



NOVENCO HVAC LAND

HI-PRES HVAC MARINE

FIRE FIGHTING

SERVICE & PARTS

Modelling of car park fires

Jelle Agema



YORK Novenco

22/07/2015

Modelling of car park fires

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➤ **Contents:**

Car park ventilation systems

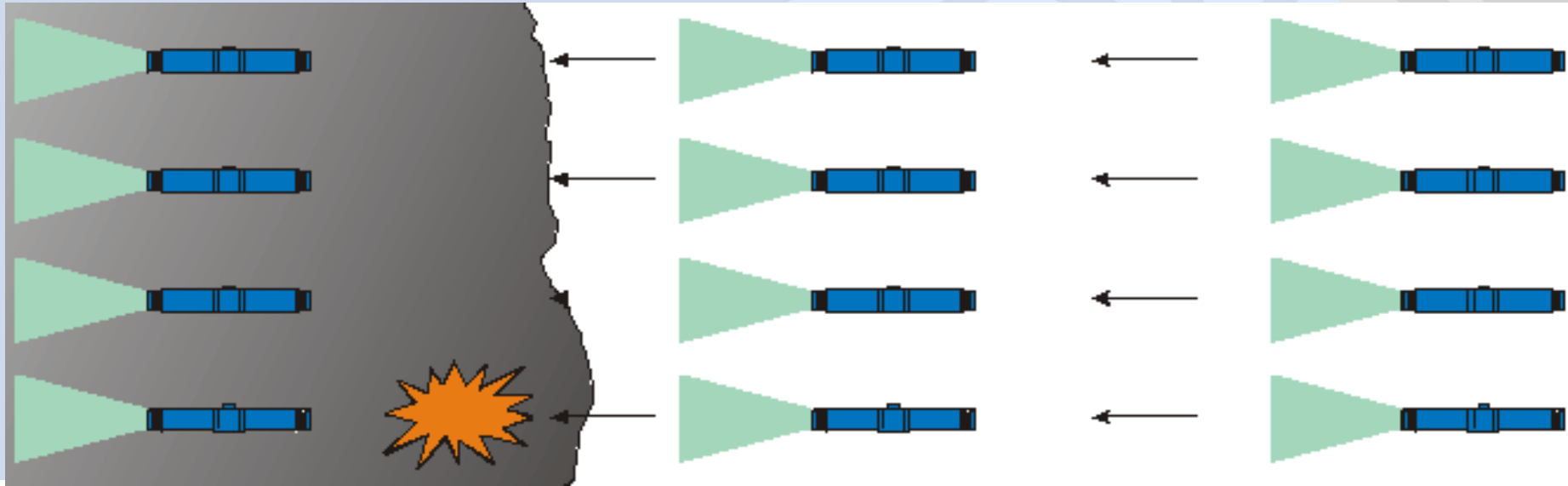
Parameters for the model

