its Engineering Company

INSPECTION DEPARTMENT

Brochure

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The Department

ITS Inspection offers services for the inspection of major civil engineering works and for managing subsequent knowledge phases: mapping of degradation, diagnostics, execution of instrumental tests, safety checks, and design/installation of monitoring systems. The department's operators are qualified for conducting NDT (Non-Destructive Testing) and Destructive Testing in accordance with UNI EN ISO 9712:2012 and UNI/PdR 56:2019 standards. The strength of ITS Inspection lies in its team, comprising licensed civil structural engineers capable of inspecting and/or testing any civil work. Besides offering access via special means (by-bridge, helicopter, drone, climbing platforms), ITS Inspection also has a team of Engineer-Alpinists qualified for rope access work as per Legislative Decree 81/2008, capable of reaching all parts of the structure, even in rugged and difficult-to-access areas.

Services

The planning of maintenance interventions on strategic and significant works adheres to principles of safety, continuity of operation, and budget planning. From this perspective, the maintenance intervention represents the culmination of a process that begins with inspection and leads to the project. Thus, direct inspection by competent and specialized personnel is crucial for the success of the intervention.

01 Technical Inspections

Technical inspection services conducted on civil engineering works, particularly those where complex access requires the use of alpine equipment or special means.

02 Surveys

Execution of geometric and/or structural surveys using various possible technologies, defined based on the objectives and requirements of the client.

03 Monitoring

Services for the design, installation, and management of monitoring of engineering works, especially those with difficult access.

04 Load Testing and Audits

Dynamic tests with accelerometers at a sampling frequency of 2000Hz. Load tests with portable water mattress kits. Load tests with a very high precision total station.

05 Material Controls and Investigations

Execution of structural tests and investigations on all types of materials, necessary to define the structural details and material properties of the civil works being serviced.

Our Projects

Roana Bridge

Service for performing structural tests at height, carried out by rope climbers on the Granatieri Bridge in Roana

Given the reduced width of the carriageway, it was not possible to use the by-bridge and it was therefore decided to create anchorages in the insole and employ technicians specialized in rope processing by preparing a simple rationalization of the carriageway by establishing the alternating one-way. Surveys conducted on the bridge include both de-structive and non-destructive surveys and could be divided into two macro-groups: Surveys for the survey and verification of geometries and construction details and Surveys for the characterization of materials. The first group is designed to investigate, detect or verify the number of the present longitudinal and transverse irons, the height of the iron cover and the geometric dimensions of the structural elements; the second group is to investigate the resistance characteristics of the materials such as removal of concrete cores and reinforcing bars, SonReb and hardness tests.

Location:	Veneto, ITALY
Client:	Vi.Abilità S.r.l.
Year:	2023
Service amount:	€24.560,00
Services provided:	Pacometric tests, localized scarification for longitudinal and transverse reinforcement survey, micro-core sampling with video-endoscopy, concrete core sampling, carbonation tests, concrete sclerometric tests, SONREB tests, mortar sclerometric tests, double-flat jack tests, hardness tests, reinforcement bar sampling

Rialto Bridge

Monitoring and Preservation of a historic Heritage Landmark

In the initial phase, all structures were geolocated and catalogued through topographic and photogrammetric surveys, with the generation of custom point clouds using drone technology. This phase was essential for the proper compilation of Level 0 inventory sheets in accordance with MIT (Italian Ministry of Infrastructure and Transport) guidelines. The data collection was complemented by a thorough historical, landscape, hydraulic, and geological documentation review for each structure.
In the following phase, certified Level 2 and Level 3 inspectors were deployed on site to complete the Level 1 defect sheets. Using drones and rope-access techniques, they were able to closely inspect every part of the structures.
Upon completion of the Level 0 and Level 1 sheets in compliance with ministerial standards, all structures were integrated into a dedicated QGIS environment. This geospatial platform allowed for interactive querying by location and structural attributes, consolidating all technical and inspection data gathered throughout the service.

