

SPAIN



Name of Association: Tasociación Española De Túneles Y Obras Subterráneas (Spanish Association Of Tunnels And Underground Works)

Type of Structure: Non-profit, open association, founded in 1974

Number of Members: Total 319 (211 individual members, 67 corporate members, and 41 young members)

ASSOCIATION ACTIVITIES DURING 2023 AND TO DATE

During 2023, to comply with AETOS purposes, several activities were carried out, in both hybrid face-to-face and virtual modes. These include, among others:

- XIX Máster Universitario in Túneles y Obras Subterráneas AETOS (endorsed by ITA-AITES).
- Activities of the Working Groups coordinated by the AETOS Tunnel Forum (FAT).
- Meetings of the European & Tunnel Forum EUFT and GIT and other counterpart Associations.
- Monography issue num. 3642 of tunnels in the ROP (Journal of Public Works). A new special issue of 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, to publish monographs which disseminate the

experiences related to performance in tunnels and underground works.

- The fulfilment of the objective of AETOS to promote the study and research of underground works, facilitating contact and collaboration between professionals within related organizations via, among other avenues, the yearly publication of the monograph.
- Technical Conference: “Tunnels in Gipuzkoa and other singular tunnels”. Donostia, 14th – 15th Feb 2023.
- Technical conference on “Innovations in tunnels and underground structures”. Madrid, 21st June 2023.
- Participation as a European Underground & Tunnel Forum (EUTF) member, in AFTES: “Strategies and guidelines for sustainable underground infrastructure”. Paris. AFTES - October 2nd, 2023”.
- Participation in the 5th Mexican Congress on Tunnel and Underground Engineering: “Aspects of design

and modelling of tunnels built with conventional methods” Mexico November 29th, 2023.

- Spanish presence at the WTC-2023, and 49th ITA-GA. Athens, September 2nd – 8th, 2023. Participating in WGs activities.
- September, 20th, 2023, 49th General Assembly of AETOS, including:
 - Medal of Honor to Emeritus Prof. Eduardo Alonso, and to Helena Castellví, the 2023 AETOS Young Tunnel Engineer
 - Diploma of recognition for Daniel Jaen Matute, AETOS Young Member Group past president
 - Posthumous tribute to Miguel Fernandez-Bollo, and Antonio Soriano Peña
 - Special Conference: “Think Deep for Sustainable Development” by Antonia Cornaro, ETZH & ITACUS co-chair

CURRENT TUNNELLING ACTIVITIES

Throughout 2023, the design, construction, maintenance, and modernization of tunnels in Spain is on-going. Some examples are listed below:

Railway Tunnels

During 2023 high-speed rail is progressing with among many, the following:

- The “Basque Y”, 140km long, including 80 tunnels, with a total length of 104.3km, meaning 60.6% of the route is underground.



Udalaitz tunnel “Y” vasca

- Also starting - and considered crucial for the improvement of the system – are the Puerta de Atocha access to Madrid and, for Valencia, the new access channel and reformation of the Joaquín Sorolla high-speed station. At the end of December 2023 the administrator of the railway network awarded the contract for the execution of these works, which will have a construction period of 60 months and a budget of €443M.
- Progress is also reported on the underground works at the Bergara Junction (Kortazar and Udalaitz tunnels) on the Vitoria–Bilbao–San Sebastián High-Speed Line.

High speed railway tunnel in construction, during 2023

- Túneles de Udalaitz (Vitoria-Bilbao-San Sebastián): 2 x 7.3km
- Artificial Bajo Valle del Cuarto Chico (Castejón-Cadreita): 0.13km
- Monte Plano (Olite-Tafalla): 1.9km
- Canal de Navarra (Tafalla-Tafalla): 0.6km
- Túnel del Rincón_tramo Lorca-Pulpí (LAV Murcia-Almería): 0.93km
- Túnel de Viator_tramo Nijar-Río Andarax (LAV Murcia-Almería): 0.88km
- Túnel artificial Fuente Flores_tramo Pulpí-Vera (LAV Murcia-Almería): 0.29km
- Túnel de Sorbas (bitubo) (tramo Vera-Los Arejos): (2 x 7.52km)
- Túnel del Almendral (tramo Vera-Los Arejos): 1.11km
- Dehesa Terzuelo (Malpartida De Plasencia-Est Plasencia/Fuentidueñas): 1.45km



Elorrio tunnel "Y" vasca

The tests and commissioning of the Pajares tunnels are completed for commissioning

The Madrid Metro expansion project is ongoing, which will see the construction of 40.5km of new tracks, by 2028 with an investment of over €1.200M

- Line 3 - Section: Villaverde Alto-El Casar, 2.5km
- Line 11 – from Plaza Elíptica to Conde de Casal, 7km
- Line 11 – from Conde de Casal to Mar de Cristal, 18.6km

In total, these projects will add more than 17km of Metro and two new stops near the Hospital Enfermera Isabel Zendal, and Ciudad de la Justicia and Valdebebas Norte which will be an interchange. The new layout will pass through the existing Madrid underground station T4, at one

of the ends of Line 8, which will facilitate a new more direct connection between the Adolfo Suárez Madrid Barajas Airport and Atocha.

