CHEVROULET Tristan *, SEVESTRE Aymeric *, GEAMBASU Georgeta *, REYNAUD Christian **

Review of Eurotunnel's Decision-Making Process

A critical appraisal of Ex-ante vs. Ex-post studies

***EPFL - LEM (CH), **Nestear (F)**

CDM Working Papers Series

31 July 2007 **LEM-WORKINGPAPER-2007-001**

Article publié dans European Commission, Cordis, FP 6 Transport Research, EVA-TREN, 2007

Keywords : Eurotunnel, large-scale project, appraisal, Channel Tunnel, review, economic, finance.
Contact : tchevroulet@berkeley.edu
JEL classification : R42, R48, R49

Abstract

This document provides a methodical investigation of the main assessment steps that have led to the construction of Eurotunnel and it compares the results of the analyses that were achieved before the key decisions with the results of studies that have been undertaken since Eurotunnel is in operation. The analysis of successful and mismatched appraisals is followed by a series of methodological recommendations aimed at helping decision-makers to gain from positive experience and to avoid the pitfalls that Eurotunnel encountered.

EVA-TREN is the acronym of "improved decision-aid methods and tools to support **eva**luation of investment for **tr**ansport and **en**ergy networks in Europe". It is a research aimed at improving decision support for large-scale transport and energy projects in the European Union. EVA-TREN is funded by the Directory General for Transport and Energy (DG TREN) of the European Commission, within the Sixth Research Framework Programme (FP6). EVA-TREN comprises, amongst other, the study of eleven significant investments in European transport and energy infrastructure. More information is available at: www.evatren.eu

Table of content

Report Structure II

1. History of Decision Making Process and General Objectives 1
1.1 Decision Making Process 1
1.2 General Objectives of the Project 4
1.3 Eurotunnel Implementation Context 5
1.4 Conclusions 6

2. Context Analysis 8
2.1 Project Dependency to other Projects 8
2.2 Access and Connection to National Networks 9
2.3 Conclusions 10

3. Analysis of Demand and Response to Market Dynamics 11
3.1 Key Features of Demand Analysis 11
3.2 Demand Forecast 13
3.3 Comparison: Passenger Demand Analysis vs. Ex-post Records 16
3.4 Comparison: Freight Demand Analysis vs. Volume Records 19
3.5 Potential Causes for the Difference between Forecast and Recorded Demand 22
3.6 Conclusions 23

4. Options Analysis 25
4.1 Alternatives Considered in the Option Analysis 25
4.2 Critique of the Option Analysis 28
4.3 Conclusion 29

5. Financial Analysis 30
5.1 Ex-ante Financial Analysis 30
5.2 Recorded Financial Values of the Project 33
5.3 Comparison: Ex-ante Analysis vs. Ex-post Records 35
5.4 Conclusions 38

6. Economic Analysis 41
6.1 Many Studies with no Distinct Result 41
6.2 Major Problem: Assessment of Overall Impact 42
6.3 Transport Market: Competition on Shares and Tariffs 43
6.4 Employment 46
6.5 Management Issues: Drawbacks of Eurotunnel’s Bicephal Structure 49
6.6 Conclusion 50

7. Sensitivity and Risk Analysis 51
7.1 Risk Analysis Focused on Bankers’ Risks 51
7.2 Competition with the Ferries 54
7.3 Conclusions 55

8. Conclusion and Potential Solutions 56

9. Recommendations in the Light of EVATREN Objectives 58

10. Glossary 59

11. References 61

12. Annex: Historical Conversion Rates 65

Report Structure

The Review of Eurotunnel’s Decision-Making Process is built in 9 sections:

1 Eurotunnel objectives and evolution of the decision making process

2 Context analysis

3 Demand analysis

4 Option analysis

5 Financial analysis

6 Economic analysis

7 Analysis of uncertainties

8 Conclusions and recommendations

9 Recommendations (summary)

Within each section, as far as relevant, the authors provide the results of the ex-ante analysis, the ex-post results of the project performance, they discuss potential reasons that may have led to deviations.

Acknowledgements

The authors would like to thank Dr. Emma Zecca (TRT), Mr. Alfredo Beggi (Csil) and the European Commission for their help in collecting bibliographical data related to early Channel Tunnel studies.

1. HISTORY OF DECISION MAKING PROCESS AND GENERAL OBJECTIVES

1.1 Decision Making Process

Decision for building Eurotunnel followed a path that seems contrary to project management logic: a decade after the highly symbolic project had been started and cancelled, new political leaders decided that the same project would be realized, but under different financial conditions. Then, experts established a procedure meant to finance, build and operate the system with no public money.

Institutional and Policy Background

In 1957, the Groupement d'Etudes pour le Tunnel sous la Manche (GETM) undertook the first studies for a transport link under the Channel. In 1960, the Expert panel that had to select the best option for that link opted for a railway tunnel. In 1964, the governments of France and of the United Kingdom announce that they shall start and finance the construction of a new railway link under the Channel. A call for tenders is launched in 1967 and the mission is given to the newly created –1971- consortium "*Channel Tunnel Group*" (CTG). CTG starts earthwork in 1973, but on January 20, 1975 the British government plunged in a financial crisis cancels the project.

Nevertheless, the railways had always been keen on a tunnel. In September 1978, Peter Parker, chairman of British Rail, proposed a joint British Rail/ SNCF scheme to build the "mousehole tunnel" which was to carrying rail traffic, but no cars. No serious economic study supported the project, but the recession and the consequent squeeze on public spending made builders more interested than ever before. In this context, the tunnel appeared as an extremely positive deal, to be proposed to clients –the governments of France and UK- which were considered reliable and wealthy enough for guaranteeing long-term work. So, a technical concept with little economic background was in the air but, according to newspapers (Dickinson, 1998), political antagonism between Mrs Thatcher and French President Giscard d'Estaing worked against any sort of significant common achievement between UK and France. Still, during the September 10-11 Franco-British summit, the French and UK governments decided to re-launch the concept. An Anglo-French consortium worked into the financial concept, but it was stopped by a fundamental divide: the French government wanted a public funding scheme, while the British wanted a private one. Still, the political situation evolved: in 1983 Mrs Thatcher won the election and could go ahead with her privatisation policy Not only the new cross-Channel link would help British entrepreneurs to reach the European market, but also it would be possible to build this link with no public funds from the government. This is what the National Westminster Bank wrote to the Department of Transport in 1984. All the pieces were on the table; one just needed to match them to each other, which was done at the highest political level: at the end of November 1984, Margaret Thatcher flew to Paris for a summit meeting with François Mitterrand. Discussions were held at the "*Salon Ver*t" at the British Embassy.

As the clock moved on towards two in the morning, Mrs Thatcher was referring to the tunnel as the most exciting project of the century. The ministers followed their leader. At two, they drank a toast to another piece of Anglo- French cooperation, the Channel tunnel, a successor to Concorde. "We had to have another drink before we were allowed to go to bed, exhausted though we were" recorded Transport Secretary Nick Ridley in his memoirs. [...]

Source: David Dickinson "12 Billion Pounds under the Sea" In: Independent On Sunday 18 January 1998

After the green light of the Salon Vert meeting, the two governments released the specification sheet (November 1984) and launched a call for tenders (1985). Promoters submitted proposals, amongst which four were selected for the last round. They were Channel Expressway, a large and expensive tunnel for cars and rail; Euroroute, a steel bridge-tunnel-bridge for cars; Eurobridge, a bridge for cars and –possibly- rail; and Eurotunnel, the rail tunnel.

On January 20, 1986 Eurotunnel project was selected. It was based on the configuration abandoned in 1975. In March 1986: France-Manche (FM) and Channel Tunnel Group (CTG) are gathered under a single brand: Eurotunnel. A 55 years concession is granted on March 14. Eurotunnel becomes Maitre d'œuvre (MdO) on August 13 (Spick, 1995, p. 20).

With the aim to control the construction, the governments of the two countries impose Setec (for the French side) and W.S. Atkins (UK side) as bodies for shared Maîtrise d'œuvre within Eurotunnel. Eurotunnel is formally a bicephal company: Eurotunnel SA in France (ESA) and Eurotunnel Public Limited Company (EPLC) in UK. ESA and EPLC become concession holders. Nevertheless the governments did not involve any public money in return of this authority.

The consortium of companies for engineering work was created in May 1986. It was called "Transmanche Link" (TML), Similarly to Eurotunnel, TML was also a bicephal organisation, with GIE Transmanche Construction on the French side and Translink JV on UK side. Costs, risks and profits were to be shared (half-half) and each company was running under its national regulation.

Earthwork began in 1987. The opening was planned in spring 1993. However, construction delays and costs grew during the 1987-1993 period. Eurotunnel was completed in spring 1994 and transport services were gradually supplied, at a lower pace than planned due to problems in fixed equipment installations and rolling stock.

During the 1994-2007 period, operation revenues did not allow financial balance. The debt was growing, the banks have increased power and the shareholders have not been satisfied.

Realization Phases	Start	Development	Consolidation	Completion
Physical	First earthwork in 1987	Tunnels bored between 1988 and 1991	Equipment and changes in safety standards until 1994	Opening to traffic in 1994
Economics	First studies undertaken by the Groupement d'Etudes pour le Tunnel sous la Manche (GETM), 1957	1981-1982 various studies, including AFSB report, basis for finance engineering.	Construction cost increase. Debt service becomes a significant element of cost.	With £4568 million in 1994, the overall figure was 69% over 1986 budget.
Legal/ regulations	1986. Political decision. Eurotunnel established in 1986.	1987: Channel Tunnel Act ratified in France and UK	Court actions between Eurotunnel and TML.	1994: concession end (2042) postponed to 2052 to facilitate new finance call.

Table 1. Eurotunnel realisation phases

Commissioning and Operations

Although the tunnels were completed on time, the installation of fixed equipment and construction of terminals were finished in April 1993, about four months late. Lack of rolling stock made it impossible to commission the installations and to run proper services during most of 1994.

Service	**Planned** (Rights Issue Prospectus, May 1994) [1]	Actual start	Full service
Eurostar passenger service	Dec. 1993- May 1994	August 1994	November 1994
Shuttle passenger service	Dec. 1993- May 1994	August 1994	December 1994, but final train received in July 1995 only
Through Freight	Dec. 1993- May 1994	June 1994	June 1994
Freight shuttle	Dec. 1993- May 1994	May 1994	November 1994

Source: Adapted from G. Winch, 1998

1. original opening and commissioning date –set at the beginning of the works- was May 1993

Table 2. Commissioning and Operations

1.2 General Objectives of the Project

Original Objectives and Changes

The Channel Tunnel was a project with the aim of creating a transport link between the UK and the Continent. Due to its high political importance, it has been strongly supported by President Mitterrand and Prime Minister Margaret Thatcher. The link would benefit both France and the UK by improving accessibility and facilitating the transport of people and goods across the Channel. The Channel Tunnel was to be an example of privately financed infrastructure, the first of this scale: the investors were being invited to commit millions without recourse to any government guarantee.

The technological objective of the project has been met: a 50 kilometres underground link between France and the United Kingdom, which comprises two terminals, a twin railway tunnel (about 7.5 m. diameter) and a smaller service tunnel (about 5 m. diameter). Shuttle trains are about 2500 tons and 750 meters long, each of them requires up to 250MVA power.

There have been no radical changes. Nevertheless, there have been management problems: the contractor (Trans Manche Link – TML) gradually lost influence on the owner (Eurotunnel) as the shareholders base broadened; the Safety Authority, in a period of transportation disasters (Kings’cross, Clapham), drastically increased safety requirement, thereby creating conflicts between the regulatory and the procurement processes and increasing costs.

The main flaw is financial: the three major financial contributors of the project –Eurotunnel shareholders, the ten contractors and the banks- have lost a lot of money (equity 3 subscribed at above £3.50, and worth less than £1 ever since). Shareholders have small prospect of receiving a dividend, while banks regularly re-arrange the debt in order to limit their losses. Last operation, an “offre publique d’échange” – (OPE) dated May 2007. The financial situation has always been difficult, nevertheless banks still receive interest on their loan.

1.3 Eurotunnel Implementation Context

Policy Actors

French and British governments, with strong personal involvement of UK prime minister Margaret Thatcher and President François Mitterrand as well as the Department of Transport of the two countries. Policy actors encouraged the private sector to invest into Eurotunnel, but they did not commit their countries in financial terms.

Regulatory Agencies

To supervise the project on their behalf, the governments of the two countries that granted the concession have established the Inter Governmental Commission (IGC), a French-Britain co-operation body of the governments. Decisions are taken in common agreement between the delegates. In case no agreement is reached, then the contentious is passed to both governments.

Institutional Bodies

Three bodies have been created to regulate the relationship between both states and Eurotunnel: the Inter Governmental Commission (IGC) (see above); the Safety Authority, and the “Tribunal arbitral”. These three bodies represented, directly or indirectly, the interests of the citizen. But without another body, the banks, Eurotunnel would either not have been built at all or it would not have been built as a fully private infrastructure.

The Safety Authority was a joint body between French and British instances (at parity). The SA advised the IGC on safety matters and, therefore, has had a very strong power over technological decisions.

The Arbitral Court was a legal institution with the duty of solving litigations between the states as well as litigations between a state and a franchiser, or between franchisers.

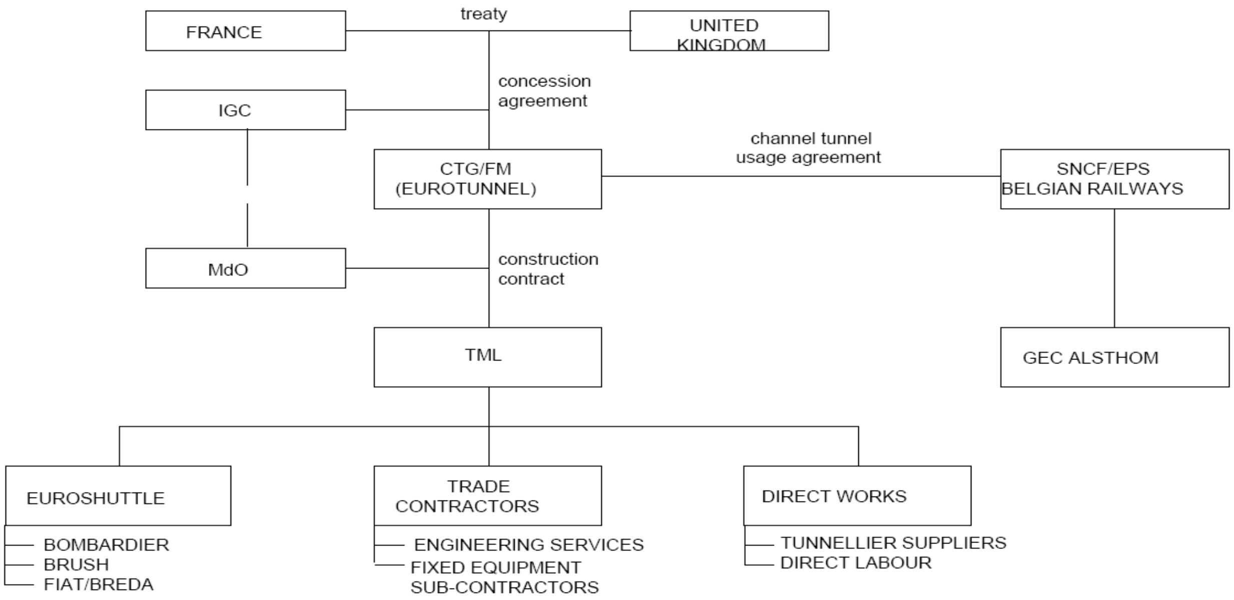
The banks were the key players of Eurotunnel: they produced the 1984 report upon which all initial financial decisions were taken, they subscribed to equities 2 to 4 and the Bank of England did put Sir Alastair Morton at the head of Eurotunnel. After operations have started, they more than once negotiated the debt and set conditions for Eurotunnel management.

Regulatory and Policy Framework

The main regulatory framework is the Canterbury Treaty, signed on February 12, 1986 by the French and the British ministers of foreign affairs. The Treaty states the strategic specificities of the project, namely the line between both land borders, defence, security and safety requirements. Then, the Concession Act, signed on March 14, 1986, specifies technical requirements of the project; it also states the concession holder’s freedom of management and of operation.

Project Complexity

In addition to the difficulties inherent to any large-scale project, Eurotunnel had a structure where all tasks were duplicated, everything being made so that each half of the tunnel would be built by a French or a British company, each operating under its own national law.



Source: Winch, 1998

Fig 1. Eurotunnel Organizational Schema (start of earthworks)

Duplication of all entities made the project very difficult to manage, not only due to the number of groups involved, but also because it was extremely difficult to build trust between duplicated managers. Winch (1998) quotes Colin Stannard, Managing Director Eurotunnel: "*There is, I believe, a fundamental error in the nature of the construction contract which led to lack of trust on both sides*".

Coordination was particularly difficult, not only due to different laws, different philosophies of work, but also because of the lack of experience. None of the managers or of the team members had accomplished such a task before whereas state- owned industries like BR and SNCF were barred from the project: … despite all their expertise.

1.4 Conclusions

The Channel Tunnel was a project with the aim of creating a transport link between the UK and the Continent. The project had high visibility and was strongly supported by President Mitterrand and Prime Minister Margaret Thatcher. The link would benefit both France and the UK by improving accessibility and facilitating the transport of people and goods across the Channel. The Channel Tunnel was to be an example of privately financed infrastructure, the first of this scale: the investors were being invited to commit millions without recourse to any government guarantee. The technological objective of the project has been met: a 50 kilometers underground link between France and the United Kingdom, which comprises a twin railway tunnel and a smaller service tunnel, with rolling stock and stationary equipment. The decision making process was led by the governments of the two countries, but decisions were taken by the main investors. This led to a situation where investors had the feeling that the states were backing the project –hence the item on which they were likely to invest-, whereas governments provided the political will only, but they were not ready to bear the costs of any sort of financial aid.

Proposed solution: coherence between political discourse and actual actions, amongst others, financial support.

2. CONTEXT ANALYSIS

2.1 Project Dependency to other Projects

Two different views of the project: in the UK, Eurotunnel was a rail link between two terminals; the terminals had first to be connected to the rest of the country by road, and sometime later, by rapid train. On the French side, Eurotunnel was considered as a potential expansion of TGV to the UK (a TGV linking Paris – London and London – Brussels was under study). As a result, the connection between Eurotunnel and the British and French rail networks has been very slow (Eurotunnel opened in 1994, but still no high-speed Eurostar services between Paris and London in 2000).

Eurotunnel has been designed as a sort of « independent project ». Implicitly, it was a direct competitor to the ferries. Of course, the rail tunnel had to be connected to the railway network of the two countries, but proper high-speed connection has always been considered a feature to be achieved over time. Indeed, it seems that the high-speed networks of the UK, France and –to some extent- Belgium do depend upon Eurotunnel more than Eurotunnel depends from them.

Eurotunnel had a very strong potential as a symbol of a closer link between European countries. Unfortunately, the project was blocked since British retreat in 1975. The European Community (EC) was growing, but still owned little financial power. Therefore, the EC regularly had to swap Member States' political decisions against financial rebates. In this regard, policy experts have in many occasions linked British agreement on Eurotunnel to an agreement upon Britain's financial contribution to the EC.

The shift itself may be explained by the nature of Britain's then relations with France and the rest of the European Community. Only at the Fontainebleau summit in June 1984, had the issue of Britain's contribution to the EC budget been finally resolved. With this issue behind her, notes Hugo Young, 'Mrs. Thatcher began to utter sentiments that were impeccably communautaire', among which the new line in favor of the fixed link must be counted (Young, 1990, p. 388 cited by Holliday, Marcou et al 1991).

