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Utilisation de l'espace souterrain à Helsinki

Underground space use in Helsinki

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EDITORIAL

The Finnish Tunnelling Association (FTA) together with the Finnish Association of Civil Engineers (RIL) are pleased to welcome all delegates and guests to Helsinki for the ITA-AITES 2011 World Tunnel Congress "Underground spaces in the service of a sustainable society", and the 37th ITA-AITES General Assembly, which will be held at Finlandia Hall Conference and Exhibition Centre, 20–26 May 2011.

Helsinki is a pioneer in the sophisticated exploitation of underground spaces in an urban area. There are maintenance facilities, archives, sports facilities, car parking halls and traffic tunnels, as well as the latest additions serving several department stores and other public and private buildings in the Helsinki city centre. The tunnelling system for the district heating and cooling system covers the Helsinki area. The greater Helsinki area is supplied with drinking water via the world's longest rock tunnel. I would urge all visiting delegates to take the opportunity to visit some of these underground sites with our guided excursions.

A tunnelling boom is going on in Finland and it is expected to continue in the future. Underground spaces are seen as key areas when developing a sustainable infrastructure for the metropolitan area. Major projects underway include the western expansion of the Metro system and an underground airport transit link. One of the big underground car parking facilities in the construction stage can be seen near our Conference Centre.

The Finnish Tunnelling Association aims to encourage the use of the subsurface for the benefit of public, environmental and sustainable development, and to promote advances in the planning, design, construction, maintenance and safety of tunnels and underground spaces. The ancient bedrock in Finland is solid and hard, and we Finns are used to hard rock!

It is a great pleasure to be able to take part in organizing this year's congress in Finland. Our Congress Organizing Committee has spent a considerable amount of time planning and ensuring the smooth running of this event. I wish all delegates an enjoyable congress!

Welcome to our hometown, Helsinki.

Mr. Kari J. Korhonen
President, Finnish Tunnelling Association

Picture: Members of the Board of Finnish Tunnelling Association are (from the left) Mr. Ilkka Vähäaho, Mr. Bjarne Liljestrand, President Mr Kari J. Korhonen, Prof. Pekka Särkkä and Secretary General, Ms Johanna Aho.

Other members of the Board (not on the picture) are Mr. Jannis Mikkola, Dr. Pasi Tolppanen, Mr. Ari Laitinen and Mr. Lasse Rantanen.

Focus on Finland

FOCUS ON FINLAND ROCK – SOUND OF COUNTLESS OPPORTUNITIES

A lack of space in built-up areas and a continuously increasing awareness of the environment have made the use of underground space an attractive option. Technical innovations and public opinion have also contributed to this trend. Only a few decades ago, underground facilities were generally regarded as gloomy and unsafe places and not appropriate for the public. Today, underground space is considered as an essential part of the built environment. Not only the sub-terrain traffic, energy, and technical facilities have shown their superiority compared to conventional solution on the surface. Even leisure-time activities have proved to be suitable to be placed underground. /1/

The Finnish power industry might be the first in the world to accomplish the final disposal of highly radioactive waste. The construction of the repository for spent nuclear fuel will start around 2015, and the target is to begin disposal operations in 2020. The in-depth research related to the design of the repository has gathered a large amount of knowledge that is useful in the design of underground construction for different purposes.

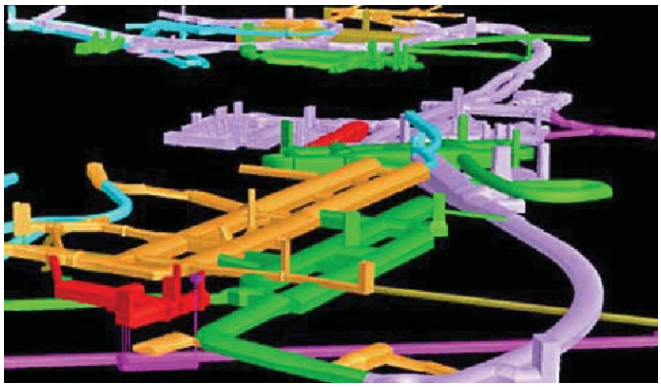
Geologically, Finland belongs to the Baltic Shield. The bedrock represents the oldest rocks of the European continent, often covered by a thin layer of very young and loose glacial sediments. The rock is generally of good quality and requires only modest rock support, making the underground construction costs reasonable. Such bedrock conditions suggest a good potential to utilize the underground space for various activities. In addition, the mineral resources of the Finnish bedrock are significant, and they had been utilized by underground mining already in the sixteenth century.

The population of Finland is small, and the societies of rock and mining engineers interact frequently. Collaboration already takes place in the university, where mining and rock engineering students are studying side-by-side. Co-operation has supported the development of both sectors, and innovations have contributed to a significant global impact on underground technologies.

UNDERGROUND MASTER PLAN

In Helsinki, underground rock spaces have been put into good use for a long time now. An ”underground world” of many layers of technical maintenance, traffic, and private operations has developed underneath the city. The network has been built one project at a time. The city co-ordinates the whole, ensuring that there will still be space for important developments in the future, and that underground projects situated close to each other could be fitted together. The underground master plan has been designed for managing this whole. /2/

Building underground has significantly increased in Helsinki. We have good rock and skilled experts for implementing these rock construction projects. Ensuring the economic foundation and maintenance of the operations situated in the center requires building underground. The business center has become denser, as spaces for technology, traffic and maintenance have been partially situated underground on as many as four levels. The companies benefit from each other and the earth surface has been freed for business operations and pedestrians, for example. Distances for pedestrian and bicycle traffic become shorter and use of public transportation and transfer connections improve.



The pedestrian zone in the business center of Helsinki is a good example of a successful and functional pedestrian zone. The underground maintenance street for the center will keep Aleksanterinkatu and its cross-streets clear of maintenance traffic also in the future. Underground building also frees property for central operations. The center becomes denser and its operational structure more versatile. Simultaneously, the synergy benefits different operations and economic well-being increases. Underground infra, power stations, energy supplies and pump stations bring

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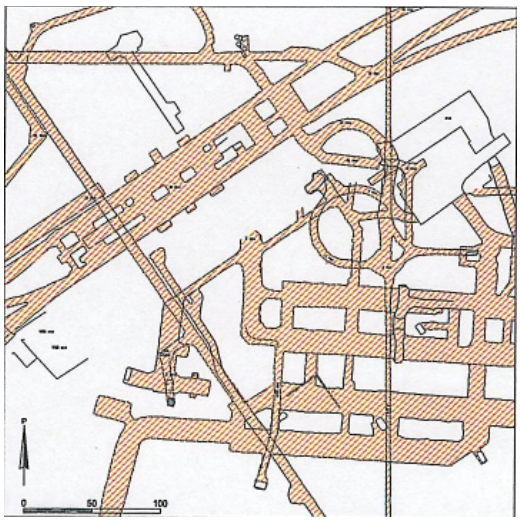
functional security and safety that even on an international level is in its own class, and makes it possible for even the most delicate maintenance operations to be located in Helsinki.

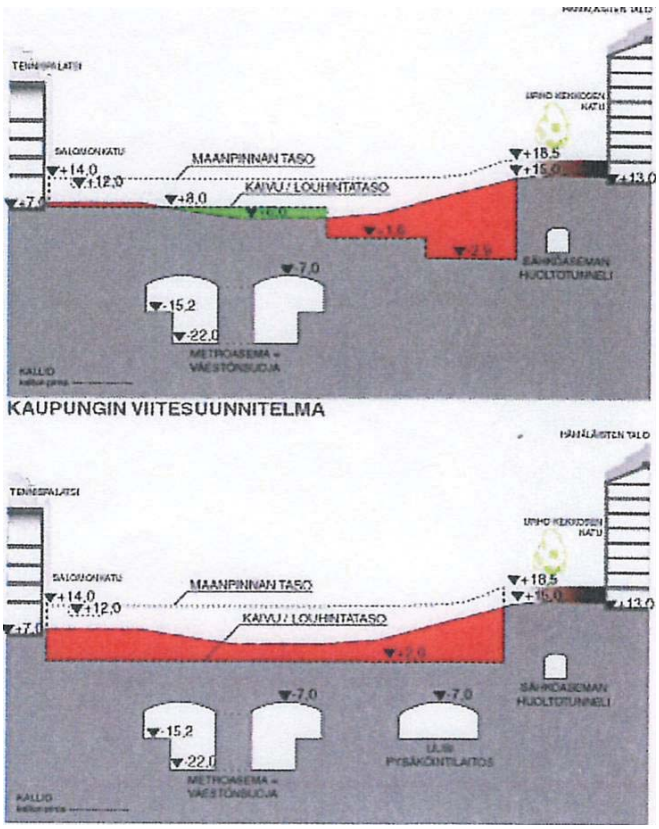
ENVIRONMENTAL IMPACT MANAGEMENT

The starting point for underground construction is always a secure construction without causing any damage to the environment, which includes both developed (urban) and natural environment. /3/

Urban environment

Designing an underground construction site in a densely built urban environment is often challenging. Especially in city centers there are underground facilities situated on several levels.The starting point for the design is to, among other things, determine the precise location, structures, and possible safety distances of these facilities. The more densely there are underground facilities in the area under design, the more challenging it is to, for example, model the rock's behavior when constructing new facilities. On the other hand, construction experience and research information on near-by facilities offer extremely important source material about, for example, the rock conditions in the area.





Geology

Managing the environmental impacts of an underground construction site is based on extensive knowledge of the surroundings. Being familiar with the area's land and bedrock conditions is a key factor when compiling programs for managing the environment. Initial geological data is acquired from different map materials, ground survey information, building foundations, and especially from on-the-spot visits. Based on this information, informative data is compiled for any given purpose of use.

Based on the initial geological data, a geological interpretation of rock properties, among other things, is made over the area, which provides source information for rock mechanical modeling. In addition, the groundwater conditions in the area are determined and the risk areas where depressions caused by the groundwater's lowering are possible are investigated for the environmental management programs.

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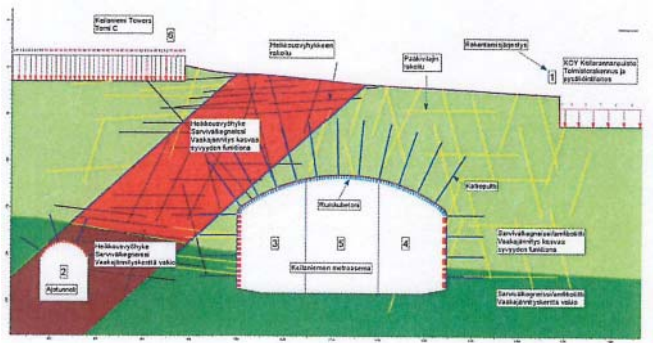
Rock mechanics

In the present-day, increasingly challenging underground rock engineering projects, rock mechanical design plays a critical role. As rock engineering skills and knowledge grow, new kinds of structural solutions can be found and ever more complicated projects can be executed. Based on rock mechanical design, the constructibility of different facility alternatives can be compared, the impact of construction on environment can be studied, and the possible problematic areas can be focused on in time, among other things, thus prolonging the operational life of the



facility.

With the help of rock mechanical modeling, we strive after simulating numerically the behavior of the rock mass, affected by changes in load and in environmental conditions. In urban construction sites, this often means primarily taking into consideration and limiting displacements and deformations caused by the excavation of underground spaces and by the removal of rock mass as a part of the design project and dimensioning solution. In addition, with the help of rock mechanical analyses, damage prediction for critical structures are compiled.

The reliability and level of precision of rock mechanical analyses are mainly dependent on the sufficiency of geological research data and other source information as well as on the correct interpretation of the data, which is why the local conditions must always be researched by professionals, thoroughly and extensively. With the help of sufficient source data and the right modeling tools, it is nowadays possible to simulate structurally very complicated excavation entities with complex duration.

Environmental risk analyses

Before the construction work can be begun, the possible risks and environmental impacts caused by excavation have to be found out. Based on the research done, a preliminary risk assessment of excavation vibration is compiled along with a management program for groundwater and depressions. The need and extent of rock mechanical monitoring is determined by the rock mechanical model made of the site and by the damage predictions.

In preliminary risk assessments, the equipment and functions most important and most vulnerable to excavation are taken into consideration. For example, in the design phase of Kamppi Center, the metro tunnel played an extremely important role, as the feasibility of the site and excavation methods were considered. During the preliminary assessment phase, trial blasts in diamond core drilling holes are often made in order to examine the rock's vibration transmittance in the critical areas with regard to excavation.

In the excavation risk analysis, the vibration-sensitive equipment and functions, such as computer and hospital equipment, in the surroundings of the planned excavation site are covered. The extent of the risk analysis is proportioned sufficiently according to the quality and duration of the excavation work and to the site surroundings.

The function of risk analysis is to serve as grounds for calculation during the competitive bidding phase and as rules during the excavation work. As regards the building developer, risk analysis is the design document that considers the environmental impact of excavation work and defines the limits of excavation in order to conduct it economically and without endangering the environment. The excavation contractor uses the information and boundary values in the risk analysis for scheduling and as source information in blasting design.

The risk analysis determines the extent and conduct of structure inspections preceding excavation, protective measures for sensitive equipment and objects (for example computers and pieces of art) to be taken before excavation, and at least preliminary places for vibration measurement points. In addition, the risk analysis determines boundary values for the intensity of excavation vibration allowed as regards structures and equipment and guides in following the measurement results.

Environmental impact monitoring

Vibration monitoring

Risk assessment during construction is mainly done by following and analyzing the measuring results of excavation vibration. When necessary, intermediate inspections

are made and for example plaster bridges can be installed, if structures are thought to be moving and fracturing – with the help of these methods, ascertained information on the impact of excavation vibration on structures can be acquired as early as possible during construction.

Vibration is monitored with vibration meters, or seismographs, which have been installed in the surroundings of the construction site in places critical to vibration. The measurement results from the vibration meters are often transmitted in real time to an online result service or as a text message into a cell phone.

Groundwater and subsidence monitoring

Water inflow into excavated spaces can lower the groundwater table in stand pipes. This can cause the soil to sink, wooden foundations to decay, or ground supported structures to be damaged. The purpose of groundwater monitoring is to actively react to the ground water lowering, so that possible damages can be avoided. The monitoring is often conducted before and during construction as well as during use. Consequently, the possible environmental impacts caused by construction can be detected during every construction phase.

Rock mechanical monitoring

Rock mechanical monitoring includes measuring the movements in bedrock and engineering geological mapping of rock quality during excavation. The results are constantly being compared with a rock mechanical model compiled beforehand and with calculated displacements. Based on the monitoring, grouting and reinforcement designs are also revised.

Noise, dust, and radon

The implementation of the boundary values set for noise is monitored during construction on site with measurements, at the very least every time that the focus of the site or the working method changes significantly. The boundary values and the objects to monitor are determined by the environmental offices of each municipality and city.

Environmental impacts caused by dust can be reduced, for example, by binding the dust during drilling with a dust collecting system and during loading and transport with the help of water. Dust measurements can be conducted as the need arises.

The radon concentration in rock spaces is monitored with measurements during construction according to a separate monitoring program when excavating in areas defined by the Finnish Radiation and Nuclear Safety Authority (STUK). The boundary values for radon concentration are determined by STUK.

Environmental damages of a project

Contractors and building developers have liability insurance in case of damages. The amounts of insurance are determined by the risks of the construction site. In smaller sites, most excavation contractors have an annual policy.

When suspecting an accident or damage, people in the surroundings of a site contact the site's representatives, in which case investigations are started. Damage reclamations are investigated and documented. If excavation work is found to have caused the damages, a compensation or repair proceedings is agreed upon.

Compensation procedure

Fairly few accidents and damages occur during excavation work in relation to the amount of on-going construction sites and their being located in residential, business, and industrial areas. Usually, the damages estimated to be caused by excavations are cosmetic by nature; serious structural damages occur very rarely. Suitable procedures are predominantly a financial compensation and damage reparations.

CENTRAL SERVICE TUNNEL

The idea of an underground central service tunnel through the city center of Helsinki dates back to the late 1970's, when the very first drawings were sketched. However, the time was not fruitful for the realization of a tunnel until the first years of the 2000's, when both public and private sector found each other in the vital question considering the future of the city center. /4/

The city planning process was carried out with co-operation between city officials and private sector in order to achieve the best possible solution in developing the central area of the downtown Helsinki. The main goals in the development of the city center area are among others

- to keep the central area viable in the future
- to keep the central area commercially attractive
- extend the pedestrian zone in the city center
- decrease traffic and and congestion in the streets

After several phases the line for main service tunnel was set from Ruoholahti to Kluuvi. The city plan for the service

tunnel was accepted by City Council in the year 2005. The city plan for the enlargement of the Stockmann department store was accepted in the same year and the city plan for the City Center shopping was accepted in 2006.

Along the service tunnel there are many other underground facilities which are connected to the service tunnel

- Kamppi Parkki – parking facility
- Block "Pyy" service facilities
- Mannerheimintie – parking facility
- Stockmann service facilities
- Rautatalo service facilities
- Electric substation
- Block "Gaselli" service facilities
- Service facilities for Kämppi shopping center

The service traffic for the main commercial blocks in that area loaded heavily the street network. When the service traffic tunnel was completed the service traffic disappeared from the busy Keskuskatu and allowed the expansion of pedestrian zone in the city center.