Location:	Veneto, ITALY
Client:	City of Venice
Year:	2022
Service amount:	€20.524,11
Services provided:	High-precision topographic survey campaign, data analysis and comparison, technical consulting for preventive maintenance planning

Messina–Palermo Highway

Census, primary visual inspections, and determination of the state of conservation of bridges and viaducts on the Messina-Palermo Highway

In the initial phase all the works were geolocated and recorded using topographic and photo-gram surveys with the return of ad hoc point clouds thanks also to the use of drones. This phase, along with a historical, landscape, hydraulic, and geological document research for each individual structure, was important for compiling Level 0 census sheets following MIT guidelines. The next phase involved the Level 2 and 3 inspectors in the field, for the compilation of the Level 1 defect sheets, who through the use of drones and mountaineering techniques were able to inspect and closely view every part of the work in question.

Once the records complying with the Ministerial regulations were completed, a special Bridge-Management-System (BMS) in the QGIS environment, where all works in a query-able format according to their geographic locations and properties intrinsic.

Location:	Sicily, ITALY
Client:	CAS - Consortium for Sicilian Highways
Year:	2022
Service amount:	€403.380,00
Services provided:	Census, primary visual inspections, determination of the state of conservation according to the guidelines of the ministry of infrastructure and transport

Giaveno and Gassino Bridges

Multilevel analysis: documentary research, inspections, investigation plan, support investigations, report on the state of the structure, and maintenance plan update

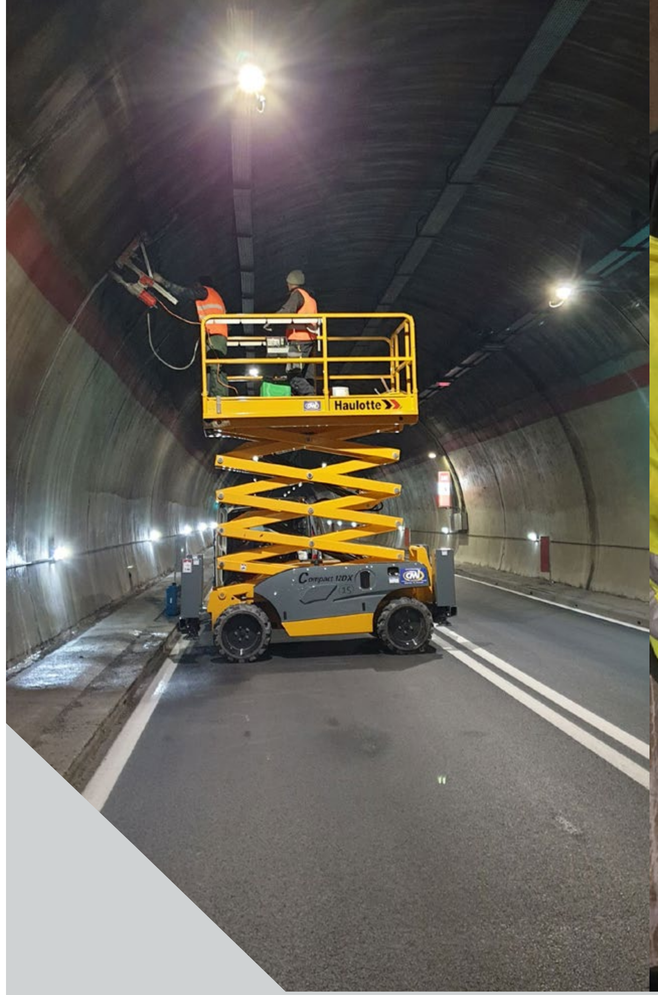
The interventions were based on a multilevel approach following the guidelines of the Ministry of Infrastructure and Transport. For each structure, historical document research, Level 0 census, Level 1 visual inspection conducted by engineers from the Inspection team qualified as Level 2 and 3 bridge and walkway inspectors, the use of mobile APRs (Drones) even in critical areas to reach less accessible areas, and expertise in reaching confined spaces, such as the interior of decks assembled for post-tensioned cable concretes. Subsequently, a plan for special investigations was developed to obtain a correct assessment of the defectiveness of post-tensioned pre-compression cables, in the case of the Gassino Bridge, and of the heads of the stays and the antenna, in the Giaveno Bridge, to reach Level 4 as required by regulations in the case of post-tensioned structures. Finally, operational direction in situ investigations was provided, with preparation of the report on the state of the work in accordance with guidelines and updating the plan of maintenance for the two works.

