

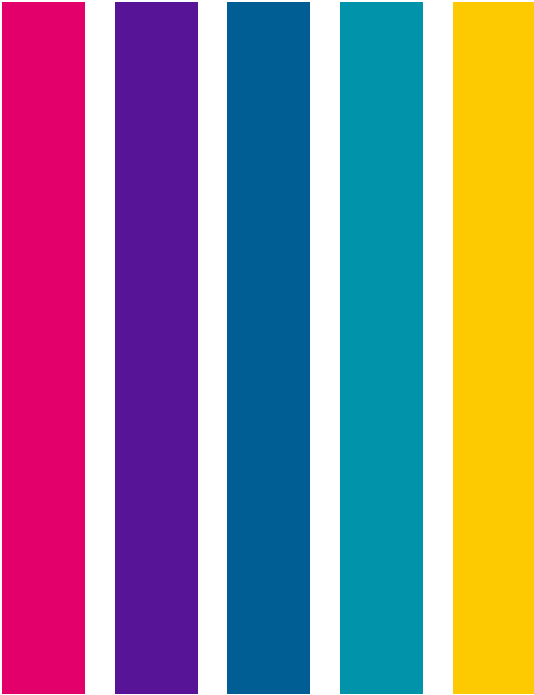


EXPERTISE, ENGINEERING AND CONSULTANCY

For safety and
sustainable mobility

GESTE

MOBILITY & SAFETY



Our expertise for sustainable connections

The exciting history of GESTE Engineering has been achieving positive results for more than 15 years. The engineering consultancy firm, established in 1999 to work on scientific research projects, lives on the commitment of our employees and the confidence of our clients and partners. As we continue to grow, our team is expanding, our core businesses are branching out, and the region we serve is widening.

We know we can depend on a brilliant team of engineers, technicians and administrative personnel, who give the company its expertise.

We work daily to create lasting connections between ourselves, our partners and our clients, as well as between people in general, by participating in sustainable infrastructure projects, particularly for road, rail and urban transportation. Our daily commitment remains faithful to our original values: using innovation and modern technologies to complete our clients' projects on time with high quality standards, serving human needs for mobility and safety while protecting the environment in which we live.

In this cutting-edge field of engineering, experience is essential: our strength lies in being able to unite experts in support of promising young engineers, thereby guaranteeing the transfer of knowledge. Our strength also lies in the quality and the professionalism of our services, the enthusiasm that we put into our activities and the loyalty that our clients reward us with. Finally, our strength lies in our participation in local projects, no matter how small, as well as more large-scale, complex and world-famous projects in Switzerland, throughout Europe and on other continents. This strength allows us to confidently expand and establish ourselves in a sector often dominated by huge engineering groups.



MICHELE MOSSI
Chairman of the Board of Directors

Domains of activities

Our experience in large projects in Switzerland and worldwide lets us actively support our clients in the development of infrastructure and equipment, by offering custom-built, original and innovative solutions, and by adopting a comprehensive, multidisciplinary approach.

To better meet to our clients' needs, we organise our consulting-engineering services into five sectors of activities, managed as business units.

RAIL

URBAN

ROAD

RAMS

FLOWS

Although we primarily offer our services in the transport sector, we do work in other domains as well, such as construction and energy:



- RAIL TRANSPORT
infrastructure and equipment
- URBAN TRANSPORT
infrastructure and equipment
- ROAD TRANSPORT
infrastructure and equipment
- OTHER SYSTEMS
infrastructure and equipment



RAIL
RAIL TRANSPORT
INFRASTRUCTURE AND
EQUIPMENT

RAIL

Railway companies are the crown jewel of sustainable transport. Today, even as they are evolving faster than ever, they also face a sizeable challenge: maintaining an ageing network while also meeting an important increase in demand that requires the construction of new lines and improving the performance of existing infrastructure.

To respond efficiently to this challenge, railway infrastructure and operation companies must be able to rely on an experienced team of project managers, specialists and engineers in railway technology and infrastructure, who know how to analyse the actual status of the existing network, assess what is needed to meet demand, and plan construction works that will have the desired impact. A team proficient in both the latest technologies and those older, now approaching obsolescence. A team that can also work on projects where rail service is already operating, whilst maintaining the safety and the reliability of traffic, minimising impact on that existing service and coming in under budget and on schedule. Consequently, the involvement of experts in all railway domains, the good planning and scheduling of the phases of the work, the multi-disciplinary management of interfaces as well as the proficiency in signalling and safety installations – which together form the core of railway operations – each play a major role in the success of such projects.

Thanks to their years of experience in railway companies and their involvement in numerous rail projects, our specialists, engineers and technicians help our younger engineers hone their skills and allow us to confidently tackle our clients' challenges. They provide expert advices, engineering and consultancy services in various railway technical professions, as well as the historical profession of safety installations and signalling, whether trackside (light signalling) or on-board (ERTMS, CBTC).

DOMAINS OF ACTIVITIES

- High-speed railway lines
- Intercity railway lines
- Regional railway lines
- Metre gauge railway lines
- Rack railway lines

CORE COMPETENCIES

- Systems engineering, work planning and scheduling
- ERTMS and interoperability
- Remote controls, signalling and safety installations
- Overhead line, power supply and cables
- Tracks
- Operation and maintenance
- Safety and ventilation



**ALPTRANSIT (CH)
NEW RAILWAY BASE LINE THROUGH THE ALPS
GOTTHARD AND CENERI**

Built under the oversight of AlpTransit Gotthard AG, by 2017 and 2019 the Gotthard (57 km) and Ceneri (15.5 km) base tunnels will form the centrepieces of the north-south railway link connecting Milan to Basel. The new base line, complying with European interoperability standards, including the ERTMS-L2 signalling system, will be used for both passenger and freight service. The passenger trains will be capable of reaching 250 km/h, while freight trains will run up to 120 km/h.

SERVICES OF GESTE

2004–2019

Since 2004, we have participated in several components of the construction of the new railway link through the Alps, both alone and as part of a consortium.

In consortium, we undertook the technical management of the Signalling group. As such, we carry out the project and call for tenders for the signalling system and the line safety equipment (ETCS-L2). We are helping to write their technical and operating specifications, define the operational processes, plan for the commissioning stage, conduct laboratory and on-site tests, and draft the safety cases.

We are also supporting the general contractor on railway and non-railway technology as well as on the coordination of interface management and RAMS procedures between the various technical domains.



**SBB-CFF-FFS (CH)
CAPACITY INCREASE OF THE GENEVA
RAILWAY JUNCTION**

In order to double the seating capacity of long-distance transport and increase the frequency of regional service to once every 15 minutes, the Swiss Federal Railways SBB and the Cantons Vaud and Geneva are leading several projects involving significant modifications to Geneva-Cornavin station as well as the Coppet-Geneva, Geneva-Airport and Geneva-La Plaine segments. Concurrently, they are constructing the CEVA cross-border link. These projects concern both the infrastructure itself and railway technology, in particular the signalling and safety installations of Swiss and French type.

