A Review of the Intercity Express Programme

Annex

Sir Andrew Foster

June 2010
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Introduction

This annex supports the main report.

Methodology of review and interviewees

The methodology adopted in carrying out this review is summarised first. It provided a framework that allowed me to address the terms of reference set out in the report, and more broadly to distil the key themes and issues that were common across those interviewed. There follows a list of those who took part in this review and I would like to thank them all for their contributions which I found to be considered and candid.

Technical considerations and credible alternatives

The thorough technical considerations of my review team on the IEP proposition are detailed next. I have endeavoured to deliver a report that is as accessible to as wide a readership as possible. Considering the report’s audiences will vary in their appetite for technical detail, I concluded that detailed technical and support material is most appropriately provided via this annex.

In seeking to assess value for money of IEP, I have sought to compare the proposition with credible alternatives and, in the short time available, broadly assess the value for money of these options. My review team’s considerations of the credible alternatives to IEP are set out in some detail. My conclusions in the main report are drawn in part from this analysis.

Supporting evidence submitted to IEP review

I have included other supporting material that I believe provides necessary or helpful background information to support the main report, including an assessment of passenger requirements, DfT strategy at various points in time, DfT value for money guidance and the BCR system, and case studies that helped to provide international perspective to my considerations.
Methodology of review and interviewees

Absorption

The first stage of the process was to absorb information. Through listening to the project team at the Department, and their advisers, and by reading documents provided to us as evidence, we were able to acquire a great deal of knowledge in a short period of time. From this, there quickly emerged key elements of the programme that warranted further understanding and analysis. We developed a simple framework that provided an effective means of focusing on these areas. This enabled a systematic and consistent approach to discussions with a wide range of stakeholders.

Framework

- passenger experience
- DfT strategy
- management and communication
- rail network issues
- technical issues
- value for money (including financing)
- GWML electrification
- International comparisons

Stakeholders

A programme of this magnitude has a multitude of stakeholders. We strove to meet as many stakeholders as possible within the 3 months allowed for this review. We met with everyone that approached us offering their perspective and found all contributions constructive. Using the framework, we were able to capture input from a wide range of perspectives, drawing them together coherently through the framework. We held discussions with 40 stakeholders in 47 meetings with individuals or small groups.
Evaluation and Analysis 1

We discussed what we had heard from the absorption stage and identified some areas that warranted further probing, testing, and challenge.

Key stakeholders

We tested our emerging thoughts with key stakeholders to probe specific areas in more detail, and to test differences of opinions where they existed.

Evaluation and Analysis 2

We discussed and analysed what we had heard from the further stakeholder meetings stage.

Synthesis of key conclusions

Distilling the many areas considered into those few that best fulfilled the remit set and added the most valuable reflections for the Secretary of State to consider.

Report consideration

Drafting and consideration, checking accuracy of information with relevant stakeholders.

Report to Secretary of State
### Interviewees

#### Government

<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Organisation</th>
</tr>
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<tbody>
<tr>
<td>Bob Linnard</td>
<td>Director Rail Strategy, National Networks</td>
<td>Department for Transport</td>
</tr>
<tr>
<td>Caroline Low</td>
<td>Deputy Director, Corporate Finance (to March 2010)</td>
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<tr>
<td>David Clarke</td>
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<td>Department for Transport</td>
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<tr>
<td>Jack Paine</td>
<td>Director Procurement, National Networks</td>
<td>Department for Transport</td>
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<tr>
<td>John Faulkner</td>
<td>Director Strategy Unit, International Networks</td>
<td>Department for Transport</td>
</tr>
<tr>
<td>Lucy Chadwick</td>
<td>Director Projects, National Networks</td>
<td>Department for Transport</td>
</tr>
<tr>
<td>Matt Dillon</td>
<td>Principal IEP Sponsor, Projects, National Networks</td>
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</tr>
<tr>
<td>Michelle Wong</td>
<td>Deputy Director, Corporate Finance (from April 2010)</td>
<td>Department for Transport</td>
</tr>
<tr>
<td>Mike Mitchell</td>
<td>Director General, National Networks</td>
<td>Department for Transport</td>
</tr>
<tr>
<td>Peter Foot</td>
<td>Network Utilisation Manager, National Networks</td>
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</tr>
<tr>
<td>Robert Devereux</td>
<td>Permanent Secretary</td>
<td>Department for Transport</td>
</tr>
<tr>
<td>Robin Groth</td>
<td>Divisional Manager, Rolling Stock</td>
<td>Department for Transport</td>
</tr>
<tr>
<td>Roger Jones</td>
<td>Deputy Director, Rail Specification / Franchising, National Networks</td>
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</tbody>
</table>
Stuart Baker  
Deputy Director, National Projects & IEP Sponsor, National Networks  
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Non-Executive Director  
Steer Davis Gleave
### Independent Advisers to IEP Review

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<tr>
<th>Name</th>
<th>Position</th>
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<tbody>
<tr>
<td>Amyas Morse</td>
<td>Controller General</td>
<td>National Audit Office</td>
</tr>
<tr>
<td>Giles Tucker</td>
<td>Managing Director</td>
<td>Infrastructure Finance, Royal Bank of Canada</td>
</tr>
<tr>
<td>Bridget Rosewell</td>
<td>Chairman</td>
<td>Volterra Consulting</td>
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### Train Manufacturers

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<thead>
<tr>
<th>Name</th>
<th>Position</th>
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<tbody>
<tr>
<td>Alistair Dormer</td>
<td>Chief Executive (AT) Managing Director (HRE)</td>
<td>Agility Trains / Hitachi Rail Europe</td>
</tr>
<tr>
<td>Andy Barr</td>
<td>Head of Maintenance</td>
<td>Agility Trains / Hitachi Rail Europe</td>
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<tr>
<td>Andy Pearson</td>
<td>Head of Rail</td>
<td>Agility Trains / John Laing</td>
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<tr>
<td>George Muir</td>
<td>Implementation Director</td>
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<tr>
<td>Trevor Sturmy</td>
<td>Director, Infrastructure Project Finance</td>
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</tr>
<tr>
<td>Paul Robinson</td>
<td>Managing Director, UK</td>
<td>Alstom Transport</td>
</tr>
<tr>
<td>Colin Walton</td>
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</tr>
<tr>
<td>John Seddon</td>
<td>Director, Strategic Programmes</td>
<td>Bombardier Transportation</td>
</tr>
<tr>
<td>David Shipley</td>
<td>Managing Director</td>
<td>Chinese Sourced Rail Equipment (CSRE) Ltd</td>
</tr>
<tr>
<td>Lance Bell</td>
<td>Business Development Manager</td>
<td>Siemens plc Mobility</td>
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### Rail Industry

