4 PURSUING THE OBJECTIVES

Different measures have been taken to finally push forward the rail in Europe that focus on eliminating concrete deficiencies. Many of them are of international interest and are therefore developed inside the frame of European Union whilst others are designed and implemented by the railways and/or the industry.

4.1 LEGAL FRAME

The EU is providing the legal frame that will make the changes possible and sets the basis for a sustainable mobility. At present, it is constituted by the following set of documents, from which the four directives are known as the “first rail package” from 2001 [20,21]:

- Directive 2001/12, update of 91/440: rail management autonomy, account separation between operations and infrastructure, debt clearance.
- Directive 2001/13, update of 95/18: licensing of railway enterprises.
- Directive 2001/14, update of 95/19: allocation of railway infrastructure capacity, charges for use of the infrastructure and safety certification.
- Directive 2001/16, update of 96/48: interoperability of the transeuropean networks for high speed and conventional lines. Of great importance since it clears the way for an obstacle-free European rail network.
- Decision 91/1893: public service obligation rules.

An extension and improvement of these measures is found in the “second rail package” (2002), which contains [21]:

- Communication “Towards an integrated European railway area”.
- Proposal for a directive amending the directive 91/440 to speed up and widen the opening of the networks to freight traffic.
- Proposal for a directive amending the directives 96/48 and 2001/16.
- Proposal for a directive on railway safety, including the proposal for a European driving license for train drivers.
- Proposal for the creation of the European Railway Agency (ERA) to advise the EU-Commission on the Technical Specifications for Interoperability (TSI), regulate -sample, judge, improve- common rail safety rules, targets and methods, and watch the adaptation of

normatives to national equivalents. In the future it shall dispose of power and authority at least on these items.

- Proposal for a decision to allow the European Commission to negotiate the conditions on the entry of the EU in the COTIF.

Additionally, other indirect measures will affect the railways. The directive 99/62 regulates the tolls to repay the investments on the motorways and similar roads, the price of which has to be set after the average cost of the way [21]. An upgrade version has been prepared containing several important conditions:

- Tax to be applied on vehicles weighing 3.5 tonnes or more.
- Other long-distance roads attached to the motorways can also be charged.
- Only for infrastructures that have not yet been financed.
- Only in those infrastructures carried out by private or semi-private partnerships can the total cost and the capital cost be considered.
- From the external costs, only the cost of accidents can be included.
- The taxes collected can only be used in the transport sector.
- An infrastructure enterprise must be created to receive and control the use of the money collected.

4.2 INFRASTRUCTURES

One of the first and main measures of the EU to improve the international transport network was known as the Trans European Networks (TEN). This plan, agreed in Maastricht in 1995, aims to improve and expand rail, road or ship connections of trans-European interest. Concerning railroads three fields have been considered for which specific networks are being conceived [18]: high-speed lines (new or upgraded, see figure 4-1), main network for combined freight transport (see figure 4-2) and other important lines.

Among the targets of the TEN are the expansion of the high-speed network to 28,900 km and the definition and improvement of a network for the rest of internationally important services consisting of 49,700 km tracks [18]. The first group of eight priority high-speed routes of European interest was included in the list called “Essen Projects" [UIC]:

- Nordic triangle: Oslo – Stockholm- Malmö-Oslo, Turku – Helsinki.
- Oresund: Malmö – Kobenhavn.
- WCML: Glasgow – Manchester – Birmingham – London.
- PBKAL: Paris – Brussels – Köln / Amsterdam, Paris – London.
- Eastern route: Paris – Luxembourg / Mannheim / Strasbourg (Rhealys).
- North-South route: Berlin – Erfurt – München – Verona.
- France-Italy route: Lyon – Torino – Milano – Verona – Venezia.
- Southern routes: Bilbao / Dax – Madrid – Barcelona – Montpellier.

Many of these projects have already been finished and are on duty (see 1.2).

