

TELT Common Operations Rules

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TELT

ABSTRACT:

TELT tunnel is a long and deep tunnel with both technical, logistical and safety challenges. Additionally, as a bi-national project, TELT has the opportunity to combine the experience and good practices from Italian and French sides. TELT had introduced in every contract “Common Operation Rules (COR)” that were presented in WTC 2019 Napoli. This guideline gives a practical set of rules defined by professionals from both countries, according to national regulations, best practices, and ground-based experiences. Those rules have been updated in 2023. On top of those common rules, TELT has set up a “Mission S” to share experiences between working sites to reach high-security standards for the project. This article presents both the update of the “Common Rules of Operation” and the “Mission S” set up by TELT on all the project work sites.

1 INTRODUCTION

1.1 *The Turin-Lyon high-capacity rail project*

The new line between Turin (Italy) and Lyon (France) will be the central and key part of the East-West “Mediterranean Corridor”, one of three major rail lines passing south of the Alps planned by the European Union. The bi-national border crossing between Italy and France includes a 57.5 km, 8.70 m diameter single-way twin-tube base tunnel, the longest in the world, which crosses the Alps at an elevation of approximately 600 m, roughly 45 km in France and 12.5 km in Italy (see figure 1). Design of the base tunnel includes four exploratory adits and tunnels. Three French exploratory adits were completed between 2007 and 2010: Saint-Martin-La-Porte (2.4 km), La Praz (2.5 km) and Modane (4.0 km). The Italian exploratory tunnel of La Maddalena (7.1 km) was completed in February 2017 and the French exploratory tunnel of Saint-Martin-La Porte (9 km) has been under construction since 2014 and has excavated more than 5 km.

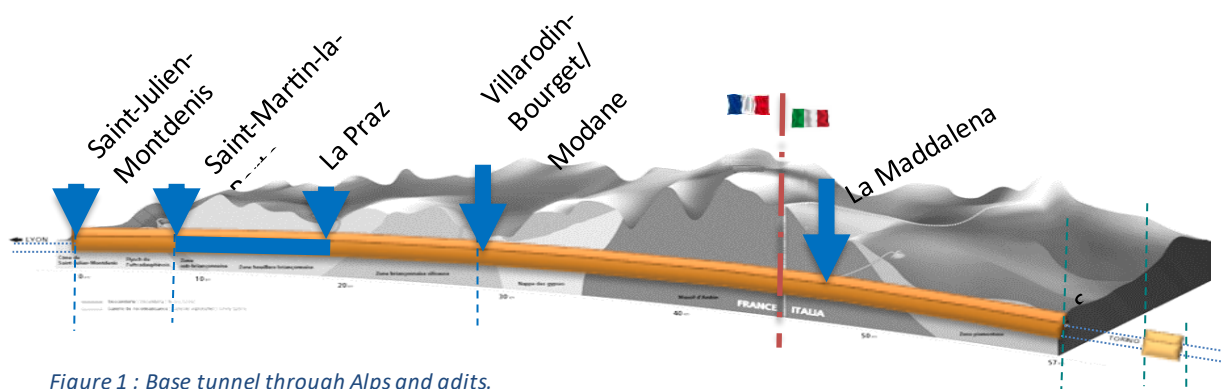


Figure 1 : Base tunnel through Alps and adits.

The Mont-Cenis base tunnel is a complete geological section of the Western Alps, which are crossed from west to east with an overburden of over 2,000 metres.

The excavations will face complex challenges due to the geotechnical and hydrogeological conditions, the nature of the rocks and the conditions of access to the workplaces, in sections dozens of kilometres away from the entrances and under extreme microclimatic conditions.

The thousands of construction workers spread across six main work sites, the need for accommodation in the Alpine valleys and the impact on the local population and the environment are other major issues that will characterise the entire project.

1.2 The Turin-Lyon challenge to safety

TELT tunnel is a long and deep tunnel with a lot of challenges to overcome to succeed. One of these challenges is guaranteeing safety for everybody on the project. To do so, TELT developed the Common Operational Rules (COR) to define uniform rules common to both countries, intending to choose the most conservative rules of the two legal frameworks, adding the experience of decades digging exploratory tunnels, to improve safety and the health of workers. The development of COR was presented in 2019 in the article “The Common Operative Rules for health and safety during the construction of a base tunnel of Montcenis between France and Italy »

This article will present the disposition set up by TELT to achieve this objective.

