

Spain



Name: Asociación Española de Túneles y Obras Subterráneas (Spanish Association of Tunnels and Underground Works)

Type of Structure: Non-profit, open association.

Number of Members: 315 (incl. 57 corporate and 23 young members)

ASSOCIATION ACTIVITIES DURING 2019 AND TO DATE

February - VII Symposium of Road Tunnels. ATC (Technical Road Association) celebrated on 12th to 14th February in Barcelona, the VII Symposium of Road Tunnels "Tunnels: shorting distances, joining people. Current overview and good practices".

March - AETOS active presence in the "Congreso costarricense de Obras subterráneas CCROS" S. José de Costa Rica. 28th -29th March.

May - ITA WTC in Naples (AETOS Represented by Miguel Fernández-Bollo).

9th and 10th May. In Collaboration with E.T.S. Engineers of Mines and Energy UPM on the occasion of 100 years of Metro de Madrid, the Conference "100 Years of Madrid Metro and its international translation"

June - BEFIPS and DACH meeting in Luzern during the Swiss Tunnel Congress. **27th June**, in the Betancourt Auditorium Madrid "Homage Act Miguel Fernandez-Bollo and Professor Carlos Oteo, Honor Members of AETOS; organized by AETOS and the CICCPC and with the collaboration and participation of different entities: DGC of the Ministry Fomento, ADIF, CEDEX, as well as different Universities and Associations.

October - European Underground & Tunnel Forum (EUTF) meeting in Lisbon, Portugal. Hosted by CPT & LNEC.

November - Seminar on "Construction and maintenance of road tunnels in Asturias". Organized by the AETOS in collaboration with Ministry of Fomento, ADIF, and Principado de Asturias. Oviedo **20th – 21st November.** Technical Visit to HS RL Pajares Tunnel

December - FAT Technical Forum to encourage the active participation of AETOS members and their incorporation into the working groups.

During the year - Regular Technical Meetings of working Groups.
Constitution of Young Members Groups.

Focus on tunnels in the ROP (Journal of Public Works). A new special issue of the ROP on Tunnels and Underground Works was presented, as a continuation of the collaboration that the Spanish Association of Tunnels and Underground Works (AETOS) and the Journal of Public Works (ROP) has been developing since 2009 which disseminates the experiences related to performances in tunnels and underground works.

In 2019 AETOS suffered some painful losses in the Spanish Tunnel Association, with the passing of a number of well-known figures in underground works: Carlos Oteo Mazo (Director of the Master of Tunnels and Underground Works that this year celebrates its fourteenth year, Enrique Fernández González (Member of the Board of Directors of AETOS and Professor of our Master), Antonio Soriano Peña (Partner of AETOS and Professor of our Master), Miguel Fernández Bollo (Vice-President of AETOS and our Representative in ITA and BEFIPS), and Felipe Mendaña Saavedra (Professor of our Master, Honorary Partner of our Association and regular collaborator of these monographs until this issue of 2019).

This circumstance forces us to strive harder in our task, to continue their efforts and to recognize their many



Parking in Sevilla-Canalejas

merits. We serve this special number as a tribute to all of them, allowing us to also publicly express our appreciation for their work and dedication.

E.T.S. Engineers of Mines and Energy UPM on the occasion of 100 years of the Metro de Madrid, held the Conference "100 Years of Madrid Metro and its international translation" in which AETOS participated with the Presidency of the Event. Alfonso XIII inaugurated the Madrid Metro on October 17th, 1919, with the current line 1 between Sol and Cuatro Caminos. Now it is the sixth-longest underground railroad in the world with some 294km (about 183 miles) of track.

The Metro has come a long way during its first century of operation. On the opening day, the route covered a mere 3.48km (about 2.16 miles), taking 10 minutes to travel 8 stops from Cuatro Caminos to Sol. On that first day, just over 56,000 passengers rode what was then called the North-South Line. Now, close to 2.3M riders take the Metro every day. Serving over 300 stations, it remains one of the most efficient ways to move around Madrid. In honour of the Metro's 100th birthday, the Regional Government of Madrid installed an educational exhibition throughout the original route, now called the 'Centenary Line.' Period photographs will highlight the Metro's history, and a new vinyl-wrapped train evoking the first train will run along the rails.

Other cities in Spain with metros in expansion are Barcelona, Valencia, Bilbao, Sevilla, Málaga, Palma de Mallorca and Granada.

CURRENT TUNNELLING ACTIVITIES

Parking in Sevilla-Canalejas and parking in Alcalá, Madrid.

Refurbishment has been undertaken in both to adapt them to the new regulations. In the same refurbishment, Sevilla – Canalejas and Alcalá car parks have been linked by an underground tunnel, and the Sevilla-Alcalá car park's first floor will be part of the Canalejas complex that will be finish by July 2020

Certification Course in Fire Management for Tunnel Control Room Operators.

