

Norwegian Tunnel Safety Conference

# **How can fire services contribute to tunnel safety?**

Tirsdag 15. november 2016  
Sola Strand Hotel

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Head Development International Fire Academy

Introduction

## **Overview**

- History
- Research form 2001 up to 2009
  - What can fire services do?
  - How do people behave in emergency situations?
- Main problem: Long escape routes
- Technical solutions
- Tactical solutions

Introduction

## International Fire Academy

Public Fire Academy

Carrier: Insurance Companies Basel Landschaft and Solothurn

Sponsor: Federal Roads Office FEDRO



Introduction

## **H. Christian Brauner**

Active in Fire Services since 1976

Head Development of the International Fire Academy

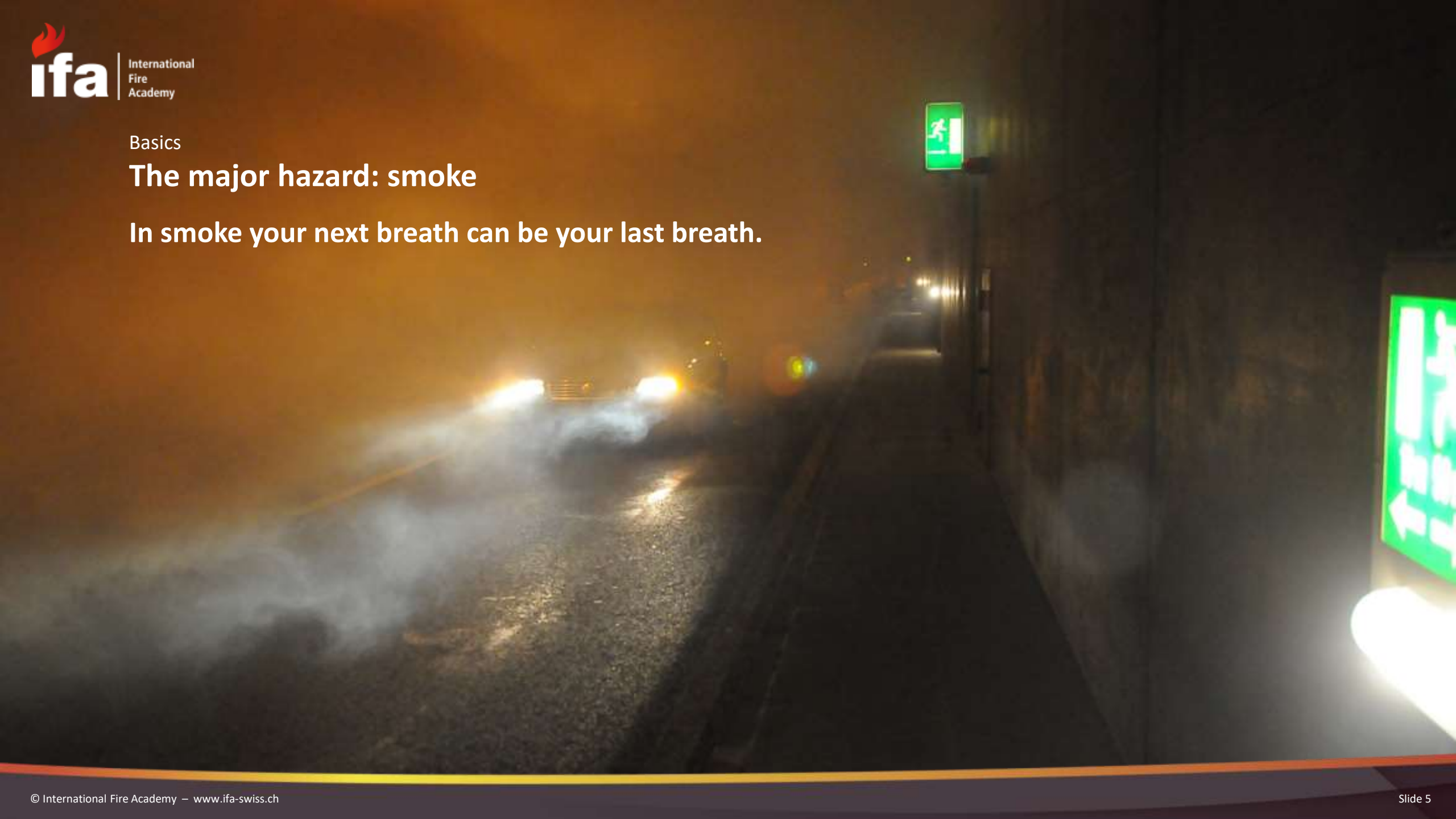
Lecturer Emergency and Crisis Management at Zürich University for Applied Science

