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### 1. Message from the Chairman

Dear friends,

Despite the economic crisis, 2011 has been quite an active year for ITA COSUF. With currently 74 member organisations from 22 countries, we are better and better fulfilling our mission: to be “the centre of excellence for world-wide exchange of information and know-how regarding safety and security of underground facilities“.

This was demonstrated by our open workshop on "Designing Underground Safety – How far to go?", which was among the best-attended and most lively technical sessions of the World Tunnel Congress in Helsinki last May. More recently, our private workshop in Amsterdam gathered more than 60 participants from 15 countries. The excellent programme prepared by our Dutch members Arcadis and Efectis was mainly devoted to the safety challenges of the underground exchange centre of the Amsterdam Central Station island (see section 2 below) and included a very interesting technical visit. We were at the core of ITA COSUF scope, a place where rail meets road and metro underground, and passengers can go from train to metro, bus and tramway through multi-purpose spaces below ground and water.

The workshop was accompanied by meetings of the Activity Groups (see section 4) and Steering Board. An important issue discussed there was a partial renewal of the Steering Board members at the next ITA COSUF General Assembly. Candidates for the Steering Board should apply by informing either our general secretary, Jan Mijnsbergen, or me by 29 February 2012.

It was also decided to reduce the ITA COSUF membership fee for private companies with less than 10 staff and make no increase for other members; additionally, an individual membership was created (see section 6).

The steering board established criteria to help decide whether an outside conference should be sponsored by ITA COSUF (with logo and possibly links on our website, no funding). Among other criteria, the event should fall within our scope, not be too specialised nor commercial, give ITA COSUF a good visibility, offer some kind of reciprocity. On this basis, it was decided to sponsor the SOLIT conference on 27-28 June 2012 in Berlin, which will include an ITA COSUF session.



Our programme for 2012 (see section 5) is substantial and will start on 18 January with the 2<sup>nd</sup> European Forum of Road Tunnel Safety Officers organised by Activity Group 4 in co-operation with the European Commission and the World Road Association (PIARC). The ITA COSUF General Assembly will take place on 22 June in Rome and will be followed by our annual open workshop, which will deal with cost-effectiveness of tunnel safety measures. Do not forget to inform students and young researchers about the ITA COSUF Award 2012, which will be handed over at the workshop (see section 3)!

I hope all ITA COSUF members will find this programme attractive and will take a still more active part in the activity groups and planned events. Non-members are invited to take part in the open workshop in Rome, and – why not? – become members so as to have access to all activities and take profit of the network.

Together with the Steering Board members, I wish all of you a fruitful and happy year 2012, professionally in liaison with the ITA COSUF network, as well as personally for you and your families.

Season's greetings

Didier Lacroix

## 2. Report on ITA COSUF Workshop in Amsterdam, 14 November 2011

The nineteenth century first class waiting room at Amsterdam Central Station was the setting for the ITA COSUF Workshop on 14 November 2011. Some seventy tunnel safety specialists had come to learn about the safety aspects of a series of projects like the Amsterdam metro project North-South line and IJ-side. The two organizing partners of the venue, Arcadis and Efectis, had also offered some Dutch non-ITA COSUF members the opportunity to attend. This was a successful initiative, as about twenty Dutch non-members were present in the audience and we were able to attract at least one additional ITA COSUF member.



ITA COSUF chairman Didier Lacroix opened this first large-scale ITA COSUF activity in the Netherlands. Then the local hosts Ben van den Horn of Arcadis and Kees Both of Efectis welcomed the visitors before handing the microphone to the first speaker Johan Bosch, professor of Underground Space Technology of Delft University of Technology. Johan Bosch was announced as the founding father of the North-South line and he kicked off by introducing the complete series of projects around Amsterdam Central Station and the North-South line.



