# Chapter 3


# Lessons from other Major Transport Projects

**Prepared by Christopher Castles & Christopher Stokes**

# 3 LESSONS FROM OTHER MAJOR TRANSPORT PROJECTS

**Prepared by Christopher Castles**

3.1 This chapter relates to the following questions listed by the Committee:

- 3.4 – What lessons should the Government learn from other major transport projects to ensure that any new high speed lines are built on time and to budget?

3.2 Large infrastructure projects have a poor record of achievement in meeting their expected outcomes in terms of costs and demand. These projects are inherently risky as a result of the long lead times before they are delivered and because most such projects have high technology and construction risks. Long lead times add to the inherent uncertainties of forecasting demand, while technology risks often result in delays in implementation and cost overruns. The HS2 project will have a very long lead time to implementation, the technology will be new in the UK and HS2 is relying on a higher specification (18 trains per hour) than is the case with any existing High Speed Railway in the world or where the industry view is that 12tph – 15tph is the maximum that can be achieved. So it is right to consider carefully the experience of other similar projects.

3.3 There has recently been some quite extensive international research into the post implementation performance of major infrastructure projects, notably by Bent Flyvberg[1] and colleagues. They have found that major infrastructure projects have a very poor record in meeting their forecast expectations, both in terms of the accuracy of the forecasts of demand and in outcomes for costs. It is also common to experience long delays in construction implementation and also teething problems before these projects are operating effectively. There has been no improvement in performance over the past thirty years. Hence the financial performance of many large scale infrastructure projects has been very poor and the costs to governments and to private investors have consequently been high.

[1] Policy and planning for large-infrastructure projects: problems, causes, cures Bent Flyvbjerg
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3.4 However, once built, major infrastructure projects are permanent and cannot be removed, even after bankruptcy of the project financiers. Hence, with the passage of time, they become established as demand builds up and initial problems fade from public memory. This may partly account for the apparent inertia in learning from past experience. The private sector has, however, been learning the lessons from the past and increasingly it is reluctant to take on risks that it is has found difficult to manage. Consequently these risks tend to return to the public sector. Major infrastructure projects also usually attract a strong lobby of interest groups to support them. These lobby groups have an interest in promoting projects with optimistic forecasts. Another factor that has limited the ability to learn from the past is that some types of projects attract public and political support on the basis of the apparent strategic benefits that success would bring, without proper consideration of risks or the reality of these benefits.

3.5 Transport infrastructure projects often exhibit these features. Railway projects are particularly prone to optimistic forecasting bias and have a poor record of implementation. Research by Flyvbjerg examined 25 major international rail projects and found that the average error in the traffic forecasts was an overestimate of 51.4%. This was considerably worse than the sample of road projects examined in the same paper, which generally had a much better record in forecasting both demand and costs. On average rail schemes experienced a 45% cost overrun which has meant that rail schemes have generally failed to meet expectations. The very poor performance of railway projects is partly because they often involve solving unique technical and engineering challenges. The market for rail travel is more complex to forecast because it is influenced by a mixture of commercial and public interest influences and it competes between air and road transport. There is some evidence that positive public and political sentiment supporting rail projects can exacerbate the tendency to overestimate the benefits and underestimate their risks.

3.6 Flyvberg and colleagues consider various explanations for the scale and consistency of this optimism bias that systematically overestimates the chances of success for major transport projects. Some of it can be explained by the inherent uncertainty in forecasting, including technical weaknesses in data and modelling. There are also psychological factors leading to delusional optimism and herd mentality. The activities of the vested interests and lobby groups representing those who expect to gain from major projects also have a significant influence. Incentives on politicians

may tend to favour optimistic expectations of success. Political and economic pressures are often perceived by project planners which influences their work. The extent and impact of these various influences are hard to disentangle. But there is sufficient evidence in the systematic nature of the bias that occurs, as well as case study evidence from the experience of specific projects, to recognise the relevance of these factors. Flyvberg and colleagues made recommendations about how to handle optimism bias in project appraisal and the principle of their work has been taken into account in calculating cost estimates for HS2, but not in the estimation of demand forecasts.