The Channel Tunnel was in some respect the first of a series of big infrastructure projects ment to shape the backbone of Transeuropean transport networks (TEN-T). Eurotunnel was just opened at the beginning the TEN-T financing period, and therefore it could not benefit from EU finance (14 priority projects : 40 billion Euros, to be spent between 1995 and 1999). In the Resolution of the European council of December 5, 1989, for the realisation of a high-speed rail strategic plan, it was already assumed that there would be a rail link between the UK and France. Not mentioning Eurotunnel within TEN-T projects enabled the EC not to interfere into project realization.

2.2 Access and Connection to National Networks

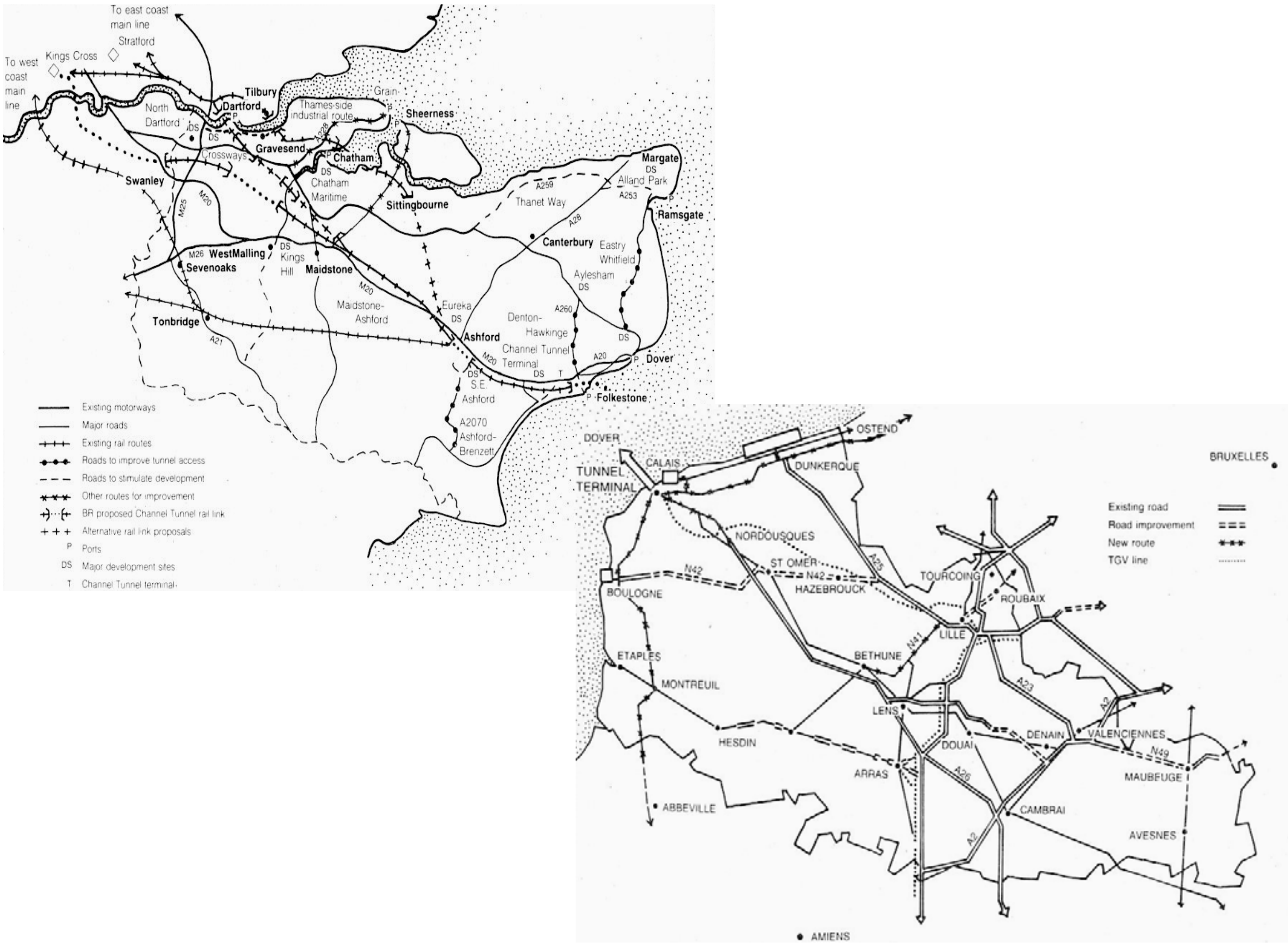
Eurotunnel is linked to the transport network of the two countries by means of two terminals, one in Coquelles (F) and the other in Cheriton (UK). Both terminals connect Eurotunnel to rail and road.

Terminals

The 140 hectares UK terminal is located in Cheriton near Folkestone. Its 480 hectares French counterpart is located in Coquelles (Frethun), about 1 km south of Calais.

Road Access

Cheriton terminal is linked to two motorways, the **M20 (**Folkestone – Ashford – Maidstone – London Ring), of which 15 km have been built on that purpose between Ashford and Maidstone, and the **M2** between Canterbury and London (with a motorway between the terminal and Rochester, and a double lane up to London ring).



Source: adapted from Holliday et al 1991

Fig 2. Access to Eurotunnel infrastructure

Coquelles terminal is connected to three French motorways: the **A 16** has been built between 1992 and 1997 with the aim to connect Eurotunnel to Paris and the Belgian border via the Northern littoral (Pas-de-Calais and Somme). The **A 25** between Lille and Dunkerque has been completed 1987. Finally, the toll highway **A 26** that links Calais to Arras, and which is connected to A2 near Paris has been extended to the French terminal in 1989. (access to the terminal has been undertaken by Eurotunnel itself).

Rail Access

British tunnels and bridges are slightly lower than those on the Continent. Nevertheless, only a few adaptations were undertaken to adapt the British network to Continental standards. Instead of work on infrastructure, the issue was solved by ordering special rolling material. A rapid connection to London, the "*Tunnel Rail Link Connection*", has been built, but it had been achieved in 2007 only.

In France, the main part of Eurotunnel traffic runs on Calais – Lille – Paris electrified line, using the capacity that has been freed by the new Lille – Paris TGV line. The only alternative, a line that crosses Boulogne, is not electrified yet.

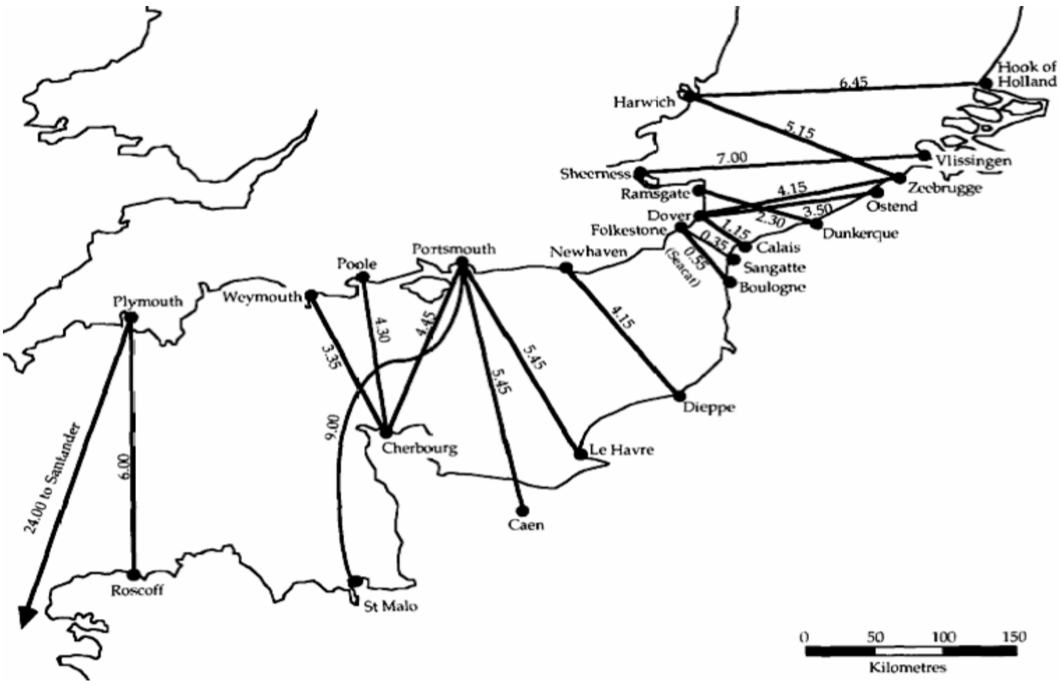
2.3 Conclusions

Two different views of the project: in the UK, Eurotunnel was a rail link between two terminals; the terminals had first to be connected to the rest of the country by road, and sometime later, by rapid train. On the French side, Eurotunnel was considered as a potential expansion of TGV to the UK (a TGV linking Paris to London and London to Brussels was under study). As a result, the connection between Eurotunnel and the British and French rail networks has been very slow: Eurotunnel opened in 1994, but Eurostar services between Paris and London took about a decade before they could operate at high-speed all over the line (connection to San Pancras station opened in November 2007 only).

Proposed solution: improve system definition. The realization of Eurotunnel, seen as an underground line plus its two important terminals, should be closely coupled with the connection to the rail network. Plans for building and financing such connections should be ready before decision is taken for starting the tunnel itself.

3. ANALYSIS OF DEMAND AND RESPONSE TO MARKET DYNAMICS

One thing is to be remembered all along the demand analysis: Eurotunnel was not alone in providing cross-channel services. Even though Eurotunnel was the only one that could supply continuity in rail transport under the Channel, it was in full competition for all intermodal services. And, with about 20 minutes per crossing it was not much faster than the fastest sea services (35 minutes). Frequency, reliability, ease of interchange and tariffs played their full role from the beginning of Eurotunnel, and they continue to do so in the 21st century.



Source Button, 1994

Fig 3. Journey times, with ferry traffic (prior to Channel Tunnel operation

3.1 Key Features of Demand Analysis

Demand analysis carried out for Eurotunnel displays unusual features, most of which were due to the exceptional project organization and to the project turbulent course. This combination of internal and external factors led to "regular forecasts produced annually by a group of traffic and revenue consultants, which were independently reviewed by another set of consultants" (Castles, 2003).

A fundamental principle of the Channel Tunnel was "moitié-moitié" (half and half): the work was to be divided equally and so the costs (Morris & Hough, 1987). That is why nearly every entity and nearly every task has been duplicated, one for the French side, the duplicate for the UK side. Between 1966 and 1969, in preparation of the first bid (1970's bid, rejected), the French consultants firm SETEC produced several updates of 1957-1959 Channel Tunnel Study Group assessments and of the

1963 British and French government studies. RTZ (UK project managers group) also review existing studies. Both results were made available by 1972.

Eurotunnel decisions have been based on a multiplicity of sub-optimal studies, but that was not all: unplanned events affected project realization schedule and increased construction costs. Such events made stakeholders require several demand analyses, some of which have been produced very late, a few even during the construction phase.

Results of the Demand Analysis Carried out before Project Implementation

The “Braibant-Lyall Working Group” (BLWG) examined a set of alternative fixed links: “the bored tunnels” with one or more tracks, “the submerged tunnels” made up by pre-fabricated components”, a “combined bridge-tunnel structure”, the projects for “variable span, multi-span suspension bridges”.

BLWG used the following methods:

- A retrospective comparison of the ex-ante and forecast data from 1971-1975 studies with the data observed in 1980
- Scenarios method to do an ex ante economic and social assessment of different alternatives
- Energy and environmental assessment of the different alternatives on both sides of the Channel

From the retrospective comparison of 1980 traffic forecast provided by the 1971-1975 studies with 1980 traffic records, Heddebaut (1994) recorded that “*observed data of growth are appreciably higher than the rates which had been forecast*”. For example, in 1980, the volume of passenger traffic with vehicles (cars and coaches) was 30% above 70’s forecast. Similarly, 1980 freight traffic record happened to be 33% above 1975 forecast (Braibant & Lyall, 1982).

BLWG concluded that all the proposals were cost-effective but the twin bored tunnel would be the best option.

The following assumptions were made:

- the competition between air transportation on the routes London-Paris and London –Brussels and a fixed link served by rail will result in 30% market share to the fixed rail link
- Deregulation of air transport in Europe will impact in transport costs fall
- The ferry services will be able to carry a large part of the forecast increase
- The traffic forecasts used by the group were produced by analysis of the work undertaken by promoters (British Rail and SNCF, Coopers Lybrand and SETEC Economie study carried out on behalf of EEC in 1979-1980, and the statistics on cross- Channel traffic)

3.2 Demand Forecast

Since 1963, there have been many attempts at forecasting the traffic that might use a new tunnel under the Channel.

Passenger forecasts		**1969**	**1971**	**1980**	**1985**	**1990**	**2000**
MoT (1963)	Total demand	5.37	5.52	6.22	5.78	–	–
	Via tunnel	4.71	4.83	5.38	5.66	–	–
C&L (1973)	Total demand	–	24.95	46.76	–	93.27	–
	Via tunnel	–	–	15.85	–	29.52	–
CTAG (1975)	Total demand	–	24.93	42.32	–	72.01	–
	Via tunnel	–		14.59	–	24.18	–
DoT (1982)	Total demand	–	–	20.6	–	35.7	48.4
	Via tunnel	–	–	–	–	15.3	19.8

Sources: MoT (1963), C&L (1973), CTAG (1975) and DoT (1982).

Table 3. Historical forecast for passengers: Total cross-Channel vs. Channel tunnel (millions of passengers)

Freight forecasts		**1969**	**1971**	**1980**	**1985**	**1990**	**2000**
MoT (1963)	Via tunnel	2.6	2.9	4.0	4.5	–	–
C&L (1973)	Total demand	–	5.7	13.1	–	25.3	–
	Via tunnel	–	–	5.4	–	11.3	–
CTAG (1975)	Total demand	–	5.7	12.9	–	20.2	–
	Via tunnel	–	–	5.3	–	7.8	–
DoT (1982)	Total demand	–	–	15.9	–	27.3	37.2
	Via tunnel	–	–	–	–	8.6	11.1

Sources: MoT (1963), C&L (1973), CTAG (1975) and DoT (1982).

Table 4. Historical forecast for freight: Total cross-Channel vs. Channel tunnel (millions of tonnes)

Demand	1993 Cross-Channel	1993 Tunnel passengers	1993 Market share (%)	2003 Tunnel passengers
Car passengers	9.5	6.3	66	7.3
Coach passengers	8.4	4.4	52	5.5
Day trip passengers	3.2	3.1	97	3.4
Other foot passengers	46.1	10.9	24	12.9
Total passengers	67.2	24.7	37	29.1
		Tunnel freight	Market share (%)	Tunnel freight [a)]
Roll on/roll off freight [b)]	24.2	6.0	25	7.5
Containers and rail wagon	7.9	4.0	52	6.8
Total	32.1	10.0	31	14.3

a) CTG-FM_s assessment of the total demand for 2003 was not published. Source: CTG-FM (1985).

b) Roll on/roll freight are accompanied lorries ‘‘rolling on and off’’ ferries or other vehicle shuttles.

Table 5. CTG-FM passenger and unitised freight forecasts—total demand (1993) and tunnel share (1993 and 2003) (millions of passengers and millions of tonnes)

Traffic volumes	1993		2003	
	1987 update	Tunnel market share	Traffic volumes	Tunnel market share
Total passenger demand	67.1		93.6	
Channel Tunnel traffic	29.7	44%	39.5	42%
Total unitised freight market	42.4		62.6	
Channel Tunnel traffic	14.8	35%	21.1	34%
1990 update				
Total passenger demand	84.2		125.2	
Channel Tunnel traffic	28.6	34%	44.6	36%
Total unitised freight market	47.2		74.5	
Channel Tunnel traffic	16.2	35%	26.8	36%

Sources: Eurotunnel (1987, 1990).

Table 6. ET (1987, 1990) passenger and freight forecasts (million of trips/tonnes)

Traffic volumes	1994		1995		1996		2003	
		Tunnel market share	Traffic volumes	Tunnel market share	Traffic volumes	Tunnel market share	Traffic volumes	Tunnel market share
Total passenger demand	71.7		77.7		82.5		107.5	
CT traffic	2.9	4%	16.3	21%	21.8	26%	35.8	33%
Total unitised freight market	43.8		47.4		50.2		73.4	
CT traffic	2.6	6%	11.1	23%	16.0	32%	25.3	33%

Source: Eurotunnel (1994).

Table 7. ET (1994) passenger and freight forecasts (million of trips/tonnes)

3.3 Comparison: Passenger Demand Analysis vs. Ex-post Records

Actual Values of the Demand of the Implemented Projects

Eurotunnel progressively opened to the traffic in 1994. Since 1996, more than 10 million passengers use the tunnel every year, either on Eurostar trains or on shuttles for passengers (and cars).

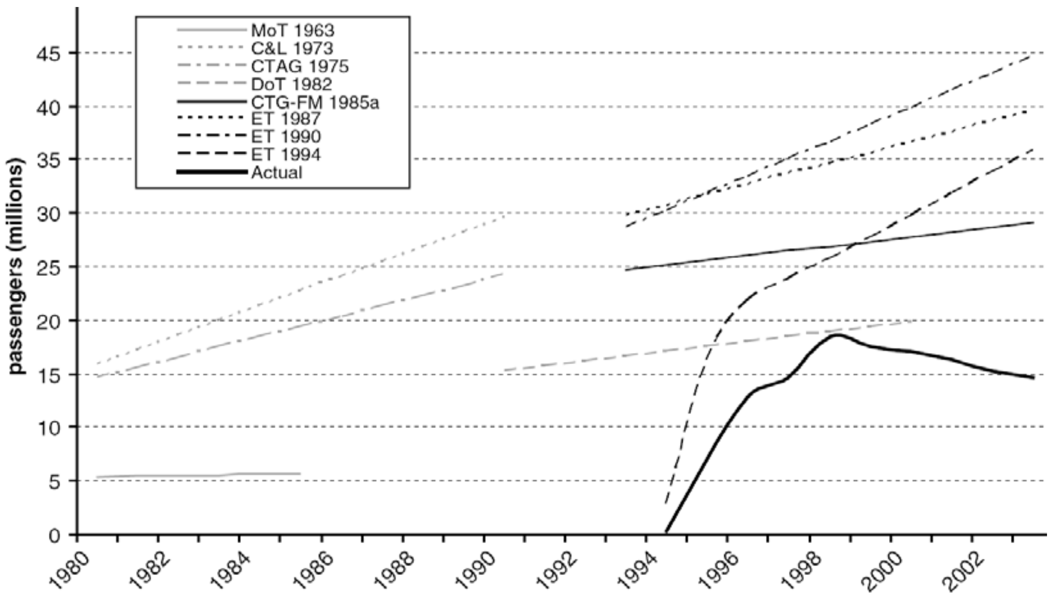
Eurotunnel passenger traffic

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Eurostar passengers	0.1	2.7	4.9	6.0	6.3	6.6	7.1	6.9	6.6	6.3
Le Shuttle passengers	0.2	4.4	7.9	8.6	12.1	11.0	9.9	9.4	8.6	8.6
CT passengers	0.3	7.1	12.8	14.7	18.4	17.6	17.0	16.3	15.3	14.7

Source: Eurotunnel Annual reports.

