



Cost-Effectiveness of safety measures in Multiple Use of Space

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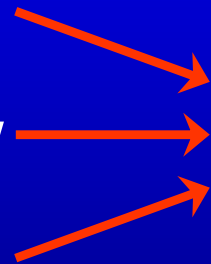
Introduction

Spatial Use in city centers:

Rising need of space

Awereness of spatial quality

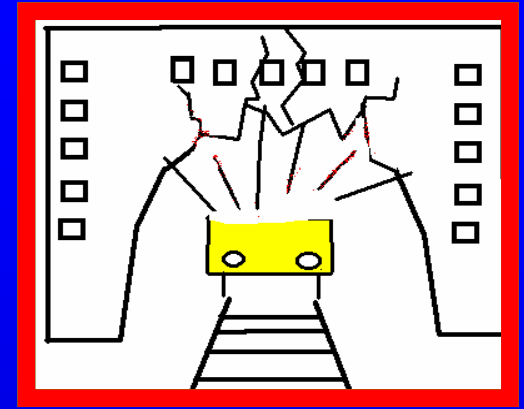
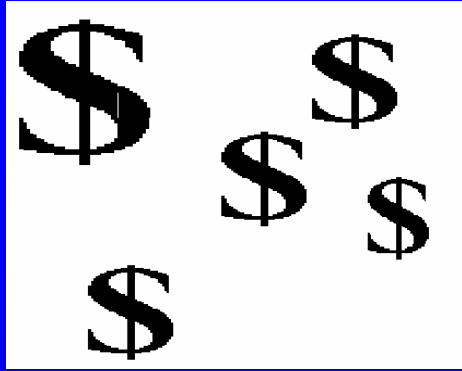
Growing welfare



**INTENSIFY
AVAILABLE SPACE**

Multiple Use of Land

An option for efficient use of space



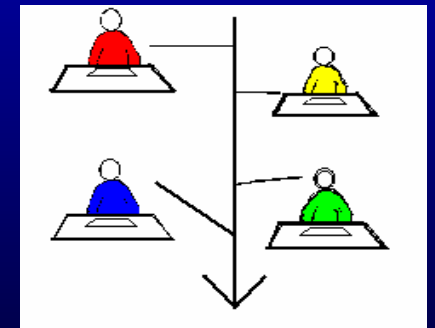
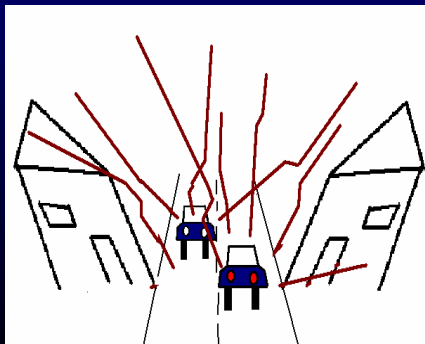
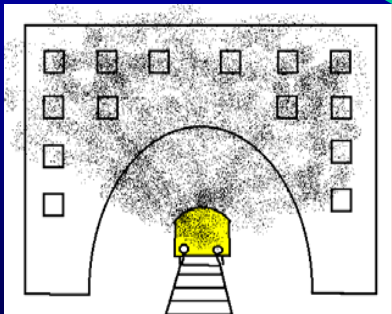
FINANCE

SAFETY

MULTIPLE USE OF LAND

ENGINEERING

ORGANISATION



Rijkswaterstaat NS
 VenW VROM Domeinen
 RWS Gemeente
 Brandweer Gemeent
 VROM NS EZ
 Gemeente Verkeer en Waterstaat

