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1. Message from the Chairman



Dear friends of ITA COSUF,

I hope you have enjoyed your summer holidays and that this Newsletter finds you in an optimal condition back at work. Already three months have gone since the COSUF Workshop “Aging Tunnels – Safety in operation and during refurbishment” has been held at the WTC 2015 in Dubrovnik. During this event Karl Fridolf was announced as the winner of the ITA COSUF Award 2015. In section 5 he presented his valuable work on Rail Tunnel Evacuation. Although the visibility of this COSUF Workshop on the Programme of WTC 2015 was inadequate, the presentations and speakers were excellent.

For those of you who were unable to attend the meeting you can find a brief report in section 2. Almost all presentations are available from our new website.

In combination with the workshop we also held our annual General Assembly. One topic was the launching of our new ITA COSUF website. Thanks to a major achievement of AG1 member Arild Petter Søvik, we succeeded in our aim to have a modern state-of-the-art website ita-cosuf.org which will help us to play our important role in the field of operational safety of underground facilities. I am sure that this new website will improve the communication between members and the outside world and will support the presentation of our ITA COSUF reports guidelines and recommendations. This will lead to increase our memberships and simultaneously enlarge the geographical scope.

You can learn about the latest developments of the core of ITA COSUF – the activity groups – in section 3.

The next meeting of all ITA COSUF members will be held in Hamburg on 28-29 October (see section 4). Our German member Christina Kluge of Landesbetrieb, Strassen, Brücken und Gewässer (LSBG) and her colleagues have prepared a very interesting programme including a site visit to the Elbe tunnel. I look forward to meeting all of you there so that we can together contribute to the future of ITA COSUF for still better underground safety!

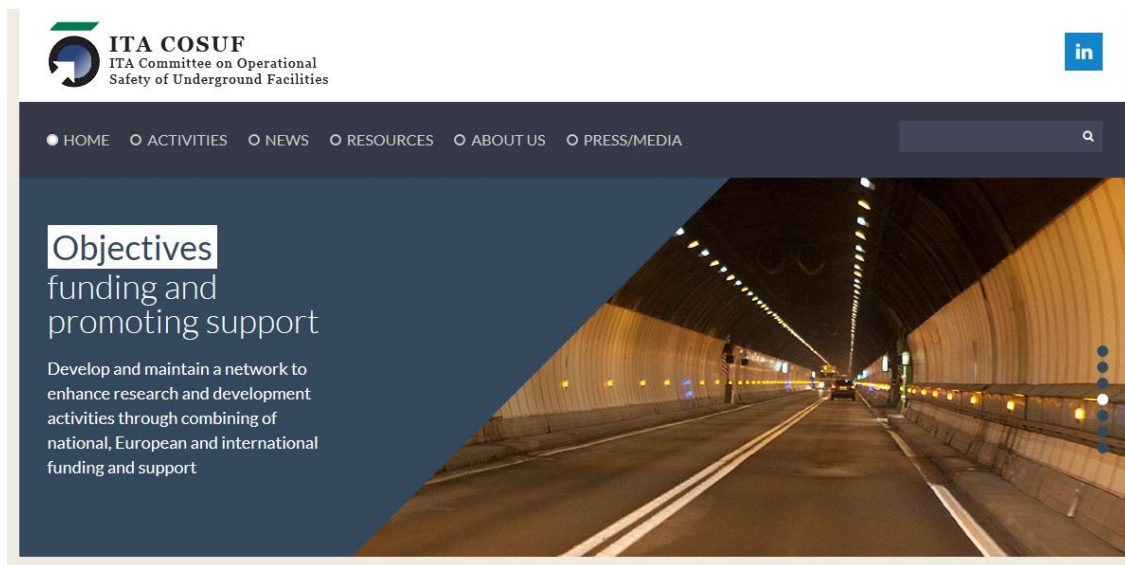
Yours

Roland Leucker – ITA COSUF Chairman



2. Report of the ITA COSUF Workshop in Dubrovnik, 26 May 2015

On the 26th of May the COSUF General Assembly took place in Dubrovnik followed by the 2015 open workshop. Theme of the Workshop was Aging Tunnels – Safety in operation and during refurbishment. The meetings were successful and the quality of the presentations was good. However, the visibility of the ITA COSUF workshop as part of WTC 2115 was poor, the workshop was not explicitly mentioned in the programme. The new homepage was presented during the General Assembly. The new website – ita-cosuf.org – was developed by AG1 member Arild Petter Sjøvik and was presented at the beginning of the workshop. The online appearance of COSUF now is modern, attractive and full with valuable information. Members and visitors will find the site easy to navigate and find information about activities, news, resources and the committee.