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<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Clive Burrows</td>
<td>Group Engineering Director</td>
<td>First Group</td>
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<tr>
<td>Andrew Coombes</td>
<td>Head of Enhancement Engineering</td>
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</tr>
<tr>
<td>Paul Plummer</td>
<td>Planning and Development Director</td>
<td>Network Rail</td>
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<tr>
<td>Rashid Wahidi</td>
<td>Future Systems Engineering</td>
<td>Network Rail</td>
</tr>
<tr>
<td>Richard Eccles</td>
<td>Director of Network Planning</td>
<td>Network Rail</td>
</tr>
<tr>
<td>Bill Emery</td>
<td>Chief Executive Officer</td>
<td>Office of Rail Regulation</td>
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<tr>
<td>John Larkinson</td>
<td>-</td>
<td>Office of Rail Regulation</td>
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<td>Michael Beswick</td>
<td>Director, Railway Policy</td>
<td>Office of Rail Regulation</td>
</tr>
<tr>
<td>Ashwin Kumar</td>
<td>Passenger Director</td>
<td>Passenger Focus</td>
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<tr>
<td>Derek Langslow</td>
<td>-</td>
<td>Passenger Focus</td>
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<tr>
<td>Christian Wolmar</td>
<td>-</td>
<td>Transport commentator and journalist</td>
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<tr>
<td>Nigel Harris</td>
<td>-</td>
<td>Transport commentator and journalist</td>
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<tr>
<td>Roger Ford</td>
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<td>Transport commentator and journalist</td>
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### Rolling Stock Companies

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<thead>
<tr>
<th>Name</th>
<th>Position</th>
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<tbody>
<tr>
<td>Kevin Tribley</td>
<td>Commercial Director</td>
<td>Angel Trains Ltd</td>
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<td>Malcolm Brown</td>
<td>Chief Executive Officer</td>
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<tr>
<td>Tim Dugher</td>
<td>Chief Operating Officer</td>
<td>Angel Trains Ltd</td>
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<tr>
<td>Chris Moss</td>
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<td>Chief Executive Officer</td>
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<tr>
<td>Simon Purves</td>
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<tr>
<td>Alex White</td>
<td>Operations Director</td>
<td>Porterbrook Leasing Ltd</td>
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<tr>
<td>Tim Gilbert</td>
<td>Engineering Director</td>
<td>Porterbrook Leasing Ltd</td>
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### Train Operating Companies

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<thead>
<tr>
<th>Name</th>
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<tbody>
<tr>
<td>Adrian Shooter</td>
<td>Chairman</td>
<td>DB Regio UK Ltd</td>
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<tr>
<td>Jon Veitch</td>
<td>IEP Project Director</td>
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</tr>
<tr>
<td>Elaine Holt</td>
<td>Chairman (ECT) / Chief Executive (DOR)</td>
<td>East Coast Trains / Directly Operated Railways</td>
</tr>
<tr>
<td>Mark Hopwood</td>
<td>Managing Director</td>
<td>First Great Western</td>
</tr>
<tr>
<td>Matthew Golton</td>
<td>Projects &amp; Planning Director</td>
<td>First Great Western</td>
</tr>
<tr>
<td>Russel Evans</td>
<td>Network Strategy</td>
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<tr>
<td>Richard McClean</td>
<td>Managing Director</td>
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<tr>
<td>Chris Gibb</td>
<td>Chief Operating Officer</td>
<td>Virgin Trains</td>
</tr>
<tr>
<td>Paul Furze-Waddock</td>
<td>Business Development Director</td>
<td>Virgin Trains</td>
</tr>
<tr>
<td>Tony Collins</td>
<td>Chief Executive Officer</td>
<td>Virgin Trains</td>
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Technical considerations and credible alternatives

Technical Considerations

Electric

The electric IEP has received broad support from stakeholders as a technically acceptable train to provide services on various routes such as London to Bristol and Swansea. The specification of the train has driven features within the design that have been questioned and may well be unnecessary (e.g. the requirement to have a small diesel generator to power the train in the event of a loss of electricity). It should be noted that without these features, there are similar broadly acceptable products available in the market from other manufacturers. The issues in the specification are noted under “growth” below.

Bi-mode

The bi-mode IEP has the ability to operate from two power sources, either from electricity collected from the 25kV AC overhead wiring system using a roof-mounted current collection system called a pantograph, or from a diesel generator vehicle that uses a diesel power unit to generate electricity and power the motors distributed along the train; the electricity is converted into the appropriate power using a transformer to drive the same motors. The benefit of the electric power source is that the pantograph and transformer can be mounted on a passenger carrying vehicle without the loss of any seats inside, which is more efficient use of space than the diesel power source which uses an entire vehicle for the diesel power unit.

There are no long-distance high speed Intercity bi-mode trains operating anywhere in the world and the UK rail industry does not appear to be supportive of the concept. While the design is not theoretically novel, as the diesel generator simply replaces the pantograph and transformer within the same train design, the fact that such a train is not operating elsewhere on long-distance services does show that it is novel and therefore imports risk. The performance of the train, when using the diesel power source, is poorer than existing trains because the design is clearly specified to be optimal using the electric power source.

From the IEP performance simulation evidence we have seen, some overall journey times may be improved where the greater proportion of the journey is with electric power. The services from London to Weston-super-Mare are such an example. However, many local and some longer distance journey times are calculated to be longer than today’s trains where diesel power is
used, especially in the hillier terrain such as north of Edinburgh to Aberdeen and Inverness, or to Devon and Cornwall. This seems counterintuitive.

The Meridian and Voyager trains currently used by East Midlands Trains, CrossCountry and Virgin Trains are a distributed power diesel train built by Bombardier between 2001 and 2005. Unusually for this type of train, their design is such that they could be converted to bi-mode or even electric trains through the addition of a pantograph and transformer. Such a conversion may well be cost effective for these trains for the services that they currently operate upon and as an existing diesel train, adding the functionality to operate as an electric train seems more sensible than building a new train designed for both. Although these trains are not a viable alternative for the IEP bi-modes as currently envisaged, such a conversion may prove useful in future years and this issue is noted further where credible alternatives to IEP are considered, below.

**Diesel generator**

There are some benefits to the IEP diesel solution. For example, the diesel generator vehicle for IEP weighs less than a traditional diesel locomotive because it only has the equipment necessary to generate the power for the motors that are distributed along the train, whereas a locomotive has its own motors, air compressor and other installed equipment.

It must be questioned however whether it is a sensible policy to be investing in IEP-specific diesel generator vehicles that will have a life of 30-40 years given the uncertainty over the future price of oil and the possibility that extended electrification might reduce the need for them after 10-20 years in service. It is technically feasible for electric trains to be hauled by a conventional diesel locomotive, specially adapted with the correct couplers, and this arrangement could be cost effectively used for some of the services that need to run through onto non-electrified routes. Were this to be specified, the risk of the locomotives becoming obsolete after 10-20 years in service is mitigated as there is an active worldwide market for diesel locomotives to haul freight trains and they would therefore have life elsewhere.

