

HIGH SPEED RAIL: INTERNATIONAL COMPARISONS

Final Report

Report

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Executive summary

1. In September 2003, Britain opened its first high speed rail line, and the SRA is expected to launch a consultation exercise on the case for a major new high speed line, linking London with northern England and Scotland. However, Britain is far behind other countries in Europe and Asia in this respect, many of which now have extensive high speed rail networks.
2. The Commission for Integrated Transport (CfIT) commissioned Steer Davies Gleave to:
 - investigate whether Britain's failure to invest in high speed rail results from differences in appraisal and decision making processes and criteria, or differences in transport markets or other factors, which mean that high speed rail is of less benefit in Britain than in other countries; and
 - make recommendations on how, if at all, Britain's appraisal criteria and processes should be changed to better capture the costs and benefits of high speed rail.
3. In order to do this, we undertook case studies of high speed rail development, transport markets and appraisal processes in Britain and six other countries: France, Italy, Spain, Germany, Japan and Australia. Australia was selected in order to examine at least one country that had not invested in high speed rail.

The market for high speed rail

4. Our analysis demonstrated that the case for high speed rail was dependent on a number of market factors and that the development of high speed rail in the case study countries did appear to be correlated with these factors. The main market factors were:
 - The case for high speed rail is strongest in countries where there is a large market for travel over distances of around 200-800km, and particularly in the range 300-600km. High speed rail offers little benefit for journeys shorter than 150-200km, and is currently not competitive with air transport for journeys longer than approximately 800km.
 - A high speed line can offer very high capacity. For there to be sufficient travel demand for this capacity to be utilised effectively, there must either be very large cities of approximately the right distances apart, or there must be a number of significant population centres that can be accessed by the same high speed route.
 - The construction of high speed lines is likely to be least difficult in sparsely populated countries, but within cities, high population densities mean that high speed railways (and conventional railways) can serve the potential market better.
 - The existence of very good conventional rail lines reduces the incremental economic case for high speed rail, particularly over shorter distances, although if it is possible to use existing railway lines on final approaches to major cities, the construction costs of high speed rail can be significantly reduced.

5. On these measures, the basic economic case for high speed rail construction in (particularly) France is stronger than in Britain. However, the case for high speed rail construction in Britain is now stronger than it would have been in the 1980s, when many other European countries were building or planning their first high speed lines. At that time, there was spare capacity on the British national rail network, but this now faces severe constraints, and the upgrade of the West Coast Main Line has demonstrated that resolving these constraints can be very disruptive and expensive.

The costs of high speed rail

6. The SRA has based its analysis of the costs of a high speed line on the Channel Tunnel Rail Link. However, this is, per kilometre, the most expensive high speed railway to have been constructed anywhere in the world, even ignoring financing costs. Some of these reasons relate to the high proportion of tunnelling required on the approach to London, and the SRA have noted that part of the gap arises from substantial sunk costs relating to routes that were not built and improvements to Ashford and St Pancras. But even adjusting for these factors, the unit costs of high speed lines in other countries were generally 30-70% lower.
7. Although construction of high speed lines in Britain is likely to be more expensive than in (for example) Spain, it is not clear why unit costs should in general be significantly higher than in Germany or the Netherlands. We examined reasons for cost differences, and indicatively estimated that efficient costs under the current basic industry framework in Britain might be in the region of 30% lower than the costs estimated by the SRA. It is likely that further reductions in costs would be possible if the industry structure, approvals process and/or environmental and safety regulations were changed.

Appraisal in Britain and the case study countries

8. Even if the economic case for construction of a network of high speed rail lines had been stronger in Britain, it is unlikely that they would have been pursued in the 1980s and early 1990s, when most other European countries were building or planning high speed rail lines. At the time, rail projects were only authorised if they were expected to generate a return on a **commercial** basis. In contrast, although most other countries conducted little, if any, economic analysis of the high speed lines they were approving, the basic rationale for the investment decisions extended well beyond commercial considerations into wider transport objectives, or strategic and political objectives.
9. However, appraisal practice has now converged to an extent, at least amongst the major European countries: all of the European countries studied (except Italy) require detailed economic appraisal, including cost benefit analysis, before major transport projects can be approved, although in some countries this is used to assess *when* and *how*, rather than *whether*, projects should proceed. European countries are less good at

assessing the wider economic impact of major transport projects: of the countries studied, only Japan undertook this analysis in detail.

10. Our view is that the new British transport appraisal structure as it is applied to railways, set out by the SRA in their new appraisal guidance earlier in 2003 and based on the new Treasury Green Book, includes most factors on which it is feasible to place monetary values, and in most areas comes close to representing best practice.
11. The ultimate decision to proceed with a high speed rail project is taken at the highest levels of government, given the very significant investment involved. The criteria used for this decision are likely to be wider than those used within the technical appraisal itself, but are difficult to assess on an objective and internationally comparable basis. There was some evidence that perceived wider economic benefits of projects, national pride issues, and wider strategic impacts, were more important in decision making than the cost benefit analysis results from appraisals. In some countries, the appraisal criteria appeared to have been explicitly or implicitly skewed to generate outcomes that were consistent with certain policy objectives.

Recommendations for appraisal in Britain

12. Although in many respects the new British appraisal framework represents best practice, we have made some recommendations, relating to the value of time, economic impact analysis, environmental benefits, and the basis of cost assumptions, allowances for risk and optimism bias.
13. Values of time are always likely to be a very important input to appraisal, but these vary significantly between regions and types of journey. Although project-specific values of time have been used on some projects in the past, we suggest that they should be used as a matter of course where the projects are large and likely to be distinctive in their journey time benefits, and that the government should produce guidance on appropriate values. This is likely to improve the case for a high speed line, as it would predominantly handle passengers travelling long distances to/from London, many of whom would be travelling for work-related purposes – who are likely to have the highest values of time.
14. The new Green Book requires that very significant allowance is made for risk and optimism bias, particularly for capital intensive projects such as high speed railways. In our view, these allowances are excessive as they relate to high speed rail: there is no clear evidence that high speed rail projects tend to exceed budgeted costs by these levels. Although the Green Book allows for the optimism bias allowance to be reduced after further analysis, there is a risk that a project will not be analysed further because of the impact of the initial higher allowances on the appraisal may be such that the project does not proceed further – particularly if they are combined with inflated cost estimates.

15. We also propose that Britain should consider undertaking analysis of the wider national economic impact of very major projects, such as a high speed line. The standard British assumption, that national economic growth would not be changed by transport projects, would not necessarily apply to a project of this scale. Evidence from overseas, including in densely populated countries such as Japan and the Netherlands, is that when undertaken systematically, analysis of high speed rail economic impacts indicates them to be higher than revealed by narrow cost-benefit analysis alone.
16. This will be particularly true if its construction could help relieve the very severe transport bottlenecks that Britain is likely to suffer from in the medium term if we do not undertake significant investment in strategic transport infrastructure. In principle the same argument could apply to a London to Scotland motorway, although as road journeys tend to be shorter, any national economic impact would be smaller.

The impact on the case for a high speed line

17. We have recreated the SRA appraisal of a high speed line available at the time of our research, and adjusted this in order to reflect the revised appraisal criteria we have proposed. The results of the revised appraisal are indicative, because we did not have access to the specific appraisal assumptions that will form the basis of the SRA's consultation on the case for a high speed railway, and therefore we had to use an earlier version. As the earlier appraisal was conducted in line with the previous version of the Green Book, we had to estimate the impact of the new Green Book. We also understand that the case for an HSL has improved as a result of different assumptions about upgrades to other long distance rail lines and the use of a different methodology for calculating the BCR.
18. With these caveats, our analysis indicated that there could be significant changes in the conclusions with revised assumptions. The outcome would be changed most significantly by the revised optimism bias assumptions we suggest. The combined effect of the changes we propose to the appraisal framework would change the benefit to cost ratio for the high speed line case that we evaluated from 1.42 to 1.97. If it was **also** possible to reduce costs to what we estimate would be efficient levels, the benefit to cost ratio would increase further, to around 2.5.
19. It is important to note that the latest revised SRA work (conducted since we undertook our analysis), which will help inform their consultation document, shows a BCR of around 2.0. The strengthening of the BCR in the revised SRA appraisal is due to a different method for calculating the BCR and the revision of their assumptions about the upgrade of the East Coast Main Line. Combining these with our proposed adjustments to the appraisal framework and using our estimates of efficient costs, would increase the benefit to cost ratio to between 3 and 4.

20. In combination, these effects would make a strong economic cost benefit case for an HSL. It is also likely that undertaking an appraisal of the wider economic impacts of the project would further strengthen the case, although it is not possible to quantify the extent to which this would be true – recent academic debate over the issue has produced incremental economic benefit estimates ranging from 3 to 30%..

1. INTRODUCTION

Background

1.1 In September 2003, the first stage of the Channel Tunnel Rail Link, the UK's first high speed railway line, opened, and the Strategic Rail Authority (SRA) is planning to launch a consultation exercise on whether a high speed rail line should be constructed to link London with northern England and Scotland. However, the UK lags far behind other European countries, and many Asian countries, in developing a high-speed rail network.

1.2 A new high-speed line to the north would represent an investment in new railway infrastructure unparalleled in recent British history. However, unlike many other countries, the UK has little experience in evaluating whether high-speed rail lines should be constructed. The Commission for Integrated Transport (CfIT) has commissioned Steer Davies Gleave to advise on whether Britain's system of project evaluation and appraisal adequately takes into account all of the potential costs and benefits of high speed rail; and whether changes should be made to these policies and processes in order to better capture these costs and benefits. CfIT also asked us to evaluate whether the reason other countries have constructed high speed rail lines can be attributed to their different system of project appraisal, or whether this has been due to other reasons (such as the potential market, construction costs, or political reasons).

Project outline

1.3 In order to do this, we have undertaken case studies of five countries that have invested significantly in high speed rail (Spain, Italy, France, Germany and Japan) and one that has not (Australia), in order to understand whether the decision to invest in high speed rail has been a result of:

- Different criteria and processes for project appraisal and decision making; versus
- Differences in transport markets and environments, which mean that either the incremental benefits of high-speed rail are greater than in Britain, or the incremental costs are lower.

1.4 We also make some recommendations on how the appraisal framework applied in Britain might be adjusted to better capture all of the possible benefits of high speed rail. Using as our base the SRA's assessment of the case for a high speed rail line from London to northern England and Scotland, that was available to us at the time of our research, we have estimated the extent to which the appraisal outcome would change if appraisal criteria reflected these recommendations. We also evaluate the potential impact of feasible cost reductions on the outcome of the appraisal.

Note on definitions

- 1.5 For the purpose of this study, we have defined high-speed rail as referring to new build lines handling trains travelling at speeds of 250km/h or more. This is a narrower definition than that used for the European Directive on Interoperability, which included upgraded classic routes with trains travelling at speeds of 200km/h. We have deliberately selected a narrower definition in order to exclude projects such as the West Coast Main Line upgrade and the Swedish X2000 programme, which present different issues from new build high-speed rail infrastructure.
- 1.6 In our analysis of the decision-making framework in Australia, we used a wider definition, in order to include projects to upgrade parts of the classic long distance network for faster passenger services.

Structure of this report

- 1.7 This is the final report for this study. It is structured as follows:
- Chapter 2 summarises the results from our country case studies. This compares the project appraisal criteria and processes used in each countries and also provides a brief summary of the differences between the transport markets;
 - Chapter 3 evaluates the market for high speed rail and the factors that enable the potential benefits of high speed rail to be maximised;
 - Chapter 4 compares the cost of high speed rail projects. It finds that these are far more expensive in Britain than in other countries, and that although part of this difference can be attributed to higher land and labour costs, most cannot;
 - Chapter 5 evaluates possible variations to the appraisal techniques for high speed rail which could be applied in Britain;
 - Chapter 6 makes recommendations on how appraisal in Britain should be changed in order to better assess the case for high speed rail construction;
 - Chapter 7 assesses the impact of possible changes to appraisal frameworks, and possible reductions in costs, on the case for a high speed rail line; and
 - Chapter 8 summarises our conclusions.
- 1.8 The appendices provide more information on appraisal and decision-making processes, and the transport markets, in Britain and the case study countries.

Exchange rates

- 1.9 As most of the cost data we collected was denominated in Euros, this report uses the Euro. Where it was necessary to translate prices between British Pounds and Euros, we use an exchange rate of £1=€1.42.

2. APPRAISAL AND HIGH SPEED RAIL IN THE CASE STUDY COUNTRIES

Introduction

2.1 This chapter outlines the appraisal and decision making process in each of the case study countries, and discusses the key criteria used for appraisal. More detail on the appraisal and decision making processes in each country is provided in the appendices.

Main appraisal method used

2.2 The most commonly used appraisal method is cost benefit analysis. This is used, if not always consistently, in all of the case study countries except Japan, and its use is being considered even there. However, between the countries that use it, there are significant differences in **how** cost benefit analysis is applied, in terms of:

- whether cost benefit analysis is applied for **all rail projects**, as in France, Germany, Spain and Britain, or only for **some**, as in Italy and Australia;
- whether a consistent, or at least similar, methodology is applied **across transport modes**, as in France, Germany and Britain;
- the **scope** of the quantified monetary costs and benefits included in the analysis – for example, whether and how environmental effects are included; and
- the **values** that are used for key inputs, such as accident costs and the value of time.

2.3 Multi-criteria analysis is used rather less consistently. Of the countries studied, Spain, Germany and Britain formally use multi-criteria analysis. However, other countries, such as France, present a non-quantitative explanation of the key benefits of the project, that are not included within the scope of the quantified cost benefit analysis, as a key part of the appraisal process. In practice there is little difference in the resulting influence of these non-quantified factors as inputs to the decision-making process, except in terms of prominence, between this type of qualitative approach and the outputs of multi-criteria analysis undertaken in Britain. Of the countries studied, only Germany assigns numerical scores to the multi-criteria analysis that are added to the result of the cost benefit analysis to give a combined appraisal score.

2.4 Although a number of countries examine the impact of projects on the regional economy and, to a limited extent, on the national economy, within either cost benefit

analysis or multi criteria analysis, only Japan of the case study countries undertakes separate economic impact appraisal using input/output analysis¹

2.5 The main types of appraisal used are summarised in the table below.

TABLE 2.1 MAIN APPRAISAL METHODS USED

Appraisal method	GB	Japan	France	Germany	Spain	Italy	Australia
Financial	✓	✓	✓	✓	✓	✓	✓
Economic cost benefit	✓	✗	✓	✓	✓	(✓)	(✓)
Multi criteria	✓	✗	✗	✓	✓	✗	✗
Economic impact	✗	✓	(✓)	(✓)	(✓)	✗	✗

Purpose of appraisal

2.6 As well as differences in the nature of the appraisal procedure used in each country, there are also differences in the extent to which it forms a central part of the **decision making process**. In the extreme cases:

- In Germany, the economic appraisal appears to directly determine whether projects are included in the national transport infrastructure plan – although in some respects the appraisal criteria appear to have been constructed to favour, in advance, specific anticipated policy outcomes; whereas
- In Spain, economic appraisal is required by law but it only determines the prioritisation of projects and more detailed aspects of them, such as the route to be taken for a high speed rail line. The main policy commitment to the scope of the high-speed network has already been taken – appraisal is used to help inform the “when” and “how” of programme delivery, rather than determine *whether* the investments should be undertaken at all.

2.7 The fact that economic analysis is an element of, but is not a substitute for, the key policy decisions to undertake investment in high-speed rail, has been addressed specifically in reports for the governments in France and Japan. High-speed rail projects are major projects of national importance, and decisions on whether or not to proceed are likely to be based on a number of issues other than the appraisal

¹ Input-output analysis attempts to capture all the flows between sectors in the economy and flows to final demand (consumption, investment and exports) The core tool is an input output table - essentially a flow table that analyses the flows of expenditure between sectors. Relationships between variables such as employment within all sectors or any given industry can be examined in relation to changes in final demand. Specifically, it provides a quantitative estimate of the impact when one or more of these variables change within an industry on the other industries. It analyses the direct effects (initial effect), indirect effect (inter industry) and induced effects (the impact taking into account the indirect effects including spending of additional earnings).

framework used – including affordability constraints. Decisions as to whether to proceed with a high-speed rail project will ultimately be taken at the highest levels of government, and the economic appraisal will clearly only be one input to such decisions.

Scope of appraisal

- 2.8 A report conducted for the Ministry of Finance in Japan makes a key point that cost benefit analysis cannot be sufficient as a basis for decision-making because it is not possible to put monetary values on all impacts. Although some benefits – such as time savings – are always included in cost benefit analysis, other benefits, such as environmental effects, may not be. It is clear that in some of the countries we have studied, analysts have tried to put monetary values on as many inputs to the appraisal as possible, but this has led to the use of inputs that do not have a clear economic rationale and, in some cases, which are counterintuitive.
- 2.9 A key problem with appraisal in Britain, which has previously been highlighted by CfIT, is that although some variables (such as noise and emissions) are quantified, they have not, historically, had monetary values placed on them and therefore are not included within the benefit to cost ratio or other monetised numerical outputs of the appraisal. Other countries tend to include the monetisation of at least some environmental effects in cost-benefit analysis.
- 2.10 In our experience, there is a tendency to assume that the benefit to cost ratio is the main output of an economic appraisal, but this should not be the case when some significant economic costs and benefits and benefits cannot be as reliably quantified. Recent SRA, DfT and Treasury appraisal guidance does advise that attempts should be made to place monetary values on these and other elements to the appraisal: this is encouraging, and it will be interesting to see the results of this approach once it has been applied to the appraisal of a major project. This could potentially have a significant impact on appraisal of rail versus air transport solutions.
- 2.11 Key differences between appraisals in the case study countries include:
- In Victoria in Australia, a key policy objective was to encourage economic and population growth in country areas instead of in Melbourne. The cost benefit analysis therefore attempted to place economic values on population and business being located away from the city.
 - Regional economic benefits are also quantified in Spain and Germany, and estimates of the employment generated by a project are included at least in part in Spain, Germany and France.
 - All the other case study countries attempt to value at least some environmental effects and include these in the cost benefit analysis. Therefore the recent revised Green Book and SRA guidance on appraisal, which state that these should be

counted, have the effect of bringing the UK into line with existing international practice.

- Britain does not count the benefits of high-speed rail to non-residents within the cost-benefit framework – whereas Germany applies a multiplier to international projects, producing the reverse effect. France assesses a cost benefit case both with and without the benefits to non-residents. As funding and rail infrastructure planning moves towards a pan-European framework (with the initiatives such as the proposed revision of the TEN-T network, the development and roll-out of ERTMS technologies for new lines, and interoperability investments to facilitate the full liberalisation of international freight services now being considered), there is a need to review how and when non-UK benefits are included in major scheme appraisals. Some of these effects would be picked up through an economic impact appraisal – for example, the impact on tourism.
- Spain and France count additional tax revenue as a benefit, whereas the other countries studies generally do not. However, in Britain, the impact of a project on indirect tax revenue is evaluated by the government, and this may work against public transport projects because they will tend to reduce revenue from taxes on petrol.
- Integration with other government policies was an explicit objective in multi criteria analysis in some of the countries studied, but none used integration with other modes of transport as an objective in its own right. However, at least in the European countries studied, transport planning is already integrated between modes and it appeared likely that such integration would be assumed as a prior requirement for any new investment.

2.12 The main factors included in cost benefit analysis are compared in the table below.

TABLE 2.2 COMPARISON OF COMPONENTS USED WITHIN COST BENEFIT ANALYSIS

Criteria	Britain	France	Germany	Spain	Victoria, Australia
Time savings	✓	✓	✓	✓	✓
Safety	✓	✓	✓	✓	✓
Other modes' opex	✓	✓	✓	✓	✓
Environment	(✓)	✓	✓	✓	✓
Road congestion	✓	✓	✗	✗	✗
Comfort	See note 2	✗	✗	✓	✗
Severance	(✓)	✗	✓	✗	✗
Tax revenue	Not in appraisal. See note 3	✓	✗	✓	✗
Regional economy	✗	✗	✓	✓	✓
Employment	✗	✗	✓	✓	✗

Values of key inputs

2.13 The values of key cost benefit analysis inputs vary significantly between the case study countries. The figures below compare the value of time (for both road and rail) transport, and the value of a life. The comparison of values of time is derived on the following basis:

- For Britain, where different values are used for working and non-working time, it is assumed that 6% of rail passengers are travelling during working time⁴;
- For France, where different values are used by distance and class of travel, a journey length of 400km (typical for high speed rail) and 25% of travel in 1st class have been assumed.

² Crowding effects are evaluated, but no wider evaluation of comfort

³ The impact on overall tax revenue is not evaluated, but the government conducts an analysis of the net cost to government of a project which will include an assessment of any change in indirect tax revenue.

⁴ This is the standard value recommended by DLTR for rail. See the Transport Economics Note.

FIGURE 2.1 COMPARISON OF VALUES OF TIME USED

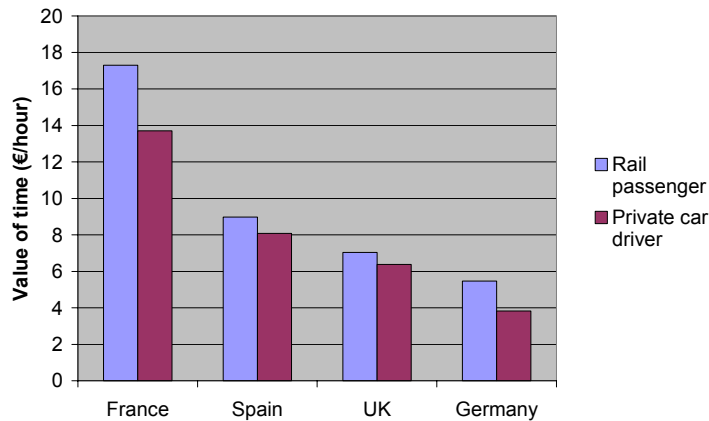
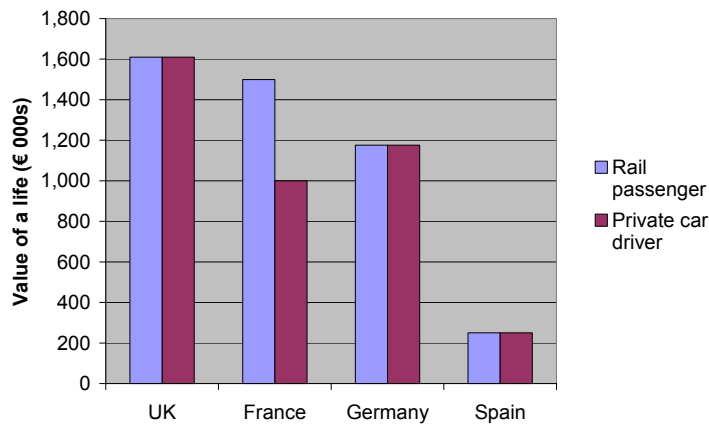


FIGURE 2.2 COMPARISON OF VALUES OF A LIFE USED



2.14 The figures demonstrate that the values of time used in Britain are materially lower than those used in France and Spain, particularly when differences in income per capita are taken into account, but much higher than that used in Germany. In contrast the value of a life used in Spain appears to be very low, but those used in France and Germany are also significantly lower than in Britain. Some of the cost differences discussed later in this report are undoubtedly due to differences in the approach to rail safety investment; these differences are potentially consistent with the relatively high value placed on safety benefits in Britain.

2.15 The high value of time used in France results in part from a formula that relates the value to the length of the journey (subject to maximum and minimum values). No theoretical basis is cited for this approach, but it is justified on the basis of empirical studies. Even the minimum value of time for inter-urban transport is higher in France

than that used in Britain. However, unlike Britain, France uses separate values for short distance (urban and rural) and inter-urban transport: the values of time for short-distance transport are much lower and similar to those used in Britain. Values of time are also higher for the Paris area than the rest of the country. Again, the substantial investments made in French high-speed rail (relative to Britain) are not inconsistent with this approach to valuing the time saving benefits delivered by such projects.

- 2.16 It appears reasonable to assume that long distance passengers and those making journeys in the capital city will indeed have higher values of time, on average. Therefore, there is a risk that use of a uniform value could skew appraisals to favour infrastructure projects that facilitate shorter journeys, rather than the longer-distance journeys enabled by projects such as high-speed lines. A similar argument could be made that the uniform value of time skews appraisal towards favouring investment in rural areas or secondary cities rather than projects in London: this will be an important issue in the appraisal of Crossrail. Britain has used project-specific values of time on some other projects in the past, including appraisal of the Channel Tunnel Rail Link, and there would be a strong case for doing this in the appraisal of the high-speed line – but only within the context of a consistent application of the principle to all rail projects, as in France.

Shadow prices

- 2.17 In many of the countries, some use of shadow prices was required in the appraisals. Spain represented the most extreme example of this: a significant proportion of the employment costs associated with a project were discounted, but simultaneously, employment was counted as a benefit, measured in terms of the employment cost.
- 2.18 The use of shadow prices for labour costs may be reasonable in regions with high unemployment where there is control over labour costs (such as minimum wage and maximum working week legislation) – including many parts of Spain and Germany – but would generally not be reasonable for the UK, where many of the skills required for high speed line construction are actually in short supply or might have to be imported from abroad. In these cases, market values will properly represent resource costs to the economy. Our view is that it would not be justifiable in any event to treat employment costs as a benefit as well as a cost in appraisal if the cost element was reduced through use of shadow prices.
- 2.19 In Britain, the Green Book currently states that market prices rather than shadow prices should generally be used.
- 2.20 The requirement to calculate (separately from the appraisal) the net impact of a project on the Exchequer, including indirect tax changes, should encompass wider effects on all tax revenues. However, if a project involves transferring passengers from road to rail, this may serve to reduce the case for investment in rail, because petrol duty revenues would be lower, to the extent that such transfers are evaluated outside of the

cost-benefit analysis calculations. We discuss the treatment of tax at greater length in Chapter 5.

Appraisal period

- 2.21 The Green Book guidance for Britain is that appraisal should cover the “useful lifetime” of the assets concerned. In practice high-speed rail involves a complex mixture of dedicated assets of varying economic lives – from equipment and systems with lives of 10-30 years, to permanent way with (for practical purposes) indefinite economic lives.
- 2.22 SRA guidance is that residual values should be calculated if the appraisal period is shorter than the useful lifetime of some of the assets. This is consistent with practice in most of the case study countries in which appraisal periods were project-specific and also generally depended on the lifetime of the relevant assets. The main exception to this is France, where the appraisal period is set at a fixed 20 years, although a residual value is also calculated for assets with an expected life greater than this and the life of permanent way (the basic route and structures for a high speed line) is assumed to be infinite. Arithmetically at least, the assumptions concerned should not affect the outcome as long as the residual values are correctly calculated.

Risk and optimism bias

- 2.23 The revised Green Book requires appraisers to make significant provision for optimism bias, with a particular emphasis on the capital costs of projects. This allowance can equate to 66% of projected (expected) costs for non-standard civil engineering projects, such as new rail construction.
- 2.24 There appears to have been some confusion amongst some of those outside government applying the Green Book as to whether risk and contingency should be evaluated separately from optimism bias: our view is that it should be included within this but we are aware that there have been different interpretations in practice and that on occasions **all three** have been quantified (risk, contingency and optimism bias), increasing the appraisal cost value by over 100%. We understand that the base costs used in the HSL appraisal included some scheme-specific risks, and therefore there was also some double-counting in this case.
- 2.25 No other country made anything like an equivalent allowance for risk, contingency or optimism bias, although we were told that cost estimates tended to include a 5-10% risk margin. Equally however the high figures in Britain in part reflect experience with previous project outcomes, where actual capital expenditures have typically exceeded the estimates on which appraisals and investment decisions were taken by a large margin. In a number of the case study countries, actual high-speed rail projects have in

recent times experienced significant budget overruns, a fact which has generally not yet been fully reflected in the risk margins adopted in the appraisal frameworks.

- 2.26 Nevertheless, despite the number of major British civil engineering projects that have substantially exceeded their projected budgets, our view is that it is better to evaluate and mitigate risks in a more project-specific way than to make large standard adjustments to the appraisal. This can be particularly injurious to the case for capital-intensive projects such as high-speed rail, relative to others where ongoing costs, not subject to the adjustment, dominate.
- 2.27 While the Green Book does allow for this margin to be reduced on further analysis, there is an obvious problem with capital-intensive projects that such further analysis may never be undertaken if they are ruled out at an early stage when the standard allowances are applied. It would be unfortunate if it were ever decided not to proceed with a major project as the result of application of an excessive optimism bias estimate at an early stage in the appraisal. Our view, as discussed below, is that the cost estimates that have been made for the high-speed line are probably too high rather than too low.

