its Engineering Company

GEOTECHNICAL & GROUND ENGINEERING DEPARTMENT

Brochure

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The Department

Soil-structure interaction is a cross-cutting theme in most civil engineering works, from the initial excavation phases to the final operational behavior of the completed structure. ITS Geotechnical & Ground Engineering was established from the need to provide assistance to all ITS internal departments in various project areas, and then to address external entities both nationally and internationally in support of geotechnical design, which today is increasingly important in civil engineering interventions. The technicians at ITS Geotechnical & Ground Engineering are capable of developing advanced 2D/3D models for studying soil-structure interactions and the subsequent design of structures even in very heterogeneous contexts: provisional and definitive support works for optimizing excavation volumes, foundation works for buildings and infrastructure, consolidation and defense works for hydrogeological instability, interventions for the improvement of existing soils, and environmental monitoring.

Services

ITS Geotechnical & Ground Engineering develops services starting from the drafting and possible direct execution of an investigation campaign, followed by the interpretation of the obtained results, preparatory to the definition of a geotechnical-geological model that accurately represents the current state. This logical process is of fundamental importance for the correct design of the intervention, which considers the functionality of the work, economic sustainability, management and maintenance costs, and environmental and landscape compatibility.

01 Planning and Design

The Department can follow all the design phases: from planning and technical-economic feasibility studies to the project verification for validation, through all the design phases up to the construction and detailed design.

02 Numerical Modelling

Technicians are trained in the use of the most advanced tools available for 2D and 3D numerical modeling of foundations and special works, underground works, study of natural phenomena such as landslides, and the analysis of earthworks.

03 Geological surveys, Inspections, and Site Supervision

ITS Geotechnical & Ground Engineering is complemented by the presence of trained geologists in conducting the necessary geognostic and geophysical surveys, thus being able to directly and suitably evaluate all site criticalities. When necessary, the team uses the most advanced mountaineering techniques (technicians certified in rope access work) to reach and inspect less accessible locations.

04 Monitoring

The Department can provide support with the most modern monitoring techniques in structures, infrastructures, and underground works, thanks to the close collaboration with the ITS Inspection department. Support is also provided in the field of hydrogeological instability, where such techniques are very useful in studying landslides and gravitational movements in general.

Our Projects

Variant Road of Motte di Oga

Road safety improvement and traffic reduction

This project focuses on the design of a new road alignment for Provincial Road N°28, providing a bypass to avoid the winding road and intersections through nearby towns. The latest road is approximately 1,200 meters long and aims to improve road safety by reducing traffic passing through the municipalities of Valdisotto and Valdidentro. The road is designed as an 'F2 secondary suburban road' and features significant support structures, such as gravity walls and tie-back anchor systems, tailored to the challenging mountainous terrain.

Special attention was given to minimizing excavation and earthworks by optimizing the planimetric and altimetric alignment. A drainage system, such as 'Gabbiodren,' was also incorporated to reduce soil saturation and prevent groundwater intrusion in landslide-prone areas. The project was developed using BIM methodology, beginning with a LIDAR survey to generate a Digital Terrain Model (DTM). An Environmental Impact Assessment (EIA) screening was conducted to ensure sustainable development.

Location:	Lombardy, ITALY
Client:	Province of Sondrio
Year:	2025
Work amount:	€10,680,415.03
Categories:	V.02, S.03, S.04, S.05
Services provided:	Final and executive design, safety coordination during design, EIA (Environmental Impact Assessment) screening

Bormio Ski Area Snowmaking System

High-altitude strategic infrastructure for artificial snowmaking in preparation for the Milano-Cortina 2026 Winter Olympics

