

THE REGIONAL IMPACTS OF THE CHANNEL TUNNEL IN EUROPE¹

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ABSTRACT

The Directorate General for Regional Policy (DG XVI) of the Commission of the European Communities commissioned a study on the regional impacts of the Channel Tunnel in order 'to examine the way in which different types of regions in the Community and different sectors in those regions will be affected by the development of a major new transport infrastructure and to access ways in which policy can be developed to ensure that maximum possible benefits can be derived from this and that any negative effects are minimised'. The study was conducted by ACT (Paris), IRPUD (Dortmund) and ME&P (Cambridge). The research design combined qualitative methods of futures exploration employing thirteen regional case studies with quantitative forecasting techniques using the MEPLAN transport and economic model.

The paper reports on the methodology, presents major results of the two approaches with respect to the impacts of the Channel Tunnel on transport flows and regional development in Europe and draws conclusions for transport and regional policy of the European Union.

The paper demonstrates that, at least in the highly urbanised centre of Europe, the removal of a bottleneck like the Channel Tunnel does not necessarily induce economic gains in all adjacent regions. Much more important for regional economic development than the reduction of transport costs are two other factors: the image to be a region well integrated into the European high-speed transport networks and an active political response of the regions to take advantage of opportunities like the Channel Tunnel. However, the Channel Tunnel as a key element in the new generation of transport infrastructure in Europe adds new significance to the debate about the role of transport for spatial polarisation and peripheralisation in Europe and forcefully underlines the need for an integrated transport and regional policy of the European Union.

INTRODUCTION

Following a resolution of the European Parliament of 1988, the Directorate General for Regional Policy of the Commission of the European Communities commissioned a study on the regional impacts of the Channel Tunnel throughout the Community. The study is

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'to examine the way in which different types of regions in the Community and different sectors in those regions will be affected by the development of a major new transport infrastructure and to assess ways in which policy can be developed to ensure that maximum possible benefits can be derived from this and that any negative effects are minimised'.

The study was conducted jointly by ACT Consultants, Paris, France, the Institut für Raumplanung of the Universität Dortmund, FRG and Marcial Echenique & Partners Limited, Cambridge, UK between July 1990 and December 1991 (ACT et al., 1992).

The prospective opening of the Channel Tunnel in conjunction with the emerging European high-speed rail system is stimulating the imagination of national and regional policy makers in north-western Europe. After the completion of the Single European Market in 1993 the Channel Tunnel will bring down one of the remaining barriers to free international travel and goods transport within Europe. In particular it promises to eventually make the British Isles a true part of the European continent - ending a thousand years of insular seclusion and turning the much-cited 'megapolis London-Milan' from a myth into reality.

Today, the British Channel with its current ferry service clearly presents a major transport barrier to free movement of passengers and goods in Europe. If through the Channel Tunnel this bottleneck would be removed, significant impacts on regional development at either end may be expected. However, many questions are not easily answered: Will the impacts be limited to the regions directly adjacent to the Tunnel exits, or will they be spread out over a larger area? Will they be more pronounced at the British or at the continental end? Will the Channel Tunnel benefit mostly the already highly industrialised and urbanised regions in central Europe and so increase concentration of activities and hence the spatial disparities in Europe, or will it tend to equalise the accessibility surface in Europe and hence have a decentralisation effect?

Despite an impressive range of existing studies on the regional impacts of the Tunnel, such important questions remain unsolved. In particular the issue whether the Tunnel will have a polarising or decentralising effect on the spatial structure in Europe has not at all been settled. Only few studies have so far discussed the broader impacts of the Channel Tunnel for the spatial structure of the British Isles and north western Europe as a whole (see for instance Vickerman, 1987; Vickerman and Flowerdew, 1990; Simmonds, 1990; Simons, 1990; Holliday et al., 1991). One important conclusion is that the Tunnel cannot be seen in isolation but only as one element in the future high-speed rail system of Europe. In that perspective it seems likely that the Tunnel would reinforce the already strong position of major centres such as London, Paris and Brussels.

The Channel Tunnel when completed will form a part of the European transport networks. It will replace or supplement existing links and in so far as it is able to offer a better service and/or a better price, it will affect directly the traffic using the existing links. Wider effects will depend to a very great extent upon the other parts of the European transport networks of which the Tunnel will be a part. Therefore the Channel Tunnel cannot be seen as an isolated project but has to be studied in a systemic way in the context of both the development of the European transport system at large and the ongoing socioeconomic, technological and political changes.

TRANSPORT AND REGIONAL DEVELOPMENT

The important role of transport infrastructure for regional development is one of the fundamental principles of regional economics. In its most simplified form it implies that a region with better access to the locations of input materials and markets will be, *ceteris paribus*, more successful than a region with inferior accessibility. However, in countries with an already highly developed transport infrastructure, accessibility tends to become ubiquitous and further improvements of transport infrastructure bring only marginal benefits. Hence, such improvements have strong impacts on regional development only where they result in removing a former *bottleneck*.

Other recent trends combine to reinforce the tendency to diminish the impacts of transport infrastructure in regional development in the European context. An increased proportion of the freight moved internationally comprises high value goods rather than low value bulk products for which the transport cost component of production is much less. Telecommunication has reduced the need for some goods transports and person trips, however, telecommunication may also increase transport by its ability to create new markets. More importantly, with economic structural change, i.e. the shift from heavy-industry manufacturing to high-tech industries and services, other less tangible location factors have come to the fore and have at least partly displaced the traditional ones. These new location factors include factors related to leisure, culture, image and environment, i.e. quality of life, and factors related to access to information and specialised high-level services and to the institutional and political environment.

On the other hand, there are also tendencies that increase the importance of transport infrastructure. The introduction of totally new, superior levels of transport such as the high-speed rail system envisaged for Europe may create new locational advantages, but also disadvantages for regions not served by the new networks. Another factor adding to the importance of transport is the general increase in the volume of goods movements (due to changes in the distribution system such as just-in-time delivery) and travel (due to growing affluence and leisure time). Both tendencies will be accelerated by the completion of the Single European Market and the ongoing normalisation process between west and eastern Europe.

Furthermore, there is a fundamental change in the way in which the transport system influences location patterns. In particular for modern industries the *quality* of transport services has overtaken transport *cost* as the most important factor. Infrastructure improvements which reduce the variability and increase the predictability of travel times, increase travel speeds or through increases in the frequency of services allow flexibility in scheduling, contribute much to improving the competitiveness of both service and manufacturing industries and are therefore valued highly in their locational decisions.

RESEARCH METHOD

To achieve the twofold objective of, on the one hand, obtaining a systemic overview of the impact of the Channel Tunnel on the system of regions in the European Union and, on the other hand, taking an in-depth look at the opportunities and challenges the Tunnel brings for individual regions, the study is organised in two parallel but interrelated parts: the first includes *qualitative* regional analyses, the second applies a *quantitative* computer model.

Regional Analyses

In the first part of the research qualitative factors are addressed. For this purpose, thirteen in-depth case studies were conducted for regions selected not as representative regions of the EC, but as regions with representative problems or characteristics with regards to the impacts of the Tunnel (see Figure 1): Kent in England, Nord-Pas-de-Calais and Bretagne in France, West-Vlaanderen and Hainaut in Belgium, Zeeland in the Netherlands, Köln and Bremen in Germany, Piemonte in Italy, Ireland, Scotland, Pais Vasco in Spain and Norte in Portugal.

Besides the 'hard' economic factors such as transport cost and transport time that are addressed in the modelling part, the impacts of the Tunnel may be affected by other less tangible factors. These include attitudinal responses and subjective judgments which may influence the way regions adjust to changing transport opportunities, but also constellations of economic, technological and political developments which interact in a complex manner and cannot be forecast with certainty. For each region questions such as the following were addressed:

- What will be the position of the region in the future European transport network? How will the Channel Tunnel, alone or in combination with various alternatives of new transport infrastructure such as the new high-speed rail network, new motorways or new levels of service of ferry and air transport, affect that position, in absolute and relative terms?



Figure 1. The thirteen case study regions.