Table 8. Channel Tunnel passengers records, 1994–2003 (millions of passengers)

Comparison with passengers' traffic records



Source: Anguera, 2006

Fig 4. Passenger traffic: Forecast vs. records

The differences between records and historical forecasts are twofold: the number of passengers as well as the volume of through rail services have been overestimated, whereas shuttle freight proved more important that forecasted.

Compared to passengers records, Eurotunnel forecasts were too optimistic by a factor 1.5 – 2 (Fig. 4).

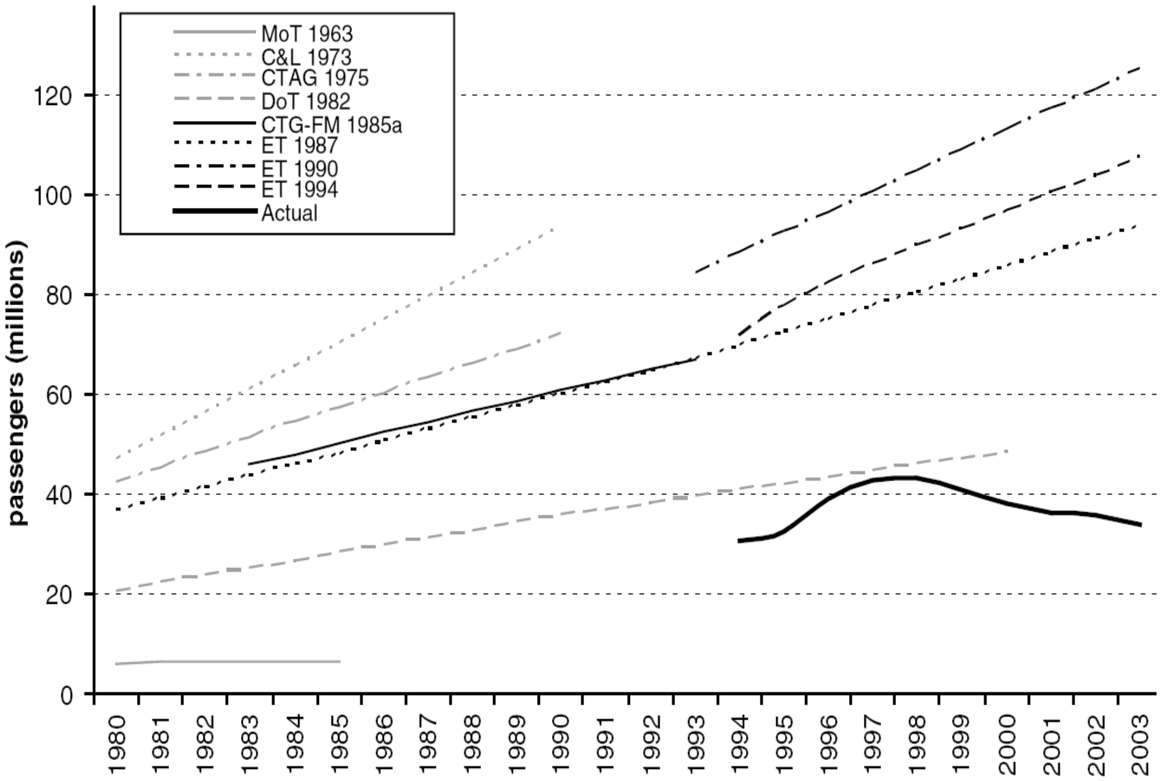
The large overestimation of the levels of passenger traffic through the Channel Tunnel may be driven by an overestimation of the total cross-Channel market. The market share itself proved to be close to the actual share captured by the Tunnel.

Total cross-Channel passenger traffic

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Unaccompanied										
Air passengers (a)	4.4	4.0	4.0	4.3	4.3	4.4	4.3	4.0	4.3	4.1
Eurostar passengers (b)	0.1	2.7	4.9	6.0	6.3	6.6	7.1	6.9	6.6	6.3
Classic passengers subtotal	7.0 I	6.7	8.9	10.3	10.6	10.9	11.5	10.9	10.9	10.4
Car accompanied										
Ferry services	23.7	21.5	22.4	23.8	20.4	19.0	16.6	16.0	16.5	14.8
Le Shuttle (d)	0.2	4.4	7.9	8.6	12.1	11.0	9.9	9.4	8.6	8.6
Car accompanied subtotal	23.9	25.9	30.3	32.5	32.5	30.0	26.5	25.3	25.1	23.5
Total cross Channel passengers	30.9	32.5	39.2	42.8	43.1	40.9	38.0	36.3	36.0	33.9

Sources: CAA (2004), DHB (2004), DfT (2003, 2004), ET Annual reports.
a) London—Paris and London—Brussels.
b) Eurostar operates through-rail passenger services between London and Paris/Brussels.
c) Includes Sea foot passengers.
d) ‘‘Le Shuttle’’ is the car, coach and lorry carrying service operated by Eurotunnel.

Table 9. Total cross Channel market passengers (millions of passengers, 1994-2003, all modes)



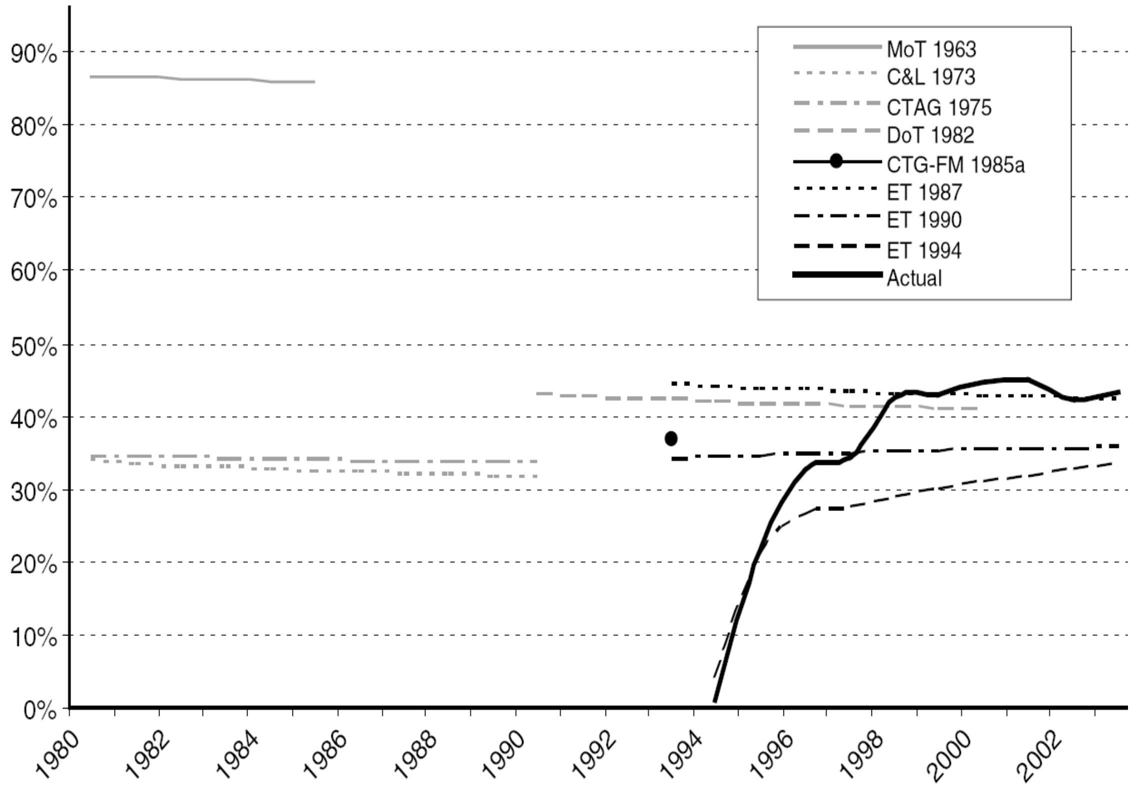
Source: Anguera, 2006

Fig 5. Total Channel passenger traffic: Forecast vs. records

The total-cross Channel passenger market had been even more severely over-estimated than the Channel Tunnel passenger segment. Duty free shops have been abolished in 1998, year of the peak demand over the Channel. Passenger traffic has decreased ever since.

Channel Tunnel Passenger Share of the Total Cross-Channel Market

The *share* of the market captured by the Channel Tunnel slightly exceeded all projections made from 1970 onwards. The only projection that produced figures that were higher than records came from MoT (1963). Still, that study considered the 1980-1985 period and, therefore, targeted a former –but similar in many respects- Channel Tunnel project.



Source: Anguera, 2006

Fig 6. Market share of Eurotunnel passenger traffic: forecast vs. records

3.4 Comparison: Freight Demand Analysis vs. Volume Records

The actual volume of freight using Eurotunnel has globally grown since the start of Eurotunnel operations (Table 8). Yet, the result of forecast is highly contrasted: Shuttle freight services over performed forecast while through-rail freight results have always stayed far behind forecasts. Even though Eurotunnel updated forecasts during tunnel construction (1990) and at completion (1994), predicted total traffic has always been overoptimistic. In 2003, it was still about one third higher than the levels observed in 2003.

In terms of market *share*, total freight volume across the Channel Tunnel is higher than Eurotunnel original forecast (1985) and close to 1987 estimates. Still, cross-channel market *size* proved smaller than Eurotunnel had forecasted, which resulted in Eurotunnel providing less freight services than expected. In November 1996, a freight shuttles took fire. This caused shuttle freight service to be closed for 7 months. As a result, Eurotunnel freight volumes significantly decreased in 1997.

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Le Shuttle freight	0.8	5.1	6.7	3.3	9.2	10.9	14.7	15.6	15.6	16.7
Through rail services		1.3	2.4	2.9	3.1	2.9	2.9	2.4	1.5	1.7
Total Tunnel freight	0.8	6.4	9.1	6.2	12.3	13.8	17.7	18.0	17.1	18.4

Sources: Eurotunnel Annual Reports, DHB (2004)..

Table 10. Actual channel tunnel freight tonnages 1994–2003 (million tonnes)

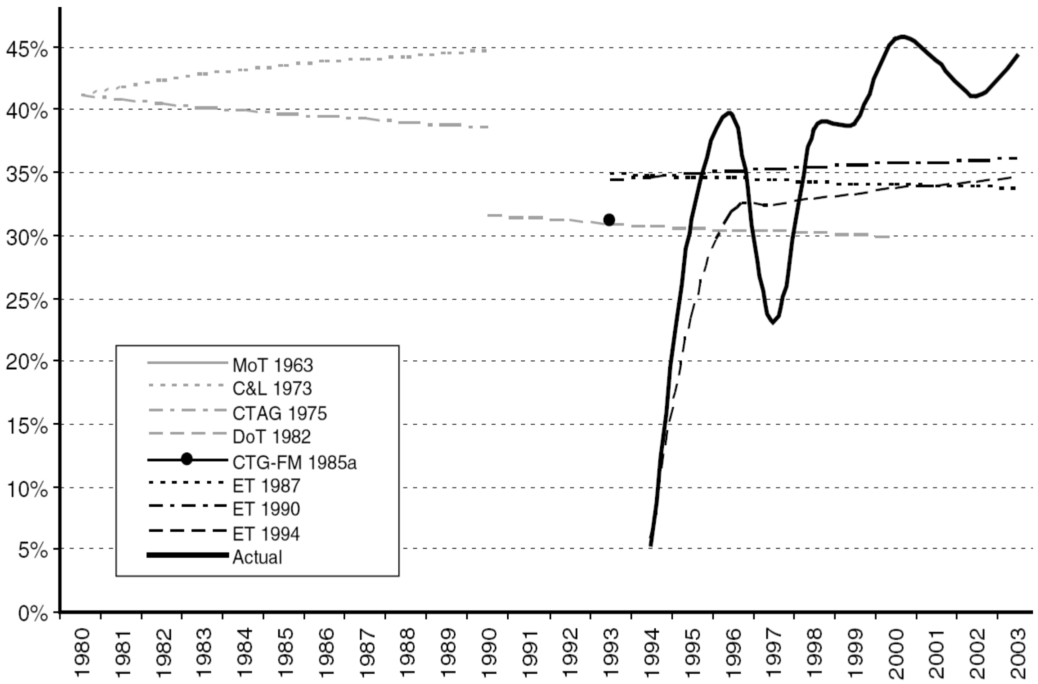
Total Cross-Channel Market (unitised freight market)

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Channel Tunnel	0.8	6.4	9.1	6.2	12.3	13.8	17.7	18.0	17.1	18.4
Port of Dover	15.1	14.0	13.9	20.8	19.8	21.7	21.0	23.0	24.1	23.2
Total cross Channel	15.9	20.4	23.0	27.1	32.1	35.5	38.7	41.1	41.2	41.6

Source: Eurotunnel Annual Reports, DHB (2004).

Table 11. Cross-Channel unitised freight 1994–2003 (million tonnes)

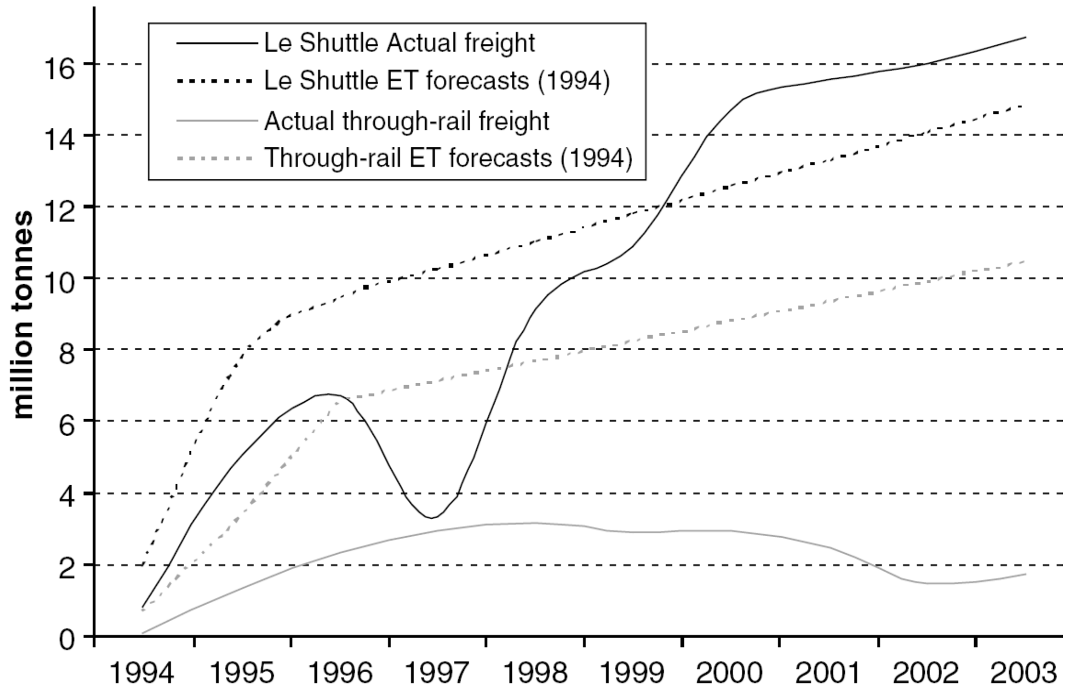
Total cross-Channel market (Table 11) has grown continuously since Eurotunnel opening until 2001 when it stabilizes at around 41 million tones.



Source: Anguera, 2006

Fig 7. Market share of Eurotunnel freight traffic: Forecast vs. records

Eurotunnel projections for unitised freight proved close to the actual volumes. Nevertheless, through-rail volume projections have been too optimistic by a factor 3 to 5 (Fig. 8).



Source:Anguera, 2006

Fig 8. Eurotunnel freight traffic volume –Shuttle service and through-rail freight: Forecast vs. records

3.5 Potential Causes for the Difference between Forecast and Recorded Demand

Between 1976-1988, cross channel traffic grew at a fast pace: 6.2% for passengers and 5% for freight. 1987 SETECE-WSA forecast for 1993 predicted 67 millions passengers and 84 millions tons freight and a decrease of growth rates. However, growth proved more positive than most optimistic expectations, with passengers reaching 1993 forecast as early as in 1989. As a consequence, Stakeholders assumed that Eurotunnel would open in an expanding market context. Setting Eurotunnel's fast rail transit advantage in such a positive context, SETEC-WSA estimated that Eurotunnel should be able to attract nearly one third of the passengers market and nearly one fifth of the freight market, even *without* aligning its tariffs with those of the ferries and airlines. In addition to the diverting traffic from the other modes, Eurotunnel was also supposed to induce new traffic because it had the potential to reduce the "frontier effect", increase transport frequency and reliability, and reduce travel time as well as tariffs. Such competitive advantages would also further increase total cross-channel market size (C.R.S. Buchanan, 1988). Amongst the problems, a few are specific to Eurotunnel, but not general. For instance the impact of service Delay: Eurotunnel had planned to start operations in July 1994, but could only do so 5 months later, which not only did cost a lot in interest payment without revenues, but made the operator miss traffic of the summer peak. The issues that need to be addressed in large infrastructure projects in general are gathered in the next chapter.

3.6 Conclusions

[1] Data relevance is not clear: the final decisions to build the tunnel have been taken on the basis of a former Channel link project, dated 1975, which had been cancelled. Even though 1970's data had been updated according to recent traffic figures and evolution scenarios, the results have been far too optimistic in some domains. Full-load freight has never been a success: 10 million tons a year were expected, but only 2 million tons have been carried the most successful years. Passenger forecast was also below records..

[2] Eurotunnel passenger market share, i.e. the share of overall cross-Channel passengers to which Eurotunnel could provide services, in competition with ferries and air transport, was correctly estimated at about 40% (Anguerra, 2006). Nevertheless, the market *size* had been overestimated by a factor 1,5 to 2. This was another reason why income from passenger transport never met expectations.

[3] Eurotunnel freight volume has been overestimated as well. Gap between estimation and historical records shows a pattern similar to passengers : the market share estimation proved to be close to reality (it slightly outpaced predictions, with 35% estimated vs. 45% experienced), while estimations of cross-channel market size had been too optimistic. The case of freight is even more contrasted than that of passengers, with through rail services stagnating far below the most pessimistic expectations, whereas shuttle freight proved slightly more important than after-1999 forecast.

[4] Overconfident in the outcomes of optimistic studies, Eurotunnel did not correctly evaluate the impact of ferries investments (between 1990 and 1992 ferries invested as much as half of Eurotunnel budget): ferries had reached a position where they could cut fares, remain profitable and carry the bulk of passengers and freight on the Dover straight. As a consequence, for both freight and passenger services, competition of the ferries obliged Eurotunnel to set tariffs at a level much lower than expected, which reduced its income. Impact on tariff overestimated: Eurotunnel originally planned to rapidly capture 2/3 of Dover strait market and, therefore, set tariffs over the Dover strait. However, poor service quality made it fail to do so. Examples of not meet competitive advantages are: Eurotunnel intended to enable faster crossing (1 hours versus 2 and ½ by ferry), but crossing duration was actually of 1 ½ hours, which was slightly faster than ferry, but not as fast as Hoverspeed. Eurotunnel planned to introduce high frequency services –every 20 minutes- but it only did so with 6 months delay.

[5] In terms of operation, Eurotunnel had been unable to manage transport demand and to match fares with consumers' willingness to pay: the operating "TUGO" concept (turn-up-and-go) ignored booking and relied fixed standard fees only. This led to peak hours overload as well as to suboptimal transport revenues. In addition to that, Eurotunnel fully underestimated that ferries had reached a position where they could cut fares, remain profitable and carry the bulk of passengers and freight on the Dover straight. In short, "*Eurotunnel did not understand its market, that is did not understand its customers and its competitors*" (Castels, 2003).