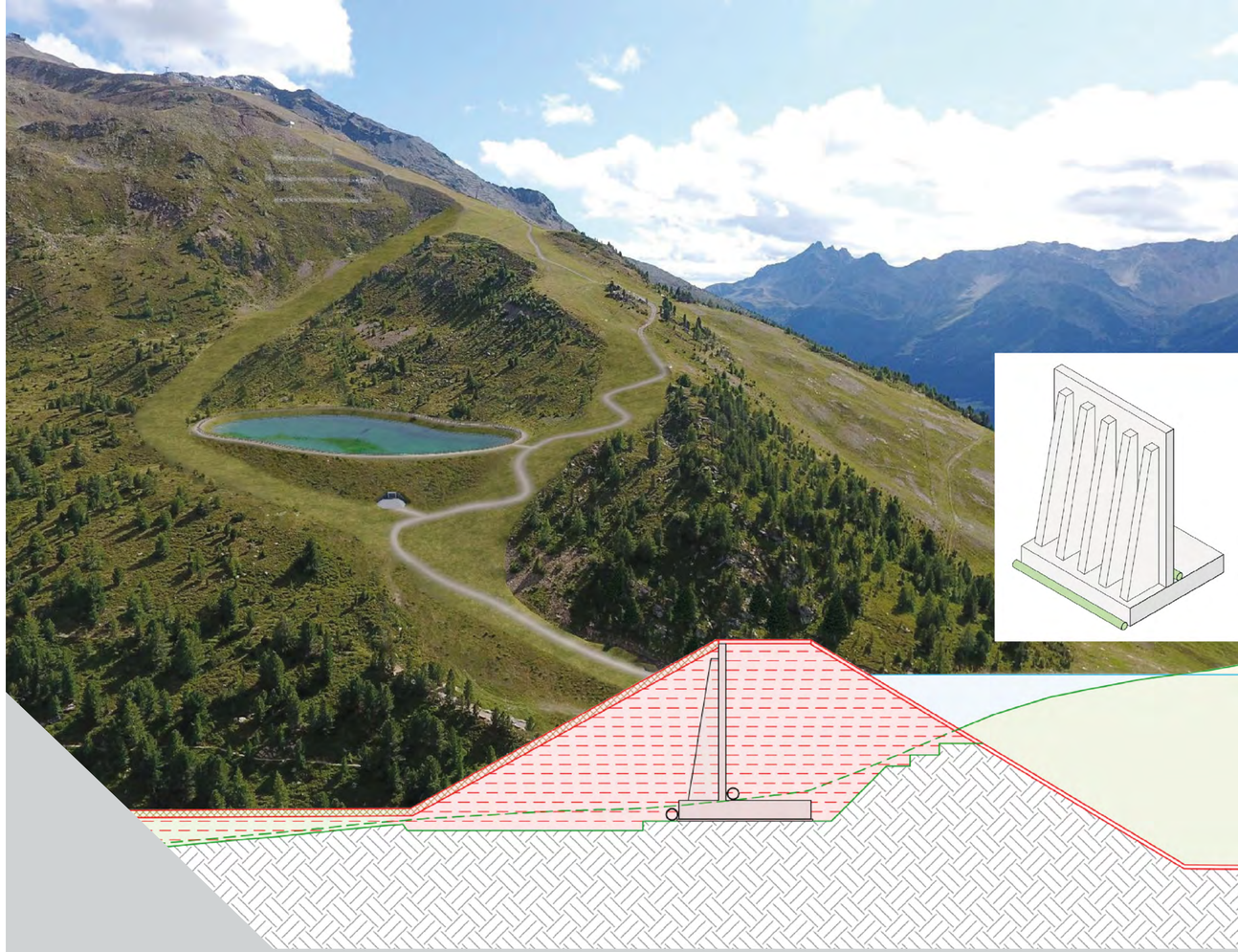
The Bormio ski area (SO) is a key venue chosen for the men's alpine skiing competitions at the Milano-Cortina 2026 Winter Olympics. To ensure optimal snow coverage for the event, our Alpine Department managed the design and construction of a critical infrastructure: the enhancement of the artificial snowmaking system, with particular focus on the renowned Stelvio slope.

At the heart of the project is the construction of a new open-air water storage basin with a capacity of approximately 88,000 m^3 located at an altitude of 2,290 m above sea level, seamlessly integrated into the alpine landscape. The work includes a containment embankment wall, water intake and discharge systems, avalanche barriers, and reshaping and restoration of the affected ski runs.

Each phase of the project was developed using a multidisciplinary and innovative approach, emphasizing site safety, environmental impact reduction, and logistical optimization.

The retaining embankment wall consists of a conventional raft foundation supporting a vertical facing of significant height but reduced thickness, made possible by the incorporation of suitably designed buttresses on the downstream side, which reduce the stresses acting on the facing itself.

The structure has been designed and verified under the conservative assumption of a complete absence of downstream soil, although in reality it is entirely embedded within the embankment.



Location:	Lombardy, ITALY
Client:	ARIA S.p.A. - Regional Agency for Innovation and Procurement
Year:	2023 - 2025
Work amount:	€8,026,626.78
Categories:	S05, IA01, IA04, D.04, S.03, V.02
Services provided:	Final and executive design, work supervision, safety coordination during design and execution phases

Saviane and Teno-Ribego Landslides

Works for the protection against rockfall on SP11 “of Val d’Adige”

The intervention area is located along the bed of the Valturcana stream, in the municipality of Alpago. The design was carried out in two phases, each focused on a landslide affecting the stream and threatening its obstruction: the Saviane landslide, approximately 3.5ha, and the Teno-Ribego landslide, about 14 ha. I The works, for both phases, aimed to both restore the hydraulic functionality of the Valturcana stream bed and clean and reshape the landslide slopes to ensure a preferential path for the runoff of meteoric water towards the planned surface drains, which will allow its removal and discharge into the Valturcana stream. The interventions in the stream bed were partly dedicated to the restoration of existing structures, mostly closed weirs from the fascist era with historical significance, requiring specific design precautions to restore the original stone claddings. These interventions were then integrated with new works, such as cliffs and mass concrete slabs for erosion protection, as well as the insertion of two new weirs made by installing “umbrella” mono-anchorage structures. The two rows of umbrellas were located at the foot of the Teno-Ribego landslide to stabilize the stream bed but also as a garrison at the foot of the landslide and to weigh it down. The choice of mono-anchorage technology arose from construction needs, as due to the difficult accessibility of the sites, the creation of a classic concrete weir was not technically and economically advantageous.