Background: Sociology und philosophy; MSc in Communications

Basics

## The major hazard: smoke

In smoke your next breath can be your last breath.



Basics

**The major hazard: smoke**

**Smoke makes you blind.**

History

## Triggering incidents

### 1999: Montblanc

- Fatalities: 39
- Operational interruption: 36 month

### 1999: Tauern

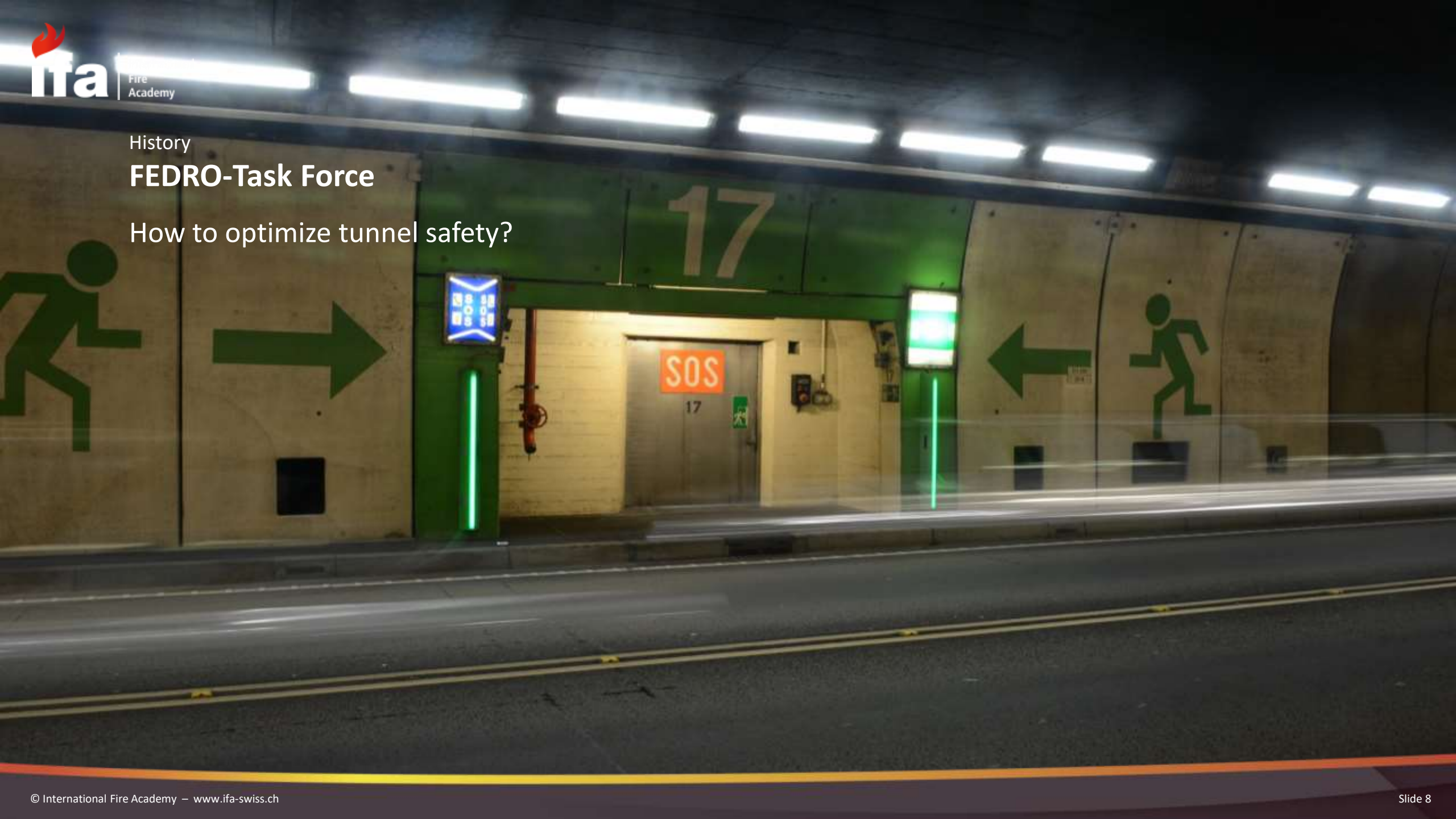
- Fatalities: 39
- Operational interruption: 3 month