The workshop – held concurrently with the ITA-AITES World Tunnel Congress 2015 – showed case studies, new technologies and new approaches from lecturers all over the world. After a short welcome by the chairman Dr. Roland Leucker, the tunnel-in-tunnel method was presented, as well as tunnel inspection and assessment, the implementation of the EU directive 2004/54 and the Mont Blanc tunnel. The second session covered “Monitoring, Inspection and Assessment” and gave examples of interesting applications in a special field of safety for underground facilities. Research and new products were central topics of the presentations and discussions of



ITA COSUF Chairman Roland Leucker presenting Karl Fridolf the COSUF Award 2015.

the third session. Finally, refurbishment and risks were the main themes of the last session. Detailed information is available on the ITA COSUF homepage.

One of the highlights of the annual ITA COSUF meeting in Dubrovnik was the presentation of the ITA COSUF Award Winner 2015, Karl Fridolf from Sweden. As part of the awards ceremony, he presented his honoured thesis on evacuation in rail tunnels. Fridolf explained the aspects of evacuation through smoke, the design of evacuation systems for rail tunnels and gave examples how to achieve this under the given circumstances. His paper is included in section 6 of this newsletter.



3. Report from the Activity Groups

AG1 Interaction with European and international initiatives

AG1 has six active members: AG1 leader Ben van den Horn (Arcadis, NL), Roland Leucker (D), Tobias Schaller (CH), Eric Premat (F), Felix Amberg (CH), Niels-Peter Høj (CH) and Arild Peter Sjøvik (N). AG1 was active in helping organising the Workshops in Berlin, Copenhagen and Dubrovnik. AG1 is promoting ITA COSUF in the international safety community (PIARC, UITP, etc) and aims to co-organise future events with other platforms. A new ITA COSUF website (www.ita-cosuf.org) was launched in Dubrovnik. Three ITA COSUF Newsletters are produced annually.

AG2 Regulations and best practice

Stig Ravn (COWI, DK) and Peter Reinke (HBI, CH) are AG2 co-leaders. The ambition is to be a global forum for tunnel safety and the place to go to for unambiguous or unresolved practices. Finally, AG2 will form an initiative part of the tunnel safety community and shall have a review role in new and published national and international regulations on tunnel safety and security. The activities in AG2 consist of providing a forum for discussion of regulations and best practice, Identifying holes or lack of relevant regulations with regards to tunnel safety, Reviewing and commenting of new national and international regulations. Outputs will be the publication of guidelines and/or recommendations for unambiguous or lacking regulations. Right in time before the WTC the guideline “Survey of existing Regulations and recognised Recommendations – Operation and Safety of Road Tunnels” has been updated and published in a new and fresh layout. It is available for download from the website.

Upcoming activities are to actively work towards presenting COSUF Best Practice Paper on the chosen subject, updating and publishing the survey of existing regulations for Road Tunnels and attempt to restructure the AG such that activity in towards the AG is encouraged and finally grow the AG group with invitation of individuals being specifically interested in certain topics.

AG3 Research and new findings

Götz Vollmann (RUB, D) is the AG3 leader. AG3 has about 22 members and AG3 work results are made available for COSUF members. Main actions within AG3 are:

1. Exchange information about research and development activities worldwide;
2. Up-to-date awareness of latest research and development results;
3. Initiate and support scientific work on subjects with high actuality;
4. Indicate research opportunities;
5. Networking for future research consortia.

Recently performed activities were the preparation of a “Marie Curie”-proposal and the support of a master thesis regarding the safety levels of tunnels under the premise that new energy carriers are in the tunnels. Next activities will be the preparation of a series of Master theses on coupled models for structural tunnel assessment (CFD-FEM-models “FDS meets Diana”) and opening up a working group within AG3 with a focus on BIM and operational safety.

AG4 Road Tunnel Safety Officers

Johan Bosch (RWS, NL) is the AG4 leader. AG4 is facilitating exchange of experience between Tunnel Safety Officers (TSO's) by:

1. Planning and organizing a biannual European TSO Forum;



2. Establishing best practices for TSO's on tasks and functions.

At present AG4 has 18 members. The ambition is that all EU TSO's become member of ITA COSUF and AG4 member. The previous TSO Forums were held in Lyon (2009), Brussels (2012) and Luxembourg (2014). The 4th EU TSO Forum is planned in March 2016. Topics of interest are maintenance and refurbishing during operation, the role and responsibility of emergency services, degrading of tunnels and failures, minimal operation requirements and best practices on tunnel safety documentation.