SERVICES OF GESTE

2008–2017

Since 2008, we have been working on the Geneva junction projects in different phases and roles.

We led the preliminary study on the capacity increase for Geneva-Cornavin station.

For the change to every-15-minutes service on the Coppet-Geneva segment, our consortium carried out the construction project and is managing the engineering and the implementation until the commissioning.

To modernise the signalling and safety installations and automate the railway junction, we planned and organised the commissioning of the interlocking at Geneva La Praille and Châtelaine, collaborated with SNCF to oversee the deployment of the KVB throughout the Geneva region and proposed a block concept for the La Plaine Franco-Swiss interface.

We are also the safety engineer on the CEVA project.

**BIÈRE – APPLES – MORGES (CH)
REGIONAL METRE GAUGE RAILWAY LINE**



SERVICE INCREASE TO EVERY 30 MINUTES

Design and construction management for a new crossing station at Chigny (systems engineering, railway infrastructure and equipment, civil engineering).

**PORT OF LE HAVRE (F)
MULTI-MODAL CONNECTION**



RAILWAY JUNCTION

Design and construction management for railway signalling in the project to connect the new multi-modal junction to the existing port rail network.

**SBB-CFF-FFS (CH)
SAFETY IMPROVEMENT OF THE SWISS NETWORK**



RAILWAY SIGNALLING

Expert advices for the planning, implementation and commissioning phases of signalling projects (expert recognised by the Swiss Federal Office of Transport).

**RFF – SNCF (F)
AUDIT OF THE FRENCH RAIL NETWORK**



SIGNALLING AND TRACK EQUIPMENT

Audit of signalling and safety installations; expertise in the ERTMS deployment; recommendations for the maintenance of switches following the accident at Brétigny.

**LAUSANNE – ÉCHALLENS – BERCHER (CH)
METRE GAUGE TRAM-TRAIN LINE**



SERVICE INCREASE TO EVERY 15 MINUTES

Design and construction management for the safety improvement, the automation and the full renewal of the signalling and safety installations.

**EUROPEAN COMMISSION, ERA, EPSF, SBB
ERTMS DEPLOYMENT**



STRATEGY AND EXPERT ADVICES

Assessment of EU-ERTMS projects; technical, interoperability and deployment expert advices relating to the ERTMS in France; migration strategy in CH.



URBAN
URBAN TRANSPORT
INFRASTRUCTURE AND
EQUIPMENT

URBAN

Urban densification, the growth in human transport, the saturation of road traffic and air pollution are issues faced by many cities, both large and small. To confront these challenges, local authorities are driven to improve existing urban transport systems and build new metro, tram and bus lines, whilst developing routes for sustainable mobility as well.

Urban transport operators are no longer simply being asked to improve their performance and ensure the operation and maintenance of existing lines that get more challenging by the day. They are also being asked by public authorities to carry out a new important mission: improve the services and expand the network. To accomplish this double mission whilst also managing projects of increasing complexity, they are seeking out competent and effective external support that can quickly understand their needs and mobilise all the resources and expertise that will be required. This external support has to apply skills in the latest technologies and managerial methods that are right for the urban network and for the provided services, both at present and in the future.

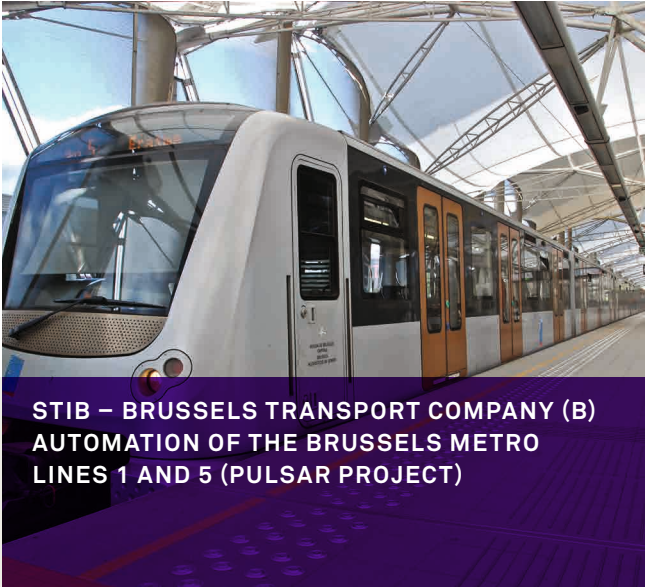
Against this backdrop, our team of specialists, engineers and technicians – with international experience also on both the industrial and operational levels – is perfectly capable of meeting the requirements of urban transport companies, by virtue of its ability to understand their requirements as well as industrial products and processes. We provide expert advices, engineering and consultancy services for metro, tram, tram-train and bus lines and depots. Our emphasis is on engineering and system architecture, signalling and automation, whether driverless or not (STO, DTO, UTO), management systems and control centres, telecommunications, safety (RAMS) and ventilation. Our experience puts us among the leaders in these domains.

DOMAINS OF ACTIVITIES

- Metros, whether driverless or not
- Tramways
- Tram-trains
- Buses and Bus Rapid Transit (BRT)
- Trolley buses
- Depots

CORE COMPETENCIES

- Systems engineering and architecture
- Automation, signalling and remote controls
- Control centres and SCADA
- Overhead line, power supply and cables
- Tracks
- Platform screen doors
- Operation and maintenance
- Safety and ventilation



**STIB – BRUSSELS TRANSPORT COMPANY (B)
AUTOMATION OF THE BRUSSELS METRO
LINES 1 AND 5 (PULSAR PROJECT)**

STIB has launched a large modernisation project for the Brussels metro lines 1 and 5, due to be completed by 2020, then lines 2 and 6, in order to increase transport capacity and aim a headway shorter than 2 minutes. The project includes the refurbishment of the train cars and the signalling and monitoring equipment, choosing a CBTC with integrated automatic operation, outfitting the train platforms with platform screen doors and creating a new depot and repair shop at the south-west terminus of line 5 to support the additional trains.

SERVICES OF GESTE

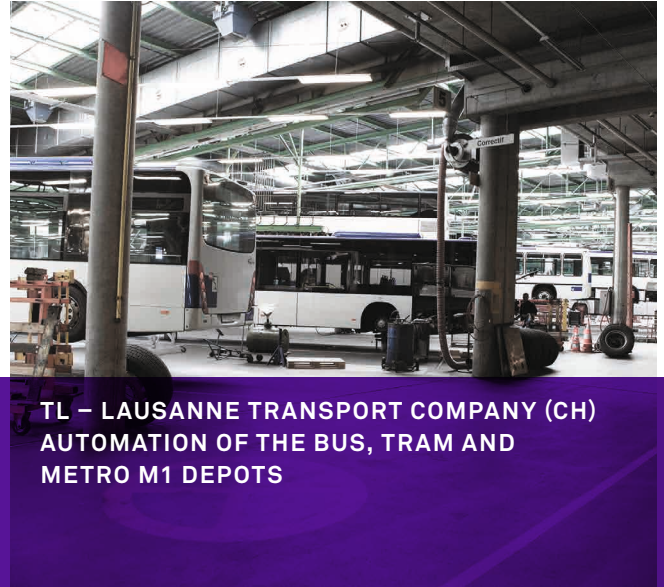
2012 – 2024

Since 2012, as part of a consortium, we have assisted the Brussels transport company STIB with experienced system consultants.