2 TELT SPECIFICITIES TO SAFETY

2.1 TELT as a binational project

The Lyon-Turin project is a binational project crossing the border between Italy and France. So, both countries and safety regulations are involved in the project. The objective for TELT is to have uniform rules common to both countries and to choose the most conservative rules of the two legal frameworks.

For the application of national regulations, the rule set up is the “portal law” so the nationality of the working site is according to the nationality of its entrance. For example, if the entrances are on the French side, the entire working site will be French.

Once the tunnels have been drilled, the border will return to its geographic position and each part of the site will fall back into its own territory.

2.2 TELT as a deep project

TELT tunnel is both long with 57,5 km between two portals and a deep project with coverage of an average of 1,000 m and a maximum of 2,500 m. To work on the base tunnel, four access roads have been built of 2,5 km to 7,1 km, in addition to the French portal (The Italian portal isn't a working site to dig tunnels).

This lengthens the access time for any safety team and is taken into account:

- Formation of personnel for first-aid efficiency
- Special organisation of firefighters on the French side.

3 COMMON OPERATIONAL RULES

3.1 COR objectives

COR is a set of operational rules set up thanks to TELT's operational experiences during the exploratory excavation phases. Following exchanges between French and Italian safety

administration and ground-based experiences, lead to a set of rules to ensure safety. The common operational safety rules for the TELT set a high objective for the following themes:

- **Preventing Accidents:** The first objective of the COR is to prevent accidents and protect workers
- **Ensuring Compliance:** The COR comply with French and Italian safety regulations and increases the level of international standards.
- **Maintaining Project Efficiency:** The safety measures set up in the COR are operational measures, issued from experience from exploratory tunnels, so it doesn't reduce significantly the efficiency of the work.
- **Common rules:** The COR objective is to have one set of common rules for all the works on the project.

3.2 *Coordination of COR*

3.2.1 *Coordination body*

The set of safety rules is shared with every TELT construction site and sub-contractor, ensuring that all companies and workers operate with the same safety culture. Coordination occurs in four main stages:

1. **Coordination between TELT and the inspection services of France and Italy** through the "Coordination Structure," which meets periodically to analyze the situation and decide on common bi-national actions.
2. **Health Coordination Structure**, composed of the physicians from each company for the various lots, meeting every six months and interacting with the Coordination Structure.
3. **Hygiene and Safety Committee** at each operational lot, chaired by the safety coordinator, which includes company representatives, inspection, and insurance bodies. The committee meets every two months or after a serious accident to propose or validate solutions.
4. **Safety, Health, and Working Conditions Board** for companies with more than five workers, including the client, safety coordinator, work directors, and worker representatives. This board ensures safety management at the site and invites relevant authorities and occupational physicians in an advisory capacity.

The safety coordinator organizes joint inspections with each company before their intervention to ensure adherence to safety regulations. Worker representatives are free to express opinions without fear of sanctions or dismissal, with paid time allocated to attend board meetings.

3.2.2 *Safety coordinator and logbook*

Key personnel to safety are the safety and health protection coordinator (SPS) mentioned above. These personnel are required by the French law (Decree n° 941159 of 26/12/94). The SPS is commissioned by the customer to set up the General Plan of Coordination (PGC), control its application and coordinate activities between contractors and sub-contractors.

He is notified for every company starting to work on-site and holds the coordination logbook that records every joint inspection, safety instruction, any observations or information he may deem necessary to communicate to the Client, the Supervisor of Works, or any other operator on the site, which he shall have countersigned in each case by the person(s) concerned with their reply, if any, and any information relevant to safety to record for the owner. The logbook is available for the client, the director of works, the administrative authority, the supervisory bodies and the coordination bodies as a record of safety measures taken on site.

3.3 *Information and training of workers*

Every worker must be informed about the health and safety risks and the protection and prevention measures adopted.

