



ITA-CET

Committee on Education and Training

Newsletter

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Editorial



Dear ITA friends,

As the 2nd year of chairing the very active ITA-CET Committee draws to an end, we feel it's time to give you an update on our activities.

First of all, many thanks to all the lecturers who took part in ITA-CET training sessions. Without your support it would be impossible to provide such high-level training. We are pleased to announce that the Committee has recruited four new lecturers who will assist us in future events. If you are interested in working with us and becoming a lecturer, please feel free to get in touch with us!

During 2015, the Committee prepared the programmes for nine training sessions, organized in collaboration with the ITACET Foundation, proving that interest in this type of traditional training event is still strong.

The Committee is proud to announce that it has developed two new programmes for such training sessions: "Calculation Methods for Tunnel Design" and "Numerical Simulation for Tunnel Design". They will shortly be included in the official portfolio. Other programmes on "Sustainable Tunnelling", "Contractual Practices" and "Auxiliary Measures" are under construction.

This year has also seen the Committee start to develop new training strategies and implement new teaching methods, thanks to the work of the four activity groups.

Activity Group 1, in charge of relations with member nations, organized the first meeting of key regional contacts in Dubrovnik in May. This meeting notably paved the way for possible future collaborations between neighbouring countries on coherent mid-term training strategies.

As one of our visions is to develop joint actions between ITA-CET and the other ITA Committees, Activity Group 2 has been collaborating with ITAtech in order to develop Deminars. These events provide participants with the opportunity to experience live demonstrations and give industry representatives an environment in which to showcase their products. A first Deminar on Waterproofing and Drainage took place in September in the Hagerbach Test Gallery (Switzerland).

Activity Group 3, in charge of developing relations with the university network will shortly publish information received from 17 higher education organizations on the tunnelling courses that they offer. Furthermore, two additional postgraduate courses have received ITA endorsement. One of these courses in an on-line course, designed with working professionals in mind.

Activity group 4 has been focusing on developing distance learning via video-conferences and / or webinars. The group is in the process of planning its first training session via video-conference, which will hopefully take place in early 2016. This new type of course will enable the Committee to reach a broader public in the future.

We feel confident that the continued actions of these four activity groups in 2016 will enable the Committee to meet emerging requirements for training. Please contact us if you wish to get involved in our work or need our help to organize an event!

Finally, we wish to take this opportunity to wish you all a very happy new year!

Rober Galler ITA-CET Chairman

Michel Deffayet - ITA-CET Vice Chairman

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FOR MORE INFORMATION

<http://www.ita-aites.org/en/wg-committees/committees/ita-cet>

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A fruitful Steering Board meeting in Zurich

by Kristen Drouard

The Hönggerberg campus of ETH Zurich was the venue of the ITA-CET Committee's Steering Board meeting on 13th October 2015.

The meeting kicked off with the introduction of the new Technical Secretary, Emmanuel Humbert, who will notably be in charge of establishing the detailed programmes for training events in relation with the host nation.

After a look at changes to the Committee members list, a new document added to the database was presented. This document provides the titles of all lectures given since 2009 by both official ITA lecturers and industry lecturers. It enables the most active lecturers to be easily identified.

Following this, the vice chairman gave an update on information concerning ITA endorsed post graduate courses. Due to a change in personnel, the MAS in Tunnelling at the EPFL in Lausanne will unfortunately cease to run. Information on the two newly endorsed courses run by AETOS, Madrid (Spain), and Colorado Boulder (USA), has been made available on the ITA-CET Committee web site (see page 5 for more details).

The Steering Board went on to study the feedback from the training events held in Mexico, Switzerland and Argentina. This feedback is globally positive and the knowledge and experience of the lecturers is particularly appreciated. Comments on any weaknesses of the training events often lack precision. It was therefore decided to revise the feedback form in order to obtain more detailed and precise information. This should help to further improve future events.



The Hönggerberg campus, Zurich. Photo courtesy of ETH.

The work of the four Activity Groups was then examined. AG1 has recently set up a key correspondent network in order to maintain and strengthen relations with the main actors involved in organizing events at a regional level. The first meeting of this network was held in Dubrovnik in May (see the article on the following page).

