Regulatory framework and railway safety approval procedures in a bi-national context - the example of the Montcenis base tunnel

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ABSTRACT: The Montcenis base tunnel between Italy and France is part of a series of 20+ km-long railway tunnels that have recently replaced, or are replacing, the older mountain pass crossings. These long tunnels require a specific look at the aspects of railway safety and accident management. For cross-border tunnels, the granting of safety certifications is complicated by the juxtaposition of multiple national authorities. This paper begins with a short description of the procedures followed for the Channel and Brenner links, which are similar to the future Montcenis base tunnel. The particular Italian-French bi-national context characterizing this latter is then presented under three aspects: the definition of a reference regulatory framework, its harmonization, and the initiatives followed to obtain the "Clearance for Development and Completion of the Project" from the respective National Agencies, as well as, upon completion of all work, the "Clearance for the Commercial Commissioning" of the infrastructure.

1 THE MAIN EUROPEAN CROSS-BORDER TUNNELS

1.1 *Introduction*

We live in a context where Europe is equipping itself with railway corridors aimed at speeding up the connections between major cities, facilitating the exchanges of goods over different countries, and shifting most of freight traffic onto railways. This in turn will decrease gas emissions and improve road safety. The large base tunnels are a core element of this strategy, as they are needed to reach the performance objectives expected for these fast connections.

Some of these tunnels are already operational (Channel since 1994, Lötschberg since 2007, Gotthard since 2016), while others will become so in the near future (Koralm in 2022, Brenner in 2025, Moncenis in 2030). All of them have required a careful consideration of the subjects of railway safety and accident management.

For cross-border tunnels, the approval process in relation to railway safety has been further complicated since the early 2000s by the contemporary presence of several competent national authorisation bodies, in particular the National Safety Authorities for railways (NSA).

Figure 1. Main railway corridors and relative base tunnels

The 50.4-km long Channel Tunnel links the city of Calais in France with the city of Folkestone in England. It consists of two main outer tubes, where the trains travel, and a third service tunnel in the middle for the various maintenance and safety services.