Another risk with any new diesel train is current legislation that applies a new limit on emissions from 2012 (known as ‘Euro Stage 3b Emission Control’). As these diesel generator vehicles will be IEP-specific, and therefore have no other application in the world, the research and development costs of developing them can only be spread across IEP which puts a question mark over value for money. New diesel locomotives that are Stage 3b compliant will be developed for the freight markets and may therefore offer more competitive pricing; they will also have a longer potential life as outlined above.
Train architecture

The general train design of IEP is not novel with its electrical architecture being based on the Javelin class 395 train recently introduced on fast commuter services between south-east Kent and London St Pancras. The distribution of the motors along the train, known as ‘distributed power’, is a positive and increasingly common feature on long-distance trains (for example, the Pendolino class 390 tilting train on the West Coast Main Line) as it increases the space available for seating by not having the necessary equipment concentrated in a locomotive. Another advantage is better performance in poor adhesion conditions that the UK suffers from seasonally. However, an alternative, well established practice for similar long-distance services across Europe is to use a high powered electric locomotive fitted with sanding equipment (which lays sand on the rail beneath the wheels of the locomotive, improving adhesion when it is low) and conventional coaching stock which allows variable length trains to operate. A significant factor for the UK is the limited lengths of platforms, particularly at London termini such as Kings Cross and Paddington where lengthening would incur significant station remodelling that is likely to be uneconomic.

The loss of space for seats using a locomotive is acceptable in the short term, and indeed this has been the case for long-distance services out of Paddington and Kings Cross since steam locomotives were in use. However there will reach a point in the longer term where growth will mean that the space occupied by the locomotive is required for passenger carrying carriages so a strategic move towards distributed power is certainly sensible at some stage in the future. The precise time when this is necessary and when it provides optimal value for money needs further analysis.

Growth

IEP has been specified to be flexible such that extra vehicles can be ordered for growth and then be quickly and easily inserted into the trains without significant re-engineering. The contract structure for IEP has mechanisms in place for carrying this out and it does seem credible that this can be done and not at an excessive cost premium. IEP would therefore create a ‘standard long-distance train’ for the UK that has advantages for future redeployments. It has been difficult to assess at what price this flexibility comes however; the specification for IEP has many unique features and, to date, long-distance trains in the UK have had vehicles that are 23m in length. IEP has vehicles that are 26m in length and there have been no trains with vehicles of this length or with the unique features required in the IEP specification, such as on flexibility or for self-powered movement of electric trains. Simple cost comparisons with other recent new long-distance train builds have therefore proved difficult.
Existing trains

The existing InterCity 125 trains have all been refurbished in the last 5 years, with the coaches receiving updated interiors and the locomotives receiving replacement diesel power units with some having also received electrical refurbishment depending on condition. When the existing franchises using them were let, it was anticipated that the new IEP trains would be delivered from 2013 onwards so the existing trains were planned to be progressively withdrawn from service as the new trains were delivered. The first ones planned to be withdrawn are therefore those that had little or no electrical refurbishment, and although the total fleet is twice as reliable now since the refurbishments, the ones that had limited electrical work completed on the locomotives will become progressively unreliable from 2013 onwards. As the earliest that new trains could be in service is now 2015-16, life-extension work must be urgently programmed to prevent these trains from disrupting services from 2013 onwards by their unreliability. All of these trains are now in use and there are no similar trains available or spare so the only other option is to reduce the number of trains in the timetable from 2013; this is not practicable.

For commuter services, redeployment of existing trains (for instance from Thameslink where new trains are to be procured) is credible. These and the existing class 365 trains could be re-engineered with new traction equipment, to improve acceleration and reliability, as well as the enhancement of passenger facilities by the installation of air conditioning equipment for instance. Other enhancements to make the trains compliant with the legislation for persons with reduced mobility can also be applied. If additional capacity is needed in the medium term, then existing designs for high performing high capacity commuter trains are both credible and technically acceptable.

InterCity 125 life-extension

The InterCity 125 trains were built between 1976 and 1982 and have proved to be a highly successful design transforming Intercity travel between many cities in the UK. The recent refurbishment of the diesel locomotives has improved the reliability of the trains and minor additional work could see the locomotives’ life extended until 2025-2030, or even beyond. They would still have an inferior performance in low adhesion conditions than new distributed power trains, but this would be much reduced by the installation of sanding equipment which could be carried out during the re-engineering of the coaches, which is discussed below. With the fitment of sanders, the provisions in the current timetable to allow for the low adhesion could be removed and journey times could therefore be marginally reduced.

The coaches remain popular with passengers and provide a high standard of ride comfort. However they are not compliant with legislation for people with reduced mobility, and all rail vehicles are legally required to achieve such
compliance by 2020. There are solutions to re-engineer elements of the coaches to almost fully comply with the requirements and the rail industry is developing cost-effective solutions to prevent toilets flushing to track and to improve the doors, which currently require a handle on the outside to be operated to open the door from inside the train. The InterCity 125 trains are significantly cheaper to lease than new trains, and such a re-engineering exercise would be cost effective for many passenger services that are largely operating off the electrified network.

Capacity

IEP was conceived in 2005, at a time of forecasted continuing rapid growth, as a train which would maximise the capacity of the existing main long-distance rail network. It was to do this by being as big as possible to fit the maximum number of passengers in each train service, and to allow maximum throughput of trains along any route through its operational performance characteristics.

By being lightweight IEP would reduce wear and tear on the infrastructure thereby reducing, in time, the need for disruptive maintenance and renewal interventions on the main line routes which are, effectively, transport production lines. It would also accelerate faster than existing trains by virtue of its higher power to weight ratio.

Capacity – or the number of passengers which can be transported in a given time along a route – is dependant on three main factors:

- the capacity of the trains themselves
- the capability of the infrastructure and
- the operational performance of the trains on the route

Train Capacity

Train capacity is a function of the length of the train and the way that length is used. This depends on several factors including seat pitch, the mix of first and standard class accommodation, and the extent of space given over to luggage, catering facilities, toilets and doorway vestibules. Another factor is seating configuration – how far “airline” type single direction seating is used compared to “bays” of seats facing each other for groups travelling together. The needs of passengers are different for different types of journey – commuter, interurban and long-distance – although a basic minimum level of personal space will be required for any seated journey.

Commuter trains do not have reserved seating, passengers generally do not travel in social groups, there is limited, sometimes no, first class seating or catering demand and personal space is secondary to obtaining a seat. In addition the journey time is relatively limited and so luggage and toilet
provision is low. Demand is heavily skewed to morning and evening peak periods.

Interurban trains have a proportion of reserved seating but journeys are still relatively short. There is substantial first class business travel and more use by family groups. There is greater need for luggage space and toilet provision and an expectation of some catering service.

The long-distance market – principally Anglo-Scottish and to the West of England – has a high proportion of leisure travellers expecting reserved seating for a specific train, more personal space, substantial luggage space and often people travelling in social groups. Toilet and catering demand is greater again. There is a certain amount of demand for first class accommodation. Often demand is focussed on a journey across the middle of the day, starting after the morning commuter peak and ending in the late afternoon.