Results

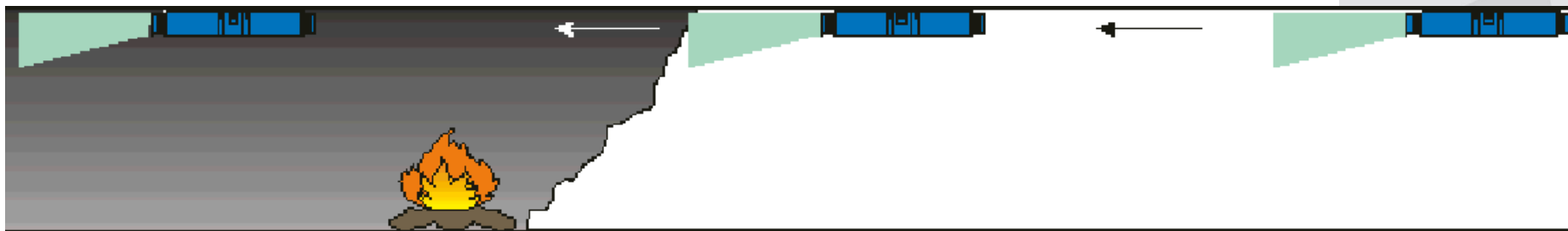


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Thrust ventilation



Top view



Side view

Jet fans



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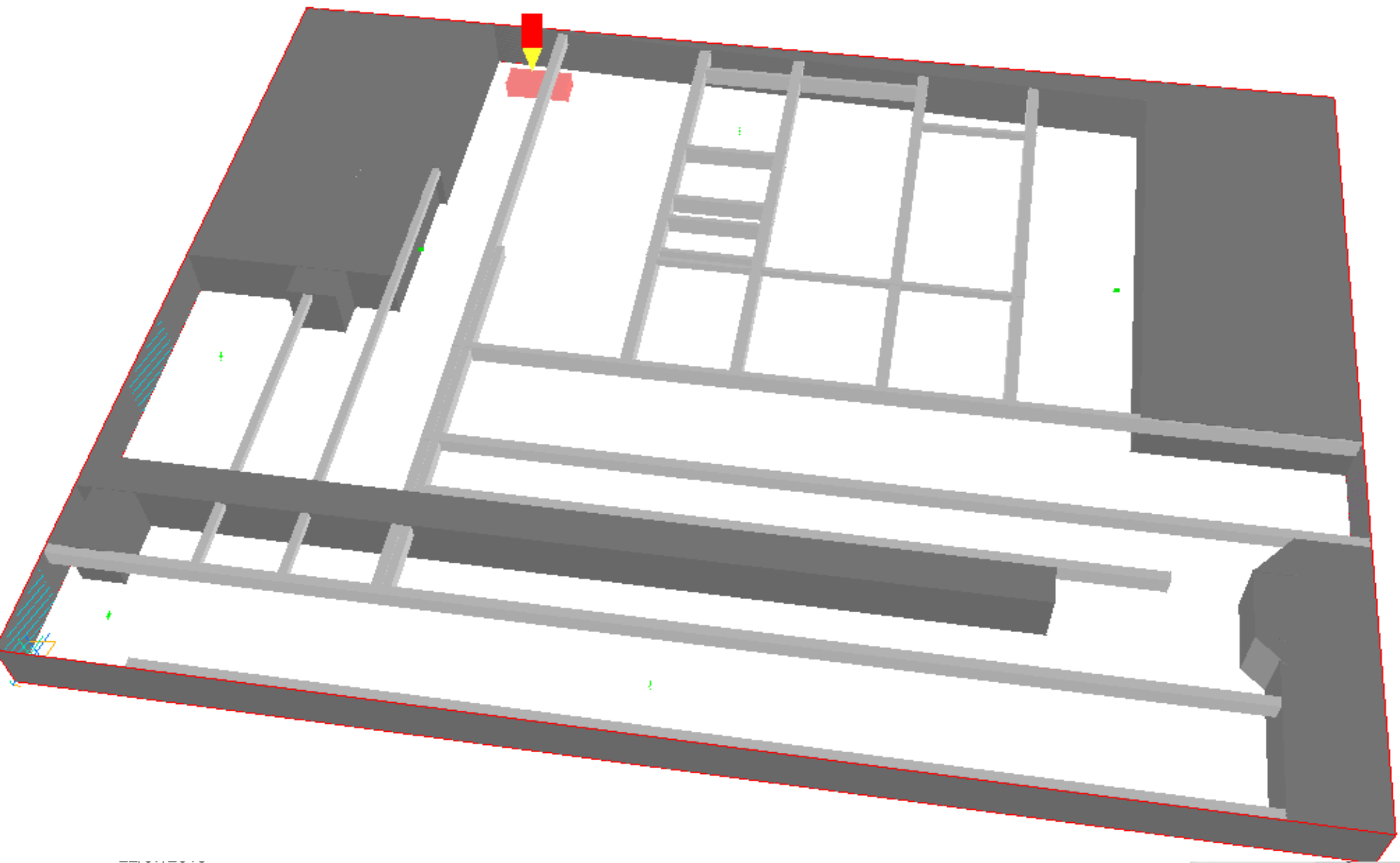
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Car fire

