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High-speed rails planned in France, Germany, Italy

Plans are already on the drawing boards for high-speed, rail-based transport, including magnetically levitated trains. Part II of a series on the European Productive Triangle.

With the reunification of Germany set to go ahead on Oct. 3, the implementation of Lyndon LaRouche's "Productive Triangle," centered on Paris-Berlin-Vienna high-speed rail links, takes on great urgency.

This series takes up some of the central features of how the Triangle must work. It is excerpted from a Special Report produced by EIR Nachrichtenagentur in Wiesbaden, Germany, titled, in English translation, "The Paris-Berlin-Vienna Productive Triangle: A European Economic Miracle as the Motor for the World Economy." This chapter was written by Ralf Schauerhammer and translated into English by John Chambless.

In Part I, we proved that the "systems analysis" and "free market" approaches to upgrading and integrating European transport were methodologically disastrous. Further, we showed how the development of rail-borne transport has been systematically neglected in Europe for decades. In the section that follows, we look at the situation in several European countries, and what must now be done.

France: progress, with problems

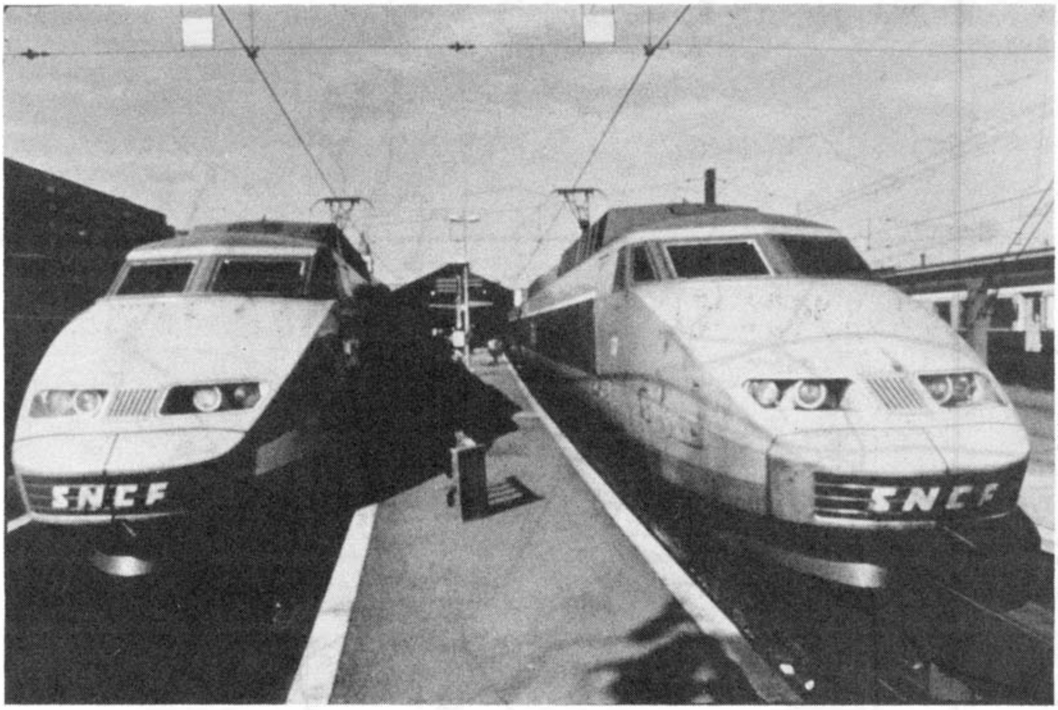
Symptomatic of the problems facing Europe in general is the situation in France, the European country that, through the construction of the TGV (*Train à grande vitesse*) network, has arrived at the leading position in the area of passenger rail transportation. In the area of freight transportation, the French national railways SNCF has suffered a decrease in traffic of one-third (measured in kilometer-tons) in the last 15 years; in volume (measured in tons), the decrease was one-half. The cause was a decrease in steel production and the switch in power production to nuclear power, which led to a situation in which transportation of ore today constitutes only 3.5% and, of fuel, less than 5% of the total traffic. Fifteen years ago, 65% of the SNCF's income was from freight transport; today it is only 35%, and the portion is continuing to shrink.

