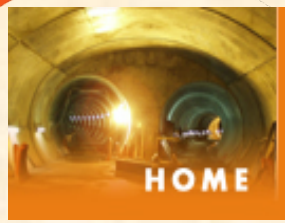
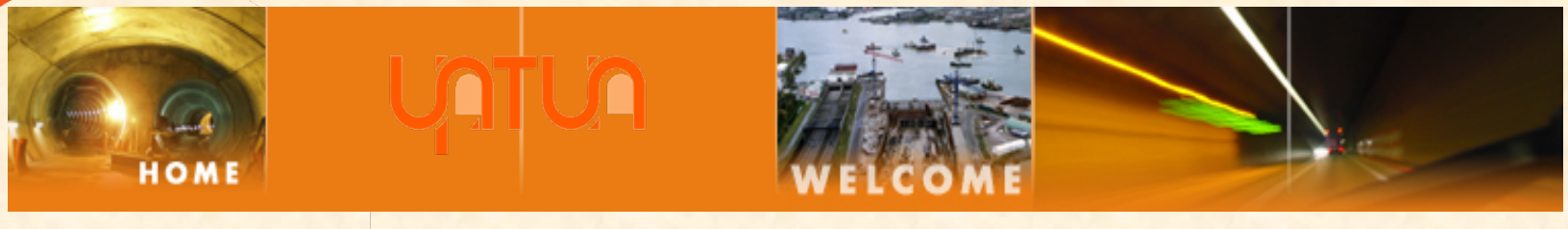


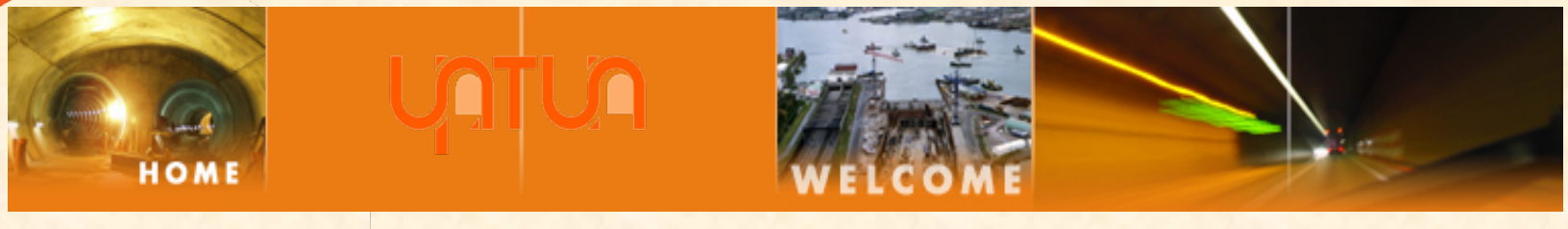
Improvements in Tunnel Safety – The Current Status of the Implementation of the UpTun Results

Dr. Horst Hejny
Dr. Horst Hejny Consulting
UpTun Exploitation Manager



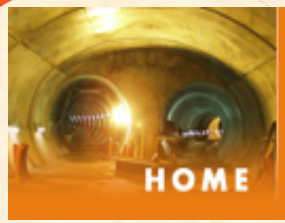
Cost-effective, Sustainable and Innovative Upgrading Methods for Fire Safety in Existing Tunnels

Dr. Horst Hejny
Consulting



Structure of the presentation

- Introduction – The European context of tunnel research
- Basic data of UpTun
- Examples of UpTun achievements and implementation
- Internationalisation of tunnel research
- Conclusions



- **Introduction – The European context of tunnel research**
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The priority political and societal objective is:

MOBILITY

MOBILITY

for passengers

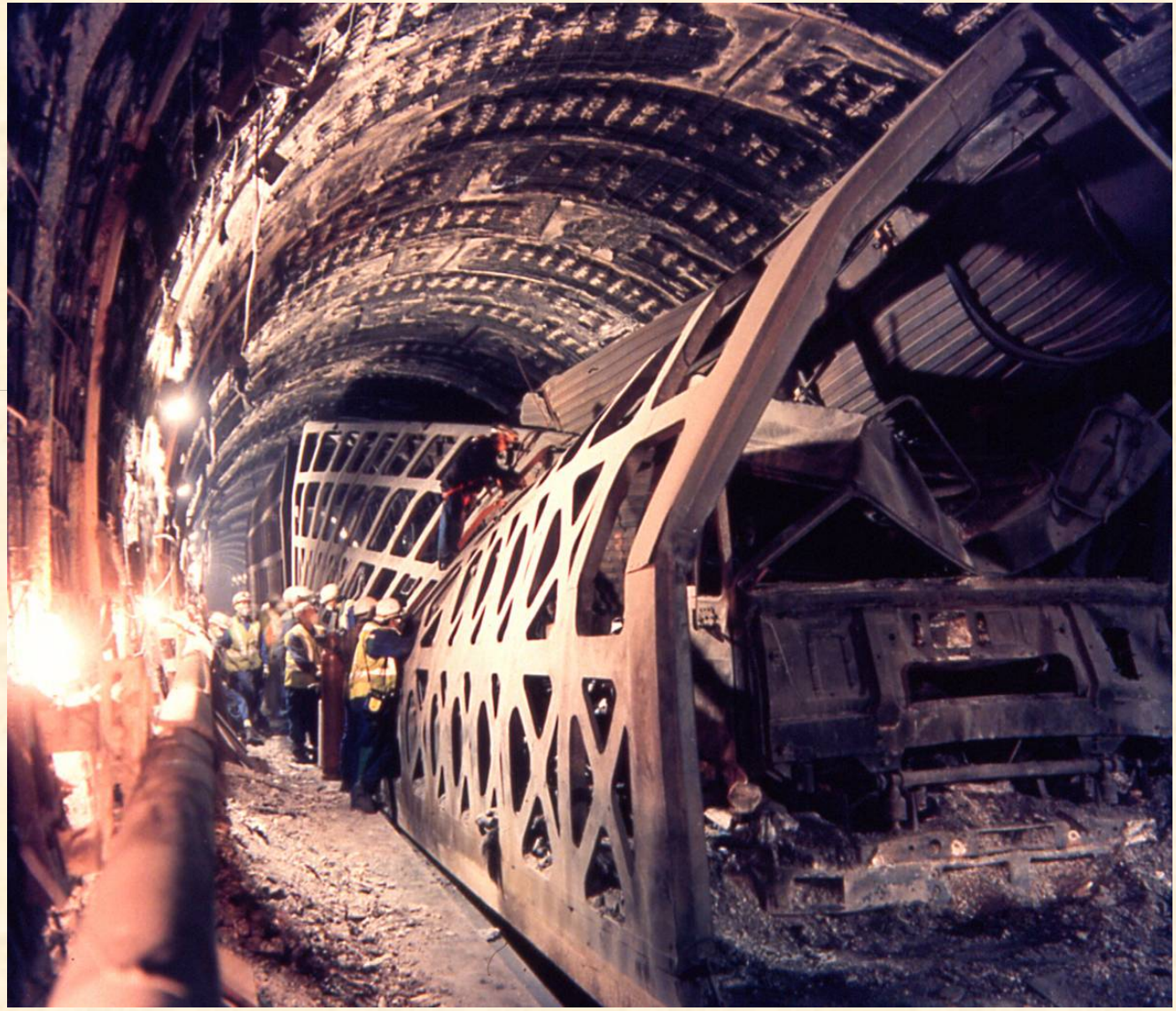
and goods

Tunnels are integral parts of the Trans-European Traffic Network

Current situation of existing tunnels

- Installations are not state-of-the art
- Traffic conditions had changed dramatically both in frequency and composition
  (more combustible and inflammable goods)
- Current safety level (especially fire safety) hamper the the use and the development of sustainable transportation systems, needed in a healthy European economy


2AV
-2



Safety risks in general

- Technical risks
  - Failure of any kind of technical installation
  - Failure of the structure
- Risk factor human
  - The human being as driver
  - Wrong behaviour in critical situations