Location:	Veneto, ITALY
Client:	Veneto Region
Year:	2022 - 2023 (Phase 1), 2023 - ongoing (Phase 2)
Work amount:	€6,5 million
Categories:	V.02, S.04
Services provided:	Final and executive design, safety coordination during the design phase. Geognostic and seismic surveys

Lenzino Bridge

Landslide mitigation and construction of the permanent bridge over the Trebbia River, municipality of Corte Brugnatella (PC)

Following the collapse of the Lenzino Bridge on October 3, 2020—caused by the failure of the central pier during an exceptional flood event on the Trebbia River—geological and geotechnical modeling played a key role in the design of the new bridge on the SS45.

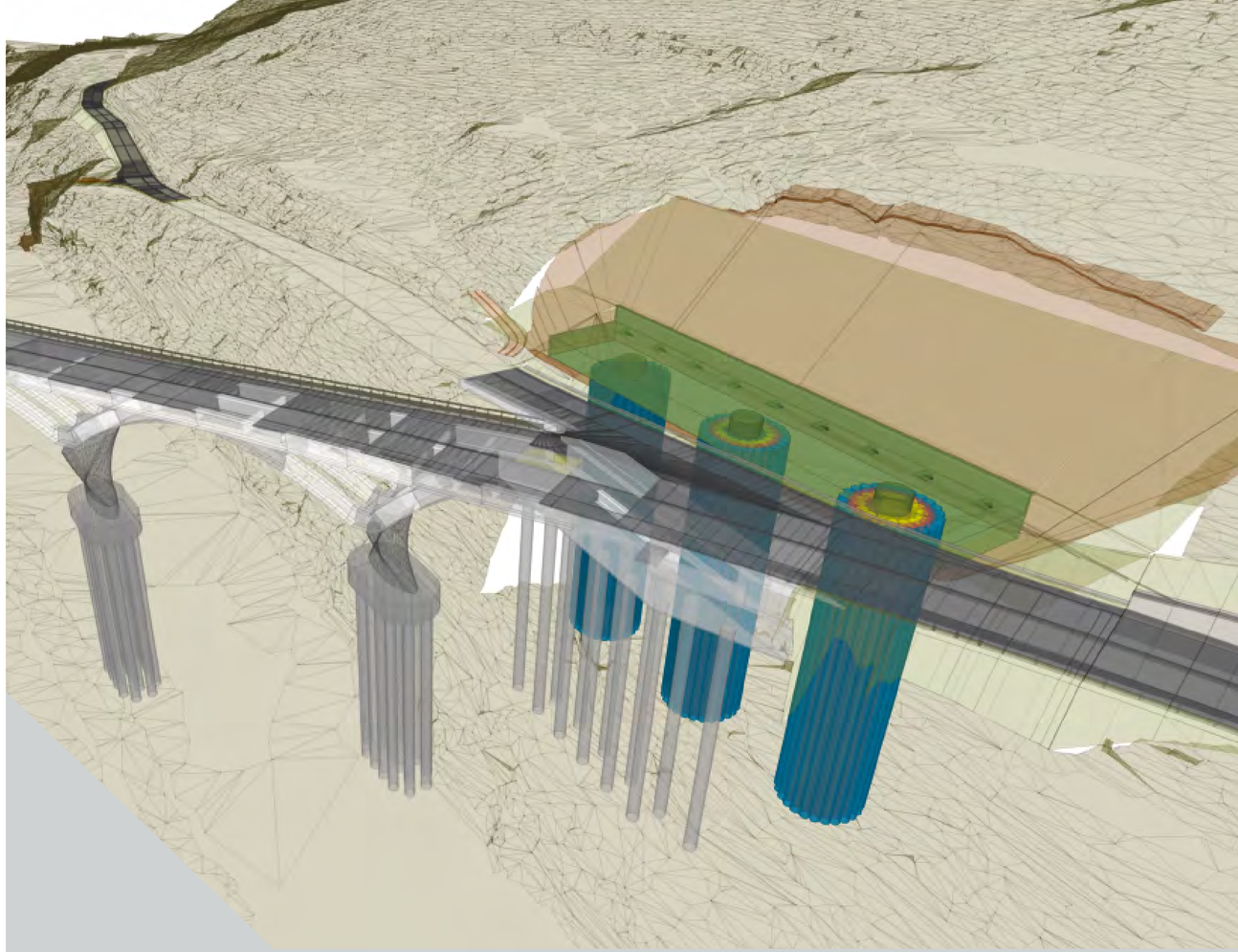
The foundations of the new bridge consist of large-diameter bored piles embedded into a deep argillite layer.

On the Genoa side, the presence of an active landslide required the construction of a protective retaining system directly anchored into the argillite bedrock, engineered to fully counteract the landslide pressure near the new structures.

This system includes three structural shafts, each composed of triple circular rings of tangent and secant Ø1000 mm piles, 35 m deep. The shafts are interconnected by a 54 m long reinforced concrete capping beam, equipped with permanent prestressed anchors, 55 m long and inclined at 30°.