Independent of the fact that the decrease in traffic in both the areas referred to must be evaluated in light of the national economy as a whole, it should be said that the railroad has not managed to keep pace with changing economic development. It was incapable of that because its rail network, freight-car fleet, and organizational forms were outmoded as the result of decades of underinvestment.

Meanwhile, the same sort of operational economic data found in other European countries made the problem of the railroad obvious. Some efforts were launched to try to improve the situation. However, it is to be expected that the concepts generally under discussion will not fundamentally solve the problem. The reasons for that are the false economic dogmas that in the past decades led to the neglect of rail transportation in the first place. Programs such as that, say, disseminated by the Society of European Railroads, in the framework of the International Railroad Union (UIC) in the last year, the "proposal for a European high-speed network," will not be powerful enough with regard to the intended development in the Paris-Berlin-Vienna economic triangle.

Proposal for a European rail network

The Work Group of the Industrial Chambers of Commerce in Baden-Württemberg appropriately characterized



French Embassy Press and Information Division

France's new high-speed TGV train, the Train à grande vitesse, is a leader in passenger rail transport. Its economic success is unique and uncontested. But when it comes to moving freight, France faces problems, like the rest of Europe.

the situation in its "Economic Proposals for a Modern Rail Concept in the Future European Fast Train Network" as follows: "The magnitude and importance of the task is clear for the economy: Practically, the work of Friedrich List and Heinrich Harkort, which, in its day, led to an optimal German rail network for the relations then prevailing, must be repeated on a European scale for Rail 2000. In this sense, what is to be conceived and realized is a well-rounded, high-performance network for rapid transport with corresponding supply routes and optimized international connections or transitions into the rapid rail networks of neighboring states."

If European officials primarily concentrate on patching together existing national solutions, that will not at all be what constituted "the work of Friedrich List and Heinrich Harkort." Rather, what must be conceptually developed is the fundamental structure of a European rail network based on the existing structure of human settlement and planned economic activities. A larger plan is necessary, which provides an orientation and unifies through that. This task must be feasible, since Europe is today significantly less fragmented than the "crazy quilt" of small German states in the time of Friedrich List (1789-1846).

Additionally, the development in Eastern Europe makes it necessary to fundamentally rethink all existing concepts on the basis of the central Paris-Berlin-Vienna development triangle. Each of the vertices of the Paris-Berlin-Vienna triangle is itself a center from which traffic networks will radiate, or from which, before World War II, they used to radiate. From Paris, the TGV high-speed network, now under construction, will go in the directions of Lyons, Toulouse, Le Mans, Amiens, and Metz-Nancy. The star-shaped network around Berlin earlier encompassed connections to Hanover, Hamburg, Gdansk, Warsaw, Wroclaw, Dresden, and Leipzig. Vienna lies in a knot of connections to Prague, Krakow, Budapest, Graz, and Linz.

Up to now, the orientation of the network has been north-south. After the opening up of Eastern Europe, concentrated east-west arterials must be constructed. That is particularly clear in Germany. Today, the principal axes all run in a north-south direction (**Figure 1**):

