International Fire Academy

Tunnel training under realistic conditions

Markus VOGT, Head of Consulting
Tunnel training under realistic conditions

**Markus VOGT**

Job role at the International Fire Academy
- Head of Consulting / Instructor
- Consultation
- Acquisition
- Training
- Development

Personal background as a firefighter
- Fire chief of a volunteer fire brigade
- Allschwil, 20‘000 residents

Instructor at the firefighter association Basel
- Chief training officer for
  - Officers training & practice
  - Commander training & practice
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Contents

– Tunnels are man’s largest buildings
– Long Distance Fire Attack
– Tunnel fire...
– The time factor and its significance when managing incidents in tunnels
– Examples of incidents in tunnels
– Safety factors in tunnels
– Training requirements
– Reconnoitering, firefighting and search & rescue
– International Fire Academy
– Summary
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Key Figures or Key Words…

Long Distances…
Time…
Communication…
Smoke and Airflow…
Reconnaissance…
Extinguish in order to rescue…
Hose Management…
Search & Rescue…
…
Tunnels are Man’s Largest Buildings...

- One-family house
- Office building
- Industrial building
- Short tunnel 250 m
- Medium length tunnel 1’000 m
- > 1’000 m long tunnel
- Gotthard Base Tunnel with 58 km length
- Brenner Base Tunnel with 64 km length
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... and the Safest Part on Most Highways

No weather influence
Constant lighting conditions
Speed limits
Tunnel and traffic control center
Surveillance cameras

...
Long Distance Fire...

What's a Long Distance Fire?

What's the meaning of a Long Distance Fire?
- Fire Dimension more then xx meters...
- Size of the Building under Fire more then xx meters...
- Is a Tunnel Fire a Long Distance Fire???

And if... what's the Difference to the Building Fire???
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**What is a Tunnel Fire?**

Can a tunnel burn?

No, only
– installations or
– vehicles
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The World's longest tunnels...

Delaware Aqueduct, New York (water supply, 137’000 m)

Guangzhou metro line (60’400 m)

Gotthard Base tunnel (57’091 m)

Channel tunnel (undersea, 50’450 m)

LEP Tunnel, CERN (26’659 m)

Laerdal road tunnel (24’510 m)
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Projects with long or special tunnels...

Bohai Strait railway tunnel (123’000 m)

Fehmarn Belt Fixed Link (road & railway undersea tunnel 17’600 m)

Brenner Base tunnel (64’000 m)

Rogfast road tunnel (27’000 m)

Stad Skips tunnel (1’700 m)
Safety in Tunnels

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SAFETY

Location & Structure

Incident Services

Safety Installations

Self-Rescue

Traffic & Vehicle
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**Safety in Tunnels: Location & Structure**

**Geography/Geology**
- Rocks / foundations
- Geological problem areas

**Building**
- Mountains or water
- City or land
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**Safety in Tunnels: Safety Installations**

**Building code**
- RABT (DE)
- BMVIT Road-Tunnel-Safety regulations
- Instructions
- and so on...

**Safety regulations**
- Road administration
- Tunnel manager
- Safety inspector
- Hazard and risk analysis
- Risk reports
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**Safety in Tunnels: Traffic & Vehicle**

**Traffic, vehicles and procedures**
- Tunnel control center
- Traffic control
- Traffic lights
- Drop counter
- HGV Control Center
- Hot spot detector
- Restrictions for transports with HazMat
- And so on…
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**Safety in Tunnels: Self-Rescue**

**Self-rescue**
- The idea behind...
- Public address via radio and loudspeaker
- Safety installations
- Indication for self-rescue
- Knowledge about safety procedures
- …
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Safety in Tunnels: Incident Services

Emergency services
- Fire service
- Police service
- Emergency medical service
- Road authorities
- and so on...

Training for emergency services
- Familiarization with facility
- Tactic and techniques
- Practice
- Experience and know-how
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**How it all Started...**

**March 24, 1999**
a truck loaded with flour and margarine caught fire in the Mont Blanc Tunnel...

**May 29, 1999**
neat to road works, after a serious pile-up, the Tauern Tunnel fire took place...
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**Some Example of Major Incidents in this century...**

**July 18, 2001**
Howard Street Tunnel fire, CSX transportation, Baltimore...

**October 24, 2001**
collision in the Gotthard Road Tunnel, Switzerland...

**November 11, 2001**
the 'Gletscherbahn Kaprun 2' caught fire in the tunnel to the Kitzsteinhorn, Austria...
Some Example of Major Incidents of the last Years... (CH)

**September 16, 2006**
collision between car and bus in the Via Mala road tunnel...

**June 9, 2011**
a HGV on train caught fire in the Simplon tunnel...

**June 9, 2012**
an unspectacular car fire in the Gubrist road tunnel...

**October 20+25, 2012**
HGV's on fire loaded with granulated plastic and plastic pipes...
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**Some Example of Major Incidents of the last Years… (NW)**

**June 23, 2011**
HGV loaded with paper caught fire in the Oslofjord tunnel…

**August 5, 2013**
HGV caught fire in the Gudvanga tunnel

**July 16, 2015**
fire in the subsea Skatestraum tunnel

**August 12, 2015**
Gudvanga the second
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And some Example of Incidents of the last couple of month...