The projects are about the redevelopment of three artificial islands, on one of which the Central Station is built. They comprise not only a metro, but also a traffic circulation plan with a redesign of the routing for cars, buses and pedestrians. Johan Bosch underlined that under the very feet of the workshop attendants the work went at that very moment; it is a unique situation of a metro line being built in the weak soil under a vast monumental train station in use. Johan Bosch explained that deep under the monument a canal was created on a concrete floor, where a 136 metre-long immersed concreted tunnel segment came in like a submarine and was eventually sunk to its place. "A whole new underground world is created", as Bosch put it. The line will not be commissioned before 2017, but this November there was already a small highlight, when the first part of the underground space was opened to the public. The new line comprises nine kilometres of new infrastructure, of which six kilometres subsurface at a depth of twenty to thirty metres. There are eight stations, four of these complex deep stations. The building process is a combination of techniques, with immersed tunnels and two three kilometres stretches of twin bored tunnels.

In the nineties, there were no detailed rules on underground safety in the Netherlands. The safety concepts had to be developed from scratch. An integral approach was followed, combining infrastructure, operations, vehicles and persons. This approach took fires, social safety aspects and terrorist attacks into account. Key to the integral safety concept was the 'safe haven' principle, based on the idea never to stop a metro train in between stations. The system is based on the drastic safety measures in stations, where the highest levels of smoke and heat extraction will be installed. In this line of thinking, the capability of self rescue for people was key. The choice was inspired by some vital differences between road tunnels and a metro tunnel. One difference is that a kilometre of road tunnel might contain two to three hundred people; in a metro there can be two thousands. In Amsterdam the depth of the platforms at twenty to thirty metres is an extra complication, as is the 3 min 45 sec interval between metros. In a later phase even a 1 min 52 sec interval is foreseen, which is not compatible with the 'safe haven principle' of having a free track to the next station.

In order to be able to get a thousand people out of a station within fifteen minutes, based on self reliance, an unconventional choice was made. This was to use high capacity, power supply safe escalators for evacuation. These only go up in case of an emergency. Escalators had always been a legislative 'no go' in the Netherlands. Therefore elaborate simulations and evacuation scenarios had to be designed and tested with both probabilistic and deterministic approaches to get the proper permits. Even a full scale evacuation test was held. It proved that even when the escalators do not run, the safety demands are met. Evacuation should be possible in seven to eight minutes instead of fifteen.

Secondly, Bart Duijvestijn of Arcadis took the stage to focus on fire safety in multiple space use during construction and operation. Arcadis is deeply involved in the IJsei project, the IJ river side of the station redevelopment. It involves four floors of infrastructure above each other: the metro at -2, the road tunnel at -1, a transfer and shopping area at 0, and a bus platform and supply area at +1.



Here, like with the metro, the lack of legislation was also a problem when fire safety engineering started in 1999. Proceedings for approval tended to become more complicated by that. A remarkable feature of the project was that the engineers were kept on when the building permit came in. The engineers did not make way for the builders, but were kept in place to solve ever emerging new design challenges.



A European directive and an even stricter Dutch law in 2006 proved this to be wise. As an outcome of this law, the building process had to be stopped to design an alternative trajectory for an escape route and an extra fire proof wall. Since then each phase was followed by a thorough integral safety evaluation with the authorities, to guarantee both project progress and optimal safety for the end situation and during the complex construction job. Duijvestijn: “When you keep the engineers in place, they come up with relatively simple measures to solve new safety challenges.”



The subject of the third speaker Tony Lemaire of Efectis was the prediction of thermal action from fires in metro carriages on the North South tunnel lining. Has the tunnel lining to be protected against fire impact? Preliminary

studies based on literature, expert knowledge and simple models were carried out first, followed by more in-depth Computational Fluid Dynamics (CFD) studies. “A good strategy”, Lemaire remarked, “in order to be able to perform the right CFD Studies with the right parameters.”

The main instrument to visualize computational outcomes is a graph with one axis representing time and the other one representing heat development in MW. Apart from that, smoke spread is important for passenger survival. Important parameters for total heat release are the materials used in carriages and the types of protective tunnel lining. Moreover, the metro train lay out has a profound impact on fire development. A walk-through metro train holds far more risks than six separate, individually fire protected carriages. Additionally, the effects of in-train fire protective measures such as fire detection, communication devices and staff training, improved material properties and water mist were taken into account.