Moreover, every worker has to be trained on safety and prevention at least at the moment:

- a) Of recruitment.
- b) Of transfer or change of duties.
- c) Of the introduction of new work equipment or new technologies, new dangerous substances and preparations

In addition to safety and risk, every worker has to be educated about their job, machinery and Personal Protective Equipment (PPE)

3.4 *Excavation and supporting*

The COR present a set of rules for excavation, support, and lining, even if companies are responsible for defining the appropriate support to put in place. The objectives are to ensure maximum worker safety during each phase. It emphasises measures to avoid collapses and rockfalls, and the need for inspection during the advancement phase.

For the TBM more attention have to be focused:

- a) To make it safe and easy for workers to move around the TBM and evacuate in case of emergency.
- b) To the accessibility and safety of workstations, both during excavation and maintenance work.
- c) To use the most advanced conceivable technical solutions.
- d) To the risks involved in the assembly and disassembly of the milling machine.

Every TBM has to be equipped with:

- 1) A canteen/leisure room module.
- 2) A shelter, able to accommodate the employees in charge of the workstations and any visitors.
- 3) The necessary personal respiratory protective equipment (escape masks).
- 4) Sanitary facilities with a washbasin area in front, in sufficient numbers.
- 5) A ventilation system.

3.5 *Access and manoeuvring routes*

Safety during access to the working site and engine manoeuvring is a crucial topic and the cause of a lot of accidents. So, the COR gives specific rules.

3.5.1 *Pedestrian*

If it is necessary to provide a route for pedestrians to gain access to the place of work, the walkway must have a usable width of at least 80 cm, be set up on one side of the roadway only and be adequately signposted and permanently illuminated. The walkway must be always kept clear of obstacles and protected from traffic.

3.5.2 *Vehicles and Roads*

Drivers entering or manoeuvring in the tunnel must have special authorization obtained through dedicated training. To minimize accident risks, speed is limited to 30 km/h, with additional slowing systems where necessary. In areas with pedestrians, drivers must respect designated walking spaces. The tunnel floor must be well-maintained, ensuring a uniform, flat, non-slippery,

and non-muddy surface to accommodate both vehicles and pedestrians. Roads should provide space for manoeuvring and parking, allowing evacuation vehicles to exit the tunnel easily at any time. The tunnel must be adequately lit, including emergency lighting, in compliance with French and Italian regulations to facilitate evacuation.

3.6 Communication and alarms

Communication and alarm systems in the tunnel must ensure clear, uninterrupted communication. Devices should be installed near underground workstations, shelters, and shafts deeper than 30 meters, clearly marked with illuminated signage. These devices must enable communication with the outside and be connected via cable or have a backup system. Emergency contact information must be posted next to each communication device, translated into the workers' languages, including public emergency numbers and details to provide. Additionally, visual and/or acoustic alarms should be placed in strategic locations, such as on tunnel boring machines and in connecting tunnels, to immediately inform workers of evacuation orders. The setup of these systems will be regularly updated as the site evolves.

3.7 Ventilation

In tunnels under construction and during shaft excavation, air quality must be kept as clean and pollutant-free as possible to protect workers' health. Air quality is monitored to ensure that exposure limits set by Italian, French, or European regulations are not exceeded, and workers are evacuated if necessary. To reduce pollution, emissions from equipment and vehicles should be minimized by using electric machinery where possible, or diesel engines with purification systems. Dust is controlled with a spraying system or by isolating workers from it. An artificial ventilation system is used to provide fresh air, delivering at least 3 m³ of air per minute per worker (such as CNAM Recommendation R494 of 25/10/16), and must maintain temperatures below 25°C. If temperatures exceed this, work hours are limited to 6 hours for temperatures between 25-30°C, and only emergency work is allowed above 30°C. Hazardous chemicals or explosive substances are assessed during the design phase by geologists. If dangerous concentrations of gas are detected and cannot be controlled, all personnel must be evacuated immediately.

3.8 Asbestos

On TBM, if any risk assessment identifies the potentially asbestos-bearing nature of the geological profiles present on the route, the TBMs used in the sections concerned must, from the design stage, foresee the appropriate devices to be put in place to protect workers (for example, more powerful misting devices for the spoil, the covering of the conveyor belts, preventive set-ups, and designated locations for the eventual installation of separation systems in the confinement and decontamination units).

3.9 Health and prevention

Health and prevention for the worker imply using collective protection as much as possible, and PPE anytime other solutions aren't available.