These solutions were made possible through extensive geotechnical and geophysical investigations—including boreholes, MASW, seismic refraction, inclinometric and piezometric monitoring, and satellite-based Synthetic Aperture Radar (SAR)—along with expert consultation from the University of Bologna (on behalf of ANAS) and the University of Perugia (on behalf of ITS).

In particular, inclinometric data from May to December 2022 revealed that landslide movements are concentrated within a slip surface approximately 2 m thick, located between 26 and 28 m below ground level.



Location:	Lombardy, ITALY
Client:	Province of Mantua
Year:	2021 - ongoing
Work amount:	€6,5 million
Categories:	V.02, S.04
Services provided:	Final and executive design, safety coordination during design, geotechnical and seismic investigation

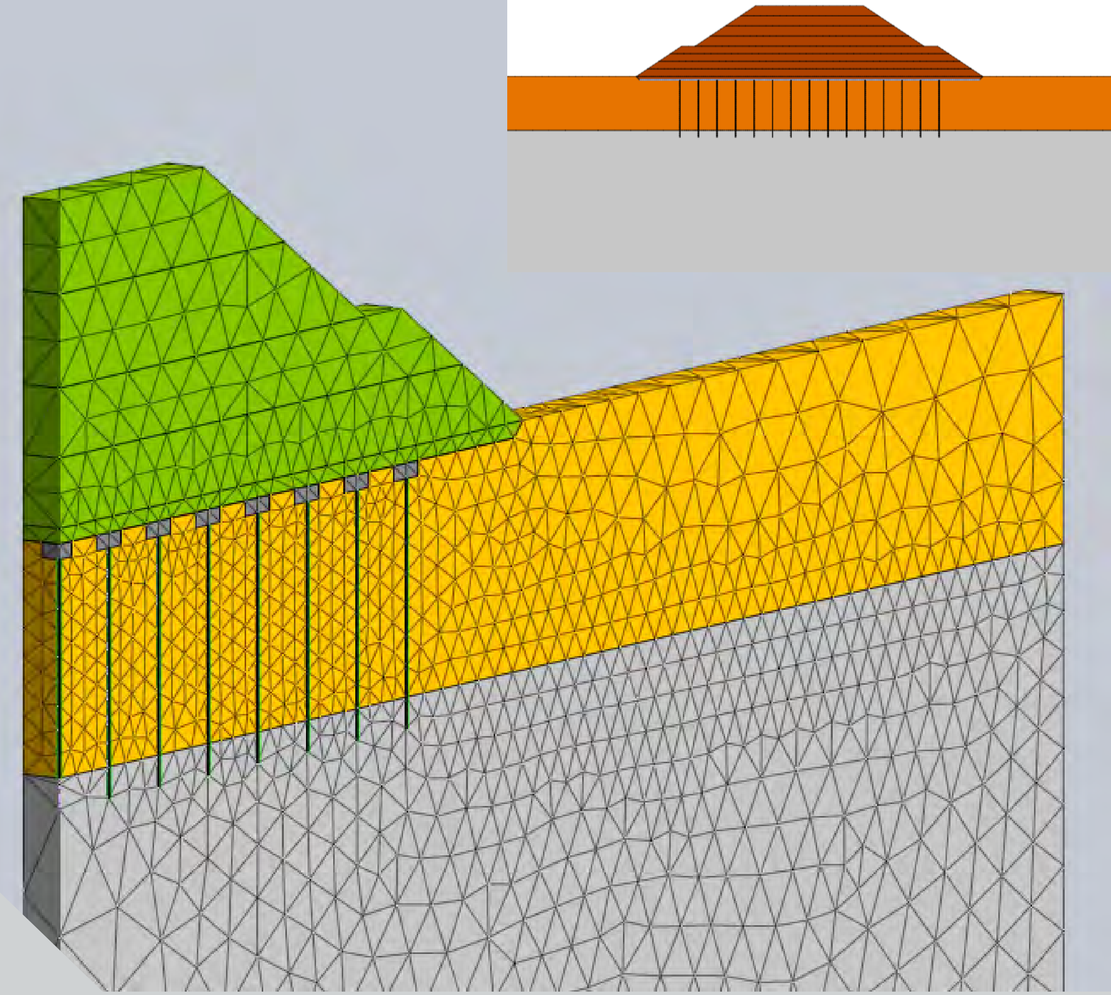
Access Ramp to the New Railway Overpass

Construction works for the connection to SP 34 “Altavilla

The design of the North access ramp to the new railway overpass, which will connect the roundabout of the “ex Faeda” area (along SR11) to SP 34 “Altavilla”, has been executed. The project involved the construction of embankments using recycled granular mixed material, with a maximum height of about 10.6 meters at the north shoulder of the railway overpass, and a slope of the side embankments of 2/3. The planimetric dimensions of the structure, combined with the presence of a cohesive and highly compressible surface layer with a maximum thickness of 8 m, necessitated the execution of ground improvement works to ensure the safety of the structure. Specifically, three types of intervention were chosen:

- for the section with heights between 7-10.6 m, a solution with geosynthetics coupled with CFA piles arranged in a 3x3 m grid was chosen. The purpose of this solution is to transfer loads to the underlying incoherent soils;
- for the section with heights between 4-7 m, a consolidation intervention with prefabricated drains arranged in a 2x2 m grid was planned. The purpose of this solution is to reduce the drainage path of the cohesive layer and thus the consolidation time;
- for the section with heights less than 4 m, a traditional embankment was planned.

