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THE DEVELOPMENT OF THE HIGH-SPEED RAIL NETWORK IN FRANCE

Jeremy Colello

Introduction

Throughout the last quarter of the twentieth century, France established itself as the cornerstone of technical development in the field of transportation. The innovations that have taken place through the creation of the TGV (Tres Grande Vitesse) high-speed rail system and the construction of the Channel Tunnel have put France in the lead in transportation development within the European Union. Through their development, France has started an effort to create a physically unified Europe. Therefore, as we move into the twenty-first century, France is in a position to take the lead in creating a physically unified Europe.

Since the inception of the European Union, all member nations have been forced to change their perspectives on infrastructure development. Previously, the main planning had been done from a national standpoint. Nations planned with the aim of opening and connecting regions within a particular country. (Voight, p. 291) With the creation of the Union, national leaders are beginning to realize that an efficient and unified transportation infrastructure joining nations must be in place for a unification to be successful. This effort will require a careful integration of each national blueprint into an ultimate transport network. To be successful, this integration needs to be strategic in its orientation and flexible in its implementation. (Button, p. 52) It is now up to France and its government to employ the existing technological foundation in France and take advantage of the central location of France within the European Union.

In this essay, I will discuss the growth that is expected to occur in France and all of Europe and demonstrate the impact that a continuous European infrastructure would have on reducing congestion. I will also discuss the possible
sources of funding for the infrastructure investments and demonstrate the social and economic impacts that France's investment in the TGV system has had on the nation. Finally, I will argue that through international cooperation now evident in Europe, the TGV system has the ability to become the main focus of a unified European transportation network.

Existing Transport Infrastructure in France

Since construction began in 1975, France's TGV system has established itself as the leader in high-speed rail transit in Europe. The TGV is an electric rail system owned and operated by the French national rail company, SNCF (Société Nationale des Chemins de Fer Français). The TGV currently operates on three branches centered in Paris: SudEst, Atlantique and Nord. The passenger cars are designed with comfort in mind so passengers do not feel like they are traveling at nearly 300 km/h. The TGV-SudEst carries an average of 53,000 passengers daily, with a very profitable 30 percent rate of return. (Strohl, p. 83) Inaugurated in 1981, the SudEst travels from Paris to Valence in the southeast of France via St. Florentin and Lyon. This line yielded the SNCF a $382 million (FF 2.0 billion, 1991 dollars) profit in 1991. (“TGV System Map”) The TGV-Atlantique established the world's record for the fastest travel by a railway train at 513.3 km/h. The Atlantique travels west from Paris and reaches Le Mans, Courtalain and Tours. This line, which began service in 1989, yielded a $157 million (FF 816 million, 1991 dollars) net profit in 1991. (“TGV System Map”) The TGV-Nord, began service in 1993 with service from Paris north to Lille (and into Brussels) and Calais (into the Channel Tunnel and England).

As shown on the map, the current track system nearly traverses France north-south and east-west. The recent completion of the Channel Tunnel from England to France adds to the ability of the TGV system, and for the first time England is permanently linked to continental Europe. Soon it will be possible for a traveler to travel through England, France, Italy and Germany entirely by rail.

Although Germany possesses similar high-speed rail technology, the French system is more developed. Plans now exist for the TGV system to be extended into Germany, Italy and Spain for the turn of the century. With the new international development, it is evident that Europe has accepted the TGV system as an important transport system needed to lead the European Union toward a unified state. With this goal in mind, the SNCF plans to put into operation 2,800 miles of new line in the next 20 years. Each mile is estimated to cost $14.3 million (FF 83 million, 1997 dollars) for construction and $13,700 (FF 80,000, 1997 dollars) in maintenance costs. (Schaer, p. 608)

The first of the projects, currently under construction, is the TGV-Thalys line, an integrated, international service which will serve Paris, Brussels, Amsterdam and Cologne. The technical advances of the Thalys will allow 300 km/h operation while running on the four different power sources used by France, Belgium, the Netherlands and Germany. The project is scheduled to be fully operational by 2003. ("TGV Thalys") It is estimated that each ten-car train set will cost $22.4 million (FF 130 million, 1997 dollars). The ownership of the eighteen cars on
the line will be divided between the national rail companies of the four nations. (Strohl, p. 96) This is the second step France has made in an effort to use its geographical location to develop an integrated international transport system.