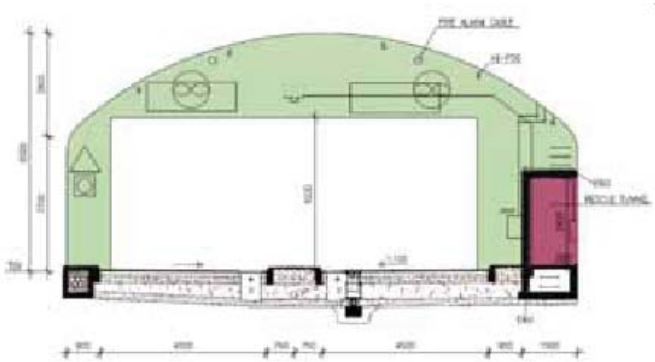
Private cars are allowed to drive along the service tunnel to the parking facilities.

Underground Service Tunnel (KEHU)

KEHU tunnel consists of two different portals, one from the west for all vehicle and one from the east for service transport only. The total length of the tunnels is c. 2 km. The tunnel cross section is about 110 m². The maximum gradient of the tunnel is 7%. The tunnel has been designed for 12 m long vehicles. The design speed is 40 km/h. The construction costs are about 90 MEUR.

KEHU tunnel is composed of the main tunnel, six technical rooms (appr. 50 m² each) and ten shafts to the surface. There are also about 20 connections to other underground facilities. When considering the strict requirements by the authorities the tunnel system can be regarded as a very complex system.

To meet all the requirements set for the work, the technical solutions used in the tunnel are a combination of the technique used in normal traffic tunnels and underground facilities. In the traffic control system all the driving connections to other adjacent underground facilities is also taken into account. The traffic control system is controlled from Jyväskylä, 300 km away from Helsinki, where the control room of the tunnel is located. In case of emergency the fire alarm cable directs the orders to other systems: fire protection system (Hi-fog), cameras and traffic control.



When considering rock mechanics, the most challenging section was the crossing of the crushed zone of Kluuvi area. Also the groundwater level was strictly observed by the authorities, no decline of the water level was allowed due to the tree props of some buildings in the city center. In the tunnel the first underground traffic circles have been introduced.

Stockmann department store with Mannerheimintie parking facility

Stockmann's Helsinki department store is the largest department store in the Nordic countries. First plans and feasibility studies for renovation and enlargement of the department store were carried out in 2001–2003. Main drafts in accordance with city planning process were completed 2003–2005 and the decision to start the project was made in December 2005. Excavation works started at the beginning of February 2006 and the project was completed in November 2010.

The underground parts of the project consisted of:

• The logistic operations servicing the department store and Academic Book Store were transferred into the caverns excavated 30 m below the store building

• Total transformation of former service and parking floors under the department store to the "Stockmann Deli" food department and personnel facilities

• Improvement of heating and cooling, ventilation, lightning etc. technical systems

• New facilities and commercial space under the Keskuskatu and transforming the Keskuskatu to a pedestrian street

• The new underground parking cavern under Mannerheimintie for 600 cars replacing those 200 places situated in the lower floors of the store.

As the result of the enlargement project approximately 10,000 m² new retail space was created and the total retail space is now 50,000 m².

Total volume of the underground service facilities is ca. 65,000 m³ including the open excavation works in Keskuskatu area. The largest span is 27 m in the main service hall and the largest height is 13 m. There are 15 shafts connecting underground facilities to the store building.

It was required by the management that all the construction works must be carried out by minimal disturbances to the operations of the store. This led to the innovative protective walls, under pressurizing all the working sites connected to the public and department store employee facilities, customer information procedures on blasting times, working during nights and weekends, etc.

The new car parking facility for 600 cars was excavated into the bedrock under Mannerheimintie, the main street of Helsinki. The parking facility consists of two 160 m long and 17 m span hall, the total volume is ca. 160,000 m³. There are three parking floors, 200 cars each.

The height of the cavern varies between 12–14 m. The Central service tunnel goes underneath the parking halls and the total height of the cavern in that area is 20 m.

There are two access routes into the parking cavern. For the traffic from Mannerheimintie there is about 240 m long route to the upper level of the cavern, about 30 m below the street surface. From west the route is about 800 m long and goes along the service tunnel to the lower level, about 37 m below the street surface.

UNDERGROUND REPOSITORY FACILITY FOR NUCLEAR WASTE

Studies into the geologic disposal of spent fuel have been carried out in Finland since the 70´s. The site selection research program for a deep repository for spent nuclear fuel was commissioned in 1983 by a countrywide survey. Field investigations, aiming at the selection of the repository site, were started in 1987 on five candidate sites. The site selection program was concluded in the selection of Olkiluoto site in 2001. /5/

The geologic disposal of spent fuel from the Finnish nuclear power plants – Loviisa 1 and 2, Olkiluoto 1 and 2 and later Olkiluoto 3 and 4 – will be executed by Posiva Oy, a company owned jointly by the two nuclear power producers Fortum Oyj and Teollisuuden Voima Oy. Preparations for nuclear waste management were started already in the 1970s when the first power plants were still under construction. In 1983, the Finnish Government confirmed a target schedule for nuclear waste management, in which the construction of the disposal facility was scheduled for the 2010s and the start of actual final disposal for the year 2020.

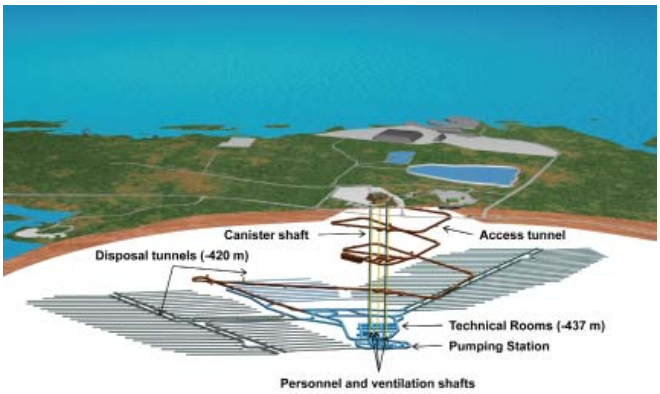
Potential sites for the disposal of spent fuel were screened in the 1980s, followed by detailed site investigations in the 1990s and an environmental impact assessment in late 1990s. In 1999, Posiva submitted an application to Government for a Decision-in-Principle to choose Olkiluoto as the site of the final disposal facility. Finnish Government issued a Decision-in-Principle (DiP) in favour of the project in December 2000. Based on this Posiva continued to investigate all important characteristics of bedrock at Olkiluoto and started to design the final repository.

ONKALO

Focus on Finland

The disposal project has progressed to the implementation stage – constructing an underground characterization facility, named as ONKALO, at Olkiluoto. ONKALO is being used to obtain further information to plan the deep repository in detail and to assess long-term safety and construction engineering solutions. ONKALO enables final disposal technology to be tested under actual, site-specific conditions. ONKALO is not intended solely for research premises, but has also been designed to serve as an access route to the repository when constructed. ONKALO will take about 10 years to complete. Construction is scheduled for 2004–2014 and investigations will be made from the start of construction in conjunction with excavation. Once ONKALO has been completed, work will start on building the encapsulation plant and final disposal repository after the final construction license has been given in 2014.

The site characterization program developed in early 1980s already included the assumption that an underground rock characterization facility would be required at the site confirmation stage to allow a detailed repository design to be developed and the preliminary safety assessment to be produced. The plans of the underground facility were realized after issuing the Decision-in-Principle. A decision was made to excavate the underground rock characterization facility, ONKALO, at Olkiluoto. The approach adopted was that ONKALO facility shall be constructed in such a manner that it allows further characterization and research work to be carried out without jeopardizing the long-term safety of the repository site. In addition, it should be possible later to link ONKALO to the repository so that they are integrated.



The main characterization level in ONKALO is at the depth of some 435 m below the sea level. The inclination of the tunnel is 1:10, which means that the length of the access tunnel will be approximately 5 km. The total length of the tunnels and shafts will be about 9 km. A total of 420,000 m³ of rock will be excavated. The site preparations for the facility were started in 2003 and the actual excavation work began in September 2004. The tunneling work is carried out by traditional drill & blast techniques. Raise boring method has been used for the vertical shafts under construction.

By the end of January 2011, the excavation of ONKALO had proceeded 4,600 m to a level of -435 m. The excavated tunnel meets the specified quality requirements, the management of leakage waters being one of the most significant requirements.

Underground characterization and research

A program for the underground characterization and research (UCRP) to be carried out in ONKALO has been established. What Posiva aims at achieving with the activities proposed for ONKALO is, that the general suitability of the site will be demonstrated. It is only with such confirmation that it will be possible to proceed to the application for a construction license for the repository. The program during the tunneling stage includes mapping of the tunnel faces, drilling of pilot and characterization holes with subsequent rock mechanical, geological, geophysical and geohydrological studies, hydrogeochemical sampling and measurements, determination of fracture and flow data plus various rockmechanical tests and measurements.

Investigations in ONKALO started in September 2004 at the same time with the excavation work by geological mapping of the tunnel roof and walls. Probe holes, which are core drilled boreholes inside the tunnel periphery, make possible to do various borehole investigations during the excavation work. From the probe holes flow measurements are made and the results are used in the grouting planning, and later also in modeling.

Long term experiments need to have a place for the set up in the tunnel. For that purpose investigation niches and specifically for demonstrations designed tunnels are planned to be constructed in 2011. The first experiments made in tunnel have been rock stress measurements and small-scale hydrogeological interference tests. These tests have been followed with geochemical and geo-microbiological studies.

Because the construction of ONKALO and later the disposal facility will affect the surrounding rock mass, a monitoring program was established. The main aim is to observe possible changes in the host rock and obtain information on the responses of the host rock to the excavation. The results of the monitoring are compared to the baseline values presented in 2003.

All the data achieved with different investigation methods will pass several modeling steps. The interpretation and modeling of the field investigations data aim at building a consistent picture of the site.

Rock mechanics studies

The aim of the Olkiluoto site conforming studies is to verify the present conclusions of the site suitability, determinate and identify the rock volumes suitable for repository space and characterize the target host rock for repository design, safety assessment and planning of the construction work. Rock mechanical information is needed to design a safe underground environment but on the other hand underground laboratory is needed to acquire more detailed rock mechanical data, like reliable state of stress information.

Rock mechanical studies are planned to be conducted in the so called main characterization level. Some of these experiments may continue even years to get estimates for long time behavior of the bedrock. Based on the rock mechanical information gathered so far rock mechanics analysis will be planned for the main characterization level of 435 m in the ONKALO. The objective of the analysis is to evaluate the mechanical state of the facilities (tunnels, technical caverns etc.). The rock mechanics analysis will give useful initial information for the repository design and then support the construction license of the repository.

TRAFFIC GOES UNDERGROUND

Up to the beginning of this century, metro was the only major underground transportation infrastructure in Helsinki. In addition to that, there was a short street tunnel, short bus tunnel and several underground parking garages in the inner city. /6/

During the first decade of this century several underground transportation projects were constructed:

• Eliel Saarisen tie bus tunnel and interchange with commuter trains at Huopalahti station (2001)

• Extension of existing bus tunnel and two major bus terminals in Kamppi (2005)

• Tunnel for service traffic and traffic to two new underground parking garages in CBD (2009–2010)

• Short street tunnel in Hakamäentie (2009)

Currently, there are several underground transportation projects that are under construction or planning phase in Helsinki.

West Metro

Extension of the existing metro to the west is under construction both in Helsinki and Espoo. The construction was started in November 2009 in Helsinki and the traffic is planned to start at the end of 2015.

The length of the new metro line is 13.9 km and there will be 8 new stations: two in Helsinki and six in Espoo. There will be two parallel tunnels going underground for the entire length of the track. The cost estimate of the project is 713.6 MEUR (in 2007). The state is going to finance 30%. The rest is financed by the two cities, Helsinki and Espoo, according to the actual costs at their territory.

Paloheinä Bus Tunnel under the Central Park

Paloheinä Bus Tunnel is a part of the new regional transverse bus line called Joker 2. The length of the tunnel is about 1.3 km and it will be constructed under the Helsinki Central Park. The cost of the tunnel is estimated to be 33 MEUR. The construction is going to start in late 2011. The operation of the new Joker 2 is planned to start in 2014.

East Metro

A new area of 30 km was incorporated into Helsinki from the municipality of Sipoo and the City of Vantaa in the beginning of 2009. The municipalities Helsinki, Vantaa and Sipoo are currently preparing a common master plan for the area of 45 km² to the east of the previous eastern border of Helsinki. In the future, the master plan area is planned to house 50,000–80,000 residents and employees in total. The public transport system in the area is planned to be based on the extension of the metro from the other eastern end station Mellunmäki.

The length of the metro extension is about 9,5 km of which about 60% is in tunnel. The new section is planned to have

5–6 stations. The preliminary estimate for the investment costs is 700 MEUR that will be covered by the three municipalities and the state. The schedule of the project is dependent on the development of the area but it is estimated that the construction is going to start in 2016 earliest.

Commuter rail loop Pisara (Droplet) under Helsinki CBD

The rail yard of the Helsinki Main Railway Station is functioning at the limits of its capacity. No commuter or long distance traffic is possible to be increased. A solution for the capacity problem is a new commuter rail loop, Pisara, under the center of Helsinki. New stations are going to increase the level of service for passengers as well.

Currently, general planning and environmental impact assessment are under preparation by the Finnish Transport Agency and the City of Helsinki. The length of the shortest loop is about 8 km of which about 6 km is in tunnel. There is going to be 3 stations in the shortest loop: Töölö, CBD and Hakaniemi with the latter two having exchange connections to the metro. There is no cost estimate based on the existing plans for the project, yet, but it is assumed that the investment costs fall between 700–1,000 MEUR.

If the planning of the project is decided to be continued immediately after this ongoing planning phase and the project finds the necessary financing it is possible that Pisara loop could be in operation by 2020.

Helsinki Airport long distance rail connection

A preliminary study on a new long distance rail connection via the Helsinki Airport has been completed by the Finnish Transport Agency. The new rail connection between Pasila and Kerava via the airport would be in tunnel for almost its entire 30 km length. The connection is going to be constructed for mainly the national rail traffic but there will be some room for a few commuter trains, too. Between Pasila and Kerava there is going to be only one station at the airport with good interchange with the Ring Rail under construction phase in Vantaa.

The new rail connection enables a direct train service from the rest of the Finland and from the Helsinki center to the airport. In addition, it gives considerable amount of required room for more commuter and freight trains on the northern main railway. It has been evaluated that the project's cost benefit ratio is over 1.

The Airport Rail Connection is scheduled for the period of 2021–2035 in the Regional Transportation System Plan. The cost estimate is 1,000 MEUR.

Pasila Metro

There is also a plan to extend metro from Kamppi to Pasila with 2–3 station in between. The project is dependent on the possible continuation from Pasila. The cost estimate is 330–370 MEUR depending on the number of stations. In the Regional Transportation System Plan the project is scheduled for the period after 2050.

Hakamäentie extensions

The transverse arterial in the northern Inner City, Hakamäentie, was improved 2010 including a short tunnel mentioned in the beginning. There are still two sections missing from the original plan between Turunväylä and Lahdenväylä. The missing western tunnel would take the through traffic away from local street network between Vihdintie and Turunväylä. The eastern tunnel would do the same to Koskelantie. In addition, the eastern tunnel would include a tunnel connection to the Kalasatama project area and further to the center of Helsinki.

The cost estimate for the western tunnel section is 180 MEUR and for the eastern tunnel sections 190 MEUR. The new tunnel sections are scheduled for the period 2021–2035 in the Regional Transportation System Plan.

Central Tunnel

Focus on Finland

The main objective of the Central Tunnel between Länsiväylä and Sörnäisten rantatie is to remove the through traffic from the streets of the CBD of Helsinki and feed the underground parking garages. Additionally, it would make it possible to enlarge the pedestrian areas in the CBD as well as make public transport work better in the CBD streets.

The cost estimate of the 3.3 km long tunnel (the short alternative) is 525 MEUR. The Central Tunnel is included in the Master Plan of Helsinki as well as in the Underground Master Plan approved by the City Council just recently. However, the detailed planning of the tunnel has been stopped by the City Board and there exists no decision to construct it.

These upcoming projects illustrate the worldwide trend to increasing use of tunnels for environmental and energy benefits, as well as for infrastructure development in populated areas. Finland, like many other countries, expects to see increased use of tunnels in the future.

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Member Nations Report 2010

AUSTRALIA

The ATS continues with its regular program of technical sessions at all regional groups. These are very well attended with new members attracted at each event.

Last year's publication on the "The History of Australian Tunnelling" is a significant achievement for the ATS making much general information on tunnelling accessible to members and the general public.

AUSTRIA

The Austrian national committee of ITA participated the World Tunnel Congress in Vancouver 2010 with 5 colleagues.

In 2010 the Austrian Tunnelling Society again organized several international conferences. The most important conference were the well established "GEOMECHANICS COLLOQUIUM" and the "AUSTRIAN TUNNELDAY" in October 2010 in Salzburg which was as usual organized by the Austrian Society for Geomechanics. Besides the President of ITA, InMo Lee from Korea, about 1000 participants from more than 20 countries followed the interesting topics presented by national and international speakers.