- How will firms respond to the new transport opportunities? Will they consider changes in production or distribution? Where will they go? Will firms from other regions move in?
- What will be the impacts on the regional labour market? Will there be in- or outmigration?
- How will local and regional governments respond? What are their decision margins?
- What will be the impacts on intraregional transport and urban/rural form?
- Which policies of supra-regional governments would be desirable to ameliorate negative impacts or encourage positive benefits deriving from the Tunnel and associated infrastructure?

Each of the thirteen in-depth studies consisted of two stages:

- Basic indicators for each region were collected in a way designed to maximise the comparability of the data across the regions and with the data collected for the model analysis.
- In-depth interviews were conducted with policy makers and experts from the fields of political parties, local and regional governments or agencies, regional firms or industry associations, trade unions, newspapers, university researchers and national ministries or agencies.

For each of the thirteen case study regions regional monographs summarise the findings of these two parts of the qualitative approach. After completion of the regional analyses a comparative synthesis on all thirteen case study regions was compiled for the final report of the project.

Model Analysis

As the focus of this study is the linkage between economic development and a major improvement in transport infrastructure, it is necessary to have a tool which can represent this linkage in a clear and consistent fashion. The MEPLAN transport and regional economic model by Marcial Echenique & Partners estimates the demand for transport, both passengers and freight based on a regional input-output model framework. The demand for transport and the pattern of regional economic development are, in turn, influenced by the costs and characteristics of the supply of transport. In the Channel Tunnel application the model provides results for the whole territory of the European Union. The regions of the EU are aggregated into 33 zones for modelling purposes. Three modules of the MEPLAN model were used.

The *Regional Economic Module* estimates the changes in the regional patterns of production and consumption in each of 33 economic sectors based on expected growth of population and income and regional differentials in transport accessibility and economic specialisation. The model uses tables of input-output coefficients to represent the interconnections between sectors of the economy. The relationship between production and consumption generates interregional trade relations as a basis for the calculation of the demand for transport. The production of a given sector in a region will consume inputs which, when added to the final demand for consumption by the population, generates the total regional demand for consumption. The module output is the value of trade shipped between each pair of regions for each economic sector.

The *Interface Module* converts the trade from units of annual value to units of daily tonnes or passengers moved along the transport system. Freight and passenger flows are aggregated into flow types which have relatively homogeneous transport and modal split characteristics. This module also feeds the generalised costs of transport back into the economic model to influence future patterns of regional trade.

The *Transport Module* takes the origin-destination matrices of daily flows of freight and passengers, divides them up into the main modes of transport and assigns them to the appropriate transport network in accordance with the generalised cost of competing routes. Multimodal assignment allows the use of different networks at different stages of the journey. The costs on the links influence the modal split and assignment.

Running the model, the transport infrastructure available for a specific year is the basis for the estimation by the transport module of the travel costs and times between every pair of zones. This produces a pattern of accessibility which is used in the regional economic model to determine the pattern of trade and of passenger movements between zones. These movements are then fed through the interface module and back into the transport module which estimates for each mode the tonnes of freight and the number of passengers travelling between each pair of zones. These flows are then assigned to vehicles on the links of the transport networks.

Starting with 1986 as the base year, for which the calibration of the parameters of the model was carried out, the model is run at five-year intervals until the year 2001 (see Figure 2). Different scenarios were used to represent the effects of the Tunnel either built or not, and to represent different levels of development of the rest of the road and rail networks. Scenario A represents the current network without the Tunnel. Scenarios B (without Tunnel) and B1 (with Tunnel) assume a limited network development with substantial motorway construction, but only a medium level of rail upgrading. Scenarios C (without Tunnel) and C1 (with Tunnel) assume an extended network with a substantial number of further new high-speed rail services.

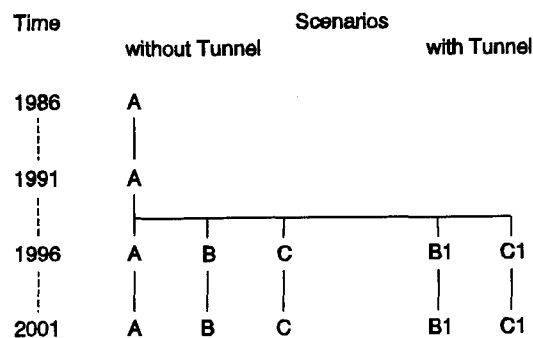


Figure 2. Simulated network scenarios.

Synthesis of Model Analysis and Regional Analyses

The model analysis and the regional analyses are closely interrelated: The hypotheses generated for and in the regional analyses were a necessary input to the custom-tailoring, testing and calibration of the model; the data needed for the model and for the case studies were similar except that more detailed data were required for the regional analyses; the case studies provided the information on which new transport infrastructure, e.g. high-speed rail links and motorways, should be examined together with the Channel Tunnel in the model.

In the final phase of the project, the results of the two methodologies were brought together in a synthesis. It was examined where the impacts of the Tunnel on transport flows and regional economic development predicted by the model were in line or in disagreement with the expectations expressed by the policy makers and experts in the regions. If there was disagreement, it was discussed whether the model might have lacked essential information or whether the views held in the particular region might have been unrealistic.

What can be learned from the study with respect to the impacts of the Channel Tunnel on the regions of the European Union? The next two sections present the results of both the quantitative and the qualitative approach in condensed form. First the forecasts on cross-Channel transport flows will be examined, then the impacts on regional development.

IMPACTS ON TRANSPORT FLOWS IN EUROPE

Travel times in Europe

The Channel Tunnel has two functions in the European transport network. The shuttle trains improve the cross-Channel link between the British and the continental motorway networks. Fast through rail services via the Tunnel close a missing link in the emerging European high-speed rail network. So the Tunnel will have strong impacts on travel times between the European mainland and Great Britain and Ireland.

Travel times are one element of the transport cost function of the MEPLAN model. Therefore the transport module provides travel times for each origin-destination relation and each transport mode. The impacts of the Channel Tunnel in combination with the full completion of the high-speed transport networks (scenario C1) on travel times are illustrated in Figure 3 for car traffic and in Figure 4 for rail. Each map shows travel times for the year 1991, i.e. travel times before the Tunnel starts operation, and for 2001, i.e. future travel times with the Tunnel in operation. The travel times are represented by isochrones for business travellers from the UK and Ireland to Paris and from London to mainland Europe.

Today's travel times across the Channel by car are mainly determined by the duration of the ferry crossings and by the waiting and loading times in the ferry terminals. Even from Kent and Nord-Pas-de-Calais, which have the shortest Channel crossing between Dover and Calais, the journey to Paris or London, respectively, takes at least 6 hours. The car travel times for other European regions depend on their individual position in the motorway network and on their specific links to the ferry ports.

In 2001 car travel times are reduced by only two hours for most areas in Europe. This reflects exactly the time savings of the Channel Tunnel compared with the ferries. The reason is that the European motorway network is already today widely developed. Only where the scenario assumes new motorways or the removal of a real bottleneck the time savings are higher. In particular the effect of the planned motorway along the Channel coast from Rotterdam to the Bretagne stands out.

Travelling today by rail across the Channel means leaving the train at the ferry port, boarding the ferry, and boarding another train at the other side of the Channel. Such a 'broken' transport is inconvenient and time consuming. Compared with the car the railway is clearly the slower alternative today for most of the cross-Channel relations. However, first effects of the high-speed rail traffic become visible: the *TGV Sud Est* linking Paris and Lyon extends the area in which rail can compete with the car considerably.

In 2001 the combined effects of high-speed rail and the Channel Tunnel become apparent. For most cross-Channel journeys by train travel times will be halved: The travel time from Paris to London will be reduced from eight to only four hours (including access time to stations). The isochrones highlight the effect of the most important high speed rail lines, such as the French *TGV Sud Est* and *Grand Sud*, *Atlantique*, *Pay de la Loire* and *Bretagne* or the international high-speed rail link from Lille via Brussels to Köln and Frankfurt.

The main result of the analysis of travel times is that the Channel Tunnel because it is integrated in the high-speed rail network primarily benefits rail, whereas the time savings for cars are only modest. This means that the train will become the fastest surface transport mode in Europe. For many relations the train will be even competitive with air travel. However, the implementation of the high-speed rail network is likely to occur more slowly than in the two isochrone maps.