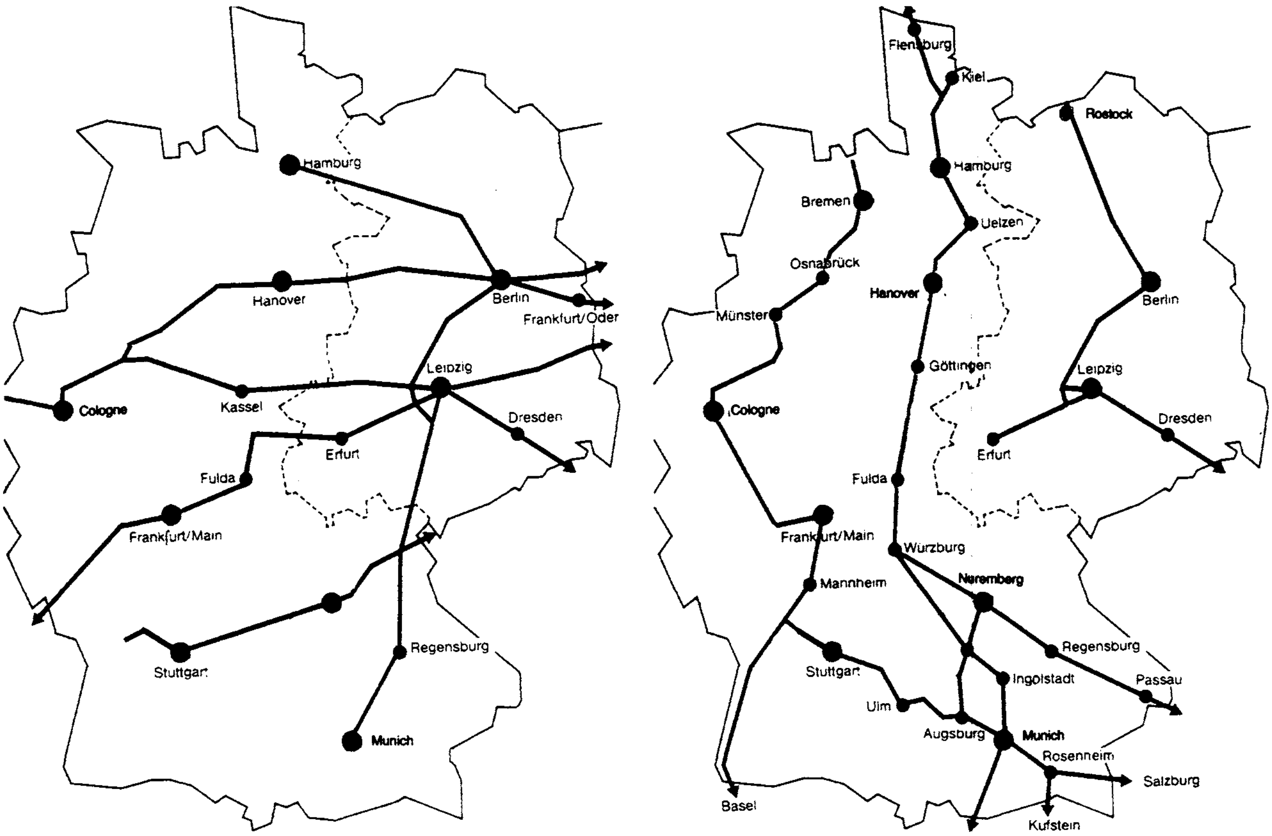
1. Bremen-Osnabrück-Münster-Cologne-Frankfurt/Main-Mannheim-Basel (with a branch to Munich via Stuttgart, Ulm, and Augsburg).
2. Hamburg-Hanover-Göttingen-Fulda-Würzburg-Nuremberg (with a branch through Regensburg to Passau)-Munich.
3. Rostock-Berlin-Leipzig (or Berlin-Dresden).

The presentation of the rail network in "Intercity System 2000," documents how strongly the national railway is conceived to be in the north-south direction.

Before 1945, the most important traffic arteries in Germany ran in the east-west direction:

1. Frankfurt/Oder-Berlin-Hamburg.
2. Berlin-Hanover-Cologne.
3. Dresden-Leipzig-Kassel-Cologne.

FIGURE 1



Germany's main rail lines before 1945 (left) and after 1945 (right), showing the shift from an east-west to north-south orientation. In the new European Productive Triangle, the east-west lines will have to be restored.