Within this framework, we work in Brussels as concept manager overseeing STIB's system architect team, as well as RAM, CBTC and automation expert.

We are responsible for writing the specifications for the most important contracts of the Pulsar project and for reviewing the tenders submitted.

With respect to installing platform screen doors in the stations, we carried out the aerodynamic studies to evaluate pressure loads on these doors when trains go by.



**TL – LAUSANNE TRANSPORT COMPANY (CH)
AUTOMATION OF THE BUS, TRAM AND
METRO M1 DEPOTS**

tl, the public transport company of Lausanne, operates a network of 10 trolley bus lines, 25 bus lines, 2 metro lines, 1 tram-train line (LEB) and, soon, a new tram line. They therefore manage more than 250 vehicles daily and currently have 5 depots (2 for buses, 2 for metros and 1 for the LEB). The project aims to create a depot management support system (SAGD) that will make it possible to plan, monitor, manage, automatically control and assist in the storage and restarting of the vehicles in the depots.

SERVICES OF GESTE

2013 – 2015

We work in direct concert with tl as general contractor for the automation project.

We defined the general concept of the depot management support system (SAGD) for the bus depots at both Perrelet and La Borde and studied whether this concept could be expanded to the metro m1 depots in Écublens and the tram-train LEB in Échallens. We have analysed the modalities of automatic guidance in the depots of the trolley pole of the trolley buses and whether the drivers' tablet computers could be used for signing on when starting a shift and for storing route information.

We are continuing this work in the project phase by conducting the system studies, managing interfaces and writing the specifications for the IT tools. This work will be followed by the tendering, implementation, test and commissioning phases.



**LAUSANNE (CH)
NEW TRAMWAY LINE T1**

DESIGN AND CONSTRUCTION MANAGEMENT

Member of the consortia responsible for serving as design and construction manager for infrastructure and HVAC, power and overhead line, tracks and signalling.



**PARIS (F)
NEXT AND EXTENSION OF THE RER EOLE**

NEW OPERATIONAL SYSTEM

Study for lots NEXT-ERTMS dynamic transition, coupling/uncoupling and powering up the trains, compatibility of Eurobalises, track-train communication system.



**LYON (F)
MODERNISATION OF THE LINES A AND B**

NEW AUTOMATIC TRAIN CONTROL

Technical assistance in the domains of systems engineering, automation, safety and signalling in the design, installation, testing and commissioning phases.



**PARIS (F)
NEW METRO RING GRAND PARIS**

SYSTEM, CTC, AERODYNAMICS, VENTILATION

Design and construction manager of on-board ATC, drafting the specifications for the centralised traffic control and ATS; airflow and ventilation in stations.



**LAUSANNE (CH)
METRO LINE M1**

MODERNISATION OF THE LINE AND NEW DEPOT

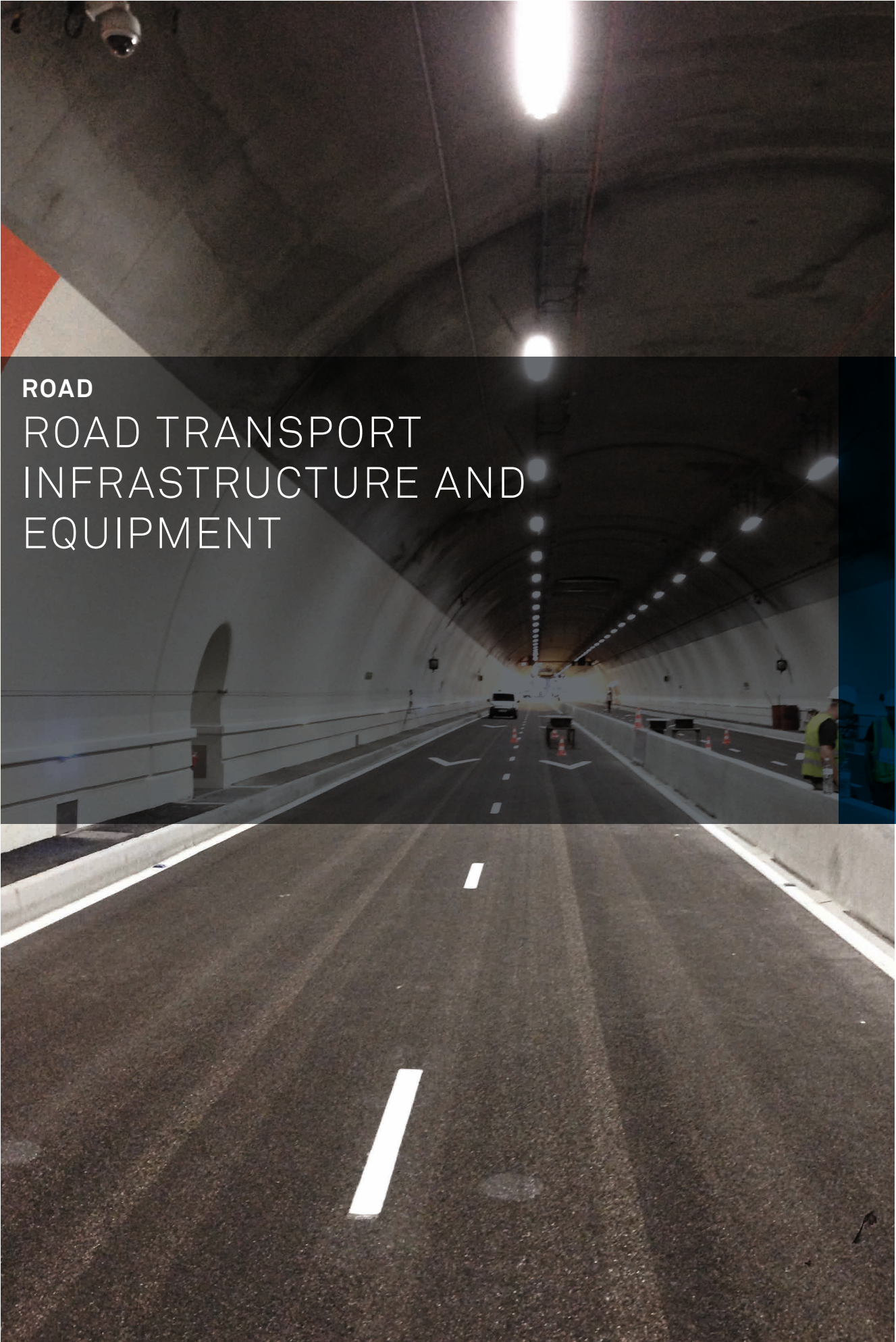
Full audit of the line, planning and coordination of the line upgrade, member of the consortium responsible for the extension and electrification of the depot.