Location:	Piedmont, ITALY
Client:	Metropolitan City of Turin
Year:	2022
Service amount:	€37.730,00
Services provided:	Multi-level analysis including census, inspections, survey plan drafting, on-site survey assistance, work status report, maintenance plan update

ANAS Framework Agreement - Tunnels Inspections

Main and in-depth inspections of tunnels of the Veneto Region Network Management Area

The intervention carried out concerns the visual and in-depth inspections of some tunnels on the ANAS roads of the Veneto Region. In particular, a first phase of geolocation of the works subject to inspection has been planned with the night closures of the tunnel to reduce as much as possible the inconvenience to normal road life (this service was also performed by ITS technicians by virtue of the technical employees trained and licensed to perform such road maneuvers). A subsequent phase involved the field of inspection according to ANAS internal guidelines and complying with MIT LL.GG, including visual inspection and a series of tests of both topographic and structural survey with: georadar tests, pacometric tests, ultrasonic tests, sclerometric
tests, sonreb tests, concrete core samples, survey and depth of detected cracks, microcarots with videoendoscopies. In the final phase, a report was prepared including all of tests and services performed, along with a series of graphical drawings suitable for obtaining an objective view of the inspection that took place and to laboratory certificates of the tests performed.

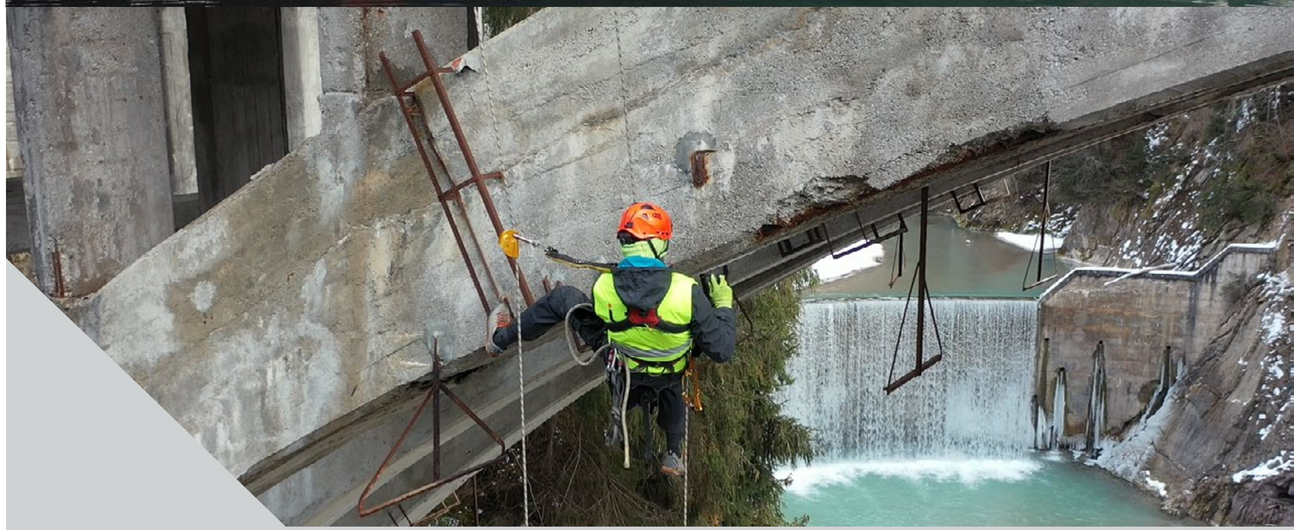


Location:	Veneto, ITALY
Client:	ANAS S.p.A.
Year:	2021
Service amount:	€330.000,00
Services provided:	Surveys, inspections, investigations, seismic vulnerability, and technical economic feasibility design