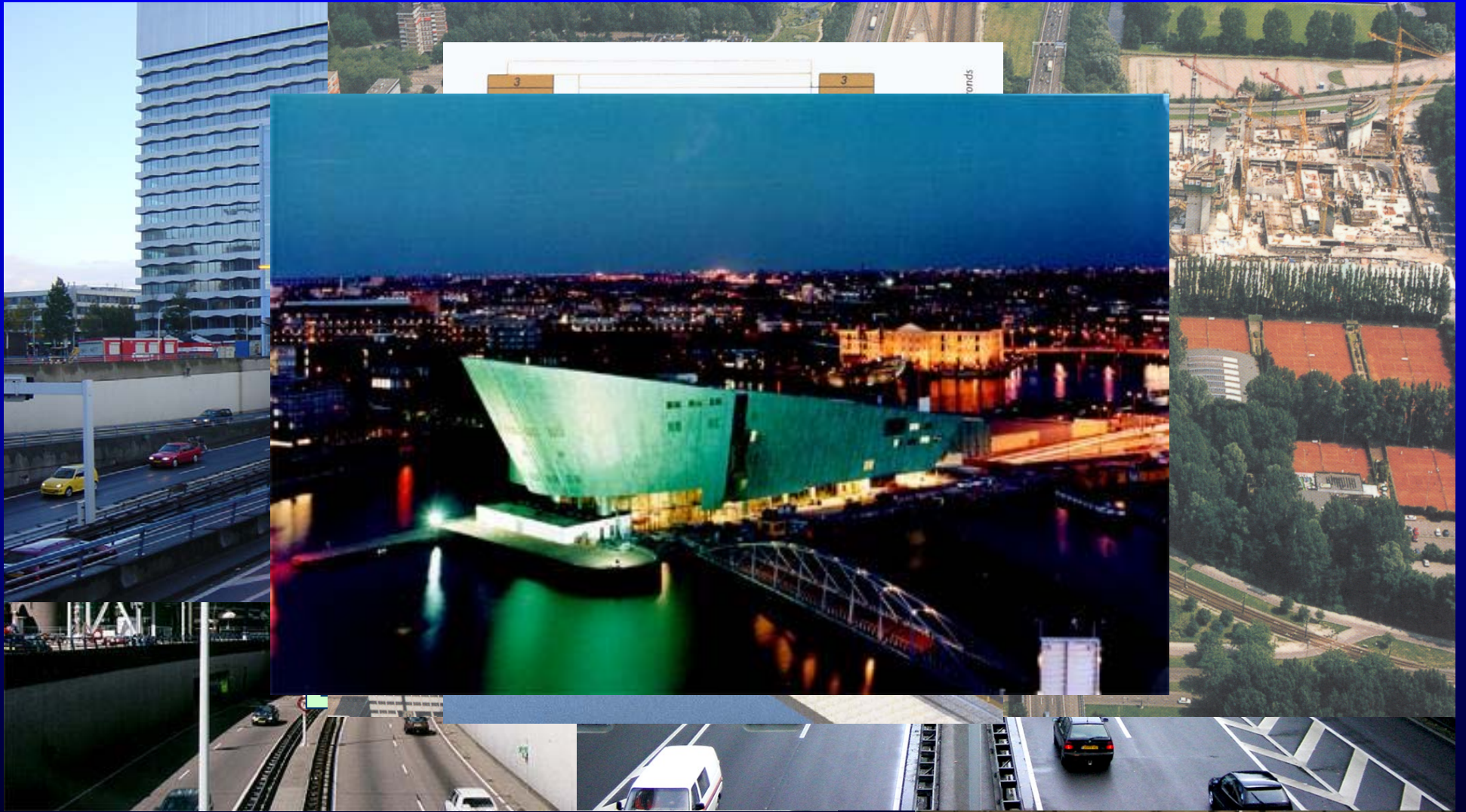
Multiple Use of Land *International*





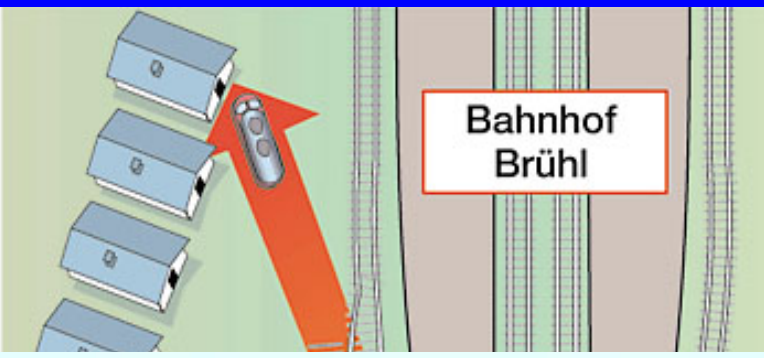
Gare Montparnasse, Paris

Multiple Use of Land in *The Netherlands*





Bos & Lommer, Amsterdam



(Un)safe



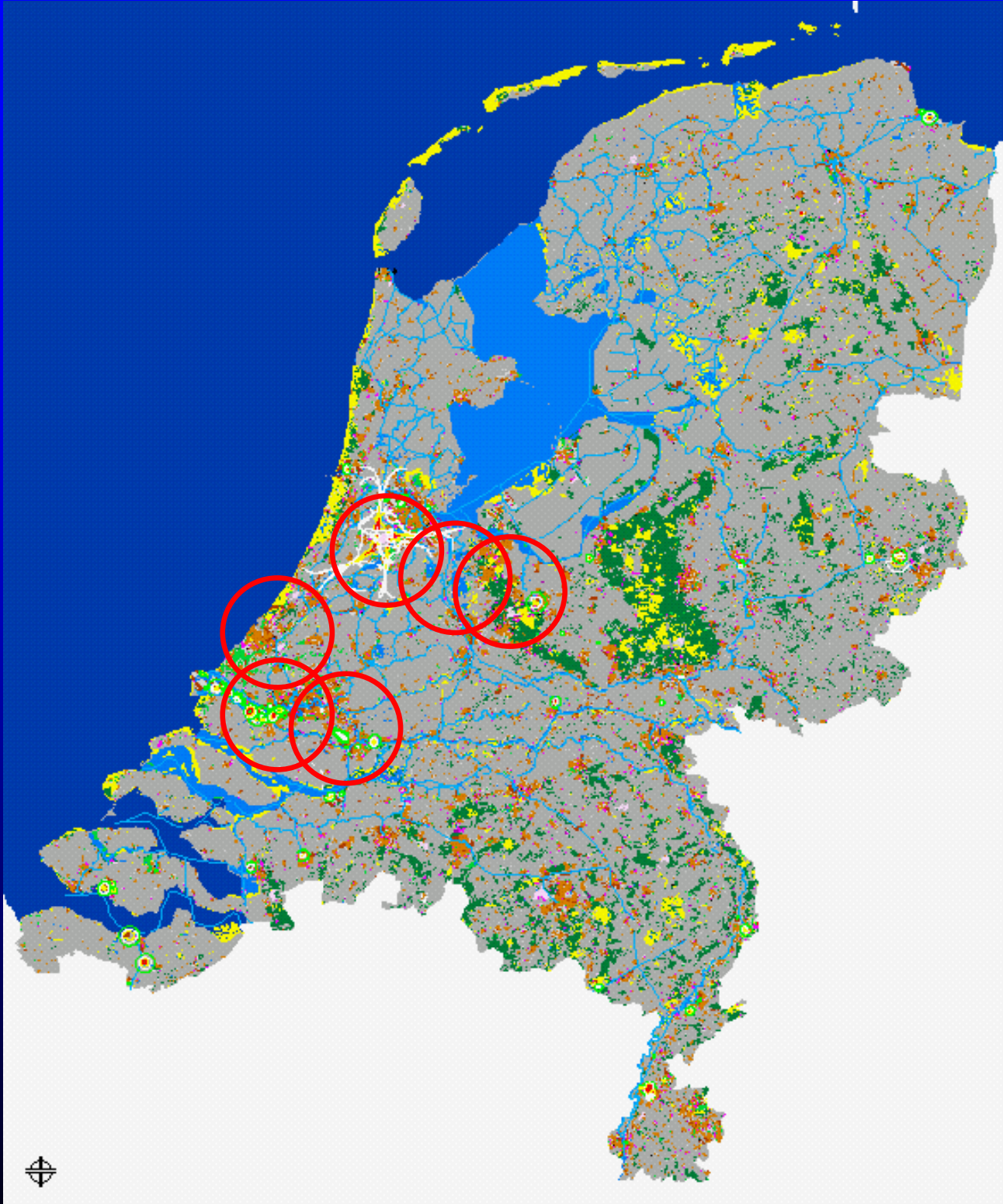




FOX

Dan komt het vuur
bij een grote brandstoftank.