4. ITA COSUF Workshop and AG Meetings in Hamburg, 28-29 October 2015

The AG meetings and ITA COSUF Workshop at the A7 Elbe Tunnel will be held on 28-29 October 2015 in Hamburg (Germany). The workshop will be organized by Landesbetrieb, Strassen, Brücken und Gewässer (LSBG). The two day programme consists of Activity Group Meetings on Wednesday 28 October (15:00-18:00) followed by a Joint dinner offered by ITA COSUF. The venue will be the Handwerkskammer in Hamburg. The workshop will be on Thursday 29 October starting at 9:00 until 17:00. Part of the workshop will be a visit to the Tunnel Control Centre (TCC) and Hochbahn. A leaflet with preliminary programme and registration form can be found on our new website on short notice. The programme is so, that you should be able to travel on the meeting days. It will be an interesting programme and we do hope to meet many of you in Hamburg! Block your agenda and register right now!



5. Rail Tunnel Evacuation by ITA COSUF Award Winner 2015 Karl Fridolf

Rail tunnel fires are rare, but can lead to disastrous consequences in terms of lives lost and injured people. This is particularly true when passenger trains cannot transport people to a safe location, but instead have to be evacuated in the tunnel. In such an event, people will have to rely on their own ability to evacuate to a safe place. This involves overcoming a number of obstacles, both mental and physical, including making a decision



to evacuate, evacuating the train to track level, and finding a way to safety in the unfamiliar environment that a rail tunnel represents.

A safe rail tunnel is, thus, a tunnel, which allows people to move to a safe location in case of fire, also when passenger trains have to be evacuated inside the tunnel. It is, therefore, necessary to consider human behavior aspects both during design and operation of rail tunnels. Unfortunately, information and data about human behavior in rail tunnel fires have until now been very scarce. However, now new research on the topic of rail tunnel evacuation is presented. Among other things, this research demonstrates that much of what we know about human behavior in building fires can be applied also for tunnels and other underground structures.

One important conclusion from this research is that people on a train rarely panic during a rail tunnel fire. On the contrary, human behavior is rational and it may take quite some time for people to interpret, prepare and act, i.e., by making a decision to evacuate. Aspects that have been shown to affect his decision are, among other things: information about the fire, the contextual role that an individual has on board a train, the expectations related to that role, and also the behavior of other people. In summary, these conclusions altogether demonstrate the large need for information to passengers on board a train in case of a rail tunnel fire.

The research that is now being presented also highlights a number of unique aspects and problems that people may face during a rail tunnel fire. Furthermore, it proposes solutions to these problems. One example of a typical



problem that people will face during a rail tunnel evacuation is the vertical height difference between the train and tunnel floor, present in many rail tunnels. When there is no platform to evacuate onto, people must instead jump down from the train to the tunnel floor, a distance typically corresponding to more than one meter. This vertical distance may cause severe flow constraints and problems to people in general, and disabled people and elderly in particular. One possible solution to this problem is to provide rail tunnels with elevated pathways. Such a pathway would also mean that people could evacuate on a flat surface, in contrast to a coarse surface material, such as macadam, which for many people is perceived as difficult to walk on.

Another problem highlighted by the new research is the fact that people who evacuate a rail tunnel often tend to move toward one of the tunnel portals. This is due to the fact that people faced with a fire want to move toward familiar places, i.e., locations that are previously known to them. In a rail tunnel, this is symbolized by the tunnel portals. This do, however, mean that it takes unnecessarily long time to evacuate a tunnel and to reach a safe location, as existing emergency exits in the tunnel are not used.



The research that is now being presented proposes a solution to this problem. By providing the emergency exits in a rail tunnel with loudspeakers, which can broadcast an alarm signal followed with a pre-recorded voice message stating that the sound is coming from an exit, people can efficiently be notified about the existence of the available exits. Compared to other types of traditional way-finding installations, such as light installations, the loudspeaker installation has also been shown to be superior in terms of attracting and getting people to use the exit (i.e., there is a difference between notifying people about an exit, and getting them to use it), also in smoke-filled tunnel environments with reduced visibility. The new findings are important, as the loudspeaker installations is both simple and cheap, which means that it can be used not only in new tunnels, but also in already built tunnels which are being refurbished.