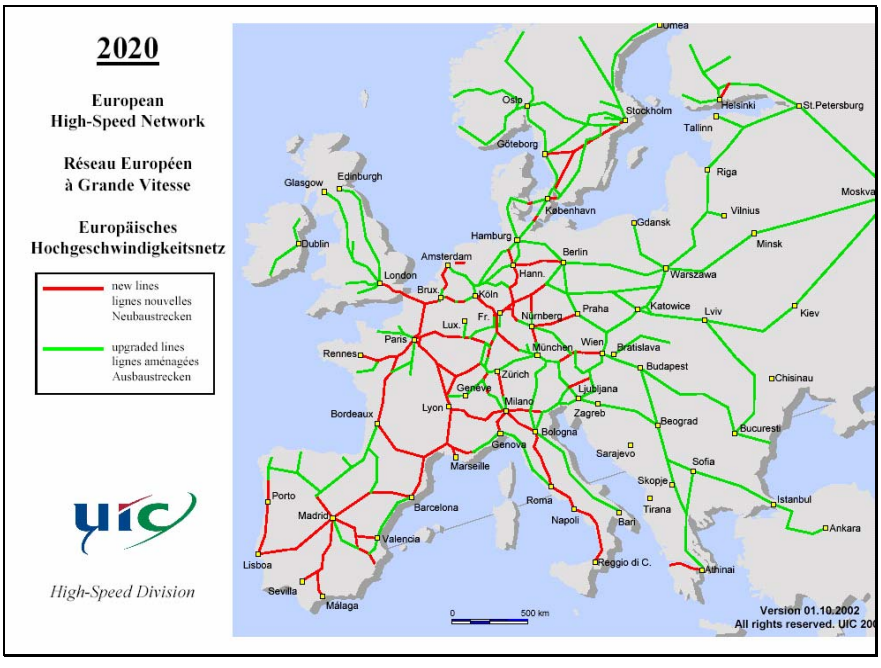

Figure 4-1: European high-speed network for 2020. Source: UIC.

At first glance, the above-mentioned projects are aimed at improving passenger services only, but this means that passenger traffic can be grouped together. This way, the rest of the infrastructure will be cleared and more capacity will be available for freight transport. Separation of traffics means no more subordination to passenger traffic conditions and adaptation to the client's demands [6]. In this context, the Trans European Rail Freight Freeways (TERFF's) have been proposed. Its goal is to create seamless border-crossing freight corridors, open to any certified company. In these routes all the infrastructure operators involved will work as one and the "One Stop Shops" (OSS) will handle all proceedings to provide a superb customer-oriented service, where clients only address to one office. The first pilot projects were set on the following routes [22]:

- Rotterdam – Bremen – Hamburg – Nürnberg – Passau – Wien.
- Hamburg – München – Innsbruck – Brenner – Verona – Brindisi.
- Muizen (Belgium) – Bettembourg – Sibelin – Vennissieux (Lyon) – Torino – Genova – La Spezia – Gioia Tauro (Reggio Calabria).