4. Berlin-Leipzig-Erfurt-Fulda-Frankfurt/Main.
5. Berlin-Leipzig-Regensburg-Munich.

Naturally, these former arterials will be rebuilt, within the framework of a European system. Of particular importance is the reactivation of the connection between the two centers Berlin and Frankfurt (with stopovers in Leipzig-Halle and Erfurt/Weimar, with Fulda as the transfer station for the new ICE [West Germany's Inter-City Express] route from Hanover to Würzburg). In a reunified Germany, Berlin and Frankfurt should not be more than two hours apart, making possible daily business trips on the express. In the European framework, where likewise the construction of north-south connections dominates, efficient east-west connections must also be constructed. . . .

The new high-speed network will be 12,080 km long, and requires investment and operational costs of DM 265 billion. In addition to these expenditures, the costs for reorganizing the railways in the East European countries must be added in; they are estimated at DM 100 billion for the East German national railroad alone.

High-speed transportation

Although the discussion of the future of the railroad has concentrated increasingly in recent years on "high-speed trains," it is hardly recognized what a radical transformation this technology will entail. With this high-speed technology, there will no longer be "trains" in the sense we now think of them, i.e., a unit consisting of a powerful and expensive locomotive and many passive rolling and relatively inexpensive cars. Merely a glance at the existing plans for high-speed trains shows that they are becoming shorter and shorter with increasing velocity, and the entire train can take on approximately as many passengers as a high-capacity airplane. Also, for operational and safety reasons, the cars of high-speed trains are no longer interchangeable; a "total train concept" is now discussed. Efficient drive and braking systems as well as lightweight construction and interior furnishings are reducing the great cost differential between car and locomotive typical of traditional trains.

The economic quality of the technology

To understand the technological and economic development that are involved here, we must recall how it came about that our railroad came to take the form of a line of cars moving through the countryside.

The technological development of the railroad was made possible through the steam engine. Steam engines can be operated economically only as relatively large operational units. In the last century, before the invention of the Otto motor and the diesel engine, there was a general economic problem with the mechanization of smaller and medium-size operations. The steam engine necessarily led in its realization to long trains with a powerful locomotive and many cars. The long trains could move safely only on rails, and a branched rail network came into existence. The rail-bound train was also distinguished by the fact the very powerful locomotive is controlled by the tracks. This technical control and guidance capacity of an operational unit that today is in general a train, is the basis for the fact that the high-speed transport of the future will be rail-bound.

Whoever speaks in connection with high-speed systems of "rail-related" transportation and equates that with transportation by trains, is confusing the historically conditioned, incidental organizational form of railroad with its essential technological character.

With high-speed transportation, the problem is exactly the opposite from that in the historical origin of the railroad. The problem consists, namely, in constructing units that are powerful enough to move and control the given masses at high speed. Along with the productive power of the motors, control—that is, acceleration and braking—is quite crucial, and here the guidance capability of tracks takes on particular importance. In the area of high-speed transportation, the railroad gains an advantage to the degree that it is successful in using control by tracks, since high road costs are then more than compensated for by low operational costs. Herein lies the qualitative advantage of the magnetically levitated, or maglev, train.

In Germany, many costly hours have been spent by engineers to prove that the potential of the conventional "wheel-track system" has not been exhausted. On May 1, 1988, an "Intercity Experimental" train pushed the world record for wheel-track passenger trains up to 406.9 kph, and, on May 8, 1990, the French TGV even reached 510.2 kilometers per hour on a "speedway."

Superficially considered, these records seem to confirm the wheel-track study. But from the standpoint of physical economy, these results are irrelevant to the development of high-speed transportation, and the engineers' time would have been more sensibly spent on the further development of the maglev system. Dozens of studies on the wheel-track system cannot change the decisive physical fact that only the electromagnetic power transmission of the maglev train with velocities at and over 300 kph is capable of developing a sensible and competitive system. The mere fact that components are increasingly being suggested for the wheel-track system that are typical of electromagnetic drive systems must give the defenders of this system pause to reflect. Eddy-current brakes, that is, a typical electromagnetic steering system, are unavoidable in the aimed-for velocity range of over 200 kph.