All participants of the congress were given the newest book of the Austrian Society for Geomechanics "NATM – the Austrian practice of conventional tunneling"

Considering the activities of the Austrian railway organisation OEBB in the western part of Austria the finishing works for the new railway in the Tyrol's Lower Inn Valley passed a further milestone with the punctual completion of 34 kilometers of track in the new tunnels. With continuous working, the contractors appointed by ÖBB-Infrastruktur AG achieved a placement rate of one kilometer of permanent way per week. 16.500 cubic meters of concrete, 6.500 ÖBB–PORR track baseplates and 560 continuously welded rails were installed in the western project section. Track construction in the Lower Inn Valley continues uninterrupted. By the beginning of 2012, another 40 kilometers will be ready. In the design of the track, special attention has been paid to vibration protection for built-up areas located along the line. A total of 24 kilometers of track have been constructed using mass-spring systems. Depending on local conditions, trackbeds of varying dimensions are placed on elastic point or surface bearings. Installation of the mass-spring systems also has been largely completed. The new Lower Inn Valley railway is part of the Brenner railway axis from Berlin to Palermo. The project is supported by the European Commission, which is providing funding for the further development of the Trans-European Networks (TEN). The forty kilometer section which is now under construction to the east of Innsbruck serves as the northern approach to the Brenner Base Tunnel and is designed to overcome capacity bottlenecks on the existing railway. 32 kilometers of the project involve new twin-track tunnel sections. A three-track section with a length of 2.3 kilometers will serve as an underground overtaking section. The tunnels in the Inn Valley have been constructed using practically all the standard methods. In addition to mixed-face excavation, two 13-meter diameter slurry shield machines were deployed. The work also involved cut-and-cover tunnel construction in the presence of groundwater from the River Inn, tunnel sections constructed with the help of jet grouting envelopes, and tunnel excavation under compressed air. The new Kundl – Baumkirchen line is equipped for ETCS Level 2 running throughout and will become operational in December 2012.

ASFINAG – Autobahnen- und Schnellstrassen Finanzierungs-Aktiengesellschaft – undertakes the design, financing, construction and maintenance as well as the charging of tolls for Austria's entire motorway and expressway system, which includes an overall length of more than 2.100 km with 139 tunnels (114 twin tunnels and 25 single-tube tunnels) in operation, with a total about 324 km tube length. The tunnel projects under design and construction correspond to a total length of about 150 km. Since ASFINAG launched its tunnel-construction offensive in 2001, approximately 4 billion euros have been invested into tunnel safety, i.e. new tunnels, second tubes for twin tunnel projects, structural and electro-mechanical measures including overall refurbishment schemes as well the upgrading of central monitoring stations.

With its length of about 6.6 km, the second tube of the Pfänder Tunnel on the A14, Rheintal Motorway, is the longest tunnel at present under construction. Hard-rock tunnelling with a single-shield tunnel boring machine (TBM-S, 11.92 m in diameter) was completed within an extremely short period of 14 months. Highly challenging geotechnical problems need to be faced at the Bosruck tunnel site on the A9 Pyhrn Motorway. Since squeezing rock has severely affected the first tube during its 35 years of operation, new primary and final linings will be installed over substantial lengths as soon as the second tube, now under construction, is finished. The commissioning of the Tauern tunnel, which is about 5.4 km long, before the summer of 2011 will mark the overall completion of the Tauern twin-tunnel project on the A10 Tauern Motorway. ASFINAG's largest tunnel project, a twin-tunnel passage of

some 8km in length beneath the River Danube and the Lobau National Park on the S1 Vienna Outer Ring Road, is in the planning and design stage. This will involve tunnelling to a maximum depth of about 60 m using a shield tunnelling machine with a diameter of about 15 m. Completion of this project will close the motorway ring around Vienna.

VERBUND, the biggest energy producer of Austria, is a world leader in the planning and construction of hydroelectric power plants. The construction of Limberg II in Salzburg Province, authorized 20.2.2006, concludes a series of works comprising the boring with a Wirth tunnel boring machine, of the water ducts (diameter 7.03 m, length 3734 m) and the penstocks (diameter 5,80m, length ca. 577m, inclination 45º), which were excavated with a Robbins tunnel boring machine. Excavation for the powerhouse (24m x 62m and 43m height) and transformer caverns (15m x 58m and 15 m height) began in 2008 and are nearing completion. Commissioning of the water power plant should take place in early summer 2011. Reißeck II in Carinthia, a high pressure project similar to Limberg II, received regulatory approval and the green light for construction in 2010. This project, an investment of €385 Mio, is meant to connect two existing installations through a 3,500m long high pressure tunnel and an 820m inclined chute. Access ducts were tagged on in 2010 in order to bring the tunnel boring machines into operation in 2011, for the drilling of the 7m wide tunnel and penstock. Total capacity of this installation is 430 MW. (more on the ITA website)

BRAZIL

The activities of the Committee are classified in four groups:

Institutional actions for promoting underground works in Brazil

Technical activities

Interviews

Reprinting the book Tunnelling in Brazil

Institutional Actions for Promoting Underground Works in Brazil

CBT has been heavily involved in promoting sustainable solutions of underground works when other types of disadvantageous solutions have been proposed. In some other situations, where underground solutions have already been selected, CBT has acted by suggesting improvements to the contracting process. A step backwards about this matter seems to have been taken in the country as new contracting parties (both public agencies and private entrepreneurs), with little or no previous knowledge about underground construction, have tended to decrease the demand for engineering design and to transfer all the budget risk and responsibility to the contractor or prospective concessionaire. In some cases, actions taken by CBT have reached the media including the most important newspapers in the country.

Brazilian High Speed Rail: The bid for the construction and concession of a 520-km long high speed rail line between Sao Paulo and Rio de Janeiro is scheduled for April 2011. The length of underground section is about 110 km. CBT has been trying to suggest improvements for the bidding process. CBT discussed the role of Brazilian companies on the High Speed Rail Project on a debate held in Sao Paulo on September 9, 2010, at the Sao Paulo State Engineers Union (SEESP).

Santos-Guaruja Immersed Tunnel: Santos and Guaruja are two major cities on the State of Sao Paulo coast, separated by the 500-m wide entrance to the busiest port in the country. The connection between the cities is currently operated by a ferry boat service used by more than 7 million vehicles per year in each direction. During the last three years, many events and public hearings gathering engineers, politicians and other decision makers have taken place in both cities about the construction of a tunnel or a bridge. CBT President Tarcisio Celestino has been invited to participate in all of them, where he has defended the alternative of an immersed tunnel. The State Government has decided to construct a 90-m high bridge with 2-km long approaches, but reactions have been strong and discussions are still going on. Media coverage about CBT actions has also been intense.

Sao Paulo Monorail System: The Sao Paulo Metro Company (CMSP) has decided to adopt monorail elevated solutions, instead of underground, for some of its future lines and connections. CBT President Tarcisio Celestino has shown the advantages of underground solutions in a recent lecture by computing additional cost due to longer extension and other reason. Concepts of Why Go Undergound have been extensively used.

Sao Paulo Ring Road Northern Link: The Sao Paulo Ring Road Northern Link (the last one to be constructed) will run along the Cantareira mountain range. One of the last natural forest areas in the outskirts of Sao Paulo is on the Cantareira scarps. The underground solution (two 8-km long, 4-lane tunnels) seems to be the most appropriate solution from the environmental standpoint, but the Highway Department favors a surface solution because of construction costs. CBT prepared a document and images of a digital virtual flight above the alignment to be taken to the Highway Department officials showing other costs in addition to construction in disadvantage of the surface solution.

Technical Activities

The following events were organized or sponsored by CBT:

St. Gotthard Tunnel, lecture given by Roland Baggenstos (Alp Transit, Gotthard AG) in Sao Paulo on March 12, 2010.

Underground excavation construction methods and their impacts on the environment, lecture given by Marco Aurelio Abreu Peixoto da Silva (METRO/SP) at University of Campinas on June 22, 2010.

Concrete for tunnels, lecture given by Paulo Fernando (Concremat), in Sao Paulo on June 24, 2010.

Risk Oriented Design and Construction of Tunnels, lecture given by Wulf Schubert (Graz University of Technology, Austria) in Sao Paulo on August 23, 2010.

Underground Fire Safety - Prevention and Risks, lecture given by Arnoud Breunese (Efectis), held in Sao Paulo on September 14, 2010.

Solutions for Megacities, event organized to celebrate CBT's 20th anniversary, with the participation of In-Mo Lee (president of ITA), Han Admiraal (chairman of ITACUS), Miguel Bucalem (City of Sao Paulo Secretary for Urban Development), Luiz Antonio Cortez Ferreira (from the State of Sao Paulo Secretary for Metropolitan Transportation) and Tarcisio Barreto Celestino, (president of CBT), held in Sao Paulo on October 26, 2010.

Interviews

Interviews too numerous to be listed were given throughout the year mostly related to institutional actions for promoting underground works in Brazil.

Reprinting the book Tunnelling in Brazil

The first edition of the book Tunnelling in Brazil is sold out. To meet the many requests for the book that keep coming, another printing was made and is now available.

The tunneling industry was very busy in 2010 in Brazil, especially with respect to the construction of hydroelectric power plants, with underground hydraulic schemes. Most of those belong to private investors. It is also important to mention that Petrobras (The Brazilian Petroleum Company) has definitely moved towards tunnelling as a solution to underpass environmental protection areas. The first rock TBM tunnel in Brazil in 2010 (a 5 km long shaft-tunnel solution, , to underpass the Serra do Mar rain forest in Sao Paulo State). Underground mass transit systems have continued in major cities such as Brasilia, Rio de Janeiro and Sao Paulo. The construction for the 14-km long all-underground Sao Paulo Metro Line 4 is at the final stage and partial operation began in May 2010. The 6-km long extension of Line 2 began operation in the middle of 2010. The bid for the construction of the 15-km long Line 5 is expected to be launched in 2011. Design of Line 6 is also expected to be bid in 2011/2012. The City of Sao Paulo is about to launch the bid for construction of the Roberto Marinho urban highway tunnel, underneath a 3-km long urban park to be created as part of the actions for urban rehabilitation of an area in the Southern part of the City, coupled with real estate investments. The work will consist of two parallel, 3-lane, 2.7- km long tunnels. The bid for construction and concession of the 520-km long Campinas – Sao Paulo – Rio de Janeiro high speed rail line is scheduled for April 2011. The total underground length of the line will be in the range of 110km to be constructed by TBM and conventional tunneling.

BULGARIA

On December 12, 2010 the Bulgarian group of companies GEOTECHMIN turned 20! The organization marked its anniversary with the slogan "Small steps. Big traces." One of the traces with great national significance left behind by GEOTECHMIN is its design and construction work on the metropolitan network in Bulgaria's capital Sofia. Subprojects <Metrostation 9> and <Connecting Tunnel "Dragan Tzankov"> were completed in the period 2005 – 2009, while subproject <Metrostation 11-II> is currently underway.

SOFIA METROPOLITAN

In 2010 GEOTECHMIN continued its work on the design and construction of Metrostation 11-II "James Bourchier" and the tunnel section after it. This is the last station of the second diameter of Sofia Metropolitan, which is now under construction and will be put into operation in 2012.

In 2010 the driving of a drainage gallery with a total length of 3000 m was completed at Ellatzite copper mine. The facility is used to lead away waters accumulated in the pit. For this purpose 12 dewatering drills with diameter 250 mm and length 120 m were executed at the end of the gallery. The driving of the tunnel with a 14-meter cross section was implemented by drill-and-blast method in difficult geological conditions characterized by faults, wet grounds and crushed areas.

CANADA

Canada occupies most of northern North America, extending from the Atlantic Ocean in the east to the Pacific Ocean in the west and northward to the Arctic Ocean. The total land area is about 9 million square km. We are the world's second largest country (after Russia) and our common border with the United States is the longest in the world (about 9000 km). Climate varies from temperate in the south to subarctic and arctic in the north.

The Tunnelling Association of Canada (TAC) promotes the use of underground space and modern technology because of its vital importance to our rapidly expanding infrastructure. TAC supports and encourages innovation primarily in the fields of transportation, hydropower, rapid transit, water and wastewater. Measured against other world countries, Canada is relatively young, with a brief history of development of underground space. However, the level of tunnelling expertise within Canada has been extensive, with the large number of tunnels that have been completed in a variety of geological settings, both in soil and rock. Most of Canada's large cities are located in areas of extensive past glacial activity, which has created challenging tunnelling conditions, while our abundant natural resources have created a mining industry with extensive experience in deep, hard rock excavation.

Canada's extensive mining industry is known throughout the world, especially in hard rock exploration and tunnelling. Many of the methods developed in the mining industry have been transposed into the field of underground civil engineering works.

Member Nations Report 2010

Transportation tunnels are of a paramount importance in Canada due to it's a vast size, spanning five time zones from the Atlantic to the Pacific coast. Developments of our transportation system and industrial base have been, and still remain, a tremendous challenge, often requiring the necessity to go under rivers or other natural obstacles, and through mountains. The first tunnel in Canada was constructed between 1854 and 1860 near Brockville, Ontario to provide rail access to the St. Lawrence River. From the late eighteenth up to the mid-twentieth century, most major tunnels in Canada were associated with railways including many on the trans-Canada rail lines through the Rockies. Two famous rail tunnels of note were constructed at the end of the 19th century. The St. Clair railway tunnel between Sarnia and Port Huron, built with a Greathead shield equipped with a segment erector, was the first tunnel in North America to be shield driven and the first in which compressed air was used. This tunnel was placed into service in 1891. The second was a world first, an immersed twin-tube tunnel, the Detroit River Rail Tunnel between Detroit and Windsor, which entered service in 1910.

EPB technology was first used in North America to bore a rail access tunnel under the St. Clair River in Sarnia. The Lovat soft ground TBM used was 8.5 m inside diameter and bored a distance of 1868 m at less than half a diameter below the river bed.

Canadian Tunnel activity in 2011

In the transportation sector, new extensions to the existing subway systems in Toronto and Montreal are in the works. Major Commuter rail system upgrades are planned for the Greater Toronto area. Light Rail Transit systems are also planned for Toronto, Ottawa, Calgary, Edmonton and Vancouver. Many of these new projects, and extensions to existing ones, will involve significant tunnelling and underground works. Eight Lovat EPB TBMs have been recently procured by the Toronto Transit Commission for the Spadina Subway Extension and the underground section of the Eglinton Cross-town LRT project. A Yonge Subway extension is in concept design. New LRT systems are in the planning stages under the downtown area of Ottawa, and for the Evergreen Line extension to the Sky-Train system in Vancouver. On the Trans-Canada Highway, a tunnel is being considered to improve the road alignment through the Kicking Horse Pass in the Rocky Mountains. Also, a new US/Canada cross border tunnel between Detroit and Windsor is in the planning stage.

Perhaps the largest network of sewer tunnels in Canada has been, and continues to be constructed for the York Durham Sanitary Sewer System. Continued growth and development in the Region of York, north of the City of Toronto, has led to the need for additional capacity. Numerous projects have been completed to date totalling approximately 26 km of tunnels; several projects are planned for coming years, including the 15 km South East Collector, which is scheduled to commence in 2011.

The City of Edmonton has taken a unique (for North America) approach to development of its water and wastewater infrastructure. The city maintains its own tunnelling crews and owns several TBMs. Since the 1960's, the City has constructed numerous tunnels, ranging in size from 900 mm to 6.25 m diameter. Tunnel work for further infrastructure improvements will continue this year.

In the hydropower sector, new sites are being studied. Newfoundland & Labrador Hydro proposes the development of a new $4 billion, 2000MW generating station at Lower Churchill River (Gull Island), Labrador. Hydro-Québec is progressing with the Eastmain - Sarcelle - Rupert project to divert water and develop a new hydroelectric plant on this system of rivers discharging to James Bay. Engineering studies for an additional 300 MW electric power at Columbia Power Corporation`s Waneta Expansion site are underway in southern British Columbia. BC Hydro is encouraging the development of small, private hydro generating sites, some of which feature tunnels from 800 m to 16 km in length.

Canada has two internationally acclaimed examples of intelligent use of underground space. Beneath the streets of Toronto, Canada's largest city, lies an underground world full of stores, restaurants, and other amenities that allow the people to shop, browse, dine, or just explore. The "PATH" system, as it is known, comprises 27 km of tunnels, walkways, passages, access to numerous buildings in the financial, entertainment, and shopping districts with approximately 1,200 stores. It links many important buildings and attractions in the downtown area to 6 subway stations and accommodates 100,000 pedestrians daily. Additionally, Montreal contains the world's largest underground complex, of approximately 12 square km, with direct access to 4,300 hotel rooms, 2,700 apartments, 1000 retailers, 68 metro stops, 9 fitness centers, 3 skating rinks and 2 libraries. Both systems continue to add new facilities each year.

The Future of Tunnelling in Canada

The tunnelling industry is vibrant in Canada, and the future is encouraging. Many tunnel projects are underway but more significantly, several major projects are also in the planning process. The Tunnelling Association of Canada is prominently positioned to take full advantage of this strong tunnel market, and to promote the industry further into the future. We look forward to many years of continued underground work.

CHINA

In August 20010, we held the Ninth Mainland-Taiwan Science and Technology Seminar about Tunnel and Underground Works. The possibility and significance of Taiwan Strait Passage Project was discussed in the seminar.

China was the third largest delegation in the 36th World Tunnel Congress of ITA, which has 113 members, 17 papers; Bai-yun was elected as ITA vice-chairman.

In November 2010 we held Symposium of 16th National Tunnel Annual Meeting.