KBS ©

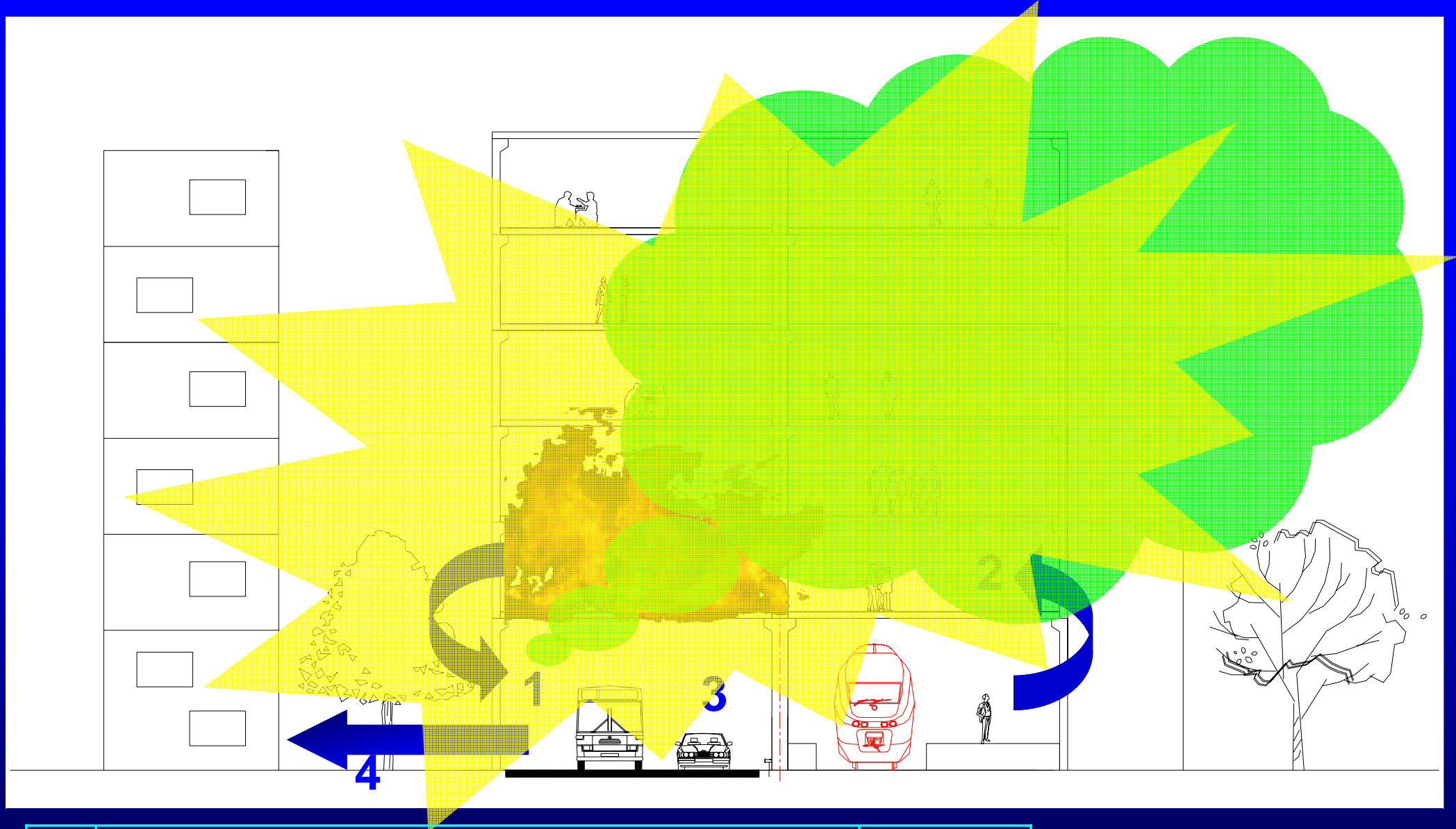


Risk-contours

- 10^{-5} Red
- 10^{-6} Yellow
- 10^{-7} White
- 10^{-8} Green

VS

Combination



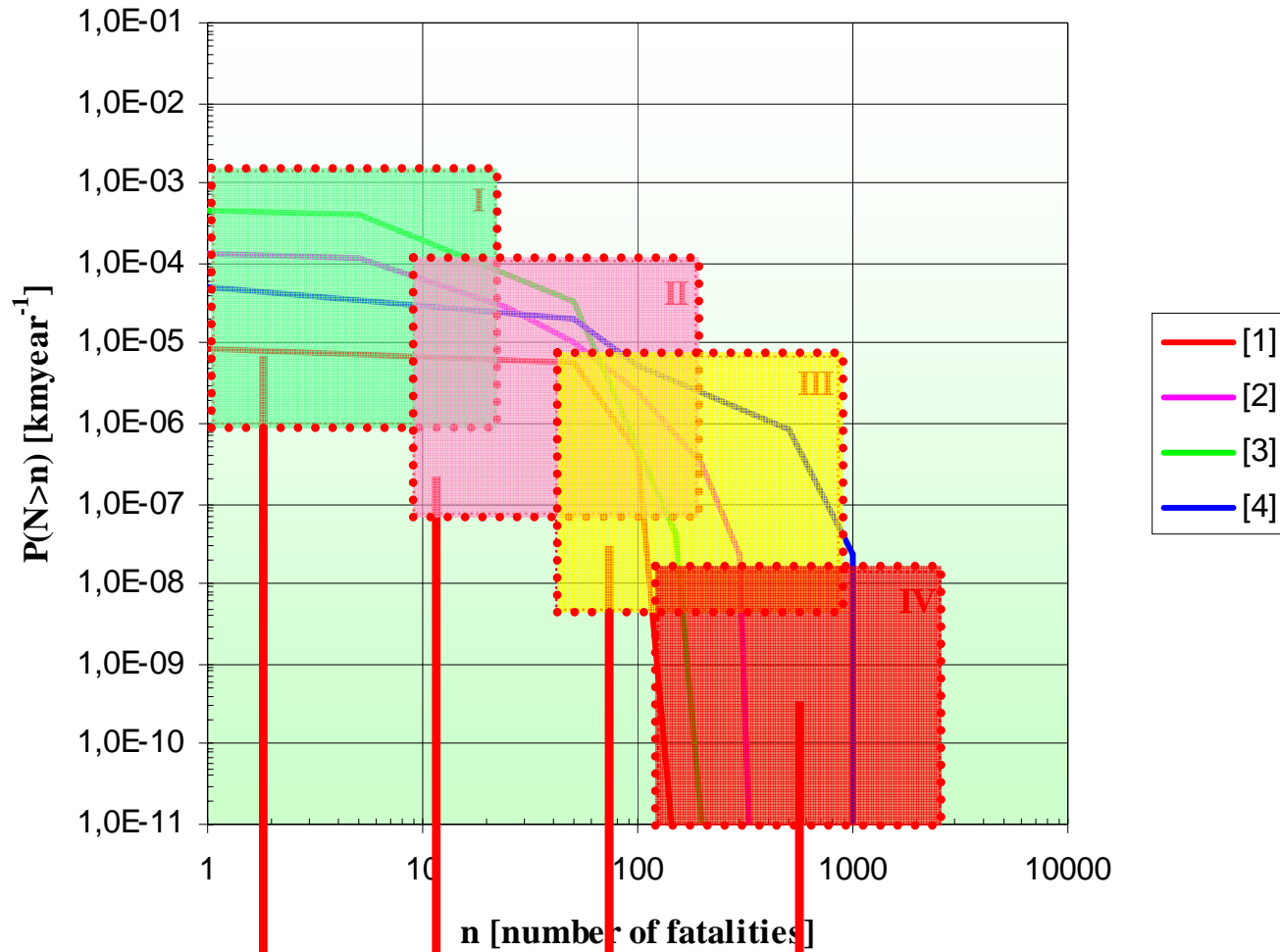
| | | |
|---|--|----------|
| 1 | Fire, falling objects | External |
| 2 | Fire, explosion, toxical materials, mech. acc. | External |
| 3 | (2) | Internal |
| 4 | Explosion, toxical materials | External |