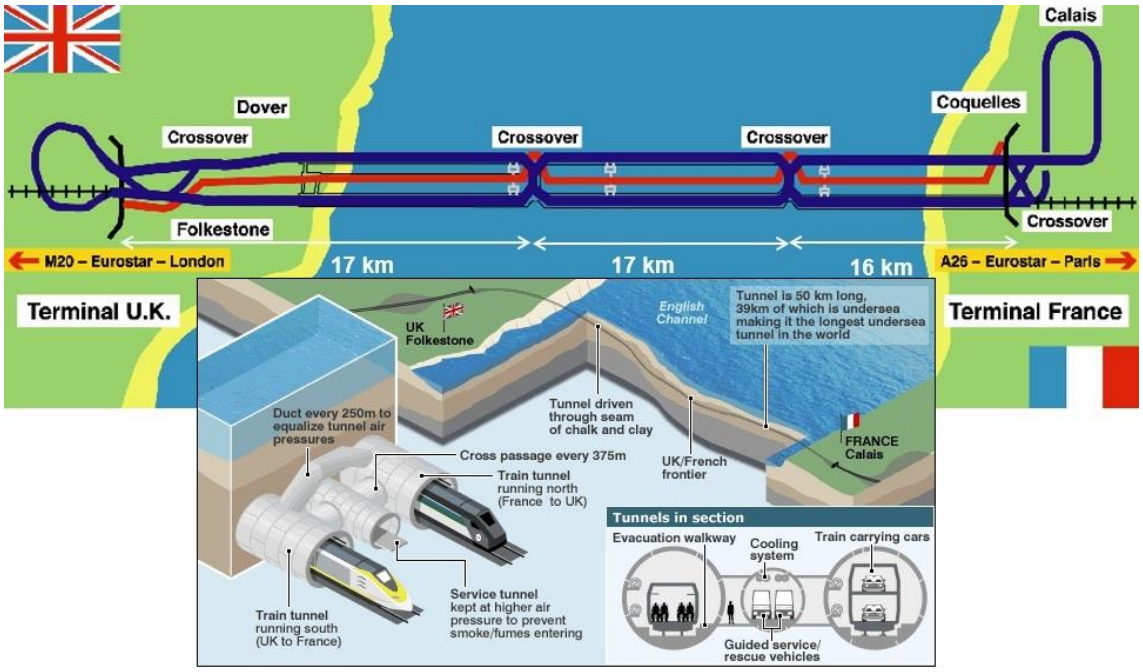

Figure 2. Channel tunnel diagram

Cross-connections between the railway tubes are located at every third of the tunnel, allowing for greater flexibility of operations during breakdown situations. The maximum speed of the trains is 160 km/h for passenger convoys and the tracks are controlled via the French TVM 430 standard signalling system. In scenarios requiring passenger evacuation, the service tunnel between the two railway tubes serves as a safety site. The damaged tube is then isolated from the undamaged one with the help of shutters and watertight doors, protecting the passengers and other trains.

The tunnel came into service in 1994 and, since the NSAs did not exist at the time, the design and construction stages were supervised by an *ad-hoc* Intergovernmental Commission (IGC), whose members were drawn from the French government, the UK government, British Rail and SNCF.

The IGC consisted of 5 sector committees: finance, design, operation and maintenance, safety/rescue (firefighters, police, healthcare personnel, etc.) and security.

In 1993, the testing and commissioning stages were approved by the IGC and consequently the French and UK governments granted the "clearance for operation".

1.2 *Brenner Base Tunnel*

The Brenner link covers the 64 km from Tulfes to Fortezza and it includes a 55-km-long tunnel connecting the village of Fortezza in Italy with the city of Innsbruck in Austria. It consists of two main tubes using ERTMS level 2 as the signalling system. Passenger trains will be able to run at a maximum project speed of 250 km/h and freight trains at 120 km/h.

Since September 2017, BBT has been engaged in developing a "Cross-border operation regulation" with the help of RFI, ÖBB, the ITA/AUS railway safety Authorities and ERA (with an advisory role). The Regulation will apply the safety principles for operation established by the Authorities and it will be based on the functional specifications already defined in the Definitive

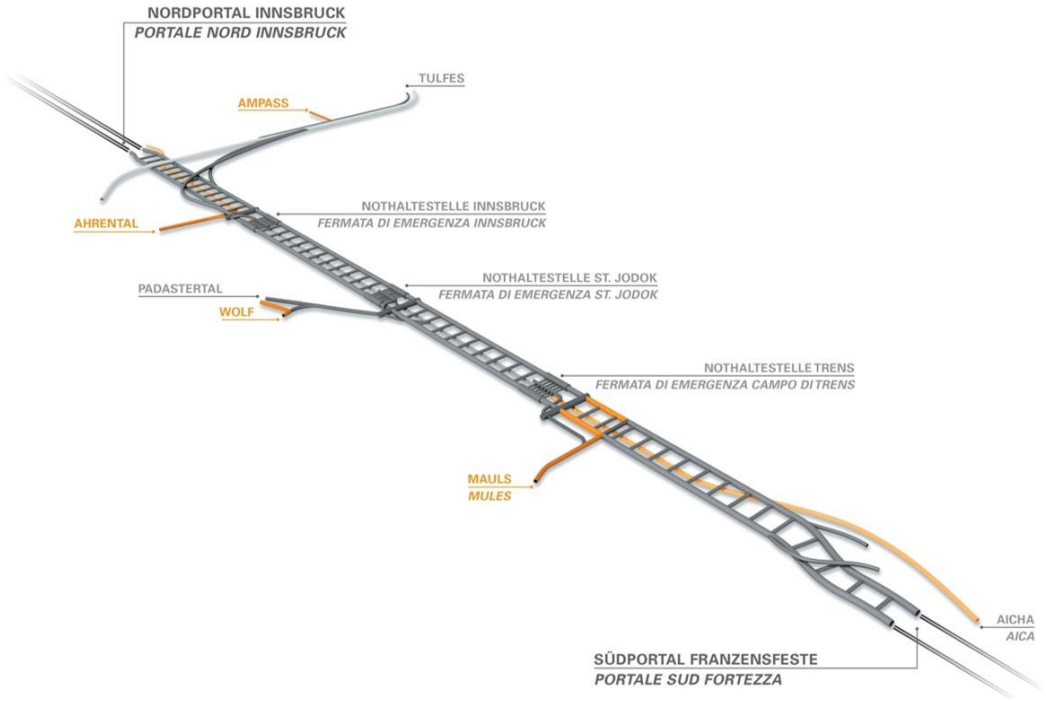

Figure 3. Brenner tunnel diagram

Plan of the Brenner base tunnel. This includes the very important "Reversing" function, an operation mode of the ERTMS system that authorises the reversal of the signalling and the backward motion of the trains in safe conditions. This will permit to reverse the train flux in case of emergencies or irregular events.