Decision making criteria

- 2.28 In most cases, the key output from the economic appraisal, for use by decision makers, was a benefit to cost ratio. The discount rate used to assess the benefit to cost ratio was 3% in Germany, 3.5% in Britain, 4% in Japan, 6% in Spain and 8% in France (although, as explained below, this is applied differently and is therefore not directly comparable to the others). In Italy, there is no standard discount rate and rates of anywhere between 4% and 8% had been used. The substantial reduction in the British discount rate from 6% that was confirmed earlier this year therefore moves it from being one of the highest in use to one of the lowest. Other things being equal this should favour projects with higher benefits far into the future, like high-speed rail. However, the use of a lower discount rate in Britain is offset by the significant adjustments for optimism bias: although a low discount rate improves the case for high speed rail, the use of a 6% rate (as in Spain) but corresponding lower contingency allowances of 10%, would actually increase the benefit to cost ratio of a high speed project (in the example we have tested, from 1.4 to 1.6).
- 2.29 The main exceptions to the use of a cost benefit ratio as a decision-making criterion were:
- France, where the output of the economic appraisal used was an assessment of the internal rate of return of a project; this has to be at least 8% for a project to go ahead. As discussed in Chapter 5 below, the BCR should be a better guide if there is a need to prioritise the use of scarce capital; and
 - Germany, where the results of the spatial impact assessments are given a numerical value, which is then added to the benefit to cost ratio to give a

combined appraisal score. This has the advantage that it ensures that all factors are taken into consideration by decision makers but a key problem is that it is difficult to be know whether the implicit monetary value this assigns to the result of the spatial impact assessment is correct. Nevertheless, as discussed above, key inputs to a conventional cost benefit analysis will also be very uncertain and the uncertainty of valuing other impacts should not necessarily be a cause for avoiding the practice. .

- 2.30 Given the scale of high-speed rail projects, the ultimate decision to proceed is a political one. It was clear in all countries that there was a clear distinction between the appraisal process and outcome and the ultimate political decision: uniquely of the countries studied, Japan has historically rejected the idea of carrying out formal economic appraisal, precisely **because** it cannot substitute for this political decision.
- 2.31 The criteria used for these final political decisions are difficult to quantify on an objectively comparable basis. However, one clear difference, from examining the limited information that is in the public domain, is that there has been more emphasis on economic effects of transport projects, including regeneration effects, in the final decision-making than in the prior appraisals. Technological advance and national pride issues have also been stressed by politicians, but are not explicitly included in appraisal. Other than this, the time savings and improved service offered by high-speed rail have been the main influencing factors in decision making, at least as far as can be evaluated from public documents, and these should be fully assessed by the conventional appraisal process. In any case, we are not aware of analysis underpinning the subjective criteria used for decision making.
- 2.32 However, in a number of countries, the appraisal criteria appear to have been developed in a way that skews the appraisal towards favouring in advance particular types of decisions; this implies that appraisal has been designed to fit a political decision rather than the political decision being based on the appraisal. For example, the analysis of the appraisal process in Germany showed that the criteria used had the potential to skew the result towards rail:
- the criteria used for the spatial impact and environmental risk appraisals would skew the results of the appraisal towards rail transport – although not necessarily unjustifiably; and
 - the use of a different value of time for rail can under some circumstances be justified, but the justification used in the German appraisal guidance is not in our view reasonable.
- 2.33 The criteria can also be used to skew the results of an appraisal in favour of certain **regions**. In Italy, “benefiting the South” is an explicit objective for all nationally funded transport projects. In Germany, the appraisal criteria do not specifically state that the project should benefit the former East, but this result follows from the criteria used. Again, this demonstrates that political objectives can determine the appraisal as much as the appraisal is used to make (political) decisions.

Wider economic effects

- 2.34 Although many countries evaluate, as part of the appraisal process, the impact that transport investments could have on the **regional** economy, none of the countries studied have attempted to analyse explicitly the **net** impact that high-speed rail programmes could have on the **national** economy. Such national effects may, nonetheless, be cited as important in decision-making processes – for example, in Japan. There has also to date tended to be no assessment of the impact of transport projects on the national economy in Britain. In Chapter 5 below, we discuss in more detail whether and how assessment of wider economic benefits should be carried out in evaluation of a high-speed line, particularly where it is inherently part of a national programme due to its size, spatial impact or future ramifications.

Other factors impacting on the case for high speed rail

- 2.35 The market for high-speed rail is different in different countries, reflecting demographic and socio-economic differences. The costs of new construction also vary significantly between countries, and this inevitably impacts on the strength of the underlying case for high-speed rail, whatever the evaluation approach adopted. These issues are discussed in Chapters 3 and 4 below.
- 2.36 In the past, there have been significant variations in how willing countries have been to make commitments to invest in high-speed rail projects *in principle*, regardless of the economic case for doing so. In the 1980s and the early 1990s, the British government's explicit objective for rail transport was that the railways should consume less subsidy to deliver pre-defined timetables. Whilst cost benefit analysis was used to determine what incremental road investment should take place, and where, all rail investment had to be justifiable on the basis of returns from commercial revenues at the Government's then-standard 8% discount rate.
- 2.37 In contrast, in France, the decision to construct the first TGV line followed pressure from SNCF (the railway company) and Alstom (the manufacturer), which in part stressed the importance of technological progress and national prestige – reminiscent, perhaps, of the discussions over Concorde.
- 2.38 However, appraisal and decision-making criteria have now, at least to an extent, converged. Both Britain and France (and the other case study countries except Japan) now evaluate projects largely on the basis of economic cost benefit analysis (although the criteria are different), and use this as at least one important common factor in the decision-making process.
- 2.39 Affordability is also clearly an important issue for high-speed rail projects and this also varies between countries. In Spain, for example, a high proportion of the costs of high-speed rail construction has in the past been paid for by the European Regional

Development Fund. In some cases this contribution has been up to 65% of project costs. It is possible that some such funding might be available for elements of a British high speed rail programme, and CTRL received some European funding, but the contribution could be much lower.

- 2.40 Under these circumstances, the European Commission requires the country concerned to carry out economic appraisal, but as the Commission's guidelines for economic appraisal are quite broad, there is a risk that the purpose of the appraisal becomes to convince the Commission that the project should go ahead (and thereby meet domestic affordability criteria), rather than to be a way for the country to decide how to best allocate its own resources. Under these circumstances, there is a risk that the appraisal will become less objective. As noted above, to the extent that European funding of strategic transport investment will remain a significant feature of the single market in future, there will be benefit in harmonising the relevant domestic and European economic appraisal processes and criteria – for example in the valuation of national and non-national benefits.
- 2.41 Finally, the financing method selected for high-speed rail projects will also impact on affordability; the cost levels discussed in Chapter 4 below do not include any financing costs (which should of course be excluded from economic cost-benefit analyses, as explained in chapter 5 of the Green Book).
- 2.42 In recent years, governments have sought in a few cases to undertake high-speed rail programmes (and other major transport projects) as public private partnerships (PPP). However, it is clear that potential funding agencies are very reluctant to take on risks associated with rail projects, particularly traffic and demand risks, which are typically influenced by wider transport policies and economic and land-use development over the longer term. The use of a PPP structure as a means to overcome government affordability constraints may enable projects to proceed, but if this is done, it is important to recognise that there are some risks that the private sector cannot efficiently manage, except at significant premia which can drive up the real resource costs of the project.
- 2.43 The consequence of this, in the case of the Channel Tunnel Rail Link, was that government guarantees were ultimately necessary for finance to be raised from the markets. Several other European rail infrastructure projects, undertaken by publicly owned companies, have also drawn on private finance, but again with an implicit or explicit state guarantee. The appraisal process should only seek to quantify the incremental (or decremental) net resource costs associated with the proposed risk allocation and funding solution, where this is engendered by affordability constraints.

Conclusion

- 2.44 Our research demonstrated that although there were some important differences in the appraisal processes and the criteria used in the different countries, the basic appraisal

tools in most of the countries studied were financial analysis and economic cost benefit analysis. In the economic cost benefit analyses, the most significant benefit of high-speed rail projects was generally the time savings a project could enable – and in this area, differences in the values of time and discount rates assumed were at least as significant as different methodologies and approaches. Although there are some possibilities, discussed in Chapters 5 and 6 below, for improving the UK appraisal system for high speed rail projects, their impact on the appraisal outcomes (relative to changes in the values of the input benefit and cost parameters) is likely to be relatively limited.

3. THE MARKET FOR HIGH SPEED RAIL

Introduction

3.1 It was clear from the country case studies undertaken for this project that the potential market justification for high speed rail has, historically, been stronger in some other countries than in Britain. This section evaluates the impact of differences in the transport market on the case for high-speed rail in each country. Key factors, which are discussed in detail, are:

- The distances between population centres: high speed rail offers an advantage for journeys over medium distances but relatively little incremental benefit over either very long or very short distances;
- The competitiveness of other transport modes, including the conventional rail network;
- Demand and capacity: many countries have built high-speed rail lines as much for reasons of capacity as for reasons of speed (securing incremental passengers rather than journey time savings for existing passengers). The benefits of new construction will be greatest when this new capacity can be highly utilised early on – particularly when relatively high discount rates are used; and
- Population distribution: the distribution of population around city centres relative to more distant suburbs, will affect the potential benefits of high speed rail.

Journey times and distance

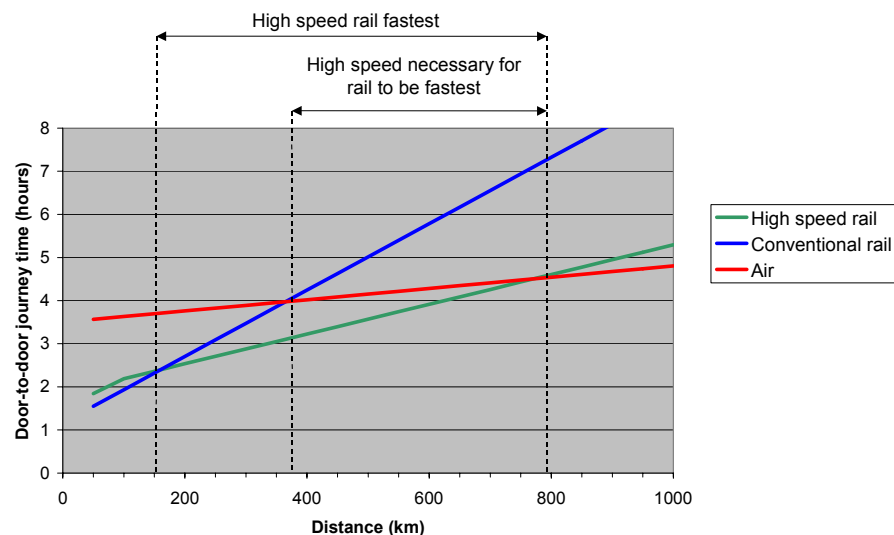
3.2 High-speed rail enables journeys over medium distances to be made quickly. However, it offers relatively little advantage for either very short or very long journeys:

- For shorter journeys, even conventional rail is faster than air travel for door-to-door journeys, and high-speed rail offers little incremental advantage because of the need to accelerate to the maximum speed. In fact, journeys via high speed train may be *slower* than via conventional train, because high speed trains often have to serve new stations that are less well-located; and
- For long journeys, air is faster and the proportionate impact that high-speed rail can make to the pre-existing air/rail journey time distances is smaller.

3.3 The exact range of journeys over which high speed rail is competitive, at least in terms of journey time, clearly varies depending on assumptions about time required for station and airport access, check in, etc. With the recent emerge of a dynamic aviation market in Europe, longer-term projections as to total air journey times are becoming less easy to predict with confidence. The market advantage of rail also varies dependent on the speed and reliability of each mode – in particular, whilst 300km/h is fairly typical for high speed rail operation worldwide, conventional rail speeds vary significantly between routes. However, this shows that, in general:

- for journeys of less than about 150km, high speed rail offers little advantage over conventional rail and may, depending on the location of stations, be less convenient for most passengers;
- for journeys of approximately 150-400km, rail is faster than air travel even if there is no high speed line, and high-speed rail will instead serve to make that advantage more robust;
- for journeys of more than 400km, high speed is necessary for rail to become the fastest mode and thereby make significant mode switches realistic; and
- for journeys of more than about 800km, even with dedicated high-speed infrastructure available for the entire route, air travel is faster. The competitive rail markets become more niche-focused (night services, car transport services, etc).

FIGURE 3.1 COMPETITIVE ADVANTAGE OF HIGH SPEED RAIL



3.4 The case studies demonstrated that there is a strong correlation between whether countries have extensive high speed rail networks (either in service or under construction) and whether they have significant population centres that are distances apart that makes high speed rail a competitive transport option:

- In France, distances are ideal for high-speed rail. The majority of journeys are to/from Paris; 8 out of the 9 other major cities are more than 400km away; and all except Nice are within 800km.
- In Spain, distances are also ideal for high-speed rail. The largest city, Madrid, is in the centre of the country and other major cities are generally on or near the coast, 400-600km away.
- In Japan, many key cities, such as Osaka, Nagoya, Kobe and Kyoto, are also in the range of distances from Tokyo for which high speed rail is the most competitive mode;

- In Germany and Italy, there are a number of cities in the range of distances for which high speed rail is necessary for rail to be competitive, but many other cities are sufficiently close together that high speed rail offers little advantage; and
- In Australia, the biggest cities are generally so far apart that high- speed rail could not be competitive, although with 350km/h technology, a link from Sydney to Melbourne could in principle be possible.

Competitiveness of other transport modes

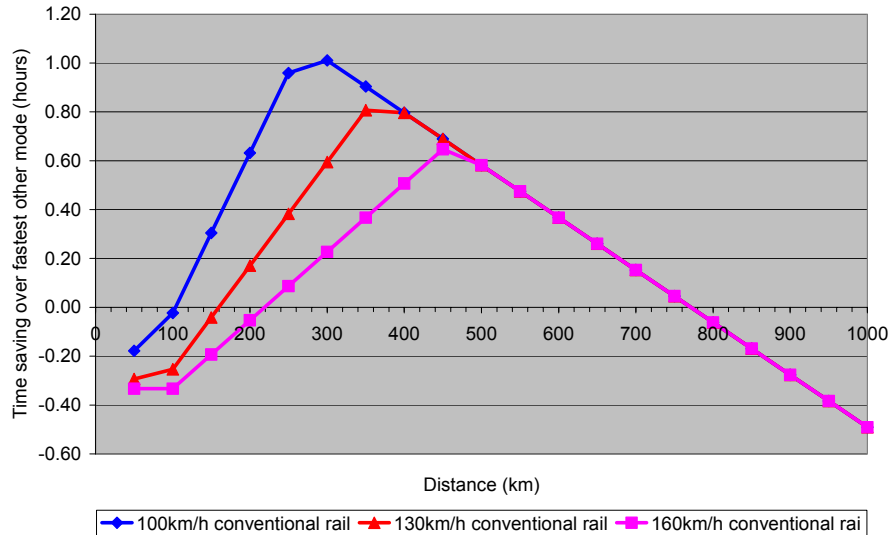
Conventional rail network

3.5 The above analysis was based on a ‘typical’ conventional rail network, assuming that conventional rail would be able to sustain a standard operating speed of 130km/h plus some time for acceleration/deceleration. However, the quality of conventional rail routes varies significantly between countries, and between different routes within the same country.

3.6 The figure below illustrates the effect this has on the potential market for high speed rail, by showing the total journey time advantage that high speed rail offers passengers over the fastest alternative mode, depending on the distance travelled:

- With a typical rail operating speed of 130km/h – which is fairly representative of many main line routes around Europe, and is also fairly appropriate for the West Coast Main Line in Britain – high speed rail offers a maximum benefit of 45-50 minutes’ saving, for distances of around 350-400km (such as London to Preston or Paris to Brussels).
- Where the standard speed that conventional rail can operate at is closer to 100km/h – more representative of Spain or England south of London – high speed rail can offer journey time advantages of 1 hour or more over all other modes, and therefore could offer benefits for shorter journeys.
- Where the standard speed that conventional rail can operate at is 160km/h, such as the East Coast Main Line in Britain, the maximum journey time advantage offered by high speed rail is about 35 minutes for journeys in the region of 450km, such as London to Newcastle.

FIGURE 3.2 JOURNEY TIME ADVANTAGE OF HIGH SPEED RAIL



- 3.7 This is a very simplified indicator of the speed benefit of high-speed rail. Where it is possible for high speed rail to use existing city centre stations – as the SRA proposes for a high speed line in the UK in most cases – or for there to be more than one station in/around major cities (as for conventional rail on many routes), the potential benefit of high speed rail is greater⁵. In addition, although high-speed rail is not significantly faster than air travel for some journeys, the overall journey may still be preferable for passengers. For example, on the Paris to Marseille route, at the upper limit of the distance range over which where rail can be competitive with air, rail has nonetheless captured 60% of the market, despite air travel offering a wider range of travel options (in terms of airports served).
- 3.8 A better conventional rail network also offers some advantages for high-speed rail construction. Where the conventional network has enough capacity for existing approaches to city centres to be used, construction costs are significantly reduced because much less tunnelling is required. In France, Germany and Italy, it has been possible to use existing routes in this way to gain access to key termini. In Spain and Japan, the poor quality of the existing rail network, and in particular the use of a different gauge, has increased the total cost of high speed rail construction, because it has been necessary to create new routes into city centres. If Australia were to construct a high speed rail line, it would also need to build new routes on the approaches to major cities.
- 3.9 In the Britain, it is likely that significant work would be required on the final approaches to key cities, and the costs of this work would increase if the peaks for long distance and commuter traffic overlapped, if these were to share the same tracks.

⁵ The use of existing stations may increase the time required for acceleration to high speed, although in practice the effect of this would be minimal.

However, as the main routes north of London are relatively good, it would probably not be necessary to build new routes into the centre of London, as has been needed for the construction of CTRL. Overall, the relatively good quality of the British rail network north of London would be of benefit in high speed rail construction, because it would allow high speed trains to provide fast services beyond the core new route. The high speed line itself would be used to bypass a number of the key capacity constraints on the existing network.

Other transport modes

- 3.10 The competitive strength of other transport modes also varies significantly between the case study countries.
- 3.11 Over long distances, the main competitor for high speed rail is air, and the recent development of low cost airlines presents a serious challenge to rail operators, many of whom have historically faced little pressure to contain their costs. All of the case study countries have significant domestic air networks but in France in particular, high domestic air fares, which have been sustainable as a result of limited competition, probably have increased the demand for high speed rail travel. Where low cost airlines have recently begun to compete against high speed trains – for example on the Paris-Cologne route and some routes in Japan – they have reduced rail’s market share significantly⁶. A high speed rail line in Britain would probably face more intense price competition from airlines than high speed rail lines in the other case study countries.
- 3.12 However, capacity constraints at British airports, particularly those in southeast England, may reduce the intensity of this competition over time – depending on whether how much, if any, additional runway capacity is provided. In contrast, it is likely that high speed rail lines in other countries will face more competition from air transport. Although it is sometimes argued that high speed trains can only mitigate a tiny proportion of air travel growth, because they cannot serve most air destinations, this is rather misleading: many passengers (primarily holidaymakers) chose their destinations in part on the basis of the cost and convenience of travel, so they may chose destinations accessible by rail or road if air travel is too expensive or inconvenient.
- 3.13 Our research did not show a clear relationship between car ownership and the construction of high speed rail routes. Car ownership in France, for example, is higher than in Britain. However, there was some relationship between high speed rail construction and the extent to which road tolls are levied. The two countries with the largest high speed rail networks (France and Japan) are also the countries that levy the highest motorway tolls. Tolls are also levied in Italy, but at a lower rate, and in Spain,

⁶ Traffic between Paris and Cologne on Thalys, the high speed rail operator, fell 14% after the entry of Germanwings, a low cost airline.

but on a smaller proportion of roads. In Germany, Britain and Australia, motorway tolls are generally not levied.

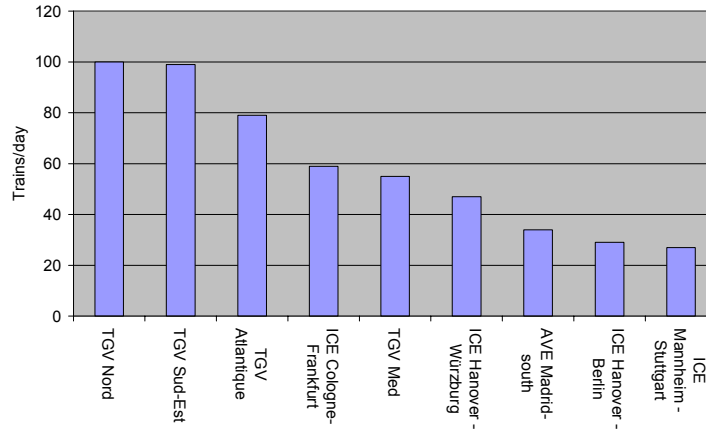
- 3.14 This discussion illustrates how the case for high-speed rail can be substantially enhanced or undermined by policy changes affecting other modes some time **after** the rail investment commitment is made. Clearly, tolling Britain's motorways could (but need not) alter their users' generalised costs, and thereby strengthen the case for rail alternatives in Britain. If runway capacity in the South East is constrained by Government decisions, the response of the aviation industry in coming years will be affected by future European and UK policy on issues such as slot allocation, airport charges, traffic distribution rules, and the economic structure, ownership and regulation of BAA plc. It will also be affected by future developments in the low cost carriers' business models, which have transformed the benefits and risks of regional aviation in last decade.

Demand and capacity

- 3.15 High speed rail offers very high passenger capacity. Signalling systems can usually handle a train approximately every 4-5 minutes; with up to 1,000 seats per train, on a double TGV Duplex unit, a high speed rail line can, in theory, carry the same number of passengers as a Boeing 737 every 45 seconds, or three parallel motorways. High speed trains in Japan have even higher capacity (up to 1,600 seats per train). Therefore, for a country to realise the maximum benefits of investment in high speed rail, not only must there be demand for journeys over a particular range of distances, but that demand must be very large.
- 3.16 It was also clear from the international case studies that a key reason that many countries have constructed high speed rail lines has been to provide extra capacity, rather than speed. Capacity was the main justification for construction of the world's first high speed rail lines, from Tokyo to Osaka and Paris to Lyon. Capacity continues to be the main reason for Italy to construct high speed lines; on some routes, such as Rome to Naples, the gain in speed will be relatively small. The construction of high speed lines provides additional capacity for many different types of trains, not just fast InterCity trains, because it frees capacity on the conventional routes for freight and regional passenger services. For example, in Britain, the opening of CTRL Phase 1 has enabled some expansion of domestic trains on the conventional line from London to south and east Kent, because Eurostar trains have been transferred to dedicated track.
- 3.17 Within Europe, the full theoretical capacity of high speed rail lines, which is typically 120-160 trains per direction per day, is never used, although capacity is often fully utilised during peak periods. However, the viability of a high-speed rail route is clearly dependent on there being sufficient demand to use a significant proportion of the available capacity. The figure below shows the trains per day operated on a number of key European high-speed lines. All routes handle at least 30 trains per

direction per day and most handle 50-100. The Shinkansen routes in Japan also carry very heavy traffic, with up to 10 trains per direction per hour.

FIGURE 3.3 TRAINS PER DIRECTION PER DAY ON HIGH SPEED LINES

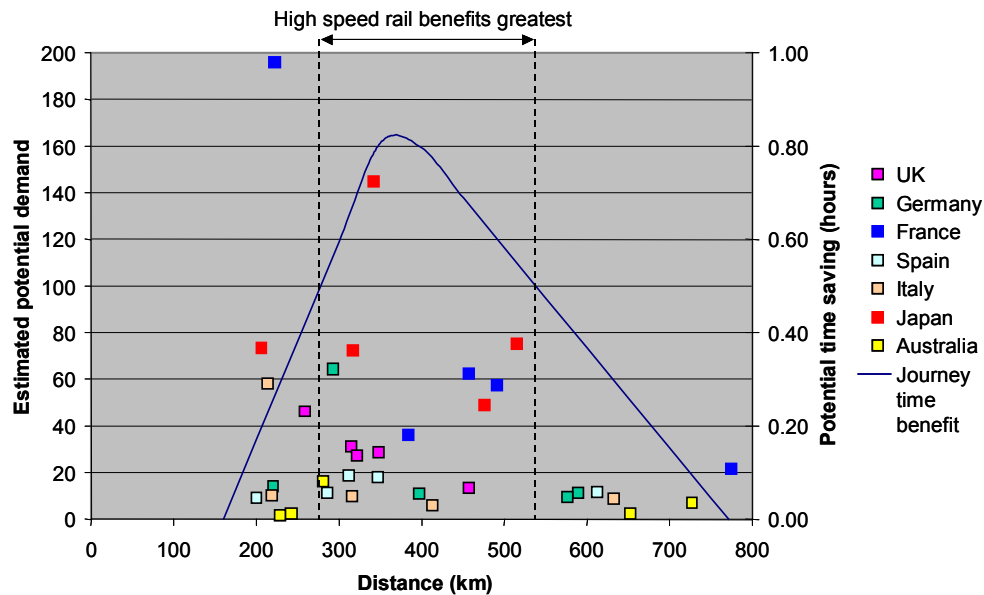


- 3.18 In terms of the capacity benefits of high-speed rail, the case for construction of high speed rail in Britain now appears strong. Britain should be able to utilise a very high proportion of the capacity on at least the southern part of a high speed line (from London to the Midlands); in fact, the SRA's analysis shows that if the high speed line served both the northeast and the northwest, the southern part of the line would be capacity constrained in the medium term. It is likely that capacity utilisation on the northern sections would be lower. It is interesting to note that the case for construction in Britain on grounds of capacity would have been much weaker in the 1970s and 1980s, when other European countries were planning their first high speed rail lines, because there was much more spare capacity available on the conventional rail network at that stage.

Combined analysis of the potential demand and benefit

- 3.19 As discussed above, the key benefit of high-speed rail is its ability to move a large number of people quickly over medium distances. This section evaluates the combined effect of these factors in the case study countries.
- 3.20 The figure below compares an estimate of the potential demand for rail on the five potentially biggest routes of at least 200km, in Britain and the other six case study countries, transposed onto a graph demonstrating where high-speed rail offers a significant potential journey time advantage. Potential demand, shown on the vertical axis, is used here as an indicator of the potential benefits of the high speed line. The assessment of demand has been based on a simple gravity model that we have developed but which we have not sought to calibrate; although we would not expect this to predict demand on any individual route accurately, it should indicate the potential magnitude of demand in each case.

FIGURE 3.4 THE POTENTIAL DEMAND FOR AND BENEFITS OF HIGH SPEED RAIL



- 3.21 The use of a gravity model is a very simple method of comparing demand for travel between routes in different countries and ignores the fact that there are many more complicated factors driving travel demand. However, this does confirm that, of the case study countries, the potential demand for high speed rail travel is likely to be greatest in France and Japan. At least on the basis of this analysis, there appear to be a number of potential routes in Britain, but the case is rather less strong than in France or Japan.

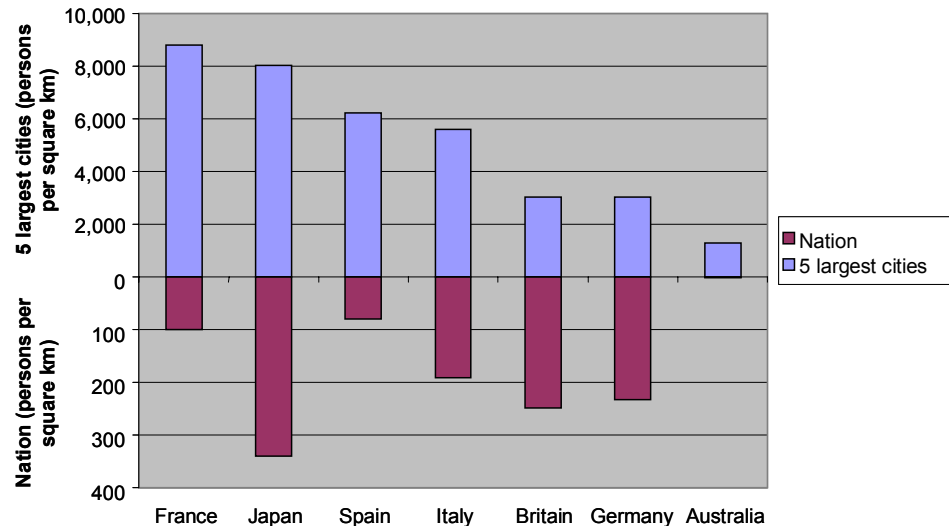
Distribution of population

Population density

- 3.22 All types of rail – conventional and high speed – are better at serving markets where demand is located densely around key nodes. High speed rail can serve a higher proportion of the potential market in countries such as Spain or France with densely populated cities than in countries such as Australia or the USA, where most of the urban population lives in lightly populated suburbs. In contrast, high speed rail construction tends to be less politically controversial and expensive in countries where the areas between major cities are lightly populated.
- 3.23 The figure below compares the case study countries. The blue bars above the axis show the population density of the five largest cities in each country; the purple bars show the population density of the country as a whole. The combined bar provides a simplified guide to the suitability of a country for high speed rail – the higher this is, the more the economic geography is “friendly” to high-speed rail. This demonstrates

that population densities are more suitable for high speed rail in France or Spain than in Germany or Britain, and that in Japan, while high-speed infrastructure is costly and disruptive (relative to Britain) its demand benefits are significantly higher.