[6] Eurotunnel had relied on unproven technology: The conjunction of the tough tunnel environment (dust, water leakage, salinity, humidity) with a rolling-stock "*which had been purpose-built, largely untested and stuffed with unique features*" (Castels, 2003) caused problems to signaling technique and electrical supplies. These problems made service unreliable for a long period.

Proposed solutions: 1) critically assess the assumptions behind passenger and freight forecast: have they been established on the basis of historical origin-destination data that include recent surveys, or are they merely updates of former *results,* without consideration of premises? 2) full-load freight on rails not only represents a relatively small share of total freight, but –contrarily to containers- its market share is decreasing since the 1970's; therefore optimistic expectations for full-load rail freight may only make sense if they are based on very special conditions. 3) Take an "outside view" on by comparing forecast with projects that are similar in some respect. See for instance the reference class forecasting method (Flyvbjerg). 4-5) Evaluate the effect of flexible pricing schemes on customers and on competitors; design flexible operating systems and estimate whether they suit revenue expectations (derived from flexible pricing and operating costs); seriously assess the potential of competitors to retaliate in a tariff war, in the short and long term. 6) use proved technology and do the most with standard components.

4. OPTIONS ANALYSIS

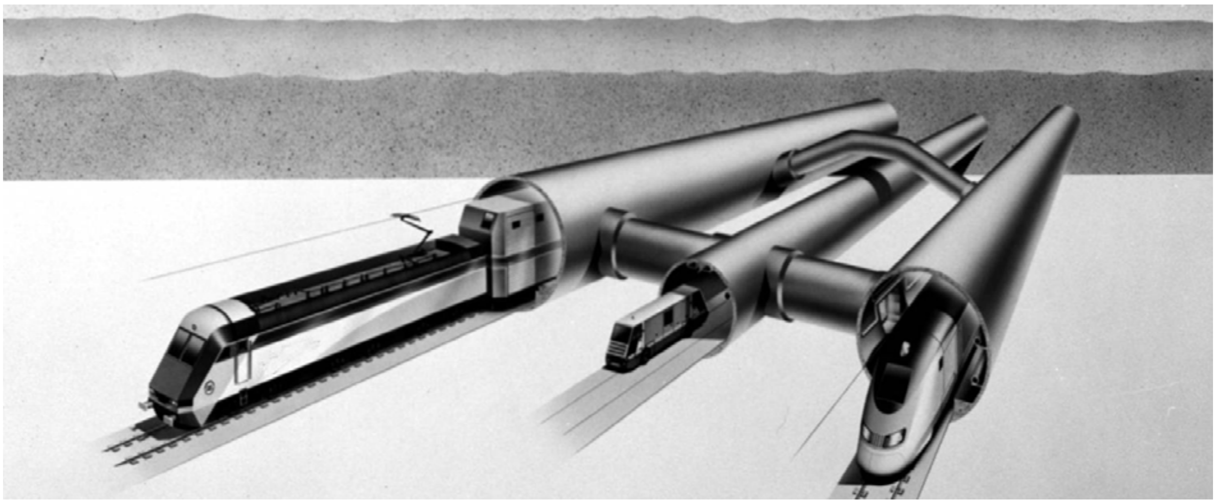
Even though railway tunnels have been projected for nearly two centuries, they are not the only technical option. In 1984, there were four alternatives amongst which Eurotunnel has been selected as the best means for creating a transport link between the UK and the Continent.

4.1 Alternatives Considered in the Option Analysis

The "Braibant-Lyall Working Group"(BLWG, 1981-1982) examined the different alternatives for fixed links, and assessed the impact of each solution on the economies of the two countries. This working group was appointed by the UK Prime Minister Margaret Thatcher and the President of The French Republic, François Mitterrand. BLWG examined a set of alternative fixed links: a couple of **bored tunnels** with one or more tracks, a set of **submerged tunnels** made up by pre-fabricated components, a **combined bridge-tunnel structure**, and a project with **variable span** and **multi-span suspension bridges**. BLWG concluded that all the proposals were cost-effective but the twin bored tunnel would be the best option. French consultants firm SETEC –which worked on the 1959 study-produced several updates between 1966 and 1969. SETEC studies also showed that the tunnel alternative would be more viable than a bridge. They even said the tunnel would provide a very high rate of return.

Finally, on October 31 1985, an official "**Invitation to Promoters**" stand out the final step of the option analysis. "*Ten entries were received by the deadline of 31 October 1985. Four contenders were thought to be serious; though even among this group adherence to the competition rules was variable. (Holliday, Marcou et al 1991*). These contenders were:

1. Channel Tunnel Group (later to become Eurotunnel): twin bored large, 7.3 metre (later 7.6) diameter, tunnel carrying shuttle and through trains. The consortium was composed of 10 contractors (5 French, 5 British) , named Trans-Manche Link (TML) and five banks (2 British and 3 French). ;



Source : Eurotunnel

Fig 9. Eurotunnel proposal

2. Euroroute: a bridge/tunnel scheme comprising bridges from each coast linked by a submerged tube tunnel 21 km long carrying a motorway, plus a bored small-diameter tunnel system for through trains, which would be built in stages;

Source : http://www.cbrd.co.uk/histories/euroroute/

Fig 10. Euroroute proposal

3. Eurobrige: a bridge scheme comprising a motorway in an enclosed tube suspended from piers in spans 4.5 km in length, using advanced plastics technology; a rail link could be provided either on the bridge, or in a small diameter tunnel;

Source : Eurotunnel

Fig 11. Eurobridge proposal

4. Channel Expressway: twin very large bored tunnels, 11.3 metres in diameter, carrying both motorway and rail traffic (later modified to comprise separate rail tunnels), using advanced ionization techniques to remove noxious gas from road vehicles.

Source : Eurotunnel

Fig 12. Channel Expressway proposal

4.2 Critique of the Option Analysis

Assessors evaluated the four serious candidates in terms of technical viability, financial robustness and environmental impact. BLWG state they have used the following methods:

- A retrospective comparison of the ex-ante and forecast data from 1971-1975 studies with the data observed in 1980

- Scenarios method to do an ex ante economic and social assessment of different alternatives

- Energy and environmental assessment of the different alternatives on both sides of the Channel

The retrospective comparison provided figures for estimated demand (CF Demand Analysis), which was to be best fulfilled, according to BLWG, by *"the construction of a twin bored rail tunnel, with a shuttle service for motor traffic if need to be... This solution offers a certain economic advantage for the two countries; security would be increased and the energy balance improved*" (Braibant & Lyall, 1982).

Many sources stress the importance of political considerations on the option choice. For instance Noulton (1999) writes "*My own analysis is that the selection of developers, through a process of **intense competition**, forced the contenders to make **unrealistic forecasts** of both costs and revenues which, in the end, could not be realized. I feel quite strongly that the selection of infrastructure concessionaires should not be based wholly on the level of subsidy required by each competitor";* Holliday, Marcou et al (1991) state that "*The process by which the CTG-FM (Eurotunnel) scheme was selected was **mysterious** even to those closely involved in it. The British government in particular was concerned not to publish assessments of financial viability*", while Gibb (1986) relates that *"The British and French Governments* […] *decided on whether a fixed link should be built, and the form such a link should take, in 81 days. The joint assessment reports, upon which the government's conclusions rest, are **not being published**"*. In addition to that, Eurotunnel clearly appears as a solution that on the one hand fulfils French traditional preferences for a rail-only project while on the other hand it enables to carry vehicles, which would –to some extent- respect UK Prime Minister's antagonism towards railways and rail unions.

A key player in option choice was the Franco-British Channel Link Financing Group (the "Banking Group"), that had been set up by UK and French governments in 1982. The Banking group[1] (1984.) based its choice on the capacity of the project to generate sufficient revenue over a predictable period of economic life (taken to e 25 years of operation) to repay all financing requirements [22]. On the basis of its analyses, the Banking Group came to the conclusion that the Channel link scheme with the highest financial viability and robustness to sensitivity tests coupled with minimum technical and operational risk is the concurrent building of dual bored tunnels [23].

[1] Note: in [brackets]: original paragraph numbering in: the Banking Group (1984). Confidential Document.

Drive-through schemes were considered attractive for users but too expensive to build and technical issues during construction and as well as potential major failures during operations made the Banking Group consider that the financial market would not assume the construction risk [24].

Phased construction (one tunnel, then the other) was considered unacceptable as it would have increased the ultimate cost and because it would not generate sufficient revenues to be viable [25].

4.3 Conclusion

Whatever the weight of political factors, technical and financial issues played a key role: EuroRoute was not only questioned about on technical and financial viability but it did never provide a sound ventilation solution to remove the exhaust from cars, coaches and lorries. Eurobridge raised doubts concerning the reaction of the bridge tube to strong Channel winds and it was too open-ended, in the sense that it postponed the decision on whether to include railways or not. Channel Expressway raised even more severe exhaust issues than Euroroute, and it was twice as expensive as Eurotunnel.

In the end, the selection of Eurotunnel was a relatively safe compromise solution, which had already gained high-level institutional support in the 1960s an 1970s, looked financially viable while relying on proven technology for tunnelling.

[1] Decision to build Eurotunnel has been taken after consideration of four options. However, the rail link had been studied for more than ten years at the time of the bid, while other proposals had been prepared in a rush. Available document provide no evidence that proper analysis of the options has been undertaken and no detailed figures of the proposals are available to the public, which suggests that political stakes outweighed other decision criteria.

[2] Eurotunnel proposal had been established on the basis of unrealistic forecast, with too low costs and too high revenues.

Proposed solution: Perform an independent assessment of the winning bid before proceeding to realization and check public acceptability, especially in the case citizen belong to targeted share buyers.

5. FINANCIAL ANALYSIS

From the start, Eurotunnel had to be built and operated without public subsidies. Such a decision implies that the project was to be designed with no financial gap between total costs and expected revenues over the operation period. Nevertheless, a decade after the tunnel has been open to traffic, service of the debt appears as Eurotunnel's most fundamental flaw. The 2007 restructuring allowed the banks to swap a part of the unpaid debt against full control of Eurotunnel.

Even though governments did not commit public money on Eurotunnel, they used their power to convince the private sector, especially banks, and the public in general to invest into the project. Unfortunately, financial aspects have been kept confidential, and those that are available to the European Commission are unclear (Franco-British Channel Link Financing Group, 1983 and 1984). This is a problem in terms of responsibility.

Li and Wearing (2000) summarise the financial issues *"it is clear that mistakes were made. For instance, by 1994 it was evident that the eventual construction cost would be almost double that predicted in 1987. Many of the original traffic and revenue projections proved over optimistic. And by the end of 1999 the share price1 stood at 71p compared with the Offer for Sale price 12 years earlier of £3.50. In addition, no dividends had been declared or paid over the 12 year period"*.

5.1 Ex-ante Financial Analysis

Introduction

UK and French governments set up the Franco-British Channel Link Financing Group in 1982, (the Banking Group, 1984[2]) "*with the task to advise the extent to which the construction of a fixed link between the two countries could be financed from market sources, avoiding as far as possible recourse to Government guarantees*" [2]. The basis for the Banking Group's discussions was the AFSG report published in June 1982. [3].

Eurotunnel's finance model from the oil industry did not match spending and revenue calendar. The model had been adapted to the new scheme with higher initial investments for tunnel building, equipment and provision of rolling stock, and revenue delayed after service provision. Nevertheless, it was the "first of a kind" and highly sensitive to the impact of unexpected costs or postponed service. Eurotunnel was a new company while the managers who had experience in large-scale investment for rail infrastructure were working for companies such as British Rail, SNCF, SNCB, CFF, DB,.. But UK government was highly reluctant to involve such companies into exchanging information on the main financial risks related to Eurotunnel.

[2] Note: in [brackets]: original paragraph numbering in: the Banking Group (1984). Confidential Document.

Market

The justification for the construction of the fixed link is based on the prediction of a steady growth of Cross-Channel traffic [13]. Apart from unquestioned AFSG data, the Financing Group made conservative hypotheses: they regarded traffic and tariffs as the only components of the revenue stream. The Group made no allowance for possible profits from duty free sales [14], whereas induced traffic had been disregarded [15]. For **passenger** traffic, the Banking Group used an overall **growth rate of 4.4% p.a**., which is half the average historic rate between 1971 and 1982. Beyond 2000, the growth rate has been halved. [16] Reasonably optimistic and reasonably pessimistic forecasts have been formulated for high and low traffic sensitivity analysis, instead of the extremely wide variations for high and low traffic in the AFSG report. The base for tariff calculations which were not made by the AFSG report is a 25% reduction in the short sea route 1979/80 fare levels as estimated by the Banking Group. [17].

Initial Financial Appraisal

The economic analysis of each fixed link option presented in the AFSG report was completed using a theoretical 100% financing case with **9% inflation** and **13% interest rate** throughout [19]. The Banking group established a viability criterion which required to demonstrate that the project is capable of generating sufficient revenue over a predictable period of economic life (taken to be 25 years of operation[3]) to repay all financing requirements [22].

Financial Market and Financing Instruments

Eurotunnel has been financed in several steps. Experts (Li and Wearing, 2000) consider the financial structure as "*extremely complex*", and that structure evolved towards increased complexity each time it had been re-engineered. At the beginning, the Banking Group had established three main funding categories: investment capital, bond issues and loan facilities [26]. The Group had made the hypothesis that reliance on a single funding source was not possible. Monies needed to be raised from the widest possible range of markets [27]. A minimum level of equity participation - £450 million in inflated money terms was necessary to finance early expenditure [28], which was to be issued during the first two years of construction. Bond finance plays a major role because of the long term financing needs. The Banking Group's report suggests two particular types of bond, Indexed Bonds (geared to inflation) and Revenue Bonds as refinancing instrument supported by operations revenue [29]. They conceived a maximum amount of Indexed bonds in the order of £325 millions and a maximum Revenue Bonds in the order of £250 millions per annum (1983 level) [30] and they expected banking loans are likely to provide the major portion for the finance required [31]. More important than financing details, the Banking Group was originally expecting some form of governmental support, as they wrote it [33] "*It must be noted that whatever financing procedure is adopted there will need to be some involvement of Governments […] in various levels and degrees of financial support*".

An important thing is that the banks refused to lend directly to the contractor (TML) and to give him financial power. Therefore, a new body, Eurotunnel, has been created to manage the construction contract and to operate the railway after tunnel completion. As a result, TML had to obey Eurotunnel

[3] This period has been extended later.

on plans TML had drawn itself! As Eurotunnel had no experience in that field, they adapted a finance model from the North Sea oil pipelines industry. (Dickinson, 1998). Nevertheless, there is a significant difference between oil industry projects and Eurotunnel: oil companies have constant revenues from sales, whereas had no former income from which they could take money for investment. Therefore, Eurotunnel had to borrow any money they needed before operations had started. Debt management appears now as the most notorious flaw of Eurotunnel history.

	Procedural Structure I	**Procedural Structure II**
Internal Rate of Return (IRR) of the Project	17.6%	17.6%
Capital		
Total Capital	£540	£540
Above in 1983 terms	£393	£393
Return to investors	20.4%	21.6%
Non-Recourse Loan (NRL)		
Maximum NRL	£5'398	£3'494
Above in 1983 terms	£1'920	£1'242
Year of Final Repayment	2000	2002
Constructors Loan Stock (CLS)		
Maximum CLS Value	0	NA
Above in 1983 terms	0	NA
Year of Final Repayment	-	NA
Recourse Loan (RL)		
Maximum RL Value	0	£868
Above in 1983 terms	0	£336
Year of Final Repayment	-	1995
Revenue Bonds (RB)		
Maximum RB Value	£5'290	NA
Above in 1983 terms	£1'222	NA
Year of Final Repayment	2007	NA
Indexed Bonds (IB)		
Maximum IB Value	NA	£3'208
Above in 1983 terms	NA	£572
Year of Final Repayment	NA	2005

Source: the Banking Group, 1984, pp. 23-24

Financial Engineering

In practice, (Stannard, 1990) the Banks had classified spendings in three categories ; Lump Sum Works, Target Works and Procurement Items. The terms are important because they imply different levels of responsibility in case of overcosts as well as different levels of incentive for saving money.

1. The Lump Sum was the banks' method of fixing part of the construction cost. This covers the Terminals and surface works plus fixed equipment, all items that could be pre-priced by the contractors. Unfortunately, many of these works had been priced at conceptual design stage and they had been subject to change by variation orders during the parliamentary and planning permission processes. Their design had also been modified according to changes in Eurotunnel commercial, marketing and operational objectives.

2. The Target Works covers all tunneling and related equipment including the tunnel boring machines. At the bid stage the line of the tunnels was not final and much detailed design work for optimum operation had still to be started. The arrangement is that if the actual cost is less than target cost at completion, the contractor will receive 50 per cent of the saving ; if the actual cost is more than the target cost, the contractor will have to meet 30 per cent of the excess, up to a maximum of 6 per cent of the target cost.

3. The procurement items are the rolling stock. Standard locomotives were to be used but the shuttles had to be designed. Eurotunnel believed that TML could take the responsibility of choosing the best deal for the rolling stock, even though TML would have no particular reward if they managed to save money. Eurotunnel's principle was to provide a provisional figure and to expect that manufacturers would provide TML with best value for money from. The requirement that the contractors procure the rolling stock would ensure TML responsibility for the full operational capability of the entire system: design and traction.

5.2 Recorded Financial Values of the Project

Shares and Project Direction

Under the agreement with the banks, Eurotunnel had to raise £1bn of equity before the banks began to disburse their loans. The construction companies had put £50m into the "Equity one" round. The next tranche of £200m "Equity two", encountered no difficulty in France with Indo Suez leading the operation, whereas the British side was ultimately saved by the Bank of England in 1986, which then put Sir Alastair Morton as a new manager at the head of Eurotunnel (Dickinson, 1998). Equity three was finalised in autumn 1987, as a huge international syndicated bank loan, with 200 banks from around the world. This allowed to meet the £1bn equity pre-condition of the French and British banks. Then the banks provided the £5 billion loan.

Source: Li and Wearing, 2000

Fig 13. Evolution of Eurotunnel share price (1998-2000)

Source: Li and Wearing, 2000

Fig 14. Share prices (£) from Eurotunnel trade suspension (May 2006) to new GET shares (- summer 2007)

Eurotunnel shares fell below £1 in 1995 and they remained low since then. Trading was suspended in London and Paris in May 2006 after Eurotunnel failed to publish annual results for 2005. At the beginning of 2006, Eurotunnel and the lending banks had designed plan that would reduce the £6.18bn debt to £2.84bn. The plan included that existing shareholders would swap their Eurotunnel shares against new Groupe EuroTunnel (GET), thereby losing any sort of control of GET (with only 13% against the creditors with 87%). As the only alternative would have been liquidation of the company, shareholders were given no opportunity to negotiate the deal. "*If there is no exchange offer, then the only prospect for Eurotunnel will be bankruptcy*" (Financial Times, 2007). Before that operation Eurotunnel's trading profits rose 42% to £220m, before interest costs, and revenues to £568m (up 5%).

Still more than 13 years after the infrastructure project had been completed, experts blame Eurotunnel's crisis at the nearly €14bn (£9.8bn) construction cost (2007 prices), while the operator has always suffered excessive debt levels.