The set of functional specifications and the definition of the cross-border regulation will also enable the definition of procedures for the safe management of accidents during operation.

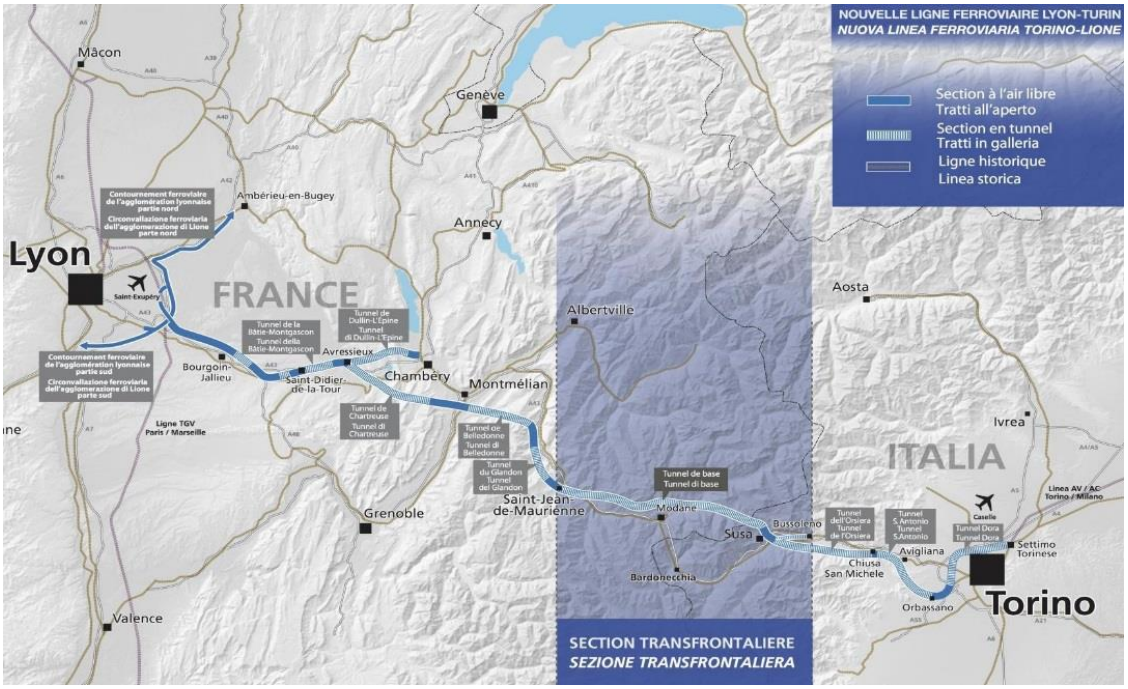

Figure 4. The new Turin-Lyon railway line

2 THE MONTCENIS BASE TUNNEL

2.1 *Main design characteristics*

The New Turin-Lyon Line consists of three parts: the French part (under SNCF-Reseau management); the Italian-French joint part (international section); and the Italian part (under RFI management). As shown in Figure 4, the international section includes the cross-border section that spans from St-Jean-de-Maurienne to Susa/Bussoleno and whose design, construction, and management is in the hands of the French- Italian company TELT (Tunnel Euralpin Lyon Turin).

This section consists of: an open-air area in St.-Jean-de-Maurienne (3.7 km) that includes the new passenger station of St.-Jean-de-Maurienne, the safety site and the connection to the existing French line; the Montcenis base tunnel (57.5 km); an open-air area in the Susa Valley (2.7 km) that includes the new international passenger station and the Susa safety site; the connection tunnel (2.1 km) to the existing Bussoleno railway track; and an open-air area for the linkage with the existing line in Bussoleno (0.9 km). The cross-border part of the joint section is therefore 66.9 km long in total and it includes 2 outside safety sites (Saint-Jean-de-Maurienne and Susa), 3 underground safety sites (La Praz, Modane and Clarea, accessible from the outside via access tunnels) and an additional tunnel for access by rescue services in Saint Martin la Porte. The two tunnels (base and interconnection) consist of two single track tubes connected via corridors built every 333 m (reduced to 50 m in the underground safety sites of the base tunnel). Along both tunnels, the cross-section of the current section consists of a service and evacuation walkway (no more than 1.20 m wide – from the side of the second tube), a rail traffic track, and a maintenance walkway on the outside side (see Figure 5).