**LAUSANNE (CH)
NEW DRIVERLESS METRO LINE M2**

SYSTEM, SAFETY, AUTOMATION

Management of the systems engineering, system safety, signalling, automation, radio, remote control and ventilation.



ROAD
ROAD TRANSPORT
INFRASTRUCTURE AND
EQUIPMENT

ROAD

In response to the increased mobility, rapid urban densification, natural obstacles, noise pollution and environmental impacts generated by motorised traffic, roads are using more and longer tunnel sections than before. Furthermore, the coexistence on country and city roads of different modes of transportation – cars, bicycles, trams, trains – means that special attention must be paid to safety. Additionally, the high increase in traffic is encouraging public officials to modernise existing infrastructure, particularly their electro-mechanical equipment, so as to meet growing demand and fulfil new requirements, especially those relating to safety.

Major maintenance, repair and construction work on tunnels is ongoing, while others are already planned for the years to come. These works have and will continue to have a non-negligible impact on road traffic and also involve a large financial and human investment. In order to optimise this investment, a prior risk and needs assessment, particularly in terms of safety and equipment, as well as appropriate design of the equipment used and concerted planning of the work, are essential.

Our experienced specialists, whether alone or accompanied by partners who broaden the range of services we offer, are in a position to perform this prior assessment and consequently define the needs in terms of electromechanical equipment, ventilation and safety. Next we cover all phases of the project, from design to commissioning tests, first for safety and tunnel ventilation equipment – our historic activity – but also for the other electromechanical equipment as well as for level crossings.

DOMAINS OF ACTIVITIES

- Tunnels
- Level crossings
- Car parks

CORE COMPETENCIES

- Ventilation
- Fire detection and firefighting equipment
- Signalling, safety installations, telecommunication
- Electromechanical equipment
- Control centre and SCADA
- Power and cables
- Risks and safety



As part of the development of Abu Dhabi's airport infrastructure, a new cut-and-cover road tunnel will link the old infrastructure to the new one by 2017. This tunnel is some 900 m long and consists of two one-way dual-lane tubes and a utility tunnel. It is strictly reserved for airport traffic for the transport of passengers and goods, as well as for service vehicles.

SERVICES OF GESTE

2014-2015

In collaboration with a local office, we are working for the Abu Dhabi Airports Company.

Our mission as design project manager covers all of the tunnel's electromechanical and safety equipment: power supply, lighting, ventilation, monitoring and fire detection, signalling, communication and management systems, cables, emergency exits, signage, technical rooms, air conditioning.

We first carried out preliminary studies so as to define what equipment and reservations would have a significant impact on the civil engineering, which allowed work on the structure to begin. We are currently proceeding with the preliminary design, construction project and invitation to tender phases.



In 2008, responsibility for the operation and maintenance of the Swiss motorway network was moved from the Cantons to the Federal Road Office. One of the reasons for this reorganisation was to create a uniform structure for the operation and management of the motorway network, especially of its operational and safety equipment. A new architecture named "Systemarchitektur Schweiz" (SA-CH) therefore had to be created, which also integrated the existing systems.

SERVICES OF GESTE

2013-2014

We worked with the Federal Road Office (FEDRO) to define availability goals, at the system and sub-system levels, for the new architecture to be used for the national motorway network's operational and safety equipment.

After analysing the current level of technology and conducting a global benchmark analysis, we performed a functional analysis of the proposed architecture by applying the ISO 31000 Risk Management standard. This allowed us to identify the major risks that would have an impact on availability and to put forward proposals and recommendations for improvement.

The main findings of the analysis were included in the FEDRO 13031 directive covering the architecture for the guidance and control systems of the operational and safety equipment.



**LYON (F)
TUNNEL LA CROIX-ROUSSE**

EXTENSIVE UPGRADE OF THE TUNNEL

Expertise in tunnel ventilation, numerical simulations of tunnel fire, adjustment of the ventilation system, definition of the test procedures and tests.



**VENNES – CHEXBRES (CH)
MOTORWAY A9**

RENOVATION OF THE MOTORWAY SECTION

Preliminary project of the Flonzaley tunnel ventilation system; general concept of maintenance for ventilation, signalling, remote control and other EM equipment.



**LAUSANNE (CH)
LEVEL CROSSING AND ROAD SAFETY**

SIGNALLING AND SAFETY

Preliminary analysis of hazards, risk analysis, multi-criteria analysis, concept for the upgrading and refurbishment of the safety installations.



**ARCUEIL – GENTILLY – KREMLIN-BICÊTRE (F)
MOTORWAY A6B**

UPGRADE OF THE ACOUSTIC COVER

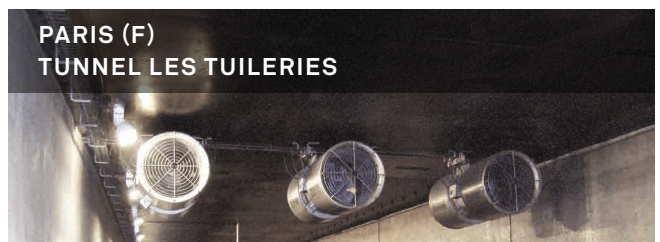
Aerodynamic calculations and design of the ventilation equipment for normal operation and emergency conditions of the covered section.



**PARIS (F)
CAR PARK ON BOULEVARD MACDONALD**

COMPLIANCE WITH SAFETY STANDARDS

Computation of the head loss in the two-floor car park ventilation network; calculation note for the design of the ventilators.



**PARIS (F)
TUNNEL LES TUILERIES**

COMPLIANCE WITH SAFETY STANDARDS

Design of the normal and smoke-extraction ventilation system, definition of the aerodynamic and tunnel ventilation test protocols.



RAMS

PASSENGER SAFETY, RAMS FOR INFRASTRUCTURE AND EQUIPMENT

RAMS

In today's society, which seeks to have total control over events, the safety of people and infrastructure has become a primary concern. It is an objective in itself, and a highly sensitive issue in our time. As a result, risk is increasingly considered unacceptable, both for individuals and groups of people. Additionally, human beings have become more and more dependent on machines of increasing technical complexity, interfaces are proliferating and operational conditions are becoming more stringent. Requirements for operational safety, as well as reliability and availability, have become highly exacting.

Against this backdrop, a multitude of national and international standards, directives and regulations have been applied in order to guarantee the safety of human beings and the reliability, availability, maintainability and safety (RAMS) of infrastructure and equipment. It has therefore become essential for safety engineers to possess experience, detailed knowledge of these standards and of the most useful RAMS methods of analysis and thorough technical expertise in these systems.

Our specialists, with their extensive experience acquired on the international level, possess these qualities. They carry out hazard and risk analyses, and prepare RAMS studies and safety concepts and files for complex systems involving human beings, infrastructure and equipment. By applying a global, systemic and transdisciplinary approach, and taking into consideration the requirements and constraints of the immediate surroundings, they provide effective risk management, whilst incorporating suitable preventive measures. They carry out services throughout the life cycle and at all stages of the risk management process, from defining the context to providing demonstrations for RAMS, applying the most appropriate method for each problem (PHA, FTA, ETA, FMECA, HAZOP, ...). For railway applications, they use the CENELEC EN 50126, 50128 and 50129 standards.