Governments provide some form of support: just before 2007 restructuring, the French government said it would allow Eurotunnel to carry forward some €890m (£600m) of tax losses incurred during the years 2000-2002. Assuming a 30% tax rate, using such losses could generate £200m extra value for Groupe EuroTunnel.

5.3 Comparison: Ex-ante Analysis vs. Ex-post Records

Outturn cost (1994) has been significantly higher that 1986 budget: with 553 million pounds instead of 448, terminals were 23% higher; with 1200 million pounds instead of 688, fixed equipment were 43 % higher, with 2110 million pounds instead of 1329, tunnels were 59% higher and, with 705 million pounds instead of 245, rolling stock ended up 188% higher. In the end, with 4568 million pounds in 1994, the overall figure was 69% over 1986 budget.

Investments (in million pounds at 1980 prices)	**1986 Budget**	**1990 Forecast**	**1994 Outturn**	**Increase** (%) re. **1986**	**Increase** (%) re. **1990**
Tunnels	1329	2009	2110	59%	5%
Terminals	448	491	553	23%	13%
Fixed Equipment	668	814	1200	80%	47%
Rolling Stock	245	583	705	188%	21%
Total	2690	3897	4568	70%	17%

Source: Eurotunnel Rights Issue Documentation 1990 and 1994, adapted from: Winch, 1998

Table 12. Eurotunnel 1986 budget, 1990 forecast and effective cost in 1994

Loss of control over costs was most striking in the case of rolling stock. TML was given the duty of finding the best rolling stock. At that time, no technical solution was available on the market the rolling stock. Not only the rolling stock had to be developed especially for Eurotunnel, with no cost competition, but also there were no safety standards on which both sides agreed upon. This encouraged TML chose over-sophisticated material. .

Tunnels ended up more than 50% more expensive than expected, this was mainly due to more staff being hired in order to fight delays due to technical problems. Good ground (blue chalk) led to underestimation of geological problems. More pessimistic estimation of technical difficulties or provision of a reserve for unexpected events, such as water surge, could have avoided overcost, but they would have made the budget less attractive for the banks. This problem of budget purpose (win a bid vs. realize a project) is recurrent in Eurotunnel case: The basis for official financial decisions was AFSG report (1982), which is the document produced for Eurotunnel bid. Bankers underestimated the fact that tenders use to provide optimistic figures to win bids.

Fixed equipment was £520 million above budget. This has been attributed mainly to changes in safety requirements, which entailed engineering changes. Even though a large part of those requirements were –a posteriori- considered valuable, they entailed high costs slowed operations at tunnel completion (for example, the centralized safety system did not allow to provide single-tunnel service while workers would complete the second tunnel).

Finance during the first phases of operation

In 1995, Eurotunnel's revenues were clearly below target. Event though service progressively generated revenues, the debt will remain a burden for long (still a crucial problem at the time of writing).

Revenue	November 1987	November 1990	May 1994	May 1997	Actual
1993	488	393	-	-	-
1994	762	764	137	-	82
1995	835	833	525	-	304
1996	908	904	737	-	483
1997	986	980	829	567	531
1998	1,072	1,070	901	649	666
1999	1,158	1,165	993	654	654

Source: Li and Wearing, 2000

Table 13. Evolution of Eurotunnel revenue: forecast and results, in £m (brackets=loss)

	November 1987	November 1990	May 1994	May 1997	Actual
1993	170	(114)	-	-	-
1994	259	(31)	(851)	-	(990)
1995	347	29	(295)	-	(556)
1996	422	91	(108)	-	80
1997	502	177	(70)	10	66
1998	577	255	(28)	111	146
1999	670	332	24	44	63

Source: Li and Wearing, 2000

Table 14. Evolution of Eurotunnel operating cash-flow after interest: forecast and results, in £m (brackets=loss)

On 14 September 1995 the management of Eurotunnel suspended interest payments on the bulk of its total debt (junior debt). This avoided legal problems and did last two years (until 14 December 1997). During this period, Eurotunnel's main preoccupation was the significance of the debt and the cost of debt service. In 1996, The Chairmen's letter to shareholders cited three difficulties: 1. Fierce competition of ferry operators hence reduced fares for all operators on cross-Channel transport; 2. Inability of the railway companies to develop traffic according to their intentions (passengers and freight carried in 1995 were only about one third of predicted levels; 3. The increase in operating costs resulting from escalating rolling stock specifications and more complex operation due to requirements of the governments and of the Intergovernmental Commission (IGC). On top of these problems, on 18

November 1996 a serious fire occurred on a freight shuttle, which affected freight shuttle service for about seven months.

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Turnover												
Turnover and other income	1	6	5	11	8	3	31	299	448	456	618	627
Own work capitalised	54	220	506	547	781	846	716					
Deferred expenses and recharges (note 1)					11	46	51	5	35	75	48	27
	55	226	511	558	800	895	798	304	483	531	666	654
Operating costs (excl. depn.)	(82)	(106)	(246)	(169)	(177)	(251)	(402)	(374)	(379)	(341)	(345)	(321)
Depreciation	(14)	(54)	(94)	(92)	(50)	(47)	(146)	(130)	(147)	(126)	(137)	(123)
Operating costs (incl. depn.)	(96)	(160)	(340)	(261)	(227)	(298)	(548)	(504)	(526)	(467)	(482)	(444)
Operating profit/(loss)	(41)	66	171	297	573	597	250	(200)	(43)	64	184	210
Interest (note 2)	41	(65)	(171)	(297)	(575)	(599)	(637)	(724)	(642)	(675)	(399)	(304)
Exceptional item (note 3)											279	296
Net profit/(loss)	0	1	0	0	(2)	(2)	(387)	(924)	(685)	(611)	64	202

Source: Eurotunnel financial statements, 1988-1999, from Li and Wearing, 2000

Table 15. Evolution of Eurotunnel balance sheets, in £m (brackets=loss)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	199…
Fixed assets (note 1)	995	1,953	3,399	4,878	6,757	8,453	9,461	9,400	9,284	9,191	9,108	9,04…
Net current assets (note 2)	180	130	584	237	(4)	(14)	301	(35)	9	29	84	5…
	1,175	2,083	3,983	5,115	6,753	8,439	9,762	9,365	9,293	9,220	9,192	9,10…
Issued share capital	467	467	752	753	755	761	1,318	1,371	1,371	469	195	23…
Share premium	556	556	844	846	849	852	1,204	1,207	1,207	1,207	1,401	1,77…
Reserves (note 3)	(25)	(26)	(9)	(43)	(363)	(246)	(782)	(2,112)	(2,084)	(1,340)	(534)	12…
Shareholders' funds	998	997	1,587	1,556	1,241	1,367	1,740	466	494	336	1,062	2,13…
Loans and overdrafts	177	1,086	2,396	3,559	5,512	7,072	8,022	8,899	8,799	8,884	8,130	6,96…
	1,175	2,083	3,983	5,115	6,753	8,439	9,762	9,365	9,293	9,220	9,192	9,10…

Source: Eurotunnel financial statements, 1988-1999, from Li and Wearing, 2000

Table 16. Evolution of Eurotunnel profit and loss accounts, in £m (brackets=loss[4])

[4] 1. Includes tangible fixed assets and financial fixed assets.

2. Current assets less current liabilities; also includes exchange suspense account, deferred income, deferred expenses, prepaid expenses provisions.

3. Profit and loss account, and exchange adjustment reserve.

Three Financial Flaws: Omission of Capital Costs – Counter-Intuitive Financial Structure – Opacity to Shareholders

Firstly, projected capital costs (on an annual basis) over the construction period 1988 to 1993 were omitted from the original November 1987 Offer for Sale document. Including more detailed estimates of the phasing of capital expenditure at the outset might have given shareholders an opportunity to monitor more closely the actual expenditures compared to predicted expenditures.

Secondly, Eurotunnel is evolving from a high risk to a low risk project. Paradoxically, its financing structure (about 80% geared) at the outset was more appropriate for a low risk project. Equity (given that dividends can be withheld when necessary) is arguably more appropriate when there is considerable uncertainty attached to a project. However, if a larger proportion of equity had been sought at the outset then perhaps the project would never have started.

Thirdly, the financial statements appear to provide little new information to users. There are some interesting anomalies in the published accounts. For instance in the first few years of construction the bottom line of the profit and loss account appears contrived to show almost zero profit or loss. The low interest outflows during 1996 and 1997 were due to the fact that Eurotunnel simply withheld payments of interest to most of its creditors while it was in the process of renegotiating its debt with the banks.

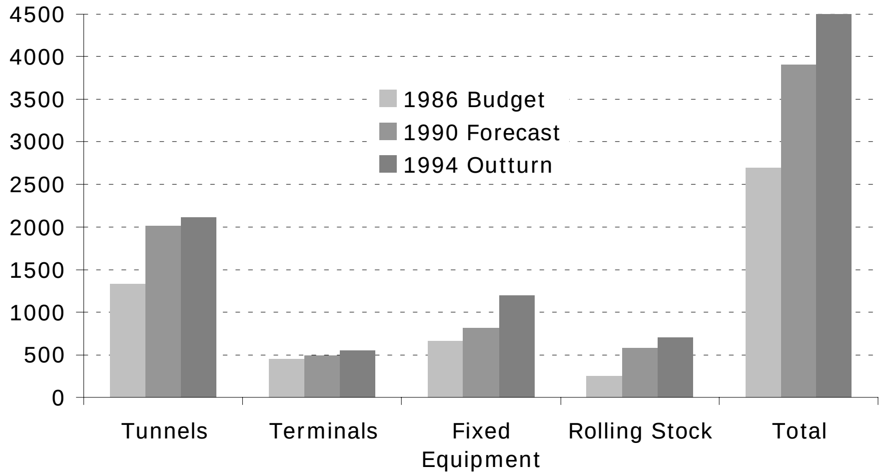
Impact of Competition on Debt

Since the decision had been taken to build a tunnel, the ferry companies had also invested in the cross-channel link: they had reduced workforces, ordered bigger and more efficient ships. When Eurotunnel started services, there were even more ferries than ever. As a consequence, the prices for the Dover-Calais crossing fell dramatically as the new tunnel and all the extra ships competed for business, which made Eurotunnel’s revenues drop to half their expected level. Eurotunnel did not produce enough income to service the debt to the banks. So, in the autumn of 1998, Eurotunnel announced a standstill on its debt repayment. It was virtually bankrupt: in its first full year operation Eurotunnel had lost more than £900m (Dickinson, 1998).

5.4 Conclusions

“*The project price ...... was put together to convince the governments, it was a viable price, a promoter’s price. What it was not was a contract price. We should never have undertaken to do the work for anything like the sums that were in the submission to the governments*”. Taylor Woodrow executive, quoted in Winch, 1998.

[1] Outturn cost (1994) has been significantly higher that 1986 budget: with £553 million instead of 448, terminals were 23% higher; with £1200 million instead of 688, fixed equipment were 43 % higher, with £2110 million instead of 1329, tunnels were 59% higher and, with £705 million instead of 245, rolling stock ended up 188% higher. In the end, with £4568 million in 1994, the overall figure was 69% over 1986 budget.



Source: Eurotunnel Rights Issue Documentation 1990 and 1994, adapted from: Winch, 1998

Fig 15. Eurotunnel 1986 budget, 1990 forecast and effective cost in 1994

i. Loss of control over costs was most striking in the case of rolling stock. In the case of Eurotunnel, a consulting company had the duty of finding the best rolling stock. At that time, no technical solution was available on the market the rolling stock. Not only the rolling stock had to be developed especially for Eurotunnel, with no cost competition, but also there were no safety standards on which both sides agreed upon. This encouraged the intermediate company chose over-sophisticated material.

ii. Tunnels ended up more than 50% more expensive than expected; this was mainly due to more staff being hired in order to fight delays due to technical problems. Good ground (blue chalk) led to underestimation of tunneling problems.

iii. Fixed equipment was 520 million pounds above budget. This has been attributed mainly to changes in safety requirements, which entailed engineering changes. Many requirements were –a posteriori- considered valuable, but railway accidents (such as Charring Cross) created a climate prone to excessive caution. This not only entailed high costs, but also slowed operations at tunnel completion (for example, the centralized safety system did not allow to provide single-tunnel service while workers would complete the second tunnel).

Proposed solutions:

i. The rolling stock should be chosen, ordered and paid by the company that will operate services, not by an intermediate.

ii. Tunneling overcosts could have been avoided with more pessimistic estimation of technical difficulties or provision of a reserve for unexpected events (such as water surge). *Iii.* Overcosts due to fixed equipment uncertainties may have been lowered by means of risk analysis techniques, for instance similar to “Best available technique not entailing excessive cost” (BATNEEC) could help taking safe decisions at reasonable cost.

[2] The basis for financial decisions was AFSG report (1982), which is the document produced for Eurotunnel bid. Bankers underestimated the fact that tenders use to provide optimistic figures to win bids.

Proposed solution: this provides an argument in favor of second, independent, assessment of large-scale infrastructure project proposals.

[3] Revenue estimates were over-optimistic. There are five reasons for this *i.* operations have started with one year delay, which caused a similar delay in revenues; *ii.* Once service provision had started, it progressed slower than planned, which made revenues lower than planned during the first year of operation; *iii.* Tariff war with the ferries was tougher than expected, which made Eurostar tariffs stand below the planned level, which, in turn, reduced revenues; *iv.* Eurostar demand did not meet expectations; *v*. the service (interest) of the debt absorbed much of the revenue.

Proposed solution: the issue of revenues is closely linked with the entire financial project engineering and the management of its uncertainties, which is Eurotunnel's notorious flaw. Instead of high-geared financing structure (80% bank loans) at the outset, a higher rate of equities would have better suited Eurotunnel's uncertainties since the company could have withheld dividends during the period with insufficient revenues (Li & Wearing, 2000). Still, literature converges on the fact that banks and politicians were not in a position to convince significantly more shareholders than they already did. This limit to private involvement suggests that the collectivity, i.e. the institutions should financially support this kind of projects, up to a reasonable level. This support could either take the form of a pure subsidy and/ or a loan with very low or zero-interest, at a level justified by expected socio-economic returns.

[4] After more than 10 years operation, experts still question the finance system *"in all, the British government has spent £3 billion on the project prior to opening, and has spent or committed at least £4 billion since then. Whether the Tunnel should have been built, or whether the tunnel should have been built as a private sector venture, are legitimate questions to ask."* (Gourvish, 2006)

Proposed solutions (Corbett , quoted by Gourvish, ibidem) "*the need to keep credit arrangements flexible, including the introduction of public sector mezzanine finance at an early stage, the ability to protect against inflation and interest rate movements, and the use of a performance-related element in rewarding debt…"*

6. ECONOMIC ANALYSIS

This section analyses the results of the ex ante Economic and analysis of the project. Available documents provide no evidence that multicriteria analysis has influenced the decision-making process.

6.1 Many Studies with no Distinct Result

Between 1957-1959 the Channel Tunnel Study Group carried out an economic analysis on Tunnel viability. Similar studies were produced in 1963 by British and French government officials. In 1970, the French consultants firm SETEC –which had already worked on the 1959 study- produced several updates between 1966 and 1969. SETEC studies showed that the tunnel alternative would be more viable than a bridge. The study concluded that a tunnel would even provide a very high rate of return. According to Coopers & Lybrand (C&L, 1979) cost and benefit studies produced for the government between 1972 and 1972 (Phase I) were limited to transport costs and benefits, but they did *not* pay attention to potential costs and benefits that were, for instance, linked to environmental impact or to employment or to relative incomes. The work carried out in Phase I concluded that "*the transport costs and benefits of the Tunnel discounted at 10 per cent per annum to 1973 gave a net present value to the Tunnel of £292 million which was equivalent to an internal rate of return (IRR) of 17.6 per cent*". The corresponding figures based on the low forecasts were £148 million, with an IRR of 14.6 per cent (HMSO, 1973). "*Sensitivity tests reported that the rate of return was relatively robust to changes in the basic assumptions on which the forecast has been made*" (C&L, 1979). These two 1973 IRR figures are –presumably- important in Eurotunnel history because they are very close to IRR estimates (Base IRR: 17.6%, Cost overrun IRR: 15.6%) stated more than a decade later in the Finance document submitted to the Commission to the European Communities by the Banking Group (1984).

In January 1975, the Tunnel project has been shelved by the Governments and as a consequence studies were cancelled. According to the interim results gathered and published by the Channel Tunnel Advisory Group (CTAG) "*the Tunnel project would have a positive Net Present Value of £176 million at 10% discount rate. The NPV happen to be almost the same whether the low cost or the Intermediate cost Strategy was adopted to provide rail connections from the Tunnel to London*". (Quoted in C&L, 1979).

Still, economic studies did never convince the unanimity of experts. For instance, the government White Paper entitled The Channel Fixed Link (HMSO, 1986), meant to set out the consequences for the public, environment and employment of the link was criticized of biasing results: "*Instead of providing a factual basis for debate, the White Paper is biased in favor of the link [Eurotunnel]. The figures examined to assess the impact of the link are those provided by the Channel Tunnel – Groupe France-Manche consortium*". (Gibb 1986). In addition to that, other direct benefits were often mentioned (Button, 1990; Kay et al., 1988) and sometimes valued, but their values have not been taken in consideration during the decision-process. Two of such direct benefits are the advantage of lower fares resulting from competition across the Channel and the value of quicker travel between UK and France (or between the Continent and UK). After he has acknowledged the difficulty of producing meaningful figures Button (1994) proposes estimates for UK personal users of the new cross-Channel services in which lower fares would produce an aggregate benefit of about £5.6 billion per year (at 1994 prices) while reduced travel time would provide benefits worth nearly £12 million.

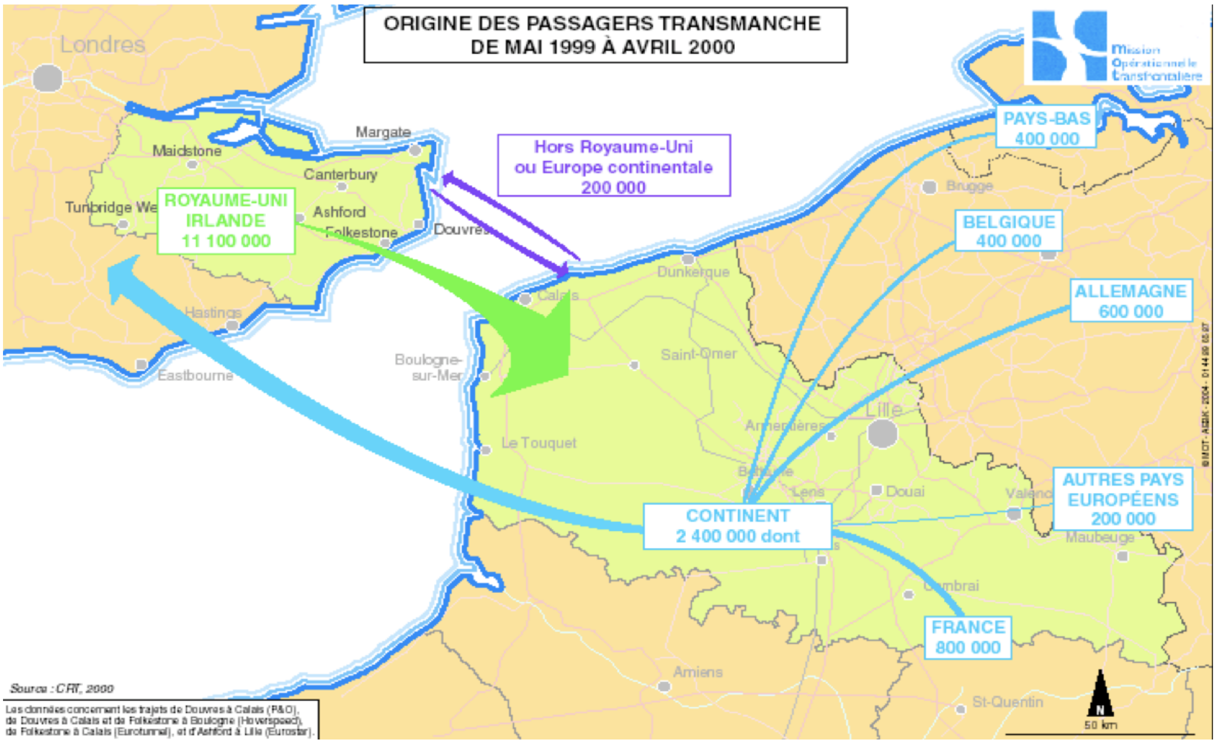
When Eurotunnel started operation, the regional effects to be expected of the new link were still unclear: according to Vickermann (1994) "*Only two serious attempts have been made to quantify the changes resulting from the present project, both using forms of land use transportation models*". The first study by ACT et al. (1992) investigates a selection of EC regions, whereas the second (Simmonds, 1992) concerns only UK regions. Vickermann highlights that both studies "*identify very clearly that transport improvements are concentrated into corridors where the associated infrastructure is improved*". However, he considers that the studies are problematic since they rely upon the estimation of "*long-run equiIibrium impacts, which tend to ignore some of the short-run adjustment problems*", such as the reduction in port and ferry employment and the disruptive effect of the construction period on labour markets near the tunnel.

