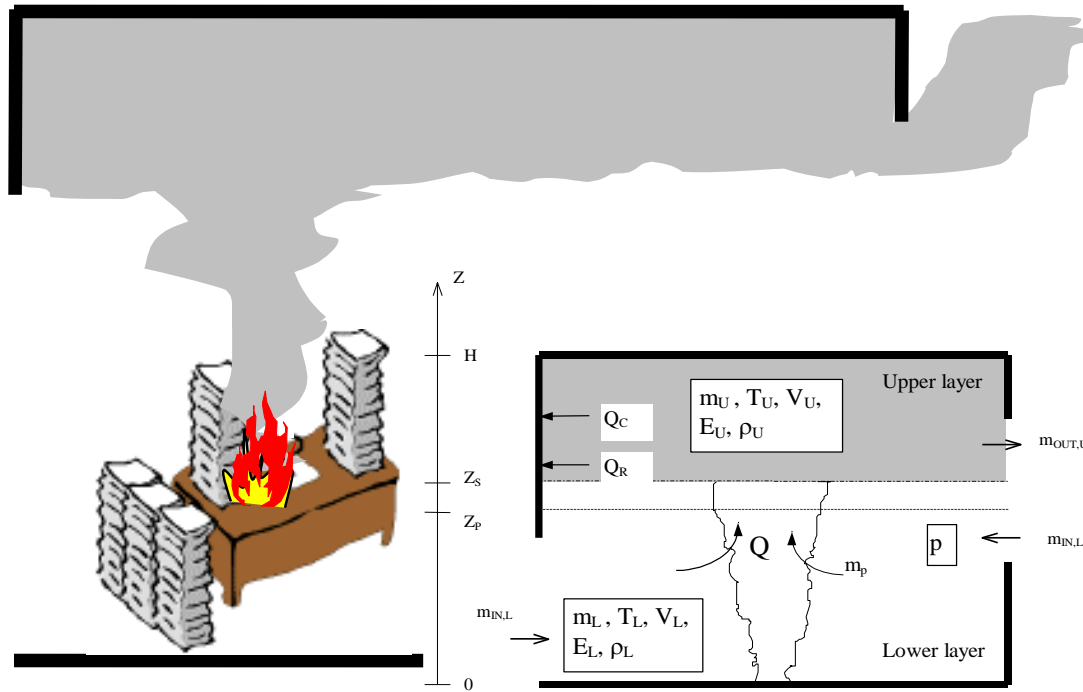
Ignição



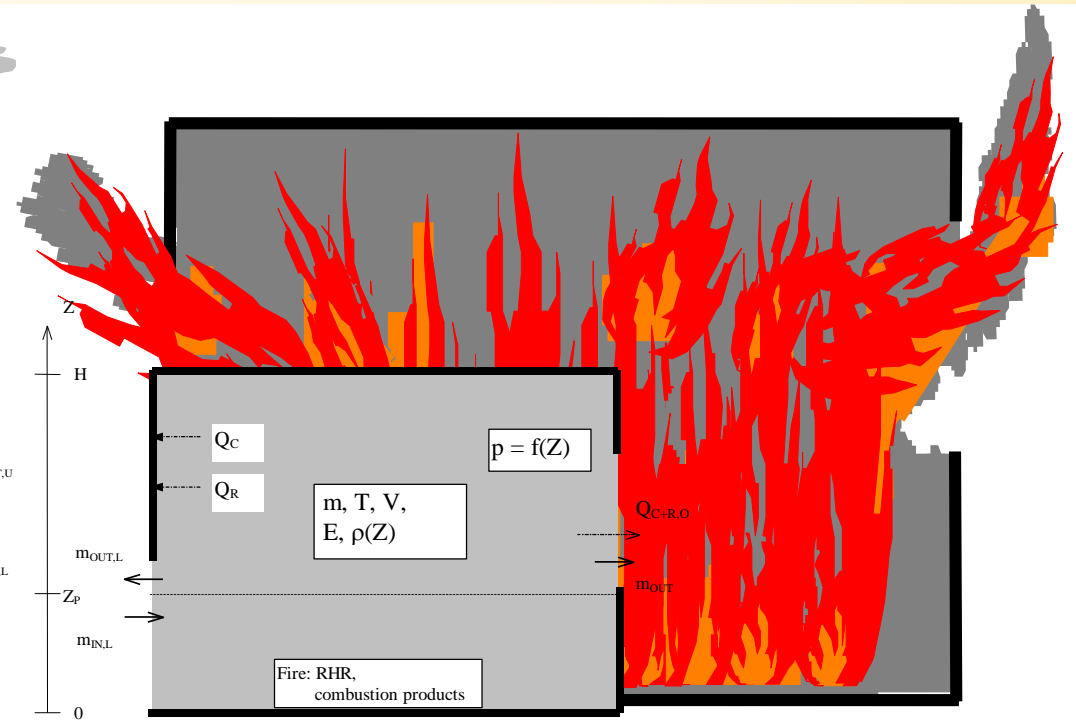
5. Programa de cálculo automático

5.1. OZone Compartimento