Whilst the needs of the three markets may be met within a single train type, the greatly different mix described above is more commonly met by a family of trains albeit sometimes from a single manufacturer with certain higher value components being common to promote reduced diversity of maintenance and parts supply. One such example is the Desiro family by Siemens as operated by South West Trains with different internal fit-outs, carriage lengths and door types and locations within the carriage length but with substantially common components and hence maintenance activity. Other manufacturers have similar families; none promote a single train for all purposes.

*Infrastructure Capability*

The capability of the infrastructure is, aside from general curvature and gradients which are largely inbuilt, a function of the number and layout of the tracks themselves, the structure gauge (which limits the cross-sectional size of trains), type of junctions hence how far flows of trains in different directions can be separated or conflict at certain points, spacing of signals and type of signalling control system, spacing of stations and frequency of stops, size of the stations, including the number of platforms and especially their length, and strength of the traction power supply on electrified lines.

All these factors have a bearing on the IEP project, given that it incorporates proposals to change frequencies and stopping patterns of train services. The length of platforms, and the proximity of the track junctions to the ends of those platforms, dictate maximum train length.

In order to accommodate the proposed IEP train design, a business case has been developed which includes the cost of certain changes to the infrastructure to provide the best overall solution to increase capacity. The changes involve such things as power supply and structure gauge improvements and platform lengthening.
Operational Performance

The capacity obtained through the operational performance of a train service on a given infrastructure is fundamentally about the use of time and space along a track.

If all trains accelerate at the same rate and then travel along a route at exactly the same speed, they can follow one another as closely as the signalling permits. When trains have different acceleration or cruising speed, they will either start or end up further apart and so the number of trains that can travel along the line in a given time will reduce.

At stations, the stopping time ("dwell" time) is dependant on the design of the train – how quickly passengers move to and pass through the doors to disembark and others then join. The greater the number of stops, the more important this factor becomes. For a long-distance train stopping only occasionally this is of minimal effect thus the number of doors can be reduced and placed out of the way of the passenger space at the ends of carriages. For commuter trains stopping frequently, reducing dwell time becomes critical and more and larger doors are generally spaced where passengers can most quickly reach them from within the train – usually at one-third and two-third points in each carriage.

A third factor is the planned stopping pattern of a sequence of services. If the first train in a sequence is planned to stop at a station but the next one not, then the following train cannot run directly behind it unless the station has separate platform lines to allow the second train to overtake. However if the first in a sequence is the one going furthest before stopping, the second the next furthest and so one, trains can be planned to depart the originating station as closely as the signalling allows hence the throughput of trains on a route is maximised.

There is a trade-off between the number of trains timetabled along a route in a given time and the reliability of the service overall. If the maximum theoretical number of trains is programmed along a route then the slightest perturbation to one train, or in the infrastructure, causes a domino or knock-on effect to the running of all following ones, leading to overall unpunctuality. Just as with fluid in a pipeline, the flow is smoothest and in practice maximised when the pipeline is not completely full. A reserve for overall reliability may be achieved by spreading trains out by slightly more than the minimum allowable or by running a sequence of closely spaced trains followed by a gap, often referred to colloquially as a "firewall in the timetable".

The proposition for the Great Western Main Line demonstrates some strengths and weaknesses. It would appear that in anticipation of maximum possible demand due to growth, a train plan was conceived to use maximum capacity IEP trains as frequently as possible along the trunk route section into
Paddington, thus placing a premium on very high reliability of trains, infrastructure and operational practice simultaneously.

Since the formulation of this proposition, through reduced demand forecasts, the size of the trains has been reduced subsequently to variously 10, 9, 8, 6, 5 and 4 passenger carrying carriages depending on time of day and mix of fleet variants. The flexibility in today’s rail timetable to substitute an alternative train for a service when one is delayed for some reason, allowed by the current standardisation of train length, would be substantially lost. However the frequency has been left at maximum possible during peak hours thereby leading to the requirement for all trains to perform similarly between stations in terms of speed and acceleration, and retaining an operational plan requiring very high reliability of all elements as before.

As the trains would be servicing different markets from commuter through to long-distance it is unlikely that station dwell times would in reality be identical, raising a question mark over the practicality in this approach. By retaining the highest possible frequency, and by forming many services from two trains coupled together but without any interconnecting corridor between them, the number of train crew necessary would be greater than otherwise necessary.

Credible Alternatives

One credible alternative approach offered to the Review team, which would place lower demands on overall reliability of the system and its human operators and users, would be to plan to run fewer but higher capacity trains. In so doing, the requirement for all trains to perform absolutely identically and therefore to be of a single type is avoided. The higher capacity of individual trains may be achieved in two ways – by adding carriages to nearer the maximum permitted train length or by using high capacity commuter trains which have internal space configuration, doors and vestibules optimised for the purpose. Thus, for example, the necessary passenger capacity of the Great Western Main Line can be achieved through a mix of new long (electric) interurban trains, existing IC125 trains with capacity similar to the reduced length bi-mode IEP variants planned for certain services, and high density commuter trains. The lower frequency of trains, resulting from the mixing of trains with different top speeds or acceleration, will be compensated for by higher individual train capacity and the effects may be reduced further by careful sequencing of trains in “flights.”

In time depending on actual growth of passenger traffic additional capacity may be provided with the investment phased in line with demand hence revenue. If there is an appropriate strategy, this may be combined with planned further electrification.

Alternatively higher specification new commuter trains may be introduced at that point to permit an increase in frequency through reduced difference in operational speed or performance.
In considering the capacity aspects of the East Coast long-distance services to destinations north of Edinburgh, the review team was mindful of the very different passenger volumes north and south of the Scottish capital and also the particular journey mixes ranging from very long-distance leisure journeys through to those of short distance where the existing trains even act as commuter services at certain times of day. There was also evidence of some significant passenger movements between the Aberdeen area specifically and the city regions of the NE of England and Yorkshire. Reservations were heard about the configuration of the rail infrastructure at Edinburgh station itself which has not been developed in a way which would make for easy attachment or detachment of locomotives to electric trains without affecting the capacity of the station during the process.

Such factors as these have led the team to consider that a number of options for the future have potential but would need to be explored in detail before one or more were selected. These include continuing electric Intercity trains from London to the north of Edinburgh at the northern limit of electrification, which will change in time as the proposals and plans for electrification within Scotland are developed further by the Scottish Government, and then either providing connectional services from that point or continuing forward with diesel locomotive haulage. Another option suggested by some would be to tailor a service between Aberdeen and Yorkshire to the specific needs of the passengers in that corridor with appropriate rolling stock. Depending on business case and further market understanding, these could range from modern diesel multiple units to slightly shortened reengineered IC125 trains offering a modest improvement in journey time, fitting in well with the Scottish internal service patterns, and also potentially avoiding additional issues of limited traction electricity supply capacity on the existing route in Northumberland.