History

## FEDRO-Task Force

How to optimize tunnel safety?





History

## Focus

- User
- Operations
  - Tunnel training facilities
- Infrastructure
- Vehicles

First meeting of project team on October, 24 2001.

Pure coincidence: same day as fire in  
Gotthard road tunnel (11 fatalities).

Research

## Raising questions

What happened to the photographer of this picture?





Research

# Tunnel fires are vehicle fires in tunnel



Research  
**Vehicle fires**



© FFW Münchweiler

Research

## Heat is not the major problem

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Research

## Getting there is the problem



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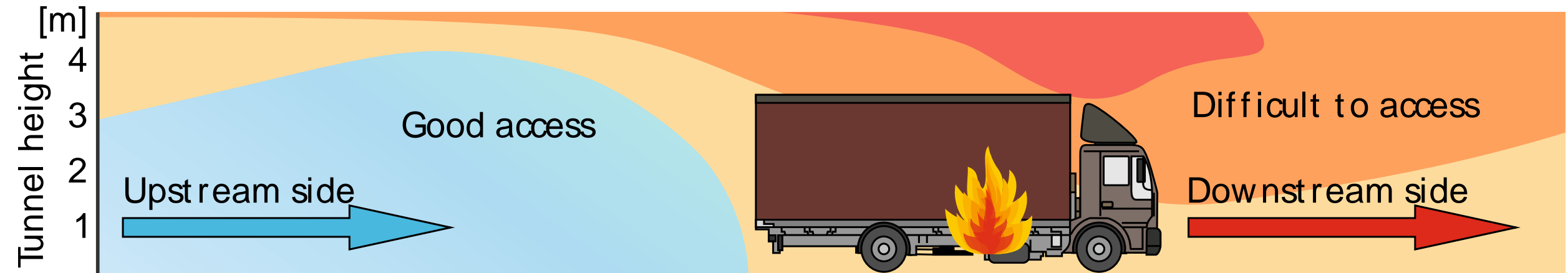


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Research

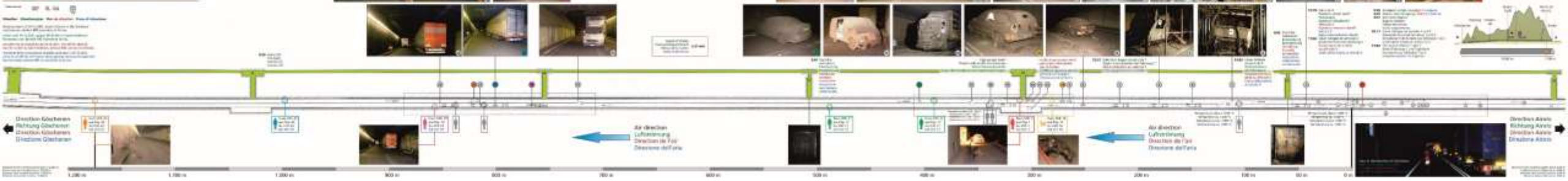
## Upstream side versus downstream side



Research

# What about the people in tunnels?

Fire 'Gotthard road tunnel' 24.10.2001  
Incendio «Sanct Gotthard Strassentunnel» 24.10.2001  
Incendie «Tunnel routier du Saint Gotthard» 24.10.2001  
Incendio «Galleria stradale del San Gotthardo» 24.10.2001