FIGURE 3.5 POPULATION DENSITY



Location of main population centres

- 3.24 As discussed above, high speed rail lines can provide very high capacity and the benefits of investment will be greater if this capacity can be well utilised. It would be very unusual for there to be such great demand for travel between two individual cities that a dedicated high speed line can be justified: the line must also be able to handle passengers to/from other cities, either along or beyond the core route. The case for construction of high speed lines is likely to be stronger if population is located in corridors that can be served by a single line.
- 3.25 The distribution of population in some countries, particularly France and Italy, has enabled maximum use to be made of high-speed rail investment. For example, when the Paris to Lyon TGV line was constructed, it was possible, using branches and the conventional rail network, also to serve many other destinations including Lausanne, Geneva, Marseille, Nice and Montpellier; the same route now also carries trains to/from Brussels and (in the summer) London. Italy's 'long and thin' nature means that the Rome to Florence high speed line is of benefit to journeys between a large number of different cities, not just these two. Similar benefits arise in Japan.
- 3.26 In contrast, in Germany, the distribution of population in a large number of medium sized or small cities that are dispersed around the country means that few long sections of line have very high traffic; as a result, it has not been possible to get the same utilisation from high speed rail investment there. Similar issues apply in Spain and

Australia. The distribution of population in Britain, along a ‘long and thin’ country, would enable a high speed railway to serve a relatively high proportion of the population.

Conclusion

- 3.27 Our analysis of the benefits of, and market for, high speed rail shows that high speed rail provides travel time benefits for trips of at least 150-200km and up to 800km; and that the benefits are greatest for journeys of 300-550km. High speed rail may offer benefits for slightly shorter journeys if the stations it serves are as well located as the conventional rail stations. However, our country case studies showed that countries have constructed high speed railways for reasons of expanding capacity as much as improving journey times. Separation of high speed InterCity services from regional passenger and freight trains offers a significant improvement in capacity.
- 3.28 Our analysis shows that the market conditions for high speed rail to be successful are met in Japan and France more than the other case study countries, and in this context it is perhaps not surprising that these countries have invested more in high speed rail than the others. The population densities in France and Spain are more conducive to high speed rail development than in the other countries, and the distribution of population centres along corridors in Japan, Italy, Britain and to an extent France but not Germany, Spain or Australia is conducive to high speed development.
- 3.29 If a high speed line was to be constructed in Britain, securing the benefits from expanding capacity would be an essential part of the overall investment case – perhaps as much as improved journey times. In this respect, the case for construction of a high speed line in Britain is now much better than it would have been 20 years ago, when there was more spare capacity on the conventional rail network.

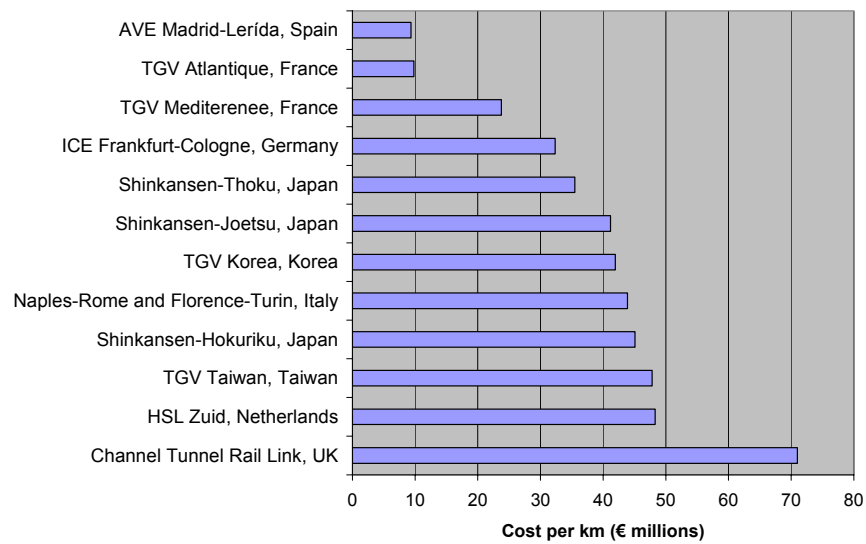
4. THE COST OF HIGH SPEED RAIL PROJECTS

Introduction

- 4.1 Chapter 3 highlighted the fact that there are significant differences between countries in terms of the potential benefits of high speed rail and that, although Britain might have had less need for high speed rail than other countries in the past, many key routes are now approaching their maximum capacity and a high speed rail line could be a way of resolving this.
- 4.2 However, as well as differences in the potential demand for high-speed rail between countries, there are also significant differences in the cost of projects, which this chapter analyses.
- 4.3 The cost of high-speed rail construction in Britain appears to be much greater than in other countries. Some of this difference is probably unavoidable: land costs, for example, are greater in Britain than in other countries and these in turn are affected by wider differences in the structure of the countries' property markets. However, we have found that some cost differences between Britain and other countries are rather hard to justify. Costs are likely to be lower if countries undertake major high speed rail construction programmes, in a number of stages over time, rather than construct a one-off high speed line. In Britain, the construction of a high speed line from London to Scotland could constitute such a programme, as the line would probably be constructed in several stages. If Britain adopted such a programme, we estimate that cost savings in the region of 20-30% should be possible. The operating costs of high-speed railways are also likely to be lower than would be assumed from extrapolation of current operating costs, as these appear to have been inflated in recent years.

The scale of the difference

- 4.4 The total cost of the Channel Tunnel Rail Link is estimated at £5.2 billion (€7.4 billion), approximately £50 million per kilometre. The figure below shows that this is much more expensive than any other high speed line that has been constructed anywhere in the world: CTRL is expected to cost 7.6 times as much, per kilometre, as the high speed line between Madrid and Lérida which opened at almost exactly the same time as the first phase of CTRL.

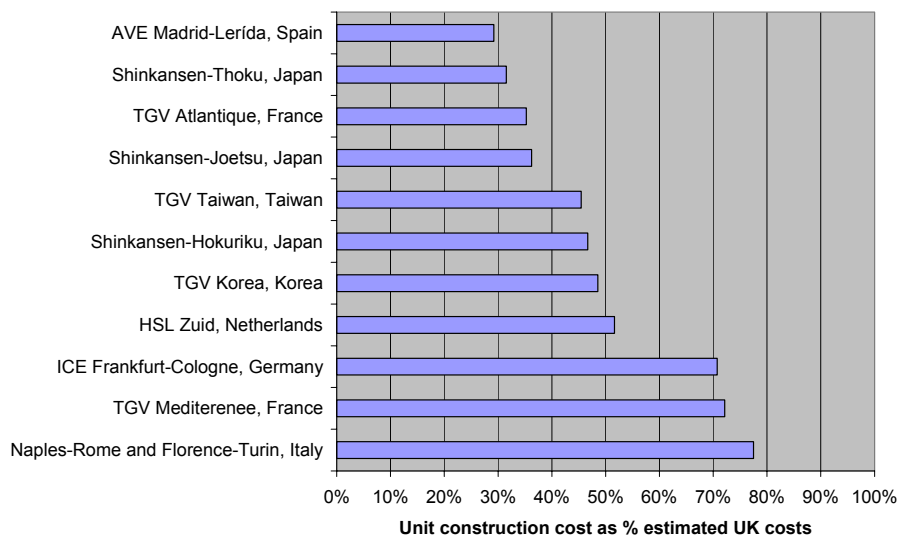
FIGURE 4.1 HIGH SPEED LINE CONSTRUCTION COSTS PER KM

- 4.5 We have reviewed the SRA's analysis of the case for a high speed line in Britain, which includes some analysis of the relative costs of high speed construction. It is important to recognise the preliminary nature of the WS Atkins work: this was not a detailed engineering study, nor were development costs market tested, and, accordingly, caution should be used in applying the conclusions in cost benchmarking. It notes that CTRL is relatively expensive because of the high proportion of route that is in tunnel and the particular circumstances relating to its construction – such as the fact that detailed route analysis, planning and preparatory work was undertaken for a number of possible routes between London and the Channel Tunnel.
- 4.6 The SRA analysis therefore develops detailed revisions to the unit construction costs for a new line, which are based in part on the construction costs of CTRL but which also take into account the variations in cost depending on whether the route is on viaduct, in tunnel or on flat or hilly land. Construction of routes through tunnels or over viaducts is shown to be 4-6 times more expensive per kilometre than construction over flat land.
- 4.7 These unit costs are particularly useful for comparison against the cost of high speed rail development in other countries, because financing and project management costs, which also may have been much higher in Britain, are separately identified, allowing a focus on the underlying engineering factors.
- 4.8 We have assessed whether these costs are reasonable, by comparing them against the equivalent unit costs of construction of other high speed lines. In order to do this, we

have assumed that the **ratio** of the costs per kilometre of different types of construction (flat land, tunnel etc) should be the same in each country even if the absolute costs are different due to differences in the relevant unit input costs⁷. This enabled us to compare the relative unit costs for each of the high speed lines for which we were able to obtain data. While terrain types in other countries, including continental Europe, will influence relative unit costs, we believe that for the purposes of this preliminary assessment, any differences arising would not fundamentally affect the conclusions of our analysis.

- 4.9 The results of this analysis are shown in the figure below. This shows that the difference in unit construction costs is lower if the figures are adjusted for the proportion of a route in tunnel or on viaduct. The results indicate that the engineering differences between different types of line go only some of the way to explaining the cost differences between Britain and the other countries. The construction costs of most of the other routes were still 30-70% lower than the estimated costs of construction in Britain. The Spanish high speed line between Madrid and Lérida is a particularly good comparison, as it has just been completed and includes significant station construction and works within major cities.

FIGURE 4.2 COMPARISON OF UNIT CONSTRUCTION COSTS



- 4.10 The actual costs used in the appraisal were 30% higher than even these levels, because an allowance for contingency was made. As explained below, this contingency has

⁷ Clearly this is a simplifying assumption because different unit cost variations (e.g. between non-traded labour and land, and internationally-procured signalling) will in practice have differential impacts on the relevant total costs of different types of construction (tunnels versus plain line, etc). However the schemes reported above include a range of combinations of different types of construction, and a British HSL would not be out of line from these; therefore no significant distortion should be introduced.

then been increased to 66% in the revised SRA appraisal to allow for optimism bias. With these revised levels, estimated unit costs would be 2.12 times higher than the next most expensive high speed line, anywhere in the world, and 5.5 times the cost of the Madrid-Lérida project. The rest of this chapter evaluates reasons for the cost differences before this additional contingency; the issue of contingency and optimism bias adjustments is discussed in more detail in chapter 6 below.

Explanations for differences in construction costs

- 4.11 It is possible that some of the costs are not comparable. This is a common issue with international comparisons in the rail industry, and we are very conscious that conclusions should be tentative unless detailed “like for like” analyses can be undertaken. We have removed rolling stock and financing costs from the estimated British project costs, and as far as has been possible to verify in the scope of this study, none of the costs from other countries include these. All estimates should include project management costs and the cost of stations, although we do not have enough information to confirm this exactly for all of the international projects⁸. Given that they should all be covering a broadly similar scope, the differences are too large to explain by definition variances alone.
- 4.12 There are a number of reasons why these unit construction costs might be so much higher in Britain than in other countries. Some are unavoidable, but others are not. Even cost differences that might be considered unavoidable in the short term might not be avoidable over the medium-term period of time in which a high speed line might be constructed. We have categorised cost differences either as:
- Cost differences that probably cannot be reduced, such as higher land costs;
 - Costs that might be challenged and influenced in the medium term, such as those caused by different regulations and approval processes; and
 - Costs where the existing estimates are already, in our view, too high and where reductions could be rapidly secured if Britain undertook a major high speed rail construction programme.
- 4.13 In addition to these general factors, it is likely that there will have been some exaggeration of costs as a result of use of CTRL as a base for developing unit costs. Costs in London and Kent are higher than in most of the rest of the UK: input costs (labour and land) will be higher, and construction costs are also likely to be higher as a result of the heavily constrained construction environment. We cannot quantify what cost overestimation may have arisen as a result of this, but suggest that it could reasonably be expected to be in the range of 5-15%.

⁸ The figures for TGV Atlantique do include costs of upgrades of some associated lines, which were not possible to separate, but much of this cost was the rebuilding of Gare Montparnasse in Paris.

Cost differences that probably cannot be reduced

- 4.14 Input costs, such as land and labour, may be higher in the UK than in some other countries – particularly southern European countries. In Spain, for example, government land is often available free of charge for transport projects. However, the comparison countries included other northern European countries and Japan, which also have high land and labour costs. Land costs are only expected to constitute around 5% of the cost of construction of a high speed line, and much of the labour involved is highly specialised and mobile (for example, there has been extensive use of engineers from France in construction of CTRL). Therefore, although we accept that input costs are higher in the UK and this probably will not change in the medium term, this cannot explain all of the difference in cost.
- 4.15 In some of the countries, including Spain and Germany, extensive use has been made of existing rail or other transport corridors when constructing high speed rail routes, and some rail lines have been closed for months or years in order to convert them into high speed routes⁹. Opportunities for doing this are far more limited in the UK, given the congestion of the existing rail network, although there may be some opportunities north of Newcastle or Carlisle.

Cost differences caused by regulations

- 4.16 In the course of our analysis, it was suggested to us that environmental and safety regulations are more onerous in the UK, and in some other countries such as Germany, than in countries such as Spain. These may impact on the total project costs as well as the unit costs of construction – some tunnelling, for example, may be unavoidable, but environmental sensitivities may increase the proportion required.
- 4.17 Cost differences caused by regulation cannot be changed in the short term. However, neither environmental regulations nor safety regulations have always been subject to cost benefit analysis in Britain. Since rail is one of the safest and most environmentally friendly forms of transport, such regulation may be counterproductive if it prevents the expansion of rail, or if the regulations imposed on rail are more onerous than those imposed on other forms of transport. As a high speed line is unlikely to be constructed within the short term, there should be significant potential to reduce costs through review of regulations applicable to rail.
- 4.18 To date, there has been little analysis of whether rail safety regulation, in particular, can be justified relative to that imposed on other modes, or what the impact of this on railway construction and operating costs is. It was recently argued that the money spent on safety on the London Underground after the Kings Cross fire would have

⁹ Examples include the ICE route from Hannover to Berlin via Stendal, and sections of the AVE lines in Spain.

prevented more deaths if it had been spent on smoke detectors for homes; and the regulations agreed subsequently for construction of new stations have significantly increased the costs of new construction. In the medium term, it would be sensible for Britain to re-evaluate whether environmental and safety regulations applicable to rail construction and operation are all appropriate, through conducting cost benefit analysis within the framework of regulatory impact assessments.

Cost differences caused by processes

- 4.19 The time period associated with construction of high speed rail projects – and other major transport projects – is much greater in Britain than some of the other countries, in part as a result of the planning system. In both Spain and France, it was stressed to us that it was very difficult for objectors to a scheme to stop it from going ahead, once the government had made a decision in principle. The slow pace of the UK approval system inevitably has some impact on cost, although the scale is difficult to quantify. It is interesting to note that the highest unit construction costs for high speed lines in Europe to date (outside Britain) is for the Italian high speed lines: Italy also faces a slow and difficult process in terms of seeking approval for projects.
- 4.20 As well as increasing costs for projects that do go ahead, the slow approval process for transport projects in Britain increases the risk that costs are incurred in preparing a project which ultimately is never implemented, either because it does not obtain approval or because policy priorities or funding availability change. The East London Line Extension and Thameslink 2000 are recent examples of projects that have been approved in principle and where significant costs have been incurred in project development, but which may not happen in the original form or to the timing used to justify the earlier investment decision, as a result of significant planning or legal delays that subsequently occur. These costs can be very significant if detailed engineering studies are undertaken or purchase of land starts: for example, hundreds of millions of pounds have been spent on Crossrail, before any decision to proceed has been made.

Cost differences which it may be possible to change

- 4.21 Some recent major UK transport projects have included elements that, rather than being merely functional, are unique and/or enable spectacular architectural achievements: examples of this include some of the stations on the Jubilee Line Extension. These can be compared with new stations on the Madrid metro, which are almost identical to each other and whilst being entirely adequate and functional, are not architecturally interesting. This may be considered a disadvantage of other countries approaches – but lower costs have meant that Madrid has been able to significantly expand its metro network, whereas London has not. A large new underground rail station is now to be constructed at the heart of central Madrid (at Sol/Gran Vía), with connections to three underground lines, at a cost around 20% of that incurred for much less complicated stations on the Jubilee Line. Station costs have

been estimated by the SRA as 8-10% of the construction costs of a high-speed line, although in most cases this would be expansion of existing stations, rather than wholly new stations.

- 4.22 A further example of ‘gold plating’ in the UK is specification of additional, expensive capabilities at the design stage of a project, which may be of limited subsequent benefit. For example, the Channel Tunnel Rail Link has been designed to handle freight, at significant extra cost – but very few paths have been set aside for freight and it is unclear whether even these trains will ever be carried. Significant costs were also incurred in procuring the original high-speed Eurostar fleet to run services north of London, which were subsequently not run. Most continental European high speed lines have been designed with the specific intention that freight will *not* be carried, although freight as well as passenger traffic benefits from the new construction because paths are freed for freight on the conventional network.
- 4.23 Cost overruns on a number of recent public transport projects, such as the new London Underground station at Kings Cross and the West Coast Main Line, have been attributed in part to project specifications being changed after work has begun. This will inevitably increase costs where this occurs. It is perceived in Spain that one of the reasons why construction costs there are much lower is that project specifications are not changed after work has begun.
- 4.24 Possession costs, at points where the new line meets the existing route, has been estimated by the SRA as 2-3% of total construction costs. These costs would not be incurred in most other countries (at least in the monetised form required by the UK contractual matrix) and might be reduced or avoided in the future in the UK as either operators are paid on the basis of management contracts, or possessions are written into franchises. However, some of the relevant costs are still likely to be incurred in terms of making alternative arrangements for passengers whose journeys are disrupted by possessions.
- 4.25 Professional staff costs, associated with project management, planning, design and legal issues, have been estimated by the SRA as 25% of scheme costs and on CTRL they constituted even more than this. We have been informed by GIF, the Spanish high speed rail infrastructure company, that total project planning and management costs for the new Madrid-Lérida line were 2-3% of total scheme costs – which were in themselves much lower than the costs estimated for Britain.
- 4.26 Some of the difference in professional staff costs is likely to arise from Britain’s relatively slow and complex system of gaining approval for projects, where the Government have already committed to process improvements, but which is unlikely to change in its fundamental basis. However, there should be some opportunities to reduce professional staff costs if there was a major high speed rail programme in Britain:

- A high speed line from London to Scotland would probably be constructed in several stages. It could be expected that there would be some ‘learning by doing’ as these stages progressed, reducing costs;
- Such a long-term scheme might allow recruitment of experienced high speed rail project management staff rather than relying on consultants, with inevitable associated management and monitoring costs. As other countries with major high speed rail programmes, such as France and Spain, might no longer be constructing high speed rail by the time Britain undertook such a scheme, there would be some opportunities to recruit staff from these countries; and
- Not changing the project specification once work was underway, or conducting detailed engineering appraisals of multiple routes, would also reduce management costs.

4.27 Given the size of the gap between UK and European add-on costs, actions to reduce this gap will be very significant in improving the case for a high speed railway.

Estimate of possible cost savings

4.28 Without major changes to UK approval processes or safety or environmental regulations, it would not be possible to construct lines at the same unit costs that have applied in other countries. Indicatively, we estimate that for a major high speed rail programme it might nonetheless be possible to save up to half of the costs of possessions, stations and project management, and to make some other savings through avoidance of over-specification. This equates to a saving of about 20% of the estimated capital cost of the high speed line. If more radical changes to the approvals regime were possible, a further 5% or more in project management costs might be saved.

4.29 In addition to this, costs may also have been overestimated by 5-15% as a result of using CTRL as a basis for analysis. We do not seek to estimate the potential cost savings through revised environmental or safety regulations, but these could also be significant.

Operating costs

4.30 The costs of maintaining and renewing the British rail network have been inflated in recent years for a number of reasons. The Rail Regulator recently estimated that it would be possible to reduce Network Rail’s latest estimates of infrastructure maintenance and renewal costs by 30-35%¹⁰. The Regulator also recently noted that costs of renewals undertaken as part of the West Coast Main Line upgrade are

¹⁰ Interim review on track access charges - draft conclusions, October 2003

significantly higher than the costs elsewhere on the network and therefore much higher than they should be.

- 4.31 The SRA's appraisal of the case for the high speed line uses operating cost data provided by WS Atkins, who refer to their own cost databases, but there is not sufficient data in the public domain available to benchmark this against other high speed lines. In particular, actual maintenance and renewal unit costs appear to have increased since the appraisal was undertaken and it is not clear whether the appraisal used these inflated values. At least some of the Regulator's proposed cost savings probably have the effect of restoring unit cost levels towards those likely to have underpinned the high-speed line appraisal work.
- 4.32 Nevertheless, in setting his latest proposed efficiency targets for Network Rail, the Regulator is accepting that previous unit cost estimates (with their associated efficiency targets) - for example those underpinning the upgrade of the West Coast line with the wider scope envisaged in 2000 - were probably too low. The true long-term efficient unit cost levels therefore remain difficult to establish with confidence, and the Regulator is suggesting some are further reviewed in two years.
- 4.33 Some savings in the operating costs of purchasing and operating trains might also be possible. The French, German and Italian railways are investigating the procurement of a common European high speed train, estimating that this might reduce costs by up to 20% due to economies of scale.
- 4.34 For the purposes of our work, we have assumed that at least some of the scope for efficiencies identified by the Regulator is incremental to that implicit within the high-speed line appraisal, and therefore there would be some potential saving here, and that also saving on the cost of trains might be possible. Staffing costs, in contrast, probably could not be reduced below those currently estimated. We have used a notional figure of a 10% reduction in operating costs to indicate the combined potential of these effects although we accept there is significant uncertainty in this area. Although it was not practical within the time available our study, it would be useful to undertake benchmarking of the operating costs of high speed railways.

5. REVIEW OF DIFFERENT COUNTRIES' APPRAISAL TECHNIQUES

Introduction

- 5.1 Appraisal techniques are used to determine on an *ex-ante* basis whether a particular project represents an appropriate use of a country's economic resources. This has to be determined on the basis of both strategic and operational objectives, and if a key strategic objective is to (for example) boost national pride then a grandiose high-tech project might still be judged to meet its objectives even if the quantifiable economic benefits were not strong.
- 5.2 This highlights a critical and central point with appraisal: the objectives against which appraisal is undertaken must be clear. In UK appraisal, until the advent of NATA (New Approach to Appraisal), economic considerations dominated, but, in line with the principles in the government's Transport White Paper, a multi-criteria approach has more recently been adopted, with five objectives of (notionally) equal importance. However, there remains the likelihood that, when we use the appraisal information to make real decisions, the economic appraisal, and especially the BCR, will take on a central role. The role of the BCR is strengthened by the new SRA guidance, which requires monetary values to be placed on a wider range of effects.
- 5.3 Decision making is, in practice, less transparent than appraisal and it may be that different weights are given to the objectives. It is also possible that the non-economic objectives in NATA may only be considered where the BCR is reasonably favourable (at least one). In some cases other wider economic impacts appear to influence decisions: job creation remains an important consideration in some parts of the UK, over and above its valuation within cost benefit analysis. It is therefore difficult to comment on those parts of the decision making process which are influenced by non-economic considerations. Within this chapter, our comments are restricted to technical issues, rather than how those involved in decisions make use of the information that the appraisal produces.
- 5.4 The second issue that has to be considered in assessing the *validity* of appraisal techniques should be an objective test of whether those techniques 'worked', in terms of whether the outcomes predicted in the appraisal actually came about. This could be the economic outcome, measured (for example) using a BCR, but could equally refer to other issues (such as transport objectives, or national pride), if these were identified in the appraisal as the main objectives of the project.
- 5.5 In other words, verification of the validity of appraisal techniques requires both appraisal findings and ex-post evaluation findings. In reality the *ex-poste* evaluation is rarely undertaken, and as a result, schemes are judged against either more informal objectives or on narrow financial ones. For example, in the absence of a re-evaluation against the original appraisal objectives, road schemes are often judged on simpler

criteria such as levels of use. On this grounds, the M25 might be considered a failure because it is congested, and the Humber Bridge because it is underutilised. Similarly, public transport schemes are often judged on patronage and/or financial grounds.

- 5.6 In practice there are too few evaluation studies on which to form objective views as to the efficiency of different appraisal techniques. Instead, the validity of appraisal techniques has to be assessed against more theoretical and ‘internal’ considerations rather than whether or not they actually achieve what appraisal is itself intended to achieve. We undertake this below for the case study countries.

Critique of case study countries appraisal techniques

Japan

- 5.7 As discussed in Chapter 2, the approach adopted in Japan is a combination of a financial and economic impact appraisal, but also takes into account considerations of national pride/interest. Superficially, projects have been successful in terms of national pride and technological objectives. However, wider economic objectives have not always been fully achieved, and in particular, objectives relating to development of new cities were not met as well as had been hoped.

France

- 5.8 In France, the first high speed rail projects were not subject to economic appraisal and although this is now used, diminishing marginal returns may apply, as the next round of possible projects appear to perform less well. This may be because the best projects have already been constructed, rather than because the appraisal process has become more defined, although verification of this would require either retrospective application of current appraisal techniques, or use of older techniques on future projects, to enable comparisons to be made.
- 5.9 Although multi-criteria analysis has not formally been used in France, in practice projects have been driven on the basis of multiple criteria evaluations, which include ‘big’ objectives (such as national pride and being at the forefront of technology). Key appraisal documents continue to include non-quantitative explanations of key benefits which are not included in the cost benefit analysis. Decision makers can then consider policy or strategic objectives alongside narrower transport economic and environmental objectives, and a financial appraisal.
- 5.10 Our research identified the following distinctive features of the French appraisal process:

- A higher value of time is used than in the UK, and different values of time are used by distance and by class of travel: as noted above this is based on empirical research findings;
- Tax revenues are counted as a benefit;
- The cost-benefit analysis is undertaken with and without benefits to non-residents;
- The appraisal time horizon is relatively short at 20 years, but allowances are made for residual values to capture impacts beyond 20 years;
- The appraisal uses an internal rate of return (IRR) rather than an NPV; and
- There is an attempt to capture some wider economic impacts by looking at regional and other employment effects.

5.11 A key issue in cost benefit analysis is the treatment of indirect taxation, as measures of consumers' willingness to pay are assessed using market prices, but governments usually evaluate on the basis of factor costs. It is therefore necessary to use a taxation adjustment factor. If this adjustment is made, tax revenues (direct and indirect) should not be counted as a benefit, as in CBA one should be concerned only with ultimate benefits to households. French practice would therefore overstate benefits. Other direct taxes and changes in payments of benefits are properly treated as transfer payments and should not figure in the final analysis.

5.12 The issue of non-residents is somewhat contentious: clearly a project would not normally be undertaken to benefit non-residents if it is residents that are paying for it (although this is not always the case for high speed rail, as many projects are funded partly by the EU). However, visitors bring expenditure which will benefit the country implementing the project. On the other hand, if the project enables residents to leave the country at lower cost, this provides them with a welfare gain, but transfers expenditure from the home country to elsewhere. Therefore, a complete analysis should probably consider all of these impacts, while a residents-only perspective could over or understate the effects.

5.13 The relatively short time horizon is reasonable if a high discount rate is used, but less appropriate when using an internal rate of return, as a high residual value can have a disproportionate impact on the IRR calculation. Generally, there is a preference among practitioners for use of NPV because of how factors such as residual values and changes in the sign of cash flows can impact upon an IRR. It would be necessary to look at actual cash flow estimates to see whether use of an NPV would have given a different answer (or ranking of projects) to that obtained using the IRR approach.