Geography

Geographically, France is positioned at the center of the European Union. France borders six member nations and has seaports on the Atlantic Ocean, Mediterranean Sea, and the English Channel. Spain is the only other nation with ports on both the Atlantic Ocean and Mediterranean Sea while two bordering countries, Luxembourg and Switzerland, have no coastline at all. As one moves into Central and Eastern Europe, there are several other nations which do not have the benefit of seaports to transport goods and people. Therefore, a highly developed French rail system with the ability to transport goods and travelers throughout all of Europe would be beneficial to other nations. The development of an integrated and efficient high-speed rail line, which has the ability to haul heavy freight, would likewise be in the best interests of the European Union, not just France. Although still in the research stages, developments are being made in an effort to place high-speed freight cars in the French system. The heavier load carried by freight trains relative to passenger trains requires special design considerations. With prime geographical location, the ability to transport goods and people through France into the rest of Europe will help further the development and expansion of France and of the European Union. The ability to haul heavy freight would be the next step in the growth of the TGV system.

The Continued Development of the TGV

The first generation of TGV is in place on the SudEst line, having come into service in 1981. In the years since, improvements in technology have increased the capacity, speed and comfort of the trains. The 1989 inauguration of the second generation, the TGV-Atlantique, allows speeds of 300 km/h due to improvements in engine design, braking and passenger comfort. New auto-piloted motor technology has allowed the increase in speed on what is both a longer and heavier train car, providing a 30 percent increase in capacity (485 seats versus 371). This gain has been accomplished by increasing engine revolutions per minute from 3,000 to 4,000. (Walrave, 1986, p. 53)

The SNCF, in conjunction with the railway brake industry, has also developed new disc brakes with power and energy well above their first generation TGV counterparts. The higher maximum speeds resulted in the need for this better braking performance. The removal of the brake shoes rubbing against the wheels has resulted in both a more efficient train and a quieter ride. In addition to the lower noise level, travel on the TGV has become smoother with the introduction of a pneumatic suspension system. The first generation cars, however, did not need to be altered in their entirety. One of the more impressive features of the SudEst, the acoustical innovations, remains in place in the newer cars. The placement of “bogies” (noise sources) remains between coach bodies and remote from passenger areas. (Walrave, 1986, p. 52) This reduces the noise levels in the cars from the friction of the wheels riding on the rails.

The TGV-Atlantique technology has been applied to the cars on the TGV-Nord branch which opened in 1993. This is the branch connecting Paris and Brussels with a link to England through the Channel Tunnel. Each Eurostar train through the Channel Tunnel carries 794 passengers at speeds of 130 km/h through the tunnel and 300 km/h on the continent. (“Channel Tunnel and Eurostar”) The development of this line signified the first step in international cooperation in the development of rail transport. The effort and cooperation was unparalleled in European history, and the construction of the Channel Tunnel stands as one of Europe’s largest infrastructure projects ever. England is now linked to continental Europe through the $13 billion (FF 2.2 trillion, 1997 dollars) joint venture.

Growth of Traffic

As Europe moves from a state of isolationism to open borders, great strains will be placed on its infrastructure. The removal of
border crossing checkpoints and free movement from nation to nation have allowed travelers to complete their journeys with ease never before seen in this region of the world. Due to the new freedom of movement in Europe, the most significant growth in passenger transport has come from cross-border traffic, which everywhere is growing more rapidly than domestic traffic. (Voight, p. 311) With continued continental integration, the growth in the transport sector is bound to continue on at least the same pace in the future.