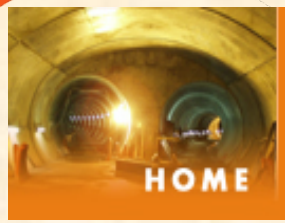
Safety risks in tunnels

Fatalities caused by catastrophic fires

High costs caused by long lasting tunnel shut-downs

Initiatives and projects on European level


Current
Knowledge
2001-2004
European Thematic Network Fire in Tunnels
fit
D·A·R·T·S
New tunnel
(design)
2001-2003
Safe T
UPTUN
"linked projects"
National &
International
Guidelines
Legislation
2002-2004
"linked
projects"
Safety measures
Existing tunnels
2002-2005



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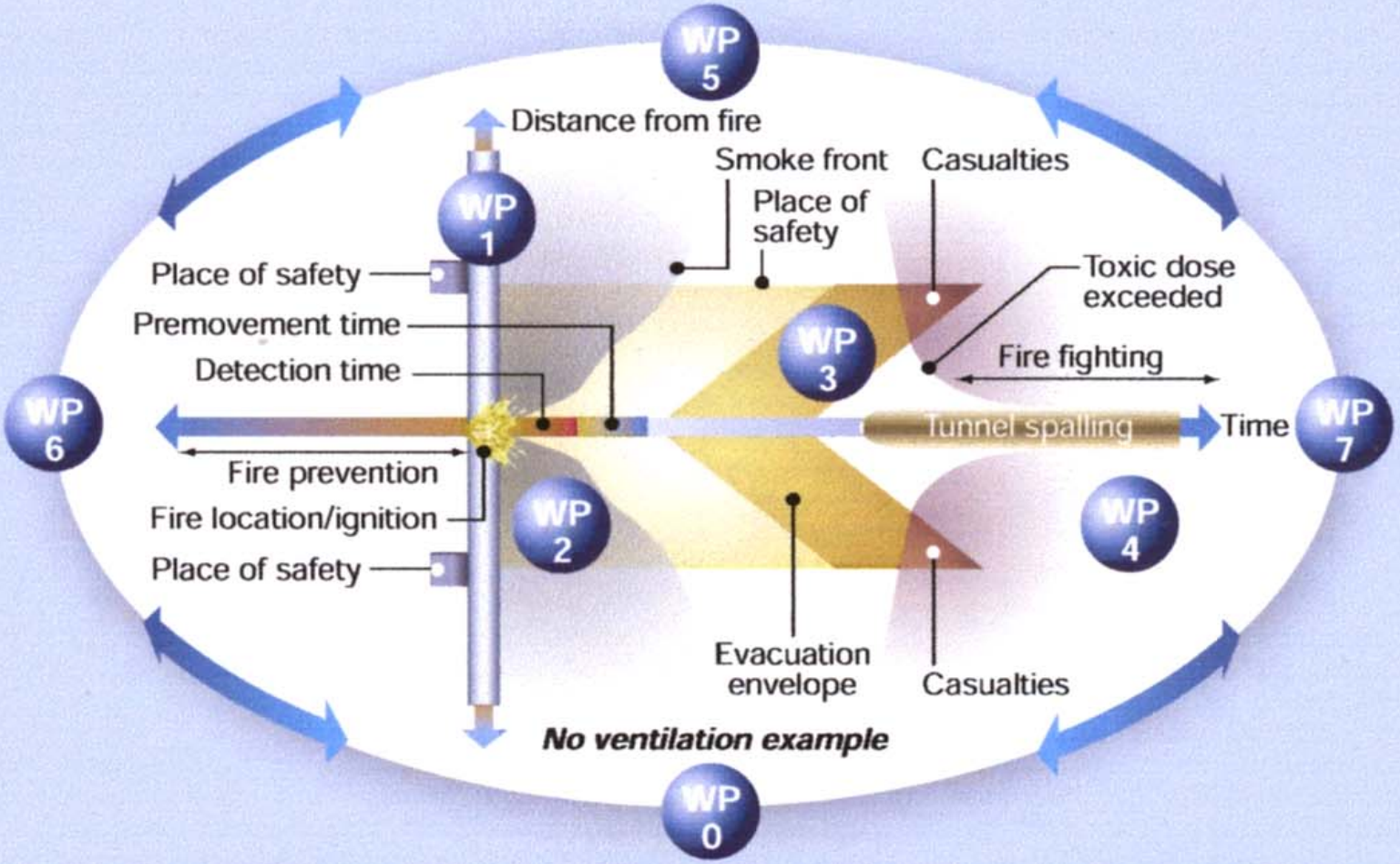
Main objectives:

- Assessment of existing technologies
- Development of innovative upgrade technologies
- Practical demonstration of measures
- Knowledge transfer
- Supply of evaluation models about upgrading

Focus:

- Technologies for fire detection and monitoring
- Technologies for mitigating fires
- Human behaviour in case of fire
- Protection of the tunnel structure
- Socio-economic factors
- Dissemination of upgrading know-how



WP 1 *Prevention, detection, monitoring*

WP 2 *Fire development & mitigation measures*

WP 3 *Human response*

WP 4 *Systems-structural response*

WP 5 *Global dynamic interactive fire safety evaluation and upgrading precedure*

WP 6 *Demonstration*

WP 7 *Promotion, dissamination, education/training, & financial socio-ecomomic impact*

WP 0 *Project management*

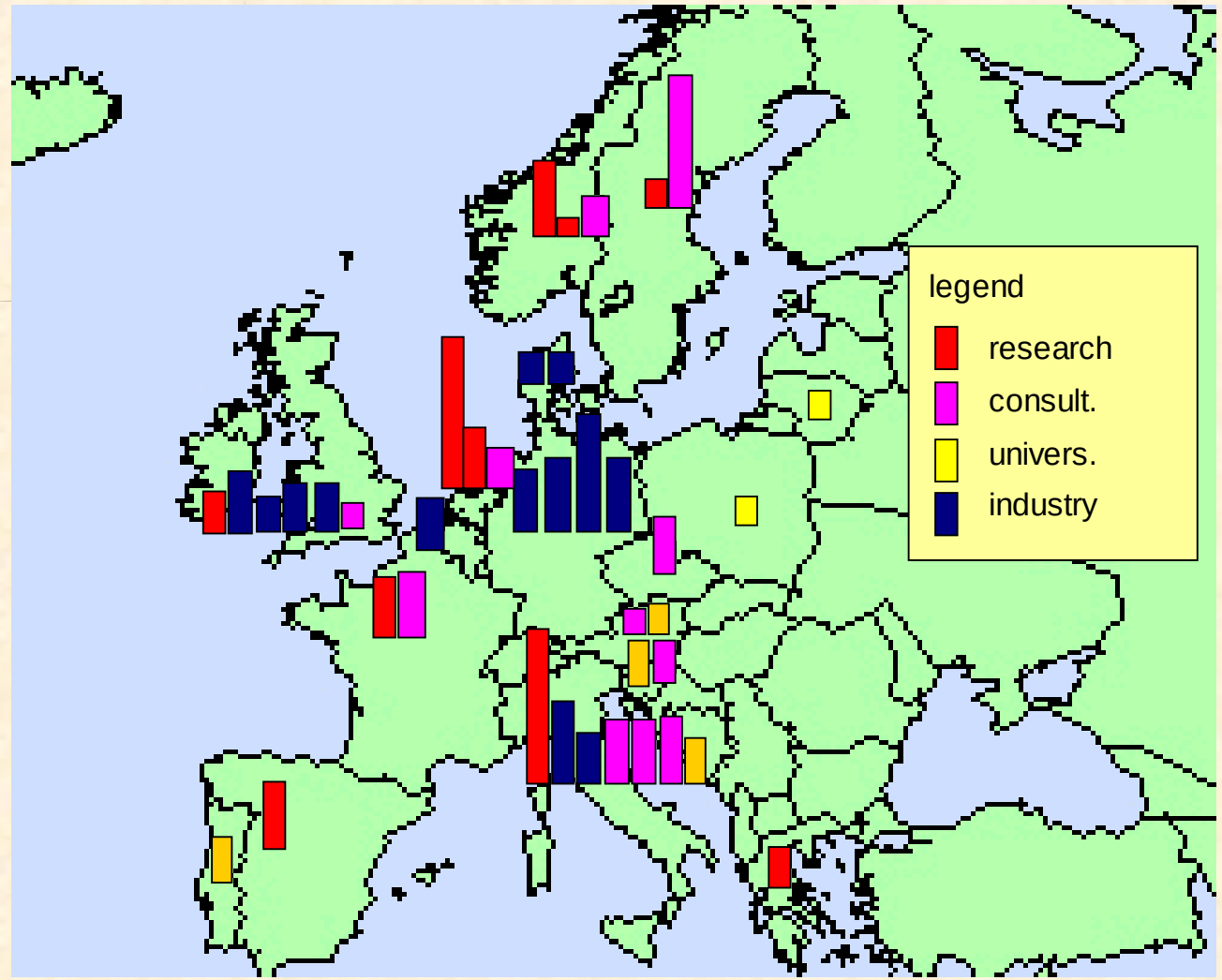
Desired spin-offs:

- Restoration of faith in tunnels
- Levelling out of trade barriers
- Increased awareness of stakeholders

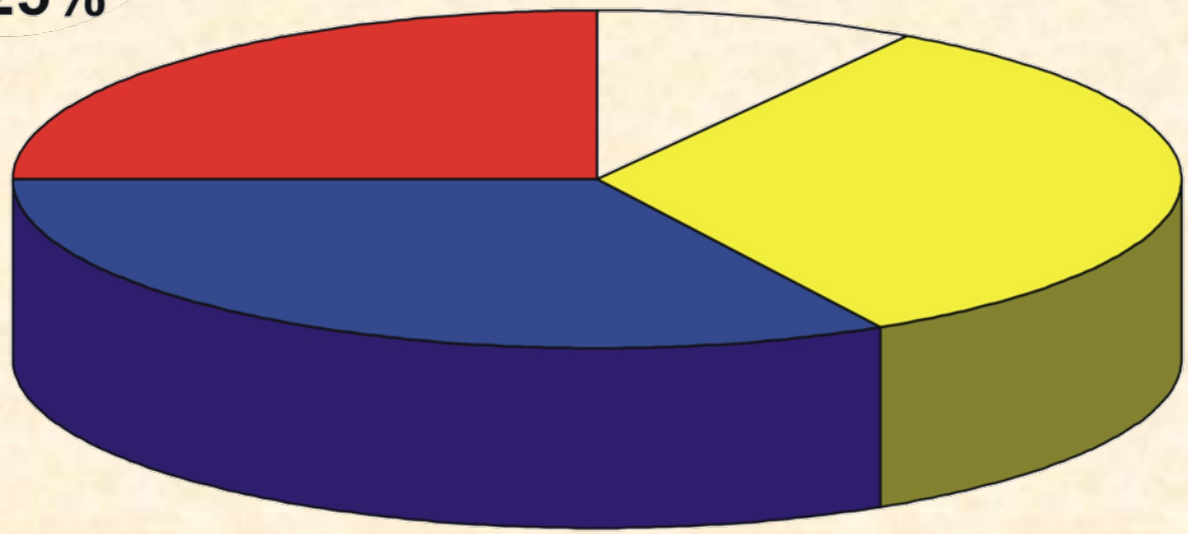
General project data:

- Duration: September 2002 to August 2006
- 41 Partners from 18 European countries
- 12 Mio € Volume (50% funding by EC)
- Approx. 950 man-months
  ≈ 80 man-years of work

The ATU Consortium

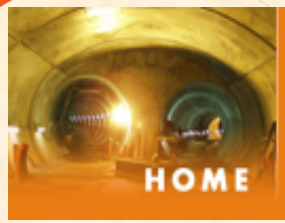


The UATUS Consortium



Technical approach:

- Holistic approach
- Development of suitable upgrading recommendations for existing tunnels
- Distinguish between the tunnel types (road, rail, metro)
- Main emphasis on innovation
  - Innovation relating to individual tunnel fire safety features (e.g. fire suppression)
  - Innovation relating to the fire safety of the tunnel as an integral unit (holistic approach)



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Achievements

Fire detection and monitoring

- Algorithm for detection of smoke and fires, especially moving fires by processing the images coming from CCTV

Achievements

Fire mitigation

- New knowledge about fire development and heat release
- Innovative mitigation technologies
  - Water mist systems
  - Tunnel plug
  - Water curtain system

Achievements

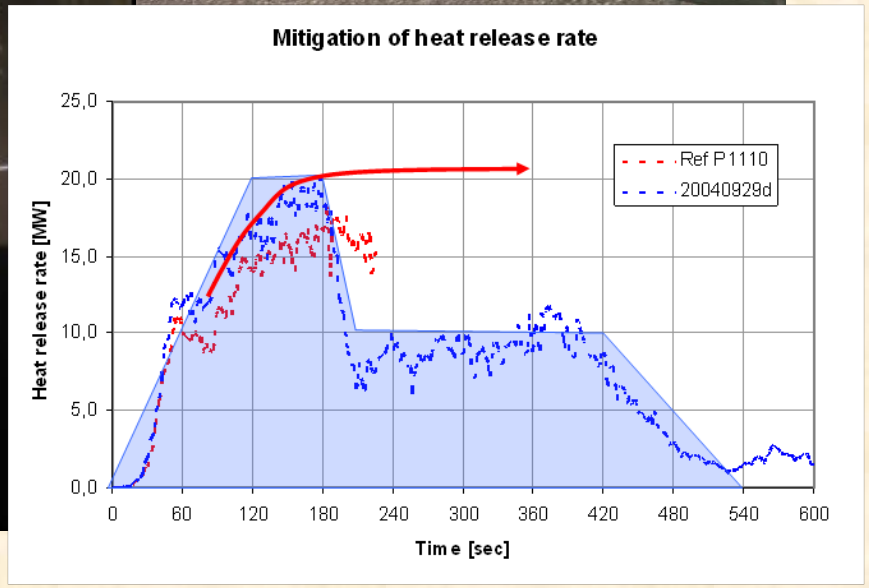
Fire mitigation

Runehamar tests

Achievements

Fire mitigation

Water mist systems



Achievements

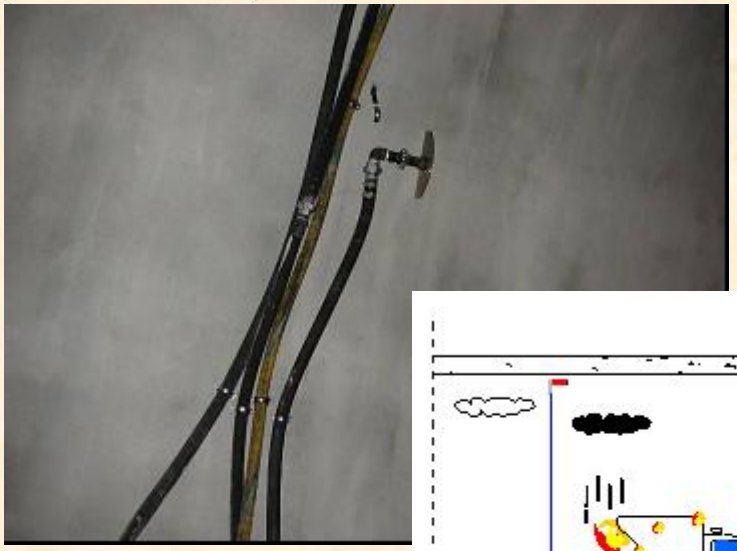
Fire mitigation

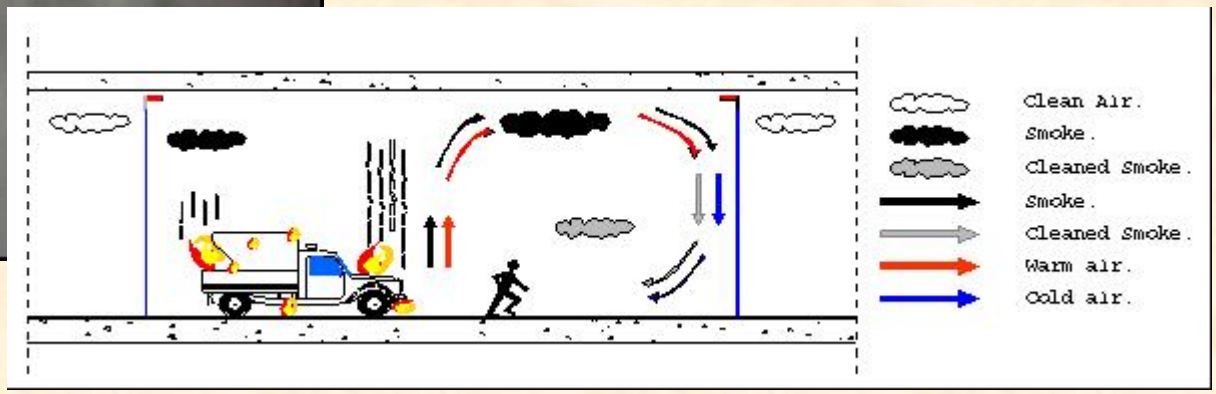
Tunnel plug

Achievements

Fire mitigation

Water curtain system





Achievements

Human response

- New knowledge about human behaviour in tunnel environment
- New knowledge about crowd movement
- Innovative egress model
- Innovative evacuation tools
  - “Evacuation beacon”
  - Sound beacon