Research

# Missing emergency exits

«Sancti Gothard road tunnel» 24.10.2001  
 «Sankt Gotthard Strassentunnel» 24.10.2001  
 «Tunnel routier du Saint Gothard» 24.10.2001  
 «Galleria stradale del San Gottardo» 24.10.2001  
 Photos / Foto: Polizia del Canton Ticino

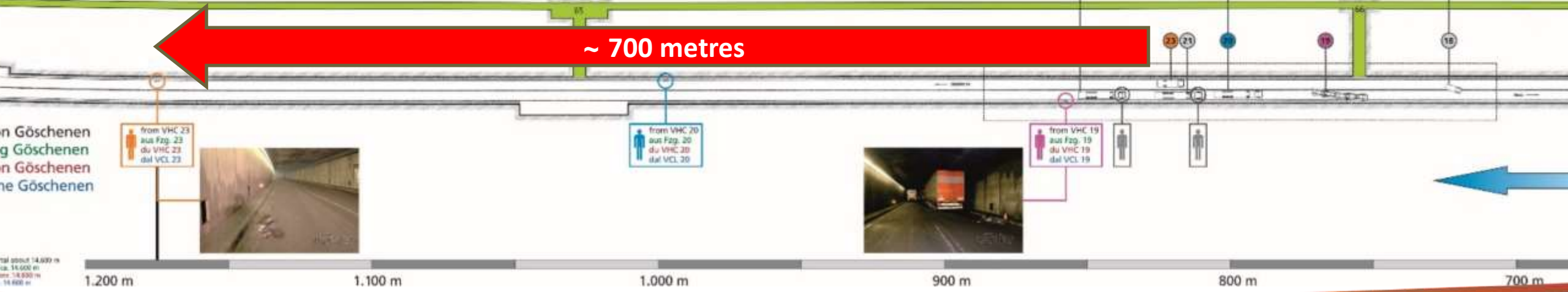


Plan Plan de situation Piano di situazione

On 24.10.2001, about 9:39 am in the Gotthard road tunnel, township of Airolo.  
 On 24.10.2001, vers 09:39, dans le tunnel routier du Saint Gothard, secteur 69F, commune d'Airolo.  
 Un incidente stradale avvenuto il 24.10.2001, nel tunnel della galleria semiautostradale del Sankt Gotthard, in territorio di Airolo.