These results can be visualised in time-space maps as presented in Figures 5 and 6. Time-space maps do not display spatial distances but time distances between cities and countries. The

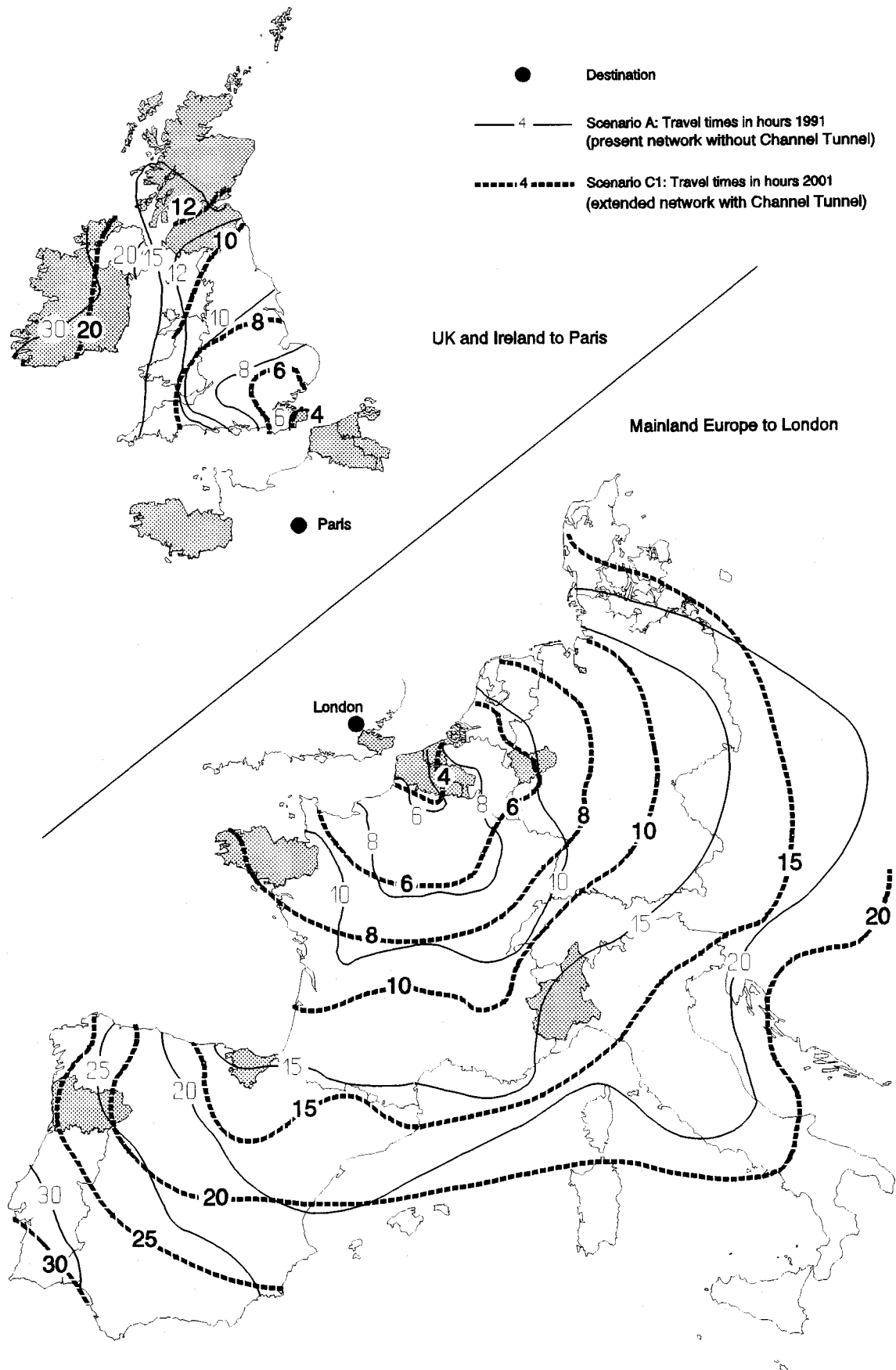


Figure 3. Travel times by car, 1991 and 2001.

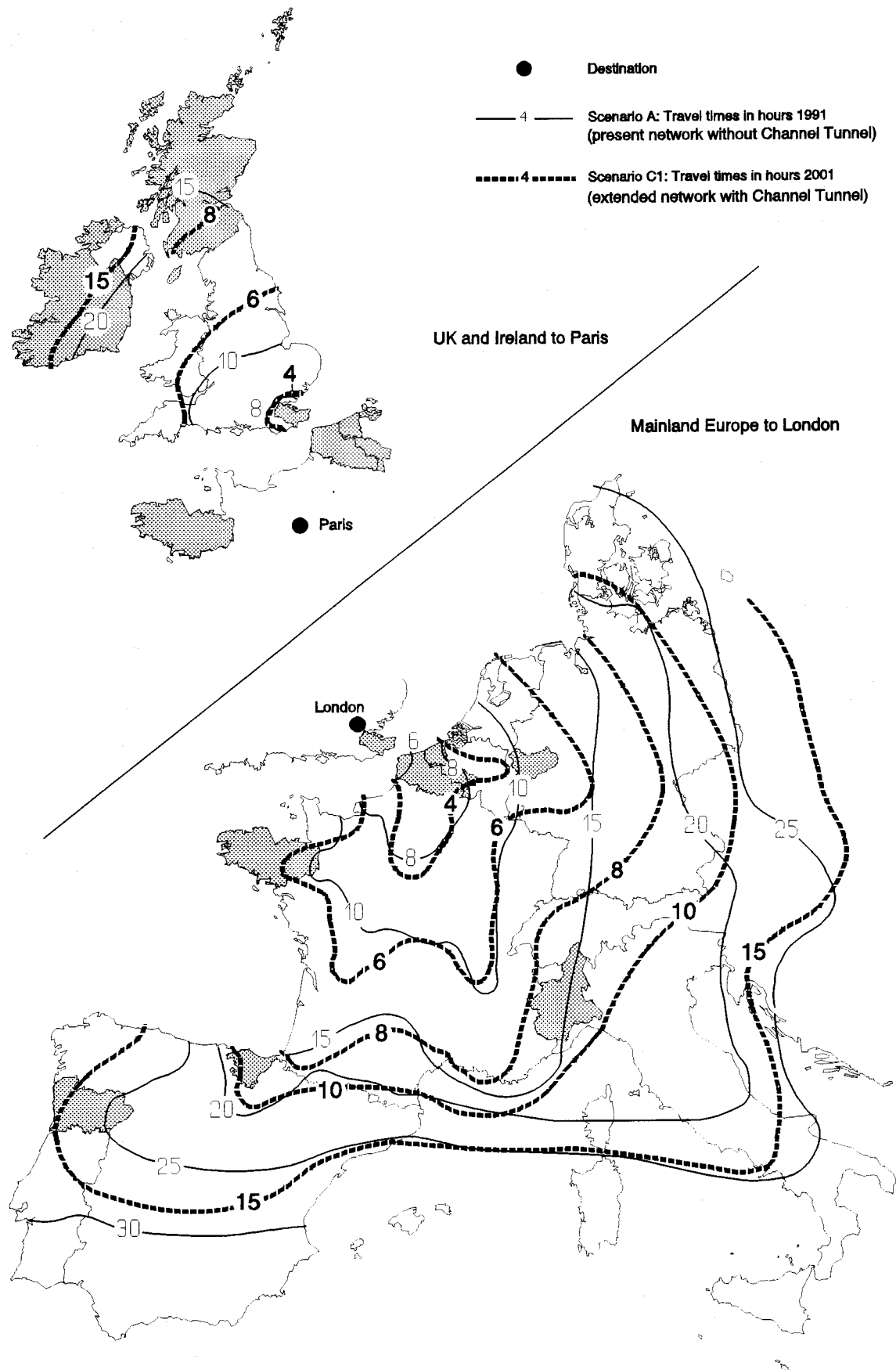


Figure 4. Travel times by rail, 1991 and 2001.