AG2 is responsible for developing training for industry. A meeting between ITA-CET and ITAtech was held in Dubrovnik in May to discuss ways in which ITA-CET can develop industry-promoted training events and spread information about new products and technologies. Within this context, AG2 is developing Deminars, mixing both theory and practice. The first was held in Hagerbach, Switzerland in September (see page 6 for more details).

AG3 will shortly publish information on tunnelling related courses offered by universities. This information will be made available via the ITA-CET Committee web site.

AG4 is developing new didactic tools and notably online training events. Following a

discussion on the advantages and drawbacks of video-conferences and webinars, the Steering Board decided to launch a pilot online training event via video-conference (see page 7).

The next item on the agenda concerned the programmes for new topics to be included in the training portfolio. Three new programmes are currently being finalized by the Committee and will shortly be published on the ITACET Foundation's web site (see page 5 for more details).

The list of future events prepared in collaboration with the Foundation was also examined. Five training events are already planned in 2016, with another two under discussion (see page 4).

The meeting concluded with the choice of venue for the next Steering Board meeting, which will take place in Lyon on 8th February 2016.

The ITA-CET key correspondent network

by Michel Deffayet

At present, the most visible part of the ITA-CET Committee's activities is the preparation of training events in collaboration with the ITACET Foundation. These events are currently organized at the request of ITA member nations, on their own initiative or following contact with representatives of the Association or Committee.

Activity group 1 is responsible for engaging discussions with the requesting nation, identifying its specific requirements for a given training session and preparing the detailed programme in collaboration with local correspondents.

Once the training event is over, it is important to maintain and strengthen relations with these local correspondents located around the globe

During the AG 1 meeting, held in Dubrovnik in May 2015, it was therefore decided to establish a key correspondent network comprising persons who had significantly contributed towards the successful organization of the 2014 – 2015 training events.

This network is a useful means of:

- establishing a durable partnership with the ITA-CET Committee,
- communicating on existing training opportunities and further training requirements at a local level, notably by contributions to the ITA-CET Committee and ITACET Foundation newsletters,
- developing training strategies and packages (possibly through international co-operations),
- developing new tools such as Webinars or video conferences to offer training opportunities to a much broader public.

Regular contact with the key correspondents will enable them to establish a solid, long-term partnership with the ITA-CET Committee and help to implement new training events. It will also enable shortfalls in previous events to be identified and overcome.

Bringing together correspondents from the same region will enable discussions on training requirements and possible future international co-operations between neighboring countries. Such discussions were initiated in the Dubrovnik meeting, in particular between South American member nations.

For example Chili envisages a continuous training programme with sessions every 6 months. This strategy could be built jointly with Peru which has expressed its interest and motivation in conducting training sessions. Brazil has also proposed working on a more coordinated strategy with Colombia.

Developing training strategies is considered particularly important. These strategies can provide coherent packages and help tailor training sessions to meet local needs and even offer complete training paths. They can also facilitate the involvement of sponsoring companies and consequently help to find sources of funding and financial support.

New tools like webinars or video conferences can reach a broader public and could be taken into account in these strategies. The ITA-CET Committee is currently looking into the best way to implement such tools.

The ITA-CET key correspondent network currently comprises around ten member nations and the Committee is confident that this network will help to expand ITA's training activities.



ITA-CET training activities maintain momentum

by Claude Berenguier

ITA-CET training activities are set to maintain momentum during the year July 2015-June 2016.

After the successful WTC 2015 in Dubrovnik which gathered a hundred Croatian students from three Universities, the ITA-CET Committee kicked off the year of training events which will lead us up to the WTC 2016 in San Francisco

Three training events have taken place so far since Dubrovnik:

- Guadalajara (Mexico) on Mechanized Tunnelling (29th -30th June 2015)
- Buenos-Aires (Argentina) on Health and Safety in Tunnelling (8th-9th September 2015)
- Shanghai (China) on Challenges in Undersea Deep Long-Distance Tunnels (17th-18th October 2015)



The ITA-CET Committee prepared the programme and chose the lecturers for these training events, whilst the ITACET Foundation took care of organizational



Training event in Shanghai, October 2015. Photos courtesy of the ITA-CET Foundation

aspects in collaboration with the requesting nation.