6.2 Major Problem: Assessment of Overall Impact

Economic studies converged on one thing: there are major problems in assessing the overall impact of the Channel Tunnel. (Button, 1994, Hay et al., 2004, Vickerman 1987, Mc Laughlin, 1997). Firstly, Eurotunnel has such an extent that it is not possible to define a basis for comparison, i.e. what would have been the course of events without it (Botham, 1982), plus the fact that the regions would inevitably change, even without the tunnel (Button, 1994); Secondly, opening of Eurotunnel coincides with the creation of the Single European Market, which has direct implications in terms of transport, with the gradual drop of European restrictions (hence costs) on maritime operations, as well as air, rail and road services. The Single Market was also expected to create a global growth of about 4-5% of EU GDP, with a regional impact that was expected, in turn, to stimulate trade and, therefore, transport activities (Ceccini et al. 1988). Thirdly, the reaction of the ferry operators is highly uncertain: they are expected to retaliate to the new competitor, but how much can they drop fares, and for how long? Another issue is the support of governments: political interventions are difficult to predict, but they are not neutral. They affect the spatial and social distribution of the impacts of large scale infrastructure developments (Vickerman, 1987), whereas UK and French governments were taking deeply contrasted approaches: UK was expecting a strong (and problematic) concentration of rail traffic in London (Pieda, 1991), together with a nation-wide economic implication in the project, while France was above all supporting the North-Pas-de Calais region. Finally, the bicephal, very complex, structure brought up by the "moitié-moitié" principle affected forecast used for economic analyses.

Eurotunnel was meant to have a significant, wide and sustained impact on both South of UK and North-West of France. Records suggest that the new infrastructure had a stronger impact on UK than on the near regions of the Continent; the most likely reason being that the Continental Market is much more important than its UK counterpart. The case of passenger trips provides an interesting illustration of this dissimilarity.

Figures from the Mission Opérationnelle Transport (MOT, 2004) indicate that more than 80% passenger trips originate from UK. Out of 27.4 million trips, about 13.7 million were return journeys. 11.1 million originated from UK, 2.4 millions from the Continent, with more than 90% from the near areas: 34% France, 25% Germany, 17% Belgium, 16% Netherlands.



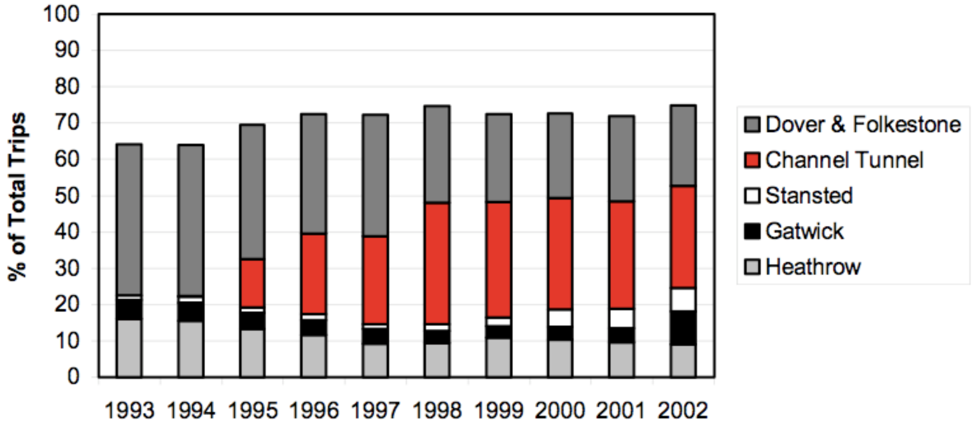
Source Mission Opérationnelle Transport, 2004

Fig 16. Origin of cross-Channel trips: 11.1 million from UK and 2.4 million from the Continent (2000).

6.3 Transport Market: Competition on Shares and Tariffs

The most obvious economic impact of the Channel tunnel is the change in transport supply, which is treated in detail in the Demand analysis section. Nevertheless, some aspects of transport have to be brought back in the economic analysis chapter because they explain further economic issues, such as employment.

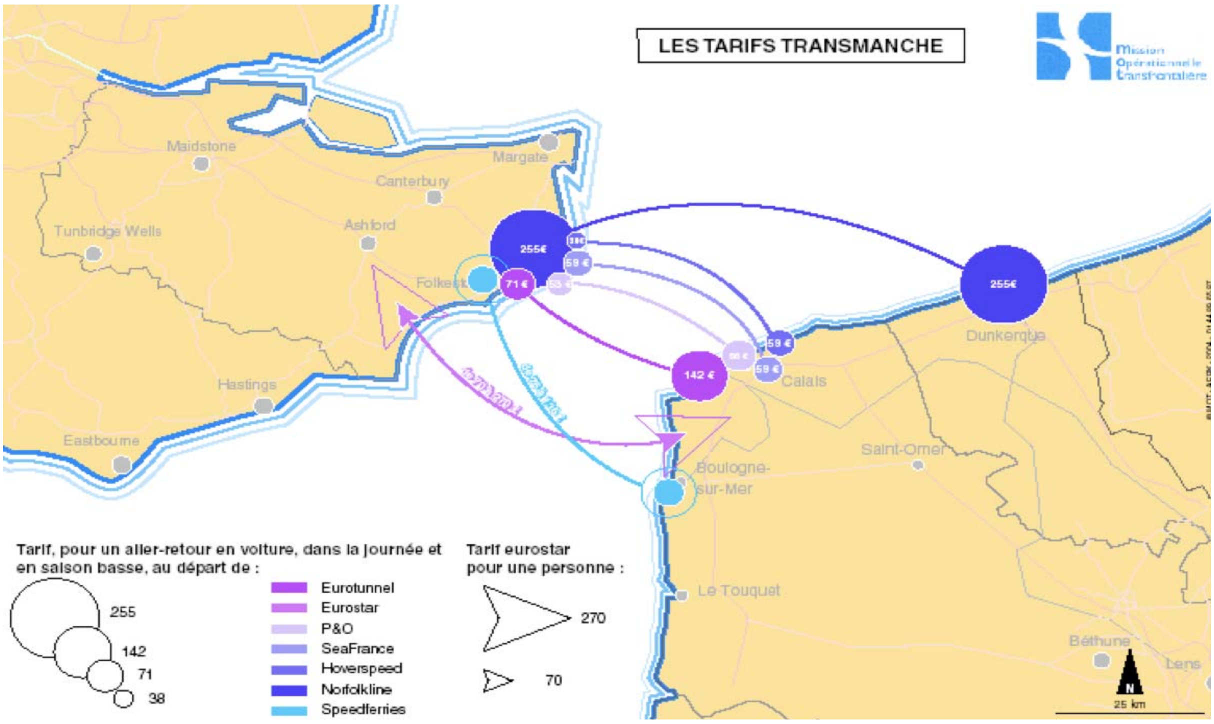
In terms of passenger trips from UK to Mainland Europe, the predicted market share of the tunnel was estimated to be 25%-35% of all Kent ports and airports, which account for 60% of all travels from UK to the Continent (MDS, 1994). Records show that even though Eurotunnel took an important part of passengers market, it never went over 18% (1998) (IPS, 1997-2002). Eurotunnel had the clearest impact on market of regions called “near Europe”, which represent more than 60% of total travel between South East of England and Europe: Eurotunnel market share reached 33% (1998), while the share of Dover and Folkerstone ports fell from 42% in 1994 to nearly 20% in 2002. The case of Stanstead and Gatwick airports is different, with a booming market for low cost airlines.



Source IPS, 2003 and Hay et al., 2004

Fig 17. Market share of the main ports of South-East of England for "Near EU" passenger travel.

Hay et al. (2004) highlight that cross-Channel ferry routes have adapted using a differentiated strategy: they have dropped passenger services from Folkerstone, Ramsgate and Sheerness, and they have left Dover port compete alone against Eurotunnel. Despite providing an important part of cross-Channel services, Eurotunnel has not been able to impose his own tariffs. Rail tariffs have rapidly decreased since the beginning of the 1995 price war with the ferries. Indeed, ferries could even keep tariffs that are higher than Eurotunnel on routes that are further than 50km away from the tunnel.

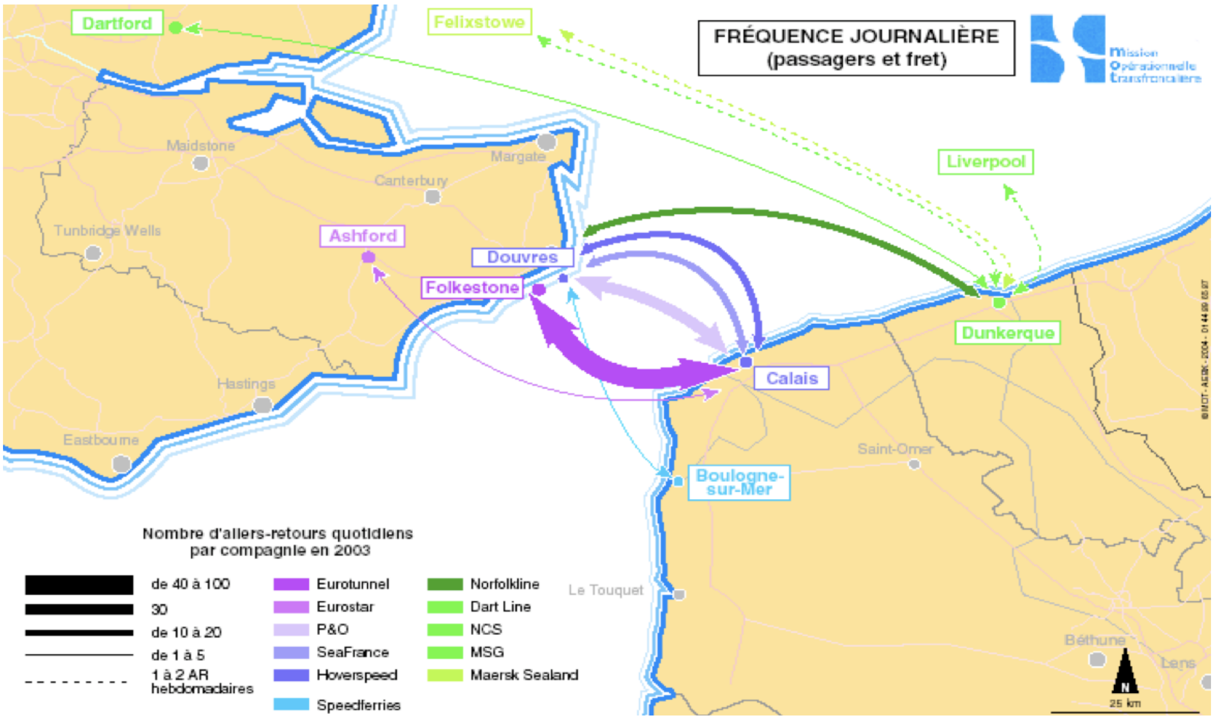


Source Mission Opérationnelle Transport, 2004

Fig 18. Tariffs for cross-Channel trips (in €, year 2004).

The picture in freight services is different: Eurotunnel operates 12 daily bulk freight trains -which did not harm sea transport very much- and on top of that, Eurotunnel provides more than 200 freight shuttles services a day, which has shifted about a quarter of Ro-Ro traffic from sea to rail. This caused service reduction from Dover (from about 70 to 50 in 2004), reduction from two to one operator in Ramsgate and cancellation of scheduled services from Folkerstone, Chaltam and Sherness.

Eurotunnel provides two different freight services that directly compete with the ferries: the roll on-roll off (Ro-Ro) and the bulk freight. Ro-Ro traffic amounts for about 12-15% of UK total port traffic, whereas Container traffic is 9-13%. Eurotunnel has taken about 25% of Ro-Ro traffic serving the English Channel route (1999). Containers are taken through the tunnel via the through rail services, which never matched Eurotunnel's expectations (see: Demand Analysis).



Source Mission Opérationnelle Transport, 2004

Fig 19. Daily cross-Channel transport frequencies, (day returns, 2003).

6.4 Employment

The tunnel was expected to generate local employment for operation and maintenance, as well as in administrative positions. It was nevertheless expected to stress port and ferry employers;

In 1987, the Channel Tunnel Joint Consultative Committee (1987) forecasted that the new link would directly create about 13000 new jobs in 1993, 3000 of them dedicated to tunnel operation only. The Committee estimated that the main detrimental impact would be a reduction of 4300-6600 jobs in ports and on ferries. These findings have then been scaled down by the Kent Impact Study Review (1991), which estimated that the new link would create less jobs, while entailing about 7,500 job losses in sea business in South-East of England. According to the Study Review, Eurotunnel was expected to draw changes *within* the employment market, but it was not expected to significantly modify the *number* of jobs.

Economic Sector	Impact of tunnel and associated infrastructures
Port and ferry business	-7440
Tunnel operations	2000
Tourism	500
Retailing	1100
Manufacturing	2750
Distribution and road freight	1000
Total	-90

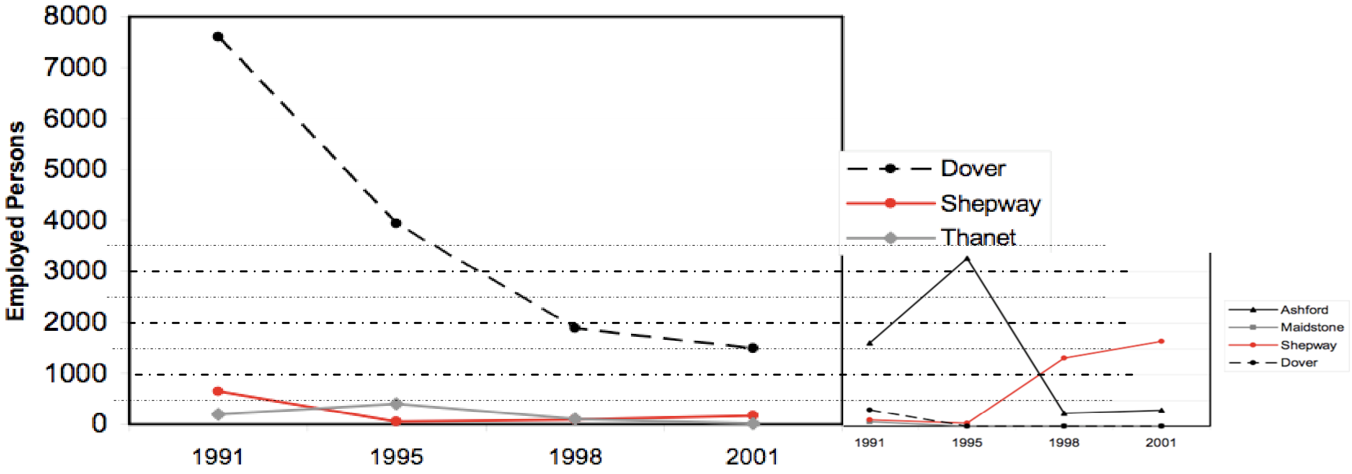
Source: Figures from Kent Impact Study review, 1991 quoted in: Hay et al., 2004.

Table 17. Eurotunnel expected impact on employment in South-East England (- = loss)

Employment records (Hay et al., p. 41-42) show patterns that are similar to ex-ante studies: since 1991, port and ferry employment considerably declines, while rail employment increases, but not as much.

Dover was the region with highest jobs losses in water transport: in 1991, about 7800 people were employed in sea transport in Dover while less than 1800 remained after 2001. Shepway saw a similar decrease, with some 800 sea transport employees in 1991 and only about 120 in 2001.

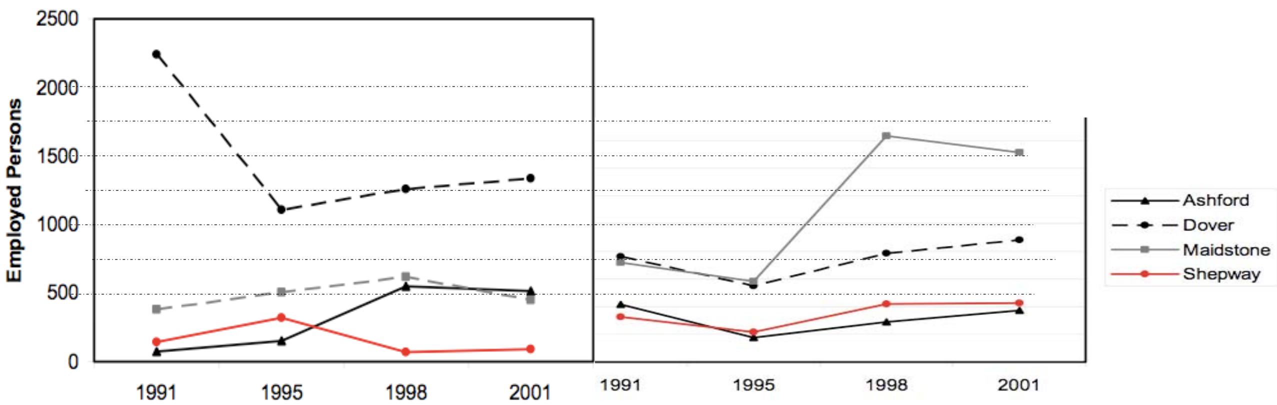
During this period, rail transport employed about 2000 people in the region, with a peak during the 1991-1995 period. Eurotunnel is the main employer in that sector in Kent, with between 1350 and 1500 people on UK side.



Source : adapted from NOMIS, (SIC 61 and SIC 601), UK

Fig 20. Evolution of employment in sea transport (left) and rail transport (right) 1991-2001

It was expected that the new link would stimulate logistics activities near the tunnel and at interchange stations. Employment in storage, handling, supporting transport activities and other transport agencies fell in Dover after the opening of the tunnel while new opportunities rose in the Channel Corridor. Altogether, the number of jobs in 2001 was about 400 below 1991. Road transport has started growing importantly since tunnel opening, with nearly 1000 more jobs in 2001. In total, jobs in logistics and road transport increased by about 550.