Achievements

Human response

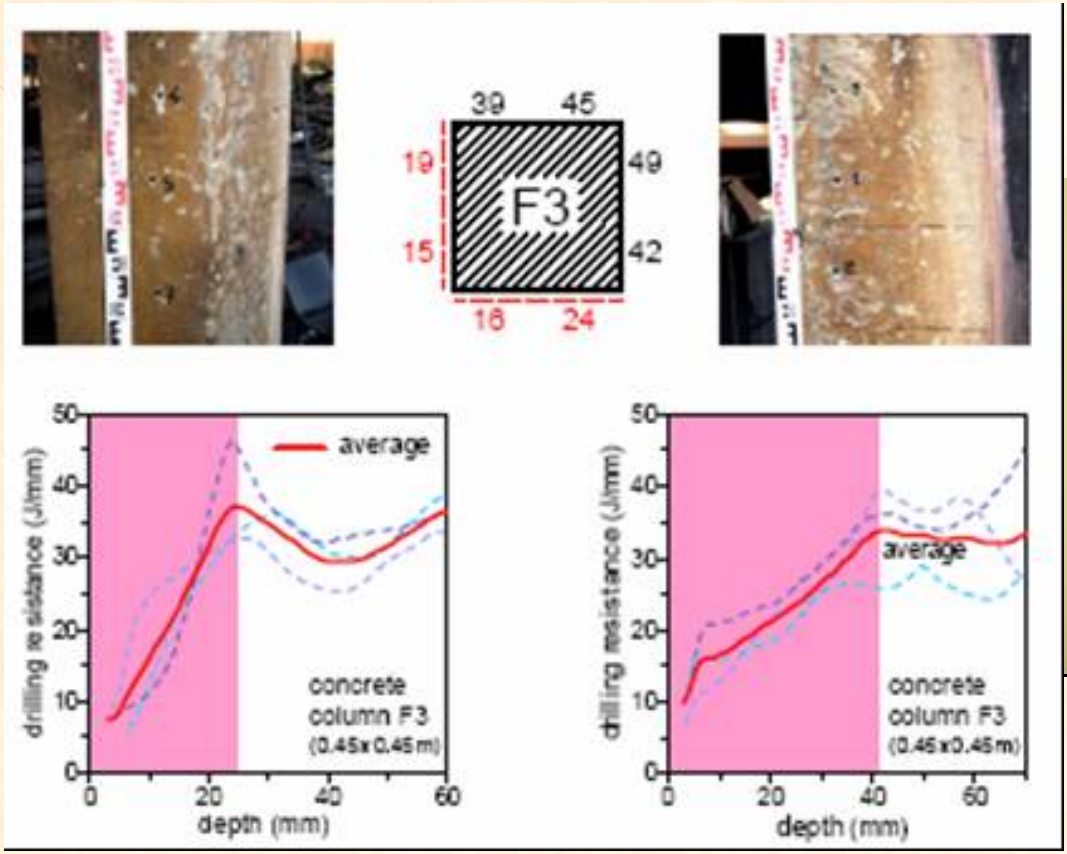
Achievements

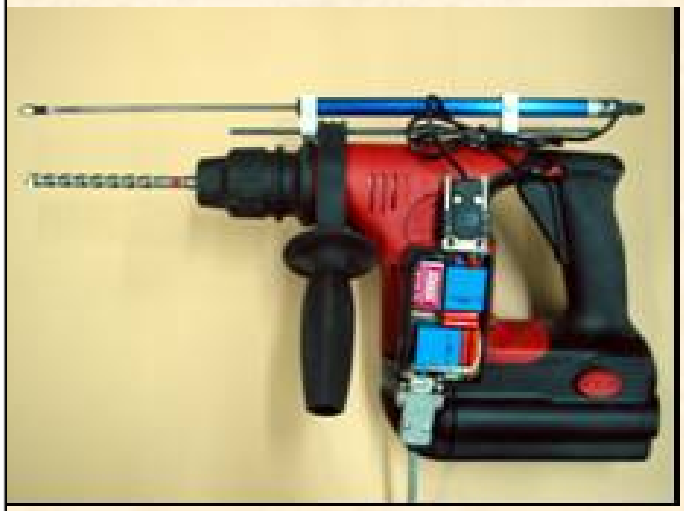
Structural response

- New knowledge about behaviour and functional capacity of functional elements
- New damage investigation method
- Repair and recovery procedures including new repair material
- Review of explosive spalling
- Spalling assessment and design tool (HITECOSP 2)

Achievements

Structural response





Achievements

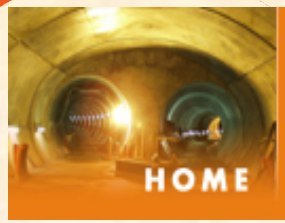
Holistic-dynamic evaluation and upgrading model

- Modelling the influence of suppression system on fire-smoke development
- Risk assessment of system-structural response
- Dynamic modelling of the human consequences for possible fire developments in the tunnel
- Use of constraint programming to optimise the number of options from the model
- Use of expert systems
- Use of logarithmic addition theory to optimise on safety levels
- Development of fire risk profiles for a tunnel as a whole for input into socio-economic model
- Socio-economic model

Achievements

Final remarks

- Not all results shown
- Much more tests and investigations have been carried out
- For more information please contact the project team members
  (see http://www.uptun.net)



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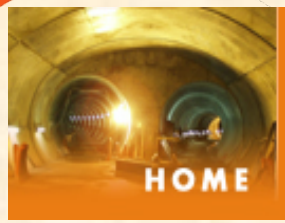
Internationalisation

ITA-COSUF



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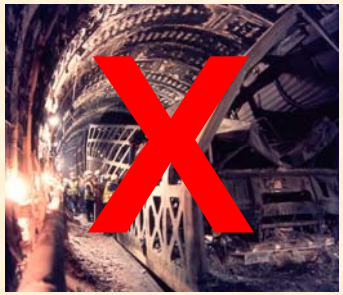
Conclusions

 ...

- … was a very successful project
- … has achieved a lot of valuable and innovative results related to fire safety
- … has now an international platform for dissemination

Ladies and gentlemen
thank you for your attention

Dr. Horst Hejny
Consulting