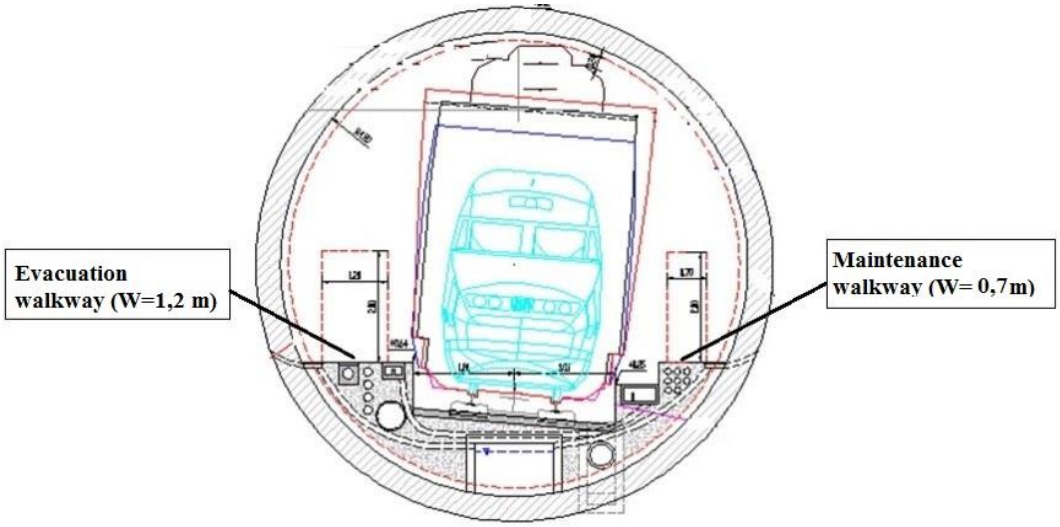

Figure 5. Tunnel typological cross-section

In particular, the base tunnel has a lighting system and smoke extraction systems that can be activated in the event of an accident, as well as detectors, a liquid collection system, and a fire protection network. The New Turin-Lyon Line will be a mixed passenger and freight traffic line designed with a nominal track speed of 250 km/h. The following train categories will be able to run on the line:

- High-speed passenger trains (HS): maximum operating speed 220 km/h on the Saint-Jean-de-Maurienne–Susa section;
- High-profile Railway Trains (AFGG) and Modalohr Railway Trains (AFM): maximum operating speed 120 km/h.
- Conventional freight trains (M), maximum length of each train 750 m. Maximum operating speed: 100 or 120 km/h depending on the category.