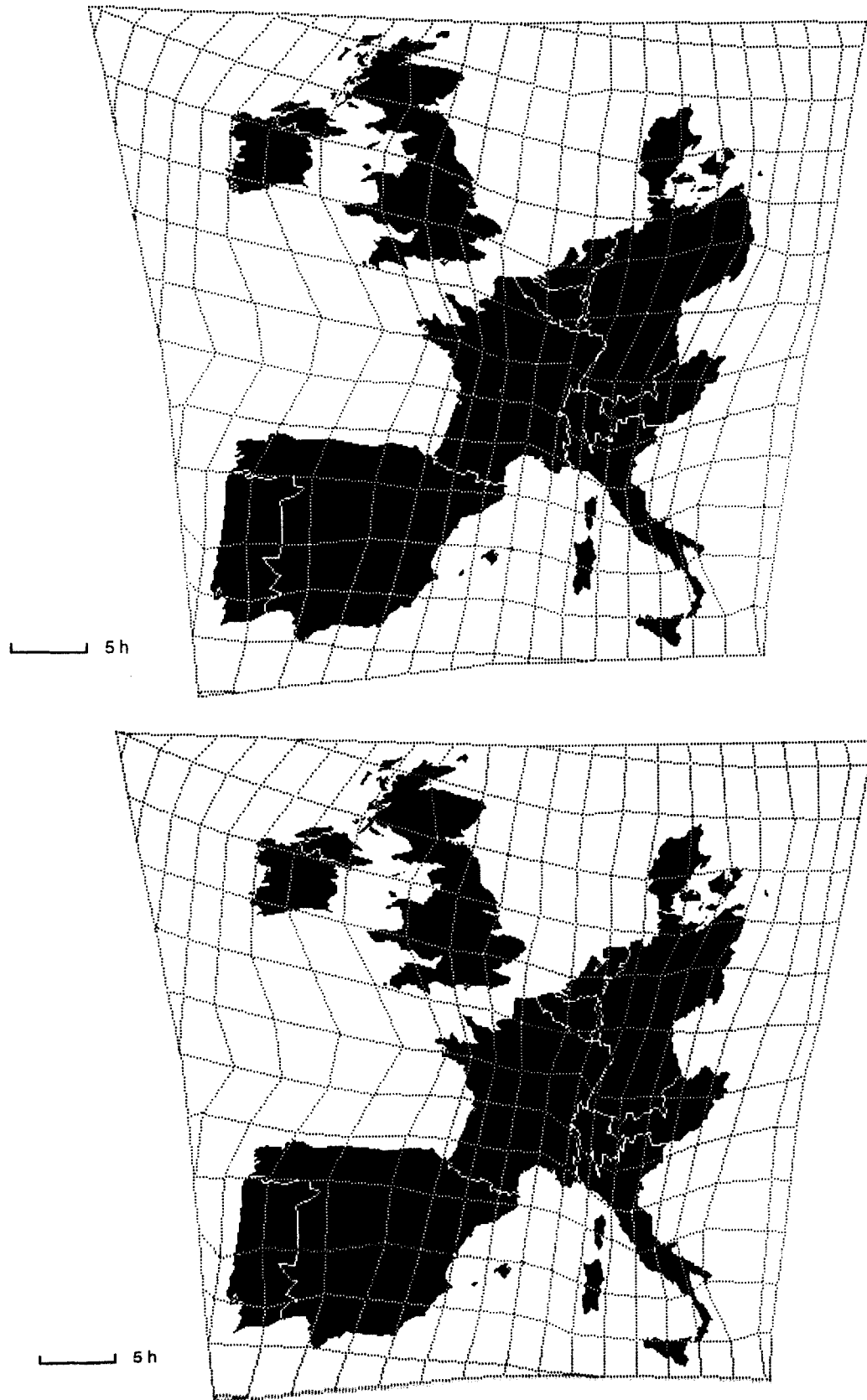


Figure 5. Time-space maps of the road network in western Europe, 1991 (top) and 2001 (bottom).

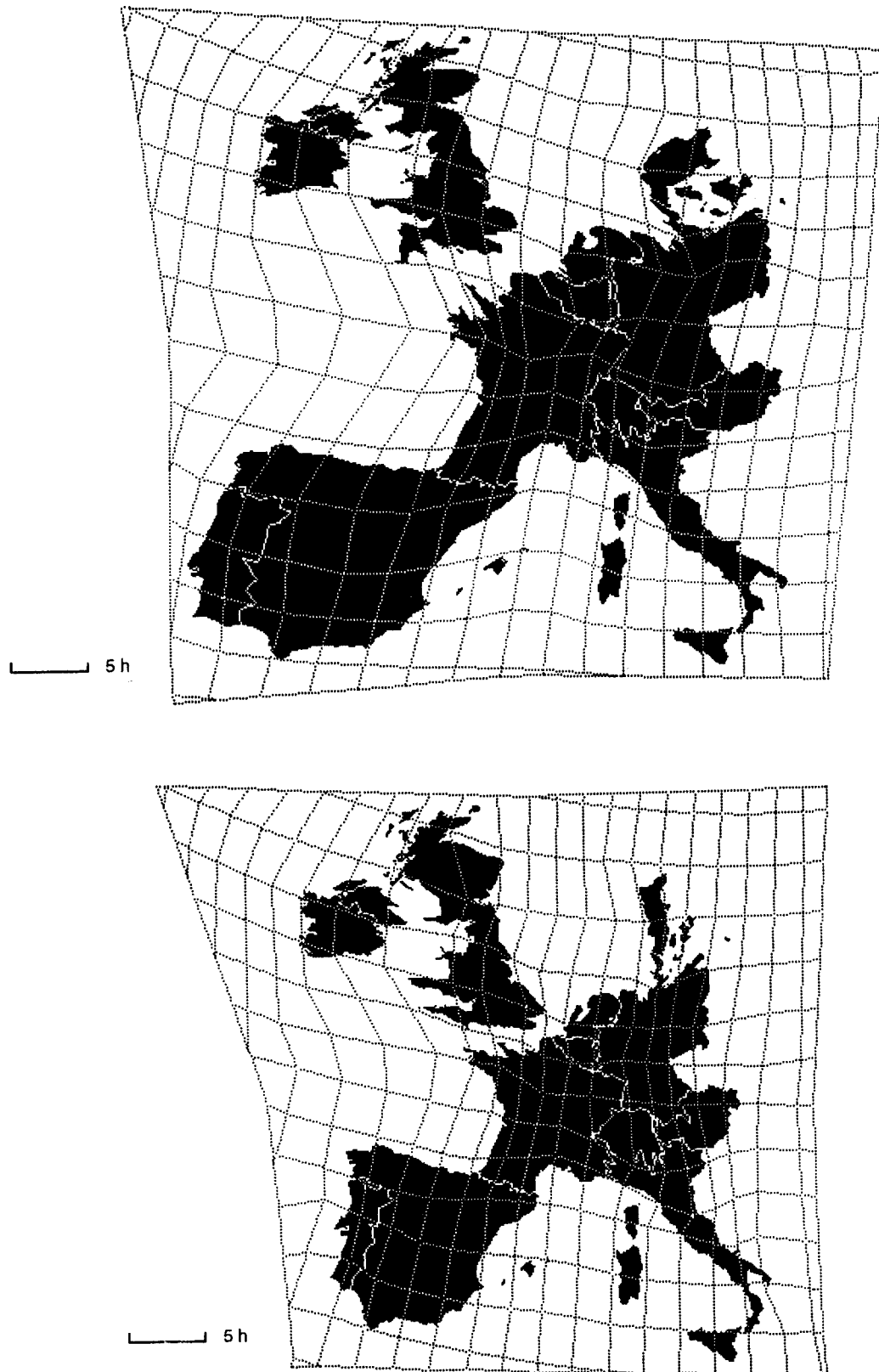


Figure 6. Time-space maps of the rail network in western Europe, 1991 (top) and 2001 (bottom).

scale of the map is no longer in spatial but in temporal units (Spiekermann and Wegener, 1992). Figures 5 and 6 are based on travel times of scenarios A and C1, i.e. travel times of the isochrone maps of Figures 3 and 4.

The time-space maps based on travel times of the road network (Figure 5) show only a slight distortion compared with a physical map of Western Europe. The shrinking of the continent is particularly visible in its core. In contrast, the Iberian peninsula appears much larger than in the physical map because its road transport infrastructure is less developed than in central Europe. Great Britain and Ireland are pushed outwards due to the slow ferry links across the Channel and the Irish Sea. The difference between the two time-space maps for road transport is rather small. This is in line with the relatively small changes in the motorway network until 2001. Only France and the new German Länder are shrinking because most motorway improvements will occur there. The opening of the Channel Tunnel has only a slight effect on the travel times between the United Kingdom and Ireland and the European mainland. The reason is that the time saving for cars using the shuttle trains through the Tunnel is only small compared with current ferry services.