These new findings offer an important contribution to the understanding of human behavior in rail tunnel fires. The findings can be used to increase the level of safety for people during rail tunnel evacuations, which in turn may contribute to safer rail tunnels in the future.

Karl Fridolf, Research Scientist at SP Fire Research and industrial PhD student at the Division of Fire Safety Engineering, Lund University. The content in this article is a popular science summary of Karl Fridolf's PhD thesis. Karl was the recipient of the ITA COSUF Award 2015, which he received during the ITA COSUF workshop in Dubrovnik on May 26. At the workshop, Karl presented some of the work included in his thesis. By due permission of the Faculty of Engineering, Lund University, Sweden, Karl will defend his thesis on Friday June 12. The thesis is publicly available at: <https://lup.lub.lu.se/search/publication/5368902>.

6. Future ITA COSUF events

ITA COSUF workshops and Activity Group meetings

- | | |
|----------------------|---|
| 28 – 29 October 2015 | ITA COSUF Workshop and AG meetings, Hamburg (Germany)

This two-day event will include a technical visit to the Elb tunnel. AG meetings will be held in the afternoon of 28 October. |
| 22 – 28 April 2016 | World Tunnel Congress 2016, San Francisco, USA

Optional: An ITA-COSUF one day open workshop, or elsewhere. |
| Fall 2016 | Private ITA COSUF Workshop: Maastunnel, Rotterdam, Netherlands |

Other events organised or endorsed by ITA COSUF

- | | |
|------------------------|---|
| 15 – 16 September 2015 | 16th International Symposium on Aerodynamics and Ventilation and Fires in Tunnels, Seattle, USA. |
| 1 – 2 December 2015 | STUVA Conference 2015 Dortmund, Germany. |
| 16 – 18 March 2016 | 7th International Symposium on Tunnel Safety and Security, Montreal, Canada. |

For all enquiries to ITA COSUF membership please contact Ben van den Horn ben.vandenhorn@arcadis.nl



7. ITA COSUF member introduction: IFAB

The Institute for Applied Fire Safety Research (IFAB) is one of the most experienced institutes in Fire Safety Consultancy and



INSTITUTE FOR APPLIED FIRE SAFETY RESEARCH

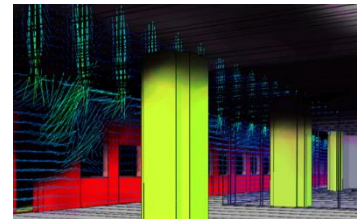
Research. The company headquarters are located in Berlin, but IFAB works internationally. The IFAB team has been involved in fire testing since 1994, and benefits from the experience gained from over 1800 fire tests in different applications. These cover numerous different applications, from laboratory scale tests for ordinary hazards to large scale tests for road tunnels with heavy goods vehicles.

In addition to fire testing, today IFAB also focuses on fire engineering. Fire engineering is carried out for different application areas, in particular related to underground (Metros&Tunnels). Reliability engineering relating to fire or life safety systems is also part of IFAB's product portfolio. The Company Mission is to provide innovative and effective fire protection services to clients at reasonable cost.

IFAB's services

IFAB provides a full range of services, from fire risk analysis and feasibility studies to the commissioning of different fire protection systems and solutions. IFAB's background is in fire testing and research. This ensures that the design methods used and solutions provided are technically and commercially optimised, providing the best value for clients. The services related to underground applications cover following:

- Fire risk analysis
- Fire safety concepts and feasibility analysis
- Computational Fluid Dynamics (CFD)
- Fixed fire fighting systems
- Ventilation
- Evacuation simulations and analysis
- Fire and smoke tests
- Fire investigations



IFAB's contribution to tunnel fire safety research

IFAB has continuously been involved to the research of tunnel fire safety. For example SOLIT2 research program or FFFS technologies comparison fire tests for Tunnel Mont Blanc can be mentioned as largest fire test programs IFAB has recently carried out. IFAB also participates to various tunnel safety research networks like ITA-COSUF. Additionally IFAB also contributes to the fire safety standardisation works.



Please visit www.ifab-fire.com for further information.

Contact:

Max Lakkonen

Tel: +49-(0)30-643185 906

Fax: +49-(0)30-643185 979

@: Lakkonen@IFAB-FIRE.com

www.ifab-fire.com