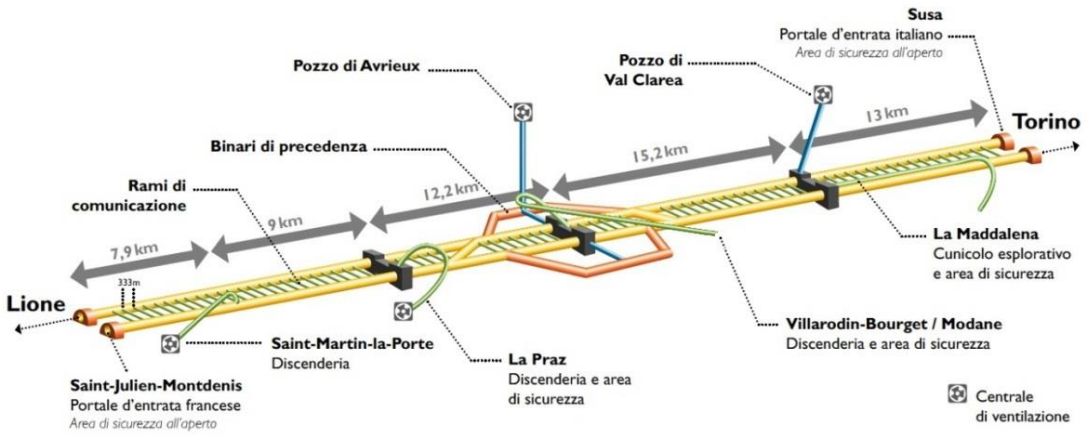

Figure 6. Diagram of the 57.5 km of the Base Tunnel and its main connected works

3 THE RAILWAY SAFETY APPROVAL PROCEDURES

3.1 *The Bodies involved in railway safety*

A massive cross-border work, such as the Montcenis base tunnel, has seen, since its early design stages, the intervention of a series of competent "players" in the field of railway safety. In particular, TELT, as Public Sponsor, is responsible for concluding and overseeing the execution of the contracts required by the design, creation, and operation of the cross-border section of the work, as well as for obtaining all the authorisations concerning the safety of the railway operation. In accordance with Directive 2001/14/EC, which provides for a specific infrastructure manager for the cross-border section, the "Public Sponsor" was officially created on 23/02/2015 and it is called 'Tunnel Euralpin Lyon Turin (TELT) SAS.

Additionally, the Intergovernmental Commission, set up by an agreement between Italy and France dating from 15 January 1996, is charged with approving the project and with proposing to the two governments the specifications for the final works, the methods of construction, and their financing, as well as the conditions of operation.

To accomplish these tasks as defined in the aforementioned agreement, the Intergovernmental Commission has decided to set up a Safety Committee to assist it with decisions concerning the technical safety of the work during the design, construction and management stages.
This Safety Committee consists of experts in the following sectors:

- Infrastructure safety and traffic in the railway sector,
- Civil safety and rescue.

The National Safety Authorities for railways (NSA) of the two countries are also represented in the Safety Committee.

All safety certification requests for the cross-border section are addressed by the Sponsor (TELT) to the National Safety Authorities for railways who, while competent for their own national territory, coordinate and express a joint decision on the basis of a 2014 protocol.

The Designated Body (DeBo) is responsible for instituting the verification procedure of structural subsystems when national standards are applied. This procedure is preliminary to the presentation of the safety files to the NSAs.

The notified body (NoBo) is responsible for assessing the conformity of the subsystems with the TSIs (Technical Specifications for Interoperability) and the applicable regulatory provisions, and it certifies the EC declaration of conformity and suitability for use of the components. This activity must also be conducted prior to the presentation of the safety files to the NSAs.

The assessment body (AsBo), in accordance with Regulation (EU) No. 402/2013 ("Common safety method for risk evaluation"), is responsible for the independent assessment of the correct application of the risk management process and for the results obtained.

TELT has envisaged appointing a single, joint body to ensure the roles of DeBo, NoBo and AsBo. This in order to avoid duplications in implementing the DeBo and NoBo missions, in accordance with Article 6 of Regulation (EU) No. 402/2013. The DeBo/NoBo/AsBo was identified by TELT as the Grouping Belgorail – RINA.

3.2 *Reference regulatory framework and consequent international harmonisation*

Over the years, a complex work of regulatory harmonisation has been conducted under the supervision of the Italian-French Intergovernmental Commission (IGC). The goal was to arrive at a common set of standards for the cross-border portion of the railway work.

These standards were first divided into two macro-categories: general standards, not strictly railway-related (for example the standards on geology, environment and non-railway infrastructure such as roads), and railway-specific standards. Within this second macro-category, the standards have been grouped into three sections, namely: "joint" standards, valid for both high-speed lines and conventional/existing lines, specific standards for high-speed lines, and specific standards for conventional lines. The regulatory framework also aims to apply technical recommendations issued by International Associations over very specific topics, such as guidelines and best practice recommendations. From the regulatory viewpoint, the standards and regulations for the international section are classified according to the following order of priority:

1. EU directives and TSI standards come first.
2. Failing that, the safety criteria established by the IGC take precedence over national standards. The IGC may lay down rules more stringent than the European directives and TSI standards, except for rolling stock.
3. In the absence of European directives, TSI standards, or IGC criteria, the standard applied is whichever national standard (Italian or French) is the strictest, subject to verification of the consistency of all provisions.