This work enabled conclusions on the right choices for carriages and tunnel lining. When a 15 MW fire gets the opportunity to build up temperatures of 600-800°C, there is the risk of ten centimetres concrete spalling, so that this situation has to be prevented. A temperature of 400-600°C is already enough to cause cracking in walls at right angles. Ventilation is a tricky subject. It can have huge impact, but it is impossible to predict in what direction one should ventilate in a metro tunnel. Plans to plug tunnel segments with a burning train to smother fire by lack of oxygen were also considered but abandoned. The risk is too high when the plugs are withdrawn to let fire fighters in.

After the lectures, all participants were keen to see some practice. First the information centre of the North-South line was visited. Photos, scale models and plans visualize the project. This was followed by a real life visit to the station, especially the IJ side with its magnificent view from under the special glazing. The 'trick' with this glass is as follows. Thin but strong glass sheets are put in position, bent and kept in place with bolts. There is one strong bolt in the middle and there are some weaker plastic bolts on the sides. If a fire starts and heat starts building up, the glass sheets straighten. The weak, light bolts snap: crevices appear to let the heat and smoke out. This prevents the steel structure from collapsing.

There is something symbolic in this. It points out that for these infrastructure and redevelopment projects, innovative safety measures had to be invented from thirty metres below surface up to this highest point of the new Central Station.

### **3. ITA COSUF Award 2012: Reminder!**

The deadline for applying for the ITA COSUF Award is 29 February 2012. The selection of the winner will be made by the Steering Board by mid April 2012.

The ITA COSUF Award is annually granted to a student or young researcher who has recently completed an outstanding research work in theory and / or practice in the area of safety and / or security of underground facilities. The award consists of a medal, a certificate and € 500 in cash. It will be handed over at the ITA COSUF open workshop which will take place in Rome on 22 June 2012. The winner will be asked to give a brief presentation of his / her work at the workshop. In addition, she or he will be asked to prepare a two-page contribution to the newsletter.

Candidates need not be ITA COSUF members. They should send a file to ITA secretariat including CV, description of work done in the area of safety and security of underground facilities and relevant documents / publications.

All readers of this newsletter are invited to inform possible candidates in their organisation or any other organisation active in the field and encourage them to apply for the award.



## 4. Report of Activity Groups

### ***AG1 Interaction with European and international activities***

On 15 November 2011 the 10<sup>th</sup> meeting of Activity Group 1 took place in Amersfoort (Netherlands). The agenda was fully focussed on the ITA COSUF activities in 2012 and the ITA COSUF outputs for the near future. It was decided to synchronise the distribution of the ITA COSUF Newsletter with ita@news and also to evaluate the Newsletter in 2012. The theme of the next ITA COSUF workshop in Rome (22 June 2012) was discussed. Although the title has not been finally set, the workshop will be addressing tunnel safety during recession periods, in other words the balance between safety and cost efficiency during the crisis, when there is less money for investment in new projects. An ITA COSUF internal workshop is foreseen in Madrid during Autumn 2012, in co-operation with AETOS, the Spanish Tunnelling Association. ITA COSUF will also organise a workshop on operational safety of large and complex underground infrastructures in the context of the ACUUS conference which will take place in Singapore in November 2012.

Regarding training actions, ITA COSUF has set up a continuous co-operation with ITACET, the ITA Committee on Education and Training. Three ITA COSUF members gave lectures at a seminar on Safety Aspects of Tunnel Operation organised by ITACET in Shanghai (China) on 12-13 November 2011. ITA COSUF will take part in a training session on Safe Operation in Railway and Road Tunnels to be held in Riyadh (Saudi Arabia) in March 2012.

### ***AG2 Regulations and best practice***

Activity Group 2 focuses on regulations, guidelines and best practice recommendations. The current activities are related to the definition of safety objectives, basic methods of technical approach and risk assessment, use and application of safety systems, equipment, process and practice. Besides, a listing of current recommendations, guidelines and regulations worldwide on operational safety of all kind of underground facilities is in progress.

During the last meeting in Amersfoort on 15 November the following topics were discussed:

- Engineering guidance for scenarios and functional objectives for the design of fire safety of urban underground rail systems;
- Engineering guidance and best-practice recommendations regarding man-machine-interface of SCADA systems for tunnels;
- Best-practice recommendations for design of safety measures in tunnels regarding implementation of EU directive on non-discrimination of disabled people, to be carried out in co-operation with PIARC;
- Engineering guidance for fire protection of platform screen doors of underground rail systems.