Spain

5.14 In Spain the principal points of note with regard to appraisal methodology are as follows

- In the CBA, a high value of time is used but the value of a life saved is low;
 - Tax revenues are counted as a benefit;
 - An assessment is made of regional/employment impacts; and
 - Shadow prices are used extensively.
- 5.15 As explained above, a further major difference lies in the use of appraisal: it is often used not to determine whether or not to undertake a project, but for project prioritisation or to address other aspects such as route choice.
- 5.16 From our review of practice, it appears that Spain represents the most extreme example of the use of shadow prices, as a significant proportion of the employment costs associated with projects were discounted, but simultaneously, employment was counted as a benefit, measured in terms of the employment cost.
- 5.17 The use of shadow prices is legitimate in a context of market failure where labour markets do not function well, for example because of institutional rigidities or legal requirements such as minimum wages. Thus if market prices (wages) exceed the marginal social value of output (what an extra unit of labour would produce, which is the opportunity cost of using the labour on an alternative project such as building or operating a railway) then it is legitimate to discount the employment costs of that labour to reflect this. However, if the labour required is skilled, it is unlikely that there will be a sustainable deviation between wages and opportunity cost of labour.
- 5.18 Accordingly this apparent use of adjustments in Spain seems likely to overstate the benefits of a project: however, given the way appraisal is used in Spain this is of secondary significance, especially if the distortions apply to all transport projects.

Germany

- 5.19 Our review suggests that appraisal is applied more directly to decision making in Germany, but that the appraisal process is set up in a way which skews decisions towards rail projects and which favours projects which will benefit the former East Germany. Again this relates to the role which objectives play and how they are set – in the case of Germany with specific spatial and environmental considerations arching over narrower transport economic factors, all embedded in a set of rules.
- 5.20 In terms of technical appraisal issues, the points of significance appear to be:
- Formal scoring of multi-criteria type analysis;
 - Application of a multiplier to international projects;
 - Appraisal of employment and spatial impacts; and
 - Use of a relatively high value of time.

- 5.21 The use of explicit scores seems to be peculiar to Germany. In the UK it is believed that scores are used in order to draw together all the information generated by the NATA analysis into a form which is usable by decision makers, including politicians. However, these scores are not stated explicitly and hence can be varied to suit prevailing agendas. As indicated in the Green Book, economic costs and benefits (eg. environmental and safety benefits) should be monetised where possible within the cost benefit analysis. Attaching separate implicit values to the same benefits in a scoring system would therefore double count them. By definition, benefits outside a cost benefit analysis, and their weights in scoring, are therefore inherently subjective. The use of an explicit scoring system enables interested parties to see how decisions are made, but also enables the promoters of projects to see which objectives/criteria are more or less significant and hence to address these in designing the project. On this basis, there is a risk that such a scoring system would therefore distort the results of the appraisal, because there can be no clear economic rationale for the weightings applied.
- 5.22 In Germany the overall numeric score from the MCA is combined with that from the cost benefit analysis to give a total overall score. This potentially involves adding together some well defined economic welfare impacts (per Euro of cost, if preferred) and a score based on weights and quantitative and/or qualitative assessment against other criteria. There seems to be no wholly objective way of testing whether this works except by whether it delivers ‘acceptable’ overall scores – that is, good appraisal delivers what decision makers want it to deliver. This is consistent with our finding that in Germany the appraisal approach appears to be set up to deliver particular political outcomes. The trade-offs between economic efficiency and other political objectives are at least visible within the German framework.
- 5.23 The rationale for the use of a multiplier for international projects is unclear. It could reflect issues such as sustaining manufacturing competitiveness within export markets and there is nothing technically incorrect about this within a MCA scoring environment. However, the use of such adjustment factors needs to be assessed in practice to ensure that the outcomes of using them is in accord with strategic objectives.
- 5.24 The appraisal of employment is part of the MCA as is the use of an explicit analysis of scoring impacts which appear to be based on regional and spatial priorities. This is discussed in more detail below.

Italy

- 5.25 We experienced difficulties in obtaining detailed insights into the approach to appraisal adopted in Italy. Decisions appear to be driven largely by wider policy objectives, including regional policy and provision of additional rail capacity, with appraisal being used to help set priorities. The lack of a standard discount rate suggests that economic analysis is not central to the decision making process.

Value of time in appraisal

- 5.26 The two key issues are the absolute values given to travel time savings (referred to here as VTTS), and the variability of VTTS with parameters such as distance and time.

Values of travel time savings

- 5.27 In the UK, working time VTTS are higher for rail than most other modes. VTTS for air travel is also high, but this is not published in the Transport Economics Note. The most recent values are shown below.

TABLE 5.1 VTTS FOR WORKING TIME BY MODE

Vehicle occupant	Resource cost	Market price
	£ per hour at 1998 prices	£ per hour at 1998 prices
Rail passenger	25.17	30.43
Car driver	17.44	21.09
Car passenger	13.69	16.56
Bus passenger	11.09	13.41
Walker	24.01	29.03
All workers	11.57	13.99

- 5.28 The values used in UK are derived from the 1996/8 UK National Travel Survey. The value for rail passengers is 2.2 times the average of all workers, reflecting the mix of incomes/occupations of rail passengers and consequently the average economic value attached to these passengers. The value of time when travelling outside work is the same across all modes (£3.74 per hour on a resource cost basis and £4.52 per hour on a market price basis). Values for waiting time, walking and cycling are double these standard values. Other research also suggested that different values might be valid, depending on the context.
- 5.29 As it is typically assumed that 6% of rail passengers travel during working time, the overall VTTS applied to rail is £6.07 per hour (at market prices). Clearly, if the proportion of passengers travelling during working time is higher, the overall VTTS for high speed rail would be higher. For example, if 40% of users were working time users, the average value would be £14.88 per hour in market prices. Converting this to resource costs and to Euros gives a value of €17.50 per hour, similar to that used in France.
- 5.30 Accordingly, one criticism of UK practice might be that, for high-speed rail projects the standard assumptions recommended by the Transport Economics Notes to weight

working time are inappropriate. A second would be that the information on which non-working time values is based is now dated and that it does not reflect willingness to pay to save travel time by rail users, which, as with studies of car users¹¹, might indicate different values depending on the amount of time saved, the duration of trip and trip purposes (as implied by French appraisal practice) as discussed below.

VTTS and the effects of distance and time – working time

5.31 There is an economic argument why VTTS should vary with distance travelled, but whilst this is relatively straightforward for working time, there is not a consensus on for non-working time. For travellers during working time, VTTS indicates the value of lost production, for which time is a better measure than distance. Distance therefore has no input to VTTS (for employers' business). Another approach distinguishes between the value of the time saving to the employer and to the employee, and considers¹²:

- The proportion of travel time savings which go into leisure rather than additional work;
- The proportion of travel time saved at the expense of work done while travelling; and
- The productivity of work done while travelling relative to at the workplace.

5.32 While this appears a promising approach, it has had little use in practice. A recent study concluded that *“there is a great deal of uncertainty about the 'true' values of the modifying parameters in the Hensher model”*¹³. At present, it is likely that UK appraisal will continue to be based on the cost saving approach.

VTTS and the effects of distance and time – non-working time

5.33 There is an economic rationale for adjusting leisure VTTS by time or distance. The longer the journey, the greater the marginal disutility of additional travel time, and the greater the significance of time constraints on that journey. There are also likely to be differences in the mix of trip purposes on long trips, compared with short distance trips, and studies into the Swedish and Norwegian values of time have found such relationships.

5.34 The effect of journey length on VTTS can be represented in appraisals in a number of ways. Time, distance or cost metrics, or some combination of these, could in principle

¹¹ As reported in current TEN.

¹² Hensher (1977)

¹³ Institute for Transport Studies, University of Leeds in association with John Bates Services, Report to DfT, 2003

be used. On behavioural grounds, time or cost appear to be more sensible measures as these are what passengers ‘spend’ in order to travel over a given distance, and hence they might be willing to pay or trade to reduce time or other cost factors. A recent study estimated elasticities of VTTS with measured distances, as this was more feasible given the data sets available; it found an elasticity of VTTS with distance in the range of 0.26-0.37¹⁴.

5.35 This effect was implied not because time becomes more valuable per second but rather that with the longer journey lengths: “the disutility of spending an additional pound is less when the absolute price is higher”. The relativity effect contradicts economic rationality, since a pound equals a pound regardless of how it is acquired or saved. However this phenomenon has behavioural plausibility and is confirmed in other value of time studies. The study identified two main options for appraisal:

- To rely on the evidence, to adopt a distance elasticity - say +0.3 - using a few distance bands; or
- To use the best estimates of income and distance elasticities to compute the average values of time but not to differentiate VTTS by distance in evaluation.

5.36 The first option would provide for consistency between values used in modelling and values used in evaluation, but would be inconsistent with the microeconomics principles on which cost benefit analysis is based, and hence the study did not recommend the use of variable VTTS with distance. Inherently, a bias against longer distance benefits remains within any appraisal based on averages however, and we believe the issue is important enough to warrant further research and, if this validates the evidence to date, to adopt differential values in appraisals.

VTTS and social exclusion

5.37 It could be argued that higher values of VTTS should be used under some circumstances to reflect social exclusion objectives. For example, the most socially excluded in society may place very low monetary values on their time, and if this was reflected in cost benefit analysis, schemes that might be considered worthwhile on equity grounds would receive a low appraisal score. However, any such adjustment within the cost benefit analysis for these purposes would distort the results: equity objectives would be better reflected through multi criteria appraisal, where subjective, rather than objective, priorities can contribute to decision making.

¹⁴ Institute for Transport Studies, University of Leeds in association with John Bates Services, Report to DfT, 2003

Wider economic impacts

- 5.38 Other countries typically measure the wider economic impacts of transport projects as employment and/or GDP impacts. In the UK, the DfT examines such impacts only insofar as they might impact upon specific regeneration areas. In contrast, in Scotland, the STAG guidance includes examination of economic activity and location impacts (EALIs) within the economy objective and is applicable to all projects. However, the presumption across Scotland, England and Wales is that the net impact of a transport investment on the “real economy” at national level will be zero after allowing for displacement and other effects.
- 5.39 The European Commission considers economic impact to be a key rationale for high speed rail investment, and their support for new links with Spain and Portugal in the latest review of the Trans-European Networks policy reflects this. The Commission sees high speed rail infrastructure as a key to continued sustainable economic development.
- 5.40 In contrast, in the UK there is considerable scepticism in government regarding the role of transport investment in enhancing overall economic efficiency and hence enabling growth in GDP and employment; it has been generally accepted that investment in transport infrastructure can influence the location, but not the scale or efficiency, of economic activity. However, in an open economy, location decisions may be international, and large projects could influence these.
- 5.41 In practice, the evidence suggests that transport can play a catalytic or enabling role alongside other policy measures, if mobility is constrained. However, in an economy with well developed transport infrastructure, the effects of **additional** investment are relatively weak. In such situations further transport infrastructure is unlikely to be a cost effective means of promoting economic efficiency, and the principal goal of transport investment should be to achieve transport rather than economic goals. Put another way, there will generally be much more cost effective ways of achieving economic development objectives than investing in transport. However, there is evidence to suggest that transport investment complements other measures in certain circumstances.
- 5.42 In the UK, therefore, the settled approach in transport appraisal has been to measure transport specific benefits, either using the consumer’s surplus as the indicator or, occasionally (and more restrictively) using predicted revenue. SACTRA¹⁵ points out that in that in theory, under conditions of perfect competition and with no external distortions, there is complete equivalence between a consumer surplus analysis and wider economic impact analysis. However, consumer surplus is unlikely to be a true

¹⁵ Transport and the Economy, 1999

measure of wider economic impacts where there are market imperfections. In such circumstances the standard approach may under or overstate the impacts.

- 5.43 In particular, the SACTRA work¹⁶ has re-opened the issue of non-constant returns to scale, by demonstrating how clusters of economic activity can form and grow, exploiting agglomeration economies. When transport links are improved, the resulting wider GDP growth can be in excess of the consumer surplus benefits assessed in the transport market – assessed to be in the order of 30%. Newbery¹⁷ found the additional economic impact was much smaller: 3%. In this light of this work, SACTRA has accepted that the total economic benefits of a transport investment might therefore be greater or less than the consumer surplus, depending upon market conditions.
- 5.44 Other European research has tried to assess how much travel time savings are fed back into productivity and economic output, rather than creating more leisure time. This depends on various factors, in particular the level of demand in the macro-economy. One major study¹⁸ found that for a German transport project there would be a GDP uplift of 0.19% by 2022, which was equivalent to an economic rate of return of 11% on an investment of €90 billion.
- 5.45 Similar results were obtained in a study examining the economic impact of a high speed rail project in the Netherlands¹⁹. This used a general equilibrium model to predict GDP and employment changes, which required input-output matrices for the Netherlands. Travel times and mode shares for passenger transport were derived from a conventional transport model. The study predicted a GDP uplift for the Netherlands of 0.10% by 2020, with regional redistributions of employment, output and consumer prices region-by-region. Broadly speaking, communities near to the ends of the line tended to benefit the most. This latter finding is consistent with work undertaken in 2000 by Steer Davies Gleave on the Shinkansen network in Japan.
- 5.46 For this scale of investment and appraisal some form of national economic modelling is clearly required. However, the input-output model used in the Netherlands does not exist in the UK and could take some time to develop. An alternative could involve the use of system dynamics modelling: our own work has previously produced credible results at a regional level; but requires further development in order to link to a suitable macro economic model to conduct national economic impact assessments.

¹⁶ Venables and Gasiorek, 1999 report to SACTRA

¹⁷ Newbury 1998

¹⁸ research using the QUEST model by CEBR for the European Commission

¹⁹ Oosterhaven and Knaap, University of Groningen

Conclusions

- 5.47 Britain now appears to have one of the most developed frameworks for transport appraisal. Key technical issues we have identified are:
- Use of different VTTS, compared with some European countries; and
 - Monetisation of environmental costs and benefits, as discussed in Chapter 6 below.
- 5.48 However, there is scope for improving approaches to the identification of national economic impact of major strategic transport schemes (such as high speed rails) and for being more rigorous in the weighting of wider objectives in the appraisal framework, as in Germany.
- 5.49 Both of these are leading edge areas where further development of appraisal methodologies is required. With regard to travel time savings, a combination of more realistic passenger mixes on high speed services and an increase in the value of non-working time over long trips appear to be justifiable. Such changes would enhance the estimates of the benefits of high speed rail projects but probably also of regional air infrastructure investment.
- 5.50 The appraisal of real economy impacts is a developing area, where there remains considerable scepticism within the UK Government. Clearly, alongside better modelling techniques there is a need to produce more concrete evidence with regard to a whole range of impacts through rigorous ex-post evaluation of transport projects.

6. RECOMMENDATIONS FOR BRITAIN

Introduction

- 6.1 Our view, discussed in Chapter 5 above, is that appraisal of rail projects in Britain is in many respects more advanced than in the other case study countries and, with the recently revised SRA appraisal guidance, comes close to representing best practice in these areas. Our recommendations are therefore limited to some specific areas: project-specific valuations of time, assessment of wider economic benefits, environmental impacts, and risk and optimism bias adjustments. Of these, optimism bias adjustments are likely to have the most significant impact on the appraisal outcome.

Valuations of time

- 6.2 Project-specific valuations of time have been used for some appraisals in the past in Britain, but on the whole, national average values are used. We suggest that project-specific values of time should be used as standard practice, at least for larger and more unusual schemes, and that it would be useful for the government to develop general guidance on this. As discussed in Chapter 5 above, on the whole values of time will be higher for longer journeys (although the relationship is complex) and for journeys to/from London than for other journeys.
- 6.3 As most HSL journeys will be long distance journeys to/from London, the variation in value with distance should potentially be explicitly recognised in the analysis. Subject to validation with relevant research, a relatively high value of time would therefore be used for high-speed rail appraisals. Given that total resources for transport investment are limited, it is also important that, where it is appropriate to use values of time that are lower than the current standard national values, the correct lower values are **also** used within a given national framework. This framework should specify which types of project would require specific time values, and which projects should receive lower, as well as higher, values.
- 6.4 It is likely that this change would improve the case for investment in long distance rail projects and local/commuter transport projects in and around London and some other major cities, at the expense of projects which involve investment in the regional transport network.
- 6.5 Values of working time are much higher than values for non-working time. Appraisals should take into account the reality that some modes of transport, particularly long distance trains, may allow travelling time to be used productively whereas other modes of transport do not. In effect, time spent travelling may be partly converted into working time if a passenger uses a high speed train rather than (for example) an

aircraft. The DfT's view is that no such conversion should be assessed because the actions of employees during working time are a matter for their employer; however, our view is that, during some types or parts of journeys, work is impossible, regardless of the fact that the passenger's employer might prefer this not to be the case, and therefore there is a potential economic benefit from passengers, in general, being more productive. Travel time is unlikely however ever to be as productive as office-based time.

- 6.6 This benefit has not previously been taken into account in British appraisal, although we understand that it is being applied in an appraisal of the Scottish rail network and has of course been used in the commercial marketing of rail for some time. One way to apply this increase would be to allow for a specific adjustment for "travelling comfort", as in Spain, although it would be better to try to assess what proportion of passengers can convert time spent travelling to useful working time, and how valuable such time is relative to working time not spent travelling, for different transport modes.
- 6.7 We suggest that appraisals should at least specify the bases for deviating from the standard "6% business" assumption in existing guidance where actual travel patterns are likely to be significantly different. For example on many domestic air routes, with which high-speed rail would compete, business travel proportions are much higher than 6%. Different values have been used on selected projects in the past, but we suggest that the bases for such deviations should be more systematically established.
- 6.8 Similarly, time values for longer journeys can alter significantly as key thresholds (e.g. feasible day trips) are passed, and will vary significantly if delays are reduced (e.g. on dedicated new infrastructure). All these factors bear specific consideration when the use of public funds running into billions of pounds is being assessed.
- 6.9 In terms of valuing the time benefits to non-UK residents, particularly in the EU, we suggest that the French approach merits consideration - whereby these passengers' time is valued separately. This would have had particular relevance for projects funded internationally to deliver international benefits (such as the West Coast Route Modernisation and CTRL)²⁰.

Environmental impacts

- 6.10 The new SRA appraisal guidance, consistent with the new Green Book, states that monetary values should be placed on environmental impacts and therefore these can be included in the cost benefit analysis, and DfT is currently seeking to improve the

²⁰ This has not hitherto been standard appraisal practice in Britain, but DfT have informed us that appraisal guidance has recently changed and international benefits should be separately quantified in future.

robustness of the valuations that are placed on a wide range of environmental costs. The failure to put monetary values on environmental impacts could have been considered one of the greatest shortcomings in the British approach to appraisal in the past, but the new **guidance** brings Britain into line with best practice in other countries. The key issue is the extent to which the new principles will be applied consistently in practice – between (for example) road, rail and air infrastructure investments in future. Given the more extensive experience of some other countries, such as Germany, in applying the relevant valuations, we suggest that in the coming year, early applications of the new criteria in the UK should be subject to validation relative to each other and to relevant European practice.

- 6.11 Britain still does not seek to put monetary values on visual intrusion effects. The government favours retaining qualitative analysis of these effects, and other effects such as ecological impacts. While the other case study countries also did not put monetary values on these effects, Scandinavian countries have tried to quantify them. Although this is relatively difficult and expensive, there is an argument for undertaking this type of analysis for projects with very large negative environmental impacts, such as new airports. This is unlikely to significantly change the case for an HSL as, on the whole, railways have a lower land take and therefore cause much less visual intrusion than other transport modes.

Economic impact analysis

- 6.12 As explained in Chapter 5 above, Britain has traditionally not undertaken detailed analysis of the wider national economic effects of major transport projects; normal practice has been to assume that transport can have no effect on the national economy. Most other countries have also only undertaken limited analysis of the economic effects of transport projects: of the case study countries, Japan undertakes the most detailed analysis of the economic effects of transport projects, but as this analysis is not made public in Japan, we have not been able to assess it in detail.
- 6.13 Although there is evidence to support the view that most transport projects do not have an effect on the national economy, this tends to be dependent on the assumptions that the project only benefits a particular region rather than a high proportion of the country (displacing resources within the country), and that the country as a whole does not suffer from any severe bottlenecks in its transport system.
- 6.14 However, Britain does suffer from a highly congested transport system; the main railway lines north of London are now reaching maximum capacity utilisation, and further expansion will be difficult, disruptive and very expensive. It follows that Britain could suffer from severe transport bottlenecks, which could have an effect on the national economy, without strategic investment in transport infrastructure. Recent surveys of business leaders have demonstrated that transport infrastructure is considered an important factor in investment decisions – national as well as regional – and that Britain does not score well in this respect. While the agglomeration benefits

to business from improved transport may be particularly pronounced in London, they may well also occur in other major economic centres in the UK.

- 6.15 Therefore, we suggest that the government should consider commissioning more detailed analysis of the potential impact on the national economy for very major transport projects, such as a high speed line, and should not automatically assume that this will not change total economic output. As noted in Chapter 5, this would require the development of tools for the purpose. DfT has informed us that this is now being addressed within government, particularly within the context of rail schemes in London: congestion within London is accepted as a potential constraint on the London economy. As illustrated by the recent impacts of the congestion charge in London, appropriate account will also need to be taken of the potential impact of longer-term transport policy measures (such as road user pricing) in evaluating the long-term economic benefits from major schemes.

Risk and optimism bias

- 6.16 The new Green Book requires that very significant allowances are made for risk and optimism bias. We understand that, in its revised appraisal of the high speed line, the SRA has made the following adjustments:

- Expected capital costs have been increased by 66%, in line with Green Book guidance for “non standard” projects of this scale;
- Expected construction times have been increased by two years, which is in line with Green Book guidance that construction overruns of 25% should be allowed for; and
- Expected operating costs have been increased by 15% (and higher estimates have been tested). This appears to go beyond the guidance in the Green Book, which states that no consistent evidence of operating costs increases has been found and recommends that sensitivity analysis should be undertaken.

- 6.17 No other countries made such significant adjustments for optimism bias or risk, although we were told in France and Spain that appraisal construction cost estimates usually included a contingency margin of 5-10%. The discussion here focuses on capital costs, as these are of primary importance for a high speed line.

Capital costs and project delays

- 6.18 The specification of the optimism bias assumptions has the potential to radically undermine the case for investment in major transport projects. For example, for a hypothetical project where all costs are capital costs and the benefit to cost ratio is 1.5, the 66% optimism bias assumption reduces the benefit to cost ratio to 0.9.

- 6.19 Although the Green Book allows for the optimism bias assumption to be significantly reduced after further analysis, there is a clear risk that projects which could be beneficial would not proceed to a more advanced planning stage if the initial optimism bias assumptions of this type are introduced at inappropriate levels. The net effect would be to bias investment away from capital intensive projects such as high speed rail. However, it would appear that, despite this, in this particular instance, the economic cost benefit case for the high speed rail project remained robust to the higher optimism bias assumptions.
- 6.20 As with most transport projects in this country, there has been relatively little ex-post analysis of whether high speed rail projects in other countries have achieved the net benefits anticipated in the appraisal.
- 6.21 The only detailed ex-post project analysis that we have obtained relates to TGV Atlantique. This showed that in most ways the appraisal assumptions were correct: the project exceeded the construction costs projected at the time the project was approved by only 0.4%. The difference between the original pre-approval cost projection and the actual cost was more than this, but this was because the scope of the scheme increased (to include a significant new station and links with the conventional rail network at Massy). This should be considered as a separate project, with its own incremental benefit stream, and appraised in its own right, as it was not necessary for the construction of the TGV line – and therefore was not a cost overrun relative to the envisioned benefits of the form allowed for in the Green Book. The only significant difference between the projections for the project and the outcome related to traffic, where the increase in traffic in 1992 was about 30% less than projected (although as most traffic was not expected to be new, the variation in total traffic was much smaller). However, this difference was attributed to a combination of the fact that this coincided with the worldwide economic slowdown, and a policy decision to increase rail fares²¹.
- 6.22 We are aware that some other projects have been subject to technical problems: for example, the line from Madrid to Lérida opened late (although the construction did not overrun by as much as the Green Book value of 25%). The extension from Lérida to Barcelona is significantly behind schedule, but this is as a result of disagreement between the regional and national governments in Spain which has delayed agreement of a final route, rather than construction delays. The only high speed line to be opened in Britain (CTRL phase one) was completed both on time and on budget.
- 6.23 The issue of contingencies and risk for railway enhancement projects was also addressed by the UK Rail Regulator in his review of Railtrack's access charges in 2000. In his draft conclusions on Railtrack's access charges, he stated that:

²¹ Bilan a posteriori du projet de desserte de l'Ouest et du Sud-Ouest de la France par trains à grande vitesse, SNCF, 1998

“contingencies should only be added to costs which have been demonstrated to be efficient (e.g. through market testing, comparisons with similar schemes or comparisons with assumptions made by the Regulator at the periodic review)”²². It is clear from our analysis in chapter 4 above that the costs on which the HSL have been assessed have not been demonstrated to be efficient and in fact appear to be well above those for similar international projects.

- 6.24 In his final conclusions, the Regulator also stated that he would not expect allowances for contingencies to exceed 25% (above the P50 cost level in a Quantified Risk Analysis), and even this would only apply for more complex upgrades of the existing railway (versus, say, a “green field” projects such as high speed rail). However, this would be applied at a point where the project had been costed in detail (to the point where a fixed price contract could be agreed), which is clearly not appropriate for the economic appraisal of the proposed HSL. As indicated in the Green Book, a higher allowance than the Regulator’s 25% maximum would typically be expected at earlier feasibility analysis stages in project evaluation – but the big jump to 66% appears difficult to justify.
- 6.25 Although the Regulator’s 2000 framework remains the basis on which the remuneration of Network Rail’s projects is regulated, there have been reports that the costs of modernising the West Coast Main Line (largely a renewals project) have subsequently increased further since that time, although comparisons are difficult given the substantial scope and timing changes introduced to the project since the Regulator concluded his work in 2000. In any event, the troubled history of the project is unlikely to provide a reliable benchmark for “green field” project cost overruns in future.
- 6.26 It should be noted that the cost figures for high speed lines provided in chapter 4 above were actual, not projected, values and therefore already include any cost overruns: on the basis of these estimates, UK cost estimates were found to be significantly higher even **before** any allowance for risk or optimism bias. Our analysis has shown that there is no consistent trend for high speed rail projects to significantly exceed projected budgets to the extent anticipated in the Green Book allowances. In Britain, the Regulator has determined that under all but the most exceptional circumstances contingencies should be less than 25%; even allowing for some additional margin, given that appraisal of a high speed line will occur when costings are at a more preliminary stage, we suggest that the appropriate contingency allowance should not exceed 30%.
- 6.27 DfT’s view is that the higher optimism bias allowance is unlikely to prevent a scheme from going ahead, and the assumption would not impact on the prioritisation of limited resources, if it was applied across all schemes. However, the 66% optimism

²² ORR, Draft Conclusions, July 2000

bias assumption is for ‘non-standard’ civil engineering schemes, which includes almost all “high speed” rail projects but not all road schemes, given Britain’s much greater recent experience in constructing roads using repeatable methods. There is therefore a risk that, as well as introducing a bias against any capital-intensive project proceeding, the optimism bias assumptions may introduce a systematic bias against rail.

- 6.28 As a number of schemes have been completed late, we suggest that the appraisal assumption of a 25% construction time overrun should be retained. In contrast to the cost assumptions however, this does not substantially change the appraisal outcome for a long term project, such as a high speed line.
- 6.29 Going forward, a priority for the UK, in conjunction with deriving a better understanding of the causes of **expected** cost differences, will be to derive a better understanding of the causes of cost and time **overruns** across different types of rail project, and then customising the optimism bias coefficients based on this improved understanding.

Operating costs

- 6.30 Optimism bias multipliers applied to operating costs should be lower. There are a large number of high speed lines in operation in Europe, most of which are technically very similar to any line that would be constructed in Britain and Britain also has reasonable experience of operating fast long distance trains. We have not benchmarked operating costs, given the greater importance of capital costs in the high speed rail appraisal and the difficulties in obtaining operating costs from other European railways – although note the extent to which the Regulator believes costs should be falling in the years before a high speed line would start operations.

7. THE IMPACT ON THE CASE FOR A HIGH SPEED LINE

Introduction

7.1 This chapter evaluates the impact our recommendations on appraisal would have on the case for a high speed line in Britain. It also evaluates the potential impact the reductions in cost discussed in Chapters 4 and 6 above could have on this case.

The base case

7.2 We have used, as the basis of our work, the appraisal conducted for the SRA by WS Atkins of the case for a high speed line from London to northern England and Scotland. It is important to recognise the preliminary nature of the WS Atkins work: this was not a detailed engineering study, nor were development costs market tested, and, accordingly, caution should be used in applying the conclusions in cost benchmarking.

7.3 The SRA has been in the process of reviewing and updating their work as an input to their expected consultation document, and this work includes a revised appraisal of the high speed line, which had not been finalised at the time that we undertook our analysis. The earlier work constrained the base case that we have used in three key ways:

- Although a number of possible routes were evaluated by WS Atkins, a detailed breakdown of the appraisal was only provided for one of the routes (option 1 in the original reports, which was a new line running from London to the West Midlands, with trains then continuing via the conventional route to provide services to the North West and Scotland). We have therefore used this as the basis for our analysis. We understand that, as the assumptions about upgrades to other rail lines have changed, there is now a stronger case for another route.
- The analysis was conducted in line with the previous Green Book; we have therefore updated this to reflect the new SRA guidance, which is consistent with the new Green Book. However, in some respects we have had to make broad estimates in order to do this. For example, the new Green Book requires monetary values for emissions to be included in the benefit to cost ratio – but on the information that was available to us, we could only make a very rough estimate of this.
- The high speed line analysis assumed as a base case that a substantial upgrade of the East Coast Main Line would go ahead in any event. This will not be included as a base case assumption in the revised appraisal. Without this upgrade, the case for a high speed line would be stronger (particularly if a more easterly route was selected).