**July 28, 2016 (DE)**
a tunnel accident with a burning truck on highway 4 near Jena

**August 05, 2016 (AT)**
Bus fire in "Gleinalm Tunnel". Seven people were sitting in that bus

**August 07, 2016 (CH)**
car fire on the Highway A13

**March 05, 2017 (DE)**
car fire in the "Döggingen Tunnel"
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**Proportion of Total Land Area to Number of Tunnels**

<table>
<thead>
<tr>
<th>Country</th>
<th>Flag</th>
<th>Tunnels &gt; 200 m (approx.)</th>
<th>Land Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Italy</td>
<td>🏳️‍🌈</td>
<td>&gt; 1’000</td>
<td>301'338 km²</td>
</tr>
<tr>
<td>Norway</td>
<td>🇳🇴</td>
<td>&gt; 900</td>
<td>385'178 km²</td>
</tr>
<tr>
<td>Switzerland</td>
<td>🇨🇭</td>
<td>&gt; 900</td>
<td>41'285 km²</td>
</tr>
<tr>
<td>Austria</td>
<td>🇦🇹</td>
<td>700</td>
<td>83'855 km²</td>
</tr>
<tr>
<td>Germany</td>
<td>🇩🇪</td>
<td>500</td>
<td>357'168 km²</td>
</tr>
<tr>
<td>Spain</td>
<td>🇪🇸</td>
<td>240</td>
<td>504'645 km²</td>
</tr>
<tr>
<td>France</td>
<td>🇫🇷</td>
<td>142</td>
<td>643'801 km²</td>
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<tr>
<td>Benelux</td>
<td>🇧🇪</td>
<td>87</td>
<td>76'657 km²</td>
</tr>
<tr>
<td>Great Britain</td>
<td>🇬🇧</td>
<td>???</td>
<td>229'848 km²</td>
</tr>
<tr>
<td>United States of America</td>
<td>🇺🇸</td>
<td>100</td>
<td>9'857'000 km²</td>
</tr>
</tbody>
</table>
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**Special Training Requirements for Tunnel Operations**

Apart from general fire service training, special training is necessary for the successful handling of emergencies in tunnels:

- Operation planning for incidents
- Tactics for operations involving large penetration depths
- Knowledge of the procedures and conditions of a tunnel facility in the event of a fire
- Working with SCBAs for a long period of time
- Advancing long distances into tunnels
- Orientation
- Knowledge of fire and smoke spread
- Firefighting in tunnels
- Search and rescue techniques
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**Time Management**

Reducing time consumption
- Use time efficiently
- Analyze your time
- Actually "gaining time" is NOT possible

Prevent loosing time!!!
- Organization
- Setting priorities
- Distinguish what is important from what is not
- Use correct, unmistakable communication

It also helps to practice procedures!!!
Practical Training under Realistic Conditions

Under difficult conditions...
- Little or NO light
- Smoke
- Long approach and escape routes

From simple to complex...
- Technique
- Course of action
- Acting automatically

Communications are important, because...
- Incident management
- Communication
- It is the largest source of error

➔ Orientation
➔ Psychological stress
➔ Physical stress

➔ How to handle equipment
➔ Acting systematically
➔ Concentration on what is important

➔ NOT without communication
➔ NOT without technique (UNFORTUNATELY)
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Initial Measures and Priorities

- **reconnaissance**
  - airflow

- **approach**
  - sustain airflow
    - location, type, extent of the fire, particular hazards
    - firefighting
      - traffic density, people behavior

- **search & rescue**

- **supporting measures** (supplying extra water, reinforcing the crew, etc.)
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Reconnaissance... why???
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**Reconnaissance and Communications Training**

The main topics when training reconnaissance are:

- **Communicating with** and conveying information to the officers
- **Efficiency**
- Use of aids such as
  - Thermal Imaging Camera (TIC)
  - Marking lights
    - **Green** "way back"
    - **Blue** "hydrant or divider"
    - **Yellow** "for rescue"
- What is important and what is not
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**Resources**

- Emergency Exit
- way back
- Waterhydrant
- Divider.
- Search & Rescue
- Locality of people
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**Firefighting**

Firefighting has top priority:
- to prevent the further production of smoke,
- improve operation conditions (as well as for search & rescue) and
- prevent the danger of suspended ceilings and cladding collapsing.