Five other training events are under finalization:

- Riyadh (Saudi Arabia) on Tunnelling and Landslides (25th-26th January 2016)
- Riyadh (Saudi Arabia) on Rockfall Protection Techniques (27th January 2016)
- Santiago (Chile) on Waterproofing (16th-17th March 2016)
- San Francisco (USA) on Underground Space Use (22nd - 23rd April 2016)
- San Francisco (USA) on Monitoring (22nd - 23rd April 2016)

Other events are under discussion but are yet to be confirmed. Bhutan and Thailand are the most probable.

The Committee has also developed a training programme for two new topics:

- Calculation Methods for Tunnel Design
- Numerical simulation for Tunnel Design.



They will soon be available in the Foundation's portfolio (see article on the following page for more details).

Finally, the Committee is developing the concept of training events via distance learning, which will allow more participants to follow lectures on their topics of interest. These events will either take the form of video-conferences or webinars (see article on page 7).

Two new topics soon available in the course portfolio

by Emmanuel Humbert

In the previous newsletter, we announced that amongst the new training session programmes under preparation were "Calculation Methods for Tunnel Design" and "Numerical Simulation for Tunnel Design". These two programmes have now been finalized and will shortly be made available in the official course portfolio

Their aim is to provide detailed information on the methods and calculations performed to assess tunnel stability. These topics were previously only dealt with briefly in the programme "Principles for Tunnel Design" in particular. They will provide detailed overviews of all calculation methods

available, highlighting advantages and drawbacks, whilst giving advice and warnings about their use, illustrated by examples.

The objectives of the programme entitled "Calculation Methods for Tunnel Design" is to present the design methods commonly used to assess tunnel stability, from those suitable for rock mechanics to those suitable for soil mechanics. The programme focuses on the progressiveness of the method required throughout the entire tunnel design process. It therefore covers not only design methods employed in the preliminary stages but also those employed in the detailed stages of studies.

"Numerical Simulation for Tunnel Design" aims to provide an introduction to numerical simulation in tunnelling. It provides a general overview of the different calculation methods, explaining the use, advantages and difficulties of numerical simulation, followed by optional, more in-depth sessions on the implementation of numerical models and associated parameters. This session is aimed at professionals in tunnelling with prior knowledge in the field of geomechanics.

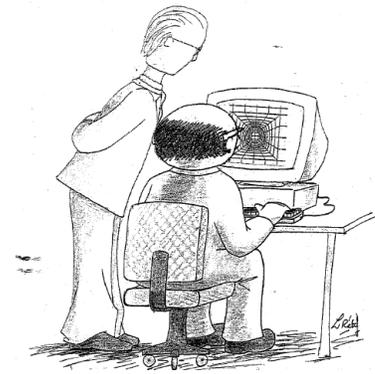


Photo courtesy of CETU

With these two new programmes, the portfolio will comprise 19 different topics.

Other programmes are under construction:

- Contractual Practices,
- Ground Improvement for Tunnelling (Auxiliary methods)
- Sustainable Tunnelling,
- Use of Reinforced Fibre Concrete,
- Sub-surface use.

They will be available within the next few months.

ITA course endorsement update

by Kristen Drouard

The year 2015 has seen two additional post graduate courses receive official ITA endorsement:

- The Master in Tunnels and Underground Works (Madrid, Spain),
- The On-line Certificate in Tunneling (Colorado, USA).

Currently in its 10th year, the Master in Tunnels and Underground Works is organized by AETOS (the Spanish Association of Underground Works), CICCIP (Association of Civil Engineers) and UNED (the Spanish Open University).

This one-year course is open to students with a degree in civil or mining engineering or geology (minimum of 4 years higher education). Its objective is to provide students with a high level of instruction in tunnelling and underground works that will grant them access to the labour market in this specific technical field. The ten course modules provide sound knowledge in planning and design and the management and execution of works.

An additional objective is to provide supplementary specialized instruction for students who envisage a career in research and/or teaching after the course.

The Master course runs from January to October and is conducted in Spanish, although a certain number of specific conferences may be held in English.

For more information on this course, please consult the [AETOS web site](#).

The On-line Certificate in Tunneling, run by The University of Colorado Boulder is open to students with an MS and BS in civil engineering, geology or mining engineering, who want to obtain a working knowledge of tunnel design and construction by applying the fundamentals acquired in their BS and MS degrees.