7.4 Having adapted the original WS Atkins work to fit with the new Green Book, we have then undertaken our analysis by making adjustments to this appraisal. In most

cases this has been by applying multipliers to particular elements. We did not have enough detail available on the original appraisal to verify the calculations provided, although in one case, as explained below, we have made an adjustment where we do not agree with an assumption made.

- 7.5 The results of the original (unadjusted) base case analysis of this option are shown in the table below. The SRA reports two appraisal outcomes, a pure appraisal of the HSL and an assessment of the combined effect of the HSL and the re-use of scarce capacity on other lines from which traffic is transferred to the HSL. Our view is that the latter figure is the relevant one for Britain, in the context of an integrated transport policy, although we also report the former to give a view of the likely appraisal outcome if an HSL is assessed on a standalone basis.

TABLE 7.1 THE CASE FOR AN HSL: BASE

	HSL	HSL with capacity release
Net present value (£ billion)	2,469	3,521
Benefit to cost ratio	1.29	1.42

Revised appraisal

- 7.6 We estimated the broad results of the revised SRA appraisal, referred to above. The most significant changes in the new appraisal are that:

- The discount rate is reduced from 6% to 3.5%, which significantly improves the appraisal case for high speed rail construction;
- Estimates for capital costs are inflated by an optimism bias parameter of 66%. The original capital cost estimate included a 30% contingency. It is also assumed that the construction period would be extended by two years, to reflect optimism bias in construction timing estimates;
- Monetary values are placed on some additional factors, enabling these to be included in the cost benefit analysis. Of these factors, greenhouse gas emissions and local air pollution appear likely to be the most significant.

- 7.7 The other values that the new appraisal criteria state should be quantified are:

- **Severance effects:** Our view is that these should be broadly neutral and therefore we have not sought to estimate this. An HSL will cause some severance, but primarily in lightly populated areas, as within cities it will generally use existing corridors or be in tunnel. It will also cause reductions in road traffic, thereby reducing the severance impact of roads.
- **Option values:** We do not expect these to be significant for an HSL and therefore have also assumed that they have no impact. The cities served by an HSL would already have access to good rail connections and in many cases also to good air connections. We would expect option values to be significant for transport projects primarily in remote regions with no good alternative public transport.

- **Noise:** The SRA's appraisal framework projects that the net impact on noise would be neutral and therefore application of a monetary value for noise has no effect.
- 7.8 Using the SRA's original appraisal, the valuation of emissions has relatively little effect. However, this is primarily because it argues that transfer from air to rail would be very low and that there would be no change in the number of domestic flights as a result of an HSL. We do not share this view. Under some options, journey times from London to Edinburgh would fall to around 2 hours 30 minutes with an HSL, and London to Glasgow to around 3 hours. Experience from other high speed lines has shown that journey times of this nature result in significant change in market share. Even if the number of flights did not change, the airlines would switch to use of smaller aircraft, with corresponding emissions savings. Nonetheless, although rail is more environmentally friendly than air, the relative benefits are not themselves sufficiently great to provide a large part of the economic case for rail investment.
- 7.9 To correct for this in our illustrative appraisal, we have doubled the estimated impact of emissions savings, although given the very poor performance of air travel especially in terms of greenhouse gas emissions, the appropriate value may be greater than this. We also note that some recent research has implied that the impact of air travel on global warming may be higher than earlier estimated, because of the effects of vapour trails; this would further increase the benefits. A reduction in air travel could also produce benefits in terms of noise reductions which are not currently evaluated in the appraisal, because it is assumed that the number of flights does not change. In their revised work, the SRA have advised us that higher air fares, and hence greater substitution from air to high speed rail, have now been assumed.
- 7.10 The table below shows our estimate of the revised appraisal outcome for the same option if the new appraisal criteria are applied. Overall, the application of the new appraisal criteria has almost no net effect on the case for an HSL: the case is significantly improved by use of a lower discount rate, but this is offset by the very large margins for optimism bias and risk.

TABLE 7.2 THE CASE FOR AN HSL: REVISED APPRAISAL CRITERIA

	HSL	HSL with capacity release
Net present value (£ billion)	6,413	8,362
Benefit to cost ratio	1.32	1.42

- 7.11 We have retained for comparability the methodology for calculating the BCR used in the WS Atkins report (in which revenue is counted as a benefit but therefore does not offset costs). We understand that the final published report will calculate BCRs using DfT's methodology, in which revenue offsets costs but therefore is not counted as benefit. This will improve the BCR, because the reduction of the benefits is proportionately smaller than the reduction of the costs.

Impact of proposed amendments to appraisal criteria

- 7.12 As explained in Chapter 6 above, we propose further amendments to the appraisal criteria, primarily relating to the treatment of risk and optimism bias and have illustrated this in the current example by assessing optimism bias on capital costs at 30% rather than 60%.
- 7.13 We proposed that adjustments should be made to the value of time in order to reflect the relatively high values of time that would generally apply to HSL passengers, most of whom would be making long distance journeys to/from London. We also suggested that adjustments should be made if it is possible for some passengers to convert time spent travelling to useful working time because of the better environment of a high speed train than an aircraft or car. However, as the SRA has not explicitly stated what underlying values of time have been used in their appraisal of a high speed line, it is not possible for us to assess the result of this change with any certainty. We have therefore assumed that the average values of time would be increased by 10% although in practice, based on the scale of relativities involved in the UK and overseas, the appropriate increase might be greater than this.
- 7.14 We also proposed that Britain should consider undertaking wider analysis of the economic impact of very major transport projects, such as an HSL. However, it is not possible to project how (if at all) this would change the results of cost benefit analysis without specific modelling tools, and hence we have not reflected this impact in the current example.
- 7.15 The results of our suggested revisions are shown below.

TABLE 7.3 THE CASE FOR AN HSL: PROPOSED APPRAISAL CRITERIA

	HSL	HSL with capacity release
Net present value (£ billion)	13,038	14,988
Benefit to cost ratio	1.84	1.97

Impact of cost reductions

- 7.16 We have also tested the impact of the reductions in cost that we consider could be possible, discussed in more detail in Chapters 4 and 6 above, on the case for an HSL. We assume that a reduction of 25% in capital costs and 10% in operating costs should be possible; further reductions would be possible if the rail industry structure was reformed and might also be possible if safety or environmental regulations were reviewed to ensure that all were appropriate. Even with a 25% reduction in costs, projected unit costs for a British high speed line would still be amongst the highest in the world, and would be by far the highest once the 30% optimism bias allowance is included.

7.17 We have evaluated this both without and with the adjustments we propose to the general British appraisal assumptions (of which the most significant, as discussed above, is the use of much lower allowances for optimism bias). The use of a 66% optimism bias allowance for capital costs, even with the 25% reduction in underlying costs we suggest should be possible, results in costs for Britain around 60% higher than applicable to the next most expensive high speed line.

7.18 The table below shows that the reduction in capital and operating costs significantly improves the case for high speed rail even without any other adjustments.

TABLE 7.4 THE CASE FOR AN HSL: COST REDUCTIONS

	HSL	HSL with capacity release
Net present value (£ billion)	10,465	12,415
Benefit to cost ratio	1.65	1.78

7.19 The table below then combines the effects of lower construction and operating costs with the estimated impact of the revised appraisal criteria discussed earlier. In our view, this combines best appraisal practice with a realistic estimate of costs. The combination of the optimism bias adjustment we retain and the adjustment to costs we have made still results in the appraisal cost values used being significantly higher than the actual costs of any other high speed line. Nonetheless, under these circumstances, the appraisal case for an HSL is significantly strengthened.

TABLE 7.5 THE CASE FOR AN HSL: COMBINED EFFECT

	HSL	HSL with capacity release
Net present value (£ billion)	16,182	18,131
Benefit to cost ratio	2.31	2.47

7.20 It is important to note that the latest revised SRA work (conducted since we undertook our analysis), which will help inform their consultation document, shows a BCR of around 2.0. The strengthening of the BCR in the revised SRA appraisal is due to a different method for calculating the BCR and the revision of their assumptions about the upgrade of the East Coast Main Line. Combining these with our proposed adjustments to the appraisal framework and using our estimates of efficient costs, would increase the benefit to cost ratio to between 3 and 4.

7.21 The findings from the revised SRA work that the project's BCR is more robust than previously evaluated is in line with our analysis, albeit that the SRA has not, of course, adopted our suggestions on appraisal criteria revisions at this stage.

8. CONCLUSIONS

8.1 Countries have chosen to invest in high speed rail for a number of reasons. It was clear from the case studies that decisions to construct high speed lines had not, historically, been based on economic appraisal alone, or at all, but were made for other reasons. The market for high speed rail is stronger in some other countries, such as France and Japan, than in Britain; and the costs of high speed rail construction are also far lower. However, appraisal practice is converging: more countries, particularly in Europe, now undertake cost benefit analysis of high speed rail projects.

The market for high speed rail

8.2 Our analysis demonstrated that the case for high speed rail was dependent on a number of market factors and that the development of high speed rail in the case study countries did appear to be correlated with these factors. The main market factors were:

- The case for high speed rail is strongest in countries where there is a large market for travel over distances of around 200-800km, and particularly in the range 300-600km. High speed rail offers little benefit for journeys shorter than 150-200km, and cannot be competitive with air transport for journeys longer than approximately 800km.
- A high speed line can offer very high capacity. For there to be sufficient travel demand for this capacity to be utilised effectively, there must either be very large cities of approximately this distance apart, or there must be a number of significant population centres that can be accessed by the same high speed route.
- The construction of high speed lines is likely to be least difficult in countries with sparsely populated countryside, but within cities, high population densities mean that high speed railways (and conventional railways) can serve the potential market better.
- The existence of very good conventional rail lines reduces the case for high speed rail, particularly over shorter distances, although if it is also possible to use existing railway lines on final approaches to major cities, construction costs can be significantly reduced.

8.3 On these measures, the case for high speed rail construction in (particularly) France is stronger than in Britain. However, the case for high speed rail construction in Britain is now stronger than it would have been in the 1980s, when many other European countries were building or planning their first high speed lines. At that time, there was spare capacity on the British national rail network, but this now faces severe constraints, and the upgrade of the West Coast Main Line has demonstrated that resolving these constraints on the existing lines of route, whilst seeking to protect a complex pattern of ongoing services, would be disruptive and expensive.

The costs of high speed rail

8.4 The SRA has based its analysis of the costs of a high speed line on the Channel Tunnel Rail Link. However, this is, per kilometre, the most expensive high speed railway to have been constructed anywhere in the world, even ignoring financing costs. Some of the gap arises from the high proportion of tunnelling required on the approach to London, and the SRA have noted that part resulted from substantial sunk costs relating to routes that were not built and improvements to Ashford and St Pancras. But even adjusting for these factors, the unit costs of high speed lines in other countries were generally 30-70% lower.. There are a number of reasons for the divergence:

- for CTRL specifically, the location of the route in Kent and South East London, densely populated and high cost areas;
- high land and labour costs;
- issues relating to the structure of the British rail industry;
- issues relating to the approvals and planning processes;
- more onerous environmental and safety regulation;
- over-specification at the design stage; and
- in part as a result of these factors, disproportionate project management costs.

8.5 Although construction of future high speed lines in Britain is likely to remain more expensive than in (say) Spain, it is not clear why unit costs should remain significantly higher than in (say) Germany or the Netherlands. We indicatively estimate that efficient British costs might be in the region of 25% lower than the costs projected by the SRA and that further reductions in costs might be possible if the industry structure, approvals process or environmental and safety regulations were changed. In particular, environmental and safety regulations which significantly increase costs should be subject to cost benefit analysis; these regulations could be counterproductive if they impose costs on rail transport, one of the safest and environmentally friendliest forms of travel, that they do not impose on other modes.

Appraisal in the case study countries

8.6 Even if the economic case for construction of a network of high speed rail lines had been stronger in Britain in the past, it is unlikely that this would have been pursued in the 1980s and early 1990s, when most other European countries were building or planning high speed rail lines. At the time, such new rail projects were only authorised if they were expected to generate a return on a commercial basis. In contrast, most other countries conducted little, if any, economic analysis of the high speed lines they were approving: they were built based on either transport objectives, or strategic and political objectives.

- 8.7 However, appraisal practice has now converged to an extent, at least amongst the major European countries. Our view is that the new British appraisal structure, set out by the SRA in their new appraisal guidance in 2003 and based on the new Treasury Green Book, includes almost all factors on which it is feasible to place monetary values, and therefore comes close to representing best practice in many areas. Meanwhile, other countries, including France, have introduced requirements that cost benefit analysis is undertaken before proceeding with major projects, and this process is not a mere formality: France has decided not to proceed with some projects on the basis of this process.
- 8.8 Economic appraisal appears to be less advanced in Italy and Australia. In Italy, it has not been used in the past for high speed lines, and although it can now be requested, there is no obligation to undertake it. In Australia, the approvals processes varies by state, and although economic appraisal has been undertaken for some projects, it has not been undertaken for others. The appraisal process in Japan is radically different from the other case study countries: economic impact analysis is undertaken, but cost benefit analysis is not.
- 8.9 The table below summarises the main types of appraisal that are carried out in the case study countries.

TABLE 8.1 MAIN APPRAISAL METHODS USED

Appraisal method	GB	Japan	France	Germany	Spain	Italy	Australia
Financial	✓	✓	✓	✓	✓	✓	✓
Economic cost benefit	✓	×	✓	✓	✓	(✓)	(✓)
Multi criteria	✓	×	×	✓	✓	×	×
Economic impact	×	✓	(✓)	(✓)	(✓)	×	×

- 8.10 In some countries, the appraisal criteria appear to have been skewed in order to favour particular outcomes. There particularly notable examples of this in Germany and Spain: for example, in one Spanish appraisal, employment costs were considered as a benefit as well as a cost, and the employment costs were simultaneously reduced through application of a shadow price. The fact that a large proportion of scheme costs are paid for by the European Union, rather than Spain, may have created an incentive to ensure a positive outcome from the appraisal. Bias in the appraisal system was more explicit in Italy, where benefiting the South was a specified objective for all transport projects.
- 8.11 The ultimate decision to proceed with a high speed rail project is properly taken at the highest levels of government, given the very significant investment involved. The criteria used for this decision are likely to be wider than the appraisal, but are difficult to assess. There was some evidence that perceived economic benefits of projects,

national pride issues, and wider strategic impacts, were more important in decision making than appraisal.

Recommendations for appraisal in Britain

- 8.12 Although in most respects the new British appraisal framework represents best practice, we have made some recommendations, relating to the value of time, economic impact analysis, environmental assessments and risk/optimism bias allowances.
- 8.13 Values of time are always likely to be a very important input to appraisal, but these vary significantly between regions and types of journey. Although project-specific values of time have been used on some projects in the past, we suggest that they should be used on significant projects as a matter of course and that the government should produce guidance on appropriate differential values. The DfT has told us that it is now developing new guidance in this area, further to recent academic research which reached the same conclusion.
- 8.14 The new Green Book requires that very significant allowance is made for risk and optimism bias, particularly for capital intensive projects such as high speed railways. In our view, these allowances are excessive in that the railway evidence on which they are in part based is inevitably coloured by experience within the UK industry in recent years, when the Government and the SRA have contended that flaws in the previous industry structure undermined effective project planning and cost estimation. Although the Green Book allows for the initial allowances to be reduced after further project development and quantified risk analysis, there is a risk that a project will not be analysed further because of the impact of these allowances on the appraisal may be such that the project does not proceed further – particularly if they are combined with inflated cost estimates.
- 8.15 While the new Green Book takes, in our view, an appropriate and pragmatic approach to the valuation of environmental impacts within a cost benefit framework, there has as yet been little practical experience of applying these principles. There is a premium on gathering good operational practice, and in this respect, account should be taken of the longer history of such techniques in countries such as Germany. The DfT is currently developing guidelines on valuation of environmental impacts, and they have informed us that these will take into account European practice, while the SRA have already started to take environmental values into account in appraising freight grants.
- 8.16 We also propose that Britain should consider undertaking wider analysis of the economic impact of very major projects, such as an HSL, as the standard assumption that national economic growth would not be changed by transport projects would not necessarily apply to a project of this scale, particularly if its construction could help relieve the very severe transport bottlenecks that Britain is likely to suffer from in the medium term if we do not undertake significant investment in transport infrastructure.

Although this analysis has not been undertaken in the past, the DfT has informed us that it is now being assessed in the context of Crossrail.

The impact on the case for a high speed line

- 8.17 The outcome would be changed most significantly by the revised optimism bias assumptions we suggest. The combined effect of the changes we propose to the appraisal framework would change the benefit to cost ratio for the high speed line case that we evaluated from 1.42 to 1.97. If it was also possible to reduce costs to what we estimate would be efficient levels, the benefit to cost ratio would increase further, to around 2.5.
- 8.18 The SRA have advised us that their more recent, revised, work (conducted since we undertook our analysis), which will help inform their consultation document, shows a BCR of around 2.0. The strengthening of the BCR in the revised SRA appraisal is due to a different method for calculating the BCR and changes to their assumptions about the upgrade of the East Coast Main Line. Combining these with our proposed adjustments to the appraisal framework and using our estimates of efficient costs would increase the benefit to cost ratio to between 3 and 4.
- 8.19 In combination, these effects would make a strong economic cost benefit case for an HSL. It is also likely that undertaking an appraisal of the wider economic impacts of the project would further strengthen the case, although it is not possible to quantify the extent to which this would be true – recent academic debate over the issue has produced incremental economic benefit estimates ranging from 3 to 30%.

Conclusion

- 8.20 Differences in the extent to which countries have constructed high speed rail lines appear to be most closely correlated with market differences. The market, in terms of geographical and demographic factors, is most appropriate for high speed rail in France and to a lesser extent Spain and Japan, than the other countries evaluated. The extent to which rail faces competition from air transport is also correlated with the extent of the high speed rail network, but it is likely that different rates of development of the more flexible and responsive air transport networks have been a consequence as much as a cause of different rates of high speed rail development. There is little correlation with other market factors, such as car ownership, possibly reflecting the fact that car market share tends to be lower for very long distance transport markets.
- 8.21 Market differences help to explain not just why some countries have constructed more high speed rail lines than Britain more generally, but also why France, for example, has constructed more high speed routes than Germany or Italy. Britain's relatively good basic conventional rail network (particularly on routes north and west of London) has meant that the case for high speed construction here has, historically,

been less strong. However, this network is now reaching its maximum capacity and further expansion will be disruptive and expensive: the case for construction of a high speed rail line is therefore now likely to be much stronger than it would have been in the 1980s. The cost of a major high speed line from London to northern England would be comparable to the cost of the West Coast Main Line upgrade.

- 8.22 Historical decisions to construct high speed rail lines were generally not mainly based on economic appraisal, and therefore variations in appraisal criteria cannot explain why other countries have invested so much more than Britain has. The use of economic appraisal is now much more extensive and, within Europe, appraisal practice appears to be converging – although in some countries the appraisal criteria appear to skew the appraisal towards favouring particular outcomes. The British appraisal system now comes close to representing best practice in many areas: the most significant issue, in terms of high speed rail development, is that the risk and optimism bias assumptions may be excessive and this could mean that worthwhile projects never get off the ground.
- 8.23 We suggest that a key priority for the SRA and the government should now be to analyse in more detail why differences in the projected costs of new-build transport projects between Britain and other countries are so high: we have estimated that efficient costs could be 25% lower than the costs on which the SRA has appraised the high speed line, and that further cost reductions might also be possible if it was possible to challenge safety and environmental regulations that could not be justified on the basis of cost benefit analysis. In parallel, more systematic application of ex post evaluation techniques, and understanding of the reasons for deviations between appraisal assumptions and actual outcomes, will allow more informed allowances to be developed for contingencies in particular cases in future.

Summary of principal recommendations

- Standard optimism bias assumptions are inappropriate for high speed rail and should be reduced, based on a deeper understanding of relevant project overruns.
- Project-specific values of time and for the proportion of working time should be used in appraisals.
- The wider economic benefits of major transport projects should be quantified and included in the appraisal.
- Safety and environmental regulations that significantly increase costs should be reviewed and subject to cost benefit analysis.
- The priority for further work should be to seek means of reducing costs to levels closer to those seen elsewhere in Europe.

APPENDIX A

GREAT BRITAIN

A1. GREAT BRITAIN

Status of high-speed rail programme

A1.1 When the second stage of the Channel Tunnel Rail Link (CTRL) is complete, in 2007, the whole new line will cover 105km, linking London with the Channel Tunnel. Preliminary analysis has been undertaken of a further new line linking London with northern England and possibly Scotland. There has been strong public support for high-speed rail services, but the actual development of lines has been highly controversial, in part due to uncertainties arising from the publication, in the late 1980s, of a large number of possible route options for the Channel Tunnel Rail Link.

Historical development of the high speed rail network

A1.2 During the 1980s and early 1990s, the government's explicit objective for rail transport was that it should consume less public subsidy. Projects had to be justified on a purely commercial basis with an 8% rate of return. This, together with the limited availability of public funds for transport tended to limit enhancement projects to route upgrades, as it was perceived that a new route would have been much more expensive (although the West Coast Upgrade has shown that this might no longer be true).

A1.3 Although detailed route analysis for the CTRL was undertaken during the late 1980s and the 1990s, no firm decision to proceed was taken until 1996. The Treaty of Canterbury, in which Britain and France agreed to build the Channel Tunnel, had stated that no public funds were to be used, although in reality the Railway Usage Contract that the British and French railways signed with Eurotunnel constituted, in effect, an indirect state subsidy.

A1.4 CTRL was structured as a public private partnership. The government initially agreed to provide some grant funding but the private sector (in the shape of London and Continental Railways, the consortium formed to develop the line and participate in the operation of Eurostar services on it) was to be responsible for raising the majority of the funds from the capital markets. The deal came close to collapse in 1998 when it became clear that Eurostar's poor performance, relative to its passenger and revenue forecasts, would preclude London and Continental from raising further funds through its envisaged flotation. Construction was able to start after the government guaranteed bonds that were issued by London and Continental, which was to build the link and then sell it to Railtrack (which would effectively manage the project and take assume construction risk for it, while leaving substantial demand risk with Government).

A1.5 Railtrack's own collapse in 2001 has resulted in the project proceeding with the support of Network Rail, its not-for-profit successor, itself the recipient of state-backed loans.

Outline of the institutional structure of the rail industry

- A1.6 Passenger services are provided by 25 franchises, which are privately owned but operate services according to increasingly detailed specifications, developed by the Strategic Rail Authority, a government agency responsible for strategy and planning of the rail network. The only high-speed operator, Eurostar, is an international consortium involving London and Continental Railways, the private company that is building the CTRL, and the French and Belgian passenger rail operators.
- A1.7 Almost all rail infrastructure is provided by Network Rail, a not-for-profit company limited by guarantee. Major infrastructure work requires the agreement of the Strategic Rail Authority and any major investment would also need the agreement of the Department for Transport and the Treasury. The CTRL will be managed by a subsidiary of Network Rail on its completion.

The transport market

Rail market share

- A1.8 The railway's share of the passenger transport market in Great Britain is 6.4%. Rail's market share varies significantly between routes: it is much higher for journeys to/from London than for other journeys.

The classic rail network

- A1.9 The classic rail network is capacity-constrained on key routes and, particularly since the Hatfield accident in 2000, has suffered from poor reliability and variable condition, reflecting the patchy history of network development under private ownership, and variable renewal and upgrade in the public sector. However, long distance operators on routes to/from London, particularly the East Coast Main Line, achieve high average speeds – even compared to some high-speed lines in other countries.

Competition

- A1.10 The UK liberalised its aviation markets before most other European countries and as a result has highly developed domestic air services and an extensive network of low cost airlines. The national rail network therefore faces intense competition on longer routes. However, in part as a result of slot constraints in south-east England, air only has a significant market share for longer journeys (especially to/from Scotland).

A1.11 Rail also faces competition from both the private car and an extensive long distance bus network. For many journeys that are not to/from London, buses may be little slower - and much cheaper - than rail. Petrol prices are high but there are no road tolls, other than specific tolls for a few sections of infrastructure, and the central London congestion charge.

Population distribution

A1.12 England, and in particular the south east of England, is densely populated by European standards. No city other than London has a population of over 1 million, although there are a number of large conurbations that together have a significant population (for example, Greater Manchester). Most of the population lives in regions within 200km of London. London is the fourth most densely populated capital city in Europe (after Paris, Brussels and Copenhagen), but other cities in England have relatively low population densities and London itself is surrounded by significant 'suburban sprawl' which makes it relatively less attractive for the development of new high-speed rail lines.

TABLE A1 MARKET SUMMARY TABLE: GREAT BRITAIN²³

	Metric	Value
Rail market share	Passenger kilometres	6.4%
	Passenger trips	2.6% ²⁴
Population	Total population (millions)	57.1
	Population density (persons per square kilometre)	249
	Average population density of 5 largest cities (persons per square kilometre)	3,040
Other market factors	Petrol price £/litre	0.75
	Toll for 100km motorway journey £	0
	Cars per 1000 population	438
	Rail fares as % air fares, largest OD pair	60-100%
	High speed trains arriving on time	N/A
	Long distance trains arriving on time	70% (within 10 mins)

²³ Figures exclude Northern Ireland

²⁴ This includes short distance local trips and is therefore not comparable to figures shown for other countries.

Outline of process

- A1.13 All transport schemes in England and Wales are appraised in line with guidance set out by the Treasury in the Green Book and the New Approach to Transport Appraisal (NATA) prepared by the Department for Transport.
- A1.14 Appraisal in Scotland is carried out in line with the Scottish Transport Appraisal Guidance (STAG), which is similar but not identical to the process and criteria in England and Wales. We do not focus on this in detail here, as it is likely that any high-speed lines constructed in the UK in the medium term would be wholly or largely within England.
- A1.15 Appraisal of rail transport projects is undertaken according to these government criteria by the SRA, which also has a separate set of appraisal criteria, although these are generally consistent with the government's. Indeed, for major projects, analysis would be undertaken by the DfT (Department for Transport) and the Treasury as well as the SRA.
- A1.16 The decision to provide government financing for the CTRL was made prior to the creation of the SRA and was taken directly by the then Department of Environment, Transport and the Regions (DETR).
- A1.17 At the time, rail passenger operations and infrastructure in Great Britain were privatised and it was expected that the private sector would take the initiative for most major rail investment proposals, albeit that public-sector funding of non-monetised project benefits was anticipated, and the SRA's predecessor (the Office for Rail Passenger Franchising, OPRAF) was provided powers, and published criteria, to evaluate and provide such financial support.
- A1.18 Nevertheless, OPRAF only provided support for one major scheme (Thameslink 2000) and as a result, the appraisal framework for rail projects appears to have been rather less precisely defined than it is now.
- A1.19 Prior to rail privatisation (during the 1980s and 1990s), major rail funding decisions were made by the Department of Transport (DoT) but rail projects were generally expected to make a return using the discount rate in general use by government departments at the time, of 8%. Although this represents a high threshold, a number of major upgrade schemes, including electrification of the East Coast Main Line, were undertaken on this basis.

Criteria used for appraisal

A1.20 The SRA uses multi-criteria analysis in line with NATA where every project should be appraised against the following basic types of criteria:

- Environment;
- Safety;
- Economy;
- Accessibility; and
- Integration.

A1.21 Monetary values are used as far as possible, and in this respect revenues and costs at market prices are subject to two adjustments:

- Shadow prices for some variables; and
- Cost estimate adjustments for risk and optimism bias.

A1.22 The SRA's guidance identifies that it is possible to put monetary values on some of the environmental, safety, economic and accessibility effects of rail projects, but not all of them. For this reason, at least in theory, other benefits that cannot be quantified financially are also included in the appraisal and should be treated as of equal importance.

A1.23 The summary table highlights that there a number of variables where, although in theory monetary values could and should be used, our experience is that in practice they are not, typically due to practical quantification difficulties:

- Personal security benefits;
- Severance: the potential effect on communities of being divided by new roads or railway lines; and
- Option values: there is some evidence that people who would not usually use a service will support its creation because they would like to have the option of using it (for example, people who never use a certain rail route might perceive that they could need to use it at some point).

Shadow prices

A1.24 Shadow prices are not generally used, because it is assumed that market prices usually represent accurate indicators of the opportunity costs of the resources used, such that transfers including indirect taxes should be included in most of the costs appraised and direct taxes would not be discounted from personnel costs. However, SRA guidance identifies that shadow prices would be appropriate in some specific circumstances - for example, if agricultural land is to be purchased for a new line, market prices may be adjusted to reflect the fact that they are inflated as a result of subsidies.