Incêndio localizado

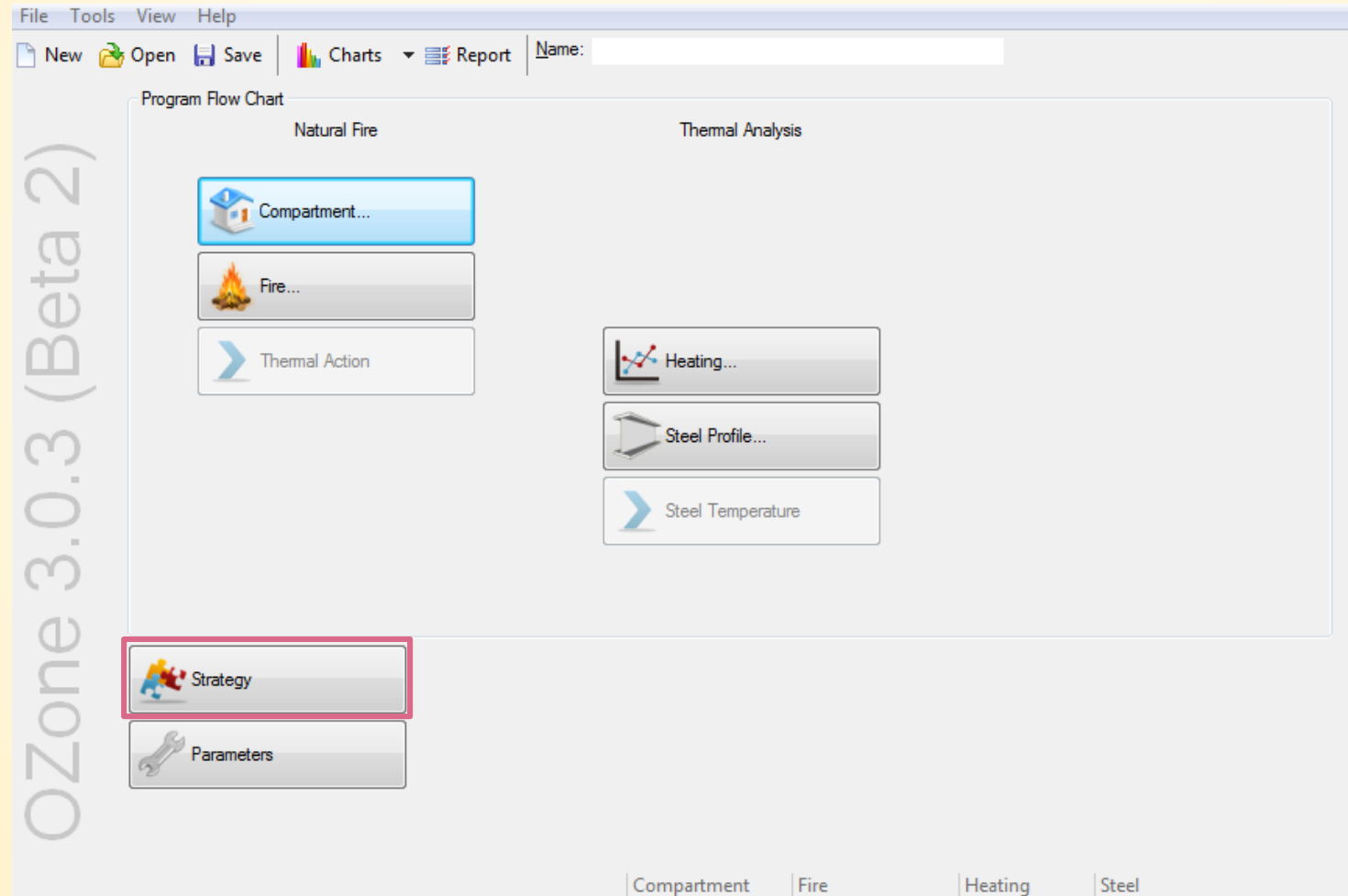


Incêndio totalmente desenvolvido



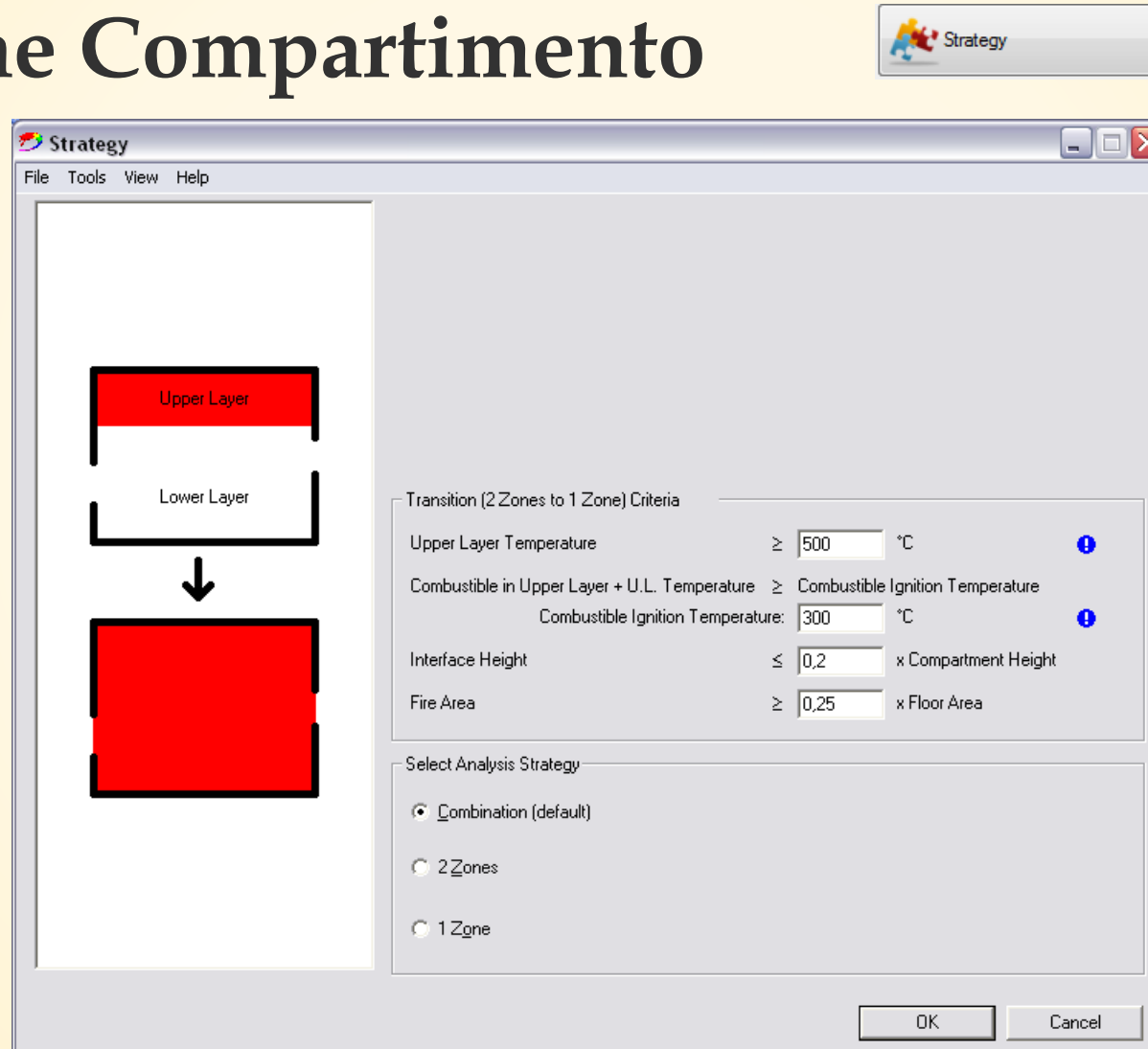
5. Programa de cálculo automático