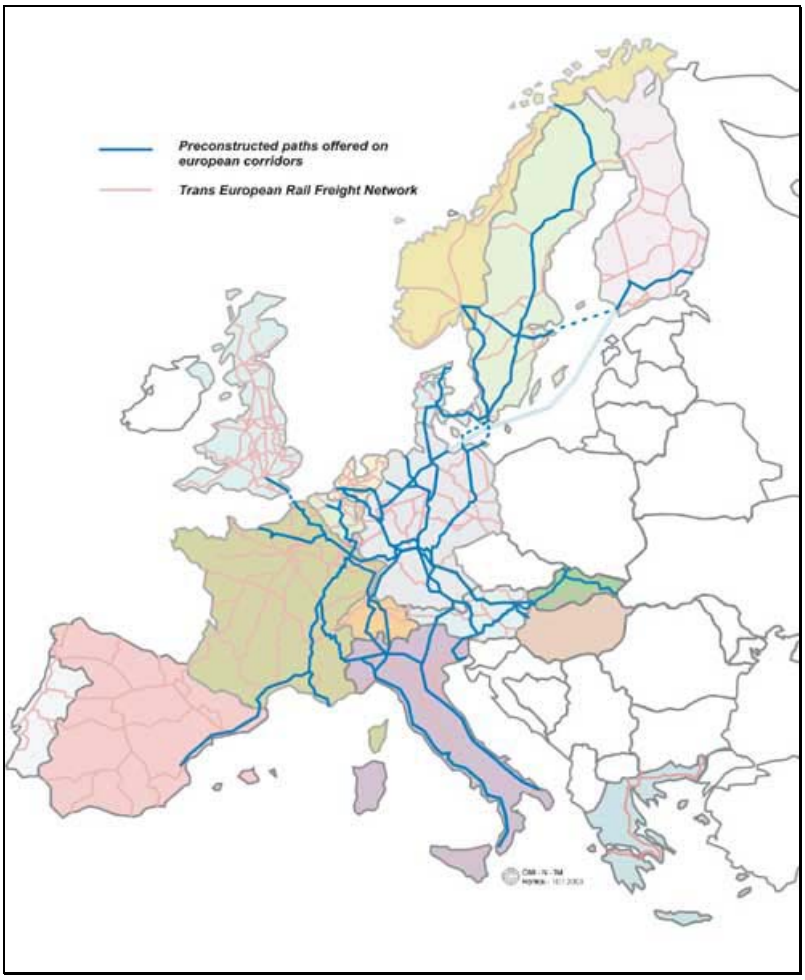

Figure 4-2: Trans European Rail Freight Network. Source: [21].

Today, the network has incorporated many other routes, as can be seen in figure 4-2, and differentiates preconstructed paths from the rest of the network. These paths can be booked at short notice, thus giving customers maximum flexibility in responding to market conditions. The number of OSS has also grown and currently every European country holds one [23].