The section below discusses credible alternatives in further detail.
Credible Alternatives

The IEP project team within DfT has evaluated certain alternatives to IEP as part of their internal project reviews and, in particular, in response to the changing economic forecasts in the first half of 2009. A summary of the alternatives that were reviewed was presented to Sir Andrew Foster, and this summary is reproduced in the table below. Proposal number 4 in the table was the one selected by the DfT as best value for money and has been the proposition under scrutiny.
<table>
<thead>
<tr>
<th>Proposal No.</th>
<th>Summary</th>
<th>Likely Resulting Programme Shape</th>
<th>Benefits and Likely Stakeholder Reaction (compared with today)</th>
<th>Core Size Order Approx</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Minimise costs by not doing IEP.</td>
<td>Minimise short-term costs and fulfil legal obligations only.</td>
<td>No IEP Programme. HST refurbishment only.</td>
<td>Zero.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>A sub-option exists to only refurb part of the HST fleet.</td>
<td>• Minor capacity reduction when compared with today (c. 5%).&lt;br&gt;• No journey time improvements.&lt;br&gt;• Some detriment to reliability.&lt;br&gt;• Likely strong adverse political reaction to 50-year-old trains operating on flagship routes.</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Like-for-like renewal of HSTs.</td>
<td>Minimise core Programme cost, but avoid political embarrassment from refurbishing HSTs by buying new IEP trains, but on a like-for like basis only.</td>
<td>Genuine De Minimis IEP. Like-for-like replacement of HSTs on ECML and GWML only, probably in 8- and 9-car sets.</td>
<td>c. 525 diagrammed vehicles.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Existing capacity sustained.&lt;br&gt;• Minor improvements to journey time, mostly on GWML.&lt;br&gt;• Major reliability improvements, mostly on GWML.</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Replace HSTs and focus capacity and journey time benefits on GWML.</td>
<td>Save some costs by deploying long trains in 9-car sets and by focussing on Great Western. Delay a decision on all of the non-HST elements of East Coast until later.</td>
<td>As 2., but also commit to more elements of Great Western now, where the need to replace HSTs is more pressing, and where it offers a possible tie-in with the Reading and electrification schemes. Long trains deployed in 9-car formations initially.</td>
<td>c. 685 diagrammed vehicles.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Reasonable (c. 15%) capacity enhancements on GWML.&lt;br&gt;• Major improvements to journey times on GWML and some minor improvements on ECML.&lt;br&gt;• Major reliability improvements, mostly on GWML.&lt;br&gt;• Possible UK manufacturing facility (dictated by funding strategy).</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Bring in some cherry-picked elements of ECML to optimise benefits-costs-ratio.</td>
<td>Save fewer costs than the options above but try to reduce the risks to the current procurement process. Deploy long trains in 9-car sets and commit to some cherry-picked non-HST elements of East Coast now (Cambridge line and c180 replacement). Delay a decision on the rest of East Coast until later.</td>
<td>As 3., but a commitment to do some non-HST elements of East Coast now (Cambridge line and c180 replacement).</td>
<td>c. 790 diagrammed vehicles.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>As 3. above, plus&lt;br&gt;• Minor capacity enhancements on ECML.&lt;br&gt;• Reasonable journey time improvements on ECML.</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Do the ITT commitments that prioritised ECML over GWML, but deploy in 9-car sets.</td>
<td>Preserve more elements of the procurement process by committing to both East Coast and Great Western now and by doing all of East Coast first, as per the ITT. Save some costs by deploying in 9-car sets initially.</td>
<td>The original Programme, but with long trains deployed in 9-car trains initially.</td>
<td>921 diagrammed vehicles.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>As 4. above, plus&lt;br&gt;• Reasonable capacity enhancements (c. 15%) on both GWML and ECML.&lt;br&gt;• Major improvements to reliability.&lt;br&gt;• Major improvements to journey times.</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>As ITT.</td>
<td>As above but deploy in 10-car trains.</td>
<td>Commitment to the Programme for ECML and GWML, with ECML first, as per the ITT, now.</td>
<td>950 diagrammed vehicles.</td>
</tr>
</tbody>
</table>
During Sir Andrew Foster’s review, concerns have mainly arisen in two key areas namely the viability of the bi-mode IEP trains, and the suitability of a single train design serving different markets such as commuter trains to Newbury, interurban fast trains to Bristol and South Wales and long-distance trains to Aberdeen. It has also become apparent that the benefits claimed as part of the DfT’s proposal above are not unique to the IEP proposition but could be at least substantially by alternative means at reduced cost. It was therefore decided to review what credible options might exist for each of the types of passenger services that IEP is currently proposed to provide. The analysis of this is shown in the tables below.

### Table: Market Analysis of IEP and Alternatives

| Market       | Current Train                                      | Proposed IEP Train          | Other Alternatives to IEP                                                                                                                                                                                                                                                                                                                                 | Advantages of Alternatives                                                                                                                                                                                                 | Disadvantages of Alternatives                                                                 |
|--------------|---------------------------------------------------|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Commuter     | Class 365 to Cambridge / Kings Lynn Class 165/166 to Reading / Newbury / Didcot / Oxford | 5 / 10 car electric 5 / 10 car electric / bi-mode | • Displaced rolling stock from Thameslink: class 377 is a modern high performing electric train  
• Displaced rolling stock from Thameslink: class 319 can be re-engineered to provide greater acceleration, higher reliability and improved passenger facilities such as air conditioning  
• Class 365 can be re-engineered to provide greater acceleration, higher reliability and improved passenger facilities such as air conditioning  
• New commuter electric train with high acceleration and possibly a top speed greater then 100mph | • Cheaper than IEP, flexible as they can be operated in 4, 8 or 12 vehicle formations with higher seating capacity  
• Significantly cheaper than IEP, flexible as they can be operated in 4, 8 or 12 vehicle formations with higher seating capacity  
• Cheaper than IEP, flexible as they can be operated in 4, 8 or 12 vehicle formations with higher seating capacity  
• Would permit greater use of line capacity | • Restrictions line capacity due to lower top speed  
• Restrictions line capacity due to lower top speed  
• Restrictions line capacity due to lower top speed  
• Only slightly cheaper than IEP |
### Market
- Interurban
  - IC225 to Leeds
  - IC125 to Hull / Harrogate / Skipton
  - Class 180 to Lincoln
  - IC125 to Bristol / Cardiff / Swansea
  - IC125 to Weston-super-Mare

### Current Train
- 8 car electric (option)
- 5 car bi-mode
- 5 car bi-mode
- 8 car electric
- 9 car bi-mode

### Proposed IEP Train
- Retain class 180 trains and re-engineer some IC125 trains to extend their life and achieve suitable compliance to the regulations for persons of reduced mobility
- New interurban electric train that can be hauled with a diesel locomotive to destinations a short distance off the electrified network; the electric train should have high acceleration and a top speed of 125mph
- Extension of electrification short distances to obviate the need for diesel locomotives (e.g. Lincoln, Weston-super-Mare)
- New high performance electric locomotive to replace one of the diesel locomotives on the IC125 trains and to later replace the electric locomotive on the IC225 trains