This on-line course can be started at any time. Its duration depends on the student's own pace, but it must be completed within 4 years.

The course comprises 11 modules, with homework assignments and a three-month internship at a construction site. A final face-to-face evaluation with the course director is organized at the end of the course.

For more information on this course, please consult the relevant pages on the [University of Colorado, Boulder's web site](#).



When examining a request for course endorsement by ITA, the ITA-CET Committee takes into account the following criteria:

- Support of the Member Nation,
- Diversity of the lecturers,
- Course content,
- Teaching methodology,
- Final assessment means.

Common classification vocabulary was agreed on during the ITA-CET Committee meeting in Dubrovnik in May 2015. This classification system gives a rapid overview of the number of years of higher education required prior to course admission, the total number of teaching hours and the language in which the course is primarily taught.

For example if a course is given the classification "ITA-3y-500h-En", this implies that students must have accomplished at least three years' study in higher education in order to be admitted on the course, they will receive 500 hours teaching over the entire course duration and this teaching will be mainly conducted in English.

At the end of each academic year, universities are required to provide the ITA-CET Committee with updated information on the course (content, the number of the students obtaining the degree, title of student theses, the nationality of the students and lecturers etc...). This enables ITA to ensure that the course still fulfills endorsement requirements.

In addition to the two post graduate courses mentioned above, three other Master courses currently have official ITA endorsement:

- The Specialized Master in Tunnelling and Tunnel Boring Machines (Politecnico Torino, Italy),
- MSc in Tunnelling and Underground Space (University of Warwick, UK),
- Specialized Master in Tunnelling and Underground Space (ENTPE/INSA, France).

More information on these courses can be obtained via the [ITA-CET Committee web site](#).

The image shows a certificate from the University of Colorado Boulder. It is titled "Presents On-line Certificate in Tunneling". It is endorsed by the International Association of Tunneling Engineers (ITA) and the International Tunneling and Underground Space Association (AITES). The director is Fulvio Tonon, and the start date is "Anytime!". The certificate was updated on June 8, 2015, and is copyrighted by Fulvio Tonon in 2015. Contact information for Fulvio Tonon, Ph.D., P.E. (Texas, Italy) is provided, including a phone number (+1-912-200-5051) and an email address (fulvio.tonon@colorado.edu).

Deminars: mixing theory and practical demonstrations

by Volker Wetzig

Water is a major preoccupation of tunnel builders and operators from the very beginning of construction and throughout the whole operation of an underground infrastructure. However necessary water may be for our daily life, its presence during the construction and operation of underground structures poses a major challenge.

Discussions between the ITA-CET Committee and the ITAtech Committee have highlighted the growing need for training sessions that provide participants with practical demonstrations of technologies available in industry. It was therefore decided to develop Deminars, which mix traditional class room presentations with practical

demonstrations, in order to illustrate the latest technological developments.

A first Deminar on the topic of "Waterproofing and Drainage" was jointly organized by the ITACET Foundation and the Hagerbach Test Gallery, Switzerland, in September 2015.

Speakers from all over Europe gave a comprehensive overview of issues and possible waterproofing and drainage solutions.

After a general overview of the topic which was given by J. Baber, the Animateur of ITA WG 11, "Immersed and floating tunnels", presentations of major tunnel projects throughout the world illustrated actual experiences. The Cross-Rail project gave an account of its experiences with different types of waterproofing means, whereas the Vereina tunnel project in Switzerland looked back over 18 years of experience with a single shell shotcrete lining.

It was shown that the quality of a solution depends not only on technical issues but also on contractual aspects and accuracy of application.

Presentations on technical solutions highlighted the wide variety of technologies available and the numerous factors which have to be taken into account.

Participants appreciated the well balanced programme and the knowledge and experience of the speakers. The mix of presentations and demonstrations allowed an in-depth insight into the topic.

During the discussions, operation and maintenance issues were discussed. A follow up Deminar on the topic "Life cycle management of tunnel installations", which addresses these issues, is scheduled for September 2016. A first draft of the programme will shortly be available on www.hagerbach.ch.