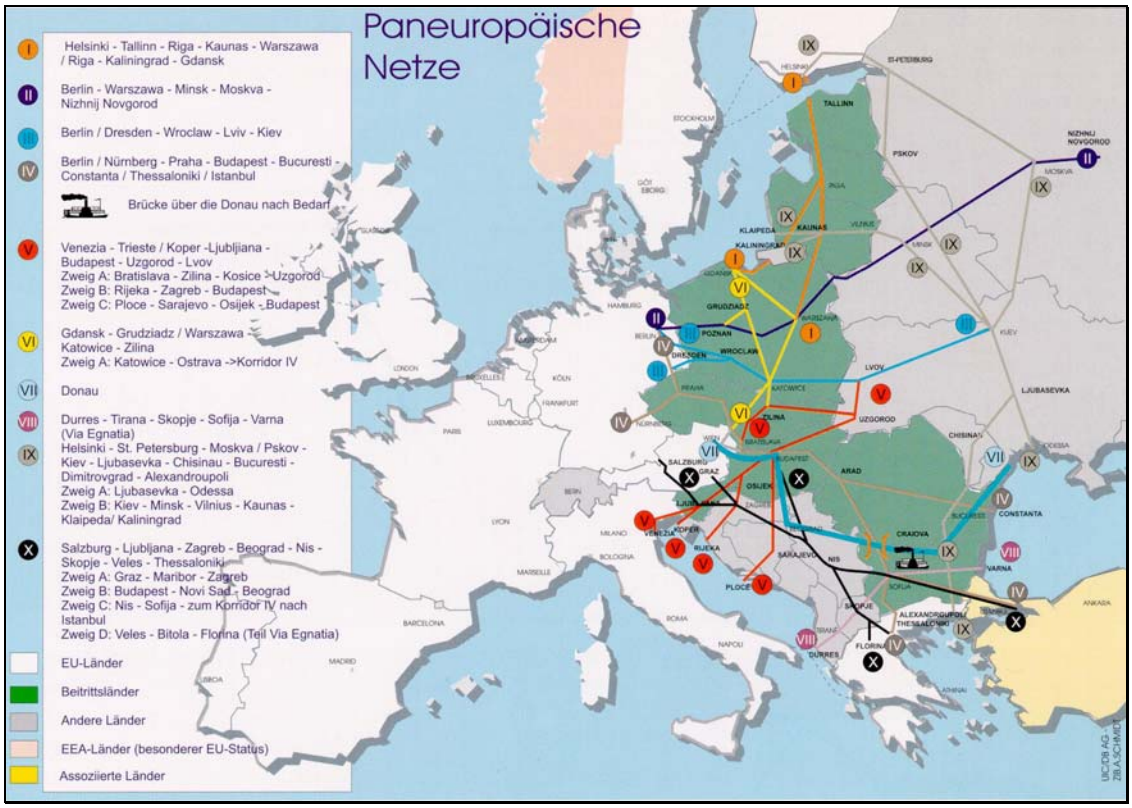

Figure 4-3: Pan-European corridors. Source: UIC.

The future admission of eastern countries in the European Union has also been considered owing to its relevance on international freight transport and to prevent their modal split to move towards roads. In agreement with the previous plans, a Pan-European network formed by ten so-called “Crete corridors” will link the eastern main cities and economical centres, among them and to the western countries (figure 4-3). So far, these corridors consider 20,000 km of rail tracks, 18,000 of roads, 38 airports, 13 sea harbours and 49 river harbours to be upgraded till the year 2015 [22]. The target is not only to improve all networks, but also to lead the eastern countries to adopt the Community’s codex for law and relationships (“acquis communautaire”).

Moreover, the EU Commission created the TINA (Transport Infrastructure Needs Assessment) to evaluate and propose infrastructure in the eastern countries and stabilize the modal split [6] (see section1.3).

4.3 TECHNICAL STANDARDS FOR INTEROPERABILITY (T.S.I.)

European rail enterprises were always aware of the convenience of sharing technical specifications. This task was started by the "Technical Unity" and afterwards continued by the UIC, but its success on international traffic was not complete. After the signature of the treaty of Maastricht and the plans for the TEN, the UIC, the UITP and the UNIFE created the AEIF (European Association for Railway Interoperability) to develop the Technical Standards for Interoperability (TSI) which should build the frame for an obstacle-free traffic for freight and passengers within Europe (high-speed or conventional) [18], and to create general harmonic rules for the benefit of both industry and rail enterprises (Directive 96/48). Although railways and industries have representatives in the AEIF, railways shall be involved only in so far as necessary to ensure interoperability and avoid an excess of norms that would only make the system more expensive. On the other hand, industries need TSI's to tell them how to do things and therefore rules have to be simple, not excessive and affordable in doing the transition to them.

The simplification of the technical components through its standardisation will allow factories to produce larger numbers of each component, thus being able to offer lower prices. On its turn, this increase in competitiveness will open up the American and Asian markets to European industries

The fields of work of the TSI's are infrastructure, energy supply, control-and-command and signalling, rolling stock, maintenance and operation. Environment and passengers are also fields of work but as part of the previous ones. On its creation, each specification undergoes an economical evaluation and a suitability or conformity test before being fully accepted. One by one, the definitive versions of the standards turn into part of the European normatives and the different countries introduce the TSI's after the corresponding stepped plans.

At present, the TSI's on some of the fields described in the directive 96/48/EG for high-speed and conventional lines have already become mandatory (May 2002) and are being followed in the new construction lines Brussels – Amsterdam, Madrid – Barcelona and Paris – Strasbourg.

4.4 LIBERALIZATION

The liberalization of rail transport companies is one of the cornerstones of the revitalisation of the rail market [17]. The introduction of competition will change the procedures of the market and also its results, economically and socially.

So far, Germany, Italy, Netherlands, Sweden, Denmark and UK have already opened its doors to national passenger transport enterprises and, above all, to freight companies. Although the conditions are not yet completely fair, in Germany for instance, the passenger enterprises have managed to reach a share of over 20%. Furthermore, in some cases the overall production of the infrastructure has raised very remarkably and the quality of the services too [21].