### Other Alternatives to IEP
- 8 car electric (option)
- 5 car bi-mode
- 5 car bi-mode
- 8 car electric
- 9 car bi-mode

### Advantages of Alternatives
- Significantly cheaper than IEP
- Cheaper than IEP if the specification allows manufacturers to develop existing products rather than design a new one
- May be cheaper than sourcing diesel locos
- Cheaper than IEP and will improve acceleration over existing IC125; also creates a bi-mode

### Disadvantages of Alternatives
- Does not adequately address growth unless additional class 180 trains or IC125 coaches can be sourced
- Diesel locomotives will need to be sourced for off-wire destinations; these must be compatible with the new electric train
- Requires capital expenditure
- Does not adequately address growth unless additional coaches can be sourced

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Note that services to Lincoln are due to commence operation in May 2011.
<table>
<thead>
<tr>
<th>Long-distance East Coast</th>
<th>IC225 to York / Newcastle / Edinburgh</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IC125 to Aberdeen / Inverness</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>8 car electric (option)</td>
<td>10 car bi-mode</td>
</tr>
<tr>
<td>Reform the management of connecting services and remove through-journeys for long-distances (e.g. Aberdeen, Inverness); connecting trains should be of high quality using re-engineered IC125 trains for instance</td>
<td></td>
</tr>
<tr>
<td>Reform existing IC225 trains by adding a single coach to each by breaking up 3 trains and redistributing the coaches; replace these with 3 trains of re-engineered MkIII coaches that are currently in storage</td>
<td></td>
</tr>
<tr>
<td>New high performance electric locomotive to replace the electric locomotive on the reformed IC225 and MkIII trains outlined above</td>
<td></td>
</tr>
<tr>
<td>Re-engineering of IC125 trains to extend their life and achieve suitable compliance to the regulations for persons of reduced mobility</td>
<td></td>
</tr>
<tr>
<td>New long-distance electric train that can be hauled with a diesel locomotive off the electrified network; the electric train should have high acceleration and a top speed of 125mph</td>
<td></td>
</tr>
<tr>
<td>Significantly cheaper than IEP and will improve journey times off wire</td>
<td></td>
</tr>
<tr>
<td>Cheaper than IEP and will improve acceleration over existing trains</td>
<td></td>
</tr>
<tr>
<td>Cheaper than IEP if the specification allows manufacturers to develop existing products rather than design a new one</td>
<td></td>
</tr>
<tr>
<td>Requires rail industry to alter current working practices on connecting trains; passenger unrest at having to change trains, political disquiet over loss of through services</td>
<td></td>
</tr>
<tr>
<td>Does not allow higher performance train to reduce journey times</td>
<td></td>
</tr>
<tr>
<td>Additional expenditure may be unnecessary</td>
<td></td>
</tr>
<tr>
<td>Does not address growth, does not allow journey times to be reduced</td>
<td></td>
</tr>
<tr>
<td>Diesel locomotives will need to be sourced for off-wire destinations; these must be compatible with the new electric train</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Long-distance Great Western</th>
<th>IC125 to Carmarthen / Pembroke Dock</th>
</tr>
</thead>
<tbody>
<tr>
<td>IC125 to Cheltenham / Gloucester</td>
<td></td>
</tr>
<tr>
<td>IC125 to Worcester / Hereford</td>
<td></td>
</tr>
<tr>
<td>IC125 to Exeter / Paignton / Plymouth</td>
<td></td>
</tr>
<tr>
<td>IC125 to Newquay / Penzance</td>
<td></td>
</tr>
<tr>
<td>9 car bi-mode</td>
<td>5 car bi-mode</td>
</tr>
<tr>
<td>5 car bi-mode</td>
<td>7 car bi-mode</td>
</tr>
<tr>
<td>7 car bi-mode</td>
<td></td>
</tr>
<tr>
<td>Re-engineering of IC125 trains to extend their life and achieve suitable compliance to the regulations for persons of reduced mobility</td>
<td></td>
</tr>
<tr>
<td>New interurban electric train that can be hauled with a diesel locomotive to the long-distance destinations a short distance off the electrified network (e.g. Carmarthen, Cheltenham)</td>
<td></td>
</tr>
<tr>
<td>Extension of electrification short distances to obviate the need for diesel locomotives (e.g. Cheltenham, Gloucester, Worcester)</td>
<td></td>
</tr>
<tr>
<td>Reform the management of connecting services and remove through-journeys for some services (e.g. Cheltenham, Pembroke Dock); connecting trains should be of high quality using re-engineered IC125 trains for instance</td>
<td></td>
</tr>
<tr>
<td>New high performance electric locomotive to replace one of the diesel locomotives on the IC125 trains and to later be used with a new order of coaches</td>
<td></td>
</tr>
<tr>
<td>Significantly cheaper than IEP, maintains long-distance journey times off wire</td>
<td></td>
</tr>
<tr>
<td>Cheaper than IEP if the specification allows manufacturers to develop existing products rather than design a new one</td>
<td></td>
</tr>
<tr>
<td>Extension to Gloucester could also cover Severn Tunnel diversionary route</td>
<td></td>
</tr>
<tr>
<td>Significantly cheaper than IEP and can be done within the one franchise for Greater Western</td>
<td></td>
</tr>
<tr>
<td>Cheaper than IEP and will improve acceleration over existing IC125; also creates a cheap bi-mode</td>
<td></td>
</tr>
<tr>
<td>Would not adequately address growth if GWML electrification were not to proceed</td>
<td></td>
</tr>
<tr>
<td>Diesel locomotives will need to be sourced for off-wire destinations; these must be compatible with the new electric train</td>
<td></td>
</tr>
<tr>
<td>Requires capital expenditure</td>
<td></td>
</tr>
<tr>
<td>Can only realistically be done for off-peak services due to long-distance commuter flows</td>
<td></td>
</tr>
<tr>
<td>Does not adequately address growth unless additional coaches are sourced or new coaches are ordered</td>
<td></td>
</tr>
</tbody>
</table>
There are other factors to take into account when considering credible alternatives, growth in passenger numbers being the most important. The UK’s railway system has seen huge growth in the last 10 years but this has inevitably slowed during the economic downturn. Growth will return as the economy recovers, and the railway industry needs to be proactive in preparing for this rather than reactive. Ordering new trains takes time, and accurate growth forecasts are essential for ensuring that demand can be met. The InterCity 125 fleet is already in full use and although re-engineering of these trains is a sensible and cost-effective solution for some passenger services for the short to medium term, doing this alone will not provide additional seats to deal with passenger growth. However the electrification of the Great Western Main Line to Bristol and South Wales will release sufficient of the IC125 fleet to cater for growth on other services in the medium term.