CURRENT AND RECENTLY COMPLETED MAJOR TUNNELLING PROJECTS

1.Nanjing Yangtze River Tunnel

2.Yellow River Crossing Tunnel in South to North Water Transfer

Project
3.Muzhailing Tunnel
4.West Qinling Tunnel
5.Taiwan Tunnel
6.Large Cross-section Underground Railway Tunnel on Straight Rail Transit Line in Beijing
7.Zhongtianshan Tunnel
8.Zhengzhou Metro
9.Guangzhou Metro
10.Shenzhen Metro
11.Urban Metro in Shanghai, Beijing and Tianjin

The quickest developmet period of China's infrastructure construction has come. Railway tunnel has been constructed 6000km and 2700km tunnel is under planning.China has passed 28 city metro plan in 2010.

CZECH REPUBLIC

The 11th International Conference on Underground Construction Prague 2010 was organised by the Czech Tunnelling Association (CzTA) ITA-AITES in the capital of the Czech Republic from 14th to 16th June 2010.

The conference was opened by Prof. In-Mo Lee, the incumbent president of the ITA/AITES. Overall, 480 participants from 22 countries were registered to the conference and 167 papers from 25 countries were published in the conference proceedings. Four Keynote Lectures were published separately in the TUNEL journal issue 2/2010, they were prepared by Dr. Nick Barton from Norway, Prof. Walter Wittke from Germany, Prof. Jiri Bartak, and Prof. Josef Aldorf from the Czech Republic. Invited lectures were presented by Prof. Robert Galler, Prof. Wulf Schubert, Dr. Harald Wagner (all from Austria), Prof. Alfred Haack, Prof. Markus Thewes (both from Germany), Mr. Jean-Gilles Arnaudet (from France), and Dr. Alun Thomas (from United Kingdom).

The conference program included 4 keynote lectures, 56 presentations in six technical sections, poster presentations, social evening in the Brevnov monastery and four excursions to Czech underground construction sites (two parts of the tunnel Blanka, Prague's utility tunnels and the Underground Educational Facility Josef).

CzTA also organised three Tunneller's Afternoons (regular seminars focused on various aspects of tunnelling). Their topics were: preparation and construction of collectors in Prague and Ostrava; preparation and realisation of tunnels from client's perspective; collapses of underground structures and contribution of pilot tunnels.

Two further seminars were also organised focused on use of Steel Fibre Reinforced Concrete (SFRC) for underground structures and on utilisation of geothermal energy.

The Blanka complex of tunnels in north-western part of the City Circle Road in Prague. It is the largest underground construction project being currently implemented in the Czech Republic. The total length of new road section is 6.382 km, with the length of tunnels reaching 5.5 km. Construction of all tunnels is done by Metrostav a. s. The aggregate length of the Kralovska Obora tunnel section reaches 3.07km, of that the mined section takes 2.231km, the rest is a cut and cover tunnel. The excavation of the invert of the triple-lane NTT and double-lane NTT tunnels was finished in August and October 2010, respectively.

The entire length of the Dejvice tunnel section is 1.0 km, the whole section is cut and cover tunnel structure, this section runs under the Milady Horakove Street. Majority of tunnelling works on this section was completed from 2008 to 2010. The Brusnice tunnel section is 1.4km long; the length of mined tunnels is 550m, the rest is cut and cover structure. On 5th July 2010 during the work on removing temporary walls of the side-wall drifts required for enlarging the excavation to the whole profile, the overburden stability loss took place in the vicinity of the central top heading face. The collapse did not cause any injury or damage to surface structures.

The extension of the Prague's metro line A from Dejvicka station to Ruzyne airport is divided by stages into in three operating sections V.A, VI.A and VII.A. The first extension, i.e. operating section V.A is currently under construction.

The purpose of the Outer Prague Ring Road (SOKP) is to link all motorways and expressways running in radial direction to the Czech capital, Prague. The Komorany tunnel (Lot 513) is 1.9 km long, the Lochkov tunnel (Lot 514) is 1.6 km long. The two tunnels were opened to traffic on 20 September 2010.

Kralovo Pole (Dobrovskeho) tunnels will become an important component of the extensive complex of construction parts of the Large City Circle Road Brno (VMO Brno). The breakthrough celebration took place on 25th March 2010.

Member Nations Report 2010

The D8 highway section 0805 between Lovosice and Řehlovice contains the Prackovice tunnel and the Radejcin tunnel. The excavation of Prackovice tunnel was completed in 2009, the excavation of the Radejicin tunnel was completed in August 2010.

The construction of tunnels on Votice – Benesov section of the railway line Prague – Ceske Budejovice is ongoing. It contains five tunnels, all of them are double-track tunnels constructed by the NATM, construction of 4 mined tunnels is done by Subterra a.s., construction of cut and cover Votice tunnel is done by Hochtief a.s.

The Osek tunnel is situated on railway line Prague – Plzeň on the section Beroun – Zbiroh.

The tunnel is 324m long, it is a cut-and-cover double-lane tunnel and was completed in November 2010.

DENMARK

The Danish Society for Tunnels and Underground Works has during the year 2010 arranged 6 member meetings including two technical site visits. The first technical site visit covered the 5.3 km long Leipzig City Tunnel project in Germany with 5 underground stations. The second visit and study tour covered a two day visit to tunnels in construction close to the City Centre of Stockholm in Sweden. The first site visit was to the almost 9 km long road tunnel of Norra Länken using drill & blast and cut & covers methods. Secondly a site visit was done to the 300 m long Söderström immersed railwaytunnel under construction next to the immersion site in the City Centre of Stockholm. The tunnel is detailed design by COWI and the contractor is a JV of PIHL (DK) and Züblin (D).

Members of the society have participated in the ITA General Assembly in Vancouver, Canada from 14th to 20th May 2010 including meetings in two ITA working groups. Members have also participated in activities within COSUF during 2010 and as tutor and lecturer within ITA - CET. One member is an active member of PIARC's tunnel Committee including two working groups on safety and operation of tunnels bringing back news for the Danish tunnel industry.

The progress on the Cityringen project continues. The project consist of a completely new Metro with 15 km metro circle line all underground (30 km tunnels) and 17 underground stations and will have its own maintenance and service centre. There will be 5 interchange stations to existing railway and metro lines.

In January 2011 the project went from the planning phase to the execution phase by the signing of the contracts for the Civil Works Construction and for the delivery of the Transportation Systems. For the Civil Works the contract was signed with the Copenhagen Metro Team a joint venture of the companies Salini, Trevi and Selli from Italy. The Transportation System contract was signed with Ansaldo, Italy. The contracts are design and build contract.

The civil works contract includes construction of 30 km of tunnels, construction of 17 stations and 3 underground chambers for cross - overs and bifurcations of the Metro line.

The tunnels will be constructed using four earth pressure balance TBMs in geology varying from competent lime stone to glacial deposits of clay till and sand layers. More than 500 boreholes and 17 km of seismic investigations have been performed in order to investigate the ground conditions and to provide a firm basis for the contract. The ground coverage to the tunnels varies between 5 to 30 m with generally 15 m at stations and 25 m at low points between stations.

The stations will be constructed using cut & cover method with retaining walls of either secant piles or diaphragm walls depending on the ground conditions and the depth of the walls. There are 14 so called standard stations and 3 special stations of which one has to be constructed partly in a water canal. The station boxes are generally 22 m side and 70 m long with platform depth of generally 19 m below ground. The civil works contract includes also the mechanical and electrical equipment such as power supply, tunnel and station ventilations and SCADA systems.

Works has already started in the City with utilities being relocated and archaeological excavations ongoing which all will be finalized prior to the sites being handed over to the contractor, which will happen gradually from March 2011 and onwards. The project value is 3 billion Euros and the Metro Circle Line is scheduled to open in 2018.

Archeological site investigations ongoing in the historical city center of Copenhagen.

Different alignment studies have been carried out for a new Eastern Bypass around Copenhagen. In February 2009 The Danish Government presented their plan for the Danish Transport Policy until 2020. The plan states that the government will initiate a strategy analysis for the Eastern Bypass. Ramboll shall report this study of different alignments in 2011.

The feasibility of a new Oresund Fixed Link between Elsinore in Denmark and Helsingborg in Sweden has been studied during 2009-2010 by IBU-Oresund, an organization consisting of regional and local authorities on both sides of Oresund. The project was partly financed by the European Regional Development Fund. Different alignments for the fixed link have been investigated with bridge and tunnel options. Ramboll has investigated a

central city-to-city link and has recommended a bored tunnel for passenger trains. The Swedish Government has initiated a more comprehensive study for the link. This study should be reported mid 2011

For a new Northern Harbour Tunnel two proposals have been developed into preliminary design in 2009 and 2010. The first proposal comprises a cut-and-cover tunnel with a length of approximately 1 km, including Ramp structures. The second proposal comprises a bored tunnel with a length of approximately 2.5 km, including ramp structures. In April 2010 the City of Copenhagen selected the proposal with the cut-and-cover tunnel as the continuing project. The project is very complex because the tunnel will be built in dense rural areas passing several heavy trafficked roads and railways. The project is being developed by the City of Copenhagen and Ramboll. The project is planned to be tendered for construction works in February 2011 and is expected to take 5 years to complete.

Overview of the portal and ramp area for a new Northern Harbour Link.

The first phase of the Marselis Boulevard Tunnel in Aarhus - connecting the Motorway system and Ring Road network with the Port of Aarhus – is under construction. The second phase with a 2 km cut & cover tunnel is delayed due to problems with the financial founding's.

The contractor PIHL has started the construction of an exceptional underground Maritime Museum located near the famous Kronborg Castle in Elsinore. The architects, B.I.G. (Bjarke Ingels Group), have created a fantastic project utilizing the old dry dock from the shut down Elsinore shipyard. The museum will be located around and inside the old dock. The client is "Maritim Museums Byg ApS" and consulting engineer is Rambøll.

The subsoil is mainly sand and gravel. In the depth 30 – 32 m below ground level the limestone starts. When the concrete dry dock was constructed during the 1950ties, a lowering of the ground water level just sufficient for the construction works was achieved, but the quantity of water pumped out into the harbour was huge due to the very permeable subsoil of sand and gravel.

A similar lowering of the ground water level for the construction of the new museum was initially deemed impossible considering neighbour buildings and the environment. The main structures including a large number of anchors against uplift and new reinforced concrete structures were then to be installed under water, with all the difficulties resulting from such an execution method.

PIHL proposed however to install a cut off wall of bentonite/cement slurry in the sand/gravel around the entire dry dock extending from the ground surface to a number of meters into the limestone. With such a cut off wall installed the main quantity of ground water, when pumping from the enclosure inside the wall, would originate only from the limestone, and the lowering of the ground water level in order to construct the museum in dry would be assumed possible.

The method was used for establishment of the dry dock in Kalundborg for the pylon caissons for the Great Belt East Bridge. PIHL was participating as one of the JV partners of GBC.

The only place where the cut off wall is not possible is under the dry dock at the entrance to the harbour. In this area the water flow is stopped by a "wall" of soilcrete columns created by jet grouting in the soil from underside dry dock to limestone surface.

When the cut off wall has been completed it is expected that only a relatively small quantity of water shall be pumped in order to lower the ground water to approx. – 9.0 m, which is sufficient. All construction works both regarding the modification and anchoring of the old dock and regarding all the new reinforced concrete structures can now be performed in the dry.

The necessary measures for this ground water lowering are very expensive, but the savings and the higher quality of the works when these are performed in the dry, more than compensates for this cost.

Close to Copenhagen Central Railway Station a new single track railway tunnel with a length of 120 m is under construction. The tunnel will be build as cut-and-cover with a high degree of complexity due to a construction site next to existing main tracks in operation. The construction works started late 2010 and the tunnel will be ready for operation by 2012. The Client is the Danish State Railway using COWI and Grontmij - Carl Bro as consulting engineers for the design.

The Femern Belt Fixed Link is a proposed permanent road and rail connection between Scandinavia and continental Europe. The Femern Belt Fixed Link will specifically connect Rødbyhavn in Denmark to Puttgarden in Germany and is expected to bring economic benefits to the entire region around the Femern Belt.

The opening of the Femern Belt Fixed Link will significantly reduce the travel time between continental Europe and Scandinavia.

A bridge and an immersed tunnel option are being designed. These designs are undertaken by separate groups of consultants commissioned by the state owned Femern A/S.

Ramboll (Denmark), Arup (UK) and TEC Tunnel Engineering consultants (The Netherlands) (RAT) have designed the tunnel project option for the Femern Belt Fixed Link.

The crossing of the Femern Belt will be one of the deepest and

by far the longest immersed tunnel in the world.

Femern A/S has in 2010 recommended the RAT immersed tunnel solution as this entails the fewest risks during the construction period and when in operation. The recommendation is based on a preliminary, comprehensive assessment of environmental and safety issues including navigational safety but also technical, traffic, time and financial issues.

Latest news and status for the planning of the combined new 18 km road and railway link crossing the Baltic Sea between Rodby (Denmark) and Puttgarden (Germany) refer to:

http://www.femern.com/

Femern Belt Fixed Link. Tunnel entrance and exit.

FRANCE

The articles of association of AFTES, drawn up in the early 70's, have been modified over these last years in order to conform with some particularities of its functioning and to the integration of both the Underground Space Committee and the Plant and Equipment Delegation. In 2010, a new evolution is on its way to better guarantee the adequacy to the new ways it operates. AFTES opens up to politicians, becomes more international, upholds French-speaking and confirms its ambitious goals such as its Master's degree and an active communication strategy. To achieve that, AFTES will increase the number of directors, modify the organization of its Board to make it more "executive" and create new committees and new think tanks.

Regarding the 2011 Congress in Lyon, AFTES, caring about improving technical exchanges between the various actors on the professional stage, Owners, Engineers, Designers, Contractors and Suppliers, will offer some innovations: 2 conference rooms allowing simultaneous presentation of two different topics, a large exhibition hall, a specialized seminar, an opening to Regions and an approach to professions.

On the underground space subject, AFTES aims at setting up some theoretical bases for the underground domain so as to inform the decision-makers, the elected members and all representatives involved in city planning and development of large transportation infrastructures, such as the Grand Paris and Arc Express projects. AFTES has also recently launched a new national research project called "10D-City, City of Ideas" (meaning in French: various sizes for a sustainable and advisable urban development within an up-and-under process).

On the education and training aspect, the new AFTES master's degree, sponsored by two high schools, aims at providing for civil engineers a complementary education in the field of tunnels and underground structures, thus allowing them to reach faster a position of responsibility either in contracting, engineering, ownership or operation.

In 2010, AFTES also opened up to other associations such as Croatia, Romania, Poland, and to some other countries to help them to create their association (Azerbaijan, Uzbekistan, Algeria) or to amend their articles of association (Russia).

As of today, 22 working groups, of which 4 are new, are operational (> 300 members). 85 recommendations in French and 40 in English, issued by the Technical Committee, are available. On the website, 53 recommendations in French and 32 in English can be downloaded free. On average, 580 recommendations are downloaded every month. AFTES has also been involved, through several meetings with the Soil Mechanics Association, the Rock Mechanics Association and others, in the final publication of the new Official Manual # 69 related to underground structures and, recently, on request from the French Civil Works Federation(FNTP), in the Working Group # 25 on the new various contractual modes and good practice.

In 2010, several large works either under construction or rehabilitation can be mentioned: 12 km road tunnels (Ponserand, Fréjus, Croix-Rousse, etc.), 9 km metro tunnels (Lines 4 and 13 in Paris and Line D in Lyon), 6.5 km of waste water tunnel (Charenton, Paris) and 8 km electric cable galleries (France-Spain). 20 km of road tunnels, 85 km railway tunnels and 95 km electric cable galleries are currently under study.

GERMANY

4 DAUB members took part in the annual traditional D-A-CH-meeting 2010 involving Germany (D), Austria (A) and Switzerland (CH). The host was Switzerland. The meeting took place in Zürich and was attended also by 18 Austrian and 12 Swiss colleagues. The ½ day technical seminar dealt with characteristics of urban tunnelling. Main topics were technical as well as contractual items. The additional technical tour led to the Zurich cross-city link including the Weinberg tunnel, which crosses the river Limmat.

Jubilee Event: 50 Years of STUVA 1960 to 2010 – The Past meets the Future

"Past meets future," was the theme from June 17 to 18 2010 in the Tonhalle in Düsseldorf. STUVA held a special conference there to celebrate its 50th anniversary. More than 550 representatives from government, academia and industry, friends and supporters of the STUVA had gathered to hear the high-profile lectures, and had a review on the eventful past of the association

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and discussed the perspectives to the future of underground construction.

The jubilee event was opened by Prof. Dr.-Ing. Martin Ziegler, Chairman of the board of STUVA e. V. After his short address a "Youth Forum" followed, during which young tunnellers passed on aspects dealing with the fascination of tunnelling. The best lecturer in this Forum, Jan-Niklas Franzius, took the prize for his contribution "Geothermal Use of TBM-driven Tunnels". This prize for up-and-coming talents was awarded by STUVA for the first time.

In the afternoon leading experts presented papers during the first, forward-looking part of the celebrations, entitled "The Future of Underground Construction" relating to the significance of the Alpine Base Tunnels for transportation, about the possibilities and limits of driving activities right up to the importance of underground construction for urban development and operating Metro trains by automatic means.

Afterwards high-ranking representatives from national and regional public bodies, including Prof. In-Mo Lee, President of the International Tunnelling and Underground Space Association, gave welcoming addresses.

The second day was devoted to Düsseldorf's Wehrhahn Line. Five representatives of the companies involved presented papers explaining this remarkable project. After a lunch at the invitation of the Wehrhahn Line JV's, participants of the event had the chance to visit the sites.