More interesting are the proposals for equipping the acceleration and inclined stretches of intercity trains with linear motors in order to reach as quickly as possible the high velocity of 250 kph, or to avoid velocity interruptions with inclines of over 5 in 1,000 because both have serious impacts on travel time. It is asserted that this mixture of intercity and maglev is especially cost-effective since it is, in fact, important to realize the expectedly brief traveling times.

More crucial still are the consequences that arise from the radius of curves and the maximum incline of the roadway and the train density per route possible on the basis of brake performance. The minimum radius for curves that can be negotiated at 300 kph is 2,250 meters for the maglev "Transrapid 06," and 3,500 meters for the Intercity Express, that is, one and a half times greater. The maximum incline for the Intercity Express is 40 in 1,000, while it is 100 in 1,000 for Transrapid, two and a half times greater. What that means for the demands on the roadway of the wheel-track system can be judged by the German national railroad, the Bundesbahn's, newly constructed routes for high-speed trains. The proportion of expensive tunnels is 37.3% on the Hannover-Würzburg route and 31.6% on the Mannheim-Stuttgart route.

The crucial advantage of the maglev train that will crystallize more and more in the future is its "active tracks." With the maglev train, the drive unit no longer needs to be a moving vehicle; rather, the passive vehicle is driven by the track. That makes possible, not only savings in locomotive weight, but it also creates the preconditions for a completely new and much more efficient organization of drive operation. In cost-intensive, personal short-haul transport, it will be an asset that flexible, small units of driverless vehicles can be steered in this manner. In freight transportation, new switching and loading systems are made possible that will allow, with the help of computerization, a network to come into existence in which individual pieces of freight can be "self-moving and -loading," such as we are familiar with in passenger traffic.

For that reason, a long-term transportation concept of the maglev train must be considered from the beginning. An appropriate network must be sensibly developed from efficient arterials that in time will be combined into a network. A farsighted transportation policy will, however, assign a high priority for the near future to conventional trains. In this connection, with regard to the long-term development of the concept preferred in Germany, it is sensible to lay out tracks for the joint transportation of passengers and freight. The construction of routes for pure passenger traffic does reduce investment costs, but can, however, prove to be shortsighted in the framework of a development in which the wheel-track system increases receives the task of absorbing freight transportation overflowing from the highways.

Before we can go into the development of the maglev train, let us take a brief overview of the state of development of high-speed trains.

The Japanese Shinkansen

Operation of the first high-speed train in the world began in 1964 on the Tokyo-Osaka route; the speed was increased from 220 kph to 280 kph for a preliminary period of operation. After the determination was made that the demands on the roadway and the rolling stock at this speed were so great that the operation became uneconomical, the speed was reduced back to 220 kph. The 513-km Tokyo-Osaka route is covered in 169 minutes, with 100 million travelers transported annually. Each day, 130 trains leave from Tokyo, where, during peak hours, trains operate at 10-minute intervals. With revenues of \$5.2 billion per year and expenditures of \$2.2 billion, the Shinkansen is the most profitable railroad operation in the world.

Since the capacity of the system cannot be further developed technically, a new high-speed track based on maglev technology is planned between Osaka and Tokyo, with an intermediate stop in Nagoia. It is to go into operation in the year 2000, and cover the distance in 75-90 minutes, which makes necessary the enormous speed of 500 kph. It is assumed that, with this new travel option, the number of passengers on the line will increase to approximately 200 million, that is, double the number today.