DOMAINS OF ACTIVITIES

- Complex systems
- Infrastructures
- Buildings
- Equipment
- Persons
- Processes

CORE COMPETENCIES

- Hazard and risk analyses, RAMS studies
- Safety cases and demonstrations
- Type-approval of installations
- Second opinions, expert advices and audits
- Safety and evacuation concepts, contingency plan
- Distribution of compartments and escape routes, fire resistance of materials



**ALPTRANSIT (CH)
NEW CENERI BASE TUNNEL AND
TECHNICAL RAILWAY BUILDINGS**

Built under the oversight of AlpTransit Gotthard AG, by 2019 the Gotthard (57 km) and Ceneri (15.5 km) base tunnels will form the centrepieces of the north-south railway link connecting Milan to Basel. The new base line, complying with European interoperability standards, including the ERTMS-L2 signalling system, will be used for both passenger and freight service. The passenger trains will be capable of reaching 250 km/h, while freight trains will run up to 120 km/h.

SERVICES OF GESTE

2006-2019

As part of a consortium, we are responsible for the RAMS studies for all the railway equipment of the Ceneri base tunnel.

Working alone, we are responsible for conducting RAMS studies on all the non-railway equipment of the Ceneri base tunnel, on its interfaces with railway equipment and the effects of their failures on the operation of the line.

Our duties also cover the technical railway buildings of both Gotthard and Ceneri base tunnels, i.e. those of Erstfeld, Bodio, Pollegio, Vigana and Vezia.

We are also supporting the general contractor for coordinating the management of the interfaces and the RAMS procedures between the various technical domains.



**SUPPLIERS OF RAILWAY EQUIPMENT
SAFETY CASES, CERTIFICATION,
TYPE-APPROVAL**

Before they are put into service on an operational line, railway and non-railway equipment must be certified as complying with current regulations. Type-approval files must thus be produced by the suppliers and validated by the competent authorities. These files include in particular complex safety cases with their specific RAMS demonstrations, which consist of ensuring compliance with the reliability, availability, maintainability and safety requirements that apply to such equipment.

SERVICES OF GESTE

Since 2003

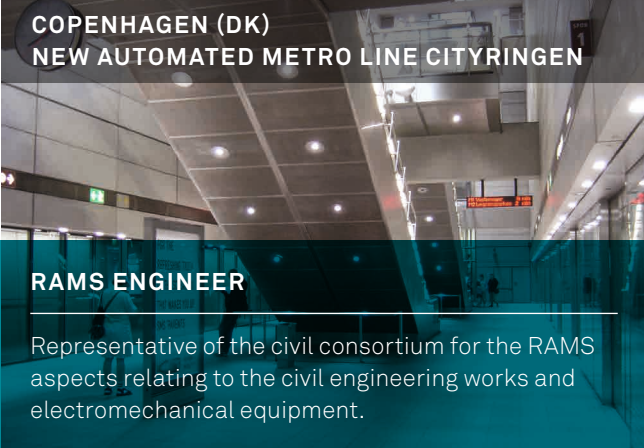
We work with various railway equipment suppliers, contributing in every step of a type-approval procedure, and assisting them in dealing with the competent authorities.

We carry out qualitative and quantitative risk analyses using various methods (fault trees, HAZOP, FMECA, ...), RAMS studies according to the CENELEC EN 50126 standard as well as the SIL calculations and safety cases and reports according to the CENELEC EN 50129 standard.

We also develop safety plans and concepts with testing protocols and validation.

We perform the supplier's safety audits.

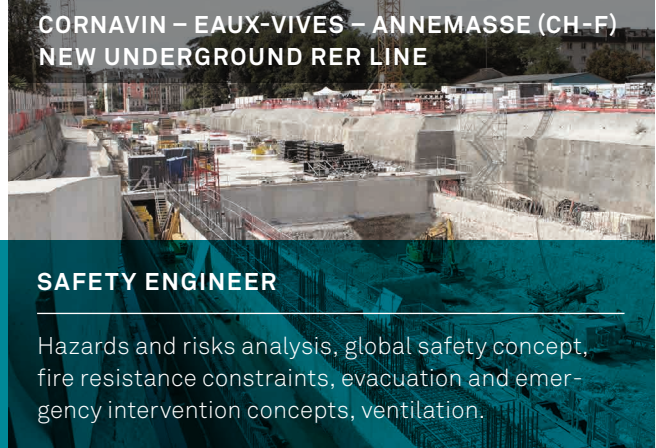
Finally, we can also act as independent safety assessor.



**COPENHAGEN (DK)
NEW AUTOMATED METRO LINE CITYRINGEN**

RAMS ENGINEER

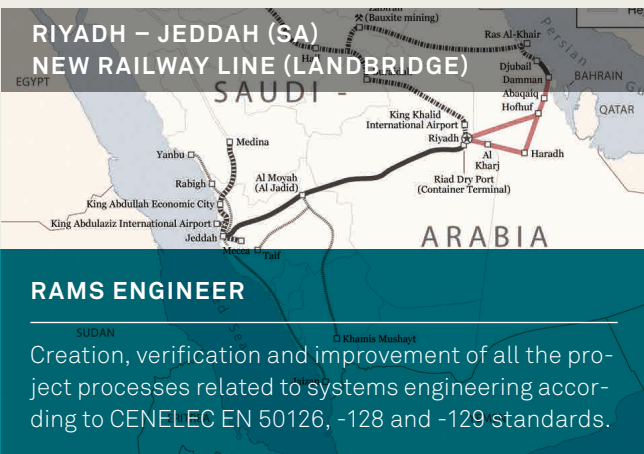
Representative of the civil consortium for the RAMS aspects relating to the civil engineering works and electromechanical equipment.



**CORNAVIN – EAUX-VIVES – ANNEMASSE (CH-F)
NEW UNDERGROUND RER LINE**

SAFETY ENGINEER


Hazards and risks analysis, global safety concept, fire resistance constraints, evacuation and emergency intervention concepts, ventilation.



**RIYADH – JEDDAH (SA)
NEW RAILWAY LINE (LANDBRIDGE)**

RAMS ENGINEER

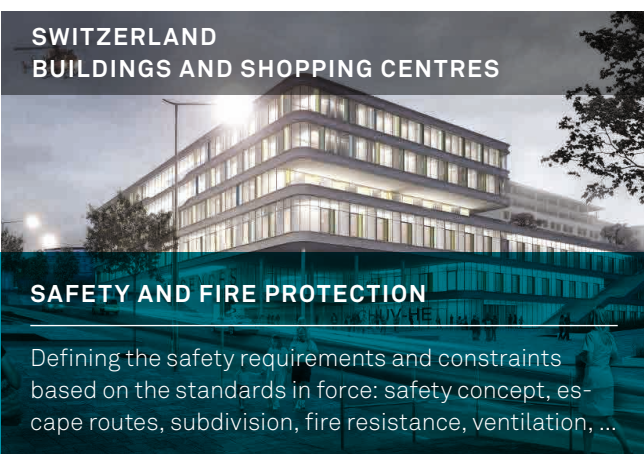
Creation, verification and improvement of all the project processes related to systems engineering according to CENELEC EN 50126, -128 and -129 standards.