- Production of:
- Heat
- Mass
- Smoke
- Using InForm SOURCE statements

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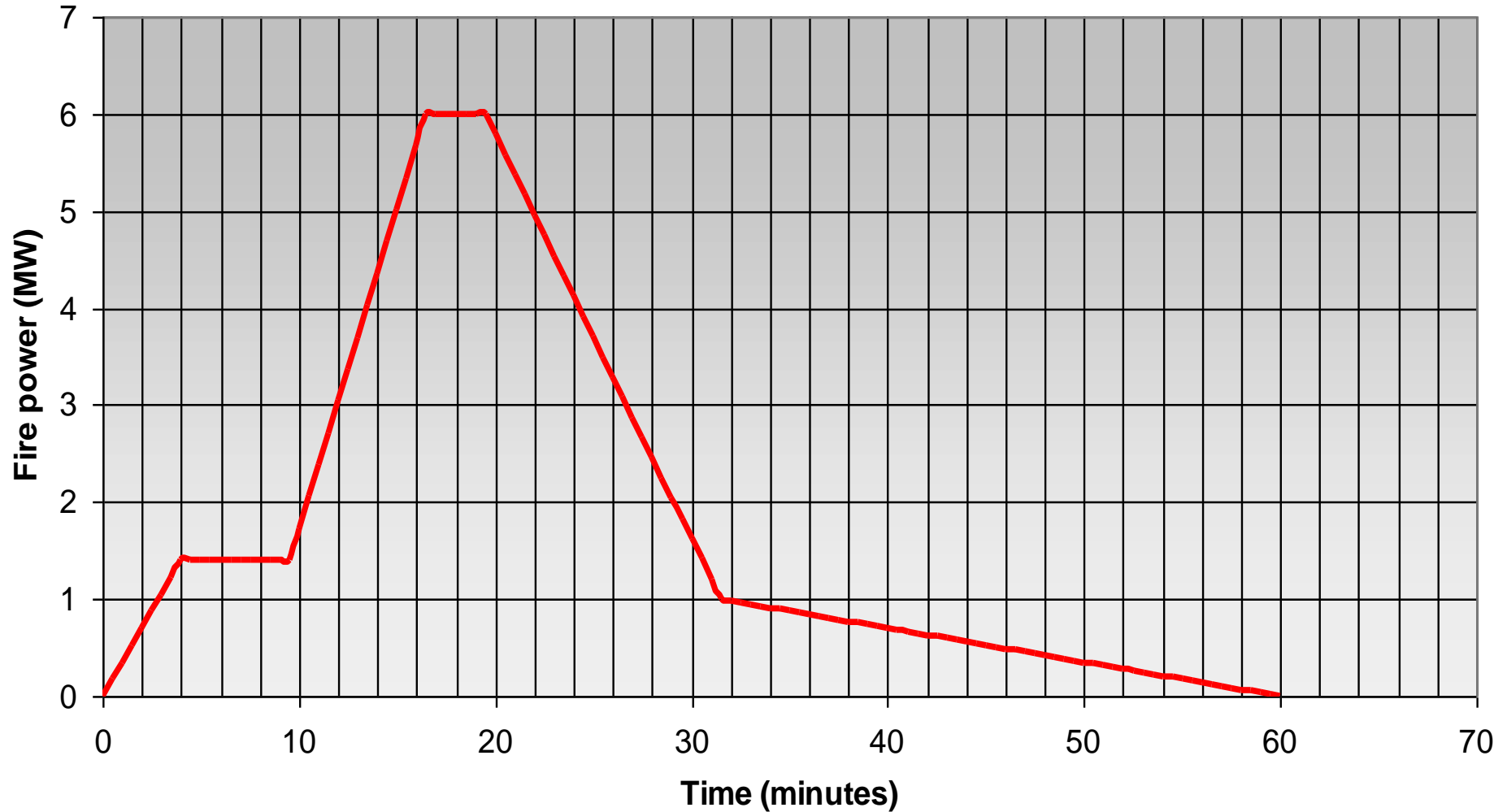
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Fire curve

TNO brandkromme (1 auto - 6 MW)



Use of the CFD's

Verification of the system for the fire brigade

Illustration of the functioning of the system to the customer

Optimisation of the system

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Requirements

Usually visibility of 30 meters 45 minutes after the fire has started

Possible additional requirements:

Sight length $>$ 30 meters in the direction of the fire

Acceptable temperatures for firemen

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For a worst case scenario

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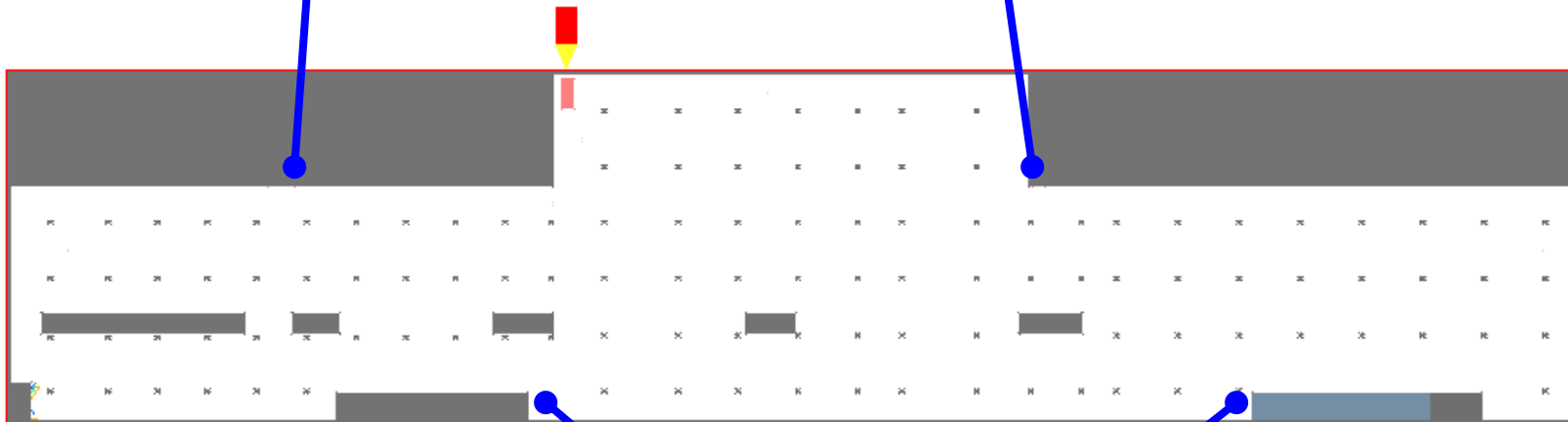
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inlet

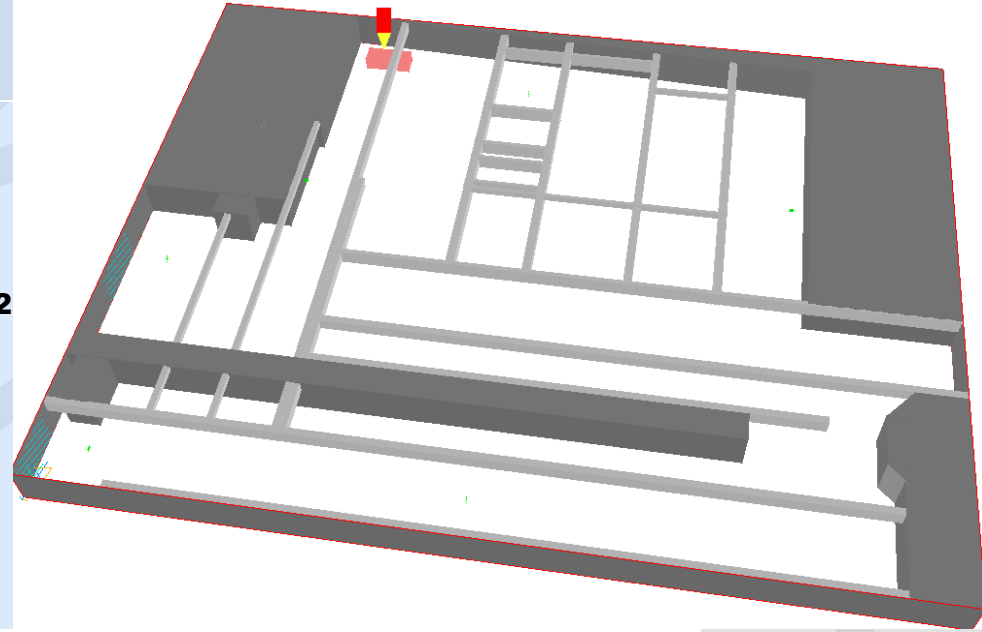
outlet



openings

Typical car park data

- **Area of 50 x 50 m² to 200 x 100 m²**
- **One or two openings (entrances)**
- **Exhaust**