For the sizing of the structures, 2D modelling was initially performed, followed by simplified 3D analysis using Midas FEA NX software.

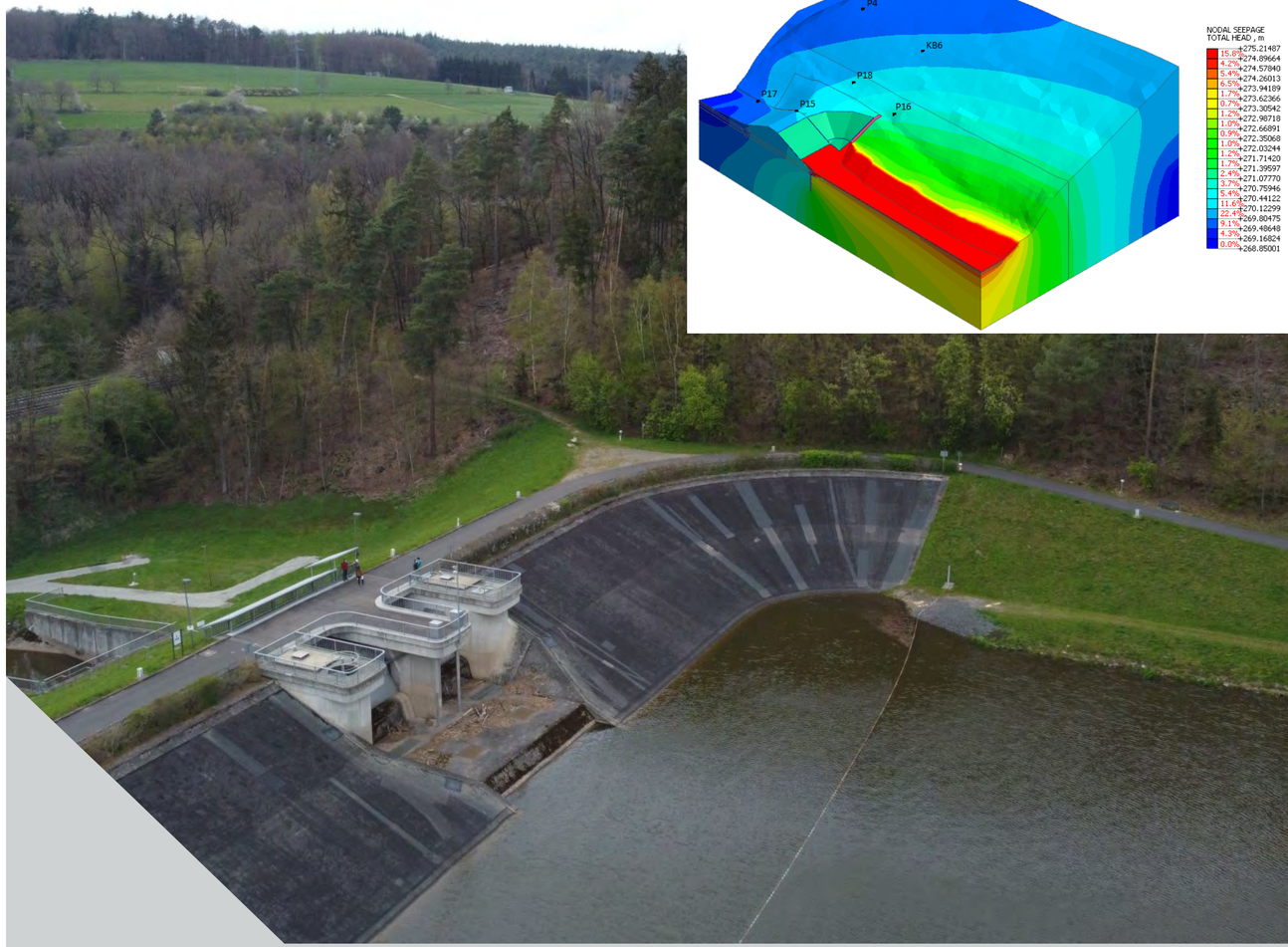


Location:	Veneto, ITALY
Client:	Municipality of Montecchio Maggiore
Year:	2022
Work amount:	€2,6 million
Categories:	IA.03, S.05, V.03
Services provided:	Technical and economic feasibility study, final and executive design, safety coordination in the design phase

Haune Dam

Assignment for hydraulic and geotechnical evaluations on the overall stability of Haune Dam -Germania