5.1. OZone Compartimento



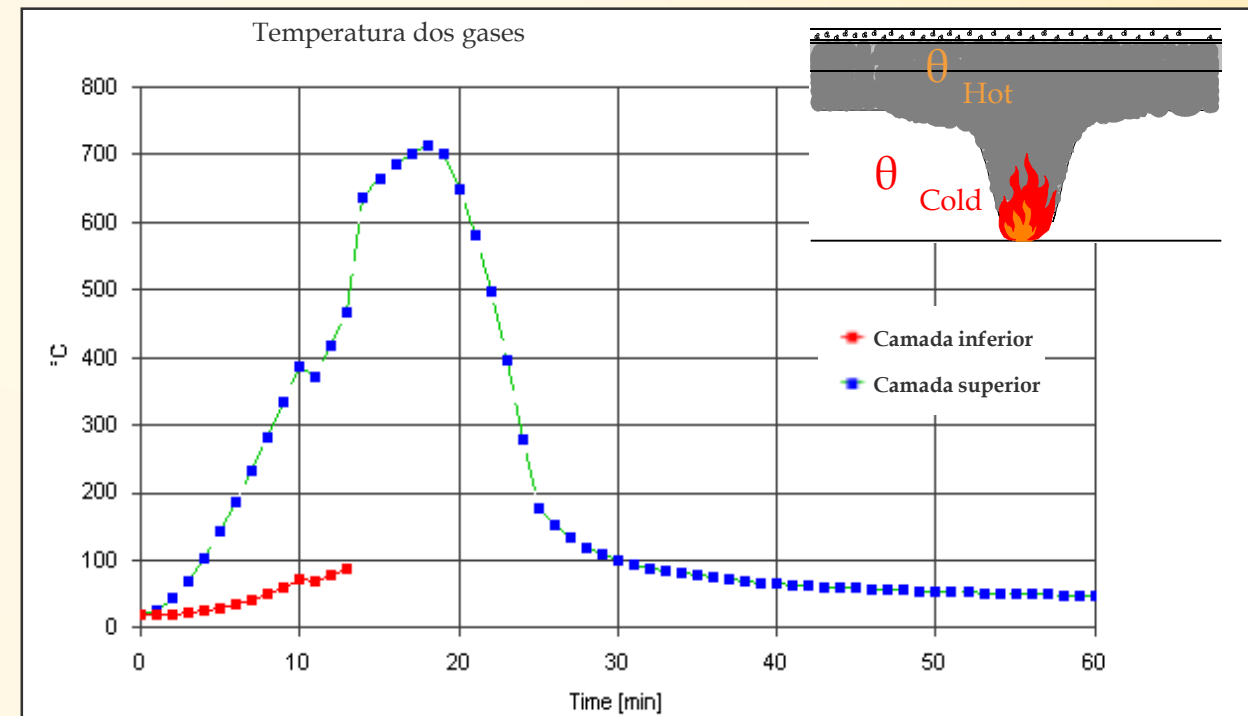
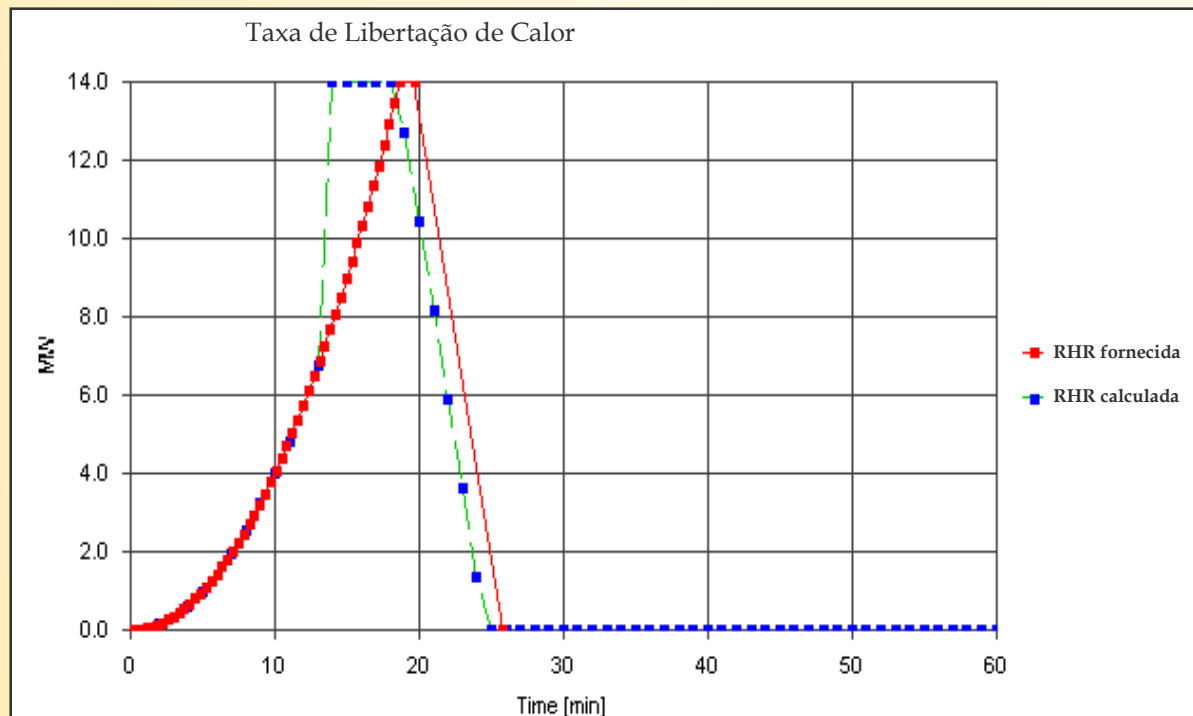
5. Programa de cálculo automático