The French TGV

The first European high-speed route went into operation in 1981, between Paris and Lyons, France. The TGV reached 260 kph on this route, and two years later could operate at 270 kph on the entire route of the TGV southeast between Paris and Lyons. Simultaneously, a further high-speed route for the TGV-Atlantique was established, running from Paris to Le Mans and further to Rennes and Nantes. On this route, operation at a maximum velocity of 300 kph could begin in 1989. The TGV's positive economic performance, which until recently contradicted widespread opinion that high-speed transportation cannot be profitable, led to the acceleration of route planning in France. The Atlantique route was extended from Le Mans through Tours to Bordeaux, and someday is supposed to be extended toward Spain through Hendaye and, on the other hand, toward Toulouse.

At the end of 1987, the construction of the TGV-North route was decided upon, which was to go into operation in 1993 with the opening of the English Channel tunnel. Additionally, the TGV-Southeast is to be extended to Valence, and later to Marseilles. Also, a TGV-East is to be built in the direction of Strasbourg. It was also recognized that this star of lines radiating out from Paris must be built up into a proper network.

The economic success and the vigor of the French TGV project are unique, and are uncontested in Europe. What is questionable, is whether this system can serve as the generally valid model for high-speed transportation in the future. The TGV's operational guidance system is, for example, merely a further development of the traditional block system. The route is divided into block sections averaging 2,100 meters. Braking at 270 or 300 kph requires 6,300 meters. Two successive trains keep a distance between each other of at least three blocks necessary for braking (3×2,100 meters) and, to be on the safe side, a further block (that is, a total of 8,400 meters). During the braking process, observations are made on whether the given speed levels are strictly maintained at the end the block section. Automatic operation is not possible with the system.

The German ICE

With the beginning of the 1991 summer schedule, the German Bundesbahn will put the ICE high-speed trains into operation on the newly constructed routes of Hamburg-Fulda-Frankfurt-Mannheim-Stuttgart-Munich and, later, the line Hamburg-Fulda-Würzburg-Munich. The trains, 41 of which have been ordered, consist of two drive units and 14 cars in between. The attempt has been made in the furnishings of the cars to outstrip the TGV with respect to travel comfort. On the newly built routes, a velocity of 250 kph will be attained.

Two considerations were particularly important in the development of the ICE. First, in the development of the ICE-M ("M" stands for "multi-engine train"), the ICE concept was developed less for maximum speeds and more for use in a European network. The first use of international rapid transit is the route from Paris to Brussels to Cologne. The other consideration is the development of an operational guidance system appropriate to high-speed transportation, which was invented with the concept of "continuous line control" (LZB) and used in Germany on newly constructed routes where speeds exceed 160 kph.

With LZB, a continuous, duplex data exchange takes place between roadway and vehicle via a cable in the track. With this operational system, it is in principle possible to allow high-speed trains to electronically operate in a fully automatic way, except for stops at terminals.

The Italian ETR 450 and ETR 500

In Italy, two concepts were pursued for increased cruising speed. First, with the ETR 450 train, existing routes at higher speed can be used; second, for new routes, the ETR 500 was developed as a high-speed train that is supposed to reach a maximum velocity of 300 kph.

The ETR 450 was developed for better use of existing routes. Its special characteristic is a track-curve independent car-body steering system that allows travel through curves with up to 30% higher velocities than conventional systems. This car-body steering is based on the experience gathered with the "Pendolino" (ETR 401) system. The maximum velocity of the ETR 450 is designed to be 250 kph. While traditional trains can only travel through track curves with velocities with a maximum non-compensated lateral acceleration of 1 m/sec^2, the ETR 450 is designed to reach up to 1.8 m/sec^2 with the newly developed car-body steering system. Gyroscopes and acceleration instruments furnish the data to a hydraulic system that changes the inclination of the car bodies. The ETR 450 trains will consist of 4, 6, 8, or 10 powered vehicles, plus cars in between, where each powered vehicle has two moters. The axle load, at 12.5 tons, is relatively low. After initial employment on the route between Rome and Milan, the approximately 30 ETR 450 trains are supposed to be replaced by the ETR 500.