The purpose of the project is to thoroughly examine an existing earth dam, in order to provide a clear representation of the structure's condition in terms of safety and consequently offer a general overview useful for planning future maintenance interventions. Based on the existing piezometric data and available photogrammetric surveys, in addition to all the historical documentation, 2D sections were analyzed using finite element software to conduct the main required checks: stability of the dam faces, filtration, siphoning, and erosion checks. Particular attention was paid to the area where the dam body joins the nearby slope: the configuration of the junction is unclear, there are no detailed geotechnical investigations, and the measuring instruments present there show a more marked response to changes in the internal basin level compared to instruments placed at greater distances. For this reason, it was necessary to create a 3D model of the entire slope and the terminal section of the dam, with the aim of studying the hydraulic behavior in the area of interest under normal conditions and during a flood event. The data obtained showed excellent correspondence between the model and reality, thus allowing the identification of an area with anomalous behavior that requires further geotechnical investigations to define a more precise geological model of the subsoil.



Location:	Germany
Client:	Ingenieurburo Professor Kuhlmann
Year:	2021 - 2022
Work amount:	€35,000.00
Categories:	S.05
Services provided:	Framework and geological-geotechnical modeling, safety checks according to German regulations

Piave River

Diaphragm wall construction in the left bank body of the Piave River

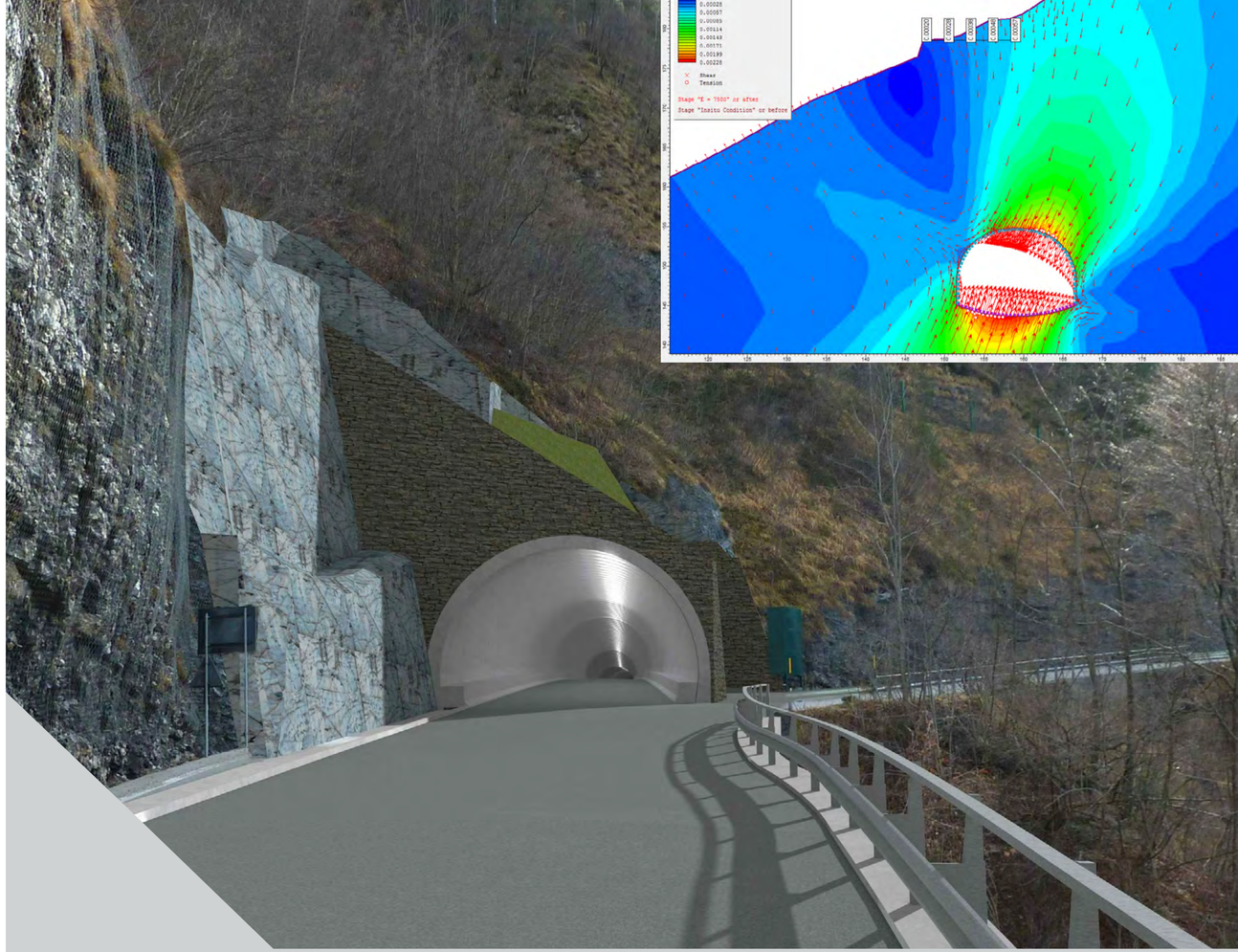
The designed intervention envisaged the construction of a bank diaphragm in the section of the left embankment from the access roundabout to the road bridge in the municipality of Ponte di Piave southward, up to approximately the municipal boundary with Salgareda. The intervention aims to eliminate the possibility of siphoning or infiltration phenomena in the event of a flood of the Piave River. Based on the investigations conducted, the possible hydraulic filtration movements that can occur in the embankment and sub-embankment during flood events were modeled. Stability verification was carried out using the Jambu method, considering circular-shaped surfaces, while for the siphoning phenomenon, the most critical area to this phenomenon, located at the base of the embankment on the countryside side, was analyzed, whether or not the waterproof diaphragm in the project is present. Subsequently, infiltration verification was conducted. The diaphragm was created using jet-grouting technique, a commonly applied design solution in similar cases. Among the peculiarities of the intervention, the interference of the construction site with local traffic, and more precisely with the provincial road SP 34 "Sinistra Piave", is significant as it is a vital artery for road connection to the maritime area of Jesolo.