5.1. OZone Compartimento



5. Programa de cálculo automático

5.1. OZone Compartimento



Após 13 minutos, a temperatura da camada superior atinge os 500°C → Passando de 2 zonas para 1 zona

5. Programa de cálculo automático

5.1. OZone Compartimento

The screenshot shows the 'Fire' software interface. The 'Compartment Fire' section has the 'User Defined Fire' radio button selected and highlighted with an orange box. The 'Localised Fire' section has the 'Localised Fire' radio button selected. A table with 5 columns (Point, Time, RHR, mf, Fire Area) and 23 rows is visible. The right panel contains configuration options for 'Data Points', 'Fire Info', 'User Defined Fire Columns', and 'Combustion'.

File Tools View Help

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

Localised Fire: ☐ Localised Fire

Point	Time sec	RHR MW	mf kg/s	Fire Area 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				

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

Data Points

Save... Load...

Fire Info

Max Fire Area: m²

Fire Elevation: 0 m

Fuel Height: 0 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

5. Programa de cálculo automático

5.2. OZone Incêndio Localizado

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	3	2.5	1.25
Fire 2			
Fire 3			
Fire 4			
Fire 5			

Diâmetro e posição do incêndio(s) localizado

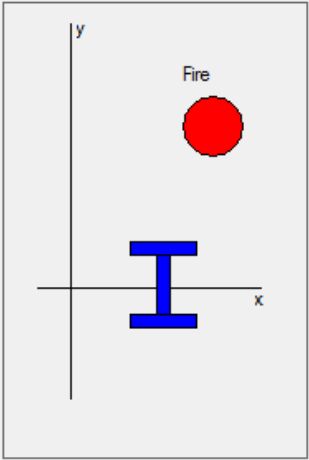
Geometrical Data

Ceiling Height: 3.5 m

Distance on Axis (x): 0 m

Height on Axis (z): 3.4 m

O alvo (coluna,...) é sempre no eixo y = 0. É recomendável localizá-lo em x = 0



	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		

OK Cancel

Evolução da RHR

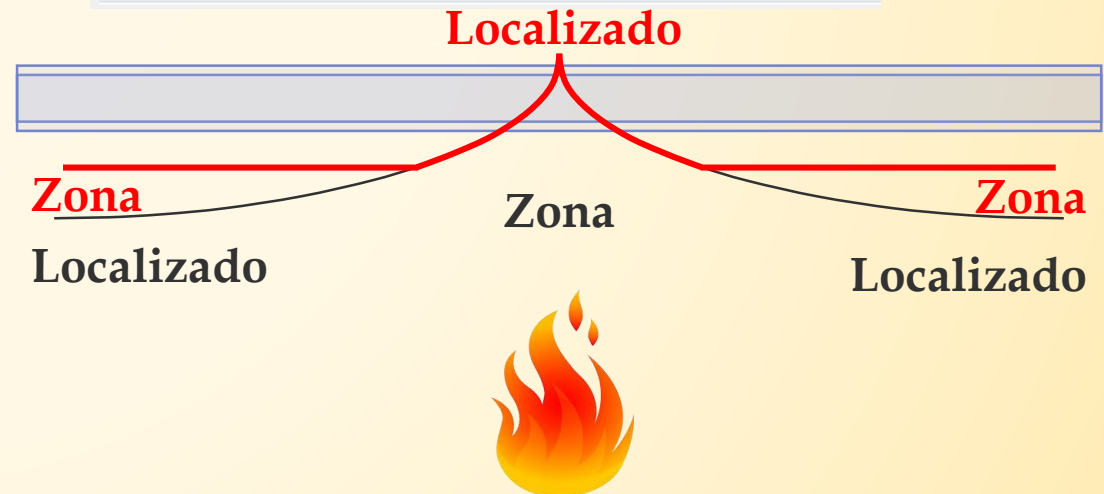
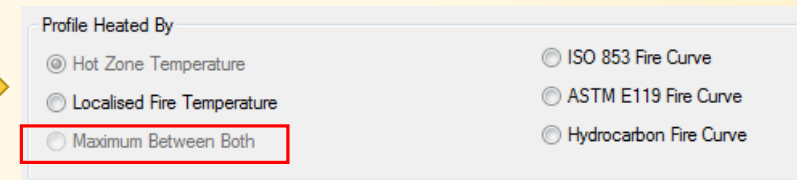
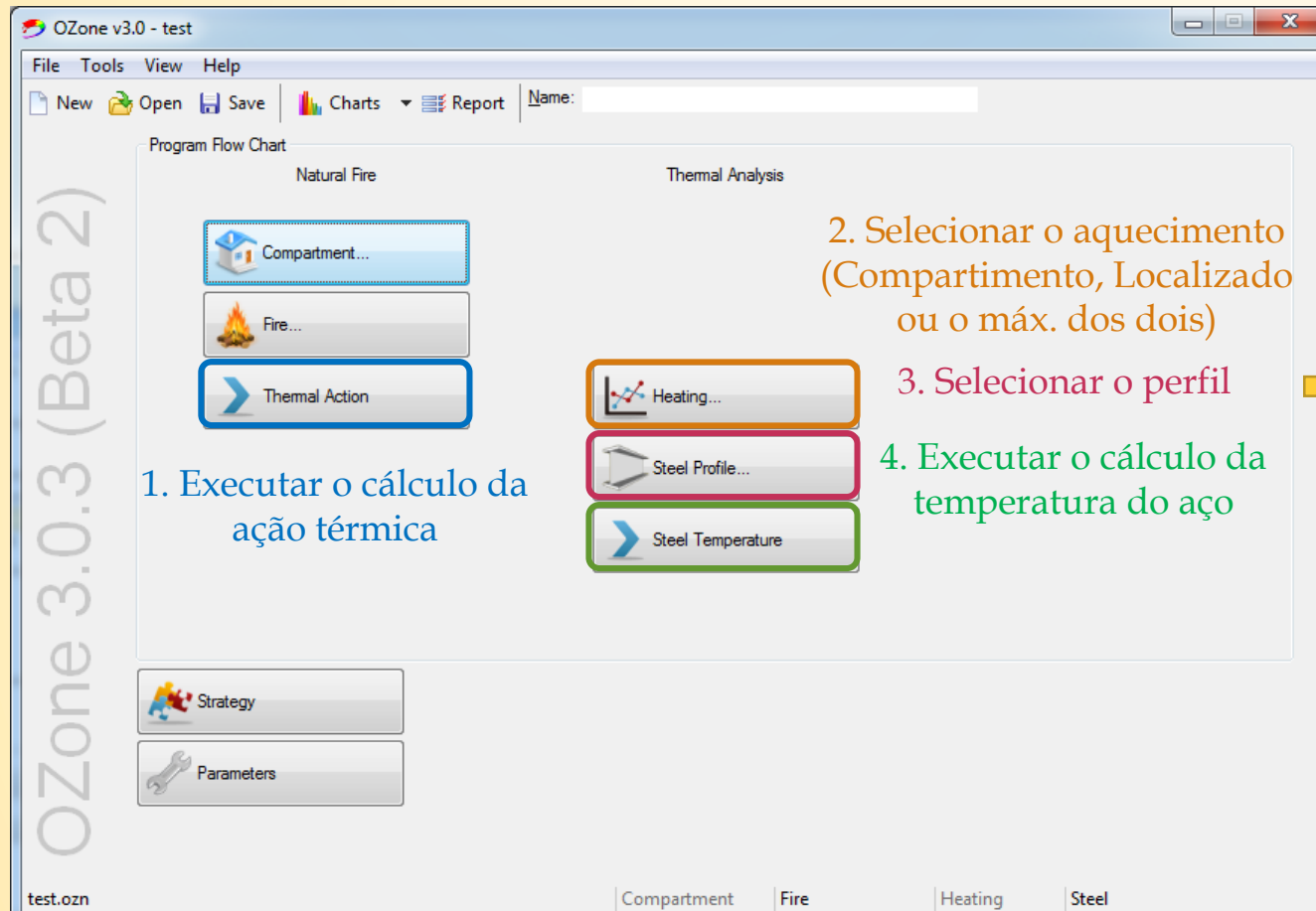
5. Programa de cálculo automático

5.2. OZone Incêndio Localizado

NP EN 1991-1-2:2010 § 3.3.2 (4)