**Railway Case Studies in the UK**

3.7 There are two recent case studies of major railway projects in the UK that are particularly relevant to the demand forecasting for HS2. These are the Channel Tunnel and the Channel Tunnel Rail Link (HS1).

***The Channel Tunnel – Eurotunnel***

3.8 The UK government made a firm policy commitment that the Channel Tunnel should be built and financed by the private sector and there would be no government backing for its financing. A large international consortium of lending banks was formed who appointed traffic and revenue consultants (TRC) and also an independent reviewer of the demand forecasts. The TRC produced annual updates of their forecasts over the more than 10 year project preparation and construction period and these were independently reviewed. The annual independent review never deviated by more than 5% from the TRC's forecasts in its assessment of their validity. The main focus of the review tended to be on macro economic factors rather than factors related to competition that proved to be the most decisive. The reviewer had a particular expertise in macroeconomic but this was not particularly relevant to the outcome of the forecasts.

3.9 The traffic and revenue forecasters used well established transport planning techniques and models for forecasting demand and revenue, although arguably these were poorly suited for preparing reliable forecasts for a commercial rail shuttle link in the competitive cross channel market. A similar comment could apply to the forecasts that have been prepared for HS2. The Channel Tunnel forecasts failed to anticipate the competitive response of the ferries to the opening of the Channel Tunnel and Eurotunnel quickly fell into financial difficulties.

3.10 The UK government wisely refused to offer assistance, although many of the international banks in the lending consortium had believed that there was an implicit government guarantee behind the financing. The lending banks appointed a business adviser, rather than a transport planning adviser, to review the forecasts and produce a revised view of future prospects for the business. The business adviser analysed the competitive dynamics of the cross channel market and produced new scenarios for the business forecasts on which the financial restructuring of the business was based.

3.11 Eurotunnel now operates under a relatively secure financial structure. But about half its capital has effectively been lost by the private investors who funded it. The opening of Eurotunnel services resulted in the breaking of an oligopolistic market and has lowered the costs to consumers of cross channel travel. Private sector financiers learned a lot from their experience with the project and have been much more cautious about the risks they are willing to take on as a result.

***Channel Tunnel Rail Link – Eurostar – HS1***

3.12 The need for a rail link to strengthen the Channel Tunnel was debated for many years during the planning stage, but was delayed by uncertainty over its funding and viability. The Government was keen not to be seen to provide public funds for the rail link which could be regarded as undermining its pledge not to provide support to Eurotunnel. This delayed the process of delivering the rail link. It eventually went through a competitive bidding process as a privately funded project using the revenue stream from the Eurostar trains that had already been purchased by British Railways and SNCF.

3.13 The bid was won by the London and Continental Railway consortium. They relied on demand forecasts produced using transport planning methodologies that are very similar to those that have been used for HS2. These rely on estimates of consumer responses to new service levels on the railway and to future changes in income and price that are expressed as elasticity of demand assumptions. These forecasts anticipated that demand would now have reached about 25 million passengers, whereas actual traffic has grown only slowly and has now reached around 9 million nearly 15 years after the original forecasts. At the time the forecasts were prepared the size of the relevant market for travel between London/Paris/Brussels was about 4 million passengers per year. LCR appeared to believe that the speed and service improvements created by

Eurostar operating on HS1 would generate a great deal more traffic than actually materialised.

3.14 Other forecasts of demand were being produced at the same time for other bidders. At least two of these bidders produced forecasts that were in a more realistic range. These forecasts were prepared by business advisers using different forecasting techniques, models and assumptions. When reviewing the bids, the government chose to accept the LCR forecasts, despite their being unrelated to the size of the existing market, or to the expectations of other bidders.

3.15 Presumably the government assumed that the risk of the outcome of these forecasts would remain with the private sector. In view of the failure of the LCR consortium soon after the opening of HS1 and the subsequent consequences for the public finances, it appears that this assumption was not entirely carried through in the negotiations over the financial structure and risk transfer arrangements [2]for the funding of HS1. The private sector had by then learned to limit its risks with major rail schemes, but it seems the government had not taken on board the same lessons.

3.16 When LCR failed the government appointed advisers to review the forecasts in 2001. By then there was a political predilection to provide a government funded rescue of LCR rather than to leave the risks with the private sector as had been done with Eurotunnel. HS1 has recently been sold for £2.1 billion, well below its construction cost of £5 billion. A large proportion of the loss has been borne by the taxpayer on the basis of unrealistic demand forecasts.