Realisation phase

Exploitation phase

Risk Characteristics

Societal Risk for building above roads *Covering length = 30m*



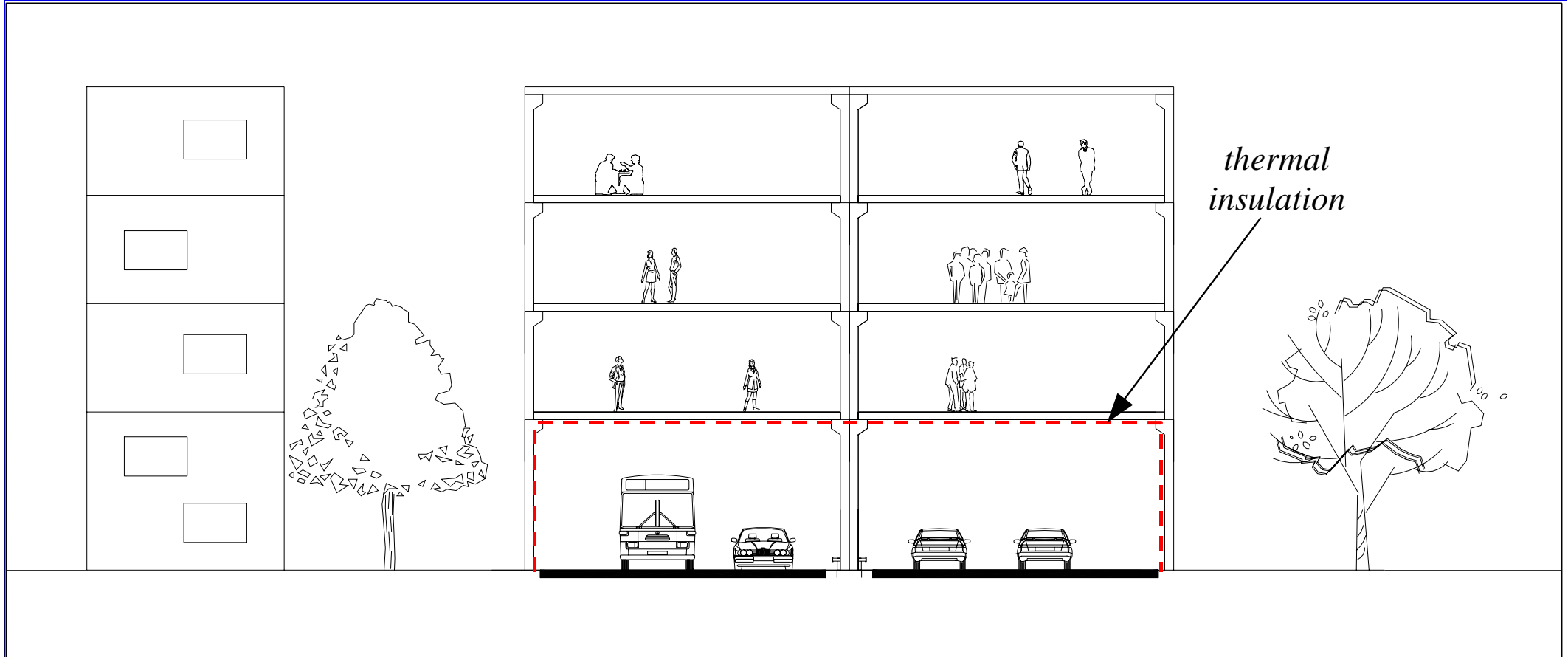
I. Accidents & small fires

II. Fires

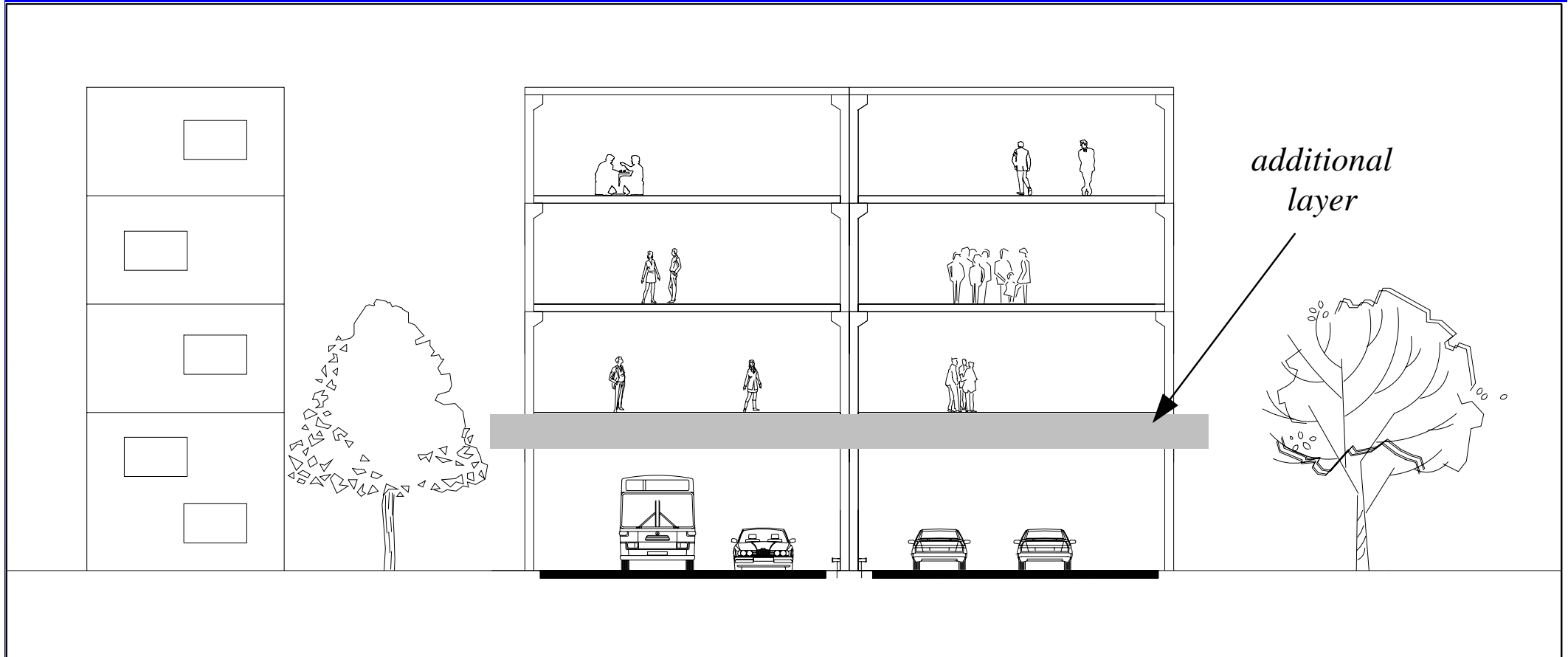
III. Explosions

IV. Toxic gasses

Measures against heat radiation (1)