DAUB run 6 working groups during 2010:

- Financing of tunnels via PPP/BOT-projects
- Recommendations for the selection of appropriate TBMs
- Recommendations for designing prefabricated tunnel lining segments
- Recommendations for contracts with low potential for conflicts
- Requirements for protective and emergency cabins on underground worksites (update)
- External communication of DAUB

These working groups are of temporary nature and will be closed as soon as they have finished their special tasks. Members of these working groups are mostly also members of DAUB, but specialists from outside are also involved in some cases.

The results of the working groups are published in technical journals, preferably in "Tunnel" (www.tunnel-online.info), but sometimes also in the German handbook of tunnelling (edited annually)..

The following excerpt shows some major tunnelling projects which were running in Germany during 2010:

19 km of double track high speed railway lines (250 to 300 km/h): between Karlsruhe and Basel; partly upgraded and partly replaced, integrating two major bored tunnel projects of 9 and 6 km respectively in length. Each tunnel consists of two parallel single tubes with about 10.5 m excavation diameter. Inauguration is planned for 2011 to improve the traffic connections between Northern and Southern Europe via Lötschberg and Gotthard base tunnels in Switzerland.

30 km double track tunnels on the new/upgraded high-speed line between Nuremberg and Erfurt with Eierberg (3.8 km) and Brandkopf (1.5 km) tunnels as freshly tackled projects. These tunnels – like the majority of the tunnels for the DB high-speed routes – are mainly built by conventional means. The Finne Tunnel (6.9 km) between Erfurt and Leipzig, whose 2 tubes were excavated by shield drivage, forms an exception. Blessberg Tunnel (8.3 km) and Silberberg Tunnel (7.4 km; both part of the Nuremberg-Erfurt high speed line) are major tunnel projects that are still under construction.

GREECE

The Greek Tunnelling Society has 287 members and 92 trial members. In 2010 GTS participated in the 36th ITA General Assembly and the WTC 2010 in Vancouver. It participated in a symposium on Quarries and Construction Works in Athens and in the symposium of Eastern & Southern European national committees in Harkany, Hungary. It organised a successful technical visit to the Thessaloniki Metro construction.

The WG on TBM selection and guidelines draft report was presented and discussed. It is now under revision in order to produce the final report.

The WGs on final tunnel linings, on shallow tunnel influence on slope stability and on vocabulary of technical terms are also in progress.

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1. Athens Metro. Works are in progress in order to finalize and deliver six (6) new stations. The six (6) Joint Ventures that have expressed their interest in the construction of the 515 million Euros Haidari – Piraeus – Evangelistria extension of Line 3, (7.6 km long tunnel, with 6 modern stations) will deliver their offers in February 2011.

2. Thessaloniki Metro. Works for the Thessaloniki metro are under progress involving 13 stations, 9.5 km of tunnels (7.7 km to be bored by two TBM and the rest using cut & cover techniques) and a depot.

The two TBM have bored 8196m of single till the end of January 2011 (Photo).

3. Three twin bore highway tunnels (T1: ~2km, T2: ~6km and T3: ~3km) with a total length of ~22 km, are under construction at the Tempi gorge along the Maliakos – Kleidi concession project.

4. Eight (8) twin bore highway tunnels are under construction for the Elefsis – Corinth – Patras – Pyrgos – Tsakona concession project (J/V Olympia Odos). These are the tunnels at Derveni (0.62 + 0.61 km), Mavra Litharia (1.18 + 1.14 km), Akrata (0.24 + 0.78 km), Platanos (1.63 + 1.57 km), Aghios Georgios, Koliri, Elia, Panagopoula (6 km) and Xylokastro.

5. The second bore of Rapsomati tunnel (1.4 km) on the Tripolis – Kalamata highway was completed and delivered to traffic in 2010.

6. Along the Ionian Highway four (4) twin bore tunnels with a total length of 6km (Klokova, Kalydona, Menidi and Skamia) are under constructioon.

7. Along the Central Greece Highway, E65, six (6) twin bore tunnels with a total length (single bore) of ~20km are under construction.

8. Along the Egion – Patras railway section, budget of 685 million Euros, there is one twin bore tunnel in Panagopoula as well as structures for the underground alignment of the railway line in Aghios Vasileios, Rio and Patras under construction.

9. Along the Kiato – Egion railway section, budget of 620 million Euros, there are 6 tunnels under construction (Melissi, Derveni, Platanos, Trapeza and Egio) with total length of 12km, 13 cut&cover structures with total length of 3.6km and 8 escape tunnels with total length of 2.15km.

10. The under construction high speed railway line from Athens to Thessaloniki, budget 1.8 billion Euros, includes many tunnels. Along the Tithorea – Lianokladi section there is the Kallidromo tunnel with 2 tubes total length 18 Km, and 7 Cut & cover tunnels with total length 1.080m.

11. Along the Lianokladi – Domokos section under construction there are 3 small double track tunnels under construction with a total length of 1.62km and the twin bore tunnel of Othrys, 6.4km per bore, including 2 long escape tunnels.

HUNGARY

The biannual conference of Hungarian Tunnelling Association was held in Harkány on 9th-10th November 2010.

The tunnels of the completed M6 motorway, the small and medium radioactivity waste container being under construction in Bátaapáti, the tunnels of Budapest metro M4 being in process of completion - all prove the renascence and development of the tunnel and structural engineering in Hungary. We organised the program of our conference in Harkány mainly around the uppermentioned constructions.

About 160 Hungarian and foreign experts participated at the conference, and Mr. In Mo Lee president of ITA-AITES honored the meeting with his presence, too. The chiefs of South-East European associations were also invited to the meeting, and the idea of special South-East European series of conference was mentioned on their coordination meeting.

On the second conference day in the afternoon the participants had the possibility to visit the Bátaapáti facility and the sites of M6 motorway tunnels.

- Snt Borbala's day, ceremonious dinner on 2nd of December with the announcement of the adjudgement of the prize « For Tunnelling » and the result of didploma work competition. (The prize « For Tunnelling » was founded by the Associacion in 2010.)

The Congress was accompanied by a training course, with 100 participants from 10 countries and 17 lectures. This training was part and closing event of the 4-semester engineers training course, which started in 2007 with the cooperation of the Technical University of Budapest Engineers' Training Institute.

NEWS ABOUT THE BUDAPEST METRO NETWORK:

The structural construction works of phase 1 of M4 are in process of completion. The TBMs had finished the 7 km length two parallel tunnels of 5,2m inner diameter in 2010, only some of the 10 stations are under structural construction works. The stations were realized as diaphragm wall box structure and mining method structures. The TBMs were only tracked over the station structures. At present, on the main part of the metro line, track construction works, necessary technology installations and final architectural appearance execution works are being realized.

Fővám square station is located at the bank of the river Danube. The open method diaphragm wall box strucure is between the closed method parts at both end of the station. (see pictures)

Rákóczi square station is the 8th on the line. End of the platform tunnel. Népszínház station is the 9th on the line. The whole station is constructed between diaphragm wall structures.

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TUNNELS OF THE M6 MOTORWAY:

The M6 motorway crosses the ridge of hill Geresd between Bátaszék and Bóly cities in a length of 10,5 km. Among the numerous alignment variants the optimum solution with the lowest cost turned out to be the one with construction of a series of structures including four tunnels and five viaducts.

The lengthiest of the four constructed tunnels is one between Bátaszék and Véménd (1331m) while three other pairs of tunnel run toward Pécs (399, 865 and 418 m). The tunnels are provided with the state-of-the-art operational and safety systems according to the EU directives (power supply, lighting, water- and fire water supply, ventilation, traffic control, internal and public telecommunication system).

Important additional facilities are the energy centers constructed outside the tunnels and the control center installed in the motorway maintenance center. The newly built tunnels are the first public tunnels in Hungary therefore their design and construction attracted an important public and professional attention.

BÁTAAPÁTI - NATIONAL RADIOACTIVE WASTE DEPOSIT

The research program aimed at resolving the final disposal of the radioactive waste of small and medium activity originated from nuclear power stations has been performed since 2002 within the investment program of the Radioaktív Hulladékokat Kezelő Közhasznú Nonprofit Kft. (Radioactive Waste Material Treatment Nonprofit Ltd).

During the project execution approx. 6 km drift advance has been realized. The surface exploration works rendered possible to study thoroughly and define the geological issues, and the drift will be used later for the waste transport and further construction works.

The construction of the container chambers of nearly 90m2 rock section has not yet been started. This is not only one of the most important mining method under-ground-level structures in Hungary but for its special requirements due to its function and the ecology sensibility it is obviously in the focus of interest of all engineers.

ICELAND

The Icelandic Tunnelling Society which represents the ITA National Group Iceland is an independant group of tunnelling professionals with corporate and ordinary members. Members were involved in investigations, design and construction of hydro and road tunnels in Iceland in the year 2010. Two major road tunnel projects were finished during the year. The president and the secretary of The Icelandic Tunnelling Society were heavly involved in the Tunnels & Tunnelling Supplement publication December 2010 on Icelandic Tunnels.

The year 2010 was relatively productive in terms of tunnel design and construction. Work was completed on the 11 km long Hedinsfjördur road tunnels between Ólafsfjördur and Siglufjordur and the 5,5 km long road tunnel between Ísafjördur and Bolungarvik (Bolungarvik tunnel) with opening for traffic in September and October respectively. Design work continued on other road tunnels and contract was signed for the Budarhals hydro scheme (4 km headrace tunnel).

ISRAEL

The Tunneling chamber within The Israel Union of Construction and Infrastructure Engineers has organized three workshops during the year:

The first one includes four lectures:

- The tunnels for the fifth water line to Jerusalem.
- The coordination of the Yokneam tunnel within the complex intersection of roads nos. 6 and 70.
- The use of Cardox for delicate excavation without explosives.
- Tunnel Project management as related to the high speed rail line to Jerusalem.

The second one was coordinated with the Ceotechnical Chamber and includes three lectures:

- The tunneling works for the underground rail station at Jerusaelm.
- Continuous monitoring of the load at rock anchor's head.
- Prevention of damage using monitoring in above and underground construction.

The third one includes one lecture and updating concerning new Israeli Standards. The lecture was:

- The Nilli twin-tunnels from a contractor point of view.

In addition the Chamber continues its cooperation with the Israeli Standard Institute concerning a series of standards for tunnels

ITALY

Società Italiana Gallerie is an open association (approximately 700 members), that promotes, coordinates and spreads the results of studies and researches in underground works. It publishes the "Gallerie e grandi opere sotterranee/Tunnels and large underground works" magazine (in Italian and English).

The working group activity in Italy, is mostly focused on the participation to the international working group for the occasion

of the International World Tunnel Congress.

RAILWAY TUNNELS :

Milan-Naples High Speed/Capacity railway line, **Bologna feed line.** The construction of the Underground station of Bologna Centrale (platforms 12-17)in an urban context is at an advanced stage.

Brenner railway tunnel, boring of the pilot tunnel (about 50 km overall) is in progress. Also Mules adit excavation has started.

METRO TUNNELS :

Naples, Line 1, Dante-Garibaldi extension, excavation of line tunnels is over, excavation of 5 stations (Garibaldi, Università, Duomo, Toledo and Municipio) is in a advanced stage. All the stations are created after freezing the ground..

Naples, Line 6, Mergellina-Garibaldi extension, the work concerns: a single tube tunnel of about 3,300 m to be created via an EPB shield of 8.30 m in diameter; 4 stations. Excavation works are in progress

Naples, Line 6, Campegna-Porta del Parco extension, the work concerns: a single tube tunnel of about 3,800 m to be created via an EPB shield of 8.30 m in diameter; 3 stations. The design of underground works are in progress

Genoa metro (**De Ferrari-Brignole section**), Line tunnel excavation is over, Brignole station excavation is at an advanced stage

Milan metro Line 5 – Garibaldi-Bicocca section, Excavation works of the line tunnel (6,250 m in length and 8.5 m dia.) is over excavation of 8 stations are at an advanced stage.

Milan metro Line 5 – Garibaldi-San Siro/Harar section, Excavation works of the line twin tube tunnel (6,755 m in length and 6.8 m dia.) and of 10 stations hThe line tunnel is bored using a EPB TBM.

Rome metro Line B1 (Bologna - Piazza Conca d'Oro), Excavation of 4 km line twin tunnel is over. The works for the construction of three stations (Annibaliano, Gondar and Conca d'Oro) are in progress.

Rome metro Line B1 (Conca d'Oro-Jonio extension), Excavation of the line tunnel (9.80m dia) has started with a TBM

Rome metro Line B (Rebibbia-Casal Monastero extension), Line tunnel of 9.80m diameter and about 3 km long. The tender is ended. Definitive design is about to start..

Rome metro Line C (S. Giovanni-Montecompatri/Pantano section), Excavation works of line tunnels (18.5 km in length and 6.75 m dia.by using 4 EPBS are in progress as well excavation works of the 12 underground stations.

Rome metro Line C (Venezia-S. Giovanni section), executive design is in progress; excavation works of line tunnels (3 km of twin tube, 6.75m dia) will start in about 2 years.

Brescia metro, 14 km line tunnel (7 of which via an EPB shield of 8.10 m in diameter) are over, excavation of 8 underground stations is 80% completed.

ROAD TUNNELS :

Pedemontana Lombarda Motorway, Dalmine-Como, Gaggiolo pass connection, Works have started

Pedemontana Lombarda Motorway- connection between A8 and A9 motorway, Excavation of 3 tunnels (3 km in total) has started

Modernisation of Motorway A1 Milan-Rome-Naples, Valico by-pass, Excavation of the base tunnel (8,700 m long) is over. Excavation of other five twin tunnels (Manganaccia, Val di Sambro, Grizzana, Quercia, Sparvo)(each tube about 180 m² cross-section) is in progress. Excavation of the Sparvo twin tunnel (2.5 km in length, 15.55 m in diameter) is done by using an EPB-TBM (the world's largest TBM).

Modernisation of Motorway A1 Milan-Rome-Naples – Widening to three lanes between Florence North and Florence South.Excavation of three twin tunnelsis over. Excavation of two twin tunnels is at an advanced stage.

Strada dei Marmi (Carrara ring road) Macina and M. Greco tunnel, Excavation works using conventional methods of Macina tunnel (1,000 m in length and 13.50 dia.) and M. Greco tunnel (2,400 m in length and 13.50 m dia.), are over in October 2010.

Salerno-Reggio Calabria highway, Works on the large areas sub-contracted for the construction of about 25 km of tunnels are in advanced stage.

E90 motorway, SS 106 "Jonica" section, 11 tunnels, Excavation works of the twin tunnels (6,671 km in total length, 6.5 m dia.) are in progress.

Quadrilatero (Umbria-Marche roadworks), 10 tunnels Works have started, there are 30 advancing face.

A14 motorway, Widening of 5 existing tunnels from two to three lanes + the hard shoulder. Works are going to start.

Frejus safety tunnel, The tender for the excavation of a tube about 8 m in diameter and 12.87 km in length, was awarded.

New tunnel at Colle di Tenda, The project, which provides for the widening of the existing tube and the construction of a new 3,200 m long tube has been approved and financed by CIPE. Public tender has to start.

Modernisation of Motorway A15 of Cisa, The preliminary design of underground works (40 Km of road and railway tunnels) is in progress.

S.S. 212 "della Val Fortone" and ex s.s.369 "Appulo Fortorina" Excavation works (in progress)of 4 tunnels (about 3 km of total length).

S.S. 106 Jonica (Sibari – Roseto Capo Spulico), Ten twin tunnels; total length about 20 km. The General Constructor tender is ended. Definitive design is about to start.

KOREA

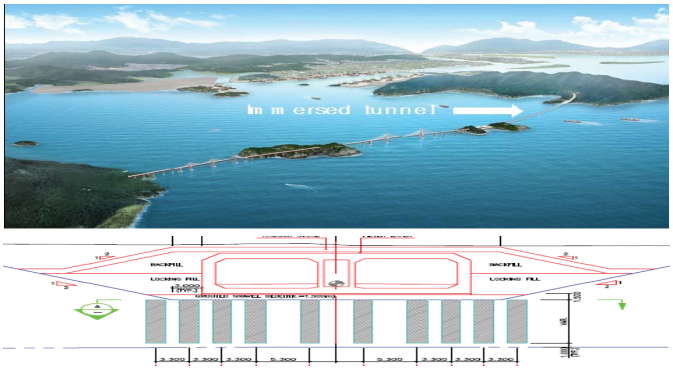
Established in 1992 as a non-profit incorporated association, the Korean Tunnelling and Underground Space Association (KTA) is a tunnel-oriented national organization to comply with the international aims of ITA. Most of the KTA members are tunnel engineers, but not limited to the civil engineering field and recent expansion into the field of fire, disaster prevention and ventilation

within tunnels, among others, are noteworthy.

The KTA has changed its English name from the Korean Tunnelling Association to the Korean Tunnelling and Underground Space Association this year according to ITA. The KTA is working closely with the Korean government in terms of tunnel-related policies and technologies, and plays a major role in revision of the tunnel specification and standards.

Total 6 working groups regarding standard & specification, mechanized tunnelling, tunnelling & support, geotechnical survey & IT, urban tunnelling and disaster prevention & environment are currently enrolled in KTA and various activities such as technical advice in the format of memorandum have been carried out this year. Technical tour of the various tunnel sites were also made to reduce the accidents and enhance the maintenance activities of the various tunnels.

