

Experts in Tunnel Fire Safety 

FOGTEC Tunnel Systems – Project SAFE – Eurotunnel

Max Lakkonen - FOGTEC



WWW.FOGTEC-TUNNEL.COM

Side 1


Experts in Tunnel Fire Safety 


Contents

- FOGTEC tunnel department
 - Services
 - Networking and testing
 - References
- Eurotunnel SAFE project
 - Fire tests
 - Implementation
 - Challenges
 - Conclusions
- Future of tunnel safety – SOLIT2 research project





Side 2

Experts in Tunnel Fire Safety 


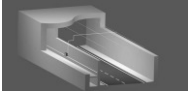



Side 3


Experts in Tunnel Fire Safety 

FOGTEC Tunnel Department – Services












- Team of specialists from different fields
- Services:
 - Consulting
 - Design (FFFS, detection, control/SCADA, video surveillance)
 - Simulation (Fire Tests where applicable)
 - System integration
 - Component supply
 - Installation
 - Service and maintenance 24/7 with local support
 - Trainings
- Active in number of working groups and participation to standardization


Side 4

Experts in Tunnel Fire Safety 













FOGTEC Tunnel Department – Fire test programs

- Fire tests with Deutsche Bahn (1995), Germany 
- Eurotunnel fire testing Program (1999), France 
- Budapest Metro Station Program (2001), Hungary / Germany 
- UpTun Research Program (2002-2006), Norway / Italy 
- SOLIT Research Program (2005-2007), Germany / Spain 
- Madrid M30 Fire Testing (2006), Spain 
- Madrid Fire Brigade Testing (2006), Spain 
- Scaled Tunnel Fire Tests (2007-2008) France 
- SOLIT² Research program (2010-) Germany, Spain 
- Eurotunnel fire test program (2010) France 
- Highways Agency – Dartford Tunnels (2010) UK 


Side 5

Experts in Tunnel Fire Safety 

FOGTEC Tunnel Department – Networking


 United Nations	 International Water Mist Association Member of the Board	 German Norming Institute
 European Norming Institute	 Member of TC 502	 Member of TC 750
 Water mist technology provider	 Safety of Life in Tunnels Managing Party	 ITA COSUF Member of the Board
 Member of FIT	 Managing Party	 Member of TC 130

Side 6

Experts in Tunnel Fire Safety 

FOGTEC – Recent references 2009/2010 (Road/Rail tunnels)

- FOGTEC awarded to protect tunnels of NTC in Newcastle, UK
 - Based on cost-benefit analysis
- FOGTEC awarded to develop fire protection concept to Channel Tunnel (Eurotunnel)
 - Including detection, control, SCADA and video systems
 - Full scale fire tests, 200+MW!
- FOGTEC awarded to develop and install fire protection concept to Dartford Crossing, UK
 - Full scale fire tests, 100+MW



Slide 7

Experts in Tunnel Fire Safety 

PROJECT – SAFE FIRE TESTS




© FOGTEC

Experts in Tunnel Fire Safety 

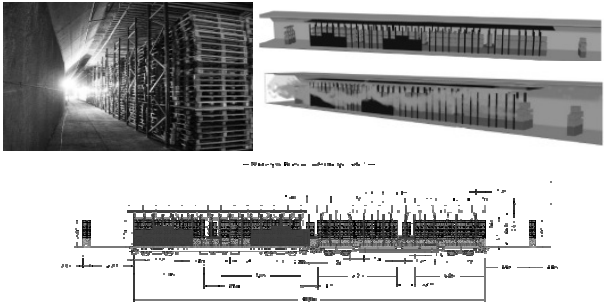
PROJECT SAFE – FIRE TESTS: Program

- Full scale fire tests:
 - Organised in TST in Northern Spain
 - IFAB carried out and recorded the tests with GSSO (simulations together with BG)
 - Efectis, Setec and STUVA have worked as independent party in SAFE project
 - Very safe protection concept was tested
- Challenges:
 - Extreme HRRs of the fire:
 - Design HRR 100 and 150MW fully developed Class A (HGV) (measured 200+MW)
 - Not only tunnel structure but equipment was put on their limits
 - Having fast fire development to design HRR
 - No reference available from previous tests