Measures against heat radiation (2)



Measures against heat radiation (3)

- Sprinkler system
 - against pool fires X
 - prevents 90 % BLEVE

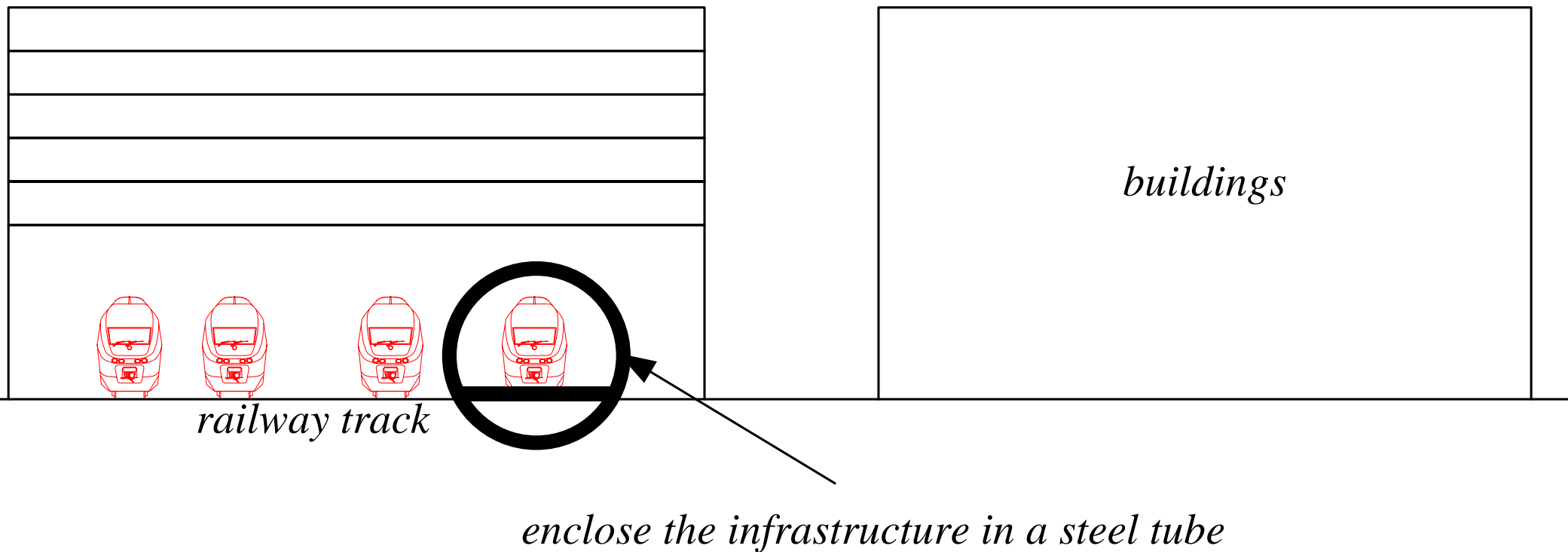
Measures against heat radiation (4)



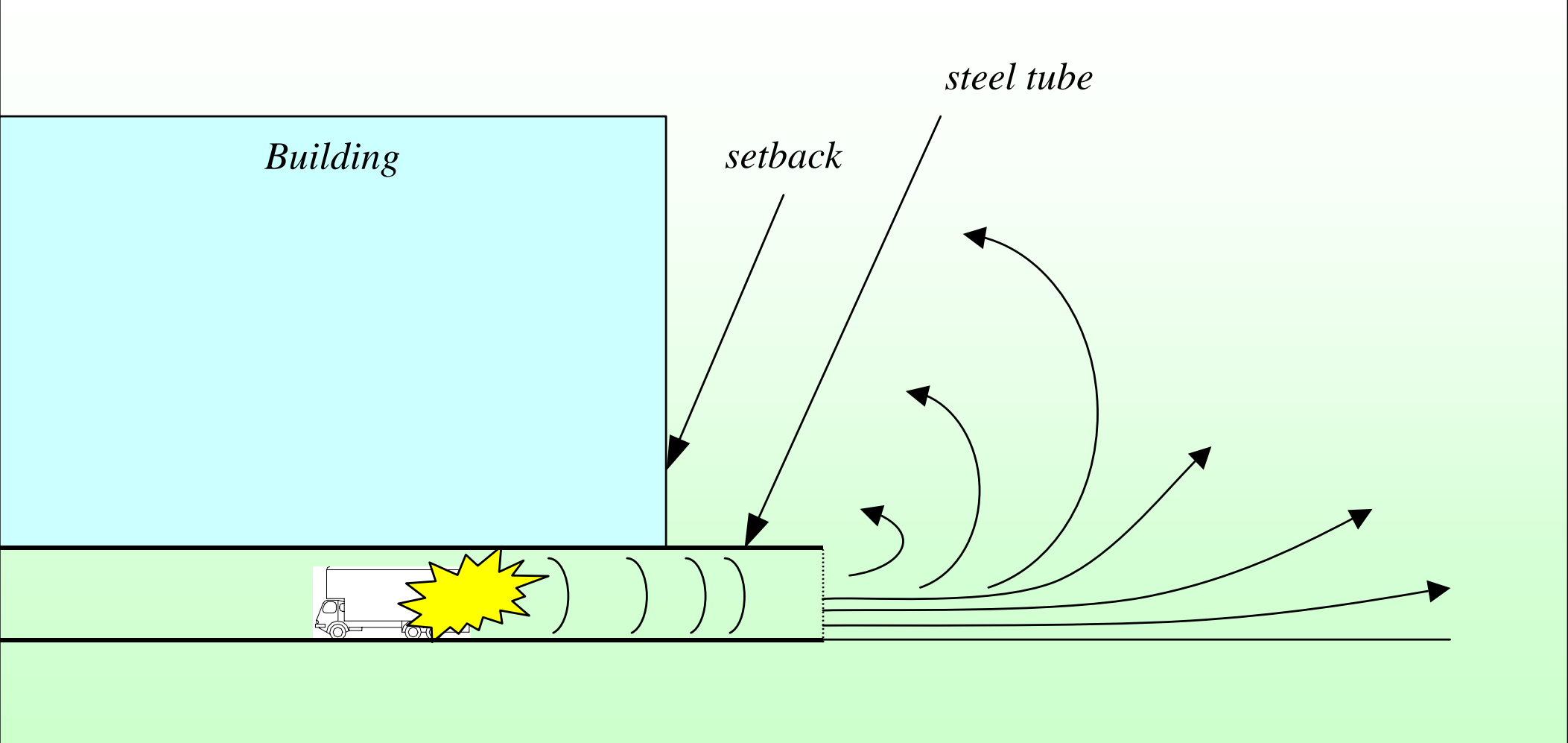
Measures against peak overpressure (1)