3.9.1 Noise and vibration

The company must reduce noise to the lowest level reasonably possible given the techniques available. Exposure must remain at a level compatible with workers' health, and national legislation, in particular regarding the protection of hearing. The first measures involve estimation, and in case of doubt, an accurate measurement of the noise exposure of workers at the different points where work is carried out throughout the site.

3.9.2 *Sanitation*

The company must provide workers with facilities for personal hygiene, in particular changing rooms, sinks, and toilets. The COR specifies rules to follow in terms of numbers and availability of equipment in changing rooms and on-site. Separate facilities must be provided for women and men. All these facilities have to be effectively kept clean at all times.

3.9.3 *Health check*

Companies must comply with the territorial legal obligations regarding occupational medicine. TELT to ensure an equal level of health protection for workers assigned to similar tasks on the construction site as a whole, and will organize meetings every six months between the different Occupational Physicians in charge, to exchange information with each other.

3.9.4 *Public emergency*

TELT involved the nearest public emergency services in the organisation of first aid (SDIS or VIGILI DEL FUOCO - 118 or SAMU). This involvement concludes with the drafting of an Emergency Management Plan and periodic on-site drills that are included in contracts.

In any case, first aid must be provided by colleagues close by; to do so first aid officers in each operational team must be trained and a first aid kit must be available. In addition, depending on the length of the tunnel, and the type of work being carried out, the first-aid workers can be complemented by a mobile infirmary room with qualified personnel. Depending on the degree of danger of the work and the size of the site, the first-aid workers are supported by the rescue team of at least 5 members, including the team leader; for each work shift, the team is duly educated, trained, physically fit and provided with adequate equipment and suitable means to be able to intervene in real-time in the event of an emergency.

3.9.5 *Evacuation equipment*

In agreement with the emergency services (Fire Brigade and 118 for Italy and SAMU for France), the contractor provides dedicated vehicles, adapted to the configuration of the site for evacuating injured persons. To allow access to the emergency unit, every working site makes available a dedicated firefighter truck with special options (thermal camera, ...), so that access to the tunnel is always possible for firefighters. To allow rescue services to intervene by air, a dropping zone must be set up and always kept clear. The DZ is positioned near the tunnel entrance, in accordance with public emergency services concerned, and must allow for landings by night.

3.10 *Fire*

Fire prevention and fire protection are implemented according to the characteristics of tunnel space.

3.10.1 *Fire prevention*

First fire prevention is organised with risk assessment considering every situation on site. The procedures and equipment must take into account the time of arrival of emergency services. Every activity potentially inducing fire requires a fire permit delivered according to a procedure accounting for the potential risks of the workstation. Ahead of the works, contacts, and agreements with the local fire brigade command to organise on-site inspections and periodic exercises. In France weekly visit are organized with the fire brigade. The workforce training must include the use of fire extinguishers. To assess the position of people and their position in the tunnels at any time, an electronic system is put in place to both count people entering and exiting the tunnel and ensure that people can be located in real-time from the outside. This information must be available to emergency services upon arrival on site.

3.10.2 *Fire protection*

Secondly, the following equipment's are set up into the working site to

- a) installation of firefighting systems (fire extinguishers, buckets, fire hydrants, sand buckets, etc.) appropriate to the risks identified, easily identifiable and located in a position free of obstacles:
 - on installations;
 - on construction site machinery and vehicles;
 - at workstations and alongside every telephone booth in the tunnel;
 - in the storage areas.
- b) Systematic installation in a safe place as close as possible to the areas of activity, of shelter (pressurised and air-conditioned containers), of adequate mechanical and fire resistance, and equipped with the necessary equipment for survival while awaiting rescue. The supply of the vital functions of these cells must also ensure the volume of air necessary for survival until the end of the rescue operation. Along dead-end tunnels, the shelters must be arranged at a maximum distance of 1,000 metres from each other, while in other areas underground, especially if by-passes connecting to escape routes or safe places are already present, they will be arranged according to the risk analyses and the envisaged emergency scenarios, always giving preference to the possibility of evacuation from below ground, rather than the presence of a shelter.
- c) Individual insulated self-contained breathing apparatus or other similarly effective devices must be made available to workers and visitors for use during evacuation or access to the shelters mentioned above.
- d) Evaluation of the applicability of installing water curtains at predetermined intervals to contain, if necessary, the spread of fumes and limit the effects of any fires.
- e) Appointment of a fire manager.
- f) Identification of the type of fire extinguisher to be used, according to the characteristics of the fire risk, to be checked at the start of work and then periodically.
- g) Limitation to an absolute minimum of storage of flammable substances in the subterranean area, with appropriate fire-fighting equipment located nearby, paying particular attention to oil and fuel tanks for work vehicles.