This change has been possible thanks to the European legislation (see 3.1.1) and its “first rail package”, although, owing to the reluctance of some countries, the lapse of time used for the conversion to national equivalents varies noticeably among the EU members. Another step forward has been taken with a new set of suggested normatives including the “second rail package” with the update of 91/440 on 23.1.2002, which will open all networks to all companies completely on January the first, 2008. Companies will then be able to operate across and inside foreign countries.

4.5 EUROPEAN RAIL TRAFFIC MANAGEMENT SYSTEM (E.R.T.M.S.)

The ERTMS project was set up in order to unify the train management and control systems, to enhance the capacity of the existing and future tracks and to open the way for the harmonisation of other sectors of the traffic management. Industries, infrastructure operators and railways (UNISIG) together with the European Commission are developing it after the specifications of the TSI and the UIC.

Its name is the addition of ETCS (European Train Control System) and GSM-R, and it has three levels of work to adapt to the needs of the tracks. Its conception is modular; therefore a track can be always upgraded or downgraded from one level to another with no need to change all the equipment.

The first level works in the traditional way: the external signals alongside the track inform the driver and beacons -or balises- between the rails detect the position of the train and transmit it via cable to the control centre (figure 4-4). The block sections are rigid.

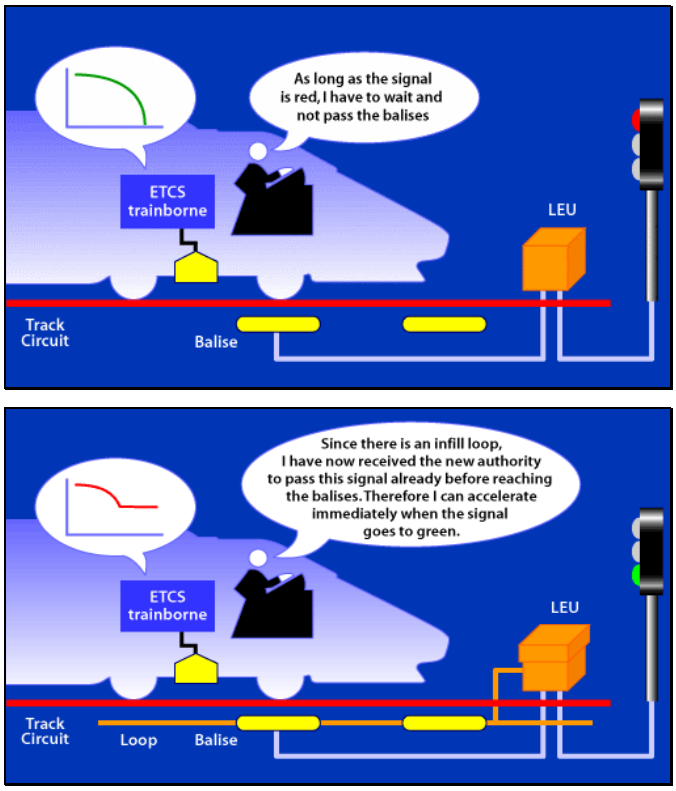

Figure 4-4: ETCS level 1, without infill (upper) or with infill (lower). Source: [24].

The second level does not require any external signals -ETCS displays them inside the cockpit- and allows transmitting data via radio, whereas the block sections and the beacons still work the same way (figure 4-5).

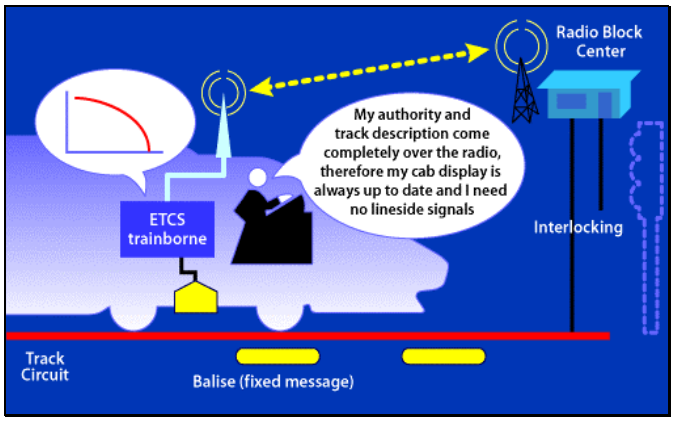

Figure 4-5: ETCS level 2. Source: [24].