ANAS Framework Agreement - Bridges Inspections

Main inspection services of bridges, viaducts and tunnels within the ANAS Territorial Structures in Lombardy, Friuli Venezia Giulia and Veneto Regions

The intervention involves visual and in-depth inspections of some tunnels on ANAS roads in the Veneto Region. Specifically in the first phase, all the interventions were located in order to catalog all possible problems. The inspection phase was carried out with the support of a digital camera and an Ipad equipped with a BMS (Bridge Management System)application. The subsequent phase involved on-site inspection following ANAS internal guidelines and compliant with the regulations of the Ministry of Infrastructure and Transport (MIT). In the post processing, the return of the inspections was processed by preparing a report detailed for each individual element of the inspected works with the defects found and their cause of origin. For completeness, plans and sections were attached schematic of the works, showing the optical cones representing the points of taking photos, and the defects at the point where they were detected on the work.
Based on the findings of the visual inspections and in particular in order to further investigate possible critical issues, some investigations were sub-sequently proposed and carried out structural targeted, to assess in a concrete way and with direct feedback, the actual state of degradation of some structural elements of the selected works.



Location:	Veneto, ITALY
Client:	ANAS S.p.A.
Year:	2021
Service amount:	€2.000.000,00
Services provided:	Surveys, inspections, investigations, seismic vulnerability, and technical-economic feasibility design

Messina–Catania Highway

Census, primary visual inspections and determination of the state of conservation of bridges and viaducts on the Messina-Catania Highway

For proper planning, all works were pre-viewed and geolocated via GPS coordinates by inserting them into a Google Earth file that served as a reference for any problem of access or interference with other minor works and for all subsequent stages. The intervention carried out included a first phase of work in which the surveys were carried out with total station and point clouds, subsequently the visual inspections were executed according to the LL.GG. of the MIT passing any type of orographic or artificial obstacle through the use of drones and mountaineering techniques. In the post-processing phase, the data sourced for the compilation of the census by means of boundary data sourced though painstaking research on the historical, landscape, hydraulic and geological documentation of the area, performed for each work. Subsequently, for the works that highlighted the need for more accurate verification, the investigation plans were carried out and the related tests as well. Each phase was done in accordance with the 'Guidelines for Risk Classification and Management, Safety Assessment and Monitoring of Existing Bridges' of the Ministry of Infrastructure and Transport.

Location:	Sicily, ITALY
Client:	CAS - Consortium for Sicilian Highways
Year:	2021
Service amount:	€816.281,00
Services provided:	Surveys, census, primary visual inspections, determination of the state of conservation according to the guidelines of the ministry of infrastructure and transport

Italferr Framework Agreement

Structural monitoring activities, execution of destructive and non-destructive investigations and detailed geometric surveys on existing structures

The Inspection team worked from time to time with the contacts of Italferr (the engineering company of Ferrovie dello Stato Italiane Group) with initial coordination phases in which operational procedures and feasibility of the investigation plans were discussed, optimizing the interventions and tests to be carried out according to the individual typological interventions, thanks to the well-standing and long experience of the team in the field of investigations. Geometric surveys and structural investigations were carried out on several types of structures, both on buildings and warehouses of the maintenance department, and on the works along the railway lines such as bridges and sub-via managed by Italferr throughout the national territory. In contexts sometimes prohibitive for the unique morphological conditions of the sites, where from time to time the most appropriate solutions have been found to be used, such as the use of boats to inspect and investigate pond piles, the adoption of work at night to limit the inconvenience attributable to the interruptions of railway lines.