3.11 *Conclusion*

The Tunnel Express Lyon-Turin project is a groundbreaking infrastructure initiative, with the potential to transform regional transportation. However, its success relies heavily on stringent safety measures. By implementing comprehensive operational safety rules, the TELT project ensures the well-being of its workforce, the integrity of its construction, and the future safety of its passengers. These rules are a testament to the project's commitment to excellence and responsibility in one of the most challenging engineering feats of our time.

4 MISSION-S

4.1 *TELT: A Concrete Commitment to Health and Safety on Construction Sites*

Through its Occupational Health and Safety Function, TELT places particular emphasis on protecting and ensuring the well-being of workers on construction sites, adopting the best available international practices. The main objective is twofold: to reduce accidents and achieve "zero fatalities." This vision is embodied in Mission-S, a clear and collective commitment to ensuring safety on TELT construction sites, founded on solid organization and collective responsibility.

4.2 *Mission-S: A Shared Safety Culture*

Mission-S is a constant call for workers to take care of themselves and others, aiming to spread a true safety culture among all workers. This program is based on individual responsibility and a sense of belonging, essential elements to ensure that safety becomes a shared and practiced value for each operator. With the support of the European Union, TELT has set an ambitious challenge: to build the longest tunnel in Europe, exceeding regulatory standards and turning it into an example of excellence, from the design phase to construction. Mission-S is structured around values that guide concrete objectives and actions for all involved parties.

The 7 Values of Mission-S

1. **Unity:** Mission-S unites France and Italy, clients and companies, supervisors and workers of different nationalities under a single operational and regulatory vision. This vision requires coordination, integration in a complex scenario, and, most importantly, a shared collective mindset.
2. **Innovation:** TELT construction sites adopt advanced technologies, such as motion sensors and detection systems, to ensure safety and manage emergencies. Innovation is the main criterion in choosing partners and is reflected in regulations, control processes, and awareness-raising activities.
3. **Rigor:** TELT applies meticulous control across all its construction sites, monitoring environmental parameters, compliance with procedures, and analyzing the causes of any incidents. Order and precision are the foundation of safety, and the company is highly demanding of itself and its collaborators, promoting a rigorous approach at every work stage.
4. **Training:** Continuous training is a cornerstone of TELT's strategy. Ongoing updates and discussions with unions and other sector entities allow for sharing of results and innovations, in the belief that transparency strengthens commitment to safety.
5. **Engagement:** Mission-S aims to engage all workers, conveying the spirit of "working together," whether at the excavation front, during construction, or on the roads. Every choice is critical to collective safety, making it essential for everyone to feel responsible for their own and others' protection.
6. **Care:** A well-organized work environment respects workers' health. The core of the program is care for people, not only during work hours but also for their living conditions outside the construction site.
7. **Will:** TELT is determined to raise safety standards, investing in knowledge and technology. This concrete commitment, together with its partner companies, aims to make a real difference in results, not just in words.

4.3 *A Multi-Stakeholder Strategy for Safety*

As the contracting authority, TELT is responsible for meeting regulatory obligations and managing a complex network of companies, where responsibilities and actions are distributed along a chain of actors. Therefore, the health and safety strategy at TELT construction sites is multi-layered, involving numerous stakeholders with whom the company is in constant dialogue.

A concrete example of this approach is the *Sharing Safety* meetings, organized as part of the Mission-S project. These meetings involve all safety managers from the contracting companies, site supervisors, and safety coordinators. The aim is to share best practices in health and safety, as well as to discuss any incidents or accidents that could serve as valuable lessons for improving working conditions and preventing future risks.

For TELT, safety and productivity go hand in hand: working safely means working better. With Mission-S, TELT aims to make safety not just a priority, but a shared culture practiced by all.