In the third level (figure 4-6), trains read their position from the beacons

and “radio block centres” linked to the interlockings or towers are needed along the line to receive information from the trains and to transmit signals [27, 24]. This configuration allows the system to use moving blocks, thus greatly increasing capacity.

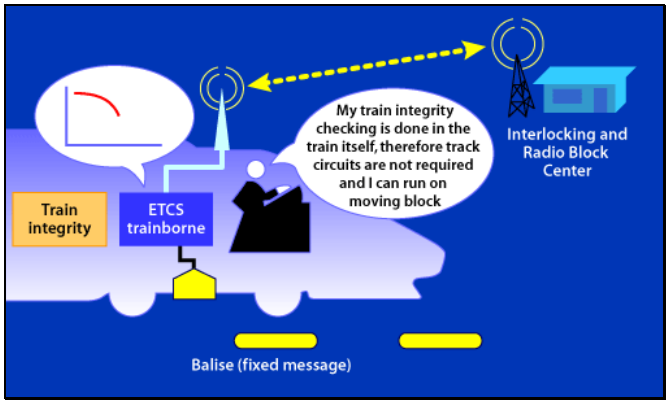

Figure 4-6: ETCS level 3. Source: [24].

The features of the system enable it to handle more information than other train control systems and it is therefore able to supervise every train individually and run every train according to its optimum characteristics. This way, line speed and capacity are increased thus bringing greater efficiency and safety to passengers, and greater revenue earning potential to the operator [25].

The development of the ETCS/ERTMS is being done all over Europe. Test tracks and commercial projects can be found in most of the western and also of the eastern European countries, putting under the test the first two levels of the system [24]. The tests of level 3 will begin once the proper functioning of these first two levels has been completely proved, presumably not before 2006 [26].

The transition to the new system is a time-demanding progressive process, therefore, where infrastructure is not converted to ETCS, the system allows the use of specific transmission modules (STM), installed in the cockpit together with ETCS, to translate the data from the infrastructure to the new language. This way, an ERTMS capable train would also be able to run on not-updated tracks.

But at the same time this solution is one of the main problems of the migration process. Fitting new train control systems on the locomotives and its control panels in the cabins is very problematic, especially in motor-coaches and international traction units – where more than one is already installed- owing to the limited free space. Moreover, the lack of free space makes maintenance more difficult [3,27,28].

Although ERTMS is the optimal concept for train control, its future is not free of risks. The possibilities of a scaled migration on converting the fleet and trackside equipment are limited, therefore up-front investments will be required [28]. Since railways and infrastructure operators cannot afford to carry out the migration at the necessary speed, they will be aided with the economical support of the EU, the European Council, the European Commission and of the governments. To better judge the particular need of

funds, the EU has requested the countries to prepare “consistent transition plans with underlying economical justifications” [28].

The main target of these investments must be projects aiming to improve safety, to fit ETCS on new lines and vehicles, and to create European corridors with ETCS. For 2008, the corridors where ETCS will commercially work can be seen in the figures 4-1 and 4-2.