Risk and optimism bias

A1.25 Many major infrastructure schemes undertaken in Britain have been completed late and over budget, or have failed to achieve revenue forecasts. This tendency for initial project estimates to be optimistic is now specifically included in the appraisal, and these adjustments for optimism bias may have a significant impact on the analysis. Adjustments are made to:

- Capital costs, the estimates for which can be increased by up to 66%, depending on the level of detail at which the analysis has been undertaken; and
- Timing of the project – it is assumed for appraisal that the project will take up to 25% longer to complete than the initial schedule indicates.

A1.26 Optimism bias estimates are not routinely applied to either operating costs or revenues associated with a project, but sponsors are expected to undertake sensitivity analysis to these and in practice a significant optimism bias assumption has also been applied to operating costs in the SRA's appraisal of a high speed line. There has been some debate as to whether risk/uncertainty should be quantified separately from optimism bias for major projects, but the consensus appears to be that optimism bias parameters should include risk.

Distributional effects

A1.27 The Treasury Green Book states that adjustments may be made in order to take into account the distributional effect of projects. However, it acknowledges that these are likely to be difficult to quantify. In practice, if distributional effects are taken into account at all in appraisal, they are not valued specifically but are included in the multi-criteria analysis.

Economic effects

A1.28 Analysis of the economic effects of a project is limited to assessing whether it will enhance the economic position of some regions at the expense of others. There is no analysis of whether the economic position of the country as a whole could be improved: this issue has been examined by the SRA in the context of a possible high speed line to northern England, but it was decided only to estimate regional effects. Total national employment is assumed to remain constant.

TABLE A2 APPRAISAL SUMMARY TABLE: GREAT BRITAIN

Appraisal summary		Notes
Appraisal type used	Financial analysis	✓
	Cost benefit analysis	✓
	Multi-criteria analysis	✓

The result of the appraisal is a multi-criteria analysis but the financial and cost/benefit analysis form an important part of this

Key variables	Discount rate	3.5%	Lower discount rates for projects with a duration of over 30 years
	Appraisal period	Period should be the useful lifetime of the assets	
	Use of shadow prices	×	Market prices used except in very limited circumstances
	Optimism bias/risk	Up to 66% for construction costs and 25% for construction period	
	Value of time ²⁵	£4.12/hour (leisure time) £27.78/hour (work time)	
	Value of life	£1.24m	
	Value for serious injuries	£140,000	
	Value of CO ₂ /tonne	No consistent or recommended appraisal value. Typical value £70/tonne (2000), increasing by £1 per year.	
		Effect	CBA
Environmental issues	Noise and vibration	(✓)	The new Green Book states that these should be valued but they have not been in appraisals to date
	Air pollution	(✓)	
	Greenhouse effect	(✓)	
	Landscape/townscape		✓
	Biodiversity		✓
Safety	Accidents	✓	
	Personal security	(✓)	Guidance states that CBA should be used, but in practice rarely is
Economy	Journey time and frequency	✓	
	Rail costs/revenues	✓	
	Other mode costs	×	
	Comfort	×	Crowding is evaluated, but should primarily reflect comfort for urban routes
	Road congestion	✓	
	Performance	✓	
	Facilities quality	✓	
	Tax revenues	×	However, this is taken into account in estimate of net cost to Exchequer.
	Regional economy effect		✓
	National economy effect	×	
Employment	×		

²⁵ Appraisal values here taken from COBA 2002. 1998 values, updated to 2002.

Accessibility	Reduction of barriers	✓	
	Severance	(✓)	Guidance states that CBA should be used, but in practice has not been and it is not clear how these would be valued
	Option values	(✓)	
Integration	Integration with other modes	✓	

Criteria used for decision making

- A1.29 For very large projects, such as a high-speed rail project, the ultimate decision is taken by the government and would be taken at Cabinet level. It would therefore be taken by a wider set of Ministers although advice from the Department for Transport and the Treasury would be of key importance in this decision.
- A1.30 The ultimate decision for the CTRL took into account a number of issues other than those identified through the appraisal framework or included in cost benefit analysis. A report by the National Audit Office found that the government also took the following key issues into account:
- A1.31 The fact that it was a priority political project, for both national and European reasons, as it will be a key part of the Trans European Network. There also appears to have been some issue of national pride/prestige, particularly as a result of negative comparisons of the slow Eurostar journey through Kent with the high speed journeys in France; and
- A1.32 The potential regeneration benefits the line could produce in east London and north Kent, which are some of the most deprived areas of southeast England.
- A1.33 Regeneration benefits would now be explicitly included within the wider elements of an SRA appraisal, although they are difficult to quantify and therefore would not be included in cost benefit analysis. As well as in the decision on whether or not to build a line at all, regeneration benefits are also important in route selection. The decision to build CTRL to a station to the north of central London, approaching via the east, was taken partly because the line was expected to benefit the Thames Gateway regeneration area, and also because of political pressure to provide better connections to the Channel Tunnel from northern England and Scotland.
- A1.34 Issues of national pride, and the political importance of completing the UK's connection to continental Europe, would still not be included within today's appraisal framework, but may continue to be key for those involved in making the ultimate decision.

APPENDIX B

FRANCE

B1. FRANCE

Status of high-speed rail programme

B1.1 France was the first European country to construct a high-speed rail line (the Paris-Lyon line, which opened in 1981). The main high-speed rail projects completed in France to date are summarised in the Table 5.1 below.

TABLE B1 COMPLETED TGV PROJECTS

Project	Opening year	Length (km)
TGV Sud-Est (Paris-Lyon)	1981-3	447km
TGV Atlantique (Paris-Tours/Le Mans)	1989-90	282km
TGV Rhone-Alps (Lyon-Valence)	1992-4	121km
TGV Nord (Paris-Calais/Belgian frontier)	1993	320km
TGV Interconnexion (Paris bypass)	1994	70km
TGV Med (Valence-Marseille/Nimes)	2001	303km

B1.2 SNCF is planning a number of further schemes although the only new line that is currently under construction is TGV Est (Paris-Strasbourg). Major schemes that are in an advance stage of planning are the link to Spain (Perpignan-Figueras) and the extension of TGV Atlantique to Bordeaux. Projects are summarised in the figure below.

AVANCEMENT DES PROJETS FRANÇAIS TGV NOVEMBRE 2002									
PROJETS TGV	Débat préalable	Etudes préliminaires	Avant Projet Sommaire	Enquête publique	DUP	Avant projet Détaillé	Approbation ministérielle / Travaux	Dates "clé" et échéances attendues	
Est							07 novembre 2000 : signature de la convention de financement Janvier 2002 : approbation ministérielle Juin 2007 : mise en service		
Rhin-Rhône Branche Est							25 janvier 2002 : Décret d'Unité Publique Juin 2002 : démarrage des études APD (RFF et SNCF)		
Rhin-Rhône Branche Sud							3ème trimestre 2002 : transmission du Cahier des Charges au Ministre des Transports 1er semestre 2003 : lancement prévisible des études préliminaires		
Rhin-Rhône Branche Ouest (Traversée de l'agglomération dijonnaise)							29 avril 2002 : approbation des études préliminaires - choix du fuseau "Dijon-centre" 1er trimestre 2003 : lancement prévisible de l'Avant Projet Sommaire		
Liaison transalpine Section française Lyon - Sibion alpin							25 janvier 2001 : Décision Ministérielle - choix du tracé de la LGV "Chambery-Nord" 19 mars 2002 : approbation du dossier d'APS par le Ministre des Transports début 2003 : démarrage prévisible de l'IMEC		
Liaison transalpine Section internationale Montmélan - Tunnels comprenant le Tunnel sous les Alpes							Septembre 2001 : création de la société Lyon-Turin-Ferrovieire (SOTRF, SOTRFI) 27 novembre 2001 : sommet Franco-italien - engagement des Etats pour apporter les garanties financières pour la réalisation des travaux. La mise en service est avancée à 2012. Mars 2003 : présentation aux gouvernements de l'APS du Tunnel par LTF		
Languedoc-Roussillon Contournement de Nîmes et Montpellier							Décembre 2001 : approbation du dossier d'APS par le Ministre chargé des Transports Février 2002 : lancement de l'IMEC		
Perpignan - Barcelone							09 octobre 2001 : publication de la DUP au Journal Officiel Août 2002 : désignation d'un concessionnaire pressenti		
Sud-Europe-Atlantique Angoulême - Bordeaux							Fin 2001 : résultat de la consultation basée sur les études préliminaires complémentaires effectuées courant 2000 Fin 2002 : APS, consultation des services de l'Etat en cours		
Sud-Europe-Atlantique Tours - Angoulême							Fin 2002 : préparation de la Convention d'Etudes d'APS avec pour objectif un démarrage début 2003		
Bretagne - Pays de la Loire							02 Avril 2001 : le Ministre autorise l'engagement des études d'APS sur le projet complet de Ligne Nouvelle 09 juillet 2002 : signature de la Convention des Etudes d'Avant Projet Sommaire		
Haut-Bugey							Avril 2002 : le Ministre demande la constitution du dossier d'IMEC, préalable à l'ouverture de l'Enquête Publique et autorise la préparation de l'engagement de l'APD		

Historical development of the network

- B1.3 In the 1970s, plans for the development of the first TGV line were conceived for primarily political and strategic reasons. SNCF, and the manufacturer, Alstom, were very effective political lobbyists at the time. TGV Sud Est was an 'ideal' project for high speed rail, running between two large cities around 400km apart that could, technically, be linked relatively easily. It was also a response to capacity constraints on the pre-existing line between Paris, Dijon and Lyon.
- B1.4 The success of TGV Sud Est made political justification of subsequent projects easier. Conversely, lower than projected traffic on TGV Nord, and cost overruns and delays on TGV Est, have both increased the degree of scrutiny of rail proposals in recent time. As a result, although there are a large number of plans for further TGV lines, only relatively modest schemes appear likely to go ahead in the short term, and some projects may be dropped altogether or postponed (for example, Lyon-Turin, where there are significant technical difficulties).

Outline of the institutional structure of the rail industry

- B1.5 The operator of almost all rail passenger services is SNCF, which is a state owned company. Separate consortia (generally joint ventures of the national railways) including Eurostar and Thalys operate international long high-speed services, but SNCF is an important partner in them. There has to date been no open access to the French high-speed rail network (or indeed, any other part of the rail network) and the government opposes open access.
- B1.6 Rail infrastructure, including all the high-speed lines, is owned by RFF, which is also a state owned company, formed in order to comply with the EU legislation on the separation of infrastructure from operations. RFF contracts all operation and maintenance back to SNCF, although as a result of the most recent EU legislation, capacity allocation is now undertaken by RFF independently of SNCF.
- B1.7 The Ministry of Transport and Tourism is responsible for all of France's transport policy, covering transport by road, rail, air and sea.

The transport market

Rail market share

- B1.8 The railway's share of the passenger transport market is 9.6% overall, which is relatively high for Europe. It is highest for journeys of 400-600km (18%). Rail has a very high share of the market on key TGV routes (see the table below) and Air France has withdrawn its services from the Paris-Brussels route, opting instead to codeshare with Thalys. Rail has a lower market share on routes where there is no TGV, and, as in Britain, has a much lower share for inter-regional routes than routes to/from the capital city.

TABLE B2 RAIL SHARE OF THE AIR-RAIL MARKET

Route	Rail market share	Rail journey time (hours)
Paris-Lyon	91%	1:55
Paris-Nantes	89%	2:00
Paris-Bordeaux	62%	3:00
Lyon-Lille	60%	3:00
Paris-Marseille	60%	3:10

The classic rail network

- B1.9 The classic rail network to/from Paris is relatively good quality in France: for example, it was possible to travel from Paris to Bordeaux in 4 hours, a distance of 570km, even before the TGV was introduced. The inter-regional rail network is poorer. TGV construction has been facilitated by the fact that TGV trains can use the existing rail routes on the final approaches to Paris. However, the network is subject to capacity constraints, and given long distances between major cities, journey times would be too high to compete with air transport without the TGV.

Competition

- B1.10 The main competition the TGV faces on domestic routes is from Air France. Rail fares have tended to be much lower than air fares and historically this was needed give the journey time advantages of air. TGV fares have historically been set with only a small supplement relative to conventional rail fares, largely for political and social reasons.
- B1.11 The development of low cost airlines in France has been constrained by a number of difficulties, particularly of the carriers obtaining adequate slots at Paris airports. As a result, many low cost airlines have had to use Beauvais airport, but this is over 100km from Paris and the only public transport connection to the city is by bus. Easyjet has applied for slots at Orly airport but has consistently been allocated far fewer than it requested. Incentives which Ryanair has received to use Strasbourg airport have been successfully challenged in court, and this reversal threatens to undermine the recent successes of low cost carriers in penetrating routes away from the main inter-urban core serviced by the TGV.
- B1.12 Petrol prices are slightly lower than in the UK but tolls are levied for long distance trips. Although there are extensive urban and regional bus systems, which are often very well integrated with the rail network, long distance buses have a low market share in France, as a result of the high quality and relatively low fares traditionally

offered by the rail system, and do not compete with high speed trains due to their relative speeds.

Population distribution

- B1.13 Paris is by far the largest city in France: the Paris urban area has a population of 9.65 million (2.11 million within the city itself). No other urban area has a population of more than 1.35 million. As a result of this, and the historically centralised development of business and government in France, most rail travel is to/from Paris.
- B1.14 Distances in France are ideal for high-speed rail. The nine major cities other than Paris are all at least 200km from Paris and all but one (Lille) is over 400km. All have the potential to be accessible within 3.5 hours by high speed train if direct routes were constructed.

TABLE B3 **MARKET SUMMARY TABLE: FRANCE**

	Metric	Value
Rail market share	Passenger kilometres	9.6%
	Passenger trips	n/a
Population	Total population (millions)	59.8
	Population density (persons per square kilometre)	100
	Average population density of 5 largest cities (persons per square kilometre)	1,892 (urbanised area) 8,796 (city)
Other market factors	Petrol price €/litre	1.00
	Toll for 100km motorway journey €	6.52
	Cars per 1000 population	478
	Rail fares as % typical air fares, largest OD pair	25-50%
	High speed trains arriving on time	90% (within 10 minutes)
	Other long distance trains arriving on time	87% (within 10 minutes)

Outline of process

- B1.15 The 1982 transport legislation *Loi d'Organisation sur les Transports Intérieurs* (LOTI) specified that all large infrastructure projects should be appraised with consistent criteria, and that evaluations should take account of construction costs and both direct and indirect social and environmental costs.

B1.16 Within this legislative framework, the current process used for rail infrastructure development was defined in 2000 in *Circulaire relative aux modalités d'élaboration des grands projets d'infrastructure ferroviaire*. RFF, the infrastructure manager, carries out most of the work required for the economic evaluation of rail projects, which it undertakes in cooperation with SNCF. The project development process is undertaken in a series of pre-defined stages. The Ministry of Transport takes decisions at each stage on whether to proceed, with its decisions being confirmed by ministerial decree. The stages are:

- Preliminary debate (*Débat préalable*): this consists of the preliminary consultation which is required for all large projects with significant potential environmental effects. Consultation includes local government, business, chambers of commerce etc.
- Preliminary studies (*Etudes préliminaires*): these studies define the main characteristics of the project and examine possible variants to it.
- Pre-project summary (*Avant Projet Sommaire*): this consists of a series of in-depth studies undertaken on one specified variant project, selected by the Government at the end of the preliminary studies. These detailed studies those on technical, traffic, environmental and economic aspects of the selected variant of the project. At the end of this stage, the Ministry decides whether the project should proceed and if so confirms the detailed basis on which it should do so.
- Survey of public utility: (*Enquête d'utilité publique*): This is a compulsory process if the project requires public funding. A project assessment is prepared and presented to the Prefect of the region that decides to launch the survey, while a funding plan for the project is also prepared at this stage. At the end of this phase, the Ministry of Transport issues a Statement of Public Utility for the project (*Déclaration d'utilité publique* or DUP), which includes socio-economic analysis of the impact of the project and an outline definition of the approved funding plan for the project.
- Detailed pre-project: (*Avant Projet Détaillé* or APD): a further series of studies is undertaken in order to finalise the detailed characteristics of the project and agree modes of financing. This stage results in an application to the Minister for final permission to proceed with the project.
- Final official agreement by the Ministry of Transport (*Approbation ministérielle finale*): at this stage, the Ministry approves the project and implementation can begin.

B1.17 During the whole process, representatives of the Ministry of Transport (for rail, the directorate DTT *Direction infrastructure et projets ferroviaires*) follow up the studies being by RFF, and act as the administrative supervisors of the project.

B1.18 The government also establishes a broader Steering Committee to monitor the whole process, comprised of regional representatives of the national government (Prefects) and regional and local elected authorities. The objective of the Steering Committee is to ensure that all relevant bodies are involved and kept informed of the progress of the project. Recently, a law passed in 2002 on 'Democracy and Proximity' requires more widespread consultation, including with the general population, for all large projects (not only in transport) at all stages of the appraisal process.

B1.19 The process of planning and developing high-speed lines appears to be faster in France than in Britain. For TGV Sud Est, only ten years elapsed between the initial studies being undertaken and the first part of the line being opened, although the elapsed time has increased for recent projects for a number of reasons:

- The decision making process has become more formalised and transparent;
- Financing has become more complicated and tends to involve more organisations. The Perpignan-Figueras line is intended to be the first high speed rail PPP in France; and
- Some recent projects (for example, Lyon-Turin) have also been more technically complicated.

B1.20 Key differences with the processes in Britain include:

- The automatic expropriation of property en-route once the *Déclaration d'utilité publique* is announced. Property owners have no right of appeal although they may be able to secure an increase in the price; and
- The authorisation process is much faster. Although the process involves extensive analysis and consultation, and local and regional governments are involved, it typically only takes one month for a medium sized project and has taken up to three months for a major project such as TGV Est. This compares with public enquiries in Britain which can last for years. As in Britain, the government is not obliged to accept the outcome of a public enquiry, but usually does.

Criteria used for appraisal

B1.21 Formal socio-economic appraisal is now required in France, although the early TGV projects were appraised on purely financial grounds and then authorised based on political and strategic judgement, rather than as a result of economic cost benefit analysis.

B1.22 The criteria now used are defined in two documents:

- The *Circulaire Idrac* (1995) which is the official appraisal document for all public projects including high-speed rail; and
- The *Boiteux* report (2001) updated this general guidance specifically for transport projects. A revised official appraisal document is under preparation, which will use the recommendations of this report. Pending this, transport appraisals are often produced using both sets of criteria - the values we show in the table below are taken from the Boiteux report, as this is more recent.

B1.23 Appraisal is based on cost-benefit analysis principles, and monetary values are placed on as many items as possible. However, the political decision to proceed with the project will take into account wider issues, such as economic and regional development, and these are also stressed in the materials that are produced such as the *Déclaration d'utilité publique*.

B1.24 The result of the cost-benefit analysis is an assessment of the social rate of return that a project will produce in comparison with the reference case (if the project is not constructed). For an example high speed rail project²⁶, this contains the following elements:

- Net financial outcome of the project (revenue less costs);
- Gains in journey time for passengers and those that transfer from other modes;
- Net losses of other transport operators (revenue less costs);
- Impact on national and local tax revenue;
- Social and economic impacts (noise, emissions, safety, congestion etc).

B1.25 The *Circulaire Idrac* recommends that two sets of appraisal results should be produced for international projects, one in which all costs and benefits are taken into account, and one in which the only benefits taken into account are those accrued by French citizens. However, in the example we have of a cost-benefit analysis for an international rail project, it is not specified whether benefits to non-French citizens are included. This form of approach is distinct from that in Britain, where benefits to international passengers are not taken into account.

B1.26 One other interesting difference with conventional British practice is that, as well as taking into account different emissions created by transport via different modes, the different rates of emissions created by diesel and electric trains also are taken into account. The *Circulaire Idrac* states that diesel trains produce emissions, per passenger kilometre, at rates seven times those of electric trains. As electric traction is used for high-speed lines, but, at least in Britain, many of the passengers who used high-speed trains would transfer from diesel trains on classic routes, reflecting differential emissions rates in British appraisals in this way would improve the appraised benefits of high-speed rail lines. However, new SRA appraisal guidance states that the emissions differences between diesel and electric trains should be included.

B1.27 The *Boiteux* report contains two types of environmental costs:

- Carbon emissions per tonne for all modes are included. Carbon is valued at a uniform rate regardless of mode and where emission takes place; and
- Other local and atmospheric pollution per tonne is calculated dependent on the mode (car, truck, diesel freight train, diesel passenger train, bus) and the area in which emission takes place (high density urban, suburban or rural). Road pollution costs per vehicle kilometre are estimated to be 45 times higher in high-density urban areas than in rural areas. Electric trains are assumed not to produce pollution.

²⁶ Liason Perpignan-Figueras, Dossier d'instruction mixte a l'échelon central, Evaluation économique et sociale

TABLE B4 **APPRAISAL SUMMARY TABLE: FRANCE**

Appraisal summary		Notes	
Appraisal type used	Financial analysis	✓	The result of the appraisal is a cost benefit analysis which includes financial analysis. Multi criteria analysis is not carried out explicitly but other factors are taken into account in the ultimate decision, which is in practice similar.
	Cost benefit analysis	✓	
	Multi-criteria analysis	✗	
Key variables	Discount rate	8%	This is the threshold value for a project to go ahead
	Appraisal period (years)	20	Residual values are also taken into account. Permanent way is assumed to have an infinite asset life.
	Use of shadow prices	✗	Market prices used
	Optimism bias/risk	Not included	
	Value of time	The values of time used are both mode specific and distance specific. Values increase by distance. Values used are: Road: €8.4-€13.7 Rail 2 nd class: €10.7-12.3 Rail 1 st class: €27.4-32.3 Air: €45.7	
	Value of life	Private transport: €1.0 million Public transport: €1.5 million	
	Value for serious injuries	Private transport: €150,000 Public transport: €225,000	
Value of CO ₂ /tonne	€100	Per tonne of carbon; assumed to increase at 3% real per year from 2010	
	Effect	CBA	MCA
Environmental issues	Noise and vibration	✓	Noise effects weighted by the number of people exposed and the level
	Air pollution	✓	Local and atmospheric pollution quantified through rates that vary by mode and by area of transport
	Greenhouse effect	✓	Quantified through cost of a tonne of carbon
	Landscape/townscape	✗	
	Biodiversity	✗	
Safety	Accidents	✓	
	Personal security	✗	
Economy	Journey time and frequency	✓	
	Rail costs/revenues	✓	

	Other mode costs	✓	
	Other mode revenues	✓	
	Crowding	×	
	Road congestion	✓	
	Performance	×	
	Facilities quality	(✓)	Not quantified, but this is emphasised in public documents
	Tax revenue	✓	
	Regional economy effect	×	These economic effects are not quantified in cost-benefit analysis but are key reasons cited as political decision criteria. There have been some attempts by academics to quantify national economic benefits.
	National economy effect	×	
	Employment	×	
Accessibility	Reduction of barriers	×	
	Severance	×	
	Option values	×	
Integration	Integration with other modes	×	

Criteria used for decision making

- B1.28 As explained above, detailed economic appraisal is now required in France, and for a project to go ahead, a rate of return of at least 8% is required. Note that the rate of return, rather than a benefit to cost ratio, is the key decision variable.
- B1.29 The government takes into account a number of other measures and impacts when deciding whether to proceed with a project. Hence, even if the project appears to be positive on all appraisal criteria, this does not guarantee that it will receive funding: appraisal is necessary, but not enough on its own. The *Circulaire Idrac* document itself states that cost-benefit analysis is intended to inform, but not to substitute for, the political decision. Political decision-making is much less transparent than the economic appraisal process, although the regional economic impacts of a project are often cited as a key criterion for the decision to proceed.

APPENDIX C

GERMANY

C1. GERMANY

Status of high-speed rail programme

C1.1 The high-speed rail programme in Germany has been less extensive than in France but nonetheless a number of new lines have been built, as indicated in Table 6.1 below, and other schemes are planned. The high-speed train (the ICE) also operates extensively on conventional lines, including internationally to Switzerland, Belgium and the Netherlands. The Thalys high-speed train also operates into Germany, although does not use high speed infrastructure within Germany as yet.

TABLE C1 ICE PROJECTS

Project	Opening year	Length (km)
NBS Hanover-Wurzburg	1988-91	327
NBS Mannheim-Stuttgart	1991	100
NBS Wolfsburg-Berlin	1997	185
NBS Cologne-Frankfurt	2002	186

C1.2 Further high-speed lines are planned, between Hamburg and Hanover, Erfurt and Leipzig, and Mannheim and Frankfurt, although construction is not as yet underway on any of these routes. Many other parts of the network are to be upgraded for fast operation at speeds of 200-250km/h, and many of these schemes involve construction of additional tracks in some places.

Background and historical development of network

C1.3 Germany produces federal transport plans (Bundesverkehrswegeplan or BVWP) every 10-15 years, the latest of which have just come into force. The Hannover-Wurzburg, Mannheim-Stuttgart and Cologne-Frankfurt lines were originally envisaged in the 1973 BVWP, primarily as a response to congestion on the classic rail network.

C1.4 By the time of the 1985 BVWP, the objective was primarily to enable rail to compete with other modes, but this was attempted through service quality as much as speed and as a result the ICE trains probably offer the highest standard of on-board passenger facilities in Europe.

C1.5 A revised BVWP was produced in 1992 as a result of reunification, and the construction of a new line to Berlin, the newly designated federal capital, was prioritised over the Cologne-Frankfurt line.

- C1.6 Unlike high speed lines in most other European countries, the earlier German high speed lines also carry a significant number of conventional trains running at lower speeds, and were also designed to carry freight. This wider capability significantly increasing costs, because of the need to limit gradients and install passing places.
- C1.7 The lines were also designed for a lower maximum speed than has been used for other 'high-speed' lines in Europe (250km/h), and point-to-point average speeds on these routes are actually lower than for the East Coast Main Line in the UK. Nevertheless, the Frankfurt-Cologne line is designed for 300km/h operation and high speed passenger trains only.
- C1.8 Public and political support for high-speed rail development has been very strong in Germany, although there has been opposition from those living alongside proposed routes; partly as a result of this, environmental mitigation measures have been more extensive than those in some other countries, which has also led to increased costs. In constructing the high-speed lines, extensive use has been made of tunnels and cuttings in order to minimise noise and the effect on the landscape.

Outline of the institutional structure of the rail industry

- C1.9 Deutsch Bahn AG (DB) both operates passenger and freight trains and is also responsible for maintaining the infrastructure. It is divided into a number of different divisions, of which DB Reise & Touristik is responsible for all long distance passenger services, including high-speed services, and DB Netz is responsible for all infrastructure. Some local/regional services have concessioned out, and private operators have thereby entered the market, and there are also a very small number of open access long distance passenger trains operated by Connex, but none of these are high speed. Thalys operates high-speed trains into Germany, but these do not actually run at high-speed within Germany itself.

The transport market

Rail market share

- C1.10 The railway's share of the passenger transport market in Germany is 8.4% overall.

The classic rail network

- C1.11 The classic rail network in Germany is of varied quality although services on all main routes are very frequent and relatively reliable. Journey times on key routes in the south and west are constrained by the geographical nature of the corridors. Germany's dispersed population (see below) means that trains have to make frequent stops and

therefore average speeds are low, in particular in comparison with France, even on routes where high-speed trains have been introduced.

Competition

- C1.12 In part as a result of long journey times, rail is facing growing competition from low cost airlines in Germany and the rail regulator (EBA) has suggested that it will be difficult for rail to compete over long distances with the airlines. Rail fares have usually been charged on a per kilometre basis in Germany, which means that rail has become particularly uncompetitive for long distance journeys. Rail also faces strong competition from the road network: motorways have neither tolls nor speed limits.
- C1.13 However, long distance buses do not provide any significant competition. DB is the monopoly provider of long distance buses, and the network has been designed not to compete with trains.

Population distribution

- C1.14 Germany's population is widely dispersed: only three cities have a population of more than 1 million (Berlin, Hamburg and Munich) and only one of these (Berlin) has a population of more than 2 million. As a result, long distance trains need to make multiple stops to serve the potential market and this tends to increase journey times; for example, the high-speed train between Munich and Hamburg makes a minimum of seven intermediate stops.