Location:	Veneto, ITALY
Client:	Veneto Region
Year:	2019 - 2021
Work amount:	€1,8 million
Categories:	D.02, S.05
Services provided:	Final and executive design, safety coordination during design and execution phase

Soffranco Tunnel

New tunnel in Soffranco along SP 251 “of Val di Zoldo and Val Cellina”

The project aims to address the critical issues on the section of SP n° 251, characterized by high tortuosity of the route, poor visibility, narrow roadway, lack of stopping places, and exposure to hydrogeological and avalanche risks. To this end, the construction of a tunnel consisting of a single two-way lane with a total length of about 755 m (of which 30 m artificial and 725 m natural) is planned. The geological-geomechanical study made use of detailed field surveys, the execution of two seismic profiles (MASW, HVSR, and refraction seismics), and four drillings with laboratory tests on the extracted samples to define the geomechanical parameters. Based on the investigations conducted, it was then possible to perform a 2D finite element modeling in a plane strain state, through a continuous model of the rock mass. In the development of the project, particular attention was given to the mountainous context in which the structure is located, finding solutions that were compatible from a landscape and environmental perspective: the two entrances are indeed characterized by significant reshaping of the rock walls, followed by covering and concealing of the walls through the construction of reinforced earth structures up to about 20 m high. For the stability analysis of the excavation fronts at the entrances, it was also possible to take advantage of consultancy from the University of Perugia.



Location:	Veneto, ITALY
Client:	Veneto Strade S.p.A.
Year:	2019 - 2020
Work amount:	€26 million
Categories:	S.05, V.03
Services provided:	Structural engineering, specialist reports, and final design services. Executive design and safety coordination in the design phase