There are many combinations of the alternatives to IEP that are credible and could be implemented. It seems apparent that a “pick and mix” approach, selecting the most affordable and best-fit solution for each group of passenger services, could deliver the best value solution to improve the services for the passenger and increase the number of seats to allow for growth in passenger numbers. Seat numbers of the IEP trains and some of the credible alternatives are shown in the following table.
### Intercity Express Programme

<table>
<thead>
<tr>
<th><strong>IEP Train</strong></th>
<th><strong>Seats</strong></th>
<th><strong>Planned Use</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>IEP 8 vehicle electric</td>
<td>528</td>
<td>GW Bristol / Swansea</td>
</tr>
<tr>
<td>IEP 5 vehicle electric</td>
<td>339</td>
<td>Commuter</td>
</tr>
<tr>
<td>IEP 2x5 vehicle electric</td>
<td>678</td>
<td>Commuter peak</td>
</tr>
<tr>
<td>IEP 10 vehicle bi-mode</td>
<td>635</td>
<td>Aberdeen/Inverness</td>
</tr>
<tr>
<td>IEP 7 vehicle bi-mode</td>
<td>410</td>
<td>West of England</td>
</tr>
<tr>
<td>IEP 5 vehicle bi-mode</td>
<td>279</td>
<td>Secondary destinations</td>
</tr>
<tr>
<td>IEP 2x5 vehicle bi-mode</td>
<td>558</td>
<td>Peak secondary destinations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Alternatives</strong></th>
<th><strong>Seats</strong></th>
<th><strong>Potential Use</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>IC225 9+1 vehicles (current)</td>
<td>530</td>
<td>Anglo-Scottish electrics</td>
</tr>
<tr>
<td>IC225 10+1 vehicles (extended)</td>
<td>606</td>
<td>Anglo-Scottish electrics</td>
</tr>
<tr>
<td>IC125 9+2 vehicles (current EC)</td>
<td>543</td>
<td>Aberdeen/Inverness</td>
</tr>
<tr>
<td>IC125 8+2 vehicles (current GW)</td>
<td>470</td>
<td>Aberdeen/Inverness</td>
</tr>
<tr>
<td>IC125 7+2 vehicles</td>
<td>396</td>
<td>West of England/Secondary destinations</td>
</tr>
<tr>
<td>IC125 6+2 vehicles</td>
<td>320</td>
<td>Secondary destinations</td>
</tr>
<tr>
<td>Class 180 5 vehicle diesel (current)</td>
<td>268</td>
<td>ECML Secondary destinations</td>
</tr>
<tr>
<td>Interurban 10 vehicle electric</td>
<td>695</td>
<td>GW Bristol/Swansea</td>
</tr>
<tr>
<td>Class 365 electric 1x4 vehicle</td>
<td>263</td>
<td>Commuter off peak</td>
</tr>
<tr>
<td>Class 365 electric 2x4 vehicle</td>
<td>516</td>
<td>Commuter off peak</td>
</tr>
<tr>
<td>Class 365 electric 3x4 vehicle</td>
<td>779</td>
<td>Commuter peak</td>
</tr>
</tbody>
</table>

It has not been possible to identify the optimum “pick and mix” solution in the short time of this review, but one set of circumstances that is possible is shown in the table below. It must be stressed that this is only a view formed during the review from assessment of the evidence offered to the team, but enough work has been carried out to demonstrate clearly that the optimum solution would be found if a detailed assessment of the options previously outlined is completed as recommended.
<table>
<thead>
<tr>
<th>Route</th>
<th>Service Type</th>
<th>Rolling Stock 2011</th>
<th>Proposed IEP</th>
<th>Rolling Stock 2016</th>
<th>Rolling Stock 2021</th>
<th>Rolling Stock 2026</th>
</tr>
</thead>
<tbody>
<tr>
<td>KX-Aberdeen/Inverness</td>
<td>Long distance</td>
<td>IC125</td>
<td>10 vehicle bi-mode</td>
<td>IC225 with connecting re-engineered IC125 from Edinburgh</td>
<td>IC225 with connecting re-engineered IC125 from Edinburgh</td>
<td>New long distance EMU using extended electrification and diesel-hauled from Dundee or Perth</td>
</tr>
<tr>
<td>KX-Edin/Newc/York</td>
<td>Long distance</td>
<td>IC225</td>
<td>8 vehicle electric</td>
<td>IC225</td>
<td>IC225</td>
<td>New long distance EMU</td>
</tr>
<tr>
<td>KX-Leeds</td>
<td>Interurban</td>
<td>IC225</td>
<td>8 vehicle electric</td>
<td>New Interurban EMU or IC225</td>
<td>New Interurban EMU or IC225</td>
<td>New Interurban EMU</td>
</tr>
<tr>
<td>KX-Hull/Harr/Skip/Linc</td>
<td>Interurban</td>
<td>IC125/class 180</td>
<td>5 vehicle bi-mode</td>
<td>Re-engineered IC125 or 180</td>
<td>Re-engineered IC125 or 180</td>
<td>Re-engineered IC125 or displaced 22x or 180</td>
</tr>
<tr>
<td>KX-Peterborough</td>
<td>Commuter</td>
<td>Class 365</td>
<td>Not IEP</td>
<td>377 or Re-engineered 365</td>
<td>377 or Re-engineered 365</td>
<td>377 or New commuter EMU</td>
</tr>
<tr>
<td>KX-Cambridge/KL</td>
<td>Commuter</td>
<td>Class 365</td>
<td>5 vehicle electric</td>
<td>377 or Re-engineered 365</td>
<td>377 or Re-engineered 365</td>
<td>377 or New commuter EMU</td>
</tr>
<tr>
<td>Padd-Bristol</td>
<td>Interurban</td>
<td>IC125</td>
<td>8 vehicle electric</td>
<td>New Interurban EMU</td>
<td>New Interurban EMU</td>
<td>New Interurban EMU</td>
</tr>
<tr>
<td>Padd-Cardiff/Swansea</td>
<td>Interurban</td>
<td>IC125</td>
<td>8 vehicle electric</td>
<td>New Interurban EMU</td>
<td>New Interurban EMU</td>
<td>New Interurban EMU</td>
</tr>
<tr>
<td>Padd-Carmarthen/Pemb</td>
<td>Long distance</td>
<td>IC125</td>
<td>9 vehicle bi-mode</td>
<td>New Interurban EMU</td>
<td>New Interurban EMU</td>
<td>New Interurban EMU</td>
</tr>
<tr>
<td>Padd-Cheltenham/Glouc</td>
<td>Long distance</td>
<td>IC125</td>
<td>5 vehicle bi-mode</td>
<td>Re-engineered IC125</td>
<td>New Interurban EMU using extended electrification ?</td>
<td>New Interurban EMU using extended electrification</td>
</tr>
<tr>
<td>Padd-Worcester/Hereford</td>
<td>Long distance</td>
<td>IC125</td>
<td>5 vehicle bi-mode</td>
<td>Re-engineered IC125</td>
<td>Re-engineered IC125</td>
<td>Re-engineered IC125 or displaced 22x or 180</td>
</tr>
<tr>
<td>Padd-Exeter</td>
<td>Long distance</td>
<td>IC125</td>
<td>7 vehicle bi-mode</td>
<td>Re-engineered IC125</td>
<td>Re-engineered IC125</td>
<td>Re-engineered IC125 or displaced 22x or 180</td>
</tr>
<tr>
<td>Padd-Plymouth/Penzance</td>
<td>Long distance</td>
<td>IC125</td>
<td>7 vehicle bi-mode</td>
<td>Re-engineered IC125</td>
<td>Re-engineered IC125</td>
<td>Re-engineered IC125 or displaced 22x or 180</td>
</tr>
<tr>
<td>Padd-Paignton</td>
<td>Long distance</td>
<td>IC125</td>
<td>9 vehicle bi-mode</td>
<td>New Interurban EMU</td>
<td>New Interurban EMU</td>
<td>New Interurban EMU</td>
</tr>
<tr>
<td>Padd-Newquay</td>
<td>Long distance</td>
<td>IC125</td>
<td>9 vehicle bi-mode</td>
<td>Re-engineered IC125</td>
<td>Re-engineered IC125</td>
<td>Re-engineered IC125 or displaced 22x or 180</td>
</tr>
<tr>
<td>Padd-Oxford</td>
<td>Commuter</td>
<td>Class 165/166</td>
<td>5 vehicle electric</td>
<td>Re-engineered 319</td>
<td>Re-engineered 319</td>
<td>New commuter EMU</td>
</tr>
<tr>
<td>Padd-Newbury</td>
<td>Commuter</td>
<td>Class 165/166</td>
<td>5 vehicle electric</td>
<td>Re-engineered 319</td>
<td>Re-engineered 319</td>
<td>New commuter EMU</td>
</tr>
</tbody>
</table>