TABLE C2 MARKET SUMMARY TABLE: GERMANY

	Metric	Value
Rail market share	Passenger kilometres	8.4%
	Passenger trips	N/A
Population	Total population (millions)	83.3
	Population density (persons per square kilometre)	233
	Average population density of 5 largest cities (persons per square kilometre)	3,018
Other market factors	Petrol price €/litre	1.08
	Toll for 100km motorway journey €	0
	Cars per 1000 population	533
	Rail fares as % air fares, largest OD pair	60-80%
	High speed trains arriving on time	N/A
	Other long distance trains arriving on time	N/A

Outline of process

- C1.15 The *Bundesverkehrswegeplan* (BVWP) forms the basis of the high-speed rail programme, as well as the infrastructure programmes for other modes. This is developed by the Transport Ministry after consultation with the *Länder* (regions), *Kommunen* (local government) and DB (the operator). The development of the plan can take up to ten years, and feasibility studies and economic appraisals for the proposed projects are carried out at this stage.
- C1.16 The BVWP forms the base for the *Bundesschienerausbaugesetz* (Federal Construction Plan Law), which has to be passed by both houses of parliament. As the upper house (*Bundesrat*) is formed by representatives of the *Länder*, the regional governments continue to be involved in the development of the infrastructure plan during the legislative process, and this provides additional pressure for the plan to include projects that benefit all regions. Projects can only receive government funding if they are included in the *Bundesschienerausbaugesetz*.
- C1.17 Once the *Bundesschienerausbaugesetz* is passed, DB can apply to undertake construction of the new lines within it. For this purpose it applies for planning permission (*Planfeststellungsbeschluss*). This is granted by the EBA (*Eisenbahnbundesamt*, the federal railway office, which also functions as the rail regulator). Objectors can make representations to EBA and, although it grants permission as to whether a project can proceed, its decisions can be appealed in the courts. EBA also undertakes an analysis of whether the financial agreement between DB and the government is reasonable and a review of the economic appraisal.
- C1.18 Although the inclusion of a project in the BVWP and the law does not guarantee that it will be constructed, we understand that projects that are included in the law usually are constructed eventually.

Criteria used for appraisal

- C1.19 The appraisal conducted for the BVWP primarily uses cost benefit analysis. In addition to this, multi-criteria analysis of environmental and spatial effects is undertaken via:
- an Environmental Risk Assessment; and
 - a Spatial Impact Assessment.
- C1.20 Uniquely amongst the countries we studied, the German appraisal guidance gives an explicit weighting to be applied to the result of the (multi-criteria) spatial impact assessment, in order to provide a combined appraisal outcome. Therefore, although these factors are not included in the cost benefit analysis, numerical values are still then applied, using a scoring system, to determine a combined cost benefit/spatial

impact evaluation. This has the strength that it ensures that factors which cannot be given a monetary value are not ignored by decision makers, and it also ensures that consistent processes are used for evaluation across all projects, but does diminish the opportunities for flexibility in interpretation of non-quantifiable results. The result of the environmental risk assessment is also a numerical score but this is considered separately from the combined result of the cost-benefit analysis and the spatial impact assessment.

Cost benefit analysis

- C1.21 Cost benefit analysis appears to be the main tool of economic appraisal in Germany, although as explained above, monetary values are also placed on wider effects to a greater degree than is the case in some other countries. The output of the cost benefit analysis is a benefit cost ratio. The analysis is based on a standard transport network model which is used for all road and rail schemes: the appraisals undertaken for the current BVWP were carried out for impacts to 2015 with and without each project.
- C1.22 Shadow prices are extensively used in the cost benefit analyses and transfer payments including all taxes and subsidies are deducted. Some financial costs are excluded to enable comparison and to avoid double counting of economic costs, for example:
- some insurance costs are left out if accident costs are included, because the economic costs of accidents include some of the financial impacts of accidents and
 - no sunk costs (such as overheads) are included in the appraisal.
- C1.23 The value of time used in Germany appears to be lower than for some other EU member states, at €5.47/hour for rail passengers and €3.83/hour for road. The explanation for use of a lower value for road is that small changes in journey time are not noticeable for most road projects in the plan.
- C1.24 This appears to be counterintuitive and we have not been able to find any justification for this. Whether or not it is appropriate that a lower value of time should be used for calculating the impact of small savings – and a recent review conducted for DfT concluded that different values should **not** be used – either rail or road journey time changes could be limited (for example, removing one speed restriction from a railway could have a small impact on journey time, but widening a congested road could have a very large impact). Although it could be possible to justify use of a different value of time for rail, we believe this would be better justified on other factors (for example, different incomes). Without adequate justification, this adjustment appears to skew the analysis to favour rail schemes.
- C1.25 A key input to cost benefit analysis is the expected employment effects of a project during construction and operation. These are determined, using input-output tables, for scenarios with and without the project in question.

- C1.26 The proportion of the employment directly generated by construction attributed to be the project varies depending on the unemployment in the region concerned: for example, if unemployment is as high as 40%, it is assumed that 90% of jobs are new, but where unemployment is 10%, only about 30% of jobs created are assumed to be new.
- C1.27 Employment created by the operation of the project is determined using regression analysis of the link between structural unemployment and the quality of transport links in a region.
- C1.28 Germany appears to be the only country that explicitly values severance effects in cost benefit analysis: although this should, in theory, be evaluated in Britain, we are not aware of any major projects for which this has actually been assessed. This is calculated using a value of time per person per hour waiting to cross roads, calculated related to the number of people affected, the number of times per day they cross roads, and waiting times as a function of the hourly traffic volume. As this is calculated from the network model, the inclusion of this effect will automatically increase the value of any road traffic reduction that is modelled as arising from the opening of a new rail line.
- C1.29 Analysis of the monetised environmental impacts of transport projects appears to be significantly more sophisticated in Germany than in Britain. The network model is used to take into account the effects of noise and all types of air pollutants by corridor, and therefore takes into account different levels of population density.

Environmental risk assessment

- C1.30 Environmental impacts that cannot be monetised are then identified in an environmental risk assessment (ERA). The ERA is conducted alongside the cost benefit analysis and Spatial Impact Assessment but is purely for decision-making purposes. It is separate from environmental impact studies undertaken as part of project planning.
- C1.31 A uniform methodology is applied for ERA work undertaken for new transport projects across all modes. Projects are classified as low, intermediate, high or very high on the basis of 'spatial resistance'. This is in turn based on the application of mechanistic criteria which give scores for a number of values on a 1 to 5 range. These criteria are, in some respects, mode-specific: for example, a road scheme receives points depending on how many additional vehicles are expected to use it; a rail scheme is scored purely on land take. Although the criteria do not appear unreasonable, there is an inevitable risk that these could skew the performance of different modes in the appraisal.

Spatial impact assessment

- 8.24 A spatial impact assessment is carried out which includes many of the (non-environmental) factors that would typically be contained in multi-criteria analysis in Britain. This tests the project for compliance with:
- distribution and development objectives; and
 - relief and modal shift objectives.
- C1.32 The former criteria appear to be specifically weighted to favour projects that facilitate development in less developed states (which probably refers to the former East Germany, although this is not specifically stated). The relief and modal shift objectives are explicitly designed to encourage shift of travel to environmentally friendly modes of transport (such as rail) from road or air. This may lead to some double counting as environmental impacts are quantified in both the cost benefit analysis and the ERA. The assessment also includes analysis of the impact on the urban environment of transport projects, which is not included in the other analysis.
- C1.33 The output of the spatial impact assessment is an award of ‘regional planning points’ on a scale of 1 to 5. Again, the procedure for allocating these points appears to be mechanistic: those undertaking the impact appraisals have comparatively little flexibility. As these points are added to the benefit-cost ratio to get the overall appraisal outcome, the use of mode shift as a specific objective (rather than a means to achieve economic and social objectives) will systematically bias the appraisal towards favouring rail schemes.

TABLE C3 APPRAISAL SUMMARY TABLE: GERMANY

Appraisal summary		Notes
Appraisal type used	Financial analysis	✓
	Cost benefit analysis	✓
	Multi-criteria analysis	✓
Key variables	Discount rate	3%
	Appraisal period (years)	Dependent on the economic lives of the components of the project
	Use of shadow prices	✓
	Optimism bias/risk	Optimism bias is not specifically accounted for except in that engineering costs will usually include a risk estimate of 5-10%
	Value of time	€5.47/hour (business travel is valued at an unpublished higher rate specified in the appraisal guide)
	Value of life	€1.176 million
	Value for serious injuries	€87,000
	Value of CO ₂ /tonne	€205

	Effect	CBA	MCA	
Environmental issues	Noise and vibration	✓		
	Air pollution	✓		
	Greenhouse effect	✓		
	Landscape/townscape		✓	
	Biodiversity		✓	
Safety	Accidents	✓		
	Personal security		✗	
Economy	Journey time and frequency	✓		
	Rail costs/revenues		✗	
	Other mode costs	✓		
	Other mode revenues		✗	
	Comfort		✗	
	Road congestion	✓		
	Performance		✗	
	Facilities quality		✗	
	Tax revenue		✗	
	Regional economy effect	(✓)	✓	Employment directly attributable to construction and operation are included in cost benefit analysis; overall regional economic effects in multi criteria analysis. Although national effects are not separately quantified, regional gains do not have to offset each other, and therefore there can be a modelled net increase in the national economic position.
	National economy effect	(✓)	(✓)	
	Employment	✓	✓	
	Accessibility	Reduction of barriers	✓	
Severance		✓		
Option values			✗	
Integration	Integration with other modes/government policy		(✓)	Integration with government policy is an objective for the Spatial Impact Assessment. Integration with other modes would be assumed.

Criteria used in decision making

- C1.34 The final decision to request to proceed with a project is made by DB and the final decision on whether to grant funding is made by the federal government in response to this request. The financial agreement between DB and the government is subject to review by the EBA before work can proceed.

- C1.35 This process does not appear to be very transparent but in practice, we understand that plans that are included in the BVWP (federal transport infrastructure plan) and the subsequent law generally are progressed. The key decision on whether to construct a line therefore appears to be taken in parliament when the law is debated. As the two houses of parliament are currently controlled by different political parties, this has recently been more genuinely a parliamentary rather than governmental process. Subsequently however the federal Government (through its funding process) determines the when and how. Therefore, no specific criteria are used but we understand that the appraisals used in the compilation of the BVWP are key factors determining the outcome.

APPENDIX D

ITALY

D1. ITALY**Status of high-speed rail programme**

D1.1 Italy has one high-speed rail line in operation, the Direttissima between Rome and Florence, but is constructing a number of others. The projects in operation and under construction are shown in the table below.

TABLE D1 ITALIAN HIGH SPEED RAIL PROJECTS

Project	Opening year	Length (km)
Rome-Florence	1981-92	248
Rome-Naples	2005	204
Turin-Milan	2006 (part 1) 2009 (part 2)	125
Milan-Bologna	2007	182
Bologna-Florence	2008	79

D1.2 Two other lines are currently under consideration:

- Milan to Genoa; and
- Milan to Venice via Verona.

D1.3 The Italian and French governments are also undertaking studies of a high-speed line across the Alps between Lyon and Turin. However, these studies are at a relatively preliminary stage, and there is some doubt as to whether this project could proceed, as construction would be technically difficult and extremely expensive.

D1.4 The current status of the network is summarised on the figure below

FIGURE D1 HIGH SPEED RAIL NETWORK: ITALY



Background and historical development of the network

- D1.5 The first route, between Rome and Florence, was opened in 1981. This was a specific response to the very poor quality of the conventional rail route between these cities, which was also the main link between Rome and northern Italy. However, Italy is currently undertaking a major expansion of high speed rail and when this is complete in 2008-10, most major cities will be connected to the network. The key objectives for the construction that is currently underway was to raise the Italian rail network to the best European standards and to improve its capacity. The significant employment that the programme will generate during the construction phase was also cited as a major benefit.

Outline of the institutional structure of the rail industry

- D1.6 The national Italian network and operations are all owned by FS (State Railway) Holdings, a fully government owned company. It has three key operating subsidiaries: Trenitalia operates all freight and passenger trains, including the high-speed trains, RFI (Rete Ferroviaria Italiana) manages the infrastructure, and TAV (Treno Alta Velocità SpA) is responsible for the planning and construction of new high speed infrastructure.
- D1.7 Some separate local rail services also exist, provided by regional governments.

The transport market

Rail market share

- D1.8 Rail's market share in Italy is 5%.

The classic rail network

- D1.9 The classic rail network is of relatively good quality. Line speeds are quite high and as a result, the opening of new high speed rail lines will only reduce journey times by 20-30%, although this will be enough to improve the competitiveness of rail against air on some key routes, such as Milan-Rome. A key reason for investment in high-speed rail is that many parts of the conventional rail network are facing capacity constraints: the transfer of long distance services to new lines will enable an expansion of regional and freight services on the classic routes.

Competition

- D1.10 High-speed rail is subject to competition both from conventional trains on parallel tracks, for which lower fares are charged, and increasingly from low cost airlines. As indicated above, because of the capacity-enhancement rationale of the further development being taken forward, rail-rail competition could potentially increase in future.

Population distribution

- D1.11 Italy's 'long and thin' nature is similar to Britain but the population is more dispersed. Only three cities (Milan, Rome and Naples) have a population of greater than 1 million. As a result, long distance trains, including high-speed trains, need to make relatively frequent stops, and this tends to reduce average speeds.

TABLE D2 MARKET SUMMARY TABLE: ITALY

	Metric	Value
Rail market share	Passenger kilometres	5.0%
	Passenger trips	5.4%
Population	Total population (millions)	57.8
	Population density (persons per square kilometre)	192
	Average population density of 5 largest cities (persons per square kilometre)	5,600
Other market	Petrol price €/litre	1.05

factors	Toll for 100km motorway journey €	5.04
	Cars per 1000 population	560
	Rail fares as % air fares, largest OD pair	50%
	High speed trains arriving on time	N/A
	Other long distance trains arriving on time	N/A

Outline of process

- D1.12 This section explains the process for making decisions on investment in high-speed rail in Italy. However, the lines that are currently under construction were approved before this process was developed: it is now being used to assess the Milan-Venice and Milan-Genoa high-speed lines.
- D1.13 The government produces a general transport plan every 5-10 years (*Piano Generale dei Trasporti e della Logistica* or PGT). This sets out broad principles to be followed when planning transport infrastructure projects and outlines the projects that could be undertaken. A project cannot be undertaken unless it is included in the PGT, but inclusion of a project in the PGT does not guarantee that it will be undertaken.
- D1.14 RFI, the rail infrastructure company, develops a priority rail investment plan which is consistent with the broader PGT (the *Piano Prioritario degli Investimenti* or PPI). This usually covers a period of 5 years. This includes high-speed rail development but also other rail infrastructure plans. The PPI includes an evaluation of each project, but detailed economic appraisal is not automatically required. Inclusion of a project in the PPI also does not guarantee that it will actually be undertaken, as this will be subject to government or other funding being available.
- D1.15 The PGT established six broad principles to be followed by RFI when developing its proposals. A project should comply with as many as possible of the following criteria:
- be consistent with safety and legal obligations;
 - improve efficiency and productivity;
 - resolve bottlenecks;
 - improve service quality;
 - develop the freight network; and
 - benefit the South.
- D1.16 RFI has its own criteria for evaluating whether a project should be included in the PPI. Projects are evaluated against these criteria according to a predetermined weighting but the criteria themselves do not appear to be defined in detail. The criteria are:
- consistency with the objectives set down in the PGT (above);

- financial viability of the project; and
 - effects on the wider rail network.
- D1.17 The PPI is reviewed annually by CIPE, the Interdepartmental Committee for Economic Planning, which is formed by representatives of the regional governments. CIPE has the ability to ask for an economic appraisal if it thinks that this is necessary, but it does not always do so and there are no consistent criteria for the economic appraisals that are undertaken. In particular we understand that economic appraisals were not conducted for any of the high-speed lines currently under construction. CIPE is also responsible for giving authorisation during the planning procedure (see below).
- D1.18 Separately from this, the government passed an ‘Objective Law’ in 2001. This prioritised certain projects from the PGT, including some high-speed rail projects. The main impact on a project of prioritisation through the Objective Law is one of fast-tracking, in that a less protracted planning and approval process then applies. We understand that the accelerated process, which would not be initiated until the government has decided in principle that it wishes to proceed with a project, consists of:
- Preliminary evaluations of the impact of a project, which are sent by the Ministry of Infrastructure and Transport to other relevant ministries (such as the Ministry of Cultural Heritage). These ministries undertake their evaluations within 90 days;
 - The Ministry of Infrastructure and Transport then has a further 60 days to evaluate the other ministries’ responses and make a final proposal to CIPE;
 - CIPE then undertakes its own preliminary evaluation of the project within 30 days; and
 - Subject to approval by CIPE, an environmental impact commission is then established. This has 60 days in which to report back to CIPE, which gives final approval of the preliminary project.
- D1.19 After this preliminary project process, the process for approval of the detail of the project (for example, the exact route plans and designs) can then begin:
- Consultation is undertaken over 90 days with local administrations and managers of related projects, although such those consulted at this stage may only object to the details of the project, not its essential characteristics;
 - The Ministry of Infrastructure and Transport then has a further 90 days to evaluate any objections from those consulted, and to formulate a revised proposal to CIPE; and
 - CIPE makes a final decision on this revised proposal within 30 days.
- D1.20 This second CIPE approval is subject to challenge by regional governments in the High Council of Public Works and, if the challenge is not resolved at this level, may ultimately require approval by the Council of Ministers, after which a Presidential Decree will be issued.

- D1.21 The process for expropriation of land in Italy is also complicated: the relevant legislation dates to 1865, and this tends to impose significant additional delays and expenses.

Criteria used for appraisal

- D1.22 As explained above, there are no consistent criteria used for appraisal in Italy. CIPE has the ability to ask for economic appraisal if it thinks that this is necessary, but there is no requirement to do so. Where economic appraisal is requested, cost benefit analysis is used. Different appraisals of major projects have used significantly different criteria: for example, in interviews with the Ministry of Infrastructures and Transports, we have been told that discount rates used in appraisals have varied from 4% to 8%.
- D1.23 The only broad principle applicable to all economic appraisal that is carried out for CIPE is that it should be consistent with World Bank guidelines. When we have been asked to carry out economic appraisal on behalf of CIPE, they have approved the criteria used on the basis of the specific project, against objectives important to the region: the priorities have been user benefits, environmental, regeneration, employment issues, private sector contributions and local economic effects. Non user benefits, such as reduced road congestion, were not.
- D1.24 In the medium term, it is likely that, as cost benefit analysis is requested more regularly, formal criteria applicable across all projects will be developed.

Criteria used for decision making

- D1.25 The key decision-making is still undertaken by the government, as this determines the budget that in turn determines whether RFI can proceed to construct any high-speed lines. At present, capital funding for the rail sector is around €4 billion per year, about half of which is allocated to high-speed rail. The criteria that the Italian government uses to assess which projects should be approved are not transparent.

APPENDIX E

JAPAN

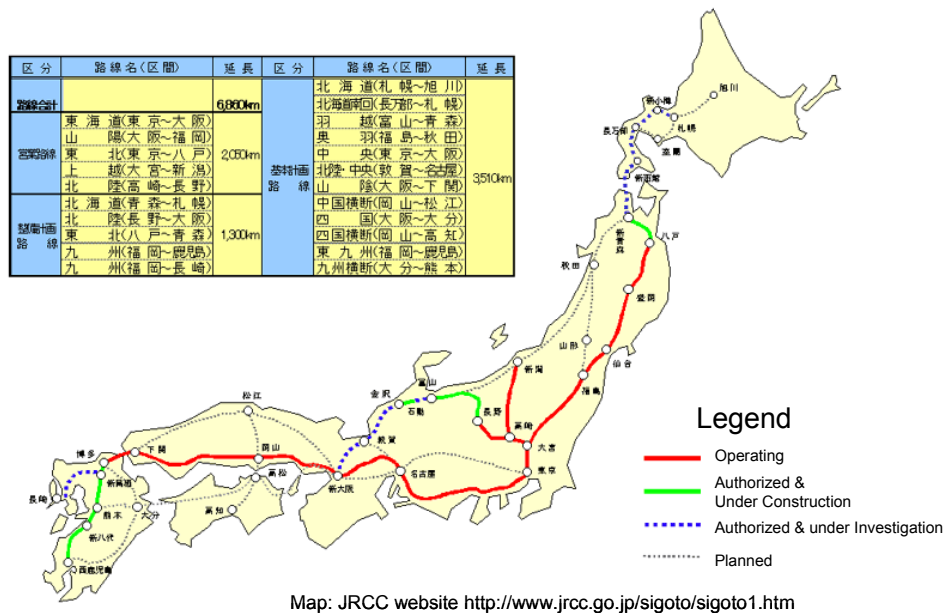
E1. JAPAN

Status of high-speed rail programme

E1.1 Japan developed the world’s first high speed railway: the Tokyo to Osaka Shinkansen, which opened in 1964. There are now over 2,000km of high-speed rail lines in operation in Japan. The development of a further 1,300km of lines have been authorised, of which 500km are currently under construction. There are plans for a further 3,510km of lines, the construction of which has not yet been authorised.

E1.2 The current network is shown in the figure below.

FIGURE E1 JAPAN'S HIGH SPEED RAIL NETWORK



Historical development of the network

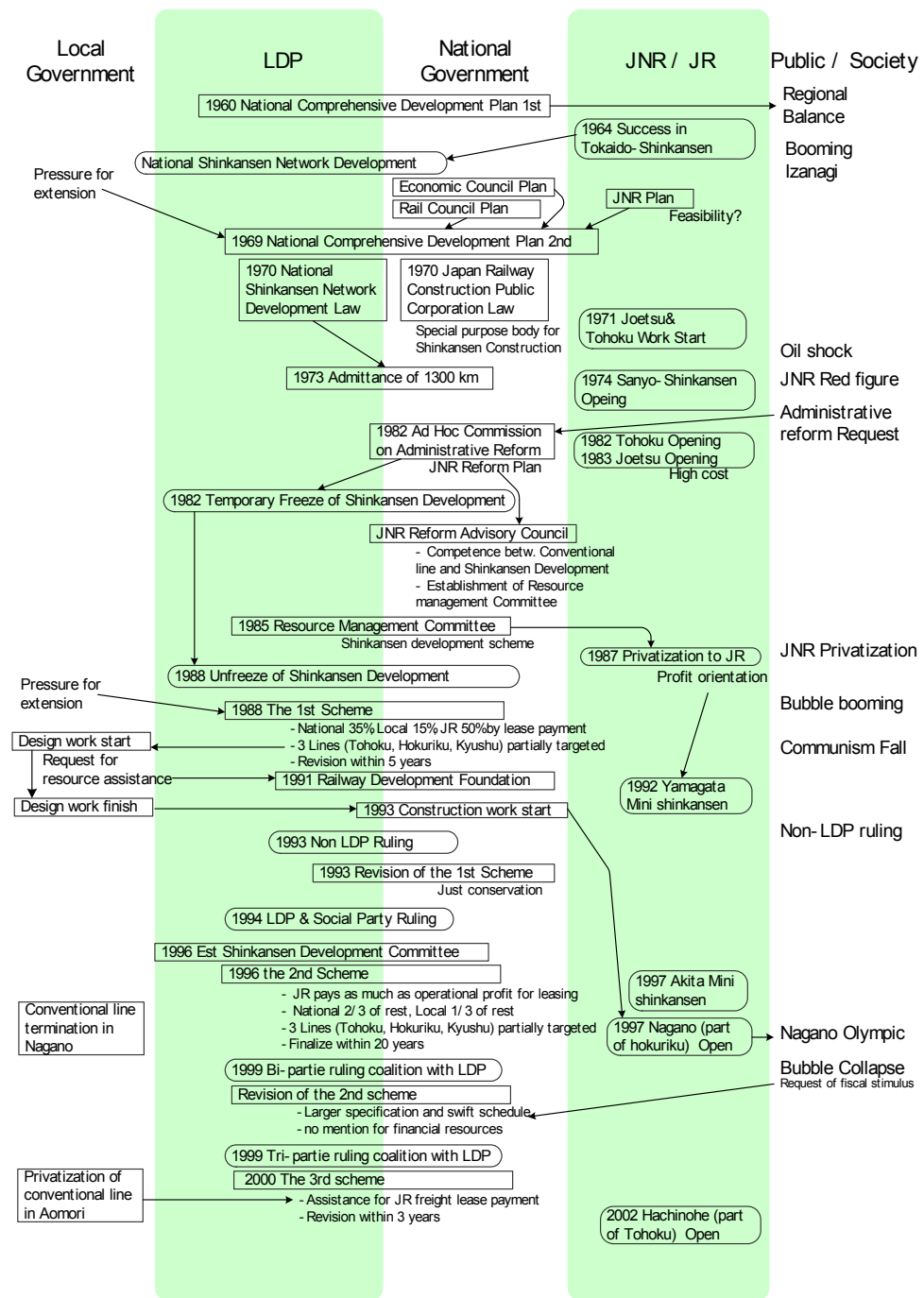
E1.3 The early development of the Shinkansen network, particularly the Tokyo to Osaka line, was primarily driven by capacity constraints in the existing rail system. The topography and economic geography of Japan creates the need for very high capacity corridors between the main cities. Capacity, as well as speed, remains a key benefit of the Shinkansen lines: trains operate at very high frequency and provide over 1,600 seats (for comparison, a double length dual level TGV provides around 1,000 seats).

E1.4 More recent development of Shinkansen lines has taken place under the National Shinkansen Network Development Law of 1970, and the rest of this section focuses

on the subsequent development of the network. This law itself followed from the Second National Land Comprehensive Development Law of 1969, the primary objective of which was to facilitate geographically-balanced development across the country, in response to the concentration of the population and economic development in a few of the largest cities.

- E1.5 The diagram below indicates the historical development of the high-speed rail network and the key factors, in terms of politics and external events, that have influenced this.

FIGURE E2 DEVELOPMENT OF HIGH SPEED RAIL NETWORK



E1.6 Public support for high-speed rail development was very strong in the earlier stages of the programme, primarily because of its perceived links with economic growth. Support is now less strong as a result of pressures on government resources and increased public scrutiny of government spending.

Outline of the institutional structure of the rail industry

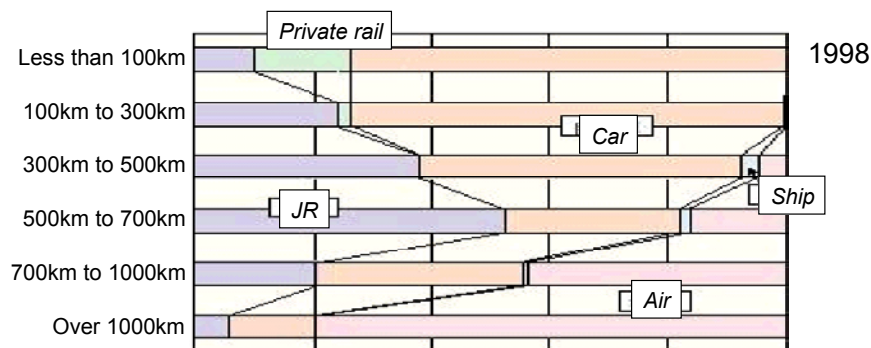
- E1.7 Japan National Railways (JNR) was broken up in 1987 into seven companies. These comprised six vertically integrated infrastructure providers and passenger operators, referred to as the Japan Rail companies. The seventh company was a national rail freight operator. The Japan Rail companies are all privatised although some of the shares are owned by the government through the Japan Railway Construction Corporation (JRCC).
- E1.8 The Shinkansen routes currently under construction are being built by the JRCC and will be leased to the Japan Rail companies on completion, which will also operate the trains. JR will be responsible for maintenance of the lines. The purpose of this structure is to retain the perceived benefits of vertical integration whilst avoiding leaving the JR companies with significant debt. The older Shinkansen routes are all owned, maintained and operated by the relevant Japan Rail companies. On privatisation, the Shinkansen routes were initially separated from the rest of the network and transferred to a new publicly owned corporation, but then subsequently sold to the Japan Rail companies.

The transport market

Rail market share

- E1.9 Partly as a result of the extensive high-speed rail network, rail has a high market share for domestic travel in Japan (27% of passenger kilometres); its share is over 50% for journeys between 500 and 700km. Private rail refers to non-JR companies, which have a significant market share for commuter journeys.

FIGURE E3 RAIL MARKET SHARE BY JOURNEY LENGTH



The classic rail network

- E1.10 The classic, narrow gauge, rail network also handles very high levels of traffic at impressive levels of reliability: average delays per train are only around 30 seconds although this is more than the high speed network (10 seconds per train). As noted above, capacity constraints on the classic network, rather than its poor quality, were the prime reason for high-speed rail development.

Competition

- E1.11 Historically, rail transport in Japan has faced competition from the three main domestic airlines, JAL, JAS and ANA. A lack of landing slots at major airports has constrained development of air services, but capacity has recently been expanded at Haneda and Narita airports in Tokyo. Since 1998, the incumbent airlines have faced competition from low cost competitors, such as Skymark and Skynet, and some have cut their prices in response. There is some evidence that air market share is beginning to increase, but this is not yet conclusive.
- E1.12 Rail has faced limited competition from long distance buses as a result of relatively long distances and road congestion. Car ownership is similar to European levels but although petrol prices are similar, tolls are levied on motorways and the rates are relatively high (nearly €20 for a 100km journey). This reflects high motorway construction costs, which have been high as a result of high population density, and design standards which are intended to protect against earthquakes.