Location:	Marche - Lombardia - Sicilia- Calabria - Friuli-Venezia Giulia, ITALY
Client:	Italferr S.p.A.
Year:	2020
Service amount:	F.A.1 = €240.000,00 - F.A.2 = €400.000,00
Services provided:	Surveys and investigations, static and seismic vulnerability checks, monitoring

Agency of State Property - Masonry Inspections

Geometric, architectural and technological surveys with structural investigations and BIM models, energy diagnosis and vulnerability analysis

The Agenzia del Demanio (Property Agency) owns a significant portion of the State owned properties in Italy. It is crucial to have a clear and comprehensive overview of the static and seismic conditions of these various buildings and to be aware of any need for seismic retrofitting or improvement. The Inspection team conducted site visits to all the structures to identify any critical issues and develop customized investigation plans. Detailed topographic surveys were conducted on every type of building using total stations and laser scanners, with the data returned via Revit 3D, from which the plans were derived to create the necessary investigation plan to achieve a Level 3 of knowledge. Investigations were carried out on all types of structures, whether masonry, reinforced concrete, or steel, by technicians qualified for both destructive and nondestructive testing (NDT). Using ITS equipment, tests such as double and single flat jack tests, penetrometric tests, core drilling, localized scabbling, sclerometric tests, ultrasonic tests, rebar sampling, load tests, and foundation coring were conducted. The data obtained were used for structural modeling and vulnerability analysis, with the final phase involving the preparation of a PFTE based on the results.

Location:	Piedmont, ITALY
Client:	Agenzia del Demanio - Regional Directorate of Piedmont and Valle d'Aosta
Year:	2019
Service amount:	€593.000,00
Services provided:	Topographic surveys, preparation of investigation plan, execution of investigations with data return and BIM modeling, vulnerability analysis, and economic feasibility study

Road Bridges and Viaducts in the Province of Pescara

Inspection, investigation, and verification of static and seismic vulnerability of infrastructure in the Province of Pescara

The service included a seismic analysis of 13 structures in the Province of Pescara, independently performing activities such as surveys, investigations, on-site and laboratory tests, monitoring, and sampling for the characterization of existing works of art on the road network in the Province of Pescara. The investigations were carried out on 11 bridges and 2 viaducts. In various cases, detailed structural surveys were conducted using a mechanical total station of the Trimble M3 type, equipped with high-precision Trimble DR long-range survey technology to obtain highly reliable measurements. Various types of tests were conducted to achieve a high level of accuracy (LC3). For example, on structures: core drilling, micro-core drilling, reinforcement sampling, pacometric testing. On the subsoil: seismic surveys with Multichannel Analysis of Surface Waves (MASW), passive seismic investigations (Horizontal-to-Vertical Spectral Ratio - HVSR), and geomechanical surveys. For each structure, vulnerability checks for seismic actions were carried out with FEM modeling, created using MIDAS GEN software, involving three-dimensional modeling of structures based on surveyed geometries, using exclusively fiber-modeled beam elements so that they capture the nonlinearity of materials and have the same mechanical characteristics as those detected during on-site investigations.

Location:	Abruzzo, ITALY
Client:	Province of Pescara
Year:	2017
Service amount:	€72.405,00
Services provided:	Survey, inspection, and investigation, seismic vulnerability assessment

San Michele Bridge

Bridge's structural safety verification

The assignment was structured into the following operational phases: collection and analysis of available documentation; development of a preliminary FEM model to support the preparation of a targeted investigation plan and a detailed operational schedule.
A comprehensive inspection campaign was carried out to survey and map the actual state of deterioration of all parts of the structure. The inspection was conducted by structural engineers using rope-access techniques, ensuring proximity of less than 1.5 meters to all structural elements.
Investigations and tests were performed on the main structural components with the objective of achieving a Level of Knowledge 3 (LC3), in accordance with current regulations for existing bridges. Mechanical characterization included:

- Destructive testing on structural steel (sampling of bars and rivets; laboratory tests on tensile strength, shear strength, toughness, and chemical composition);
- Non-destructive testing on structural steel (Visual Testing – VT, Magnetic Particle Testing – MT);
- Foundation investigations (core sampling and uniaxial compression tests);
- Asphalt surveys (drilling and thickness measurements).

The final phase of the service involved the definition of the structure's vulnerability and safety levels under various load combinations.