Inlet

8 to 30 jet fans (+/- 20 m/s)

10 to 30 air changes per hour ($V_{\text{average}} = +/- 1.0 \text{ m/s}$)

Modelling (assumptions, parameters)

Phoenics Flair

Cartesian grid, +/- 250,000 cells

Usually +/- 150 iterations until convergence

Hybrid differencing

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Modelling (assumptions, parameters)

K-ε model, buoyancy modified (highly turbulent air flow and free air stream)

No radiation

Smoke production, according to: Smoke potential of $400 \text{ m}^{-1}/(\text{kg}/\text{m}^3)$

Jet fans using air speeds from measurements

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Validation

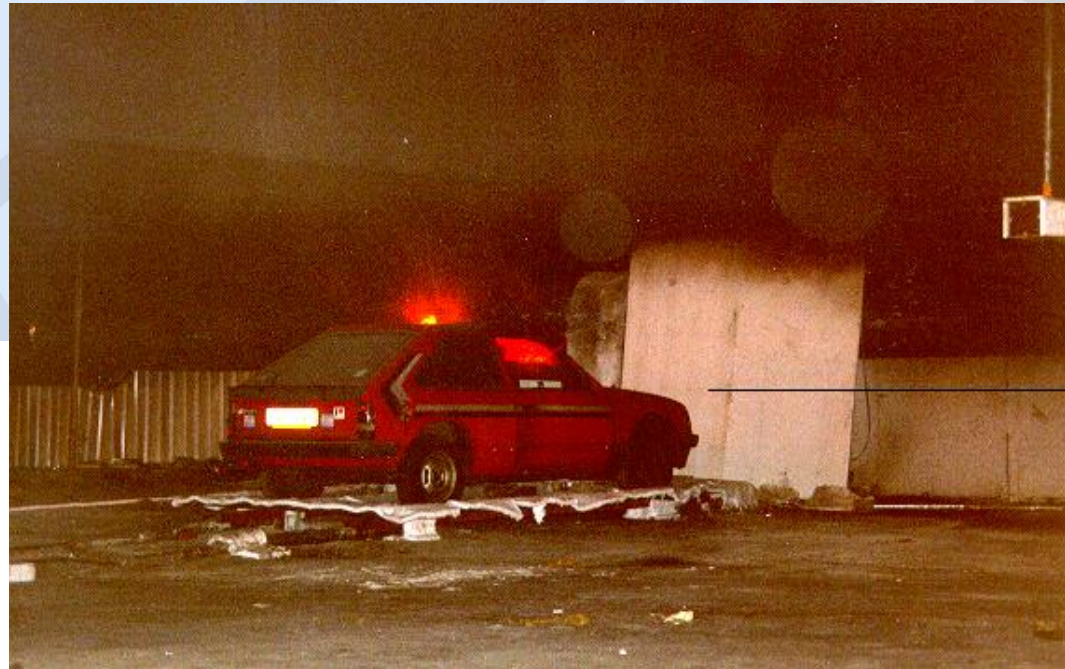
- Fire Tests TNO Delft 1998
Car Park Fleerde Amsterdam
- Other CFD's

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Results

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- **To view the animation for the sight length for light reflecting objects (SLR1, in meters), please open the presentation “Car park animation.ppt”, and start slide show.**

This is a top view just above eye height. In the dark blue areas the smoke is most dense.

Jet fans are located at various positions throughout the garage. Openings are shown in slide 10.

The red box is the car on fire.

Questions ?

Burning questions ?

Questions ?

Brandende vragen ?

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