### ***AG3 Research and new findings***

Currently Activity Group 3 has two main objectives. On the one hand AG3 tries to keep its members up to the latest research projects and their results in the field of underground safety and security. Tackling this task is rather easy since many members of AG3 are involved in some of the biggest R&D projects which are currently carried out within EU as well as national research programmes. On the other hand AG3 tries to define benchmarks regarding several safety and security related topics. In this framework the group will put its future focus on CFD simulations and try to recommend parameters as well as input values for state-of-the-art CFD modelling.

### ***AG4 Road Tunnel Safety Officers***

The fourth AG4 meeting (11 participants) took place on 15 November and was mostly dedicated to preparing the 2<sup>nd</sup> Forum of Tunnel Safety Officers to be held in Brussels on 18 January 2012. The forum will be reserved for Safety Officers appointed according to Directive 2004/54/EC. It will be proposed to repeat similar forums every two years. A discussion on guidelines for Safety Officers took place. No conclusion was possible so far on a shared document. It was rather accepted that it would be difficult to draft a common document which could be agreed by Safety Officers of all EU countries. This remains a topic for future AG4 meetings. A proposal for a questionnaire for Safety Officers much more elaborated than the one made at the starting of AG4 was made by M. Vagiokas from Greece. It was agreed that it was too late to be considered for the next forum but will be examined in future meetings (exact content, data collection and conclusions).

Alain Picard thanked all participants for the job done during the four meetings organized in preparation of the 2<sup>nd</sup> forum and Johan Bosch, as the future new AG4 leader, had some words of conclusion encouraging everyone to continue to contribute since a lot remains to be done.

After contacts with the European Commission and PIARC, the invitation to the forum with the detailed programme was sent at the beginning of December to all tunnel Safety Officers known by AG4. Additional promotion will be made by the European Commission and PIARC.

## **5. Future ITA COSUF events**

### ***ITA COSUF workshops and activity group meetings***

**21-22 June 2012** ITA COSUF Open Workshop 2012 and General Assembly, AG meetings, Rome (Italy)

**2<sup>nd</sup> half of 2012** ITA COSUF Internal Workshop, AG and SB meetings, Madrid (Spain)

**June 2013** ITA COSUF Open Workshop 2013 and General Assembly, AG meetings, Geneva (Switzerland)

This event will be organised in conjunction with the ITA World Tunnel Congress, which will take place in Geneva from 31 May till 7 June 2013



## ***Other events organised or endorsed by ITA COSUF***

- 18 January 2012**      2<sup>nd</sup> European Forum of Road Tunnel Safety Officers, Brussels (Belgium)
- After the success of the 1<sup>st</sup> forum organised in Lyon on 4-5 November 2009, ITA COSUF organises the 2<sup>nd</sup> forum in co-operation with the European Commission and the World Road Association (PIARC). This event is reserved for Safety Officers appointed according to the European Directive 2004/54/EC. It will be devoted to exchanging experience and preparing guidelines regarding the activity of Safety Officers.
- 27-28 June 2012**      International Conference on Safety of Life in Tunnels (SOLIT) – Integration of Fire Fighting Systems, Berlin (Germany)
- ITA COSUF will hold a working session during this conference, which is mostly devoted to the results of the SOLIT<sup>2</sup> research project.
- 7-9 November 2012**      13<sup>th</sup> World Conference of ACUUS (Associated research Centers for Urban Underground Space): Underground Space Development – Opportunities and Challenges, Singapore
- ITA COSUF organises a workshop on Operational Safety of Large and Complex Underground Infrastructures in the context of this conference.

## **6. ITA COSUF 2012 membership fee**

The membership fee has been reduced to € 250 for private companies with less than 10 staff and no change was made for other corporate members. Consequently, the 2012 fee will be:

- € 250 for public organisations, educational institutes and bodies with less than 10 staff,
- € 500 for all other bodies.

Up to 4 staff of any corporate member can take part in private workshops and get a reduced fee for open workshops.