Location:	Lombardy, ITALY
Client:	RFI S.p.A.
Year:	2015 - 2016
Service amount:	€389.800,00
Services provided:	Inspection and investigation, verification of static and seismic vulnerability, structural and functional adaptation

Livenza Bridge

Inspections of the structural elements of the cable-stayed bridge along the “di Meduna” road over the Livenza river in the municipalities of Motta and Meduna di Livenza

The inspection activities carried out can be summarized in the following points:

- Visual inspection of all the anchor tie rods placed at the shoulder Motta side of Livenza;
- Visual inspection of the steel at the antenna head;
- Visual inspection of all the cables with restoration of the sleeves that have had slips on the protective sheaths of the cables;
- Control of the base and top heads with restoration/replacement of the protective grease;
- Dynamic control of all the cables with the indirect determination of the internal tension;
- Visual inspection of the expansion joints;
- Visual inspection of the support devices.

All these inspections were carried out by structural engineers qualified for non-destructive control on 2nd level steels pursuant to the UNI EN ISO 9712:2012 standard and qualified for rope work pursuant to Legislative Decree 91 of 9/4/2008.

Location:	Veneto, ITALY
Client:	Province of Treviso
Year:	2015
Service amount:	€35.900,00
Services provided:	Inspection and investigation

Persano Dam

Investigation, seismic vulnerability and monitoring on the Persano crossbar

In the first phase, a historical-critical analysis identified the existing structural system and its state of stress, then we proceeded with the geometric-structural survey to develop an accurate model of calculation of the structure.
Through mechanical characterization of the materials with specific on-site investigations that took place using mountaineering techniques and laboratory tests in order to achieve the most accurate level of knowledge possible, it was arrived at the definition of the actions and related structural analysis with the determination of the vulnerability of the existing structure system.

Location:	Campania, ITALY
Client:	Consortium for land reclamation on the right side of the Sele River
Year:	2013
Service amount:	€40.000,00
Services provided:	Structural investigations using alpine techniques for seismic vulnerability classification and subsequent installation of the monitoring system

Chimney of the Former Silk Factory Ancillotto

Renovation and arrangement with seismic adjustment of the former silk factory, re-development of external areas, and structural adaptation of the chimney

The work was aimed at developing the exhibition and service structures used by the company "Santa Lucia Fiere". The project consists of a renovation and conservation intervention for the reuse of the west pavilion of 6,910.2 cubic meter and the construction of a new 3,740 cubic meter building that functionally connects the two existing pavilions. The scope of the project includes the unbuilt space between the two pavilions, the connecting body to the north, and Via Mareno to the south. The adaptation project (after modeling and dynamic analysis of the structure) aimed to ensure the static and seismic safety of the chimney by intervening with two combined solutions: increasing the load-bearing capacity of the masonry that forms the shaft of the tower and reinforcing the foundation system capable of transmitting the stresses from its own weight and wind to the ground. The increase in the load-bearing capacity of the masonry was possible thanks to a new pre-compression system with high-strength harmonic steel strand cables in two overlapping sets, anchored at the base and tensioned at two different heights along the shaft. The new foundations were made with micro-piles connected at the top and anchored to the existing raft via a network of reinforced concrete beams.

Location:	Veneto, ITALY
Client:	Municipality of Santa Lucia di Piave
Year:	2012 - 2014
Service amount:	€2.017.000,00
Services provided:	Technical and economic feasibility study, final design, executive design, safety coordination during design phase, work management

Cadore Bridge

Structural characterization, new monitoring system and extraordinary maintenance work of the Cadore Bridge on the Piave River

In a first phase the instrumental diagnostic campaign have been planned and the detailed surveys of the entire work (geometry, structural construction details) began. In addition, through the instrumental diagnostic campaign, it was possible to define the properties of the structural materials and the soil of sediments, both through sampling and destructive testing, and through non-destructive checks on the materials.
Thereafter, the dynamic characterization of the artifact under ambient vibration conditions was performed to determine the frequencies of the main modes of vibration of the bridge and access viaducts, associated with their modal deforms. A more detailed bridge model was developed, by which the Non-Linear Dynamic analysis was conducted.

Location:	Veneto, ITALY
Client:	ANAS S.p.A.
Year:	2012
Service amount:	€107.430,00
Services provided:	Structural investigation campaign, dynamic characterization, new monitoring system design and implementation

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