Demonstrations in the Hagerbach Test Gallery

Online learning: bridging the distance gap

by Kristen Drouard

One of the tasks of Activity Group 4 is to develop "online" or distance learning in order to enable a wider audience to benefit from ITA training events.

The term "online" learning encompasses a range of technical tools such as video-conferencing, webinars or webcasts. The ITA-CET Committee took a look into the advantages and drawbacks of each of these tools before deciding on how best to launch its first online events.

Webinars are live seminars held online by one or several lecturers, who can be based in different locations if required. Participants can log on to the webinar from anywhere in the world, thus enabling a wide outreach. However, time zone constraints will naturally tend to limit the geographic area in which the webinar audience is located.

A major advantage of this tool is that the only equipment required by participants is a computer with an internet connection and speakers. The disadvantage is that although the participants can see the lecturers on their screen, the lecturers cannot see or hear the attendees. Initially this can be daunting for lecturers who are only used to speaking face-to-face with their audience. It is also difficult for lecturers to know if they are successfully capturing the participants' attention, bearing in mind that a participant's attention span will generally be a lot shorter than for a face-to-face event.

Nevertheless, interaction is generally possible via chat boxes where attendees can type questions or comments into a screen window. In this case a mediator is generally required to select incoming questions and publish them for all to see on screen. Polling can also enable the lecturers to have feedback from the participants (e.g. their location in the world, their occupation....).



Image courtesy of Cool Design at freedigitalphotos.net

Webcasts are mere one-way broadcasts and do not enable any form of interaction. They include broadcasts of pre-recorded lectures made available online or broadcasts of recorded live webinars, enabling those who could not attend the webinar "live" to view the event at a later date. The advantage of webcasts is that they can be viewed at a person's own convenience and are not subject to time zone constraints.

Video-conferencing provides real-time two-way audio/video communication between two or more locations. It therefore gives the impression of a face-to-face encounter between the lecturer and the participants. It also facilitates interaction, notably during question and answer sessions. The drawback is that it requires specialized equipment at both ends for a successful conference.

After in-depth discussion at the last ITA-CET Steering Board meeting in Zurich, it was decided to opt for video conferencing as an initial means of launching ITA online training events.

Video conferencing equipment is already available to several European based ITA-CET lecturers at universities or training organizations. The use of this equipment

would require less training for lecturers than webinar software. It was therefore decided to conduct initial technical tests between the University of Leoben in Austria and the ENTPE in Lyon, France, using existing video-conference equipment on these premises. If these technical tests are successful, the Committee will organize an initial pilot video conference for a group of students, the idea being that the lecturers would be based in one location and the students in another.

At a later stage, the ITA-CET Committee envisages implementing webinars, which could be either live or recorded. These short webinars would be modules of a specific topic, which when grouped together would form an entire training programme.

The implementation of online learning events will enable considerable financial savings by reducing travel costs for both lecturers and participants. It will also enable wider audiences to be targeted, thus helping to fulfill ITA's commitment to worldwide knowledge sharing in the field of tunnelling and underground space.

Resource-efficient tunnelling: lessons learnt from the DRAGON project

by Robert Galler

Due to increased global competition, budgetary constraints and tighter environmental regulations, resource efficiency is of increasing concern in the tunnelling industry.

With future tunnelling projects in Europe expected to generate around 800 million tons of excavated material, efficient use and recycling of this material on site or in other industrial sectors is of great economic and environmental interest.

Currently, most excavated material is disposed of in landfills, with all the environmental impacts this entails. Recycling this excavated material would reduce the amount of primary mineral resources used and substantially reduce environmental problems and CO₂ emissions involved in landfilling and related transport activities.

The ITA-CET Committee is currently developing a training programme entitled "Sustainable Tunnelling" which will notably deal with this issue of resource-efficient tunnelling. One of the sessions in this programme will look at the chemical and physical characterization of excavated material and the requirements of industries that may benefit from the recycling of such material.

While drafting this training programme, the Committee was able to draw on the lessons learnt from the DRAGON project (Development of Resource-efficient and Advanced Underground Technologies).

This research and development project, funded under the EU's Seventh Programme for research, technological development and demonstration, set out to develop a system for the automated by-pass analysis, online classification and in-stream sorting of excavated material. All units are directly integrated into the TBM so that the entire analysis and sorting process of the excavated material takes place underground.