One of the most significant accomplishments in the Korean tunnelling in 2010 is the opening of an immersed tunnel which is



located within Busan-Geoje fixed link. The Busan-Geoje fixed link is an 8.2km long 4-lane motorway connecting Busan, Korea's southernmost and second largest city, to the island of Geoje where a couple of big shipbuilding yards are located. This motorway includes a 3.3km immersed tunnel which is one of the longest immersed tunnels in the world and two cable-stayed bridges. The immersed tunnel is made up of 18 elements and each element is approximately 180m long, while the exterior width and height of the standard tunnel element is 26.46m×9.97m. The tunnel elements are prefabricated in the temporary dry dock and towed to the site. The elements are next lowered into the final position in a dredged trench and are directly placed on the gravel bed without temporary supports. Since the deepest depth of the immersed tunnel is 47m below mean sea level and the site is subjected to gusty winds as well as strong tidal currents, the project becomes the most challenging immersed tunnel ever built. Details of the project will be published in Tunnelling in Korea 2011.

THE NETHERLANDS

The Department of Tunnelling and Underground Works has over 600 members who meet 4 to 7 times a year. The meetings deal with both tunnelling and underground space projects, discussing new and ongoing projects and new developments in the field of

tunnelling technology.

In Amsterdam work on the new North-South Metro Line continues. This includes major works under and in front of the historic Amsterdam Central Railway station to accommodate an immersed tunnel element as part of the metro tunnel under the IJ river. The immersion is scheduled for 2011. The TBM that works under the historic old part of the city has commenced in 2010 and has succesfully finished the first trajectory along several monumental buildings.

.In Delft work has been commenced on the two km cut & cover tunnel carrying four railway tracks as part of the widening of the Rotterdam – the Hague railway line. The work includes a new underground station and car parks. The tunnel will replace the elevated railway which transverses the city of Delft.

Work on the Second Coen Tunnel, an immersed tunnel under the North Sea Canal near Amsterdam in the A10 motorway, has been continued. In 2010 the tunnel elements were finished and the submerging is scheduled for 2011.

In Rotterdam the TBM-driven northern extension of the existing North-South metroline has been finished and opened to the public.

Preparation for the A2 motorway tunnel project in Maastricht has been started. The project includes a two km long cut and cover tunnel with two levels for motorway and urban traffic respectively. The plans are partly financed by redevelopment of city areas adjacent to the project.

The contract for the building of a new TBM driven tunnel under the canal from Terneuzen to Gent in the south-west part of the country near Sluiskil has been approved. Preparations will start in 2011.

The go-ahead was also given for a new tunnel project in the Hague. The Trekvliet bypass will provide a new access to the centre of the Hague via the Binkhorst Industrial Estate to the A13/A4 motorway intersection at Ypenburg. A 1,6 km bored tunnel is part of the proposed solution

In Rotterdam the work on the Museum Park Underground Car Park has been finished. This facility includes an underground water storage basin.

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NORWAY

The Norwegian Tunnelling Society with its 1060 personal- and 65 company members has accomplished another active year with good progress in distributing the latest development in rock excavation techniques. Main events of the year was the annual Rock Blasting conference and various courses and seminars related to underground technology in general and rock excavation in particular.

There are five permanent committees covering Shot firers, Development, International Activities, Information & Public Relations and finally Conferences. Each of these appoints sub-committees (task forces) to cover specific projects. International Committee is responsible for ITA-matters, support the participation in ITA Working Groups and international conferences in general. The Development Committee initiates technological projects. During 2010 focus has been on health and safety as well as technology related to water proofing in tunnels. The Committee for conferences is responsible for arrangements, this year three. "Information" is promoting recruitment to the rock blasting and tunnelling profession as well as strengthen the image of the profession in general. The objective is to distribute correct and positive information on construction activities at large. The shot firer committee is arranging short courses for personnel from smaller companies involved in rock blasting as well as an annual 3 day seminar covering the latest techniques and is giving an update on new rules and regulations concerning rock blasting.

Tunnels and caverns under construction

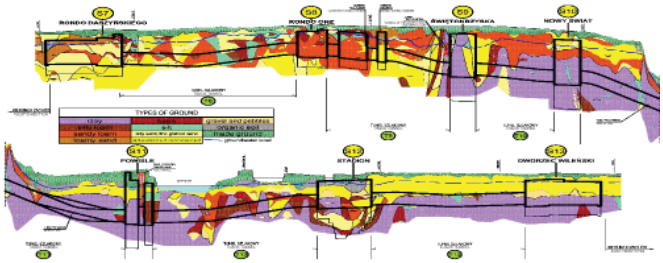
1. New railway tunnel between Sandvika and Lysaker, 5,5 km double track tunnel
2.Frodeåsen railway tunnel, Tønsberg, 4 km double track tunnel
3.Gjevingåsen rail tunnel, Trondheim, 5 km single track tunnel
4. E6 Øyer – Tretten, road tunnel
5.The T – connection, 9 km subsea roadtunnels
6.Ryaforbindelsen, 5 km subsea road tunnel
7.Lørentunnelen, 1 km underground road system
8. RV 64, The Atlantic ocean tunnel
9. Kvivstunnelen, road tunnel
10. Vossapakko, road tunnel
11.Kjøsnesfjorden HEP, about 25 km of small section tunnels and shafts
12.RV 48 Helland – Havsgaardsdalen, road tunnel
13.Jøssingfjord underground hydroelectric power project
14. Rendalen HEP
15. Øksendalsoverføringen water transfer tunnel
16. Johndalstunnelen, road tunnel
17. Storforshei, access tunnels for mine development
18. Fv 78 Toventunnelen, road tunnel
19.Many smaller projects

During the year 2010 the underground activity in Norway increased with nearly 90 % compared to the year 2009. Excavated volume from underground openings reaching about 4,5 mill. m³. Total length of underground openings was in the range of 73 km. Excavation of road tunnels was by far the biggest sector with more than 3,4 mill. m³ followed by hydro power tunnels with a volume of 0,4 mill. m³.

The outlook for 2011 is that there will be an increase in the rock excavation activity compared to 2010. Several railway and road tunnels are in the final planning stage and the Government is boosting their early start up.

POLAND

The construction of 6.3 km long central part of underground line in Warsaw started in march 2010.The building permit design for 7 stations have been completed. The stations will be built using the cut and cover method, two single-track tunnels - with the use of 3 TBMs.The constructions of Rondo Daszyńskiego station, used as TBM starting shaft started at the end of october 2010. The TBMs are constructed by Herrenknecht.The first TBM will be assembled in Warsaw in april 2011. The second and third TBM will start from S11 Powisle station. The most difficult part is drilling the tunnels under Vistula River and construction of S10 d S11 stations. First – is the deepest station (39 m of D.W.) on the line, second one is located under the existing road tunnel. In Warsaw, tunnels and 30 m deep excavations are built in Tertiary and Quaternary deposits – soft to very stiff soils. The geological conditions along the line ad the location of stations are shown at fig. 1.



The station will be constructed using diaphragm walls (20 m to 40 m deep and 1,0 m to 1,50 thick) and jet grouting bottom plague. The main contractor is the joint-venture made of Astaldi (Italy) acting as the Leader, Gulermak (Turkey), and Przedsiębiorstwo Budowy Dróg i Mostów (Poland). The price is approx. 1 billion EUR ; end of works - 27th October 2013.

A design for the construction of a tunnel under the river Vistula in Warsaw has been finished. The tunnel will be used to transport wastewater from the left-bank part of the city to the currently modernized wastewater treatment plant situated on the right river bank. The 5.35 m diameter TBM is already completed (fig. 2).

The starting shaft, about 30 m deep, made with use of diaphragm walls is located at the right bank of Vistula. The tunnel with internal diameter of approximately 4.5 m contains two delivery pipelines with diameter of approx. 1.6 m. The length of the tunnels between the shafts is approx. 1350 m.

The road tunnel in the locality of Laliki on the S69 road in sou-

thern Poland is completed and already in operation. The tunnel was built in the geological formation called Carpathian flysch, using blast and bored method (Fig.3).

The total length of the tunnel is 678 m and the structure is composed of the main tunnel containing a two-line roadway and one smaller evacuation tunnel situated at the distance of approximately 30 m from the road tunnel and connected with it by 4 passages.

The tender design phase has been completed for the road tunnel under the Martwa Wisła river in Gdańsk. The TBM method was accepted. Two independent 950 m long tunnels will be built with internal diameter of 13.50 m, containing two-lane roadways with a 3.5 m wide emergency lane. The total length of the passage will be 1970 m including the sections to be built using the cut and cover method – 680 m as well as open approach ramps with length of 340 m.

The construction of railway tunnel in Warsaw, 1350 m length, connection line between Warsaw Central Station and Airport Terminal 2. The tunnel is constructed using cut & cover method with diaphragm walls.

PORTUGAL

CPT, the Portuguese Tunnelling and Underground Space Comission, was created in 2006, as the Portuguese Member of ITA, inside SPG - Portuguese Geotechnical Society. SPG has 1001 members, 148 being members of ITA and CPT. In 2010, CPT organized a Course on Tunnelling in Urban Areas and a Conference on the Use Underground Space and joined AFTES and 4 other European countries in the organization of the International Congress of Lyon, 2011.

Working Group on Portuguese Tunnels – data collection is in progress, after a Seminar organized in Lisbon, May 2008. A book on Portuguese tunnels will be published by 2012.

The other Working Groups, as mirror groups of those in ITA, are under development (Conventional Tunnelling, Health and Safety of Underground Works, Urban Problems and Underground Solutions, Risk in Tunnelling)

Major projects :

The Porto Subway Line to Gondomar, including a 1 Km tunnel, was completed by the end of 2010 and open to the public on the 2nd January of the new year.

Complementary geotechnical studies for the the tendering of the 2nd phase of the extension of Porto Subway (4 lines, 17 Km of tunnels, 29 Underground Stations) were carried out.

The extension of the Red Line of the Lisbon Subway from Oriente Station to the Airport, with over 3,5 Km long tunnels, was under construction, at an advanced stage.

Design studies for the high-speed railway lines Lisboa-Porto and Lisboa-Madrid, requiring a significant length of tunnels in the approach of densely urban areas, have also been ongoing.

Relevant activity concerning the construction of road tunnels in Madeira Island was carried on.

The Marão Tunnel (2 galleries, 5655 m each the longest Portuguese road tunnel), was under excavation.

Tunnels and underground structures for the reinforcement of the hydroelectric power schemes of Venda Nova III, Bemposta, Picote, Alqueva and Baixo Sabor were under construction too.

Underground power plants and hydraulic circuits for 10 new dams with high hydropower potential, are in design phase.

ROMANIA

A new special issue of “Constructii Subterane” Magazine has been published. The 7th National Conference of ART will be held in October, 2012. Implementation of European Norms to Romanian Tunneling regulations is underway.

MAJOR PROJECTS :

1.Continuing works to the hydropower development of the river Jiu on the sector Livezeni-Bumbesti includes 2 HPP located in the gorges area, connected by a headrace tunnel having a length of 20 km : concreting of primary and secondary lining along 6 km.

2.Works on Bistra – Poiana Marului Hydropower System, White River, first water supply tunnel with 2.8-km in length, 2.8-m in diameter.

3.Works on Surduc-Siriu Hydropower System, Nehoiasu water supply tunnel, 18-km in length (14-km already done), 3.8-m in diameter, concreted on 6-km long.

4.Works on Brazi (Raul Mare – Retezat) power plant: grouting for under crossing and strengthening in geological faults.

5. Awarding tender for the New Metro Line 5:

- Lot 1.2 - Valea Ialomitei Sector (cut and cover tunnel, station and depot) awarded to Max Bögl.
- Lot 1.1 – Raul Doamnei – PS Opera (6 km), TBM method tunnels, 9 stations cut and cover method awarded to ASTALDI-FCC-DELTA ACM -AB CONSTRUCT JV.

6.Awarded tenders for works on Section 2 of Bucharest Metro Line 4 (1 Mai station – Bazilescu station): track works, waterproofing and finishing works to SOMET SA; signaling, traffic control in tender procedure.

7. Forecast commissioning of Section 2 (2.7 km) of Bucharest Metro Line 4 (1 Mai station – Bazilescu station): June, 2011.

8. Protocol for collaboration between Municipality of Bucharest and Ministry of Transportation (METROREX SA) for completion the works on Razoare 1 Intermodal Traffic Corridor, in interaction with Metro Line 5.

9. Tender for Consultancy services for new Metro Line 6: Gara de Nord – Otopeni “Henry Coanda” International Airport.

Member Nations Report 2010

SINGAPORE

The Tunnelling and Underground Society has a total membership of 632 which is made up of individual and corporate members.

During 2010 monthly technical seminars were held at the SMRT auditorium with a capacity of 140 participants followed by networking sessions at the Bobby's bar.

Two Training Courses, one on the "Planning and Design of Tunnels" and another on the "Construction of Tunnels", were conducted with attendance by local and regional participants.

The Hulme prize paper competition for young engineers below the age of 35 years was held in September 2010.

This was won amid stiff competition by Rizwan Muzzamill of Mott MacDonald with his paper on "Quick assessment of ground settlement limits to restrict building damage to "Slight" category".

This years' TUCSS Annual Lecture was given by Dr. Alastair Biggart which was a repeat of his Harding Lecture to the BTS entitled "The Development and Use of Closed Face Tunnelling Machines". The event was attended by over 150 members and guests. A dinner gathering was held after the lecture at the famous Jumbo sea food restaurant.

TUCSS Annual Dinner was held at the Resorts World Sentosa in October 2010. This event was attended by over 600 members, spouses and guests.

The winners of the Hulme Prize 2010 were presented with their awards during the dinner by Prof. Zhao Jian.

The recipients of the Geotechnical Awards 2010 from NUS and NTU were also presented with their certificates by TUCSS Vice President, Mr. Kulaindran Ariaratnam. TUCSS President Mr. Ow Chun Nam gave a welcome address and acknowledged the generosity and contribution of the five Annual Dinner sponsors.

Other notable events held during the year include two TUCSS Golf Tournaments, Technical site visit and participation at the Singapore International Water Week.

TUCSS renewed the Memorandum of Understanding (MOU) with Institution of Engineers Singapore (IES) and Association of Consulting Engineers Singapore (ACES) in 2010 for the IES/ACES Accreditation Scheme for Site Supervisory Staff (Tunnel).

During 2010 TUCSS Sub-Committee considered and responded to applications for RE/RTO (T) submitted through IES.

A brief description of the tunneling works in the railway, roads, utilities and bulk storage that are being planned, designed or under construction during 2010 is given below.

Underground Railway Tunnels

During 2010, Stages 1 & 2 of the fully underground Circle Line (CCL) railway that connects from Bishan to Dhoby Ghaut interchange stations were opened for revenue service. This was after the opening of Stage 3 in 2009. The construction works for the remaining Stages 4 & 5 of the 33.3 kilometre long railway with 29 stations at a cost of approx $8 billion, are now complete and are expected to become operational in late 2011.

The construction works of the Downtown Line Stage 1 (DTL1) have been progressing well in 2010. The works comprise 4.3 kilometre route length of tunnels with 6 stations in the Central Business District. In order to minimise access disruptions to the financial centre and offices, major traffic diversion measures including the construction of a temporary viaduct were put in place.

Site works related to the 16.6 kilometre long Downtown Line Stage 2 (DTL2) which comprises one depot and 12 stations, including three interchange stations at Little India, Newton and the Botanic Gardens were commenced in 2010. These 3 interchange stations will link to the North East Line (NEL), North South Line (NSL) and Circle Line (CCL) respectively, giving commuters greater accessibility to the rest of the island and significantly improving travel time.

The 21 kilometre long Downtown Line Stage 3 (DTL3) is the final stretch of the 42 kilometre Downtown Line. It will enhance rail connectivity in the eastern corridors to the Central Business District and developments in the Marina Bay area. Fully underground, DTL3 comprises 16 stations, including three interchange stations at MacPherson, Tampines and Expo. These interchange stations will link to the Circle Line (CCL) and the East West Line (EWL), providing greater accessibility and significantly improving travel time for commuters. Detailed design of this line was completed during 2010 and tenders for construction contracts are being invited/awarded at present. DTL3 project will require the use of 28 tunnel boring machines (TBMs) and the Land Transport Authority (LTA) has directly placed orders for 6 EPBMs from Shanghai Tunnelling and 4 EPBMs from Herrenknecht recently.

DTL project is fully underground and caters for driverless 3-car train sets that offer a line capacity for 500,000 passengers per day. It is being implemented at an estimated cost of approximately $10 billion.

LTA called consultancy tenders during 2010 for the design of 25 kilometre long fully underground Thomson line comprising of 23 stations. Thomson Line will travel northwards from Marina Bay through the Central Business District and up through Ang Mo Kio all the way to Woodlands connecting estates such as Sin Ming, Kebun Baru, Thomson and Kim Seng which do not now have a direct MRT link. The consultants will be appointed in early 2011 for this line which is expected to become operational in 2018.

Underground Road Tunnels

The dual five-lane, 5 kilometre long Marina Coastal Expressway (MCE) will be the tenth expressway in Singapore. It will form a key element of the strategic island-wide road network to support the long-term growth of Singapore.

In January 2009, LTA awarded the last of six major civil construction works contracts for the MCE. In addition, LTA has also awarded four contracts for the provision of various Electrical & Mechanical (E&M) and cladding systems with a total value of $4.1 billion. Works for the MCE have commenced in April 2009 following the ground breaking ceremony at Marina South. Good progress was made during 2010 with some sections reaching formation level.

The Singapore government has recently approved the alignment of the North-South Expressway (NSE) between Admiralty Road West and Toa Payoh Rise. The NSE, announced under the Land Transport Master Plan, will be Singapore's 11th expressway. One of the most challenging engineering undertakings to date, the NSE will serve the North-South corridor, bringing faster travel from residential estates such as Woodlands, Sembawang, Yishun, Ang Mo Kio, Bishan and Toa Payoh to the city centre.