Population distribution

- E1.13 Japanese cities have very high population density, which means that much of the population has easy access to high-speed rail lines. The population also tends to be concentrated in city centres. The areas around many of the major cities, particularly Tokyo, and the flatter coastal areas are also densely populated and this has had impacted on Shinkansen development in a number of ways:
- the costs of Shinkansen development have been increased: some recent Shinkansen lines have been constructed almost entirely on viaduct or in tunnel; but
 - airport development has been difficult and expensive, leading to high landing charges and severe capacity constraints; and
 - as these areas are well served by conventional railways, which link to the Shinkansen termini, much of the population has had easy access to the Shinkansen.
- E1.14 Major cities such as Osaka, Nagoya, Kobe and Kyoto are within 300-600km of Tokyo, which are ideal distances for high-speed rail to be competitive with other modes. The

Shinkansen has a lower but nonetheless significant market share (11%) for travel to more distant destinations such as Fukuoka (around 1,200km away).

TABLE E1 MARKET SUMMARY TABLE: JAPAN

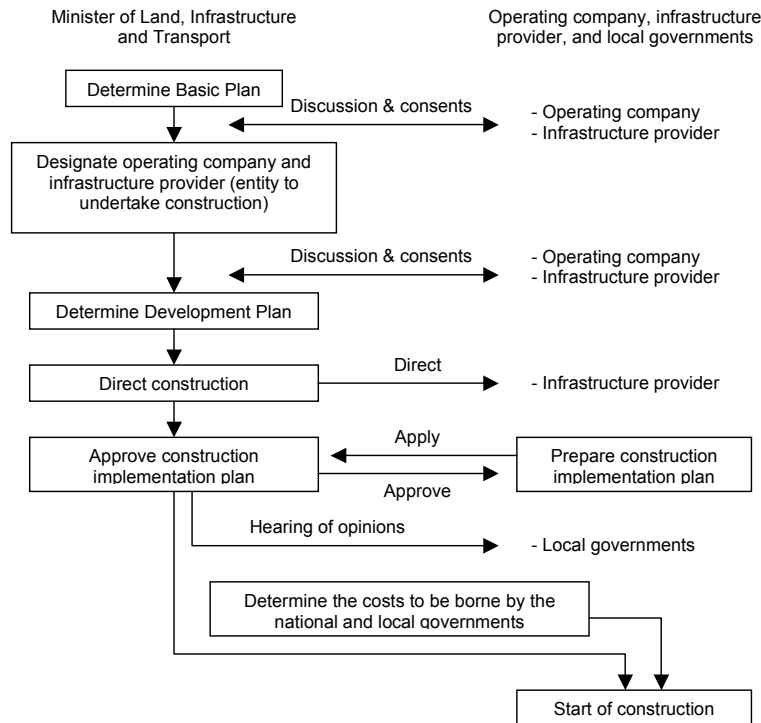
	Metric	Value
Rail market share	Passenger kilometres	27.1%
	Passenger trips	25.6%
Population	Total population (millions)	127
	Population density (persons per square kilometre)	341
	Average population density of 5 largest cities (persons per square kilometre)	8,033
Other market factors	Petrol price €/litre	0.87
	Toll for 100km motorway journey €	19.83
	Cars per 1000 population	411
	Rail fares as % air fares, largest OD pair	70-100%
	High speed trains arriving on time	Average 10 seconds delay
	Other long distance trains arriving on time	N/A

Outline of process

- E1.15 The extent of the network that was ultimately to be developed had been decided before the National Shinkansen Network Development Law had been passed, and subsequent development has been consistent with this. The subsequent focus of appraisals has been on the prioritisation of lines and the affordability of new construction rather than the nature of the programme. There have not, historically, been formal criteria for assessing whether to build lines or which lines to construct, although some limited use of cost benefit analysis is now being made (see below).
- E1.16 Recent developments in project appraisal processes have reflected two agreements, in 1987 and 1996, between the government and the main political parties, on the criteria to be used by the government deciding which lines to prioritise. These agreements were made between the parties in a series of committee meetings and are available publicly; however, they are not comparable to the forms of multi criteria or cost benefit analyses that might be conducted in Britain. The government's subsequent decision to proceed with Shinkansen route construction reflects these agreements.
- E1.17 The 1970 law established a procedure for authorising the construction of high-speed lines. The implementation of the procedure appears to have been largely driven by central government although in recent years local government has been more involved in order to facilitate obtaining consents, etc. The procedure appears to be quite slow by western European standards, although delays have been as much driven by

restructuring and the national economic situation than the planning procedure itself. This procedure is summarised in the figure below.

FIGURE E4 PROCEDURE FOR AUTHORISING CONSTRUCTION



Criteria used in appraisals

E1.18 As explained above, neither formal cost benefit analysis nor multi criteria analysis is undertaken in Japan; the 1987 and 1996 agreements between the government and the political parties agreed the elements to be used in determining the prioritisation of projects.

E1.19 The 1987 agreement established the following basic elements:

- demand forecasts;
- construction costs;
- the prospects of profitability and the impact on the Japan Rail (JR) companies;
- the condition of alternative transport facilities;
- whether rail lines parallel to the new line could be abandoned.

E1.20 The 1996 agreement revised these basic elements. Account was also to be taken of progress in obtaining planning permission and other necessary agreements in order to proceed with construction. The additional elements are:

- estimated lease payments that JR companies will be able to make to JRCC (effectively, track access charges);
- the consent of local governments for the separation of parallel conventional rail lines from JR; and
- consent of JR companies.

E1.21 For each potential line, a regional economic impact analysis is conducted using input-output techniques; the gross regional product with and without the project is compared. This takes into account the potential benefits of reduced journey time but does not attempt to value time savings and other benefits in the way for cost benefit analysis.

E1.22 The government's decision takes this economic impact analysis into account but neither the analysis itself, nor the detailed reasoning behind the government's consequent decisions, are published.

E1.23 An advisory panel to the Ministry of Finance issued a report in October 2002 on the use of cost benefit analysis for public works projects which stated:

Since there are technical limits to benefit calculation, cost benefit analysis is not a perfect method at present, and therefore the adequacy of projects should be judged using other evaluation methods as well as cost-benefit analysis. However, it is necessary for the fiscal authority to continuously improve the analysis and effectively use it in order to ensure transparency and accountability regarding the overall undertaking of public works projects from the perspective of tax payers.

E1.24 We have provided an appraisal summary table similar to those provided for other countries, although as neither cost benefit analysis nor multi criteria analysis are undertaken, we have used a simplified format.

TABLE E2 APPRAISAL SUMMARY TABLE: JAPAN

Appraisal summary			Notes
Appraisal type used	Financial analysis	✓	The appraisal process has some similarities to multi-criteria analysis and takes into account costs and benefits but is not directly comparable to these processes in the UK.
	Cost benefit analysis	(✗)	
	Multi-criteria analysis	(✗)	
Key variables	Discount rate	4.0%	Standard discount rate used for public projects
	Market prices	N/A	
	Optimism bias/risk	✗	Not allowed for other than conducting basic sensitivity analysis to demand/cost projections.

	Value of time	N/A – cost benefit analysis not undertaken
	Value of life	
	Value for serious injuries	
	Value of CO ₂ /tonne	
Environmental issues	Environmental impact assessments are carried out but environmental effects are not included in analysis	
Safety	The impact on safety is analysed but it is not quantified	
Economy	The combined economic benefits are taken into account through regional input-output analysis, but not through cost-benefit analysis as yet. Other economic effects, such as improved reliability, are emphasised but are not explicitly quantified.	
Accessibility	This tends to be emphasised by the government but again it is not quantified. There are national policies on dispersing economic development	
Integration	Integration with other policies (for example land use policy) is also emphasised by government but again not quantified.	

APPENDIX F

SPAIN

F1. SPAIN

Status of high-speed rail programme

F1.1 The first high-speed railway to be constructed in Spain was the Madrid to Seville AVE (Alta Velocidad Española), which opened in 1992. Parts of two other major routes (Madrid-Valencia and Barcelona-Valencia) have been upgraded for fast operation and are both defined as high speed by the Spanish government, but are not within the definition of high speed used for this study.

F1.2 The government has now embarked on a very extensive high-speed rail construction programme, and has promised that all regional capitals will be within 4 hours of Madrid and 6 hours of Barcelona by high-speed train. Several routes are currently under construction. These are shown, with projected dates of opening, in the table below.

TABLE F1 AVE PROJECTS

Project	Opening year	Length (km)
Madrid-Seville	1992	471
Madrid-Lerida	2003 (in theory)	493
Madrid-Toledo	2005 (approx)	74
Lerida-Barcelona	2006	150 (approx)
Córdoba-Málaga	2007	193
Madrid-Valladolid/Medina del Campo	2008	170

F1.3 Several other lines are in advanced stages of planning although construction has not yet commenced, and a tender is being let, jointly with the French government, for the new international line between Figueras and Perpignan. The map below shows the full planned Spanish high speed rail network.

FIGURE F1 PLANNED HIGH SPEED RAIL NETWORK: SPAIN



Background and historical development of the network

- F1.4 The motivation for the constructing the first high speed (AVE) line from Madrid to Seville was that Seville was chosen for the Expo in 1992, and the AVE was intended to transport people to this. We have not been able to find any evidence of economic appraisal being used to justify the decision to construct the line to Seville first, and indeed there were some complaints from Cataluña that the AVE should have gone there first.
- F1.5 The Madrid to Seville high-speed line is perceived as having been very successful both in transport terms and in terms of its economic effects. Journey times are about 60% less than via the old line, and 99.8% of trains arrive within 3 minutes of their scheduled arrival time (the corresponding figure for UK InterCity trains is 70% within 10 minutes). This has increased the public and political pressure to deliver the rest of the high-speed rail programme. There has been significant political pressure from regional governments to connect their regions to the network, and this is important given Spain's devolved government structure.

Outline of the institutional structure of the rail industry

- F1.6 RENFE is the national rail passenger operator and is a state-owned company controlled by the ministry of public works (Ministerio de Fomento). RENFE is primarily funded by central government, although the regional governments provide some additional funding and are undertaking a greater role in planning transport infrastructure.
- F1.7 At present, RENFE both operates trains and manages all the infrastructure, including the Madrid-Seville high speed line. The government has recently proposed to set up a new body, ADIF, which would take over all of Spain's rail infrastructure, in order to be compliant with European law which mandates management separation of operations from infrastructure. A separate state-owned organisation, GIF, is responsible for development of the high-speed lines that are under construction, but, if the new rail structure proposed by the government becomes law, responsibility for the construction and maintenance of new lines will transfer to ADIF.
- F1.8 In addition to RENFE, there are three other passenger rail operators but only one of these, FEVE, provides long distance services and these are all on its own dedicated narrow-gauge tracks. FEVE is also a state owned company controlled by Ministerio de Fomento.

The transport market

Rail market share

- F1.9 Rail market share in Spain is very low by European standards: within the EU, it is lower only in three countries (Ireland, Portugal and Greece). 4.8% of domestic trips and 5.2% of domestic passenger kilometres are made by rail. The market share of bus is more than twice this level and on some routes buses provide a faster and more frequent service than rail.

The classic rail network

- F1.10 Spain has a poor quality conventional rail network, particularly if compared to countries such as France, Italy or even the UK. Capacity is limited by long sections of single track, and line speeds are low as a result of curves and gradients. Tilting trains have long been used in Spain in order to minimise the impact of this on passenger journey times, but these can still be very long by European standards. Madrid to Barcelona, a similar distance to London to Edinburgh, takes 7 hours by train at present. As a result, high-speed rail offers greater time savings in Spain than elsewhere in Europe, strengthening the case for investment.

- F1.11 The poor nature of the conventional Spanish rail network, and the fact that it uses a broader gauge than that used in the rest of Europe and for the high speed lines in Spain, has meant that it has not been possible to use the conventional network for the final approaches of high-speed trains to cities, as has been done in many other countries.

Competition

- F1.12 The railway faces competition from a well-developed domestic air network. Although there are no domestic low cost airlines, in practice both the service provided and fares offered by one of the main carriers, Air Europa, are comparable to those provided by low cost airlines. The railway also faces competition from an extensive long distance bus system. There are a large number of low cost air services from Spain to northern Europe although these compete with other airlines rather than the railway.

Population distribution

- F1.13 Madrid is the largest city in Spain with a population of 2.9 million in the city and a further 2.5 million in the immediate surrounding area. Most other major Spanish cities are on or near the coast and are therefore 400-600km from Madrid. The remainder of the inland area has very low population density, which has facilitated high-speed rail construction, but the terrain is also very mountainous. Many Spanish cities are very densely populated by European standards.

TABLE F2 MARKET SUMMARY TABLE: SPAIN

	Metric	Value
Rail market share	Passenger kilometres	4.8%
	Passenger trips	5.2%
Population	Total population (millions)	40.8
	Population density (persons per square kilometre)	81
	Average population density of 5 largest cities (persons per square kilometre)	6,220
Other market factors	Petrol price €/litre	0.83
	Toll for 100km motorway journey	€6.86 (where levied)
	Cars per 1000 population	444
	Rail fares as % air fares, largest OD pair	30-120% ²⁷

²⁷ The railways in Spain do not use yield management. Therefore although the train is usually cheaper than air travel, this is not the case for journeys booked long in advance and/or at unpopular times.

High-speed trains arriving on time	99.8% (within 3 minutes)
Other long distance trains arriving on time	95.7% (within 10 minutes)

Cost differentials

F1.14 An important issue to highlight is that high-speed rail construction costs appear to be much lower in Spain than in other European countries and in particular far lower than in Britain. For example, the Madrid-Valladolid high-speed line is expected to cost about £1.1 billion, around 20% of the cost of the Channel Tunnel Rail Link, despite being 70% longer and crossing extremely difficult, mountainous, terrain.

Outline of process

F1.15 In the development of the high-speed network plan, there have been two main processes:

- Firstly, Ministerio de Fomento (public works) carried out broad analysis of where investment would deliver most value; and
- Secondly, Ministerio de Fomento and GIF, the rail infrastructure development company, carried out more detailed analysis of how higher speed railway operations could be delivered on each corridor.

F1.16 Although detailed economic appraisal is carried out, the purpose of this analysis is to prioritise schemes rather than to make a decision in principle as to whether they should be undertaken. In effect, the political decision was made when the government committed that all regional capitals should be within 4 hours of Madrid and 6 hours of Barcelona by high-speed train. The Government has published target journey times for all corridors. These are in many cases 60-70% lower than current journey times, and therefore can only be achieved through construction of dedicated high-speed infrastructure.

F1.17 However, the high-speed rail programme has, of late, been subject to some delays (in part resulting from what appears to have been an overoptimistic schedule) and in the medium term it is likely that Spain will cease to obtain such significant quantities of European regional development funds. In the past these have in some cases been expected to pay for the majority of the infrastructure costs.

F1.18 Therefore, it is possible that lower priority projects will not be implemented, and as a result, economic appraisal may in future may decide which projects ultimately happen, even though this not the stated purpose of the appraisals.

Criteria used for appraisal

- F1.19 Economic analysis for all rail projects is carried out in accordance with unpublished guidelines produced by Ministerio de Fomento. These are understood to be consistent with the principles established by the European Commission Directorate General for Regional Policy²⁸, as many Spanish rail projects have received significant funding through the regional development funds, as noted above. However, key variables, such as the value of time, are not specified in the Ministry's guidelines and vary between projects. Financial analysis and multi-criteria analysis are also undertaken during project appraisals.
- F1.20 A key difference between Spain and Britain is that extensive use is made of shadow prices and conversion factors in appraisal in Spain. This is consistent with the guidance from the European Commission if the use of these factors corrects for market failure, although we are unconvinced that such justification exists in all cases and that, for example, the extensive counting of staff costs as a benefit rather than a cost in the appraisal process could lead to some double-counting.
- F1.21 For example, we note that in one economic appraisal that we have obtained for a high speed line²⁹:
- A conversion factor of 0.7 is applied to all employment related costs, which reflects the fact that social insurance contributions are a significant proportion of wages. In itself, this may be reasonable given that relatively high unemployment in Spain means that these contributions might not otherwise be made;
 - 30% of all work undertaken in construction of the line is assumed to be performed by workers with new jobs, and the entire salary cost of these staff is taken as a benefit without adjustment by any conversion factor; and
 - One third of the incremental operating costs of the system are assumed to be salary costs, which are also taken as a benefit without application of any conversion factor.
- F1.22 Another relatively unusual feature of Spanish cost-benefit analysis is that improvements in journey comfort are explicitly valued. In Britain, improvements in comfort might be taken into account in project appraisal but only in the specific scenario (applicable to urban transport but not normally to InterCity transport) of reducing overcrowding. For appraisal of InterCity transport, improved comfort would only be taken into account to the extent that it could be expected to generate additional traffic and revenue.

²⁸ Guide to cost-benefit analysis for investment projects, Evaluation Unit, DG Regional Policy

²⁹ Based on Estudio de Demanda y Rentabilidad de las Alternativas de Adaptación de Trazado a Alta Velocidad en el Corredor Atlantico Ferrol-Tuy. This study states that it is consistent with the overall Ministerio de Fomento guidance, although as we have not been able to obtain this guidance, we cannot verify this.

F1.23 In Spain, passengers are assumed to benefit from high-speed rail at the rate of €0.02 per kilometre if they transfer from a conventional train, and €0.03 per kilometre if they transfer from a bus, in terms of additional comfort. At typical speeds for high-speed rail, these translate to €4/6 per hour respectively, which are respectively 44% and 67% of the value of time for rail passengers.

F1.24 In other respects, the cost benefit analysis used for Spain appears to be broadly consistent with that used in Britain. However, we understand that the appraisals that have been conducted for other high speed lines may have been less detailed; we are unable to verify this.

TABLE F3 APPRAISAL SUMMARY TABLE: SPAIN

Appraisal summary		Notes	
Appraisal type used	Financial analysis	✓	The appraisal includes all of these
	Cost benefit analysis	✓	
	Multi-criteria analysis	✓	
Key variables	Discount rate	6%	The recommended rate, but may vary between projects
	Appraisal period (years)	Project specific	
	Use of shadow prices	✓	Extensive use of shadow prices. The following multipliers are applied: Personnel costs – 0.7 Investment – 0.9 Maintenance costs – 0.8 Energy – 0.9 Fares – 0.7
	Optimism bias/risk	✗	There is no pre-defined allowance for optimism bias or risk although some margin may be assumed in construction costs
	Value of time	This varies between projects and mode; specific values are also used. For example: Car - €8.08/hour Bus - €6.26/hour Rail - €8.98/hour It is not clear how values of time are calculated when passengers transfer between modes.	
	Value of life	€250,000	
	Value for serious injuries	€30,000	Applies to all injuries, not just serious ones
	Value of CO ₂ /tonne	Values are used but are per passenger kilometre not per tonne	
Effect		CBA	MCA
Environmental	Noise and vibration	✓	Mode specific values per passenger km

issues	Air pollution	✓	Mode specific values per passenger km
	Greenhouse effect	✓	Mode specific values per passenger km
	Landscape/townscape	✗	
	Biodiversity	✗	
Safety	Accidents	✓	
	Personal security	✗	
Economy	Journey time and frequency	✓	
	Rail costs/revenues	✓	
	Other mode costs	✓	Mode specific values per passenger km
	Other mode revenues	✗	
	Crowding	✓	Included within evaluation of comfort
	Road congestion	✗	Not usually applicable in Spain
	Performance	(✓)	Not explicitly valued but emphasised as a key benefit
	Facilities quality	✓	Included within evaluation of comfort
	Tax revenue	✓	Impact included through use of conversion factors
	Regional economy effect	✓	GDP growth is assumed to be higher in regions served by high speed trains
	National economy effect	✗	
Accessibility	Employment	✓	Included in cost benefit analysis
	Reduction of barriers	✓	Effect on territorial accessibility evaluated
	Severance	✗	Not evaluated
Integration	Option values	✗	
	Integration with other modes	✗	Not evaluated but likely to be assumed

Criteria used in decision making

F1.25 As in other countries, the criteria that have been used by decision makers are less transparent than the criteria used for economic appraisal. The development of individual routes is consistent with the overall policy objective that all regional capitals are to be connected to Madrid within 4 hours by train: since this policy objective has been defined and published, government decisions are limited to prioritisation and how to implement this. There is strong support for the development of the high-speed rail network at both national and regional government level, and the government has faced strong criticism as a result of recent delays in completion of the Madrid-Lerida-Barcelona route.

APPENDIX G

AUSTRALIA

G1. AUSTRALIA

Introduction and background to high speed rail

- G1.1 By European standards, Australia has no high speed rail lines. However, many states have extensive suburban rail networks and there is also an interurban and rural network, which is primarily used for freight but also conveys some passenger traffic.
- G1.2 Passenger rail services are generally a matter for states rather than the commonwealth government, although the federal government has partly funded major projects such as the Alice Springs to Darwin railway, which is due to open in 2004 (primarily for freight but with a very limited passenger service). Each state has its own rail network, which for passenger services is focused around major cities, and different track gauges are used in different states. Although there are some interstate services, these are relatively limited. The only long distance interstate trains are the services to Alice Springs and the transcontinental Indian Pacific train, but these are operated by a private company on a commercial basis, and are primarily aimed at tourists.
- G1.3 Australia has undertaken advanced planning and analysis of high-speed rail. The State Government of NSW and the Federal Government of Australia invited expressions of interest in 1998 from the private sector for a concession to build, finance, maintain and operate a high-speed line between Sydney and Canberra. The concession was won by the Speedrail Consortium. The consortium proposed to use TGV-type technology. There was an expectation that the line could eventually be extended from Canberra to Melbourne although in practice this might have been too far for rail to have won a significant share of the market from air, unless speeds of over 300km/h were used.
- G1.4 The government proposed that the Sydney-Canberra line would be constructed without net costs to the taxpayer. Although some limited funding from the commonwealth (federal) government was envisaged, this would have replaced funding that would have otherwise been necessary for other infrastructure. The project was therefore put to the market on the basis that it would primarily be a commercial venture. It eventually collapsed when it became clear, following the response from the private sector, that substantial government funding would actually have been required.

Outline of the institutional structure of the rail industry

- G1.5 The structure of the Australian rail sector is complicated given the country's federal structure of government. There is a national infrastructure company, the ARTC, but it is only responsible for part of the national interstate standard gauge rail network (part of which it owns and part of which it leases from other infrastructure owners). Passenger services are operated by companies in each state, although Countrylink (the New South Wales long distance passenger operator) provides some interstate trains,

and Great Southern Railway provides three infrequent long distance trans-national passenger trains.

G1.6 Each of the more populous eastern states has its own rail system and the structure of these varies:

- In Queensland, a vertically-integrated structure predominates, with the state-owned Queensland Rail both owning the infrastructure, and providing suburban, regional and long distance passenger services, as well as being the main freight operator;
- In New South Wales, the State Rail Authority provides suburban, country and interstate passenger rail services (under the brands Cityrail and Countrylink) and the Rail Infrastructure Corporation maintains all rail infrastructure. Some of the Cityrail services actually cover quite long distances and are interurban rather than suburban. Both organisations are state owned. Freight services are however privately operated; and
- In Victoria, suburban and long-distance rail services are provided by V-Line, which had been let as a concession to the private sector but has since returned to government ownership. The holders of freight and passenger concessions are responsible for maintaining their own infrastructure, although there are agreements that allow the operation of trains on tracks maintained by other companies.

The transport market

Rail market share

G1.7 Rail accounts for around 4% of trips in Australia of over 40km in length; road and air are the dominant passenger transport modes.

The classic rail network

G1.8 The classic rail network is designed primarily to handle suburban/regional passenger journeys around the major cities and long distance freight. Although the rural and interstate rail system is much more extensive than in, for example, the USA, trains are slow and infrequent.

Competition

G1.9 For most long distance passenger journeys, rail is not competitive in terms of journey time with either air transport or the private car. Journey times are often similar to those offered by long distance buses. In part due to route densities, the air market in Australia is not particularly competitive by European standards with only two domestic carriers, Qantas and Virgin Blue; Virgin Blue has not been able to expand as

rapidly as it had hoped, due to slot constraints and difficulties in obtaining access to termini.

Population distribution

- G1.10 Australia is very sparsely populated compared to either Europe or the USA. The cities themselves are also relatively dispersed compared to cities in Europe. Distances between the main south-eastern cities (Sydney, Canberra and Melbourne) are low enough for high speed rail to be competitive, in principle, with air transport.

TABLE G1 MARKET SUMMARY TABLE: AUSTRALIA

	Metric	Value
Rail market share	Passenger kilometres	N/A
	Passenger trips	4%
Population	Total population (millions)	19.1
	Population density (persons per square kilometre)	2.4
	Average population density of 5 largest cities (persons per square kilometre)	1,279
Other market factors	Petrol price €/litre	0.52
	Toll for 100km motorway journey €	7.78 (where levied – usually 0)
	Cars per 1000 population	494
	Rail fares as % air fares, largest OD pair	40-100%
	High speed trains arriving on time	N/A
	Other long distance trains arriving on time	N/A

Appraisal criteria

- G1.11 As there are no current plans for any high-speed lines comparable to those in Europe and Asia, we have investigated whether economic appraisal has been used for other investment in long distance passenger rail. Economic appraisal was not used to decide on whether to invest in the Sydney-Canberra link: as the policy at the time was that this was to be undertaken at no net cost to the taxpayer, the project was required to be justified in largely commercial terms.

New South Wales

- G1.12 In New South Wales, the most populous state, there has been significant investment in expanding the suburban rail network in recent years, but no improvement in the country or interstate rail system. Although the investment in the suburban rail system has received significant government funding, this was not the result of application of economic appraisal processes, and there are no standard criteria applicable to rail investment.

Queensland

- G1.13 Queensland has significantly improved its main long distance rail link, which runs between Brisbane, Rockhampton and Cairns. The main purpose of upgrading the line

was to improve the speed and capacity for freight services, which are run on a commercial basis. The subsequent introduction of high-specification tilting passenger trains has enabled operation at what is considered high speed by Australian standards but nonetheless still leaves rail journey times similar to journey times by private car.

- G1.14 We have not been able to find any economic justification for the incremental investment in tilting trains, although the investment was relatively small as the line upgrade was primarily to improve freight services (which cover their costs). We understand that part of the purpose of the investment in tilting trains was to boost tourism along the route, and that new trains of some kind would probably have been required anyhow if a passenger services was to be maintained. For other Queensland rail projects currently under consideration by the government, we have found no evidence of cost benefit analysis being used but there is a broad multi-criteria assessment of compatibility with the state's wider policy objectives.

Victoria

- G1.15 Victoria currently has a more extensive long distance rail investment programme than any other state, the Regional Fast Rail (RFR) programme. This involves significant upgrades of the regional rail network, including construction of some new infrastructure, to raise route speeds to up to 160km/h, which, again, is high speed by Australian standards. The project also includes new rolling stock. Unlike other rail schemes in Australia, this investment was appraised using cost benefit analysis, and the form of cost benefit analysis used was consistent with that used by the Victorian Department of Infrastructure for road schemes.

- G1.16 A high proportion of the benefits of the RFR programme identified in the cost benefit analysis are wider **economic** benefits, in particular benefits that are perceived to arise from encouraging relocation of the population away from the main city towards regional areas. Travel time savings represent less than 20% of the capital investment costs over the appraisal period, a far lower proportion than would be expected for European schemes. The full benefits cited are:

- Multiplier effects of the capital investment (approximately 20%);
- Travel time savings for existing and transferring passengers;
- Reduced car operating costs and parking charges;
- Reduced road congestion, accidents and emissions;
- Net gain in state economic output from regional growth generated by the project (it is not clear how this is calculated but the impact is very large, equalling around 70% of the capital investment cost);
- Travel costs and benefits of population relocating to regional centres (less local travel required); and
- Avoided infrastructure provision costs in Melbourne, as a result of population relocation.

- G1.17 It is also notable that the RFR programme enjoyed very strong support (87% in favour) in the regions concerned, even though rail's share of passenger travel is very low in Australia. This is consistent with strong overall public support for rail development in Australia. A report for the Government of New South Wales attributed some support for rail services to a partly irrational "nostalgia" for rail travel and suggests this was largely amongst people who do not actually use the services and were unlikely ever to do so. However, public support for rail development does not appear to have extended to support for major government investment in high-speed rail.
- G1.18 It is clear from the government project documents that the primary purpose of the RFR programme is to encourage economic and population growth in rural and regional Victoria. The wording of the project documents imply that economic appraisal was used to decide details of the project – for example, whether to design for a maximum speed of 160 or 180km/h – rather than to make the decision as to whether, in principle, to proceed.

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