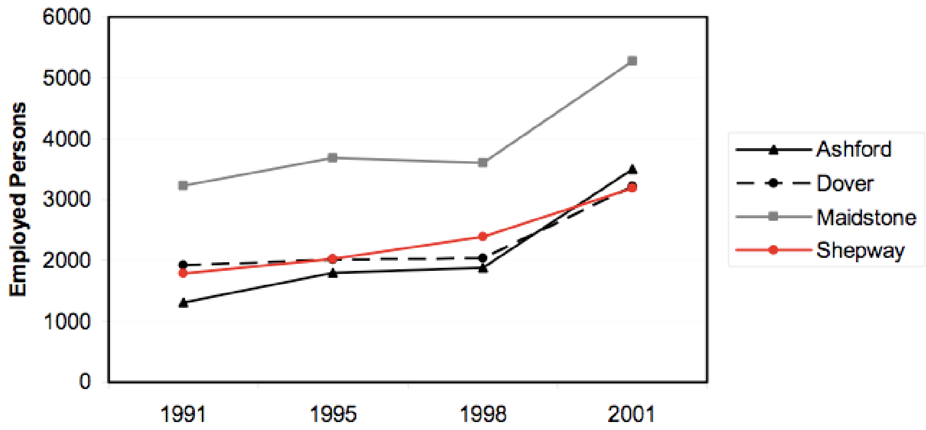


Source : adapted from NOMIS, (logistics: aggregated by Hay et al. 2004; road: SIC 6024)

Fig 21. Evolution of employment in logistics -storage, handling and support activities- (left) and road transport (right) 1991-2001

.

Tourism was thought to beneficiate a lot from the new link. Statistics show that the number of jobs in this sector rose significantly, but started to do so only four to five years after tunnel opening.



Source : NOMIS (SIC 55)

Fig 22. Evolution of employment in tourism (hotels and restaurants) 1991-2001

Employment in hotels and restaurants has increased by more than 6500 people in the four main cities along Eurostar line in Kent, whereas national average remained below 5% during that decade.

Other statistics, amongst others manufacturing and retail, do not show definite evidence of tunnel impact on the economy. There are of course a lot of contributions that statistics do not allow to attribute to the new link only because they are or too diverse, too small, too indirect or geographically too widely spread, or a combination of that. Most of the economic developments, especially indirect ones, depend upon political interventions, which would take us far from Eurotunnel appraisal, thus are not further developed in this report.

As a result, the economic impact of Eurotunnel on Southeast UK can be summarised as follows: the estimation of changes in employment that were linked to the transport sector proved to be close to records, while ex-ante estimations of sectors that importantly depend on other policies -such as regional planning- provided figures that do not correspond to records: in the case of Eurotunnel, employment in tourism has been strongly underestimated, though the main growth happened four to five years after changes had occurred in transport sectors.

Economic Sector	1991 estimation of Eurotunnel impact	2001 outcome of Eurotunnel impact	Ex-ante vs. Ex-post
Port and ferry business	-7440	-6700	90% match, overestimated
Tunnel + rail operations	2000	2000	100% match
Tourism	500	6500	Underestimation by factor 13
Retailing	1100	Unclear likely > 0	Not relevant
Manufacturing	2750	Unclear likely > 0	Not relevant
Distribution and road freight	1000	550	55% match, overestimated
Total	-90	2350	Total relevant ex-ante results below 2001 records

Source: ex-ante figures from Kent Impact Study review, 1991 quoted in: Hay et al., 2004.

Table 18. Eurotunnel impact on employment in South-East England: ex-ante studies (left) vs. 2001 records (right) (- = loss)

6.5 Management Issues: Drawbacks of Eurotunnel’s Bicephal Structure

Another issue that had a direct and strong impact on Eurotunnel performance, hence on Eurotunnel’s economic impact, is the way the company had been run. More precisely, the adverse consequence of the internal decision-making process on the quality of economic forecast. In March 1971, when an agreement was signed between the British and French governments, £1 million were committed to studies to take place between 1971 and 1972. The RTZ project managers group (UK) considered that their first task was to review the existing studies. RTZ concluded that the traffic forecasts were outdated, they declared that further study was necessary and they required £ 500, 000to that purpose. According to the moitié-moitié principle, French side had to undertake a similar study, which was completed in May 1972. Both produced new traffic forecasts, with the French estimate in Francs and the British estimate in £ sterling.

Whereas it seemed logical to combine the two outcomes by means of a common exchange rate, the discussion turned to another –paradoxical- topic: the forecast of exchange rate: the French consultants were ready to accept any rate but not one showing the franc falling against the Pound, while the British wanted the same for their currency. Eventually, both parties agreed upon a fixed exchange rate, which had been set at the study completion date. Still, experts of both sides knew a fixed rate was not adequate. This example highlights how Eurotunnel's organization specificity affected the quality of the economic analyses.

6.6 Conclusion

Little effort had been devoted to ex-ante economic analysis. Most studies appeared after the Tunnel had become a hot scientific issue, which was too late to influence governmental decisions on finance. Gourvish (2006) summarises the link between economic appraisal and public involvement in infrastructure finance as follows (p. 383): "*it is difficult to finance large infrastructure schemes with evident social benefits but speculative private gains without public guarantees…*". Direct benefits other than job creation were merely taken out of the decision-making process, with no reason being given. What about the *yearly* £5.6 billion benefits (Button, 1994) of lower fares resulting from competition across the Channel ? Would Button's estimates (for UK only) have been inconvenient for a government that had ruled out public money from the start ? Such a yearly benefit, calculated on one side of the new infrastructure only, is as high as Eurotunnel's total Estimated Funding[5] Requirement ! There is no doubt such a figure would question rejection of public participation to financial plan.

Proposed solutions: there are no "simple solutions" to economic analyses, which are complex by essence. The only recommendation is to undertake economic analyses with full consideration of social benefits.

[5] Bankers Group, 1984.

7. SENSITIVITY AND RISK ANALYSIS

Under "Sensitivity Test", Coopers & Lybrand (C&L, 1979) relate that tests had been undertaken in order to indicate the sensitivity of the first model results (Phase I), concerning:

a) the impact of the changes in transport costs arising from the increased cost of energy;

b) the effect of an increase in air journey times of half-an-hour to alow for increased congestikon and security checks at airports;

c) the effect of the developments of a high-speed rail network in Western Europe;

d) the effect of lower rates of economic growth

Phase I studies were completed in 1973. Unfortunately, the sensitivity tests were part of Phase II, which has been interrupted in 1975, as a result of the tunnel project being shelved by the governments. C&L (1979) state that *"Because of this, the major innovative features of the Phase II studies were not brought to completion."*

Later Eurotunnel forecast have been primarily based on 1977's International Passenger Survey[6,] commissioned by UK Department of Trade. Data was used to fuel a linear impedance model, with impedance expressed as a generalized cost.

7.1 Risk Analysis Focused on Bankers' Risks

Omissions of some relevant variables

The 1975 cancellation of the Channel Tunnel Project killed what started in the 1970s as a very comprehensive investigation of the community cost and benefit study. As no government money was to be invested in the Eurotunnel project that followed in the 1980s, no solid government requirements directed further economic and risk analyses. On top of that, private companies –the potential constructors- had already invested so much money for studies related to the cancelled project that they could not start again. As a result Eurotunnel data used for making decisions were merely updates from former –partly unfinished- studies. The risk aspects were led by finance experts (the Banking Group) which had established many margins for error, especially wide margins for tunnelling works, but developed no deep understanding of what might go wrong from design to operation, and, consequently, had not established sufficient plans to tackle problems as soon as they would appear. Such an approach did put more weight in making sure that the tunnel could be built (and be sold by lenders in case of owner's insolvency), rather than in making sure that the link could provide transport services.

[6] Cf. Chap II Methodology of Traffic models, Nb 21,p.9 (passengers and cars),. In: Coopers Lybrand, 1979.

Freight flow data were obtained from HM Customs and Excise on a UK Port-Country-Mode basis; UK origin and destination by zone were deduced from the NPC 1976 1% survey, while estimations had to be made for South-East, South-West and East Anglia as no full survey was available at that time. In terms of freight[7,] one important problem is that "(91). *Container and Rail wagon tonnages were combined*" This may have played a role in the significant overestimation of through-rail forecast. Other difficulties were[8] (9.4) *i.* the general paucity of data; *ii.* The complexity of the market; *iii* variations in discount schemes; *iv*. confidentiality of data. Freight transport was estimated on the basis of an average fixed charge, plus a variable charge per mile, which allowed for a comparison of haulage costs from UK to the Continent, France, Switzerland, Austria, etc. The same was done for transit times (fixed cost + time per mile).

Total Estimated Funding Requirement

Costs were estimated on the basis of Anglo-French Scientific Group (AFSG) report 1982, which had been reviewed by the Banking Group in 1983 (the Banking Group,1984). The Banking Group report relates "*The AFSG Report contractors's quotation figure has been updated for inflation to £1,862 million in 1983 prices with a 7 years period*." [48]. No chapter of this document mentions any sort of "risk analysis". Nevertheless, the Banking Group proposed two conceptual "*Procedural Structures*", i.e. two ways of financing the project, which they estimated would include "*acceptable margin for cost and time relative to known technical and geological difficulties plus an allowance for overheads and profit.*" [48]. In short, they estimated that Eurotunnel could meet funding requirements if they would include the following margin: *i*. increase overall cost by 10%; *ii.* add one year to construction duration, which would make it last 8 years instead of 7; *iii*. insure construction risks (amount not available in the Banking Group,1984); *iv*. make provision for escalation of capital costs at the estimated rate of inflation [authors: inflation is later stated as 9%]; *v*. account with a capitalized interest on the total amount [authors: interest rate is later stated as 13%]. After these risk considerations had been made, the Banking Group states that "*The Target Cost for Construction is therefore increased to £2,047 million in January 1983 prices […] a Total Estimated Funding Requirement of £5,938 million is produced*" [50].

Cost	Margin
Overall costs	+10% overall cost
Construction overtime	+ 1 year construction (total: 8y)
Other liabilities	+ Insurance
Economic environment	Inflation 9%, interest 13%
=> Total Estimated Funding Requirement: £5,938 million (1983 prices)	

Source: adapted from: the Banking Group, 1984, pp. 12-13.

Table 19. Provisions of the Total Estimated Funding Requirement produced by the Banking Group, 1984.

Once the Total Estimated Funding Requirement had been produced, the Banking Group established an "*Economic Viability Test*" which was meant to "*calculate the Maximum Amount of Debt that could be*

[7] Freight Route Choice Model, Nb 84, p. 34. ibidem.

[8] Freight, Nb 94, p. 36. ibidem.

repaid over 25 years of operation while at the same time permitting an adequate Return on Investment". [51].

Source of finance was planned as a Non-Recourse Bank Loan -£5,398 million- in which the lending banks would support various financial instruments (see table), plus an Investment Capital -£540 million- which would be predominantly raised through issue of Convertible Loan Stock. The Banking Group also states that "*Governments/EEC must also assess and accept the risks and are required to provide a Continuity of Funding Undertaking…*" [85].

Cost Overrun Scenario

After they had established the above Procedural Structures, the Banking Group stated (1984) that "*The Estimated Funding Requirement already contains a basic element of cost overrun cover relative to the overall Target Cost for Construction…*" [48]. Nevertheless, to lessen the risk of loss at the Bank side, the Group designed a variant of the Procedural Structures, which was meant to cover an even more pessimistic outcome of the reference scenario: This most pessimistic scenario was entitled "*Overrun Case*" in the table below. The Overrun Case has been formulated by estimating a doubling of tunnel boring and related construction costs plus a further 10% increase on all other costs with an additional two years delay in construction time. This would give a figure of £2,727 million (1983 prices) with a construction period of 10 years. Funds to cover this pessimistic scenario would be raised by bank loans (90%) and investment capital (10%) which ended up with a loan life that the Banking group judged not acceptable by the finance market. Therefore, the banks proposed a new and very complex system based on issue of bonds that would enable Eurotunnel to refinance bank debt soon after construction. The Banking Group wrote that such a system "*… has never been used for a project of the size and nature of the Channel link*" [58].

Cost	Margin
Tunnel boring and related costs	+ 100%
Other costs	+ 10% other cost
Construction overtime	+ 2 years construction (total: 10y)
=> Total Overrun £2,727 million (1983 prices)	

Source: adapted from: the Banking Group, 1984, pp. 12-13.

Table 20. Provisions for Cost overrun.

Finally, the Banking Group proposed the following financing plan to stakeholders, with all variants based on the "Total Estimated Funding Requirement" established on the basis of AFSG report contractors' quotation figure (7 years construction period - £1,862 in 1983 prices).

	Procedural Structure I		Procedural Structure II	
	Base Case	Overrun Case	Base Case	Overrun Case
Internal Rate of Return (IRR) of the Project	17.6%	15.6%	17.6%	15.6%
Capital				
Total Capital	£540	£849	£540	£540
Above in 1983 terms	£393	£542	£393	£393
Return to investors	20.4%	17.3%	21.6%	19.9%
Non-Recourse Loan (NRL)				
Maximum NRL	£5'398	£5'396	£3'494	£3'329
Above in 1983 terms	£1'920	£1'776	£1'242	£996
Year of Final Repayment	2000	2002	2002	2002
Constructors Loan Stock (CLS)				
Maximum CLS Value	0	£1'018	NA	NA
Above in 1983 terms	0	£235	NA	NA
Year of Final Repayment	-	2004	NA	NA
Recourse Loan (RL)				
Maximum RL Value	0	£4'605	£868	£945
Above in 1983 terms	0	£691	£336	£336
Year of Final Repayment	-	2011	1995	1997
Revenue Bonds (RB)				
Maximum RB Value	£5'290	£5'785	NA	NA
Above in 1983 terms	£1'222	£1'120	NA	NA
Year of Final Repayment	2007	2013	NA	NA
Indexed Bonds (IB)				
Maximum IB Value	NA	NA	£3'208	£8'008
Above in 1983 terms	NA	NA	£572	£1'428
Year of Final Repayment	NA	NA	2005	2009

Source: the Banking Group, 1984, pp. 22-24.

Table 21. Procedural structures with Overrun Case.

Two periods of project life must be differentiated: *i.* until the project opened in 1994 a major uncertainty involved initial traffic volumes plus growth rates; *ii.* after operations had started the area of uncertainty reduced to growth rates (which are also dependent on the actions of competitors) and the management of debt under pressure of the banks. The 2007 restructuring that gives the banks full power clarifies the deal.

7.2 Competition with the Ferries

Records suggest that the traffic model provided transit time results close to performance after Eurotunnel had supplied regular services. However, forecast of haulage costs did not take into consideration the drastic change that ferries managed to impose on the global cross-Channel market.: Eurotunnel made unrealistic assumptions of diverted demand and fundamentally underestimated the capacities of ferries to retail after rail services had been opened. Before and during tunnel construction, the ferries invested in new ships and they improved their organisational efficiency. In 1994, when Eurotunnel was unable to deliver proper services, the ferries did not move, but as soon as Eurotunnel's situation improved, they started a very aggressive price war which not only forced Eurotunnel to lower rail tariffs, but also significantly reduced Eurotunnel's market share. Conjunction of both factors was a terrible shock on Eurotunnel's revenues. (Typical case of project where promoters did not consider early enough what the clients needed).

The project was *"assembled round a hole like a Polo mint...[there was] no client driving it forward with a vision of what the operator needed to have"* Sir Alastair Morton, Co-chairman, Eurotunnel. In: Winch, 1998.

7.3 Conclusions

Demand analysis was based on a conservative assumption, with a growth rate of half of that observed during the years prior to project launch. Nevertheless, the main part of the risk analysis itself is extremely brief. The Franco-British Channel Link Financing Group (1984, confidential) submitted an "Estimated Funding Requirement" (Chap. 49) that *included (a) 10% increase and additional one year on overall Target Cost for Construction; (b) allowance for any insurance to cover for construction risks; (c) escalation of capital costs at the estimated rate of inflation* [authors: 9% stated under Chap. 50]*; and (d) capitalized interest on the total amount borrowed* [authors: 13% stated under Chap. 50]. This procedure led to an Estimated Funding Requirement of £5,938m. A more pessimistic scenario entitled "*cost overrun*" has been established, costing about 50% more, which was close to 1994 outcome. Not much attention has been given to the cost overrun scenario, except that was thought to be financed by Indexed Bonds. As a consequence, with all attention drawn to tunnel completion, the stakeholders ended up with a tunnel that was operational, but also with a system that was unable to provide enough money to start reimburse the debt just after operations had started as well as to pay for the interests of the huge debt over the following decade.

Proposed solutions: the risk analysis should not purely consist of a given margin of error added to the figures drawn by project promoters (in that case, figures taken from the AFSG Report). Scenarios should be developed from the main causes of uncertainties in project evolution, and risks should be estimated according to the most realistic scenarios.

8. CONCLUSION AND POTENTIAL SOLUTIONS

In comparison to other EVA-TREN projects, Eurotunnel is an “old project”. Decisions have been taken according to their political potential, rather than on the basis of sound and transparent socio-economic arguments. Most of the work has been based on the main study for 1975 underground rail Channel crossing, which had been abandoned. Most of the studies that followed were undertaken by the private sector, as attempts to win the bid of building the “chantier du siècle”, at a time when potential contractor companies had been struggling for long in the 70s adverse economy. This means that they could commit only limited resources to the project. Therefore, only demand was computed, but on the basis of “updated” figures on an old model, while no comprehensive ex-ante study of socio-economic impact had been completed. Then, once governments gave their green light, contractors and banks rushed into construction in order to access finance. This way of doing had a disastrous impact on project finance: construction was the first time the figures were aligned. Unfortunately for Eurotunnel, demand analysis ended up far from operation results, which made its debt unsustainable and led to the 2007 re-engineering which put the banks in undisputed control of Groupe EuroTunnel, the new company.

Literature is univocal not only in stating Eurotunnel’s infrastructure success, but also in criticizing its financial plan. Nevertheless, it is now a fact that Eurotunnel provides high quality, fast passenger and freight services, at costs that are competitive with those of the ferries. Hence, despite a bad financial structure that had resulted from an impossible mission (no public funding), Eurotunnel continues to generate a social benefit that is computed nowhere, even though experts consider it worth more than £5.6 billion a year (Button, 1994). Eurotunnel’s main problem was therefore not due to assessment tools, which are not meant to appraise policy decisions, but to the mismatch between responsibilities and tasks: those who had to undertake tasks did not bear the responsibility of matching finance with their tasks, whereas the governments politically backed the project without ever being in control of it, with no other authority than concession grant and legal requirements.

Legal requirements evolved similarly to the tunnel project: loss of control led to outstanding tailor-made technological achievements, but a financial nightmare. The Safety Commission was free to strengthen requirements to a paradoxical level while the contractor –Trans Manche Link (TML)- had to design parts of the system while it was still under construction. Then, TML could pass costs to the debt, which, in turn, was handled by the banks, which, in the end, received political support for convincing investors.

As a result of the absence of accountable authority, external events have increasingly shaped the project while the constructors and banks shifted the costs to the shareholders and, finally, to the citizens.