A new individual membership has been created. The fee is € 250 and includes the same information as corporate members, give the possibility to attend private workshops and get a reduced fee for open workshops. Individual membership can for instance be used by staff of large corporate members in order to receive direct emails and invitations from ITA COSUF.

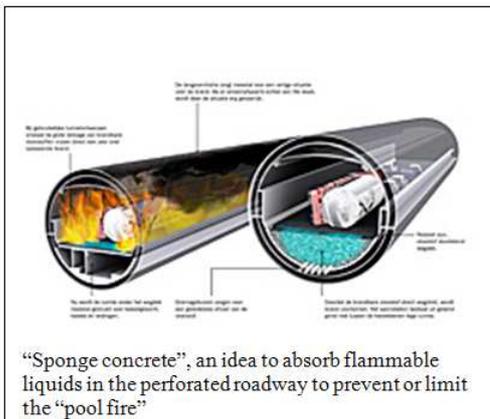
For all enquiries to ITA COSUF membership please contact Ben van den Horn  
[ben.vandenhorn@arcadis.nl](mailto:ben.vandenhorn@arcadis.nl)  
<http://cosuf.ita-aites.org>



## 7. ITA COSUF member introduction: TNO



TNO is an independent research and development organization whose expertise and research contributes to the competitiveness of companies and organizations, to the economy and to the quality of society as a whole. Innovation with purpose is what TNO stands for.

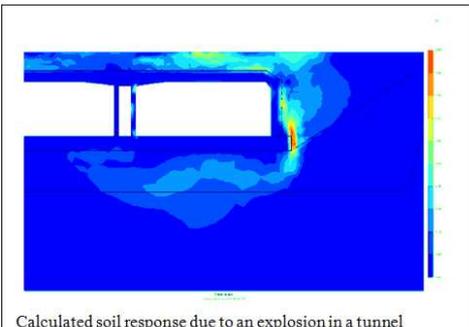


Our experts are based in three knowledge centres, "Earth, Environmental and Life Sciences", "Behavioural and Societal Sciences" and "Technical Sciences". This expertise is available for all market sectors or business lines. In our business line "infrastructure" tunnel safety plays an important role. As TNO has such a wide range of expertise within the organization, expertise for most of the subjects involved in tunnel safety are available within the knowledge centres. Some of the important tunnel safety issues are mentioned here.

To assess the safety of people in and around tunnels TNO has been involved in the development of scenario analysis tools and Quantitative Risk Analysis (QRA) methods and tools. Of course we have been able to use these tools in a variety of projects. And if risks are considered

unacceptable, TNO will advise on safety measures to improve the safety level.

TNO has been involved in laboratory scale, large and full scale testing of a variety of safety issues, like car driver behaviour, evacuation behaviour, spread of fire and smoke and explosion load and effects. With these tests TNO has contributed to safer tunnels against acceptable or even lower costs and to the introduction of innovative concepts. We are one of the five L-surF founders, a cooperation of well known and experienced organizations in the field of tunnel safety and security.



Structural safety is an important and complex issue for tunnels especially when the tunnel structure is exposed to exceptional loads like fire and explosions. Tunnels are often part of key transportation routes in Europe, which are open for transport of dangerous goods. TNO has been leader of a project with Technical University of Delft and Deltares in a cooperative research program (Delft Cluster). This project aimed at a better understanding of the consequences of explosions in tunnels. The project covered modelling the blast and the load on the tunnel construction, modelling the response of the tunnel and the influence of the soil and resulted in a process to deal with this issue.



Tunnel safety is highly effected by the behaviour of the tunnel operator. Fortunately calamity situations do not occur often. The other side of this is that operators are not experienced in dealing with this. Training of tunnel operators in exceptional situations is therefore essential for tunnel safety. For such training full scale tunnel training sites can be used, which is quite expensive. A smart mix of training on site training and regular training with a training and simulation tool can save costs and improve the experience of the operators and therewith the safety of the tunnel. TNO has developed a simulation tool for training purposes, based on our experience in the defence industry. With some modifications the tool can also be used to test the functionality of the software and hardware installed in the tunnel (detection, response chain).

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