~ 700 metres

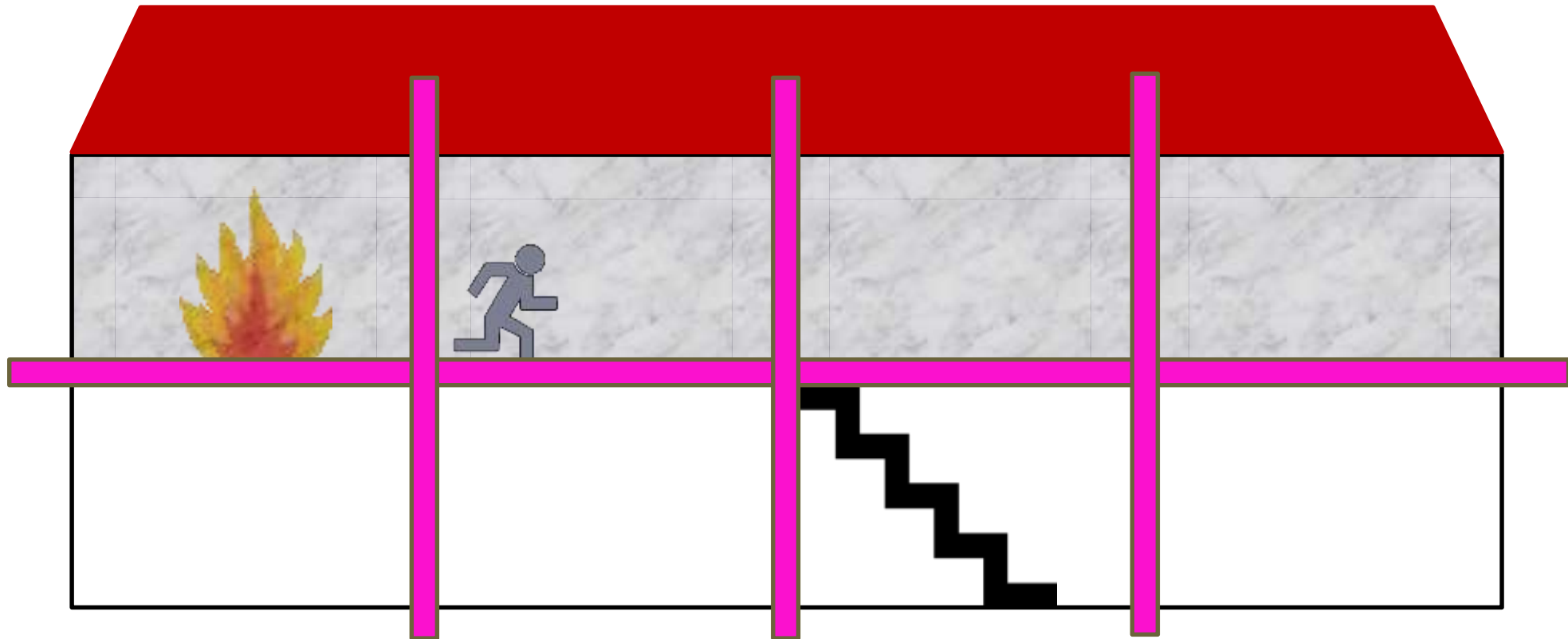


in Göschenen  
 in Göschenen  
 in Göschenen  
 in Göschenen

total about 14,000 m  
 ca. 14,600 m  
 ca. 14,600 m  
 ca. 14,600 m

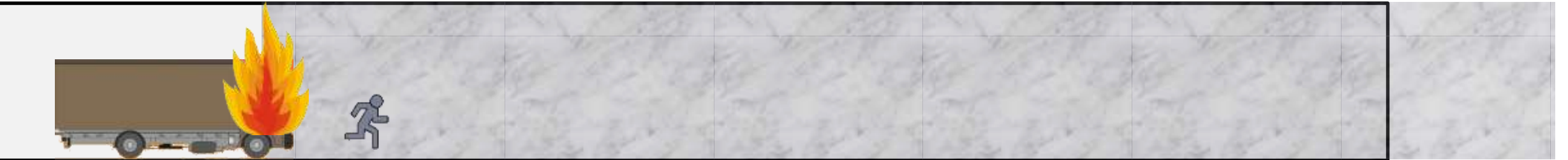
Research

## Self rescue in buildings: smoke slower than users



Research

## Self rescue in tunnels: smoke faster than users



Research

## Self rescue has its limits

- Elderly people
- Small children
- Injured people
- Confused people
- Overstrained people
- Time for self rescue about 5 to 10 minutes
- People react often too late: “Sit and wait”