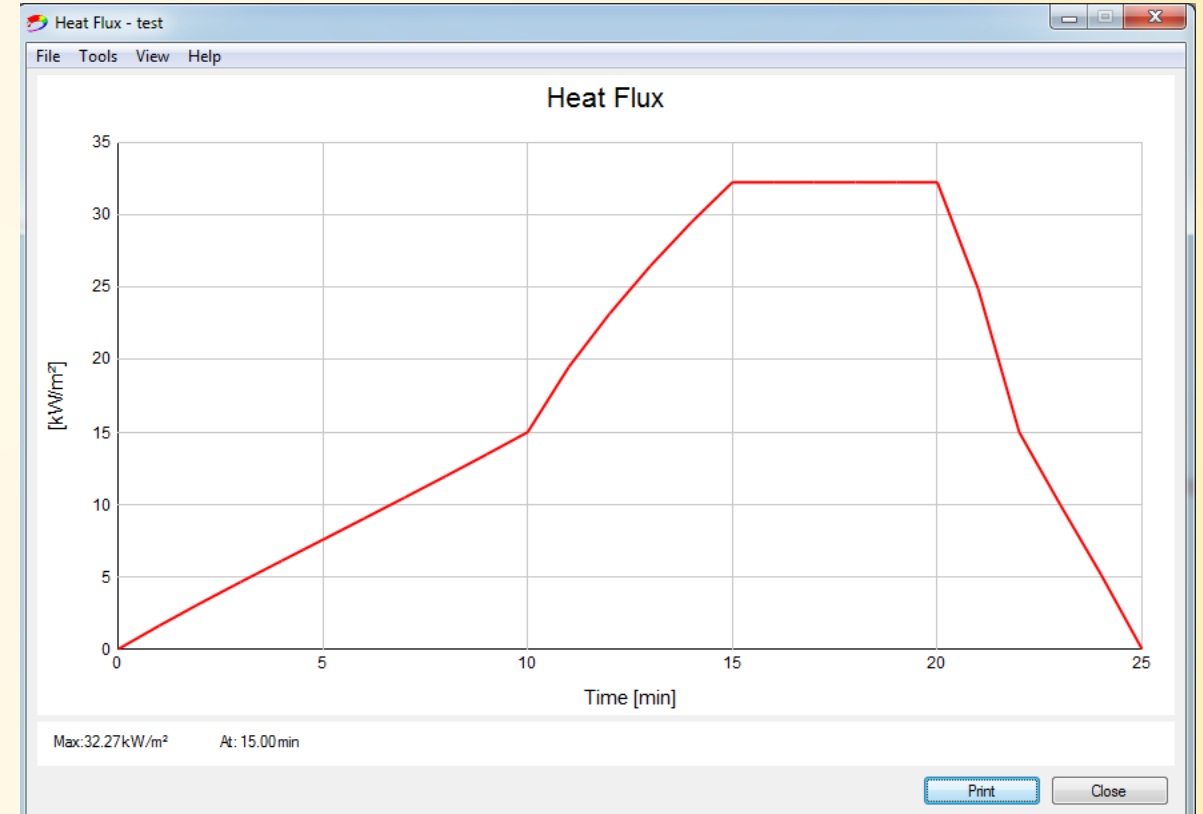
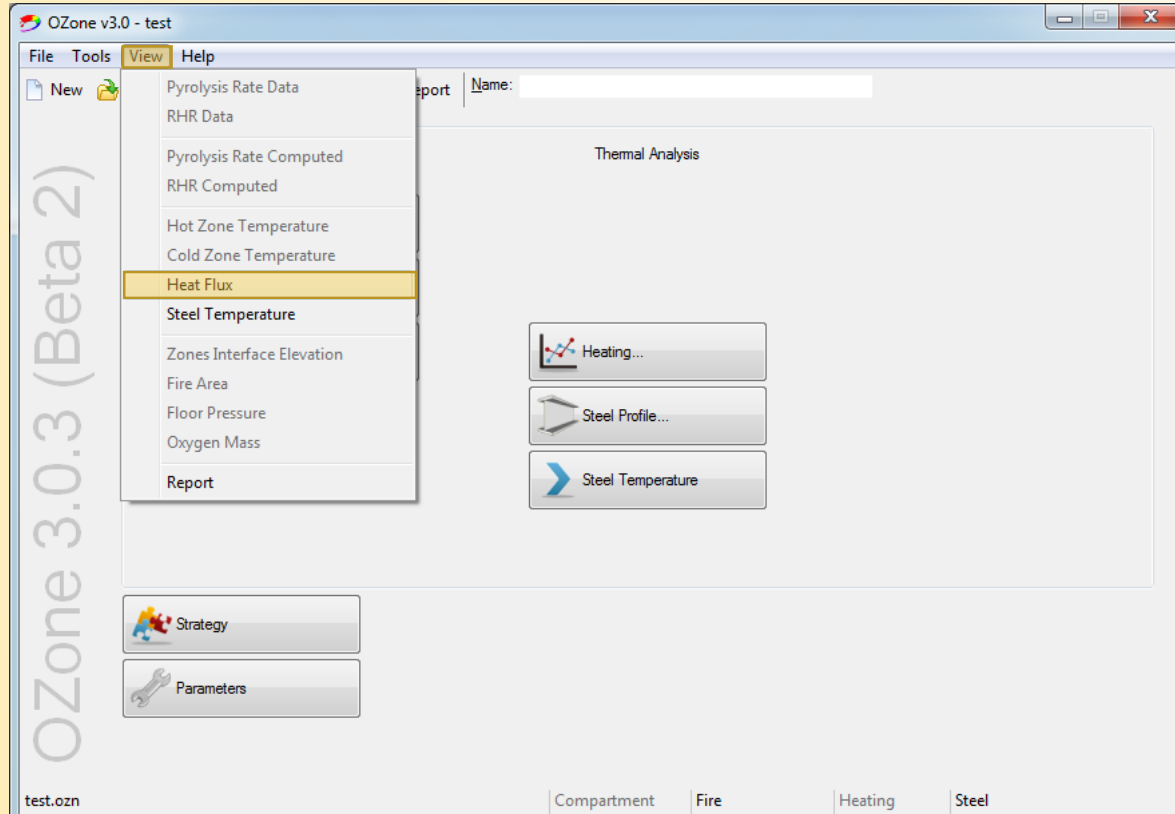
Para calcular mais corretamente a distribuição de temperatura ao longo de um elemento, no caso de um incêndio localizado, deve ser considerada uma abordagem que combine os resultados obtidos com um modelo de duas zonas e um incêndio localizado.

NOTA: O campo de temperatura no elemento pode ser obtido considerando o máximo efeito em cada localização dada pelos dois modelos de incêndio.