**BOMBARDIER (CH)
NEW INTERCITY DOUBLE-DECK TRAINS**

SAFETY FOR FAMILY RAIL CARS

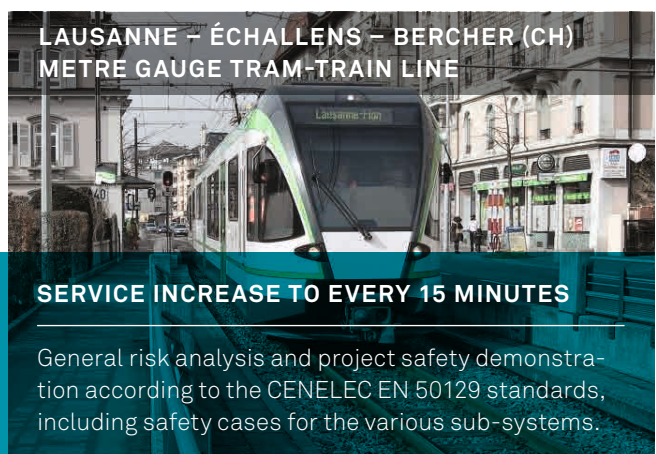
Concept and verification of technical specifications in matters of safety, analysis of the technical offers and client support during the negotiations.



**SWITZERLAND
BUILDINGS AND SHOPPING CENTRES**

SAFETY AND FIRE PROTECTION

Defining the safety requirements and constraints based on the standards in force: safety concept, escape routes, subdivision, fire resistance, ventilation, ...



**LAUSANNE – ÉCHALLENS – BERCHER (CH)
METRE GAUGE TRAM-TRAIN LINE**

SERVICE INCREASE TO EVERY 15 MINUTES

General risk analysis and project safety demonstration according to the CENELEC EN 50129 standards, including safety cases for the various sub-systems.



FLWS
VENTILATION,
AERODYNAMICS AND
FLOW MANAGEMENT



FLOWS

The growing mobility of persons and goods, the faster cruising speeds of mass transit, the development of more and longer tunnel sections and increased awareness of safety and environmental impacts are just some of the crucial factors that are driving manufacturers and operators to continuously improve the comfort and performances of their systems as well as the safety of human beings and infrastructures.

Against this backdrop, and in the confined space of the tunnel, aerodynamic and thermal phenomena, the spread of smoke in the event of a fire, comfort and emergency ventilation, the flow and evacuation of persons, the intervention of emergency services and the protection of people and infrastructures now play a critical role and are given consideration early in the design phase of new transport systems and underground structures, as well as when modernising the existing infrastructures.

Our engineers – thanks to their long experience, their skill and their excellent theoretical knowledge – are able to work on all these important topics. They produce studies and projects relating to aerodynamics, thermodynamics and ventilation as well as others for the evacuation and management of pedestrian flows. To do so, they use mathematical calculations, experimental measurements and numerical simulations carried out with well-known software:

- Fluent, StarCCM, FDS, NSMB, which are 3D aerodynamic solvers for the study of fires and unsteady flows in complex geometries;
- SimWalk, a software application for simulating and analysing pedestrian flows;

or with our own software, ad hoc developed and approved by our engineers:

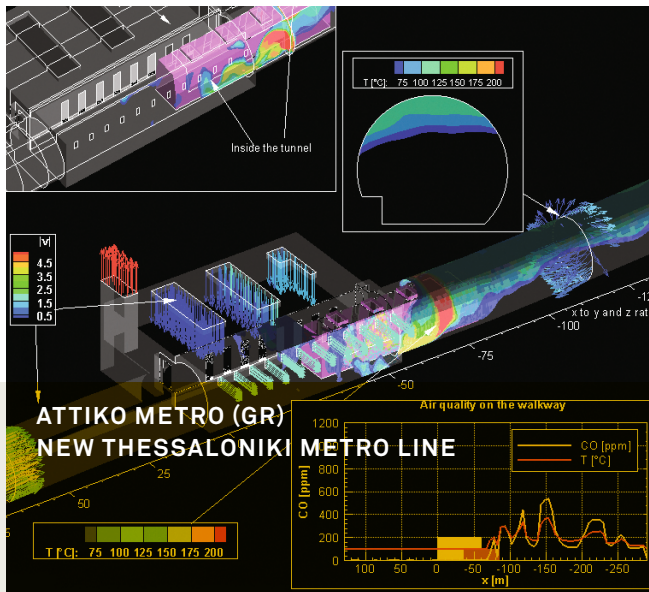
- TNT, a 1D aerodynamic solver for calculating the unsteady air flow field, the smoke propagation and the evacuation of people through a tunnel network;
- TunClim, a 2x1D thermodynamic solver, for calculating long-term changes in temperature within deep tunnel networks.

DOMAINS OF ACTIVITIES

- Tunnels
- Rail and bus stations
- Underground infrastructure
- Car parks, garages and depots
- Buildings
- Enclosed spaces
- Vehicles

CORE COMPETENCIES

- Ventilation and smoke extraction
- Fire protection
- Aerodynamics and pressure waves
- Thermodynamics and heating
- Fire resistance of materials
- Numerical simulations
- HVAC
- Pedestrian flows
- Concepts for safety, people evacuation and intervention of emergency services



To develop its public transit network, the city of Thessaloniki is building its first metro line. An initial East-West stage some 10 km long, with 13 stations, will be brought into service around 2017. A second stage, consisting of 5 additional stations further to the South, is already being constructed. An extension towards the North is also planned. The infrastructure consists of two single-track tunnels that will be used by automated driverless vehicles.



In operation since 2008, the new driverless Lausanne metro line m2 is being built on a 6 km long track, 95% of which is underground. It incorporates 14 stations and is characterised by an average slope of 6%, reaching 12% in some places, a world first for a metro line. The line consists of four single-tube, mostly two-track tunnels, each equipped with its own ventilation system capable of operating independently in “normal” or “fire alarm” mode.

SERVICES OF GESTE

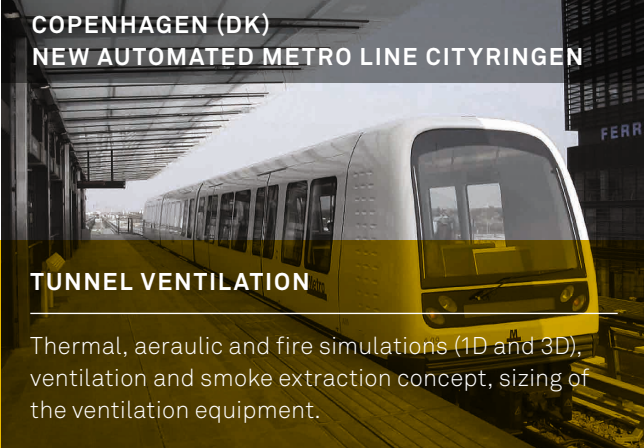
2007–2014

We have been responsible for sizing the tunnel ventilation system and have carried out numerous 1D and 3D numerical simulations with TNT and Fluent software. We have defined ventilation strategies for normal and degraded operation mode, including the directions for passengers to escape and for smoke to be extracted in the event of a fire. We have also determined the sizes for the necessary infrastructure and ventilation equipment. We have studied the long-term evolution of the air temperature within the tunnels and stations with TunClim software and have defined the best strategy for keeping that temperature within the project’s limits. Finally, with the aim of determining the size of the platform screen doors, we calculated the pressure loads generated by the arrival of vehicles at the station.