Figure 6 shows that the impacts of the new high-speed rail lines are much larger. Even in 1991 (Figure 6, top), France was contracted by the first TGV between Paris and Lyon, whereas Spain and Portugal appear larger and Great Britain and Ireland are pushed towards the periphery. The full 'space eating' effect of high-speed rail becomes visible with the implementation of the high-speed rail network by 2001 (Figure 6, bottom): The continent has been reduced to half its original size. The southern parts of England are pulled to the continent by the Channel Tunnel, whereas Ireland and the north of Scotland remain peripheral. The Alps remain a major barrier in the core of Europe because in this scenario the Alpine base tunnels are not assumed to be built.

Cross-Channel transport flows

The number of cross-Channel passengers (including air) was 67 million in 1986 and will rise to 84 million in 1991. This number will steadily continue to increase with 107 million cross-Channel passengers predicted for 1996 and 135 million for 2001. These predictions of MEPLAN are higher than other forecasts. The reason for this difference lies in different definitions of cross-Channel air passengers which in MEPLAN include passenger movements between the UK and Ireland and all continental airports. These differences, however, do not affect cross-Channel surface trips which are unambiguously defined and reliably counted. As the validation of the model has shown, MEPLAN with high accuracy reproduced the 23 million passengers that crossed the Channel by ferry in the year 1987. The model predicts that in 2001 about 55 million passengers will use either ferry or Tunnel (see Figure 7), the remaining 80 million will go by air.

These forecasts represent a 100-percent increase over total pre-Tunnel passengers in 1986, but a 130-percent increase for surface trips over pre-Tunnel ferry passages. Cross-Channel air travel will increase by 80 percent from 43 million to 79 million per year. Of the 55 million surface travellers in the limited-network scenario B1, 34 million are predicted to use the Tunnel; of the 58 million surface travellers in the extended-network scenario C1, 39 million will use the Tunnel.

A corollary of this is that total ferry passenger volume, after a temporary loss in the years after the opening of the Tunnel, in 2001 is only down by 20 percent compared to pre-Tunnel volume in 1986. In other words, in the decade after its opening, the Tunnel will take over the growth in cross-Channel surface traffic. In fact, if the Tunnel would not be there, in 2001 the number of ferry passengers would be twice as large as in 1986. Air traffic, too, would nearly

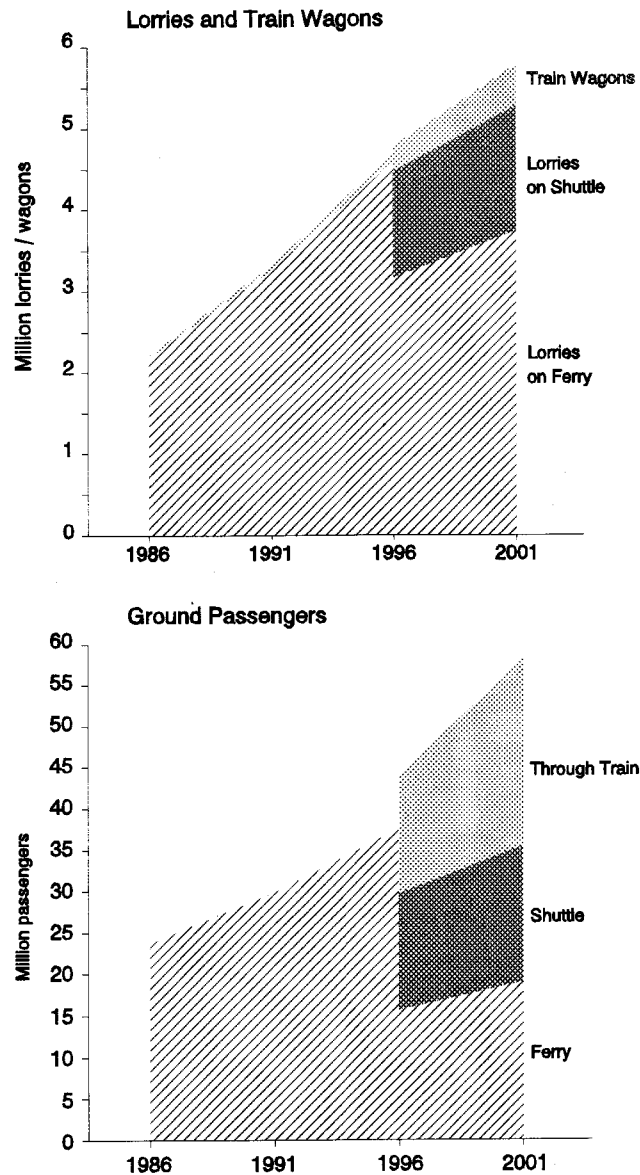


Figure 7. Surface cross-Channel transport flows, 1986-2001 (scenarios C and C1).

double without the Tunnel, but with the Tunnel it will still grow by 80 percent, the remaining passengers shifting to the Tunnel. About four million cross-Channel passages per year would be Tunnel-induced, i.e. would not be made without the Tunnel (the difference between scenarios B1 and B or C1 and C).

In cross-Channel freight transport a similar picture emerges. The model reproduced with high accuracy the 2.1 million lorries and 29,000 rail wagons per year in 1986. It predicts that by 2001 the number of lorries crossing the Channel will grow by 140 percent to 5.5 million (in scenario B1), of which 1.6 million or 30 percent will go by Tunnel (approximately 17 million tonnes). The forecasts for rail freight depend more on the introduction of a high-quality through-rail freight service via the Tunnel than on the Tunnel itself. If freight through-trains are introduced (scenario C1), the model predicts a sixteen-fold increase of rail freight compared with 1986, but only a threefold increase without such a service (scenario B1).

These results are perfectly in line with the results of the regional analyses. It was confirmed by the model that most Tunnel passengers would be pulled away from the ferries, mainly from

the short sea routes, but that due to the general growth in traffic ferry traffic would soon return to its present level and grow afterwards. This is in agreement with the fact that all ferry companies and port authorities in the maritime regions Kent, Nord-Pas-de-Calais, West-Vlaanderen and Zeeland expect that there will be a secure future for Channel ferries after an intermediate period of passenger losses. Similarly, it was confirmed by the model that only fast train connections at either end of the Tunnel would draw a significant proportion of air passengers to the Tunnel. The model predicts that if the extended rail network of scenario C1 would be implemented, there would be an additional 4.6 million through-rail passengers per year compared with scenario B1; about 4.3 million of these would be air passengers (though they would represent only 5 percent of 2001 cross-Channel air traffic).

With regards to freight transport the hypothesis in the regional analyses was that the Tunnel will attract a substantial proportion of freight from road and air to rail only if fast freight through-trains would connect major industrial centres on the British Isles and the continent via the Tunnel. This hypothesis was clearly confirmed by the model as demonstrated by the differences between scenarios B1 and C1. One other important result from the regional analysis, the expectation that longer Channel crossings between the continent and east and north England ports are not really affected by the Tunnel with respect to freight transport, was also confirmed by the model.

European transport flows

The effects of the Tunnel on European transport flows are the results of many complex, interacting influences. The Tunnel cannot be seen as an isolated project without the related infrastructure developments, in particular the emerging European high-speed rail network. It is therefore not surprising that the impacts forecast are not confined to the regions close to the Tunnel, nor do the impacts decrease in a simple way with distance from the Tunnel; rather a more complex picture of interaction of travel time, modal characteristics, regional characteristics and orientation with respect to the Tunnel emerges.

Different transport modes are affected in different ways by the Tunnel. There will be shifts in modal split for both passenger and freight transport, but the increasing volume of traffic will in general offset most of the losses for any mode. However, different regions will be differently affected by these changes in transport flows. This subsection will group the regions with respect to transport impacts of the Tunnel (see Figure 8). The categories, explained below, are not exclusive, so one region can appear in different groups.