The Madrid Metro today includes 302 stations and 294km of tracks, the fifth largest network in the world behind London, New York, Shanghai and Paris. If on schedule, within seven years it will have 309 stations and 334km of tracks. The extension of L8 of the Barcelona Metro and Line 5 of the Bilbao metro are also under construction.



Madrid Metro L3 in construction



Pajares Tunnel. Passenger evacuation drill

Road Tunnels

In compliance with the European Directive on minimum safety requirements, the adaptation of road tunnels of the RGE to R.D. 635/2006 required 65 tunnels to be put out to tender, with a cumulative length of over 32km. Among others the following projects for road tunnels are ongoing:

- San Juan Tunnel (Alicante)

- Aguadulce, Bayyana, La Parra and La Garrofa tunnels (Almería)
- Adaptation of various tunnels in the province of Barcelona
- Llado, Collaguets, Fogá and Juan Carlos I tunnels (Lérida)
- Montefurado, Piedrafita San Pedro, Doncos, Cereixal and Neira tunnels (Lugo)
- Villafranca, Trabadelo and La Escrita (León)
- Capistrano, Tablazo, Frigiliana, Lagos, Torrox, Churriana and San Pedro tunnels (Málaga)
- El Carmen, Llovio, Tezangos, El Fabar, Arenal de Morís, Ángel Uriel, El Padrún and Duestos tunnels (Asturias)
- Gedo, Somaconcha, Lantueno, Las Caldas, Riocorvo and Pedredo, Caviedes, Hoz, Torrelavega, Gibaja, Astillero, La Marga, Maliaño, La Albericia, La Morcilla and Limpías tunnels (Cantabria)
- La Canda, Padornelo, Padornelo N-525 and La Canda N-525 tunnels (Zamora)

Throughout 2023, more than 400 conservation actions have been performed in tunnels on the M-30. These are carried out after detailed inspections, which are supported by laser scan and thermographic images.

This year, 6,000 miles of roadways, 55 enclosures (including emergency exits) technical rooms and ventilation shafts were inspected, as well as the 21,500 bearings that support the roadway platform of the twin tunnels that make up the M-30 by-pass.

For the inspection of the 8,000m of extraction galleries on the by-pass, an autonomous vehicle was used due to the complexity of access, on which a 360° camera was placed, with the images later analyzed at the office.

In Gran Canaria, the final La Puebla tunnel (number five) between the La

Hoya and La Palma ravines, and tunnel number 11 were completed. These were added to the already initiated project that will preserve the La Aulaga archaeological zone. In total, 8.4km has been excavated between the nine tunnels and the three evacuation galleries in case of an emergency.

Hydraulic Tunnels

- The Mularroya tunnel that will transfer water between the Jalón and Grio river basins. Of its almost 13km, a total of 11km is programmed to complete in March of 2024. The tunnel has an internal diameter of 2.9m and an external diameter of 3.3m, and will cross the municipalities of Calatayud, Paracuellos de la Ribera, El Frasno and Morata de Jalón, with the capacity to transfer 8 cubic meters of water per second.
- In 2023, the first construction works for the San Silvestre began, with an internal diameter of 3.6m, and a water transfer capacity of 10m³/s, the tunnel will have a total length of 7km.
- In the Basque Country, the Galindo stormwater tank, which will have a storage capacity of 90.000m³, is under construction by roadheader.

FUTURE TUNNELLING ACTIVITIES

Forecast for during 2024

- 50th Anniversary AETOS celebration. Including General Assembly. 28th – 30th Oct 2024, Madrid
- Seminar: “Túneles en Cataluña” (pending programme)
- Seminar: “Madrid Metro lines” - new extensions (pending programme)
- EUTF, regular meetings and sharing European initiatives to strengthen ITA interest
- AETOS WGs activities coordinated by AETOS Technical Forum (FAT) are on-going

EDUCATION ON TUNNELLING IN THE COUNTRY

Tunnelling Master and Degree course in several Universities, the most relevant being: 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).

Edition XIX “Master in Tunnels and Underground Works” (2023-2024) is ongoing. The Master degree is currently a Post-Graduate Master Course from the National University of Distance Education (UNED), with an equivalence of 60 ECTS, and is training recognized by the ITACET (International Tunnelling Association). This Master Course has an important international scope through collaboration with the ITA Member Associations, especially those with development in Spanish-speaking countries, such as: ACTOS, AMITOS, APTOS, etc. within which AETOS maintains collaboration agreements.

The teaching cycle, which includes 1250 teaching hours and a Master thesis (plus individual study, design practices, etc.), has allowed us to train numerous specialists in the fields of Design, Construction and Maintenance of Tunnels and Underground Works over the last 16 years, and many of our students have been successfully incorporated into tunnelling works in different areas of the Public and Private sectors.

To offer the highest quality of teaching, since 2014, AETOS has been collaborating with the National University of Distance Education (UNED) (through its Permanent Training program) and with the College of Civil Engineers (CICCP), to offer distance learning possibilities, to access a greater number of students.



STATISTICS

1. List of tunnels completed: (A tunnel data base it is being promoted by AETOS) Activity of High-Speed Railway tunnels during 2023

Status	Number of tunnels	Cumulative length (km)
Panning	4	1.8
At the start of construction	1	3.4
In construction	12	37
In service	3	55.1
Total	20	97.3

2. List of tunnels under construction: Commented on in this report