3.17 The Transport Select Committee investigated the failure of the Channel Tunnel Rail Link in 2006. These were primarily the failure to evaluate the impact of low cost air carriers and the unrealistic elacticities of demand used to forecast passenger responses to Eurostar's services. The Committee's reported that '*The Department told us that it has now learned from all this experience, and that the next time it considered undertaking a major transport project, it would factor more severe downside assumptions into its business case analysis'*. It is difficult to reconcile this statement with the work that has been done by HS2 Ltd.

3.18 It appears that the government has been slower than the private sector to learn the lessons implicit in the inherent unreliability of the forecasting

techniques applied for railway projects. The HS1 experience demonstrates all the factors outlined above leading to optimism bias. The Department has not followed its own advice while the planning of HS2. It has relied on the same forecasting methods and assumptions and has not taken account of the risk in these forecasts in evaluating a full range of options for providing the capacity needed on the West Coast Mainline. Instead, it has focussed on one solution, high speed rail, and has then adopted an approach which is likely to bias the evaluation in favour of that solution. In view of the costly experience of Eurotunnel and HS1, that seems a highly questionable approach.

**Railway Case Studies - International**

***Financial Results***

3.19 Most HSR routes have been funded by governments and operated by state railways, so the financial results are in the majority of cases obscure, particularly given the degree of political support for the projects. The general view is that only two projects have produced a conventional financial return, the Tokaido Shinkansen between Tokyo and Osaka and the original TGV Sud-Est route between Paris and Lyon

3.20 Academic research suggests that over-forecasting is endemic for major rail projects both in Britain and elsewhere in the world. Research on this by Danish academics in 2006[3], states:

*"for nine out of ten rail projects, passenger forecasts are overestimated; average overestimation is 106%"*

3.21 A number of completed HSR projects are known to have serious financial problems, particularly the new Dutch high speed line between Amsterdam and Brussels (106miles) as stated in February 2011 by Schultz van Haegen (Dutch Infrastructure Minister) *"operational profits at HSA are substantially lower that those envisaged due to fewer domestic passengers than originally projected",* and the Taiwan route. The proposed Tampa – Orlando HSR in the United States has recently been cancelled, at a very late stage in its development. Despite Federal capital funding for its construction costs, the new Florida State Governor was unwilling to commit to the indefinite operating subsidies likely to be required.

[3] Inaccuracy in Traffic Forecasts. Bent Flyvbjerg, Mette K. Skamris Holm and Søren L. Buhl, Department of Development of Planning, Aalborg University

***Markets***

3.22 HSR projects have addressed a wide range of markets. Taking the two most successful routes as examples:

*Tokaido Shinkansen*

3.23 The Tokaido Shinkansen serves probably the most densely populated corridors in the world between Tokyo and Osaka, including a number of other major cities such as Yokohama, Nagoya and Kyoto, as well as many large towns. There are 15 intermediate stations on the route. The route serves an enormous market and carries very large passenger volumes, both end to end and to intermediate stations, and is almost certainly the most profitable rail operation in the world.

*TGV Sud-Est*

3.24 In contrast the TGV Sud-Est route serves no significant centres of population between Paris and Lyon, and is largely built though open country. There are only two intermediate stations, both of which have a very limited train service.

3.25 In addition to serving the Paris – Lyon flow, the HSR route extends to Marseille and Montpellier, and train services operate to a wide range of destinations on the classic network, providing fast long distance surface travel to the whole of south east France.

***HS2 Markets***

3.26 The markets potentially served by HS2 have some similarities to those served by the Tokaido Shinkansen, albeit on a smaller scale.

3.27 The existing London – West Midlands route links not just London and Birmingham but a number of cities and towns between them (Watford, Milton Keynes, Rugby, Coventry and Birmingham International) and continues beyond Birmingham to Sandwell and Dudley and Wolverhampton.

3.28 The current classic service links these points very effectively, albeit not at HSR speeds. In contrast, HS2 will not serve a major part of these markets, only directly replicating Birmingham New Street and Birmingham International, and services to stations such as Coventry and Wolverhampton will be degraded through a combination of reduced frequency and extended

journey times as a result of additional stops. There are similar issues for the other corridors to be served by HS2.