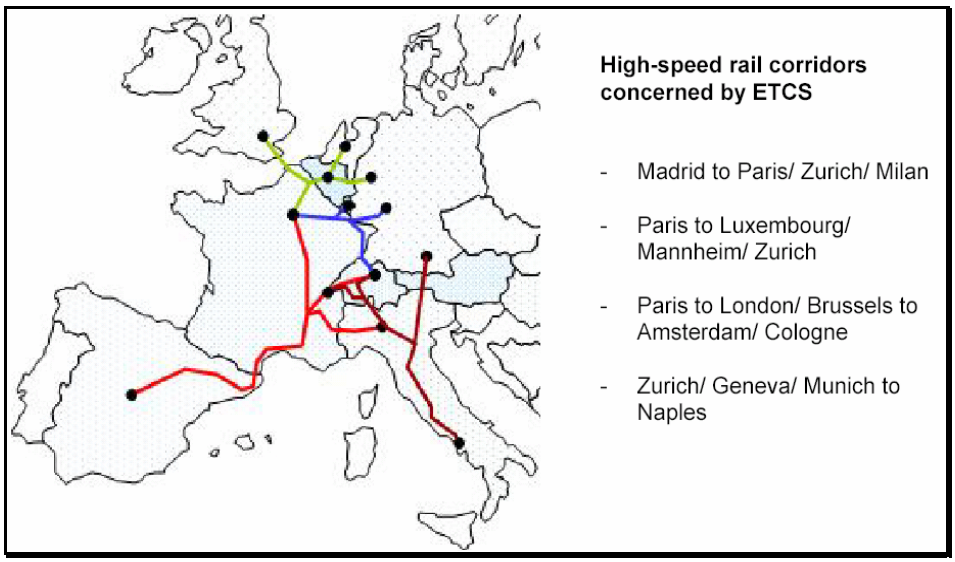

Figure 4-7: High-speed rail corridors concerned by ETCS for 2008. Source: UIC in [28].

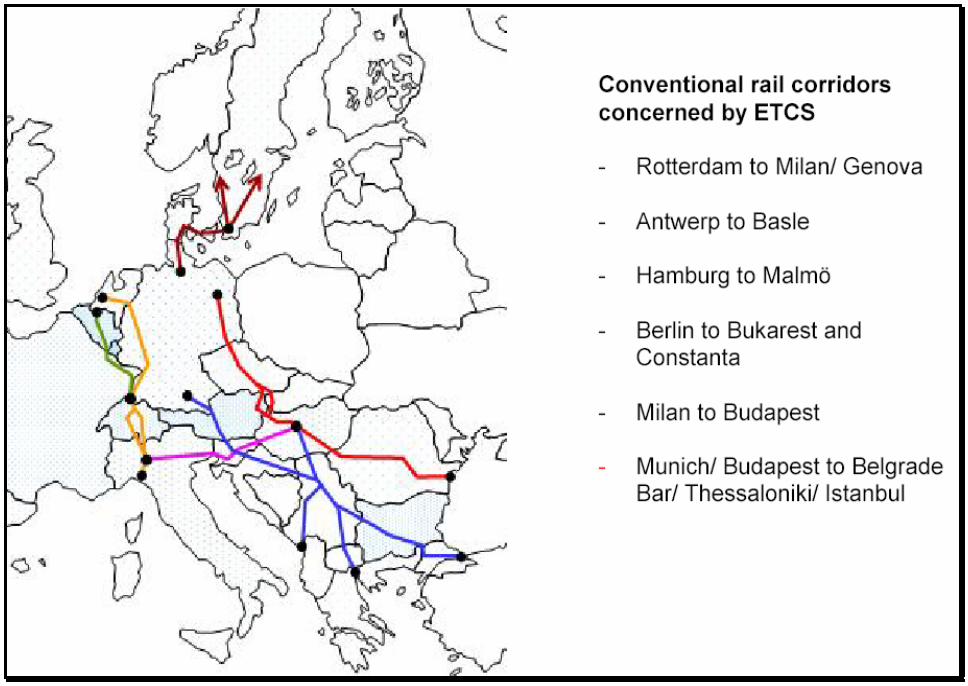

Figure 4-8: Conventional rail corridors concerned by ETCS for 2008. Source: UIC in [28].

The matter of purchase costs is also important, and to make them low there needs to be competition among the producers. Promotion outside Europe is being carried out, with great interest of potential clients [27], which will make the investment in the development more interesting and reduce the unitary costs.