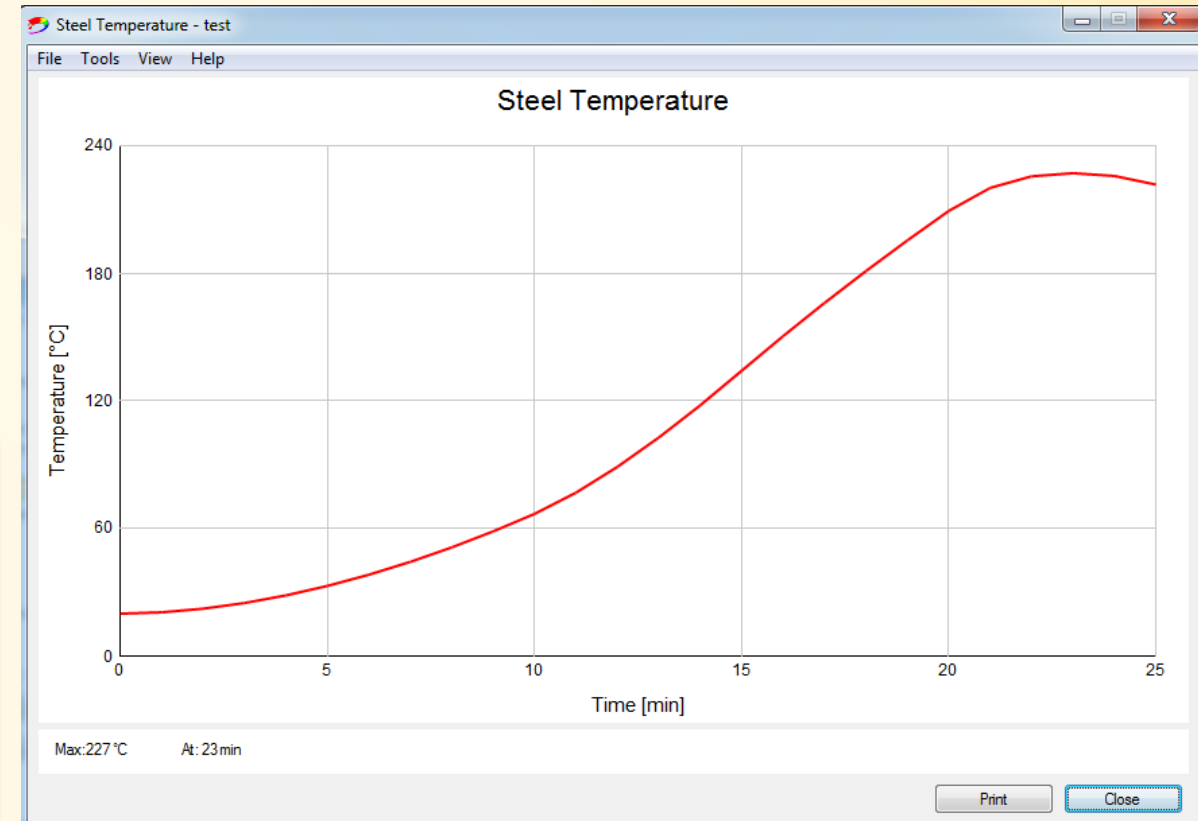
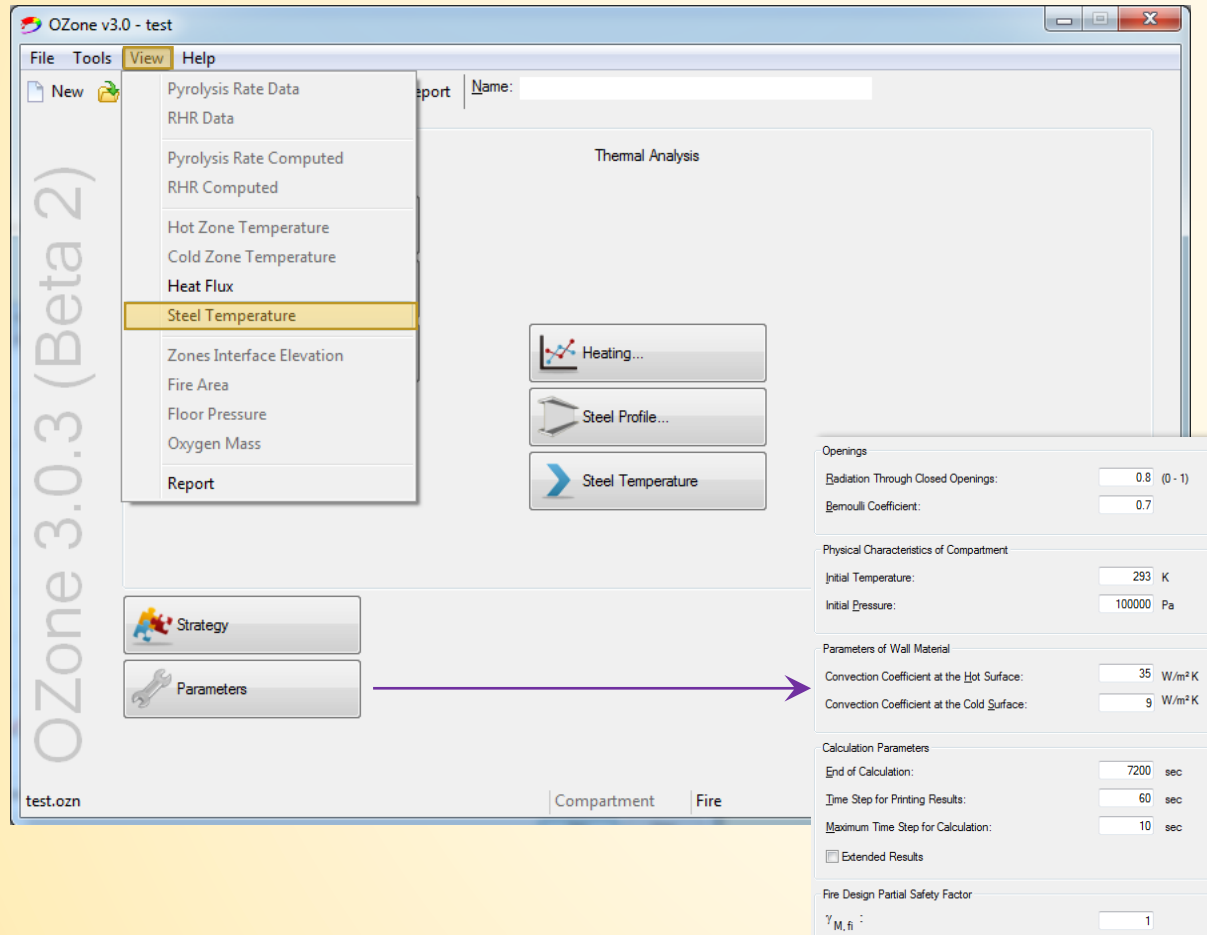
5. Programa de cálculo automático