***Journey Length***

3.29 HSR operations generally cover significantly longer distances than those served by HS2; Britain is a relatively small country, with most of its major population centres quite close together.

3.30 HS2 would therefore be markedly different from the TGV Sud-Est operation, where all passengers have a very fast long distance trunk haul. The ***minimum*** journey distance on TGV Sud-Est is 265 miles (Paris – Lyon), and a significant part of the market is for much longer journeys, for example to Marseille (466 miles). In contrast, the great majority of HS2 journeys would be much shorter than this: Manchester is 184 miles from London, Birmingham 113 miles.

3.31 The few shorter routes, for example the Dutch HSR route, offer relatively small overall journey time savings, as the proportion of time taken up by accessing the HSR station at either end represents a much higher proportion of the door to door journey time. For HS2, even the additional access time from the local public transport network including Birmingham New Street to the new Curzon Street station will dilute the promised journey time savings.

3.32 On the face of it, the Cologne – Frankfurt route appears to be equivalent to London – Birmingham, at essentially the same distance. However, Cologne – Frankfurt is part of a much wider network, with almost all trains going to or coming from somewhere else, as part of longer distance routes such as Amsterdam – Basel and Dortmund – Munich. The HSR route also gives proportionately much greater time savings than HS2 to Birmingham, with Cologne – Frankfurt times of 62 minutes, compared with timings on the tortuous classic route of 140 minutes – but London – Birmingham is only 84 minutes today.

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minutes today, and Virgin Trains say that they could deliver 70 minutes on the existing track. The table below sets out the impact of HSR routes on journey times.

**TABLE 3.1 IMPACT OF HSR ROUTES ON JOURNEY TIMES**

| | Distance | Pre – HSR | Post – HSR |
|---|---|---|---|
| Tokyo – Osaka | 515km | 6hrs 30mins | 3hrs 10mins (now 2hrs 30mins) |
| Madrid – Seville | 472km | 6hrs 30mins | 2hrs 45 mins (now 2hrs 30 mins) |
| Paris – Lyon | 431km | 4hrs | 1hrs 55 mins |
| Frankfurt – Cologne | 180km | 2hrs 20 mins | 1hr 2 mins |
| London – Manchester | 296km | 2hr 08mins | 1hr 13 mins proposed (from 2032) |
| London – Birmingham | 182km | 1hr 24 mins | 49 mins proposed |

3.34 What is striking is that: elsewhere in the world their journey times were much slower pre-HSR than in the UK, where WCML already operates at 125mph; post-HSR their journey times are all more than halved; with the exception of one case the distances are much longer.

***Impact on Classic Networks***

3.35 It is inevitable and logical that classic services are reduced when a parallel HSR route is built. There are no through trains from Tokyo to Osaka or Paris to Lyon on the classic routes, and smaller intermediate stations in Japan can only be reached by using the Shinkansen and interchanging.

3.36 The HS2 business case reflects this, with a Net Present Value saving of £5.4 billion for reduced services on the classic network, and it is difficult to see, for example, how the current 20 minute frequency from Coventry to London could be sustained if all Birmingham – London passengers are assumed to have transferred to HS2. However, this inevitably leads to degradation of the quality of service to many towns not directly served by HS2, as set out in Chapter 8.

3.37 Additionally, there are also potential opportunity costs for the wider rail network. This is shown by France, where the non-TGV network has suffered because investment has been channelled into TGV routes. The Independent (9th April) reported Guillame Pépy, the President of SNCF as describing the system as *"decaying…facing a financial impasse… heading for the wall"* and that France was in danger of going too fast in the construction of fast lines:

*"we risk having longer and longer high speed lines which are used less and less."*

**Conclusions**

- Financial results for HSR projects are generally poor, with endemic over-forecasting of demand.
- Capital costs are very high in Britain, reflecting both higher unit costs and system design.
- Most journey lengths in Britain are too short for HSR to be an appropriate transport solution, particularly given existing fast and frequent rail services to and from London.
- Existing services will inevitably be reduced on parallel "classic" routes.