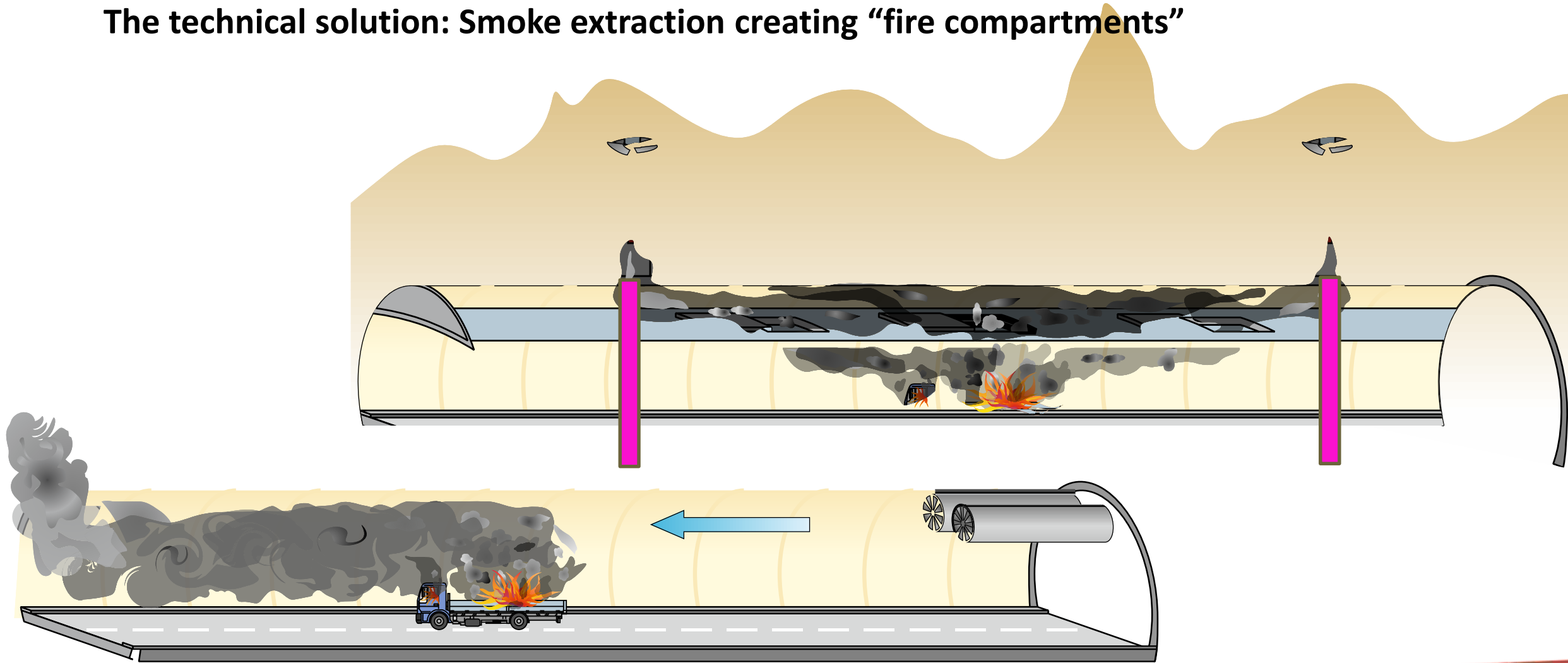


Research  
**Summary**

- For users: Very long escape routes
- For firefighters: great depth of penetration
- All operations are extended in time

Research

## The technical solution: Smoke extraction creating “fire compartments”







Research

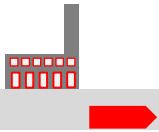
## Tactical solution: Stop smoke production first

“Extinguish to rescue”