To meet the long term growth in travel demand generated by developments in the North and North-Eastern sectors of Singapore, the dual three-lane carriageway will consist of a combination of viaduct and road tunnels to provide a new high speed road link. The NSE will also connect to existing expressways, such as the Seletar Expressway (SLE) and major arterial roads like Marymount Road.

LTA will be building a new 1.3 km long two lane road tunnel to meet demands from the expected growth in traffic as a result of the continued development in the Sentosa Island and Harbour Front areas. The Sentosa Gateway Tunnel will complement a suite of road improvement measures that LTA announced in February 2008 to cater for the increase in traffic demand from the Resorts World development at Sentosa. Construction of the tunnel by the sprayed concrete tunneling method will commence in early 2011 and is expected to complete by end of 2015.

Utility Tunnels

The Public Utilities Board (PUB) is undertaking a water supply programme known as the NEWater Infrastructure Plan Transmission Mains Extension. This project is to extend the NEWater (NW) transmission network to Jurong Island, to meet the increasing demand of NEWater by industries on Jurong Island. It consists of the installation of approx 5.5 kilometres of 2.2 metre diameter and 9.0 kilometres of 1.6 metre diameter NEWater pipelines on mainland and Jurong Island by surface laying and pipe jacking methods. The construction of an approximately 3 kilometres long, 6 metre diameter undersea tunnel, with twin 2.2 metre diameter pipelines from Jurong Island to mainland Singapore forms part of this project. The construction contracts for these works were awarded in 2010.

The Singapore Power is proposing to construct 34 kilometres long, deep cable tunnels of 6 metres internal diameter. Design consultancy contracts for these tunnels and shafts were awarded in 2010 and construction works are expected to start in 2012 and continue till 2018.

Jurong Cavern

The first underground hydrocarbon bulk storage facility in Singapore and South-east Asia is being constructed in Jurong Island. Construction contract was awarded to Hyundai E&C in 2009 to construct 8 km long tunnels and five caverns from the two completed access shafts. Each cavern is made up of two storage galleries of 20metre (W) x 27metre(H) x 340metre(L), approximately nine storey high. The overall storage capacity is approximately 1.47million cubic metres. Phase 1 of this project is expected to be completed by 2014.

SLOVAKIA

The report is rating work and activities of the association within the year 2010 in which the most important was to prepare the execution of the most difficult part of the western – eastern Slovak highway project, in fact as far as the Ukrainian border in total length of 75 km. This highway goes through mounainous terrain where there is a large number of bridges as well as four tunnels.

At the same time next stage should have been executed in Central Slovakia with its longest tunnel Višňové in the length of 7.5 km. Respectable attention was paid to these projects concentrated to a few talk events and promotions (creating of positive significance, asset of tunnels for ecology and environment). The new technological regulation was necessary to work out – The Fire Precaution of road tunnels by STA specialists. All highway projects were executed by the form of PPP (private public partnership).

But they were all stopped following certain political decisions in spite of having been in a quite semi-finished stage in the end of 2010.

We believe that all the work done on these projects untill today will be used in the nearest future. The association has already traditionally supported Slovak universities and development of

tunnelling science among students. In April 2010 40 students and their teachers took part in the Betontang in Vienna. All the costs were paid by STA.

At the same time the best underground construction diploma thesis was gratified.

The STA commitee met four times in the year 2010. The General Assembly took place in April 7, 2010. Now there are 47 corporate bodies and 5 individual members.

STA shared the conference „Underground construction 2010 in Prague“ together with Czech Tunnelling Association in June 14 – 16, 2010.

In September 28, 2010 the seminar "Preparation and Tunnel Construction" took place under the concern of the best foreign specialists (Herrenknecht, Basler-Hofmann, prof. Haack).

When Norwegian King visited Slovakia in October 29 – 31, 2010, Norwegian Tunneling Society with STA organized together a forum of competence about secondary lining. Norwegian society was led by professor and president of NTS Eivind Grøv and STA by its chairman Ing. Róbert Turanský.

In April 2011 the General Assembly of STA and at the same time commitee voting is taking place.

Association commitee will try to support technical growth of engineers and to raise interest of young people in this area and to create appropriate conditions in the Government for construction of tunnels.

SWEDEN

The Swedish Rock Construction Committee is an independent group of tunnelling professionals with 86 members. BK arranged the BK-day in march 2010 with 560 visitors.

Members of the committee was represented in Vancouver from 14th – 17th May including meetings in six ITA Working groups. The Swedish Rock Construction Committee have representatives in 12 Working Groups

Some Tunnels and Caverns under Constructions

Stockholm City Line

The two railway tracks at the southern approach to Stockholm are unable to handle both current and future rail traffic, for freight-, commuter-, regional- and national railway. Leading the commuter traffic into a separate tunnel makes it possible to double the capacity of both the existing tracks and the commuter traffic.

The City Line is a six-kilometer commuter train tunnel from Tomteboda to Stockholm South Station and new commuter stations at Odenplan and T-Centralen in Stockholm City.

We're also building a 1,4 kilometer railway bridge over the track area in Årsta, south of Stockholm.

The City Line is today the biggest infrastructural building project in Sweden and will be finished in 2017.

The North Link.

Runs between Norrtull and Värtan and connects to Roslagsvägen at Stockholm University. Together with Södra Länken and Essingeleden, Norra länken forms a centrally located, continuous traffic route system. Norra länken is a route of national interest through its connection to Värtahamnen and Frihamnen, Sweden’s most important seaports for cargo and passenger traffic to the Baltic States, Finland and Russia

The work on Norra länken started 2007 and involves the construction of rock tunnels, concrete tunnels and a new interchange.

There will be a total of 11 km of road tunnel, of which 9 km are rock tunnels and 2 km concrete tunnels.

To construct Norra länken, over one million cubic meters of rock and 0.4 million cubic meters of soil have been excavated.

In the tunnels there will be 13 electrical power substations, 140 jet fans and 100 emergency exits.

Outside the tunnels, 2 km of new and up-graded road will be constructed as well as a 200 m long new railway bridge, a 400 m temporary railway bridge, 1 km of railway station track and 1.5 km of new pedestrian and cycle paths.

There will be 140 000 m^2 of asphalt paved road in the tunnels and 60 000 m^2 outside the tunnels.

Bypass Stockholm

The E4 Stockholm bypass is a new route for the European highway west of central Stockholm. The new route will improve the quality of every-day life in the fast growing Stockholm region, by linking the southern and northern parts of the county and reducing the vulnerability of the road traffic system.

To minimize the impact on sensitive natural and cultural environments, just over 17 of 21 km of the motorway are in tunnels. The tunnels are built as separate tubes with three lanes for each direction, all together measuring a length of 54 km of tunnels, including ramps. The construction work is planned to start in 2012 and it will take at least eight years to finish. Volumes of approximately 18 million tons of rock will be blast out over a period of five years.

When the link opens for traffic it will be one of the longest road tunnels in the world. By 2035, the Swedish Transport Administration (Trafikverket) estimates that the E4 Stockholm bypass will be used by approximately 140,000 vehicles per day.

SWITZERLAND

During the year 2010 the Swiss Tunnelling Society has organized and carried mainly the following events:

Swiss Tunnel Congress in June 2010. This annual main event has attracted more than 820 participants and took place in the prestigious Lucerne Congress Hall. The congress dealt with general and technical features of the Gotthard Base Tunnel and other projects in Switzerland and foreign countries. Next to this lectures a colloquium was held on the previous day with the topic ‘Concrete Technology’. The congress was combined with

extended visits to five construction sites in Switzerland. The proceedings of this conference are available on our website.In 2005, www.swisstunnel.ch.

The STS organises each year two excursions. The excursion in May paid visit to the Bypass Biel /Bienne and the excursion in October to Nant de Drance, a pump storage power plant in Martigny. Excursions are open to everyone and both were well attended.

STS organised in 2010 two evening lectures: Prof. Pavlos Marinos, NTU Athens, delivered a presentation about Tunnelling through karstic rocks and Mr. Ing. Remo Grandori, President of Seli SpA, spoke about TBM excavation and TB design for rock tunnels under high cover in critical geological conditions. Both lectures were held at the ETH Zurich.

Interaction with other national underground industry societies took place in two parts: The meeting with the tunnelling societies of the German speaking countries in September (the German DAUB and ITA Austria) in Zurich Switzerland organised by STS and in November with AFTES, ABTUS, AETOS, SIG und CPT in Bruxelles, organised by ABTUS. Beside the general exchange of information the scope of these meetings included also a study day with the topic "Large tunnels projects abroad".

On the international level, STS members were active in different working groups and committees of ITA.

WTC 2013: The Swiss Tunnelling Society is pleased to welcome to Geneva for the ITA-AITES 2013 World Tunnel Congress and the 39th ITA-AITES General Assembly, which will be held at the International Conference Centre, Geneva (ICCG) from 31st May - 5 June 2013.

International Tunnelling Awards 2010: Representing the Swiss Underground Community, the Swiss Tunnelling Society picked up the NCE International Tunnelling Award for the Project Gotthard Basetunnel, on December 2010 at the Grosvenor House in London.

In 2005, STS started publishing the 'Bulletin', which is edited twice a year. The 'Bulletin' can be downloaded from www.swiss-tunnel.ch.

Projects

1.Gotthard Base Tunnel - World record on the Gotthard! : The longest railway tunnel in the world has become a reality. On 15 October 2010 in the east tunnel, 30 km from the north portal and 27 km from the south portal, the final breakthrough of the Gotthard took place. The tunnel boring machine, drilling from Faido, broke through the last meter of rock on the route to Sedrun.

Next steps in the Gotthard Base Tunnel: The final breakthrough does not end work in the Gotthard base tunnel. Before timetabled operations can commence, probably in December 2017, the interior work on the tunnel must be done. The plan is to have all the tubes and shafts lined and the concreting finished by 2014. Shell construction specialists will equip the tunnel with mechanical and electromechanical installations such as doors, gates, and ventilation and other technical systems. These will ensure that the tunnel can be operated and maintained safely. In parallel to the last shell construction and installation, railway infrastructure will be fitted. This work started back in may 2010 at the south portal of the Gotthard base tunnel, in the Faido-Bodio-west section. The railway equipment comprises the track itself, the overhead line, power supply cables, telecommunications and radio installations, train control and automation systems, and signalling technology. - www.alptranist.ch

2.Ceneri Base Tunnel: In the north portal of the Ceneri Base Tunnel at Vigana, driving under the A2 motorway continues. At Sigirino, the north-west drives in the caverna operativa (CAOP) are complete. In the south-west tunnel, driving continues with good advance rates. www.alptranist.ch

3.Cross-City Link Zurich: The Weinberg Tunnel, the under crossing of the southern part of the main station Zurich, with mining and cut-and cover methods and the crossing of the Sihl for the station Löwenstrasse are the core construction sites of the Cross-City Link in Zurich and under construction now. Commissioning will be in 2013. http://infra.sbb.ch/bauarbeiten/weinbergtunnel.htm

4.Bypass Biel, A5 Eastern Branch: Together with the construction of the Western branch the Bypass Biel will influence the city for at least twelve years. The Eastern Branch under construction consists of the 1.5 km long Büttenberg tunnel and the 2.5 km long Längholztunnel. www.a5-biel-bienne.ch

5. Nant de Drance : The Nant de Drance project involves constructing a pumped storage power station in an underground cavern between the existing Emosson and Vieux Emosson reservoirs, a pair of lakes situated in the community of Finhaut. The power station is designed to generate electricity at times of peak consumption. Water from Vieux Emosson will be channelled through turbine generators to the Emosson reservoir 300 meters below. At night and at weekends, when demand for electricity is lower, the water will be pumped back from the lower to the upper reservoir. Equipped with 600-megawatt turbines, the Nant de Drance power station is expected to generate around 1500 million kWh of peak energy a year. The pumps will require some 1800 million kWh of energy.

6. Kraftwerk Limmern : A new underground machine aggregate center will be created about 600 m inside the mountain at the foot of the dam for Lake Limmern, at approx. 1700 m above sea level. Two pressure tunnels will connect Lake Mutt to the machinery center, and the centre will be connected to lake Limmern by two underwater tunnels measuring about 500 m in length. Access to the underground machinery centre from Tierfehd is via a 4 km long access tunnel, equipped for this purpose with a cable car.

Other tunnel projects in Switzerland :

the list of tunnels under design or construction sees many more projects. To mention just a few of them:

- Tunnel Engelberg, www.zentralbahn.ch
- Umfahrung Lugano (Vedeggio-Caserate)
- Zentralbahn Lucerne, tunnels Hubelmatt and Allmend, www.ausbau-zentralbahn.lu.ch
- A8 Umfahrung Lungern, Tunnel Lungern, www.a8-ow.ch
- A13 Umfahrung Roveredo, Tunnel San Fedele, www.gr.ch
- A28a Umfahrung Saas, www.gr.ch

- A16 Transjurane, tunnel Moutier, tunnel Neu-Bois, tunnel de Bure. www.a16.ch
- Bypass Visp, Tunnel Visp, Tunnel Eyholz, www.a9-vs.ch
- CEVA, www.ceva.ch

TURKEY

The name of the Organization is TURKISH ROAD ASSOCIATION (TRA). There are seven National Working Groups in the Association. TRA is an independent and open Association. The members are combined of individuals, organizations and companies of public and private sector. TRA published several books and some National Conferences are at planning phase.

The working groups and important events of the year 2010 are:1) Planning Working Group, 2) Road Construction Working Group, 3) Bridges and Tunnels Working Group, 4) Maintenance Working Group, 5) Traffic Safety Working Group, 6) Highway and the Environment Working Group, 7) Intelligent Transport Systems Working Group. The working groups organized various meetings, national conferences, exhibitions and published some books, reports and booklets.

In various lines of Istanbul city transportation net, construction of road, metro and passenger tunnels, stations have been progressed in 2010. Excavation and support of the underground structures have been carried out as TBM and NATM applications. Due to the historical nature of Istanbul archeological excavations and preservation works have been going on together with underground construction. Improvement of some structures at the ground and ground improvements beneath the ground were essential to minimize induced deformations due to underground construction facilities.In Marmaray Project construction has been continued in 2009 with some delays due to archeological works. It is planned to finish construction in 2011. Two current metro projects in Istanbul are Kadıköy-Kartal with 53 km tunnels and Taksim-Yenikapı with an approximate length of 5 km.

Design and construction of two main routes for speed railway (Eskişehir-Köseköy and Ankara-Sivas) are continuing. They consist of 39 tunnels with length of 39 km and 7 tunnels with 10 km respectively.

In highways , number of tunnels in operation increased to 171 with an approximate length of 118 km. 49 tunnels (29 km) are under construction, design of 145 tunnels (36 km) are going on.

UNITED KINGDOM

The British Tunnelling Society continues to be active in providing its extensive membership with a range of professional, technical and social activities throughout the year. Monthly meetings are held at the Institution of Civil Engineers in Westminster and are open to non-members. Tunnelling engineers on visits to London are particularly welcome. In addition the BTS continues to produce technical guidance on a range of tunnelling-related topics.

1 During 2009, BTS working groups were drafting guidance on best practice for monitoring of underground construction. were capturing knowledge on timber support techniques.were revising the BTS Specification

2 The BTS Compressed Air Working Group has agreed to work with ITA WG5 to draft guidelines for good practice in High Pressure Compressed Air work.

3 The BTS continues to assist with an employers' training forum to deliver National Vocational Qualifications in tunnelling at operative level.

4 BTS has continued to interact with MPs through its Parliamentary Lobby Group.

5 BTS interfaces with other UK professional groups interested in geotechnical matters through membership of the Ground Forum.

6 BTS supports the ICE's Panel for Historic Engineering Works – Tunnels sub-panel.

7 BTS contributes to the work of various British and CEN standards relating to tunnelling and tunnel machinery.

8 BTS ran two successful training courses in 2010, one on tunnel design and construction and the other on health and safety in tunnelling.

9 BTS has worked with the University of Warwick to help it develop an MSc course in Tunnelling to be offered from Autumn 2011

London Underground Ltd are undertaking complex conventional tunnelling operations at Tottenham Court Road as part of station upgrade works in connection with the Crossrail project

Recovery works are underway in the headrace tunnel following the collapse which closed the power station at Glendoe. The work is being done by conventional rock tunnelling techniques

Various tunnels were being designed or constructed for water, sewerage and cable utility services including construction of sewerage schemes in Preston and Brighton along with 30km of cable tunnels for National Grid

Major tunnel refurbishment works were completed on Bell Common tunnel on the M25 motorway

Fitting out of the twin bore A3 road tunnel at Hindhead

Shaft construction for the Lee Tunnel – a major deep storage and transfer tunnel system in London to reduce storm sewer discharge into the Thames

The 2nd Tyne Tunnel – a combination of two short sections of SCL tunnel, cut and cover box and immerse tube tunnel was completed

Contracts were let for two major lengths of bored tunnel for the Crossrail project along with contracts for intermediate stations to be constructed by conventional means

ITA "Prime Sponsors" report 2010

BASF - MEYCO

BASF Construction Chemicals, with its global customized MEYCO® solutions, is a leading supplier of innovative product technologies, offering specialized equipment and engineering knowledge. Tackling all your underground engineering problems safely and cost and time effectively, BASF has been instrumental in bringing new methods to the tunneling and mining industry: Expanding Horizons Underground.