In the most comprehensive work about the Channel Tunnel, Gourvish (2006) reminds that *“… had costs been closer to the original estimate of £2 billion for the tunnelling and £4 billion in total project costs, then Eurotunnel’s profit and loss account would have been more satisfactory. But whatever the trading picture, the Tunnel remains a monument to the imagination, a potent symbol* […] *few would currently challenge the view that the Tunnel is an essential piece of European transport infrastructure, with economic gains…”.*

Having placed financial problems in the shadow of historical value, Gourvish relates, amongst what he calls *"simple lessons"* (pp. 383, 384) that Graham Corbett –Eurotunnel's former Finance Director-recommends following in large infrastructure project: *"… the need to avoid design and build contract[s] where the contractor is not going to be the operator*". Nevertheless, not all experts agree on such simple lessons since, in the same chapter, Gourvish himself states (p. 383) that *"It is important to work with a concessionaire who is distinct from the promoters (banks and construction companies)"*

(Underline by authors).

Aside from the net social –and historical- benefit stated by Gourvish, official historian of the United Kingdom, we ask whether the governments did act in a manner that citizens may expect from them, when they had decided that they would commit no public money. Eurotunnel was supposed to become a model for projects financed by the private sector, which is definitely not the case. The study demonstrates that Eurotunnel's main flaw is the financial system dysfunction. Indeed, the impossibility of compensating for missing institutional funding led bankers to produce an obscure finance plan, which only the largest shareholders could periodically renegotiate with a view of potential benefits. In letting businesses taking all financial decisions, the governments have implicitly backed a system that now directs Eurotunnel's operating profits to the lending banks, rather than to the entire community of investors.

Therefore, as a conclusion about assessment methods, and not about Eurotunnel itself, we observe that Eurotunnel's problems mainly arose due to a mismatch between political will and the financial involvement of governments. The fact that no public money was to be committed did put irrational emphasis on the quest for convincing private investors, which resulted in a series of flaws that no authority had countered: *i.* an overoptimistic cost estimate due to non-critical appraisal (use of bid figures as basis for financial plan); *ii.* an over-optimistic estimate of revenues that purely neglected ferry competitors and falling trends in the bulk freight market; *iii.* no provision for potential delay in train service operation; *iv.* attribution of responsibilities to bodies that did not have to bear the costs of their interventions; *v.* no proper responsibility for cost management.

In retrospective, the Channel Tunnel appears as a project that sailed between assessments because the first thorough studies, cancelled by governments in 1975, had never been completed, while the second attempt avoided government commitment to such an extent that there was no authority in charge of making sure that the business plan was viable for Eurotunnel in the long run. On top of that, the second attempt was realized under such time pressure and lack of initial money that no stakeholder was keen to undertake assessments that would have cost millions and might have revealed the project unrealistic.

9. RECOMMENDATIONS IN THE LIGHT OF EVATREN OBJECTIVES

Domain	Issue	Element of solution
Objective	Political support	Coherence between political discourse and actual actions, amongst others, financial support
Context	System appraisal	*i.* Assess the project as a full part of the global system in which it is to be integrated. What happens in case adjacent elements are not developed in time? The underground line, with terminals, should be closely coupled with the connection to rail network *ii.* Plans for building and financing such connections should be ready before decision is taken for starting the underground work
Demand and market dynamics	Estimation of demand under uncertainty	*i.* Integration of the potential reaction of competitors (such as the ferries) in terms of fares, quality of service and market share. Development of response scenarios *ii.* Attention to declining sectors of a given market (unless drastic change occurs, bulk freight is a small and declining market)
Options	Choice between high-investment-high revenue projects (toll road) vs. lower investment-lower revenue (rail)	*i.* Perform an <u>independent assessment</u> of the winning bid before proceeding to realization. *ii.* Check public acceptability, especially in the case citizen belong to targeted share buyers.
Finance	Finance plan	*i.* Involvement of the public sector, as a contributor to initial loans as well as of governmental institutions as independent bodies for ensuring that the financial plan is viable *ii.* Need of second, independent, assessment of large-scale infrastructure project proposals
Economics	Estimation costs and benefits	Full consideration of social and economic benefits
Sensitivity and Risk	Misunderstanding of significant risks	Scenarios analysis (see: demand and dynamics of market)
Ethics	Denial of financial or social responsibility	*i.* Independent, critical appraisal of the project's premises *ii.* critical appraisal of actors' roles and responsibilities
Management	Responses in case things follow an unexpected path.	Responsibility (and rewards) should be established and clearly defined among the several parties, with unambiguous accountability

10. GLOSSARY

Cost-Benefit analysis (CBA): Conceptual framework applied to any systematic, quantitative appraisal of a public or private project to determine whether, or to what extent, that project is worthwhile from a public or social perspective. Cost-benefit analysis differs from a straightforward financial appraisal in that it considers all gains (benefits) and losses (costs) regardless of to whom they accrue. CBA usually implies the use of accounting prices. Results may be expressed in many ways, including internal rate of return, net present value and benefit cost ratio.

Demand analysis: Analysis that allows for the accurate estimation of what will be the demand for the good/services produced by the project. More specifically regarding transport and energy project, it is better to talk of the estimation of the users. Total demand usually consists of the sum of the existing demand (the number of users of that specific service, at the time before the project has been implemented), the generated demand (the number of new users induced by the project implementation) and the diverted demand (the number of new users deviated from the use of facilities, alternatives to the one implemented)

Discount Rate: The rate at which future values are discounted to the present. Financial discount rate and economic discount rate may differ, in the same way that market prices may differ from accounting prices.

Economic analysis: Analysis undertaken using economic values, reflecting the values that society would be willing to pay for a good or service. In general, economic analysis values all items at their value in use or their opportunity cost to society (often a border price for tradable items).

Economic rate of return (ERR): an index of the socio-economic profitability of a project. It may be different from financial rate of return (FRR), because of price distortion. ERR implies the use of accounting prices and the calculation of the discount rate that makes project benefits equal to present costs, i.e. makes economic net present value (ENPV) equal to zero.

Financial analysis: Analysis that allows for the accurate forecasting of which resources will cover future expenses. It allows to: 1) verify and guarantee cash equilibrium (verify the financial sustainability), 2) calculate the indicators of financial return of the investment project based on the net discounted cash flows, related exclusively to the economic unit that activates the project (firm, managing agency).

Financial rate of return: The internal rate of return (IRR) calculated using financial values and expressing financial profitability of a project.

Financing gap: It is the current approach used to determine the Commission co-financing rate on the project total costs. This approach works as follow: C is the present value of total cost of the investment, R the present value of the net revenues generated by the project, including its residual value, E the eligible cost, (C-R) is the financing gap, we have that r is the co financing rate and G is the EU grant defined as follows: $r=(C-R)/C$ and $G=E*r$.

Internal rate of return (IRR): The discount rate at which a stream of costs and benefits has a net present value of zero. Financial rate of return (FRR), when values are estimated at actual prices. Economic rate of return, (ERR) when values are estimated at accounting prices. The internal rate of return is usually compared with a benchmark in order to evaluate the performance of the proposed project.

Multi Criteria Analysis (MCA): Tool used to compare several interventions in relation to several criteria. Multicriteria analysis is used above all in the ex ante evaluation of major projects, for comparing between proposals. It can also be used in the ex post evaluation of an intervention, to compare the relative success of the different components of the intervention. Finally, it can be used to compare separate but similar interventions, for classification purposes. Multicriteria analysis may involve weighting, reflecting the relative importance attributed to each of the criteria. It may result in the formulation of a single judgement or synthetic classification, or in different classifications reflecting the stakeholders' different points of view. In the latter case, it is called multicriteria-multijudge analysis.

Net present value (NPV): The sum that results when the discounted value of the expected costs of an investment are deducted from the discounted value of the expected benefits. Economic net present value ENPV. Financial net present value FNPV.

Option analysis: Technique that compares actual benefit with the net benefit potentially generated by an alternative project. It aims at giving evidence that the project under exam is the best option of all feasible alternatives. Generally for each project three alternatives could be considered: the "do nothing" alternative; the "do minimum" alternative; the "do something" alternative.

Risk probability analysis: Technique used to analyze a range of events or trends that could undermine the achievement of the project objectives. Risk analysis tries to assess the probability distribution of all possible expected returns corresponding to all possible deviation of the variable influencing the project outcomings.

Scenario analysis: The technique to consider jointly certain "optimistic" and "pessimistic" values of a group of variables in order to demonstrate project adaptability to different scenario. To define optimistic and pessimistic scenarios it is necessary to choose for each critical value, the extreme values among the range defined by the probability distribution. Project performance indicators are calculated for each hypothesis.

Sensitivity analysis: The analytical technique to test systematically what happens to a project's earning capacity if events differ from the estimates made about them in planning. It is carried out by varying one element or a combination of elements and determining the effect of that change on the outcome.

11. REFERENCES

ACT CONSULTANTS, IRPUD, MARCIA1 ECHENIQUE & PARTNERS (1992) *The regional impact of the Channel Tunnel throughout the Community*. Final Report to DG XVI, Commission of the European Communities. Summarized by Fayman et al. (1992).

ACT CONSULTANTS, IRPUD, ME&P, *"The regional impact of the Channel tunnel throughout the Community"*, Final report for the DG XVI, Bruxelles, février 1992.

ADLER, H.A., 1997, *Economic appraisal of transport projects*, EDI Series in Economic Development, World Bank, Baltimore, USA.

ANDERSON, G. and ROSKROW, B. (1994), *The Channel Tunnel Story*, London, E. & F.N. Spon.

ANGLO-FRENCH SCIENTIFIC GROUP (AFSG), June 1982, report cited by the Banking Group, 1984. Not public document.

ANGUERA, R., *The Channel Tunnel-an ex-post economic evaluation*, in: Transportation Research A, 40 (2006) 291-315.

BANKING GROUP, 1983, 1984. See "FRANCO-BRITISH CHANNEL LINK FINANCING GROUP" below.

BECHTEL France, *Impacts et perspectives pour la egion Nord – Pas de Calais du lien fixe transmanche,* Conseil Régional Nord – Pas de Calais, Lille, août 1985,

BELLI P. et Al. (2001), *Economic Analysis of Investment Operations*, The World Bank, Washington D.C.

BRAIBANT G., LYALL A., *Rapport du groupe de travail franco-britannique sur la liaison transmanche, "Manche : quelles liaisons ?"*, Paris, Documentation Française, 1982,

BUTTON, K.J. (1990) *The Channel Tunnel – the economic implications for the South East of England*. Geographical Journal, 156, 187-199.

BUTTON, K.J. (1994) *The Channel Tunnel and the economy of South East England*. Applied Geography, 14, 107-121.

CHANNEL TUNNEL ADVISORY GROUP (CTAG), (1975a), *Channel Tunnel Provisional Estimates of Costs and Benefits*, UK, April 1975.

CHANNEL TUNNEL ADVISORY GROUP (CTAG), (1975b), *Channel Tunnel and Alternative Cross-Channel Services (The Cairncross Report)*, UK, July 1975.

CHANNEL TUNNEL JOINT CONSULTATIVE COMMITTEE (1987), *Kent Impact Study: overall assessment*. London: HMSO, UK.

CHANNEL TUNNEL JOINT CONSULTATIVE COMMITTEE (1991) *Kent impact study*. Maidstone: Kent County Council.

COOPERS & LYBRAND, Economie, Study of the community benefit of a fixed Channel crossing, Interim report, Bruxelles, Commission of the EC, May 1979.

COOPERS & LYBRAND, SETEC Economie, Study of the community benefit of a fixed Channel crossing, Bruxelles, Commission of the EC, January 1980.

DICKINSON David, "12 Billion Pounds under the Sea" in: Independent On Sunday 18 January 1998 pp. 10- 14.

EUROPEAN COMMISSION, DG Regional Policy (2002) *Guide to cost-benefit analysis of investment projects in the Framework of Structural Funds, Cohesion Funds and ISPA*, Brussels.

FAYMAN, S., METGE, P., SPIEKERMANN, K., WEGENER, M., FLOWERDEW, T. and WILLIAMS, I. (1992) The regional impact of the Channel Tunnel: qualitative and quantitative analysis. Paper presented to 6th World Conference on Transport Research, Lyon, June 1992.

FETHERSTON, D. (1997) *The Chunnel : The Amazing Story of the Undersea Crossing of the English Channel* New York, Times Books.

FINANCIAL TIMES, Pan Kwan Yuk, *Eurotunnel shares set to resume trading next week*, Companies International, Mar 24, 2007.

FLYVBJERG B., BRUZELIUS N., ROTHENGATTER W., 2003, *Megaprojects and Risk*, Cambridge University Press.

FRANCO-BRITISH CHANNEL LINK FINANCING GROUP, 1983, *Finance for a fixed Channel Link*, Interim report covering the first stage of analysis, Confidential report sent in July 1983 to the Commission of the European Communities, DG VII-C-1.

FRANCO-BRITISH CHANNEL LINK FINANCING GROUP, 1984, *Finance for a fixed Channel Link*, Summary and conclusions, final draft, Confidential, 29 February 1984.

GIBB, R. (1986). *The Impact of the Channel Tunnel Rail Link on South East England*. The Geographical Journal 152 (3): pp. 335-350.

GOURVISH, T. R., *Britain and the Channel Tunnel*, New York, NY : Routledge, 2006

HAY, A., Meredith, K., Vickerman, R. *The impact of the channel tunnel on Kent and relationships with Nord-pas-de-Calais*, final report, June 2004, University of Kent, UK.

HEATCO (2005), *Current practice in project appraisal in Europe*, Brussels.

HEATCO (2005), *State of the art in project assessment*, Brussels.

HEDDEBAUT, O. *Méthodes d'évaluation des grandes infrastructures de transport: comparaisons intermodales et selon les pays en Europe,* Rapport de Convention INRETS/Region, dec. 1994, France, 1996.

HEDDEBAUT, O., *Le Plan Transmanche: analyse rétrospective des politiques mises en oeuvre* (deuxième phase évaluation "ex-post"du volet infrastructure, convention INRETS/GRRT, Conseil régional Nord-pas-de-Calais, 2000.

HEDDEBAUT, O., *Les effets socio-économiques du tunnel sous la Manche,* Séminaire de clôture de l'action COST 317 du 20 décembre 1996, Actes INRETS, 1997

HEDDEBAUT, O., *Politique d'accompagnement du tunnel sous la Manche et évolution de la fréquentation touristique aux frontières de la region Nord-pas-de-Calais,* 8th World Conference on Transport Research, Antwerpen, July, 1998.

HMSO, *The Channel Tunnel: A United Kingdom Transport Cost-Benefit Study*, UK, May 1973.

HOLLIDAY, I., MARCOU, G. & VICKERMAN, R. (1991). *The Channel Tunnel, Public Policy,* *Regional Development and European Integration*. London, Belhaven Press; 210 p.

HUNT, D. (1994) The Tunnel Upton-upon-Severn, Images Publishing.

IPS, INTERNATIONAL PASSENGER SURVEY, *Travel trends: A Report on the International Passenger Survey*, Office for National Statistics, UK 1997-2002

JOAN, JM, JOIGNAUX, G., *Le rôle du tunnel dans l'évolution des flux d'échange sur le Transmanche*, Association du Corps préfectoral et des hauts fonctionnaires du ministère de l'intérieur, Paris, 1999.

KAY, J., MANNING, A. AND SZYMANSKI, S. (1988) *The Channel Tunnel*. Economic Policy, 8, 211-234.

KEEBLE David, OWENS Peter, THOMPSON Chris, *Economic potential and the channel tunnel,* AREA, Institute of British Geographers, 1982, Volume 14, N° 2, pp. 97-103

KENT IMPACT STUDY REVIEW, Kent County Council, UK 1991.

KIRKLAND, C (ed.) (1994) *Engineering the Channel* Tunnel London, E & F.N. Spon.

LANGRAND M., in MARCOU G., VICKERMAN R., LUCHAIRE Y., *"Le tunnel sous la Manche entre États et marchés*", PUL, Lille, 1992.

LEMOINE, B. (1994) *Le tunnel sous la manche* Paris, Le Moniteur

LI, C., WEARING, B., *The financing and financial results of Eurotunnel: Retrospect and prospect*, WP No 00/13, Working Paper, Department of Accounting, Finance and Management, University of Essex, Nov. 2000.

MACKIE P., PRESTON J., 1998, *Twenty-one sources of error and bias in transport project appraisal*, Transport Policy, 5 (1998) – 7 Elsevier Science Ltd.

MDS Transmodal, *Kent Ports Strategy*, UK, March 1994.

MELATT, CETE Nord - Picardie, *"Etude d'impact de la liaison fixe transmanche sur l'environnement en France"*, Dossier préalable au lancement de l'Enquête d'Utilité Publique du 16 juin au 17 juillet 1986.

MISSION OPERATIONNELLE TRANSFRONTALIERE, *Etude Pour une coopération Transmanche de proximité plus intégrée entre le Kent et le Nord-Pas-de-Calais : enjeux et perspectives opérationnelles*, Juillet 2004.

NOULTON, J. (1999). *Lessons from the Channel Tunnel Experience*. Seminar on public-private partnerships (PPPs) in transport infrastructure financing, Paris.

Proceedings of the Institution of Civil Engineers (1992-5) *The Channel Tunnel : Part 1 Tunnels; Part 2 Terminals; part 3 French Section; Part 4 Transport Systems Special Issues*, Civil Engineering vols 97-108.

REYNAUD, C., *Faire de la France une "plaque tournante" de l'Europe du Nord*, JV, 1986, France

RIDLEY Tony M., "*The influence of the Channel tunnel : both sides contrasted*", University of London, 1990, 4 p.

SERETE et CODRA, *Étude sur les effets socio-économiques du tunnel sous la Manche (côté français), pour la proposition de « France Manche-Channel Tunnel Group »*, Septembre 1985, Rapport général, + Rapport annexes

SETEC Economie et Wilbur Smith and Associates, *Trafics et recettes des liaisons transmanche pour la proposition de « France Manche-Channel Tunnel Group»*, Septembre 1985, Rapport général + Rapport annexes.

(Also in English) *Traffic and revenue of Channel crossings for the France Manche- Channel Tunnel Group proposal,* September 1985

SIMMONS, D., *Regional impact of the Channel tunnel and associated links*, Consultancy report, 1992

STANNARD Colin J., 1990, *Managing a Mega-project. -The Channel Tunnel*

STONEHAM, P., *The Eurotunnel Rights Issue*, *Part One: Strategy*, in: European Management Journal, Vol. 13, No 2, pp. 201-211, 1995, Elsevier, UK.

WINCH, G. M. (1996) *The Channel Tunnel; le Projet du Siècle* Le Groupe Bagnolet, Working Paper 11.

European Commission support to Eurotunnel

Type of study	***Year***	***Financial support (EUR)***	***Project ID***
Etude d'évaluation	1991	5,000,000	91 - UK - 107
Etude d'évaluation	1992	12,000,000	92 - UK 133
Etude d'évaluation	1993	10,000,000	93 - UK -33
Generic*	1997	24,000,000	97 - UK - 290
Generic*	1998	25,000,000	98 - UK - 158
Generic*	1999	29,500,000	99 - UK - 164
Generic*	2000	30,000,000	00 - UK - 1501

12. ANNEX: HISTORICAL CONVERSION RATES

Historical conversion rates: 1 GBP -> FRF and Euros

Year	EUR	FRF
2001	1,608	10,55
2000	1,640	10,76
1999	1,518	9,96

Year	FRF
1998	10,52
1997	9,56
1996	7,99
1995	7,88
1994	8,49
1993	8,51
1992	9,32
1991	9,95
1990	9,69
1989	10,45
1988	10,59
1987	9,54
1986	10,16
1985	11,55
1984	11,64
1983	11,55
1982	11,83
1981	11,03
1980	9,82
1979	9,06
1978	8,66
1977	8,58
1976	8,62
1975	9,51