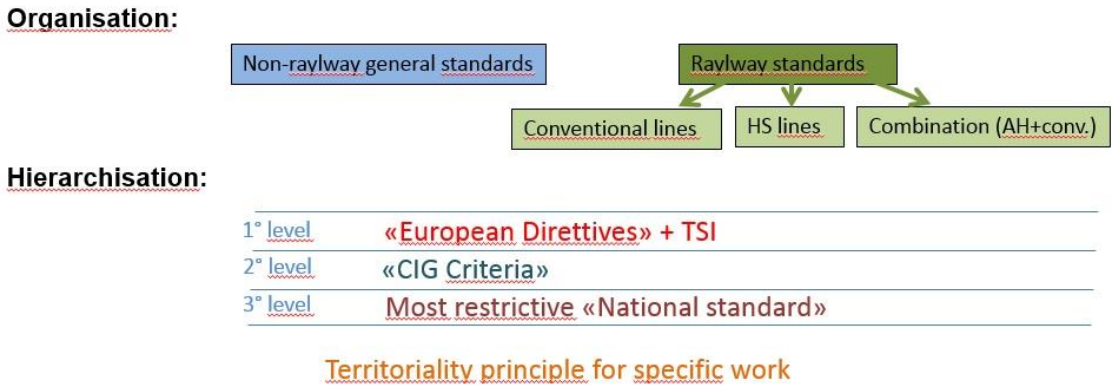

Figure 7. Structure of the regulatory framework

It is clear that compliance with the TSIs is a necessary condition for the safe integration of the international section into the trans-European rail system, to which it will be connected through both the French and Italian sections. On the contrary, for all "non-line" works strictly linked to their geographical location (for example, in the case of technical buildings), the territoriality principle applies, i.e. the legislation of the country of origin applies (see Figure 7).

In the context of the regulatory framework described above, and in application of French Decree 2006-1279 on the traffic and interoperability of the railway system, TELT had to draft, already at the time of issue of the Definitive Plan, a Preliminary Safety Dossier (DPS: Dossier Préliminaire de Sécurité), subject to the approval by the French Rail Safety Authority (EPSF: Établissement Public de Sécurité Ferroviaire).

In compliance with the agreement between the two NSAs of 2014, the DPS was also sent for analysis to the Italian National Railway Safety Authority (ANSF: Agenzia Nazionale italiana di Sicurezza Ferroviaria).

In short, during the course of the year 2017, the DPS for the cross-border section was first subject to an independent investigation by the NoBo/DeBo, and then to the joint investigation by the two NSAs (EPSF and ANSF).

3.3 *Obtaining the "clearance for development" for the construction of the work and, upon completion, the "clearance for commercial commissioning" of the infrastructure*

The first version of the DPS was issued in March 2017, covering an overall summary of the full TELT Project. It was subjected to compliance checks with the Technical Specifications for Interoperability (NoBo) and national standards (DeBo) by the independent validator identified by TELT for the roles of both NoBo and DeBo. This investigation ended in early July 2017 with a favourable opinion on the compliance of the infrastructure portion of the DPS (Rousse 2018).

On 13 July 2017, the reviewed version of the DPS and the NoBo/DeBo compliance report were sent to the NSAs to begin the investigation aimed at obtaining the "clearance for development" for the part relating to the infrastructure.

The special Italian-French bi-national context characterising the Base Tunnel involved a close exchange of information, clarifications and requests for additional documents, in particular:

- The forwarding by TELT of more than 110 design documents in reply to requests for support/clarification;
- The definition of the reference regulatory framework applicable to the infrastructure, including aspects regarding its Italian-French harmonisation, and the approval of its scope and completeness by the NoBo/DeBo;
- Demonstration of compliance with the Rail Traffic Regulations (ANSF Decree No. 4/2012);
- Redefinition of some procedures to manage tunnel accidents and train reversing;
- Drafting of a risk analysis in accordance with Ministerial Decree 28/10/2005 "Safety of Railway Tunnels".

On 2 May 2018, TELT received formal approval of the infrastructure portion of the DPS by the EPSF, pursuant to French Decree 2006-1279 of 19 October 2006 on the safety of rail traffic and the interoperability of new railway lines. This approval formally allowed the beginning of civil works in the base tunnel in France.

As previously stated, the investigation for the DPS Infra was carried out jointly by the Authorities of the two countries on the basis of the 2014 protocol, although at this stage of the design process it was an exclusively "French" obligation.

The technological part (Energy and Command/Control/Signalling) of the DPS should be developed later (TELT plans to issue it by 2023). It will take the form of sector-specific DPSs which will then follow the same approval process: with the independent NoBo/DeBO validator first, and then with the NSAs, thus clearing the start of technological works in the tunnel.