Tunnel competitors with strong impacts: Ferries are in direct competition with the Channel Tunnel for cross-Channel transport. However, the impacts depend on geographical characteristics of the single routes. Therefore, regions with cross-Channel transport are not affected in the same manner. Only in its vicinity, the Tunnel will cause a major reduction of transport volume for short sea crossings. The Tunnel has its strongest impacts on ferry lines with both ports within the regions of Kent, Nord-Pas-de-Calais and also, but to a lesser extent, West-Vlaanderen. In the first years after the Tunnel starts operating, these ferry lines will lose passengers, in particular coach and foot passengers, and lorry traffic. This traffic, for which today short ferry trips are the preferred way of crossing the Channel, will take advantage of the time savings provided by the Tunnel. However, because surface cross-Channel transport volume will grow significantly, there will be a secure future for these companies and ports on condition they survive in the first years of Tunnel operation. A less desirable side effect of the Tunnel will be the large increases in road traffic in these regions.

Tunnel competitors with slight impacts: Most of the regions with cross-Channel transport are much less affected by the Tunnel. This is true for areas along the western Channel (south-

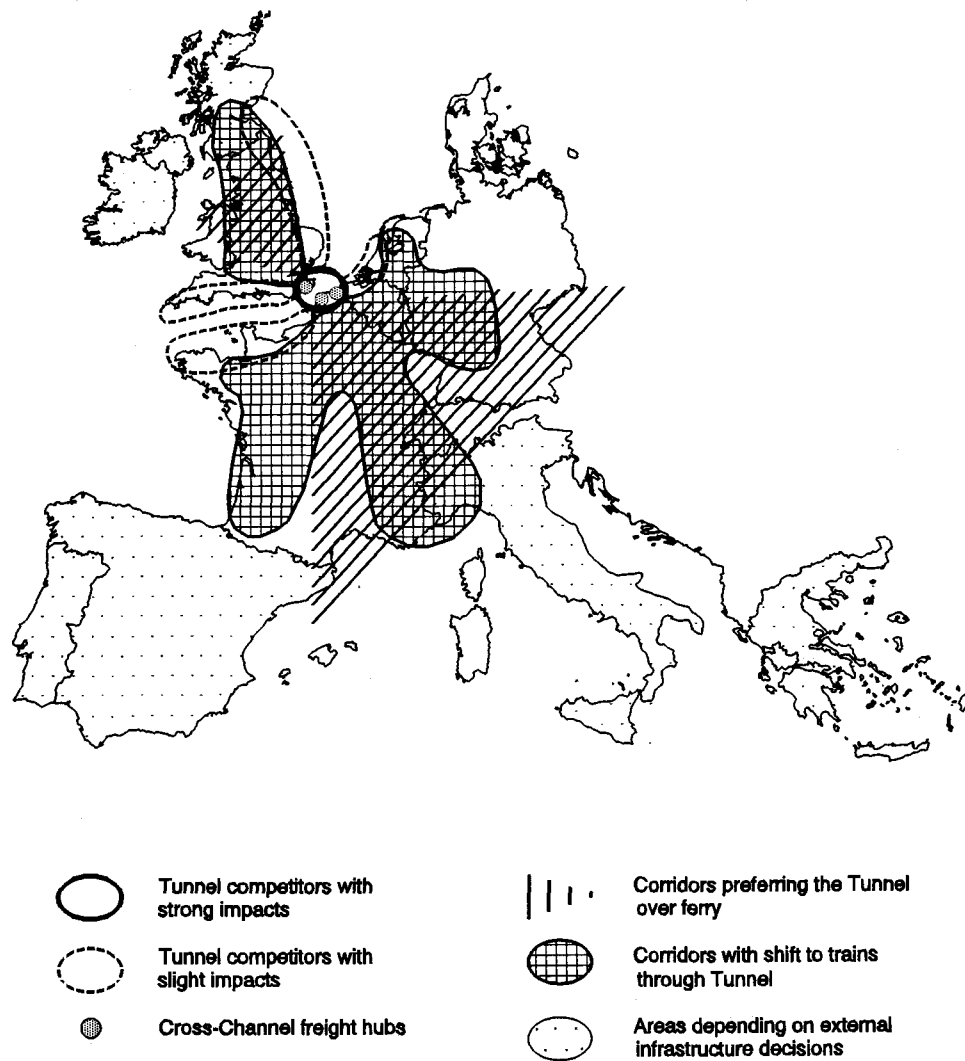


Figure 8. Impacts of the Channel Tunnel on transport flows.

east England port regions, Normandie, and Bretagne), mid and north England ports, parts of West-Vlaanderen and the Netherlands. Here, ferry lines will have slightly decreasing transport volumes if the second port is located in one of the above regions with strong Tunnel impacts. However, this initial decrease will soon be offset by the total growth in cross-Channel transport. For other ferry routes there will be only a slight reduction in growth *potential*, i.e. growth would be even more pronounced without the Tunnel.

Cross-Channel freight hubs: Three regions will serve, as today, as main freight hubs between mainland Europe and the UK: on the continent Nord-Pas-de-Calais for lorry traffic going through the Tunnel and West-Vlaanderen for unaccompanied RoRo traffic going to or coming from Thames estuary and mid England ports; in the UK Kent for both kinds of RoRo: Dover for lorry traffic going through the Tunnel and, with less importance, north Kent ports for unaccompanied RoRo traffic. The difference compared with today is the shift within Kent and Nord-Pas-de-Calais from the ports to the Tunnel for lorries. It depends primarily on the regional strategies whether these hub functions can be enlarged and used as a base for future economic growth.

Corridors preferring the Tunnel over ferry: There is a clear pattern of regions that prefer the Tunnel over the ferries for cross-Channel road transport. In general, these regions are the ones that today prefer short ferry crossings. They are located in a central corridor along the extended Tunnel axis on both sides of the Channel. With growing distance from the Tunnel and from this extended Tunnel axis other ferry options become more attractive.

Corridors with shift to trains through Tunnel: The future European high-speed rail network will significantly reduce cross-Channel travel times for many relations. Particularly along the high-speed rail lines in France, Belgium, the Netherlands and Germany, but also in Piemonte and parts of the UK, the Tunnel will induce a shift towards rail for cross-Channel passenger transport. There will also be a shift of some freight towards rail in these zones, but again this depends on the implementation of respective links and services.

Areas depending on external infrastructure decisions: The study has shown that the area of influence of the Tunnel on transport flows is limited. The European periphery is more or less excluded from the improved communication network in the European core. Scotland and Ireland, Spain, Portugal and Greece, but to a certain extent also Italy belong to this group. However, these areas are at the same time dependent on infrastructure decisions taken mostly outside their own nation if they are to be physically included in the ongoing integration of Europe.

IMPACTS ON REGIONAL DEVELOPMENT IN EUROPE

Impact of the Channel Tunnel on the case study regions

Figure 9 shows the summarised impacts of the Channel Tunnel on regional developments for the thirteen case study regions as predicted by the two methodological approaches.

The model forecasts for regional economic development are expressed as change of total value added (the sum of payments on taxation, labour and profits of all goods and services produced in a region) in the year 2001. The diagram shows two *differences* between 2001 values: The difference between scenarios C and A (white) indicates the additional growth in the regions due to changes in transport infrastructure without taking account of the Channel Tunnel. The difference between scenarios C1 and C (shaded), however, shows the positive or negative impact of the Tunnel. If only the first kind of change is considered, Kent, Zeeland and Bretagne achieve the largest gains. As already indicated, this can be attributed to motorway construction in Zeeland and Bretagne and to high-speed rail investment in Kent. Negative impacts of transport investments, however small, are found in Köln, Bremen, Scotland, Ireland and Norte. The additional impacts of the Tunnel are largest in the regions closest to the Tunnel: Kent, Nord-Pas-de-Calais, West-Vlaanderen and Hainaut. Negative Tunnel effects are found in Köln, Scotland, Ireland, Pais Vasco and Norte. However, it should be noted that in no case the isolated Tunnel effect exceeded one third of a percent.