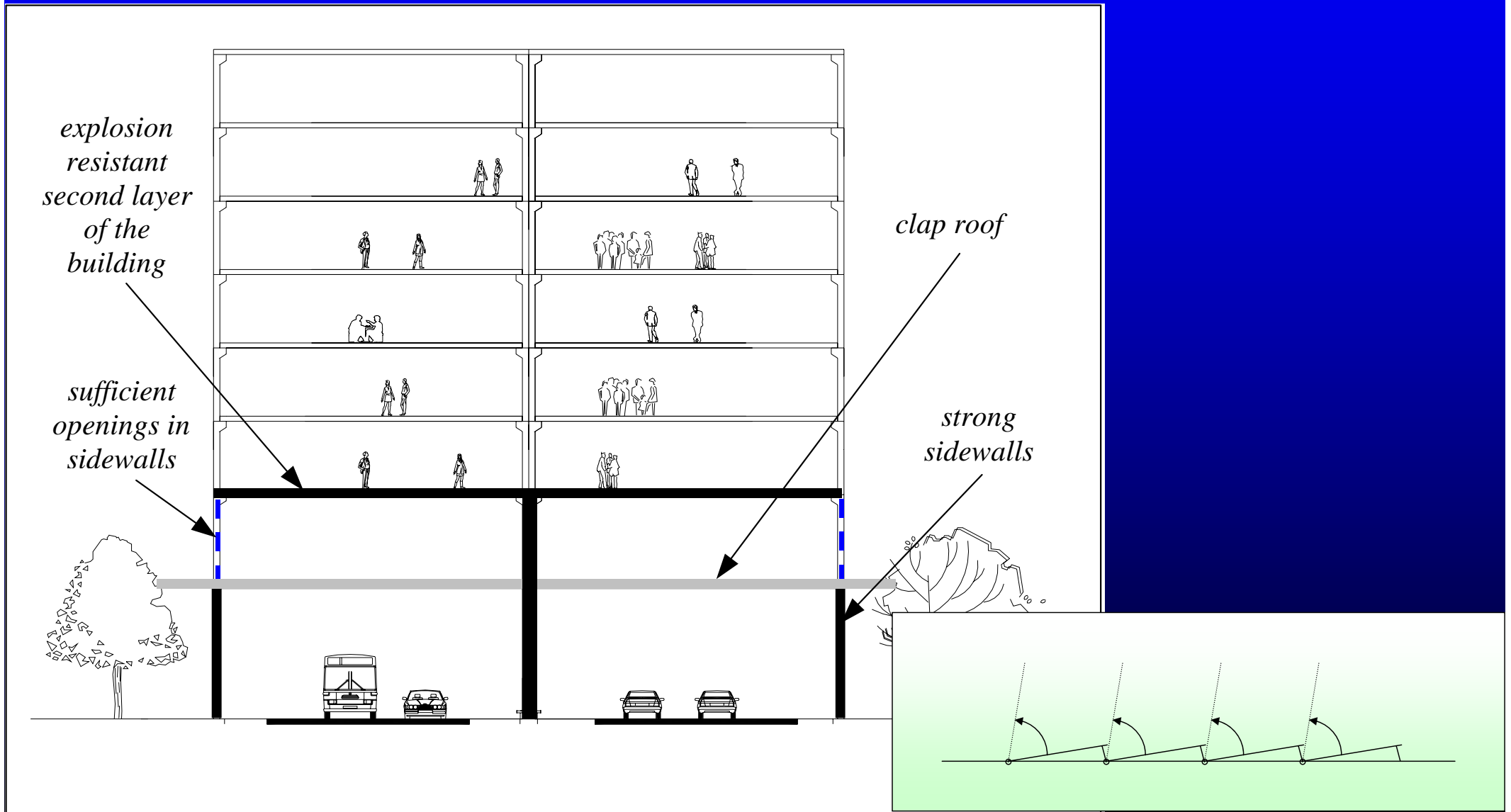
Measures against peak overpressure (2)