Once construction of the infrastructure is completed, TELT, as infrastructure manager, will have then to obtain from each relevant National Authority an authorisation for railway activation with territorial validity, which will certify its compliance with a regulatory framework structured on European and national directives (see Figure 8).

In particular, the Italian Authority will issue the Commissioning Authorisation (AMIS: Autorizzazione alla Messa in Servizio) for the section in the Italian territory, and the French Authority will issue the Commercial Operation Authorisation (AMEC: Autorisation à la Mise en Exploitation Commerciale) for the section in the French territory.

These authorisations require first the approval of a Safety File (TELT plans to issue it by 2028) which will describe in detail the whole work and everything related to the safe management of railway operations. In particular, the plan will detail the emergency procedures adopted, the management procedures for critical issues, the interoperability constituents used in accordance with the TSIs, the testing and inspection programmes, the maintenance levels of the work, the minimum operating conditions, and the tasks and functions of the personnel employed.

To further complicate the approval procedures, according to the so-called One-Stop-Shop initiative, the EU Agency for Railways (ERA) will become, from 2019 onwards, a European-level Authority with the power to:

- Issue single EU-wide safety certificates to railway undertakings;
- Issue single EU-wide vehicle operation certifications;
- Grant pre-approval for ERTMS infrastructure.

Clearly, TELT, as infrastructure manager, will be involved exclusively in the pre-approval of the Command/Control/Signalling sub-system (based on ERTMS), but it will nonetheless be required to verify the certificates and authorisations necessary for railway undertakings to run in its area of competence.

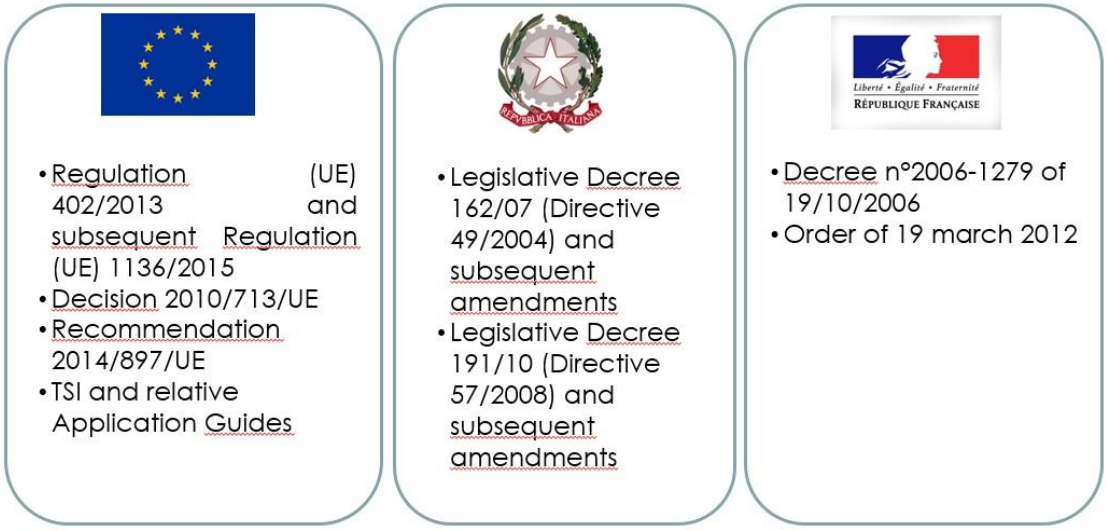

Figure 8. Reference regulatory framework for the commissioning authorisation procedures

4 CONCLUSIONS

A cross-border project structured as a long railway tunnel requires, since the early design stages, to respect a series of complicated approval steps which aim to ensure safety of the railway and its compliance with the interoperability requirements described in the TSIs.

To date, the local entities with the authority to issue development approvals are the National Safety Authorities for railways, but, as of 2019, they will also be supported by the European Agency (ERA), which will give advance notice on the aspects related to ERTMS.

In the case of the Montcenis base tunnel, at the end of the design stage, the National Safety Authorities have jointly expressed a "clearance for development" in relation to its "Infrastructure" portion and, in the future, they will have to do the same for the "Energy" and "Command/Control/Signalling" systems.

The Commissioning is therefore the final act in this complicated process by which the infrastructure managers brought a structural element into operating status, after providing proof of compliance with all the essential requirements and therefore with all applicable regulations.

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