With a currently congested highway system, the citizens of France will be forced to look towards alternate modes of transportation. Data compiled by the ECMT (European Conference of Ministers of Transport) showed that road traffic increased by a factor of 2.2 between 1970 and 1991 in Western Europe. Continued growth at this rate may lead to a substantial increase in the use of railways, specifically the TGV. As the rail system expands, more and more citizens will look towards the TGV system for its comfort and ease relative to automobile travel. This is a trend that was witnessed before and after the opening of the SudEst line in 1981. From 1980 to 1985 there was a 75 percent total increase in the use of rail in France. Of this new traffic, 18 percent was diverted from road travel and 33 percent from air travel. As a share of the rail-air market, rail transport increased from 52 percent of the market to 83 percent over the same five year period. (Nash, p. 388) This can be attributed directly to the TGV because the development of the system was the only major change in the French transportation infrastructure during this time. This shows how quickly the citizens of France adapted to the introduction of the TGV.

As the comfort level in riding on the TGV rises, more and more people may even use it as their daily mode of transportation to and from work. The TGV allows a citizen to work in one region of France and live in an entirely different region. In this respect, the TGV has a tremendous advantage over automobile travel. However, recently it has become unnecessary to travel at all in order to do business.

Alternatives to Travel

With the opening of European borders, long-distance travel can only be expected to increase over the first part of the next century. Historically, the growth in personal transport has been nearly perfectly proportional to the growth of communication. (Andersson, p. 74) However, the rapid and sustained growth of the telecommunications industry has created a new outlook on these projections. Technological advancements in telecommunications have, in some instances, made long-distance travel obsolete. With the ability to teleconference, it is no longer always necessary for one to travel for a meeting. The meeting can now take place over the phone lines. The growth in the telecommunication sector will act, in effect, to constrain some of the forecasted traffic growth. (Button, p. 45)

Travel Projections

The growth in traffic, particularly automobile traffic, within France during the last few decades has been astounding. Road traffic increased by 79 percent between 1970 and 1987, while goods moved by roads has risen by 93 percent in France over the same period. (Button, p. 33) The growth in road traffic has lightened the load that the rail transport sector has had to carry. From 1970 to 1991, the rail sector of the total transport market fell from 30 percent to 17 percent. (Voight, p. 300) This trend must be reversed in order for France — and Europe — to avoid gridlock on the highways as passenger transport in France continues to grow. Currently, the estimated cost of time lost due to traffic congestion ranges between 1.3 and 3.4 percent of France’s GDP. (Claisse, p. 638) Between 1988 and 2010, France is expected to experience an annual growth rate of 3.3 percent in passenger transport. (Voight, p. 304) This means a further increase in economic losses to the French citizens unless the government of France changes its position on the development of transport networks.

The underlying problem is that under cur-
rent policies the efficiency of the transport system will inevitably deteriorate in Europe as congestion develops. (Button, p. 34) Linked to this problem is the realization that there may be difficulties in terms of congestion of existing facilities, and massive expansions in capacity are unlikely to be the answer. There is a need to develop entirely new transport networks within Europe. (Button, p. 34) The imminent congestion on the highway system can be effectively offset by a highly developed high-speed rail network. The new era of European cooperation has led to an effort to develop a Western European high-speed rail network to be operational by 2010. With the reduction in border checkpoints and in non-physical barriers, long-distance traffic in Western Europe will increase by half from 1988 to 2010, and cross-border traffic will increase by 90 percent. (Voight, p. 306) A prime example of cross-border traffic is the operation of the TGV-Nord. For this line, the SNCF projected 15 million passengers in its first year of operation and 31.5 million passengers by 1998. (Strohl, p. 97) A separate forecast from the OECD concluded that ground transport in France will increase by nearly 50 percent between 1988 and 2010. This means that the average French citizen will increase the distance traveled every day to and from work, social events, meetings, etc., from 32 km per day to 47 km per day. This is a larger increase than that forecasted for the United States over the same period. (Andersson, p. 73) This leaves the government of France in a situation requiring it to expand the TGV system to avoid the congestion that comes along with national growth.