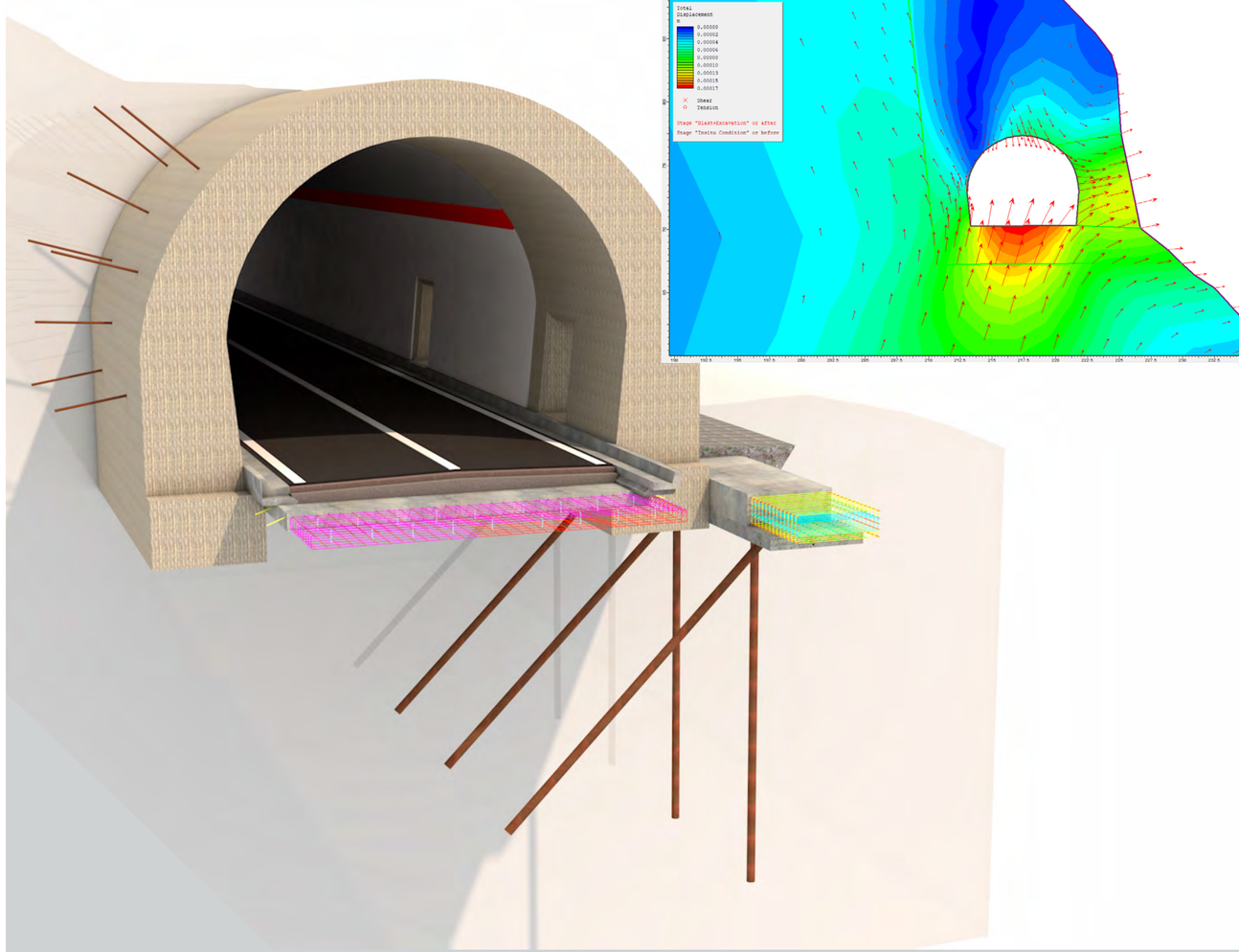
Predil Tunnel

Extraordinary maintenance works for the arrangement of the natural tunnel “Passo Predil”

Following evident settlements with the opening of joints in the rock mass, widespread problems of instability of rock portions as well as a structural insufficiency of the external upright, some extraordinary maintenance interventions of the natural tunnel “Passo Predil” were necessary. The interventions in the project aimed to secure the tunnel, stabilizing the wall rock mass and the walls above the entrances. Interventions for the reinforcement/restoration of the support and lining structures inside the tunnel were also implemented.

Among the main interventions, it is highlighted:

- Nailing of the section with n. 9 nails (in B450C steel and fiberglass) for the stabilization of the mass at the natural tunnel;
- Waterproofing of the external surface of the artificial tunnel, as well as the creation of a curb with a micropile trestle for the stabilization of the section:
- Cleaning and scaling of the walls, stitching in passive B450C steel bars, double twist metal nets, and subhorizontal drainages;
- Sealing cracks with polyurethane resins or shotcrete.



Location:	Friuli-Venezia Giulia, ITALY
Client:	ANAS S.p.A.
Year:	2019 - 2020
Work amount:	€4,9 million
Categories:	V.02, S.03, S.05, D.04
Services provided:	Final and executive design, safety coordination during the design phase

Ski Area Rumerlo accessibility

New access road to the Rumerlo and Piè Tofana ski areas - Plan for interventions for the CORTINA 2021 Ski World Championships

The intervention mainly involves the construction of a road bypass at the Rumerlo finish area, to allow for its modification according to the requirements of the FIS (International Ski Federation).
The BYPASS consists of the construction of a road section with a total length of about 640m and a platform width of 6.0m. The infrastructure design involved numerous complexities, due to the typically mountainous topographic conditions with steeply sloping and partly unstable terrains. To ensure the stability of the slopes in the excavated sections, given the poor bearing capacities of the encountered soils, the design of significant support structures such as reinforced concrete retaining walls, pile foundations, and an anchored micropile berlin wall was necessary. Upstream of the berlin wall, an additional support for the slope located between the bypass and the "Muro de Ra Cioure" ski slope was also designed, made with a green-faced nailed wall.

Location:	Veneto, ITALY
Client:	Fondazione Cortina2021
Year:	2019
Work amount:	€4,840,000.00
Categories:	V.03, S.03, S.04, S.05, D.04, P.02, IA.01
Services provided:	Technical and economic feasibility design, final and executive design, safety coordination during the design phase

F.A.I.T. Underground Parking Garage

Project for the recovery and building redevelopment of the “former Esso Station” and “former Pocol Cable Car Departure Station” area in Cortina d’Ampezzo

The project involved the construction of a multi-story underground parking garage (7 levels) using the top-down technique in the center of Cortina d’Ampezzo. The project was particularly complex both from a structural and geotechnical perspective, due to the nature of the soils (plastic clays related to ancient landslides), the complex multi-aquifer hydrogeological system, and the proximity to existing buildings. ITS specifically oversaw the operational management and part of the geotechnical monitoring. In particular, data related to remote monitoring and spot monitoring with various techniques were correlated. Additionally, the renovation project of the former Pocol Cable Car departure station was carried out, which involved the stabilization of the slope at the base of the building using self-drilling bars.

Location:	Veneto, ITALY
Client:	F.A.I.T S.r.l.
Year:	2015 - 2017
Work amount:	€14,000,000.00
Categories:	S.06
Services provided:	Work supervision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