On the 5th and 6th November, a training workshop for tunnel control room operators with practical exercises and simulations using real fire was organized in the TST testing tunnel. Operators can gain personal certification, which provides them with a record of their technical competence in fire



Requejo VI Tunnel

management. This certification involves practical exercises and drills with real fire carried out in the TST testing tunnel. The first edition took place on 9-10th April, 2019 in Siero (Asturias).

Road Tunnels In Glories Square In Barcelona.

Site supervision of 1,300m of road tunnel works under one of the most important street junctions in Barcelona. Due to its construction in a consolidated urban area, it is necessary to excavate the tunnels whilst taking into account the presence of multiple existing utilities and to reduce disruption due to a large number of traffic diversions. The tunnel passes under four old railway and metro tunnels, which requires the construction of extremely rigid provisional support methods to reduce possible movements (large diameter steel tubes filled with concrete).

Málaga metro L1-L2 works.

Works of the Málaga Metro are ongoing in the Renfe-Guadalmedina section, which runs 100% underground between el Perchel-María Zambrano Station. Lines 1 and 2 of the Malaga Metro, to El Perchel-María Zambrano, constitutes the network in commercial service since July 2014, and consist of 12km of track with 17 stations. Currently, the Ministry of Development, Infrastructure and Land Management is advancing the works of the Renfe-Guadalmedina and Guadalmedina-Atarazanas sections, which cross the centre of the capital and which include the two additional stations

at Guadalmedina and Atarazanas, in the Paseo de la Alameda, Malaga.

The section currently under construction is 713m in length and contains a station, called Guadalmedina. The route between the stations of El Perchel and Guadalmedina, is of about 481m, both Lines 1 and 2 converge, to enable, as in the El Perchel interchange, the meeting of the two lines on the same platforms at the Guadalmedina station, so that the tunnel in this route consists of three levels to house both lines, as is also the case with the Guadalmedina station.

Tunnel 2 of the Cortes de Pallás Hidropower Plant

Extensive repair and rehabilitation design works for Tunnel 2 on the Cortes de Pallás pumping plant, Valencia (España).

M-14 highway tunnel

Due to the flooding in the M-14 highway tunnel located in the general airport system of Adolfo Suarez Madrid Barajas Airport, Madrid, a structural analysis and replacement of the damaged electromechanical systems has been performed.

Eight new tunnels in La Aldea de San Nicolás (Gran Canaria)

In October 2019 work began on the El Risco - Agaete stretch, in the Gran Canarian municipality of La Aldea de San Nicolás. The El Risco-Agaete section will complete the route of the GC-2 to La Aldea and replace the old GC-200 road, a dangerous road due to constant landslides that have forced its closure

repeatedly, and left the inhabitants of La Aldea virtually isolated from the rest of the island.

The construction of eight new tunnels that, with a maximum length of 5.5km, will account for three quarters of the 8.5km of the total length of the work. The aim is to build and commission the first tunnels, those for El Risco, within 24 months of the start of the works. Mechanical means and controlled blasting will be used for the excavation. In this first phase two parallel tunnels of just over 2km each will be built with a radius of 6m and a gauge of 5m.

The Aldea Tunnel is a tunnel of 3,145m length that will be the longest in the Canary Islands and will be among the 20 largest in Spain. The tunnel has two tubes, each with an 11m platform for two lanes, two carriageway and two sidewalks. The project and involves an investment of €152M and its construction period is 65 months.

Calle 30 Urban, the Highest Highway Tunnel in Europe (Madrid)

The 48km of tunnel on the Madrid Calle30, executed by "cut and cover" and TBM, make up the longest network of urban tunnels in Europe. EMESA, as the contractor for the maintenance and operation of the M-30, carries out the inspection and maintenance of both the infrastructure and its facilities, and manages the operation of the road. One of the most relevant projects this year was the inspection of 7,500m of tunnel and a total of 60 enclosures between the emergency exits, technical rooms and ventilation wells, following an inspection procedure in-house developed specifically for these tunnels. The 21,500 support devices that support the slab in the TBM built section (total length of 8km) have also been inspected.

Recoletos railway tunnel renovated

The renovation of the rail track and catenary of the Recoletos tunnel is complete and will improve the reliability of the infrastructure and reduce incidents in this key section for the Commuter network of Madrid. Renfe Cercanías de Madrid will resume the usual service through the Recoletos tunnel, which reopens once the comprehensive improvement work has been completed.

The work carried out in the tunnel, which is one of the most important actions of the Madrid Plans of The Commuter Plan, has involved an investment of more than €45M (VAT

included). This infrastructure, 7km long, is the busiest on the entire Spanish railway network, with 470 trains and 200,000 commuters per day.