However, many other programmes are necessary for the success of the new system. Under their scope, the management procedures (HEROE - Harmonisation of the European Rail Operating Rules) will be homogenised and become part of the TSI and communication tools as well as informatics to control subsystems (EIRENE and EMSET respectively) will be defined and developed.

4.6 HIGH-SPEED TRAIN EUROPE (H.T.E.)

In view of the oncoming scenario, railways have felt the need for a low-cost interoperable high-speed train. Aware of the lack of alternatives, the Italian, French and German railways have started the development of the HTE [29].

The project aims to create a vehicle of low purchase price and low maintenance and operation costs that will allow the overall cost per seat to sink around 30 or 40%. Thanks to its modular conception and to the use of standard components it will also be interesting for other railways. A complementary advantage is that on its design, the newest TSI's for high-speed are being accomplished, and so it will be able to circulate on all European high-speed tracks from the very beginning.

According to the forecasts, the first generation will roll before the end of the decade.

4.7 OTHER MEASURES:

- European certification: The certification of material and rolling stock at a European level is being prepared in accordance with the provisions laid down by the ERC; a unique recognised railway accreditation body will accredit recognised railway certification bodies all over the EU and consequently recognised railway test laboratories. The same accreditation criteria must be applied throughout Europe to ensure that the bodies are recognised at pan-European level.
- EuROPE: This programme developed by CORDIS (Community Research and Development Information System) is divided in three parts:
    - TRIS: Teleconferencing Railways Information System
    - TRIO: Transportation Railways Innovative Optimisation
    - TRIP: Transportation Railway Integrated Planning

    TRIS aims to develop a telematics and information technology system that provides railway companies with innovative concepts and demonstrators in timetable planning, implementing EU Directives for access-to-infrastructure and operations on trans-European corridors. TRIO introduces support for workflow management, and TRIP focuses on more strategic planning models.
- NEAT: The overwhelming road traffic through the Alps led to the construction of this trans-alpine rail project. The environmental impact will be reduced with the two tunnels under the Gotthard and the Lötschberg (57 km and 36 km long respectively), with maximum climbs of 12,5 ‰ and radii only exceptionally smaller than 4,000 m. These features will allow freight trains to cross the most sensitive parts of the Alps at a speed of up to 160 km/h and passenger trains at up to 250 km/h with the slightest of impacts.
- Combined transport truck/rail [30]: A complementary solution to the problem of road freight traffic through the Alps consists on combining the two systems. The solutions vary from transferring standardised containers to loading the trailers in the wagons, both in an intermodal centre. An innovative variation of the last one are the so called “rolling motorways” or “piggyback system”, where the whole trucks are driven into special wagons that form a convoy of continuous and shallow bottom with small wheels. This system requires a small load centre and allows the truck drivers to rest. To improve and intensify the use of this system are the goals of the ongoing projects.
- Tolls: The introduction of a toll system for lorries in the German motorways is one of the most recent measures that will set fairer conditions on competition (see 2.) while it will also punish those who damage the infrastructure.

- Reduction of energy consumption: Some railways have engaged themselves in reducing their energy use to meet the requirements of a more sensitive environmental politics and reduce costs, internal and external. This way, DB planned to cut the consumption by 25% from 1990 to 2005. But by 2000 it had already achieved to lower the consumption per pkm a 24% and per tkm even a 33%.
- Netz 21: The German railways developed a programme to first improve the use of their networks and afterwards build the supplementary tracks. By splitting slow and fast traffic they intend to raise capacity, both for passengers and for freight, and thanks to more harmonic flows, they will also save energy. After these purposes they have classified the tracks on three networks:
    - Priority: only one kind of train on each track; 3,500km for high-speed, 4,500 km for slow traffic and 2,000 km for suburban traffic.
    - Performance: 10,000 km for mixed daily traffic.
    - Regional: 17,000 km of little used tracks for mixed traffic.
- New bogies: Universities, enterprises and many others are developing new technologies on bogies in order to lower the noise production (especially important if the augment of traffic shall not disturb the public), the weight and the purchase and maintenance cost. Alternative braking systems or materials and new structures are under the test.