Transport Solutions and the Need for a Centralized Plan

The problem of successfully handling European economic growth has been addressed by the member states of the European Union. Their December 1994 meeting planned the launch of fourteen major transport projects. ("Trans-European Networks") Of the fourteen projects, four are TGV high-speed rail lines with a European dimension. These are lines which would carry the TGV across the French borders and onto foreign soil, joining the Channel Tunnel and the TGV-Nord project in an international capacity. The first of these projects has been the construction of the Thalys line connecting Paris, Brussels, Cologne and Amsterdam. Yet another connects Paris with Strasbourg on the France-Germany border, while a third includes a France-Spain high-speed train. The fourth project is for a Lyons-Turin high-speed line. ("Trans-European Networks") These projects signal the first step towards a European Transport Policy.

France was quick to recognize the importance of a central, unified transport policy. Early in the development of the Union, France requested that the transport policy be written into the Treaty on the European Union, known as the Maastricht Treaty. The treaty states that transport networks should be developed to "promote the interconnection and interoperability of national networks while taking account of the need to link island, landlocked and peripheral regions with the central regions of the Community." ("The Citizen's Network") This document made the development of a unified transport policy a European policy, and requires that all member nations plan transport networks that are efficient and cohesive with existing and planned networks of other nations.

Once a national policy has been initiated, the problem then lies with the implementation of that policy. Since there does not exist a central authority to control and direct projects within the Union, there is a great challenge in trying to obtain funding and coordinating the projects with member nations. A European-wide authority responsible for the internationally important infrastructure improvements would assist in coordinating investment programs and help ensure greater compatibility of technical standards. (Button, p. 49) Without coordination, the directives set forth by the member states would never get off the ground.

As Europe becomes more economically (and possibly politically) integrated, national transport policies will have to be subsumed into wider international policies. Whatever the initial intention, national ownership and operation of transport possess the inherent danger that national governments will attempt to manipulate the system to their own economic ends. This has been one of the traditional stumbling
blocks in the creation of a European Union Common Transport Policy. (Button, p. 51)

Sources of Funding

After developing a transport policy, the need to fund transport projects has been the next hurdle in the effort to create an interconnected and unified Union. The complications of bringing together fourteen separate countries and agreeing on a common objective and on a best way to achieve the objective have proven to be more difficult than previously suspected. The problem stems from the strong heritage and isolation that these nations have felt for centuries.

The members of the Union have been, up to this point, unable to view the problem from a continental perspective. As Rana Roy, chief economist of the European Centre for Infrastructure Studies, has stated: “The benefits of the Trans-European Network projects are significantly greater for the Union as a whole than for its individual countries.” (Bruce, p. 25) Even when the members can remove their tunnel vision, the questions of how to pay for the projects and who will supply the funding remain.

Again, although fourteen transport projects have been envisioned by the Union, there exists a wide gap between what projects can be technically developed and what projects can be funded. As Sir Brian Unwin, President of the European Investment Bank, states, “There is a gap in many cases between a project being economically and financially viable and unless you get a grant or equity to bridge that gap, then it cannot be done.” (Bruce, p. 25) The effort to bridge the gap in France is coming from three directions: the European Union and its members, the government of France and the SNCF, and the privatization of public resources.

Funding from the European Union

In order for the Union as a whole to agree to fund a transport project, the agreement of the member states on the worthiness of the project is required. A problem with this is that it is difficult for the representatives of England, for example, to see the benefits of a new project in Italy. As a result, it has been very difficult for the member states to agree on the validity of many projects because it is difficult for them to place the good of the Union ahead of the good of their nation. The European Bank for Reconstruction and Development sees the improvement of the transport infrastructure as one of its main functions. As a result, indications are that the bank is going to commit a substantial part of its own resources to this end. (Button, p. 50)

Another possible source of funding is the European Investment Bank. The EIB will provide long-term loans to complement direct subsidies to bring the less developed regions of Europe up to the standards of the Union. Between 1995 and 2000, European funding will come from “structural funds” for regions whose development is lagging behind, and from a special budget heading for the other regions. (“Trans-European Networks”) With loans from such institutions as the EIB, certain investments have become possible. Other investments, however, will have to be funded directly from the nation in which the project is planned.