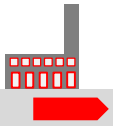
Tactics

## Open road



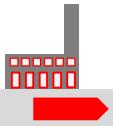
Tactics

## Tunnel upstream side



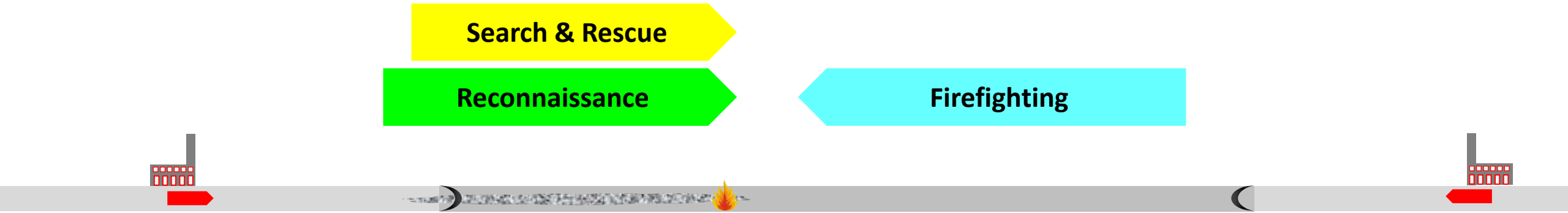
Tactics

## Downstream side



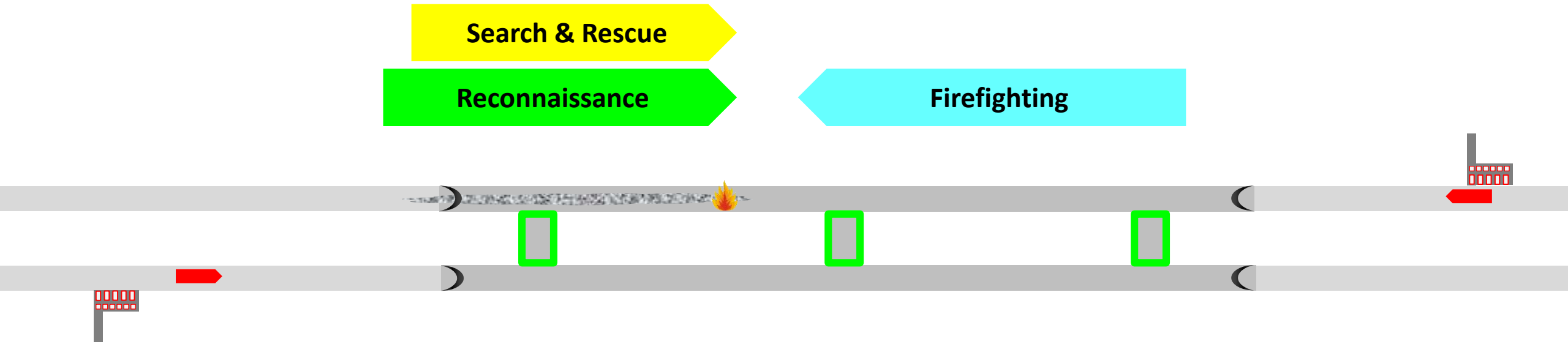
Tactics

## Two-sided attack



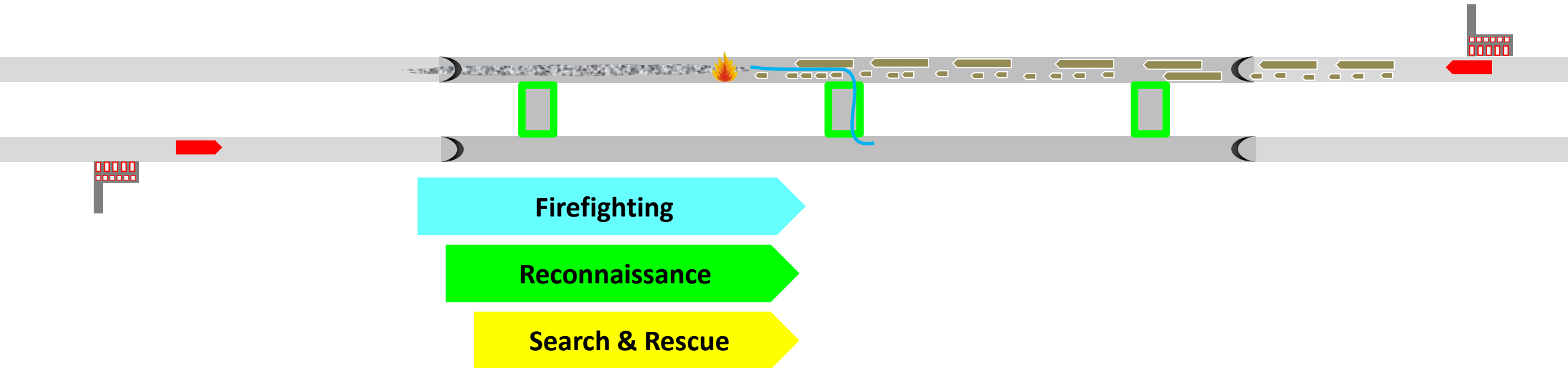
Tactics

## Coordinated two-sided attack



Tactics

## Coordinated two-sided attack when access is blocked





Tactics

Many units required on both sides



Techniques  
**Search sticks**



Techniques

## Transport aids

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Summary

## What can fire services contribute to tunnel safety?

- Support self rescue
- Improve conditions for all operations
- Increase chances to survive
- Reduce time of business interruption
- Reduce fire fighters risks

Summary

## What do we need to contribute

- Only few special tools
- Stable ventilation
- Very close cooperation with all partners
- Tactics need to match specific
  - tunnel
  - needs, capabilities, basic conditions ...
- Training

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