The ETR 500 is supposed to reach a maximum velocity of 300 kph on newly built routes. A car-body steering system is not planned because the number of curves on these routes will be kept small. The trains will consist of two drive units with 8-14 cars in between. The powered locomotives, equipped with four motors, have an axle load of 18 tons. With an experimental train, the ETRX 500, calibration trips have been carried out since 1988. Beginning in 1993, the ETR 500 will operate on the Italian north-south axis, from Milan to Rome to Naples. A travel time of five hours is estimated from Milan to Naples.

The train through the English Channel tunnel

The special conditions for the trip through the English Channel tunnel between France and England led to the development of a multisystem train, 30 units of which have been ordered since the end of 1989. For those trains, the safety requirements for traveling through the tunnel, as well as the inclination ratios of the tunnel ramps, create special operational demands. These trains are therefore too restrictive to serve the basis for a general standardization, and would lead to train systems uneconomical for normal routes. For that reason, a type of special train will be developed in the long term for the English Channel tunnel.

The Transmanche Super Trains (TMST), as these trains for the English Channel passage are called, are supposed to travel between London and Paris as well as London and Brussels, and will be operated by the French, British, and Belgian railroad corporation. The peak velocity of these trains, which consist of two drive units and 18 cars in between, will be 300 kph. They should be able to use the three different train power systems in northern France, Belgium, and southern England, as well as allowing for the different clearance and loading-platform heights. At the beginning of 1992, two prototypes of these trains will undertake trial runs, and delivery of the uniformly manufactured trains is expected for the end of 1992.

The continental train

As mentioned in connection with the ICE-M train, the effort is being made to develop a high-speed train that is also adaptable to the various European railway systems. The first specifications for a train of this sort had already been drawn up by the Belgian, German, French, and Dutch railways. According to the specifications, those trains will have a length of 200 meters, can be joined together, will be able to travel at 300 kph on newly constructed routes and 220 kph on expanded tracks, and will have a wheel-set load of no more than 17 tons. Further requirements will probably be pressurized cars for tunnel runs and the requirement that the speeds of 300 kph can be maintained on steep routes.

A further high-speed track for international traffic that has already been discussed is the POS Project (Paris, eastern France, and southwest Germany). Of the three routes being considered (through Strasbourg, Saarbrücken, or Luxembourg), the line to Strasbourg should be completed. An actual continental train, however, must be able to serve the new east-west connections and be appropriate for Alpine transit. The possibilities and conditions for the expanding east-west connections are not yet explored at all.

Also, with regard to Alpine transit, and hence the integration of the Italian rail network, no decisions have yet been made. Travel time from Milan to Basel is today five hours, to Lyons, six hours, and to Munich, seven hours. Hauling freight across the Alps, in particular, demands new solutions. Many variations for Alpine transit are being investigated: 1) the connection between Lyons and Turin through the Frejus Tunnel; 2) the connection of Chur and Chiavenna through the Spulga Tunnel; 3) several variants of connections through a new Gotthard Tunnel; 4) a connection through a new Lötschberg Tunnel and Simplon Tunnel; 5) a new Brenner Pass route between Innsbruck and Bologna.

The extreme demands of the terrain seem to make it advisable to separate the lines for rail transport of heavy freight and for passenger travel, and to optimize each, for which a maglev route would be a possibility, at least for passenger travel.

For the transport of trucks across the Alps, a proposal is being discussed in Vienna to load the tractor-trailer rigs onto cars in Reutte (south of Füssen) that will then be pulled magnetically through a tunnel almost 100 km long to Bressanone near Brixen—and hence a magnetic truck pipeline through the Alps.

Spanish high-speed trains

An important political decision for European transportation was made at the end of 1988 in Spain, with the introduction of standard gauge track for high-speed transportation. The first part of the Seville-Córdoba-Madrid-Zaragoza-Barcelona route is supposed to be traversed in 1992 by the high-speed TAV trains, which are the same type as the French TGV and use German high-power locomotives.