"Extinguish the fire, save lives!"
- fight vehicle fires,
- prevent the fire spreading to other vehicles and
- cool the structure, in particular the tunnel ceiling.
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Firefighting Training

The main topics are:

- **Hose management**
- **Cooling / extinguishing**
  - Dynamic and purposeful
- **Management** and coordination of firefighting crew
  - Use of thermal imaging cameras
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Firefighting Training

Reference/Quelle/Référence: STUVA: Brandschutz in Fahrzeugen und Tunnel n des ÖPNV
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Tasks for the Firefighter

Hose management

&

Cooling and extinguishing

&

Management and coordination

= EFFICIENCY
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Problems...
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Possibilities / Procedures...
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**Search & Rescue Training**

Training for search & rescue and appropriate main points of the course are as follows:

- Use of aids
  - Thermal Imaging Camera (TIC)
  - Search stick
  - Marking lights
  - Transport aids

"EVERY SQUARE METRE SEARCHED SYSTEMATICALLY IS THE ULTIMATE GOAL"

- Management and coordination of the search & rescue operation
Goals of search & rescue

- Finding people who have been unable to save themselves
- They should be rescued using suitable equipment
- Officers should stick to the motto

"EVERY SQUARE METER SEARCHED"
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Tasks of the Firefighters

Procedures
&
Communication
&
Using the right equipment

= EFFICIENCY
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Possibilities / Procedures...
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**Scope of works**

- **Concept and building** of a tunnel training center
- **Developing** tactic and technique in case of tunnel incident and education concept
- **Volume** about CHF 40 Mio.
- **Train and educate** fire fighter
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**Target of this projekt**

**Target**

- **Reducing risc of fire fighter**
- Grow up chances for rescue people
- Reduce damage on enviroment
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Realitätsgetreue Übungssobjekte

Scale 1:1

National road profile

Elements like

– Sliding doors
– Overpressure airflow
– Vehicles
Since 2009: Trained more than 12,000 firefighters
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**Two Training Facilities: Balsthal**
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**Two Training Facilities: Lungern**
Balsthal Railway Tunnel
Balsthal Railway Tunnel
Balsthal Road Tunnel
Balsthal Road Tunnel
Balsthal Road Tunnel
Balsthal Road Tunnel
Balsthal Road Tunnel
Bals-Tal Tactic Center
Lungern Road Tunnel
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International Fire Academy Services
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Examples for training...

Leadership training at your facility
- Basic theoretical training
- Up to 40 participants
- Topics:
  - Basics on Tunnels
  - Incidents in Tunnels
  - Analysis on the Gotthard 2001
  - Basic tactics on tunnel firefighting
  - Individual requirements
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Examples for training...

Train the Trainer

– Basic training Road or Railroad

– Training including advice for local drills & training sessions

– Possible additions:
  – Tactical training
  – Command & Control
  – Additional training at the multi story car park on request

– Visit of
  – LRZ
  – SWG
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**Examples for training...**

Local / Onsite training
- Simple methods
- Simple equipment

= Effective training
- Training by Multiplier
- Optional support of International Fire Academy on request
Summary

**Incidents do happen** in tunnels, so we must be prepared for them.

**Time** will always be an **important factor** and can determine success or failure.

Clear, **unmistakable communication** lead to success when it comes to incident management in tunnels.

Firefighting has a very high priority, therefore "**Extinguish the fire, save lives!**"

Whenever possible, **search & rescue** operations must run simultaneously with firefighting.
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Conclusion

The International Fire Academy conducts research and development in close collaboration with fire services.

The International Fire Academy offers an environment for learning and gaining experience.

Reconnaissance – Firefighting – Search & Rescue

Visual and aural safety measures

Less technical equipment, preferably practical and theoretical training
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More Information on our Website

www.ifa-swiss.ch
Little but the right things

During the initial planning stages for the development of these operating procedures, the members of the DET assumed that firefighters and officers have to be equipped with all kinds of aids and safety equipment, such as additional air tanks, additional hoses and the standard tools. By the time the idea arose to construct a special trolley to carry all the equipment, it became obvious that adding more and more equipment and weight was the wrong approach. The goal must be to master tunnel operations using the standard equipment as far as possible. Accordingly, the list of specialised equipment for operations in UTS is short:

- thermal imaging cameras (TIC)
- search sticks
- marking lights (LED flares)
- transport aids

Thermal imaging cameras are listed here because they are still not commonly available to firefighters or are often relatively large and impractical. As shown in the following, TICs are very helpful tools especially for tunnel operations as they increase chances of success and can improve the safety of firefighters.

Thermal imaging cameras

Thermal imaging cameras make operations in smoke filled tunnels much easier. Walls, ceiling, exits, niches, kerbstones and more can be clearly seen on the monitor as well as vehicles, objects in the lanes and people. Used correctly, TICs reduce the time it takes to advance in smoke and the searching of the carriageways, which is especially useful when time is limited due to the use of breathing apparatus.
Thank you very much!