The minerals contained in tunnel excavation material vary considerably. The DRAGON project therefore aimed to identify industries that would be interested in using these raw materials extracted from underground construction sites: cement, steel, ceramic or glass industries.

In parallel to the development of advanced online technologies for analysing the

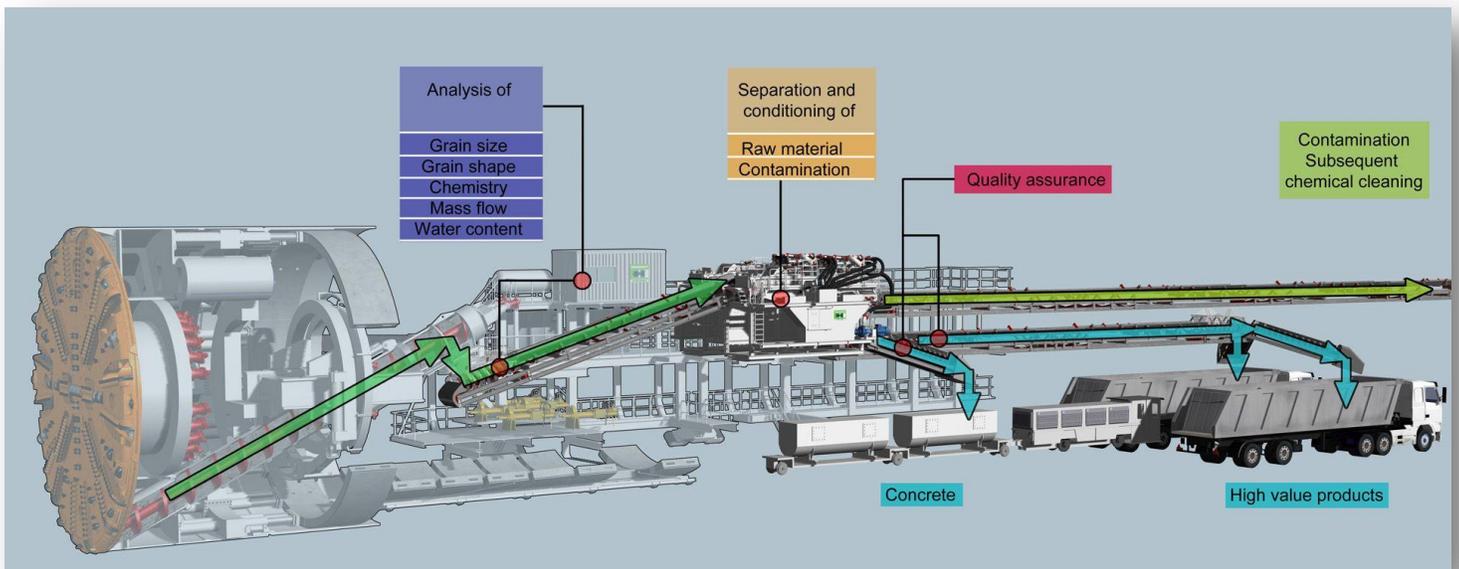
excavated materials, DRAGON aimed to acquire important information on industry requirements for the use of raw materials: grain size distribution, mineralogical composition, geochemistry, different water content and water absorption properties.

Tunnel construction – not only with TBMs – is already a highly industrialized and technologically demanding process. It was therefore highly important to both the machine manufacturer and the construction companies that the tunnel advance rate should not be affected by new DRAGON technologies.

An additional goal of the project was to assess how DRAGON could contribute to wider EU policy objectives and to identify any barriers that may prevent the application of the resource-efficient technologies developed by DRAGON.

The project was coordinated by the Chair of Subsurface Engineering, Montanuniversität Leoben, (Austria). The research group consisted of Herrenknecht AG (Germany), Indutech Instruments GmbH (Germany), B+G Betontechnologie + Materialbewirtschaftung AG (Switzerland), Jacques Burdin Ingenieur Conseil (France), Thinkstep (United Kingdom) and Porr Bau GmbH (Austria).

More information on the DRAGON project can be found at www.dragonproject.eu



The principle of the DRAGON system: image courtesy of Montanuniversität Leoben