Sprayed Concrete

For lower health risks and less environmental impact during production than dry mixtures, our wet mix permanent sprayed concrete tunnel linings provide state-of-the-art single shell structures with time and cost reductions over conventional tunnel designs.

Equipment

Certified to the highest industry standards, MEYCO Equipment's production, research and development resources supply training, troubleshooting and advice. Products include:

MEYCO Roadrunner sprays MEYCO SA alkali-free accelerator on the Skarsmotunnelen, Lillehammer, Norway

- Dry or wet spraying machines
- Hi-tech spraying manipulator booms
- Fully equipped and modular spraying mobiles for mechanized/automatic spraying
- Accelerator dosing pumps and sprayed concrete testing units

Injection

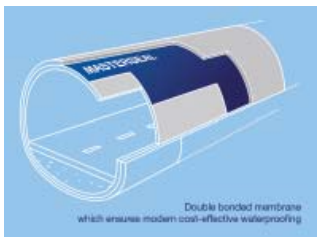
Pre-injecting ground with microcements is an economical approach to avoid unexpected water ingress, while post-injection may be required for soil stabilization or even structural repairs. BASF offers a complete menu of high performance chemical injection products and technical support.

TBM Solution

Our innovative total solution approach makes TBM drives more successful, even in highly challenging ground conditions. BASF has the largest range of products and services available for TBM tunnelling, suitable for TBM projects with up to the largest diameters used today and 4 bar water pressure.

Waterproofing

Conventional sheet membranes are unsuitable for complex tunnel shapes and susceptible to leakages. BASF's innovative spray applied waterproofing membrane, applied in a sandwich construction between sprayed/cast concrete shells, provides excellent bonding between membrane and concrete to facilitate single shell linings and eliminate potential water paths.



Fire Protection

In a tunnel fire, a thermal barrier prevents explosive concrete spalling without loss in strength of structural concrete or decreased reinforcement tensile strength. High production rates, even finish and controlled, minimal thickness, make cementitious sprayed thermal barrier MEYCO Fireshield 1350 ideal for new build tunnels and existing unprotected tunnel linings with a limited structure gauge.

Service

Our global presence supports seamless technology and service transfer for international contractor and design teams. MEYCO's professional technical and site support for products, equipment and application are recognized as the best service in the industry.

BASF with its MEYCO solutions was involved in a number of successful projects in 2010 across all these technologies, e.g. www.meyco.basf.com/gotthard.

HERRENKNECHT

Herrenknecht is the technology and market leader in the area of mechanized tunnelling systems. As the only company worldwide, Herrenknecht delivers cutting-edge tunnel boring machines

for all ground conditions and in all diameters – ranging from 0.10 to 19 meters. The Herrenknecht product range includes tailor-made machines for transport tunnels (Traffic Tunnelling) as well as for supply and disposal tunnels (Utility Tunnelling). Herrenknecht develops innovative technical solutions to sink vertical shafts down to great depths as well as to successfully excavate sloping shafts.

Under the umbrella of the Herrenknecht Group, a team of innovative specialists has formed to provide integrated solutions around tunnel construction with project-specific equipment and service packages upon request: these include separation plants, conveyor belt systems, navigation systems, rolling stock systems and segment moulds right up to turnkey lining segment production plants. With more than 3,200 members of staff worldwide and more than 60 subsidiaries and associated companies, Herrenknecht is able to provide a comprehensive range of services close to the project site and the customer.

In 2010, the breakthrough at the Gotthard Base Tunnel on Oct. 15th, 2010 marks the most significant milestone on the way to completing the longest tunnel in the world. Four Herrenknecht Gripper TBMs excavated more than 85km of the main tunnel tubes. In Italy, the Herrenknecht S-574 EPB Shield will install two 2.5m tubes for the Sparvo Tunnel, extending the A1 highway between Bologna and Florence. With an excavation diameter of 15.62 meters, it's the largest tunnel boring machine ever built. In Singapore the Land Transport Authority (LTA) is realizing the expansion of the metro network. In the construction Phase of Downtown Line Phase 2 ten Herrenknecht TBMs are being employed in mixed ground conditions to meet the tight overall time schedule. Not only the extension of metro systems, also the implementation of high speed railway networks like the Guangzhou-Shenzhen-Hong Kong Express Rail Link in China – for which Herrenknecht will be providing 6 TBMs - are attracting great interest. This is also the case for the two-tube Hallandsås railway tunnel in Sweden: in one of the most difficult tunnel projects in the world, the jobsite team celebrated breakthrough at the eastern tube in August 2010 using the convertible Herrenknecht Mixshield S-246 (Ø 10.53m).

MAPEI

During 2010 the UTT "Underground Technology Team", the division of the MAPEI group fully specialized to the underground activity, continued the development of its international applications of technologies within the Construction Industry, by the expansion of the activities, increasing product development resources, and strengthening development of its service business with the help of trained and experienced technical personal.

MAPEI UTT, as main supplier in some mechanized tunneling job sites, such as the Metro Line C in Rome (20 Km excavated up to now) and the hydraulic tunnel "Maldonado" in Buenos Aires (10 km up to now), has successfully applied ground conditioning products, such as the foaming agents of POLYFOAMER and STABILFOAM ranges, admixtures for backfill grouting (MAPEQUICK CBS SYSTEM), and greases (MAPEBLOX range).

MAPEI UTT is the market leader in Europe and Scandinavian countries (in particular Finland), for supplying chemical products in traditional tunnelling methods. The complete range of alkali-free accelerators (MAPEQUICK), rock-bolting anchoring products, PC superplasticizers (DYNAMON series) and other admixtures for concrete, etc. allows us to be able to provide always the optimal solution to our customers, from a technical and economical point of view. For example, during 2010 MAPEI products were applied in Southern Norway for the construction of the new 38.3km-long E18 highway from Grimstad to Kristiansand, including 7 rock tunnels for a total of almost 12 km. In Italy, UTT participated as main supplier of alkali-free accelerators for the "Base Tunnel" (2x9 km tunnels with a 160 m2 cross section) in the highway "Variante di Valico" project between Bologna and Firenze.

As far as tunnel waterproofing is concerned, we offer a full range of solutions, including PVC sheets (MAPEPLAN range), one-component sprayable polymeric membrane (MAPELASTIC TU SYSTEM), chemical resins for injection (polyurethane, organo-mineral, epoxy). UTT MAPEI gave its important contribute during the construction of the first immersed tunnel "Bjorvika" project, at the city center of Oslo in Norway, where MAPEPOXY and MAPECURE products were applied, in order to protect and repair the underwater concrete structures.

ITA "Prime Sponsors" report 2010

NORMET

Normet produces solutions for demanding customer processes in underground mining and tunnelling.

Besides the equipment and vehicles for mining and underground construction Normet offers Life Time Care services for the maintenance and usage processes for the entire life time of the products.

In April 2010 Normet acquired 40% of TAM International (a rapidly expanding construction chemicals manufacturer and distributor) and formed a global partnership with TAM to create a broader offering around the tunnelling process.

This partnership will enable both Normet and TAM to help their customers to achieve improved quality and more cost effective results in their underground construction process especially in sprayed concrete application, rock support, waterproofing, injection and repair of structures.

Normet is presenting TAM products in areas where TAM is not yet active and, in return TAM is acting as agent and distributor to Normet equipment and services in the UK, Hong Kong, Taiwan and ASEAN.

Normet and TAM together have now 31 locations in 20 countries worldwide to support customers in their underground construction projects.

In 2010 Normet also strenghtened its tunnelling equipment offering by introducing at Bauma 2010 in Munich the Spraymec 8100 VC, the most advanced model for concrete spraying in its Spraymec series.

The Spraymec 8100 VC is designed for high performance sprayed concrete applications. The NorSmart state-of-the-art concrete sprayer control system provides efficient, productive and high-quality concrete spraying with low-pulsation spraying and pumping, accurate and reliable accelerator dosing, accurate sspray boom and nozzle movements and positioning, real-time control and fault diagnostics of the spraying process and comprehensive vehicle fault diagnostics. The Spraymec 8100 VC is also designed easy maintenance with full access to all service points on the sprayer.

In 2011 Normet will together with TAM further develop its presence, offering and support to help their tunnelling customers where ever in the world.

ROBBINS

Keep Tunnelling: Robbins TBMs excavate Day and Night

With 60 years of experience, The Robbins Company manufactures custom TBMs to bore continuously through everything from soft soils to mountainous hard rock. Robbins Earth Pressure Balance Machines (EPB TBMs) continue to make swift headway on a variety of projects in multiple countries. Pioneering applications have minimized project schedules and reduced downtime, from efficient TBM assembly methods to optimized machine designs resulting in landmark performances.

Robbins' Onsite First Time Assembly (OFTA) method was first used on Canada's Niagara Tunnel Project in 2006. The method has been proven to result in significant time savings and cost reductions for the contractor, all by initially assembling the TBM at the jobsite rather than in a manufacturing facility. That first assembly, for the world's largest hard rock TBM (14.4 m diameter), was accomplished in just 17 weeks.

While Robbins still maintains its workshops in locations around the world, OFTA is now being carried out on multiple projects and on all TBM types. The method has been used most recently on a 10.2 m EPB assembled for Mexico City's Metro Line 12, and a 10.0 m diameter Hybrid EPB for India's Sleemanabad Carrier Canal in Madhya Pradesh State.

Worldwide, Robbins EPBs have proven their reliability in a variety of ground types, achieving multiple records. In Mexico City, the giant EPB boring the Metro Line 12 is tunneling under shallow cover with minimal settlement—all while achieving weekly advances up to 135 m. Overseas, a 6.3 m diameter EPB boring China's Chengdu metro has achieved an astounding pace of 180 m per week—significantly higher

than any of the 11 other machines on the project.

In 2011, Robbins is also set to launch three 8.9 m diameter EPB TBMs for Mexico's largest infrastructure project—the 63 km long Emisor Oriente waste water tunnel. The emergency tunnel will prevent potential flooding of downtown Mexico City due to deteriorating sewer lines.

To learn more about the latest tunneling feats, stop by the Robbins stand # 18.2 at the World Tunnel Congress. The stand will feature project information in an interactive format and will be staffed by a team of Robbins employees from the world over.

SANDVIK

Understanding underground

Sandvik focuses on continuously developing tunneling methods and equipment to be more efficient and more productive, giving a safe result of the highest quality. Sandvik's tunneling expertise covers a range of methods: Drill and blast, mechanical cutting and breaking. The equipment range includes tunneling jumbos, roadheaders and cutting units, bolters and bolts, drilling and cutting tools, hydraulic breakers, loading and hauling equipment, mobile crushers, and financing, parts and consumables, training, technical support, and repair and rebuild service.

We invest heavily in research and development. Our in-house cutting test laboratory lets us address special customer requirements and offer the latest technologies in mechanical cutting. We also have a unique test environment - a test mine – in connection with the drills factory, where practical testing in real life conditions takes place, and a laboratory for measuring drilling dynamics and performing rock drill and tool lifetime tests.

Sandvik works in close cooperation with universities and research institutes everywhere in the world. A good example is a research and development project called "ICUTROC", a result of which is a more effective, energy-saving cutting system for tunneling roadheaders. Not to mention the intelligent tunneling concept – the DTi jumbos with iSURE process optimization tool – in drill and blast: They deliver an uncompromisingly accurate drilling result, with minimum vibrations, taking safety in tunneling, and in tunnels, into new heights.

In 2010, Sandvik equipment was employed, among others, in Monte Ceneri and Sedrun, Switzerland, Berapit tunnels in Malaysia, Express rail link C822 in Hong Kong, Durango-Mazatlan highway in Mexico, Changuinola hydropower project in Panama, Seoul ring road in Korea, La Romaine hydropower project in Canada, Brisbane Airport Link in Australia, the Sochi Olympic Games site in Russia, the metro Bilbao site in Spain, the Citybanan metro site in Sweden and a wide range of projects in Finland.

SIKA

Market

2010 has seen a leveling out of the decrease of the last 3 years in most western economies. While cement consumption in Europe was still negative, North America seems to recover. All other regions showed increased activities in construction.

Sika's position

Sika achieved overall a better performance compared to cement consumption. Strong efforts were made to support Sika's growth strategy in emerging markets. The results confirmed our strategy to focus resources in markets which will contribute over proportionally to the growth in construction in the coming years. Newly introduced products and systems compensated the decline in the existing concrete business in developed countries.

The vertical integration with productions facilities around the globe allows us to develop a broad base of polymers. As a consequence Sika is in a position to formulated state of the art admixtures for each market and application. This know-how assures the leadership in construction chemicals in many markets worldwide, not only in admixtures but in all application in which sealing, bonding, damping, reinforcing and protecting is required. In tunneling a new generation of cost/performance optimized shotcrete accelerators and an optimized supply chain strengthened our position in large infrastructure projects.

Outlook 2011

Due to shortage of capacity and increased oil price, the raw material costs will increase substantially in the coming months. Subsequently prices for construction products will increase.

The outlook for the construction market is similar to last year. Europe and North America are expected to show small or no growth, whereas the emerging economies will see a cement consumption increase between 5 and 15%. Financial restraints of various governments in developed countries lead to a delay of big infrastructure projects. Nevertheless the backlog in emerging countries where financial resources are available will compensate the slow down.

Sika's innovation power and its consistency since more than 100 years assure that we are ready to face the challenges ahead.

ITA "Supporters" report 2010

BABENDERERDE

As a German company, with subsidiaries in the US and in Brazil, we provide consulting services for tunnel and underground projects worldwide. Dedication and focus on quality has allowed us to deliver successful projects for Clients and Contractors. Most recent services include design work for highway tunnels under water straits, technical specifications for mechanized tunnelling, construction management services for railwayprojects, as well as inspections and trouble shooting forTBMs in difficult situations. New projects around the world have broadened our experience in contracting modes such as DBB, D&B and PPP.

Our TPC software, engineered to monitor all aspects of mechanized tunnelling, has been enhanced to provide comprehensive and user friendly reports. Tunnelling data, shift reports, quality management data and production statistics –all can be easily accessed from a central client's computer or through the internet.

COWI

COWI is an international consultant company with 6000 employees working within Engineering, Economics and Environment. We work with a full range of engineering services within selected regions. Globally we work within selected services of which tunnels and underground structures is one.

Within the tunnels and underground structures the positive trends we have achieved in recent years have continued.

Metro in Copenhagen

We have prepared the conceptual design and tender documents for the new Copenhagen Circle line, which consists of 16 kilometres of bored tunnels, 17 underground stations and four shafts. At the start of 2011 a contract to construct the project was signed with a consortium of Italian contractors. COWI will assist the Client Metroselskabet I/S in implementing the project.

Tunnels inaugurated in 2010 in Korea, Ireland and Sweden,.

During 2010 we saw three of our major tunnelling job going from construction into operation. In October 2010 the Busan-Geoje immersed road tunnel opened for traffic. COWI has been involved since 2004 performing the detailed design as well as construction site technical services to the BOT contractor Dawoo Construction. In December 2010 we participated in the opening of the railway Citytunnel and three underground stations under the city of Malmø, when it was inaugurated by the King of Sweden. COWI have in the period 1999 to 2010 being the consultant to the owner Citytunneln preparing conceptual design, contract documents and design follow up during construction. Our work in Ireland on the Limerick tunnel was successfully completed with the celebration of the opening of the immersed road tunnel in July 2010. We have being assisting the owner National Road Authorities (NRA) with the implementation of the BOT project during the period from feasibility studies in 2002 until completion of the project in 2010.

Ongoing tunnel projects in Sweden, China, Abu Dhabi and Russia.

In Stockholm, Sweden, we have completed the detailed design of the Söderström railway tunnel for Züblin-Pihl JV. Construction work is in full swing, and the three immersed tunnel elements are being pre-cast within the steel lining and made ready to be submerged. We have also taking the design for the Marieholm tunnel in Gothenburg, Sweden to a level where it is ready for tendering for a contractor. Our Client is the Swedish Traffic Administration and the tunnel is an immersed road tunnel under the river Göta.

In China we have completed the preliminary design and have progressed into the detailed design phase for the Hong Kong-Macao-Zuhai link working for the Chinese contractor CCCC. The project includes a six-kilometre immersed tunnel for road traffic. In Abu Dhabi we are well advanced with the detailed design for the STEP sewerage project phase 2 and have also won the detailed design for the phase 3 of the project. We are working as consultants for the Italian contractor Impregnilo. In Russia we have recently been assigned a contract to review the design of the Orlowski tunnel in St. Petersburg, taking the road traffic under the river Neva in a bored tunnel to be constructed using a world record TBM of 17 m diameter.

HYUNDAI

Hyundai E&C has been the top E&C company of the nation since 1947, and is moving forward to global top tier company. Hyundai E&C has the technology and a variety of experiences in civil and environmental engineering, plant facilities, nuclear energy and housing. One of the current vision 2015 strategies is underground space and tunneling business. As seabed and riverbed long tunnel projects have been won by Hyundai E&C, the leading company in tunneling field. Main recent tunneling projects are summarized below;

Boryoung-Taean Road Tunnel (The longest seabed tunnel in Korea – 6,900m); Seoul Western Underground Road (Length – 9,308m); Riverside Expressway Expansion Project (The longest riverbed tunnel in Korea – 4,280m) ; Daegok-Sosa Railway (Length – 11,388m)

These construction projects are expected to start either in this year or the next year.

Abroad projects such as Mass Rapid Transit (Singapore and Hong Kong) and Taiwan High Speed Rail, etc. are completed. In Singapore, Jurong Rock Cavern for oil storage under the seabed is under construction.