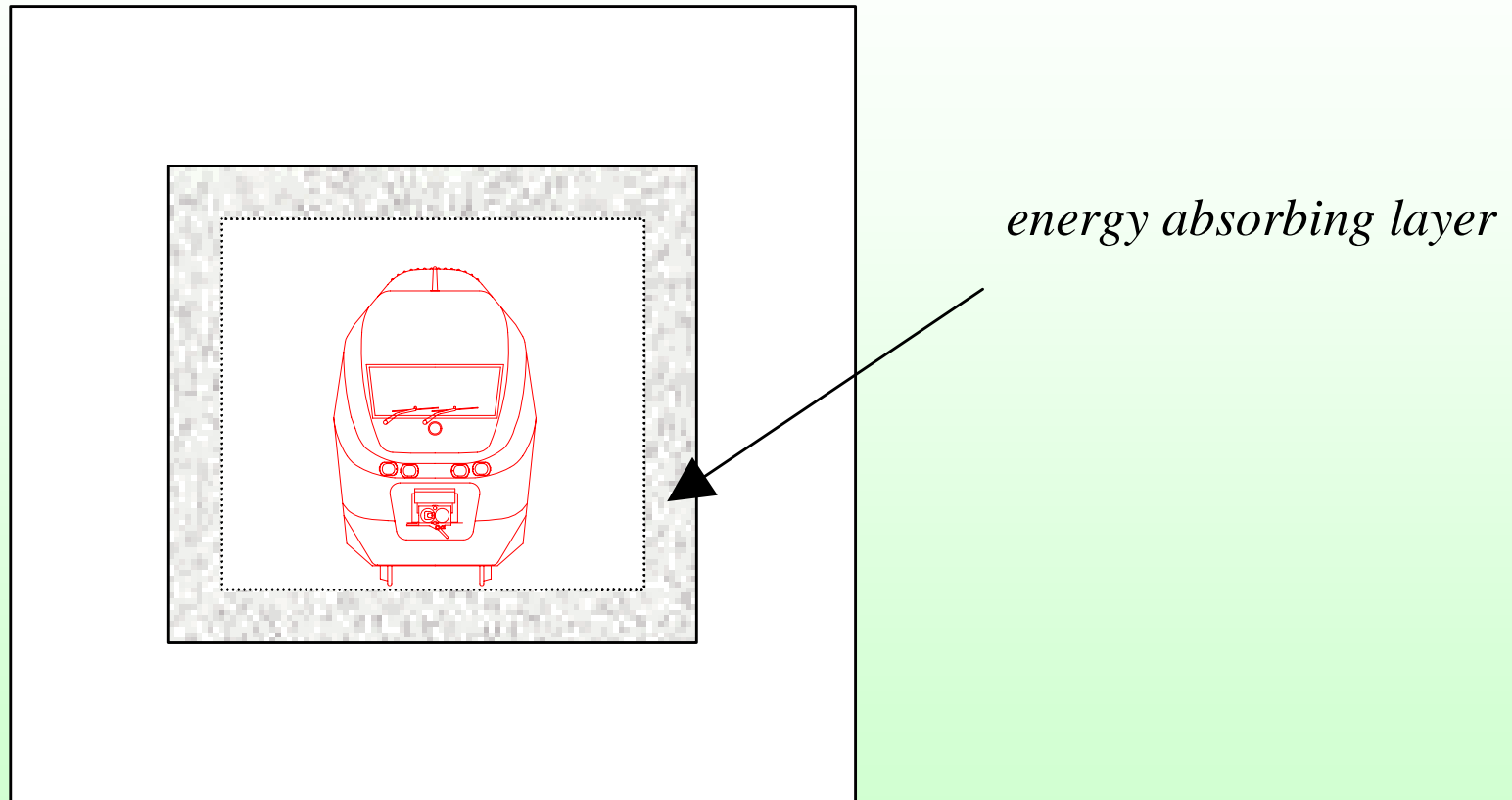
Measures against peak overpressure (3)



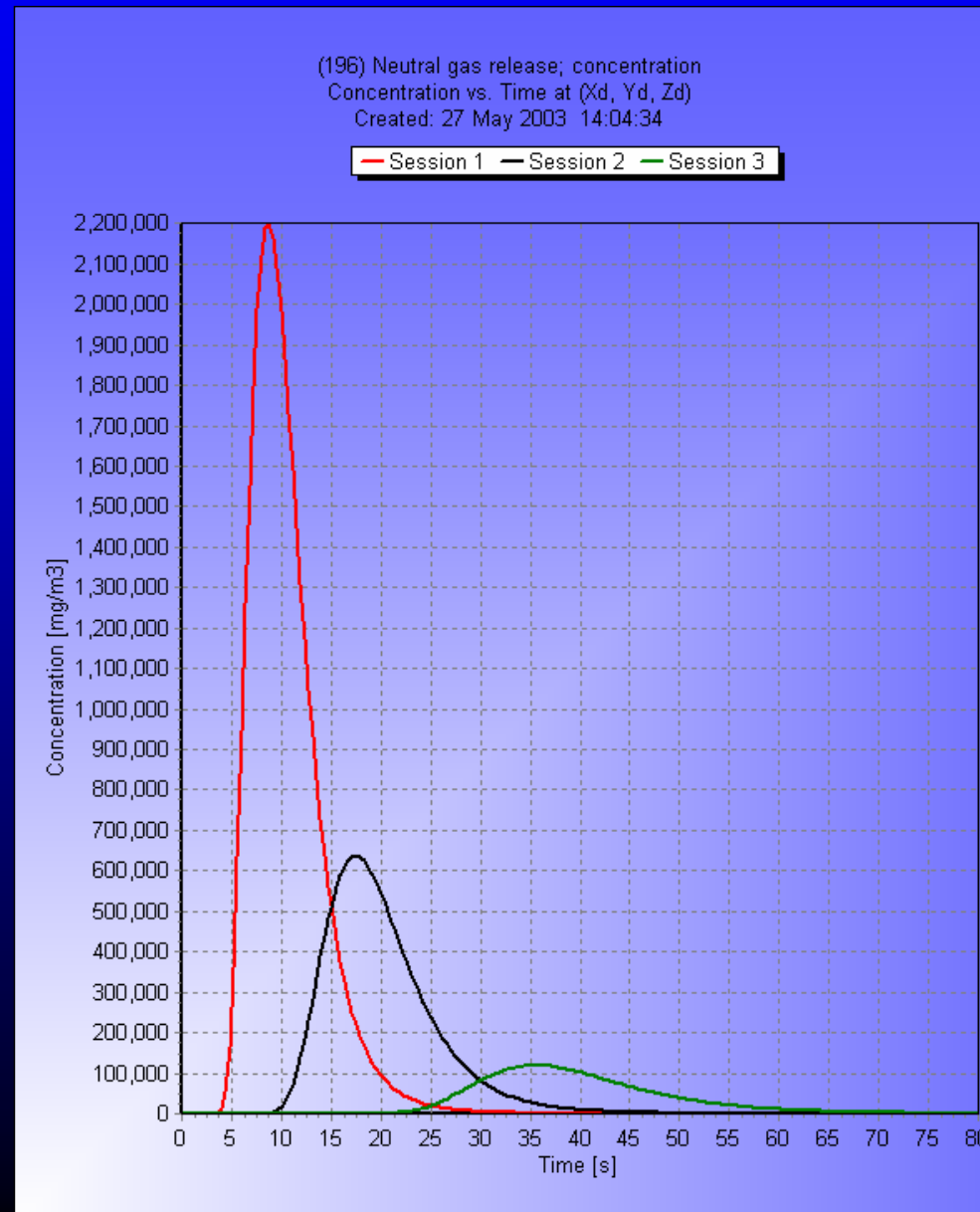
Measures against peak overpressure (4)