The results of the regional analyses are expressed in the figure only in the most condensed manner as global effect of the Tunnel. The regional analyses forecast positive impacts in study regions in a distance of up to 400 km from the Tunnel, save Hainaut, and none or negative impacts beyond that distance. The regional monographs make a distinction between the subjective expectation of the regional actors the objective economic situation and prospects of the regions. It was found that sometimes regional actors tend to overestimate the likely impacts of the Tunnel in regions close to the Tunnel and to underestimate them in remote regions. Some of this is consistent with the model results, but in several cases, there are some differences between the forecasts of the two approaches. These differences can be explained in three ways:

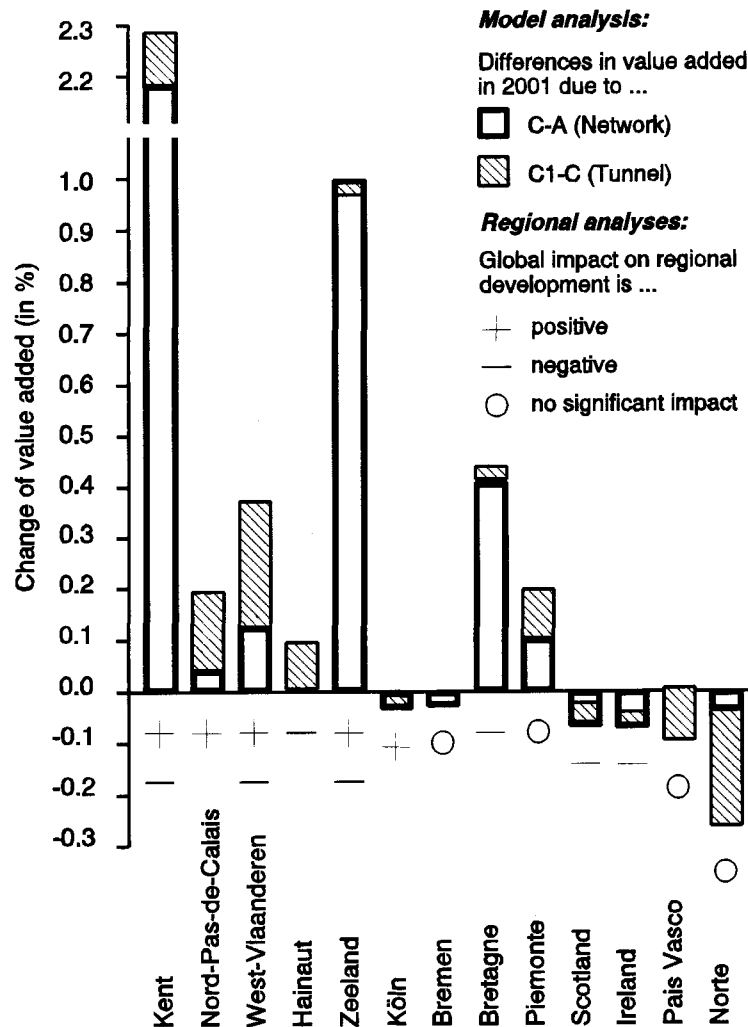


Figure 9. Summarised impact of the Channel Tunnel on the case study regions.

- The model predicts gains while the regional analyses predict negative impacts, for example, in Hainaut, Scotland and Ireland. On the model side, it may be that the transport costs changes are given to much weight in relation to other, more strategic, considerations of carriers; on the regional analysis side, it may be that the negative effects of a lack of regional power, or synergy between national and regional authorities or between public authorities and businessmen were overestimated.
- The model predicts losses and the regional actors forecast no effects, for example, in Pais Vasco and Norte. The latter may be due to a failure to evaluate how even remote places can be affected by major changes in the European transport network; in this case the model results are useful to make regional actors aware of the risks they may face.
- The model predicts large gains and the regional analyses forecast both positive and negative impacts, for example, in Kent and West-Vlaanderen. In this case the negative impacts of the regional analysis refer to non-economic issues such as the environment, i.e. they are not in contradiction with the economic forecasts of the model.

These few remaining differences notwithstanding, the results of the two approaches agree as to the general impact on the case study regions. Figure 10 visualises these changes in terms of criteria such as economic state, strategic capacity and degree of centrality in Europe. The arrows indicate the direction of change in the position of the individual regions.

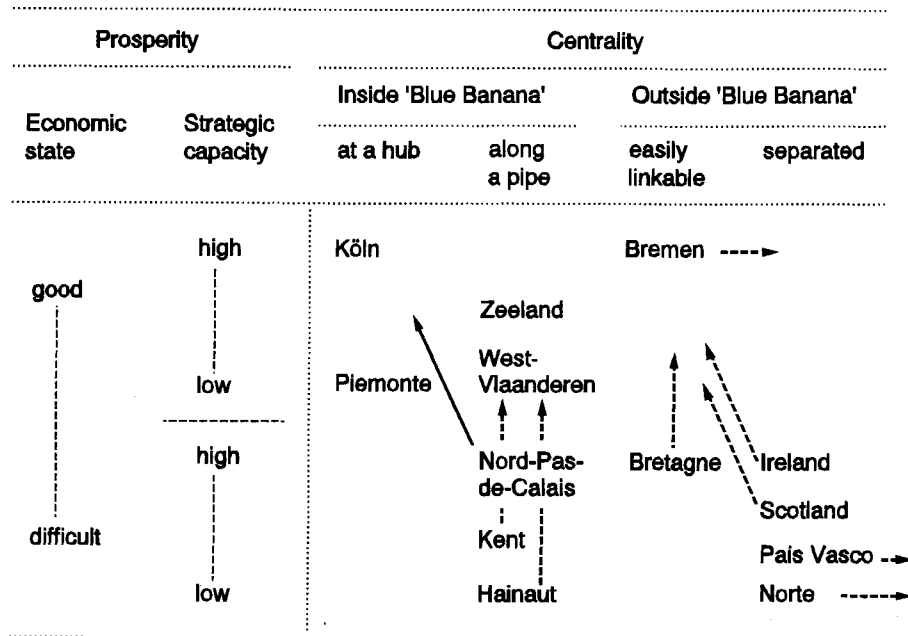


Figure 10. Impact of the Channel Tunnel on prosperity and centrality.

Nord-Pas-de-Calais is the only region really moving from one class of centrality and economic position to another taking advantage of its potential hub functions in north-west Europe. All other regions remain more or less inside their previous category; all, however, are affected by the Tunnel either with a tendency of moving or maintaining their position. The latter is true for Köln, Piemonte, West-Vlaanderen and Zeeland. Kent, Hainaut and Ireland and Scotland have the opportunity to improve their economic situation, but this depends mainly on their pursued strategies or on decisions and support from outside. All regions classified as situated 'along a pipe', Zeeland, West-Vlaanderen, Hainaut and Kent, will face increasing transit traffic through their regions without gaining too many opportunities from it. Bremen, and even more so Pais Vasco and Norte, are relatively drifting away; however, Bremen has confident perspectives based on the opening up of eastern Europe.

It therefore appears that the transport network to be built in conjunction with the Channel Tunnel will to a certain degree modify positions of the regions with regard to core and periphery under a double effect of polarisation and diffusion: tightening up the core area on one side and spreading out positive impacts from a north-west/south-east central corridor.

Impacts on all European regions

In this final section the results derived for the 13 case study regions are generalised for all regions in the European Union. Figure 11 is an attempt to show the main areas of relative growth and decline of *value added* induced by the Channel Tunnel and the related transport infrastructure for manufacturing, services and tourism. It is important to note that in order to arrive at employment forecasts, these results have to be seen together with sectoral productivity gains, i.e. even a gain in value added can imply a decline in employment.

Manufacturing: The changes in industrial value added due only to the Tunnel will be relatively small ranging from -0.17 percent in Portugal to +0.17 percent for Ireland in 2001. The regions benefitting most are not only among the closest to the Tunnel but include a large portion of north-western and central Europe.