5.2. OZone Incêndio Localizado



5. Programa de cálculo automático

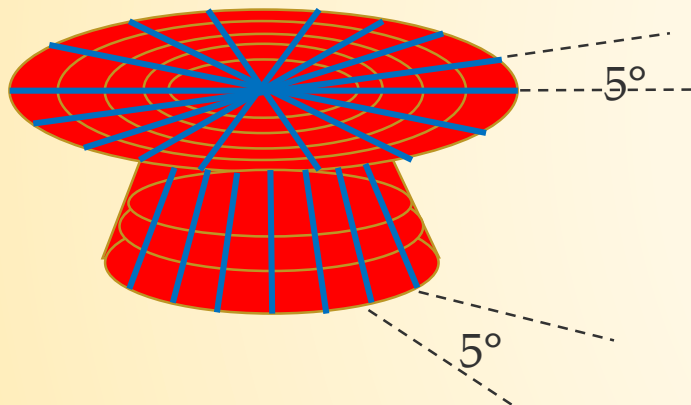
5.2. OZone Incêndio Localizado



5. Programa de cálculo automático

5.3. SAFIR Incêndio Localizado

Chama cilíndrica
(tocando o teto)



- O método geométrico foi implementado no SAFIR (troca direta de calor entre superfícies finitas).
- Isto gera uma **distribuição não uniforme de temperatura** nas secções analisadas.
- Cada incêndio é descrito pela posição (x, y, z), forma (cilíndrica ou cônica), posição vertical do teto, evolução do diâmetro no tempo, evolução da RHR no tempo.
- No caso de vários incêndios, os efeitos são somados e limitados a 100 kW/m^2 .

Franssen, J.-M., & Gernay, T. (2017). Modeling structures in fire with SAFIR®: Theoretical background and capabilities. Journal of Structural Fire Engineering, 8(3), 300-323.

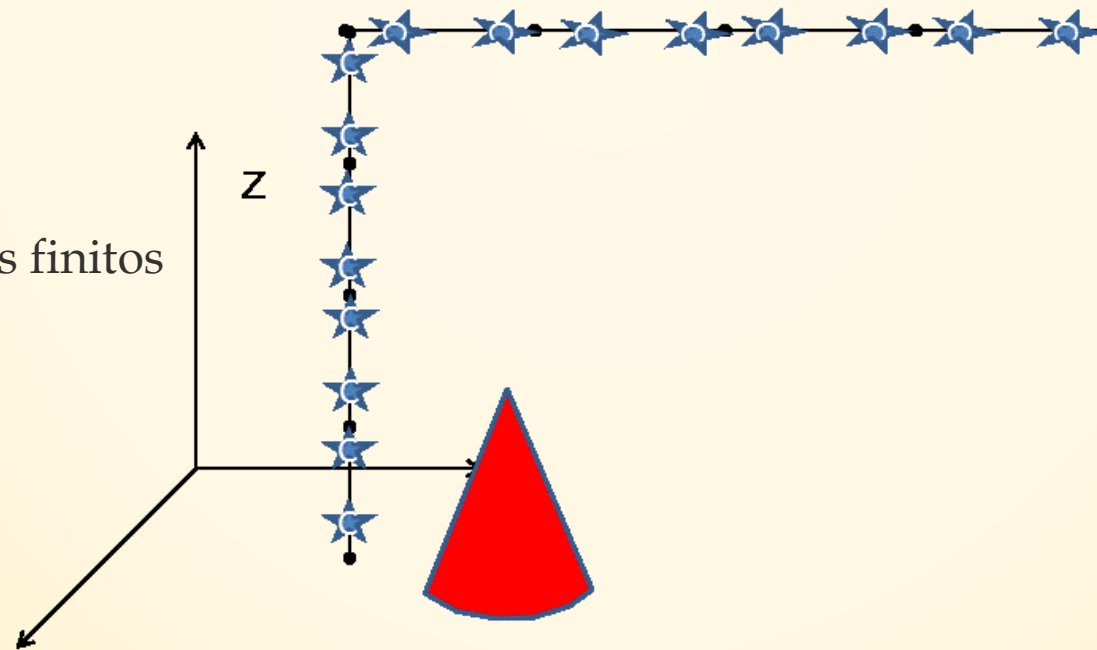
5. Programa de cálculo automático

5.3. SAFIR Incêndio Localizado

- Uma análise térmica 2D é realizada em cada ponto de Gauss de cada elemento finito de barra (ou casca).

Esta coluna tem 4 elementos finitos => 8 pontos de Gauss

Esta coluna tem 4 elementos finitos
=> 8 pontos de Gauss



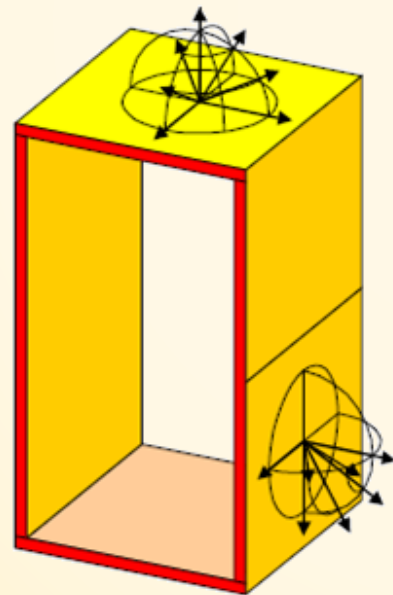
Esta coluna não é aquecida

5. Programa de cálculo automático

5.3. SAFIR Incêndio Localizado

- Numa secção côncava, o efeito de sombra é automaticamente considerado se a secção estiver fora do incêndio.

Forma convexa



Forma côncava