SERVICES OF GESTE

2000–2014

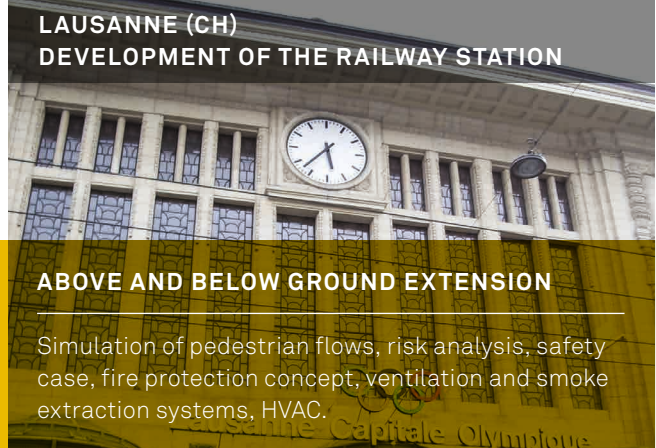
We were involved in the m2 project beginning with the feasibility studies in 2000. We started by conducting climate studies, which led to the installation of a track heating system to reduce the formation of frost in winter. By simulating more than 5,000 passenger evacuation scenarios, we carried out the fire-smoke risk analysis, which led to the decision to ventilate the tunnels. We were then in charge of the design and construction management of the ventilation project, from the preliminary project phase through to the operational testing and commissioning phases. We also calculated and measured the pressure loads on the platform screen doors. We are currently upgrading the ventilation system in order to incorporate the new projects (LEB, SBB station, tramway T1, m3).



**COPENHAGEN (DK)
NEW AUTOMATED METRO LINE CITYRINGEN**

TUNNEL VENTILATION

Thermal, aeraulic and fire simulations (1D and 3D), ventilation and smoke extraction concept, sizing of the ventilation equipment.



**LAUSANNE (CH)
DEVELOPMENT OF THE RAILWAY STATION**

ABOVE AND BELOW GROUND EXTENSION

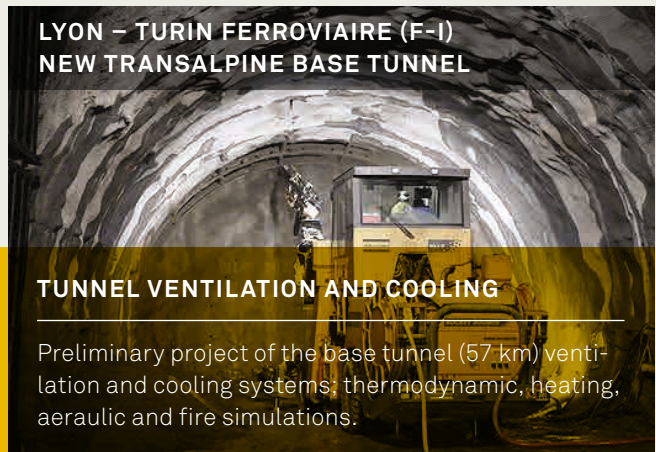
Simulation of pedestrian flows, risk analysis, safety case, fire protection concept, ventilation and smoke extraction systems, HVAC.



**HOLM – NYKIRKE (NO)
NEW RAILWAY TUNNEL**

AEREAULIC DESIGN

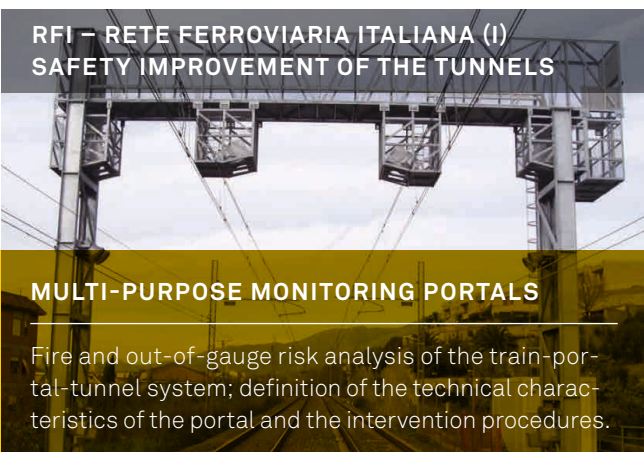
Aeraulic study and numerical simulations for the safety and tympanic comfort on board the trains, in the tunnel and in the Holmestrand underground station.



**LYON – TURIN FERROVIAIRE (F-I)
NEW TRANSALPINE BASE TUNNEL**

TUNNEL VENTILATION AND COOLING

Preliminary project of the base tunnel (57 km) ventilation and cooling systems; thermodynamic, heating, aeraulic and fire simulations.



**RFI – RETE FERROVIARIA ITALIANA (I)
SAFETY IMPROVEMENT OF THE TUNNELS**

MULTI-PURPOSE MONITORING PORTALS

Fire and out-of-gauge risk analysis of the train-portal-tunnel system; definition of the technical characteristics of the portal and the intervention procedures.



**SWITZERLAND
BUILDINGS AND SHOPPING CENTRES**

VENTILATION, SAFETY AND FIRE PROTECTION

Numerical simulations of fire scenarios, strategies and concept for smoke extraction, sizing of the ventilation equipment, testing.