Funding from France

For those TGV projects which do not receive funding from the Union, it will be up to France to supply the necessary resources to bring them to fruition. The TGV was developed through support from France. Nearly all of the funding for the TGV came from the SNCF, with the difference being subsidized by the French government. The TGV-SudEst was financed by the SNCF through borrowing on the domestic and international markets. (Rail Network..., p. 75) Approximately ten years after full commissioning, the full cost of the new line, $3 billion (FF 17.1 billion, 1981 dollars), will have been paid back. (Mathieu, p. 689) The TGV-Atlantique, which cost $1.2 billion in 1986 (FF 7.75 billion, 1986 dollars), received financing from the French government for 30 percent of the infrastructure costs. The SNCF borrowed the remaining 70 percent from the money market. (Rail Network..., p. 78) While it seems unlikely that nations will be quick to invest in the TGV, it is reasonable to see the attractiveness of the TGV to private investors.
Privatization

The movement toward privatization of transport is being led by the Union itself. Recent European Union directives have adopted an objective that national railway companies be “unbundled,” meaning that the tracks and trains should be under separate ownership. (Bruce, p. 25) This coincides with a general European trend towards greater involvement by the private sector in the supply of goods and services. (Button, p. 50) Recently this trend has moved into the transport sector in the European Union.

Great Britain is leading the way in the effort to privatize the transport sector. British Rail is no longer under government control, and the United Kingdom is well on a course to privatize twelve percent of its highway network. (“Consortium...,” p. 26) The decentralization of transport policy decision making in many European countries has begun to take place over the past decade. (Button, p. 50) Germany, Italy, Switzerland, and the Netherlands have all made efforts to privatize their railways. The trend in these countries has been to separate infrastructure from operations. (Privatisation..., p. 153) The emergence of the private sector as a source of funding has led the European Bank for Reconstruction and Development to anticipate that a considerable part of its transport investment funds will be drawn from the private sector. (Button, p. 50) It seems inevitable that private sector involvement in both the provision of transport infrastructure and in transport operations will increase into the next century. (Button, p. 50)

The growth in private sector influence is expected despite the financial drawbacks of the construction of rail systems. Obtaining resources from the private sector is a challenge because initial construction costs are high. In addition, the attraction for the private investor is limited from the outset due to the long loan repayment periods required. (DeWaele, p. 12) Without a guaranteed level of profitability, private investors will not be attracted. (Walrave, 1993, p. 127) As I have demonstrated previously, the TGV has shown to be profitable in the past. With a seemingly guaranteed profitability, its attractiveness to future private investment seems assured.

Influence of the TGV on the French Economy

The development of the TGV and the completion of the Channel Tunnel have allowed the economy of France to grow and its citizens to be more productive. The TGV allows citizens to live in one region of France while working in another region, thereby reducing the number of cars on the roads. The reduction in traffic congestion created by the use of the railway system has resulted in savings estimated to be two percent of France’s GDP. These savings are four times the amount spent on public passenger transport across the whole European Union. (“The Citizen’s Network”) The development of the TGV has changed the face of the transport economy of France and reduced the use of less energy efficient modes of transport.

Impacts on Air and Auto Transport

The TGV has played a role in the reduction of automobile and air traffic along competitive routes. For example, on the main tollway in the south, which is in direct competition with the TGV-SudEst, traffic abruptly stopped growing in 1982, the first full year of operation of the SudEst. This phenomenon was not experienced on the tollways in the north and west, tollways not in direct competition with the SudEst line, during the first year of TGV service. (Mathieu, p. 1846) The shift in traffic towards the TGV has enabled the SudEst route to show an internal rate of return for the SNCF in excess of 15 percent and a socio-economic rate of return of 30 percent. (Mathieu, p. 1846)

The TGV-Atlantique has had a similar impact. Since the line came into service, traffic growth on the Paris-Bordeaux and Paris-Le Mans tollways, which are in competition with the Atlantique, started to taper off immediately. (Mathieu, p. 1846) Again, this trend was not mirrored by the north and east tollways where traffic volume continued to grow. (Mathieu, p. 1846)

Air traffic along these routes has experienced similar declines. A sharp drop in Paris-Lyon air traffic has been noted. (Mathieu, p. 1845)
Air services in competition with the TGV-Atlantique have almost without exception experienced a substantial drop in traffic. (Mathieu, p. 1845) Because the inauguration of the TGV-Nord line was so recent, no statistical trends can be discerned here.