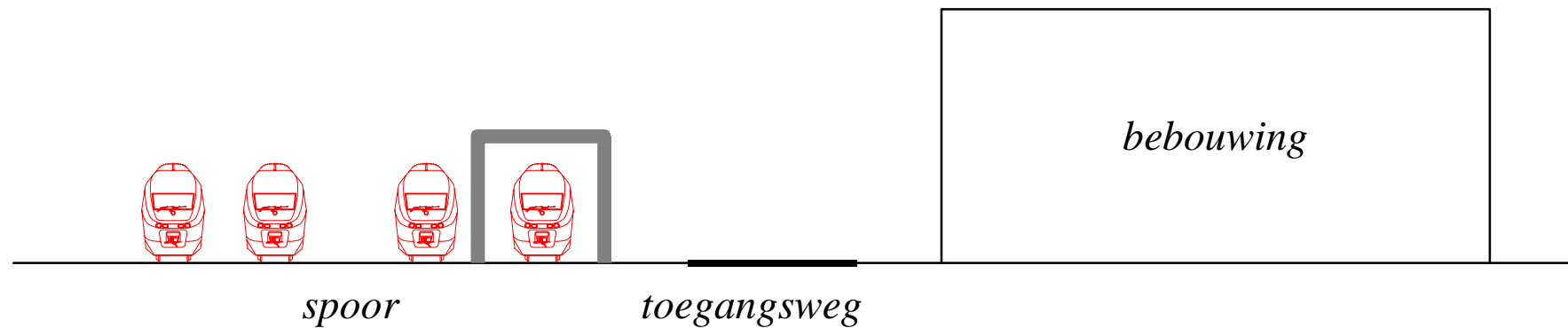
Measures against peak overpressure (5)



Measures against toxic loads (1)



Measures against toxic loads (2)



Measures against toxic loads (3)



Measures against toxic loads (4)



Airproof buildings
(with additional ventilation)

Measures against mechanical accidents (1)

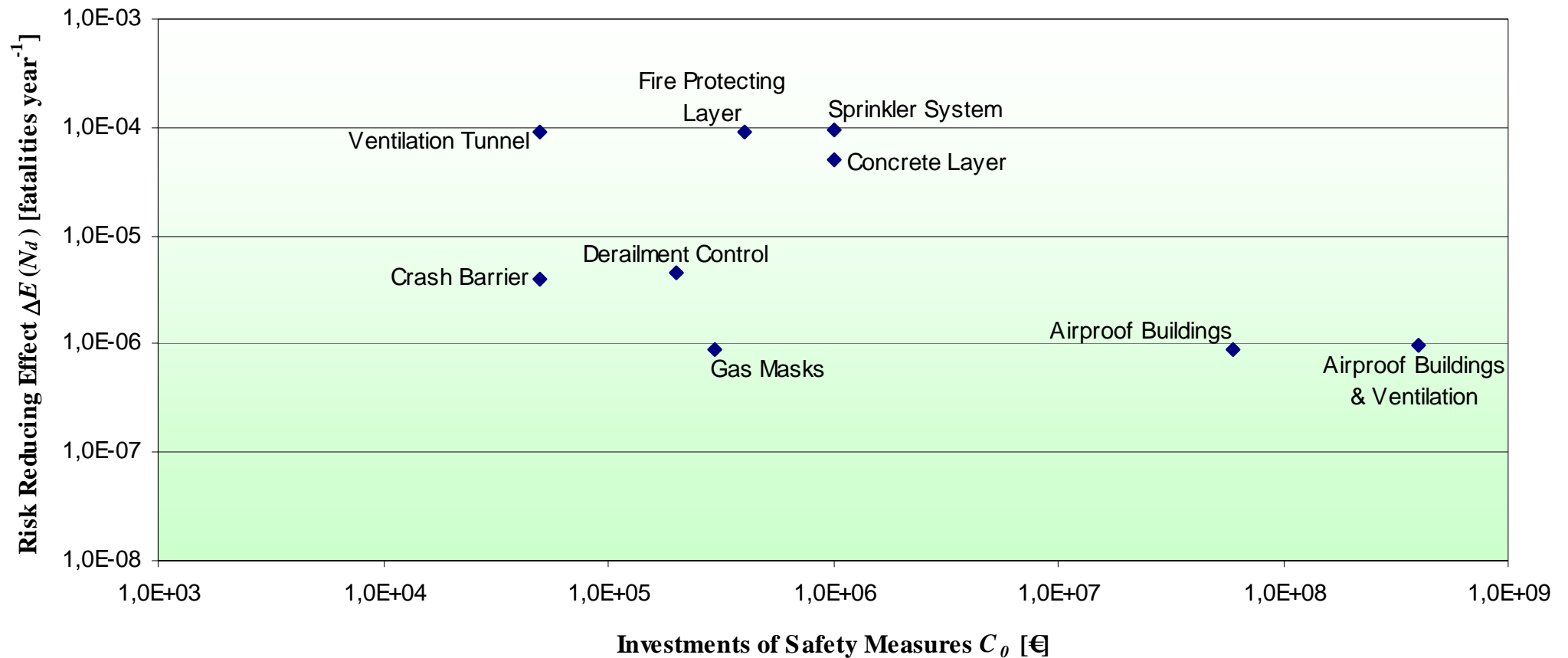
- Measure against collisions:
 - crash barrier
 - redailment control
- Structure of the building





Cost Effectiveness of Safety Measures

Cost Effectiveness of Safety Measures



Conclusions and discussion

- Covering infrastructure results four main scenarios:
 - fire
 - mechanical loading
 - toxic gas release
 - explosions
- Measures against heat radiation and toxic loads **OK** ✓
- Measures against peak overpressure **DIFFICULT X** & expensive
- Implement measures with less investments and maximum risk reducing effect...

QUESTIONS

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