Experts in Tunnel Fire Safety 

PROJECT SAFE – FIRE TESTS: Mock-up



Slide 10

Experts in Tunnel Fire Safety 

PROJECT SAFE – FIRE TESTS: Test tunnel




Slide 11

Experts in Tunnel Fire Safety 

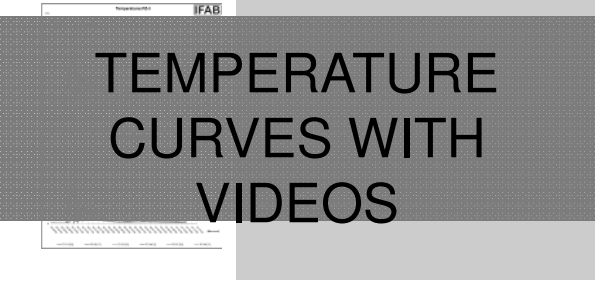
PROJECT SAFE – FIRE TESTS: Results

- Very good results were recorded:
 - Fire development followed the simulation and design HRR sizes were reached within short time
 - Even in case of 200+MW HRR fire, temperatures around the fire were got in control in two minutes
 - FOGTEC system was able to achieve all aims which were set for SAFE project



Experts in Tunnel Fire Safety 

PROJECT SAFE – FIRE TESTS: Results




Slide 13

Experts in Tunnel Fire Safety 

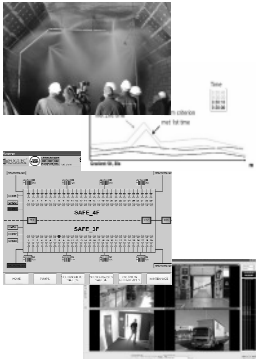



Slide 14

Experts in Tunnel Fire Safety 

PROJECT SAFE – SYSTEM COMPONENTS

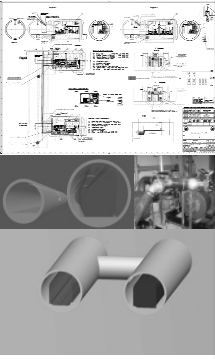
- State-of-art fire suppression system based on high-pressure water mist
 - Full scale tested 100/150/200MW
- Sophisticated linear heat detection system
 - Detection concept developed by FOGTEC for high redundancies and multiple detection cables (fibre optics)
 - Tested in full scale fire tests
- Control system
 - Fully automatic
 - SCADA interfaces
- Video surveillance and recording



Experts in Tunnel Fire Safety 

PROJECT SAFE – FFFS

- One pump station for 2 SAFE areas (one in both France and UK side)
 - Following UPTUN R251
 - Requirements completely different than for other WM applications
- Only very high corrosion resistant materials used, minimum AISI316
- Very innovative solutions for different technical aspects:
 - Dilation design criteria (1000°C)
 - Maintenance operations
 - Redundancies / RAMS studies




Experts in Tunnel Fire Safety 

PROJECT SAFE – Challenges

- Implementing the tested system to real tunnels
 - Very limited installation times (slots) available for rail tunnel
 - Reaching the installation areas
- Full integration to Eurotunnel safety concept
 - Integration of control systems
 - Integraion of operating protocols
- Very challenging design aspects
 - Tolerance against possible high temperatures
 - Harsh environment
 - Extreme high availability (proper RAMS studies)



Experts in Tunnel Fire Safety 

PROJECT SAFE – Conclusions

- Very effective fire suppression system was developed to specification of EUROTUNNEL:
 - Design specs were generated with the knowledge of real fires
 - Fire sizes were extreme demanding for test equipment, test tunnel and for FFFS
 - All tests were passed with excellent results
- Implementation and integrations is challenging for tunnel which is in operation most of time:
 - Limited installation times
 - Harsh environment
 - High availability for SAFE system
- EUROTUNNEL tunnels have already very high standard of life and fire safety, but new SAFE system is new improvement and very historical application for whole industry

Slide 18

Experts in Tunnel Fire Safety

FOGTEC[®]
FIRE PROTECTION

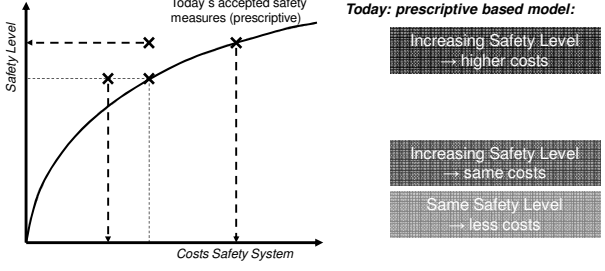


**FUTURE CHALLENGES –
SOLIT2 RESEARCH PROGRAM**

Experts in Tunnel Fire Safety

FOGTEC[®]
FIRE PROTECTION

SOLIT2 – Future approach (following UPTUN and SOLIT)



Today's accepted safety measures (prescriptive)

Today: prescriptive based model:

- Increasing Safety Level → higher costs
- Increasing Safety Level → same costs
- Same Safety Level → less costs

Safety Level

Costs Safety System

Slide 20

Experts in Tunnel Fire Safety

FOGTEC[®]
FIRE PROTECTION



**THANK YOU FOR YOUR
ATTENTION!!!**

Slide 21