New High speed railway tunnels - ongoing

The Pajares New Line is part of the León–Asturias Line, belonging to the High-Speed North-Northwest Corridor. It is specifically located between La Robla (León) and Pola de Lena (Asturias), in the central hub of this line, between the León - La Robla and Pola de Lena - Oviedo sections. It is 49.7km long and, in addition to the construction of the two main Pajares tunnels, between Pola de Gordón (León) and Telleo (Asturias), it also includes the outer stretches in the direction of La Robla and Pola de Lena. The Pajares Tunnels, approximately 25km in length, will be the sixth longest in Europe and the seventh longest in the world. Another important tunnel on-going is the 6km long Pontones Tunnel. The final construction of these tunnels (expected in 2025) will allow the Puerto de Pajares mountainous massif to be crossed, while ensuring a high-speed connection between Madrid, Castile-León and Asturias. The distance between Asturias and Castile-León will be shortened by 33km compared to the current railway route, with a new route designed with high-speed parameters, where trains will be able to reach speeds of over 250km/h. The time taken to travel along the new line will be approximately 15 minutes.

Improving safety of highway tunnels

Detailed design of refurbishment works for several tunnels on the road network are ongoing to national tunnel regulation RD 635/2006.

Among the tunnels under study in 2019 to suit European regulations are:

- Tunnels at Lladó, Colladetes, Fogá and Juan Carlos I (Vielha)", in the provinces of Huesca and Lleida
- Tunnels de Santa Isabel, Bubierca; Ateca and Sant Just", in the provinces of Zaragoza and Teruel
- Tunnels at Jarrío and Rellón. Highway A-8. Tt. MM. Coaña y Navia", in the province of Asturias
- Tunnel at Somosierra, province of Madrid

Metro San Sebastian (Basque country)

The scope includes the construction of a 2,020m length tunnel (cross section of 60m²) plus one station cavern (110m



long and 190m² cross section) plus two access drifts 490m and 220m long and several galleries and service shafts. A Heavy-class 130 ton roadheader is carrying out mechanical excavation in Flysch

Cabanasses ramp, ICL (Barcelona)

Excavation in rock with a heavy roadheader at the new potash mine development at Cabanasses ramp within the Phoenix Project of ICL Group in Iberpotash mine (Suria, Barcelona, Spain), planned length of the drift = 4.5km.

Section 9A, Peñascal-Bolintxu, of phase I of the metropolitan south (Basque country, Spain)

Lot 9-A Peñaskal-Bolintxu of the South Bilbao Bypass includes the Arnotegi twin road tunnel with a total length of 1,760m per tube, and an average excavated cross-section of 115m². The project includes eight connection galleries (214m) of 33m² cross-section and 112m of technical rooms at 62m². Excavation method is drill & blast through marl and limestone. It is the first underground project in the Basque country fully executed on a BIM platform

FUTURE TUNNELLING ACTIVITIES

- New emergency exits for the E.T.S. tunnels located on the route of the Vitoria – Bilbao – San Sebastián axis of the high-speed train network. The project consists of four different tunnel sections where, by the new regulations, it is necessary to fit new parallel emergency galleries so there are no more than 1,000m of tunnel without an emergency exit.
- AETOS to collaborate with the Road Ministry DGC at conferences regarding road tunnels in Colombia and Chile
- March 2020 AETOS Seminar Metro in Sevilla (Solución sostenible para el transporte en la ciudad)
- May 2020 AETOS Seminar in Bilbao, the "Lamiako tunnel", a 3km highway tunnel under the Nervión River
- Jun 2020 Annual Conference AETOS
- October 2020 XI Simposio Nacional de Ingeniería Geotécnica SEMSIG – AETOS in Mieres (Asturias)
- Under construction 12km length Hydraulic tunnel at the Mularroya Dam
- Finishing more than 20 (> 100km) of High-Speed Railway tunnels currently under construction
- Technical meetings and WG activities on going

EDUCATION ON TUNNELLING IN THE COUNTRY

Tunnelling Master and Degree courses:

UPM Polytechnic University in Madrid, UPC Cataluña, UPV Valencia, Univ. Cantabria, Univ. La Coruña, Univ. Castilla la Mancha, Univ. Granada and Univ. Sevilla.

All courses with a Discipline of Civil Eng ECTS (European Credit System, according to the European Higher Education Area).

XIV Edition "Master in Tunnels and Underground Works". The Master's degree is currently a degree from the National University of Distance Education (UNED), with an equivalence of 60 ECTS and is training recognized by the ITA (International Tunnelling Association). This Master Course has an important international projection through collaboration with the ITA Member Associations, especially those with development in Spanish-speaking countries, such as: ACTOS, AMITOS, APTOS, etc. with which AETOS maintains collaboration agreements.