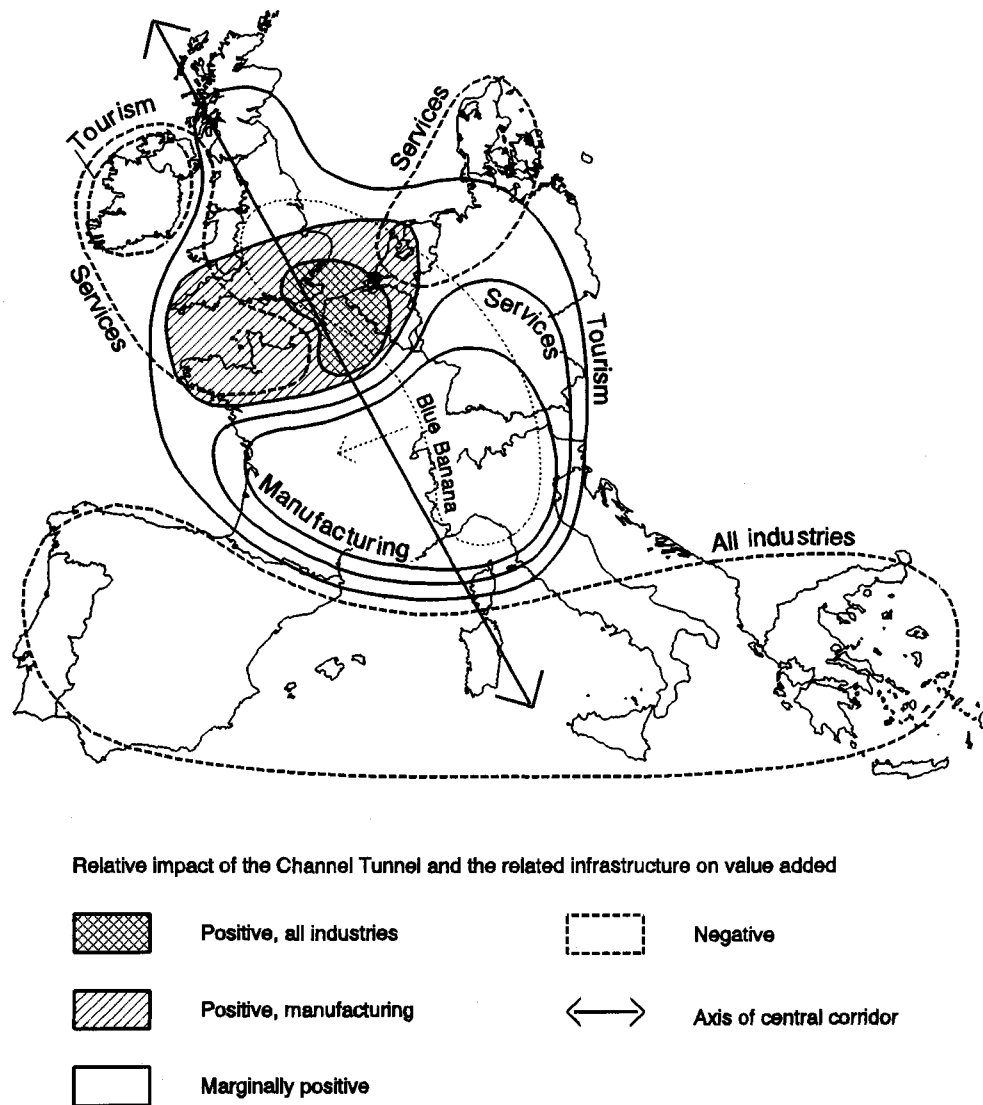


Figure 11. Impacts of the Channel Tunnel on economic development.

Services: New rail passenger services will favour service industries in metropolitan areas and 'hub regions'. Cities such as Köln or Lille are quite aware of the new opportunities offered by the Tunnel and the related infrastructure; they have designed very active policies, public and private, to take advantage of this opportunity. As a result, the concentration trend in services will be reinforced.

Tourism: The Tunnel and the extended rail and road networks tend to redistribute tourist flows away from their traditional destinations. This is especially true for British tourists who are likely to shift somewhat from air travel to Mediterranean Europe in favour of road and rail travel to France, Germany and the Netherlands. Compared to other sectors, the impacts on tourism are more polarised, and the gap between losers and winners is greater. However, gains in tourism are spread out to a greater number of regions than in services or industry.

It has been suggested above that the Tunnel and related infrastructure will have a twofold effect of polarisation and diffusion. These effects can now be extended to the whole territory of the European Union by classifying the regions into groups with similar impacts:

Cross-Channel space: the most advantaged triangle: The greatest impacts will be concentrated in the London-Bruxelles-Paris triangle, with positive value-added increases for London, Kent, Nord-Pas-de-Calais, West-Vlaanderen and Ile-de-France. Although Hainaut and parts of Normandie are included in a geographical sense, they do not fully participate in this growth.

The central corridor and its expansion: The Tunnel cannot be considered alone without taking into account its related infrastructure which is primarily a high-speed rail and motorway network. In particular, the French TGV is responsible for an expansion of the so-called 'Blue Banana' towards Paris and Lyon and for a diffusion of the positive impacts of the Tunnel across France, except Normandie and peripheral Bretagne. The future extension of the European high-speed rail network will benefit Belgium, mid and south Germany and northern Italy.

Grey service zones at the Tunnel exits: The polarisation effect tends to deprive regions next to regions with positive impacts on both sides of the Tunnel exits. In this sense, the Tunnel and the related infrastructure create economic grey zones, in particular for service industries. Normandie appears to be one of the regions located in the geographic core of Europe without really belonging to its economic core. In this way the Tunnel creates *interstitial spaces* on both sides of the area along the continental sea shore. A tentative explanation is that the Tunnel tends to exert a centripetal effect at its two exits, concentrating all positive impacts in a restricted zone and that these impacts are diffused on each side of the main axis beyond a certain distance from the Tunnel.

Increasing relative peripherality: The likely impact of the Channel Tunnel is to tighten up the core, while the polarisation effect induces negative trends even in economic active regions which are close to the Tunnel such as northern Italy, northern Germany, Denmark, Pais Vasco and parts of the rest of Spain. In this sense, the European periphery starts in direct proximity to the central corridor. The southern peripheral regions will suffer in all economic sectors not only from not being connected to the European core but also from lack of special planning policies and/or of means to support such policies. Ireland, Northern Ireland and northern Scotland can expect different impacts of the Tunnel on different industrial sectors; in particular in Ireland the benefits in manufacturing will be outweighed by negative impacts on services and tourism.

POLICY CONCLUSION

This study about the regional impacts of the Channel Tunnel in Europe has been unique in the sense that it simultaneously applied two different methods of analysis: a 'quantitative' computer model of transport interactions and economic activities (MEPLAN) and mainly 'qualitative' regional case studies based on empirical research and interviews with regional experts and decision makers.

It was demonstrated that, at least in the highly urbanised centre of Europe, the removal of a bottleneck like the Channel Tunnel does not necessarily induce economic gains in all adjacent regions. Much more important for regional economic development than the reduction of transport costs are two other factors: the *image* to be a region well integrated in the European high-speed transport networks and an active *political response* of the regions to take advantage from opportunities like the Channel Tunnel.

Moreover, the changes in regional development induced by the Tunnel are small compared with the expected general growth in the regions. In particular the negative impacts are very small. Therefore no general programme of the Commission to compensate for negative economic impacts of the Channel Tunnel seems to be necessary. However, the Tunnel may have specific negative impacts for some individual regions, and these may require action by the

General issues

- No general action programme necessary to compensate for small negative impacts of the Tunnel.
- Transport infrastructure scheme for the European Community to coordinate nationally oriented policies.
- Linking of peripheral regions to the European core to counteract peripheralisation process.
- Strong regional policy of the Community to counteract polarisation tendencies of high-speed infrastructure.
- Support of cross-border projects in order to stimulate European awareness in regional policy making
- Environmental protection measures to match negative consequences of Tunnel-related infrastructure.
- Fair competitive conditions in the cross-Channel business to guarantee alternatives to the Tunnel.

Specific issues

- Strengthen peripheral continental regions by supporting the modernisation of industries and ports.
- Help Ireland and Scotland to get better transport connections to continental Europe through England.
- Promote quick implementation of Tunnel access infrastructure to enable regions to benefit from the Tunnel.
- Assist Channel port regions to adjust their port activities to the competition of the Tunnel.
- Counteract negative impacts of overagglomeration in large metropolitan areas.

Figure 12. Main issues and policy actions.

European Union. Improvement of the transport connections to Ireland and Scotland or assistance to the Channel ports in their efforts to adjust to the competition of the Tunnel may be examples for this (see Figure 12).

At a more general level, the Tunnel, as a key element in the new generation of transport infrastructure in Europe, adds new significance to the debate about the role of transport for spatial polarisation and peripheralisation in Europe and forcefully underlines the need for an integrated transport and regional policy of the European Union.

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