The shift to the TGV has also had a positive effect on the consumption of energy in France, which is a limited commodity. In France, highways and airplanes account for half of all oil consumption. Per passenger carried, the TGV consumes half the energy of an automobile and two-and-a-half to three-and-a-half times less energy than a plane. In addition, the TGV operates on “clean” energy, electricity. (Taille, p. 136) Another external benefit of the TGV system is its safety. The French argue that the installation of a TGV line in an area will bring about an annual reduction of 23 percent in the costs to the general public from automobile accidents. (Strohl, p. 107) Given the fact that railways are also three times more economical in terms of land use than motorways, there should be no hesitation about the development of new rail lines to connect regions of France and Europe. (Nilsson, p. 68)

Regional Development

France, as a nation, is composed of 22 regions, each with its own mini-economy and regional industry. Throughout history, the growth and development of Paris has dwarfed the rest of the country. In 1950, the greater metropolitan area of Paris, which covers only 2.2 percent of the national territory, contained 18.6 percent of the population, 33 percent of all new companies and nearly 25 percent of the national wealth. In an effort to offset the regional disparities, in the 1960s France began to implement development policies aimed at achieving a more even distribution of economic activity and population. (“Regional Development”) The shift in activity away from Paris resulted in an increase in competition among regions. Regions of France began to compete with each other in an effort to acquire business and development. All that changed, however, with the opening of European borders in the 1990s.

With free movement within all of Europe, France has begun to plan in a European frame-work rather than with just a domestic mentality. As a result, French regions are now far less likely to be competing among themselves than with their European counterparts. In this European perspective, plans are underway to stimulate development around a dozen or so regional cities which have been identified as having the potential to become “European” cities. (“Regional Development”) One common denominator that many of these cities have is service by the TGV. As part of France’s drive to introduce business and investments to the outer segments of France, the TGV will serve as a vital resource. This is especially the case in regions not serviced by large airports. The impacts the TGV has had on regional development can be seen by looking at the original line, the SudEst.

Studies of the SudEst (Paris-Lyon) line have suggested some benefits and disadvantages of the SudEst line for Lyon resulting from the TGV’s construction. For instance, while there is no observable effect on industry, some service sector firms based in Lyon entered the Paris market; on the other hand, the ability to complete trips in a day reduced hotel business in Lyon. (Nash, p. 380) This means that few industries from Paris found themselves competing more heavily with industries from Lyon. In fact, some firms based in Lyon were able to expand their base into the Paris market. The mobility that the TGV brings to the citizens of France can only aid in the strengthening of the regions surrounding Paris.

Conclusion

From a national perspective, it is clear that the continued development of the TGV system is vital to the sustained growth of France. The TGV has proven itself as a reliable and safe mode of transport. Both the SudEst and Atlantique lines have been profitable for the SNCF, and a benefit to the French society as well. The electric TGV operates much more cleanly than auto or air transport and offers the speed and comfort of flying at a cost closer to that of road transport. This is what has made the TGV so attractive and will continue to do so in the future as the reliance on high-speed transport increases. Future development of the
TGV should therefore focus on bringing about development and growth to various regions and spreading economic activity across the nation. In so doing, regional cities will have the ability to develop into cities of European importance on the level of London, Berlin and Brussels, among others.

From a European standpoint, the further development of an integrated Trans-European high-speed rail network will be the foundation of continued prosperity in all of Europe. Without further international development of the TGV, traffic will continue to worsen on the already congested road systems. By extending TGV technology throughout Europe, an efficient network can be developed which will serve to link the economic centers of Europe. This has already begun with the connection of Paris, London, and Brussels with the recently completed TGV-Nord. In order to further this international integration the members of the European Union will need to develop policies from a continental perspective rather than from the traditional national perspective. The development of a continuous high-speed rail network through Europe will serve as an economic boost to the interested parties and the Union as a whole.
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