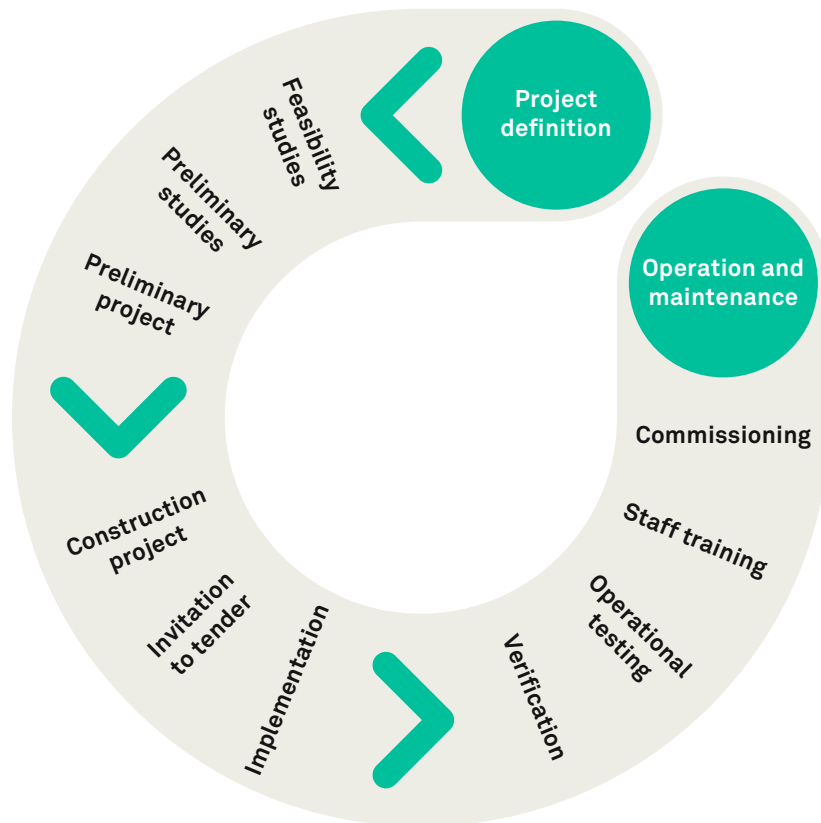
COMPANY
EXPERTISE, ENGINEERING AND
CONSULTANCY

Services

With the support of a highly trained, international, multidisciplinary team that possesses a great deal of professional experience, we are able to offer in each of our sectors of activities sustainable solutions adapted to our clients' requirements. Our engineering-consultancy business has led us to conduct studies and tests, to lead projects as design and construction manager or assistant to the contracting authority, and to provide expert advices and perform audits.

- | | | |
|---|--|--|
| <ul style="list-style-type: none"> ▪ Studies ▪ Engineering ▪ Testing | <ul style="list-style-type: none"> ▪ Project management ▪ Design & construction management ▪ Assistant to the contracting authority | <ul style="list-style-type: none"> ▪ Consulting ▪ Expert advices ▪ Audits |
|---|--|--|

Our services are based on a global and transdisciplinary approach. They cover the project's entire life span, from feasibility studies to commissioning, and also include support and assistance for our clients in setting objectives as well as operational and maintenance concepts.



Company Profile

GESTE Engineering Ltd is a private limited company with offices in Lausanne, Bern and Paris. Founded in 1999 as a start-up at the Swiss Federal Institute of Technology, Lausanne (EPFL), its headquarters are in Lausanne, in the heart of the EPFL Innovation Quarter.

Within this dynamic framework, GESTE Engineering gathers the know-how and expertise of experienced engineers and technicians who have contributed and continue to contribute to the success of major projects in Switzerland, France and throughout the world. This international dynamic in the company's activities, which now accounts for more than 30% of our business, can also be found in the composition of our team, who are used to working in multiple languages.

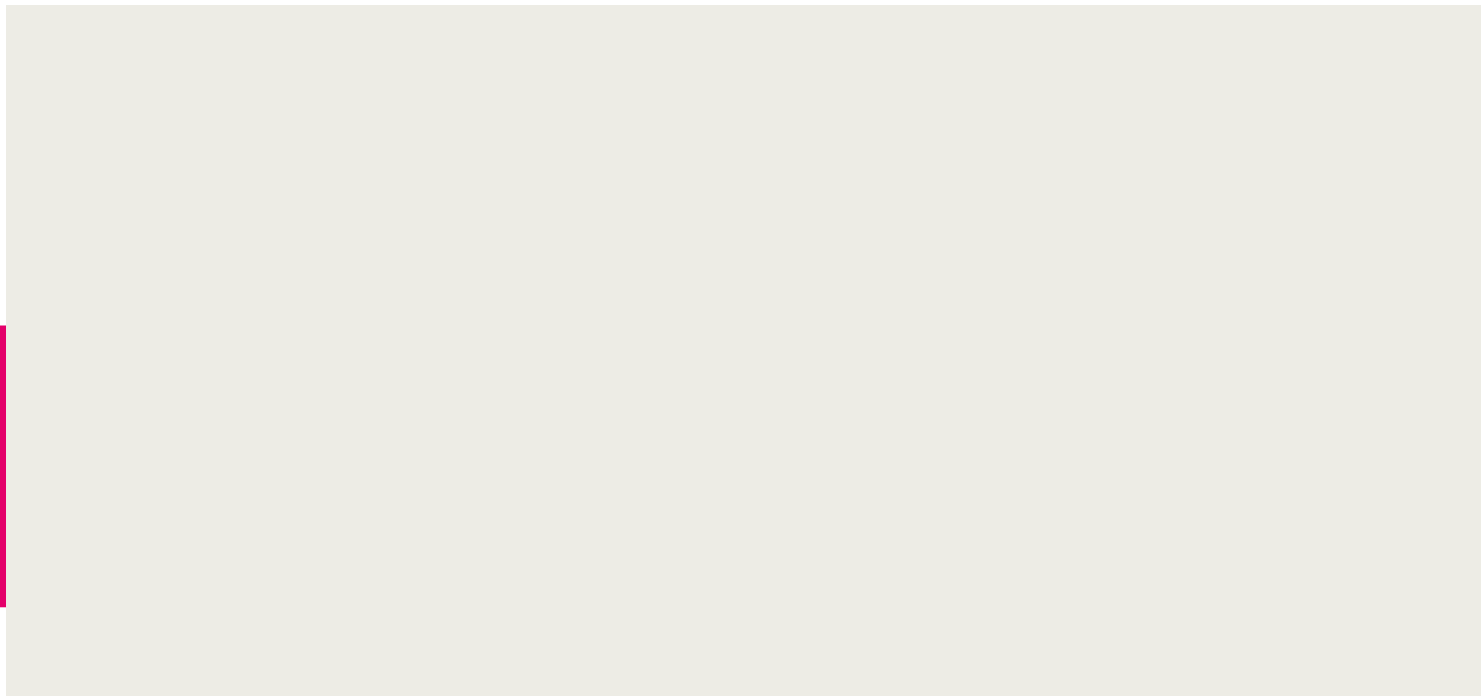
Since our founding, we have successfully partnered with public and private companies, industrial groups, engineering companies and architectural firms, with public administrations and private organizations, and with universities and international research centres.

The French name GESTE – whose main meanings in English are « gesture, deed » – also stands for « *Groupe d'Étude de Systèmes de Transport dans leur Environnement* » (study group of transport systems in their environment). It reflects our energy and our commitment to take action and to consider transportation systems – whether for passengers or freight – to be an integral part or component of an environment that has human beings and their well-being at its core.

In addition to this name, our logo, designed to celebrate the company's 15-year anniversary, illustrates our daily work, which consists of assembling, connecting and completing objectives, ideas, individual solutions into a comprehensive, systemic, efficient, finished project.

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GESTE ENGINEERING LTD | LAUSANNE, BERN, PARIS

headquarters

GESTE ENGINEERING LTD, EPFL INNOVATION PARK – C, 1015 LAUSANNE, SWITZERLAND
T +41 21 694 18 00, F +41 21 694 18 01, INFO@GESTE.CH, WWW.GESTE.CH

GESTE

MOBILITY & SAFETY