It must be stressed that this table depicts one possible “pick and mix” solution that emerged during the review; it is by no means the definitive solution and a detailed assessment of the available options must be carried out.
If new trains are confirmed as necessary in the short to medium term, it is also clear that the specification for them must be written so as to permit the manufacturers to tender a development of their existing product ranges. This will encourage a more cost-effective outcome than a highly specialised train specification that has no market elsewhere in the world.

The effect of cascade of other trains is a key factor for consideration as well. Assuming that the Thameslink rolling stock procurement continues, this will release a number of electric commuter trains that could be cost-effectively redeployed onto services currently proposed for IEP. Should the conversion of the Meridian and Voyager trains into bi-modes go ahead, this may well provide suitable trains for currently-planned IEP services in 10-15 years time depending on the development and expansion of electrification from the routes currently agreed to be implemented. All of these options need full assessment by an experienced group of industry experts, perhaps the first role of a new independent procurement agency.
Supporting evidence submitted to IEP review

My team and I met a wide range of stakeholders as indicated in the report. Their open and candid commentary was often supported by helpful illustrative material which they provided to us to inform the review. The most relevant material has been selected and included below.

What customers want

Passenger Focus provided the review with a recent study they had done into what passengers on the East Coast services want. A summary of this study is below and this was used as the basis for understanding passengers' needs.
This brochure summarises Passenger Focus’s advice to Government about what passengers want from the new Intercity East Coast franchise – previously run by National Express and now operating as Government-owned “East Coast”. The new franchise is expected to start operating from late 2011. These recommendations are based on research in September 2009 where 6000 passengers were surveyed to gather the views of passengers and findings from the National Passenger Survey. The table below shows what passengers regard as the priorities for improvement.

### Priorities for improvement

<table>
<thead>
<tr>
<th>Priority</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Punctuality and reliability of the train</td>
<td>1</td>
</tr>
<tr>
<td>Value for money for the price of the ticket</td>
<td>2</td>
</tr>
<tr>
<td>Being able to get a seat on the train</td>
<td>3</td>
</tr>
<tr>
<td>Length of time the journey was scheduled to take (speed)</td>
<td>4</td>
</tr>
<tr>
<td>Facilities and services on board the train</td>
<td>5</td>
</tr>
<tr>
<td>Frequency of trains for this journey</td>
<td>6</td>
</tr>
<tr>
<td>Provision of information about train times/platforms</td>
<td>7</td>
</tr>
<tr>
<td>Personal security while on board the train</td>
<td>8</td>
</tr>
<tr>
<td>Personal security at the station</td>
<td>9</td>
</tr>
<tr>
<td>Ticket-buying facilities</td>
<td>10</td>
</tr>
<tr>
<td>Ease of getting to and from the station</td>
<td>11</td>
</tr>
<tr>
<td>Facilities and services at the station</td>
<td>12</td>
</tr>
</tbody>
</table>

(1=highest priority and 12=lowest)

*Passengers have told us that their top priority for improvement in the new franchise is the punctuality and reliability of the service.*

The Intercity East Coast franchise scores highly in Passenger Focus’s National Passenger Survey (NPS), achieving the best overall satisfaction score among long-distance train operators in seven of the last ten NPS surveys. That is despite a relatively poor, although improving punctuality record. Passengers have told us that their top priority for improvement in the new franchise is the punctuality and reliability of the service (78% of trains were on time, that is ‘right time or early’, at destination in the last 12 months), followed closely by improving value for money – which our research has shown is about quality as well as price and ticketing.

Based on this research, Passenger Focus’s recommendations to Government about the new Intercity East Coast franchise include:

- **Punctuality and reliability**
  - Challenging but achievable targets for improving the number of trains arriving on time (that is, actually on time and not just up to two minutes late) and reducing the number of trains that are more than 20 minutes late.

- **Value for money and ticketing**
  - An easily-understood fares structure that will be regarded by passengers...
A Review of the Intercity Express Programme - Annex

as logical, transparent and a fair price for the journey being made. The walk up Off-Peak Single ticket, formerly the Saver Single, should be 50% of the Off-Peak return and not £1 less as at present. Passengers with Advance Single tickets who miss the train on which they have booked should be permitted to pay the difference, plus an administration fee, between what they have paid already and the appropriate new ticket they need to purchase. The facility to pay for an annual season ticket in 12 instalments should be provided and restrictions should be printed on passengers' tickets to remove confusion over validity.

- Frequency and getting a seat
  - Service Level Commitment 2' timetable changes should be implemented subject to passenger feedback at consultation stage. Additionally, services should run more frequently at weekends, and trains should run later on Saturday evenings and start earlier on Sunday mornings.
  - Facilities and services on-board
    - The trains should have a buffet and some seating in Standard and First Class (we recognize that on a very small number of trains providing both may not be cost-effective) and key business and other long-distance services running over meal times should offer hot meals to passengers. WiFi should continue to be provided free of charge and major problems with the reliability of the current system must be addressed.

Targets should be introduced to improve passenger satisfaction with the cleanliness and upkeep of trains.

Further information about Passenger Focus's research and our full submission to Government about what passengers want from the Intercity East Coast franchise is available at www.pasengerfocus.org.uk

*Wi-Fi should continue to be provided free of charge and major problems with the reliability of the current system must be addressed.*

Contact us:
If you want to know more about the work we are doing on your behalf to ensure you get a better deal when you travel by rail, bus or coach contact us:

Passenger Focus
Froestech House, 192-196, Lower Bridge St
Manchester M5 8AQ
0300 123 2950
info@passengerfocus.org.uk
www.pasengerfocus.org.uk

Intercity East Coast franchise: what passengers want
Through-journeys

Passenger Focus provided the review with some analysis of recent research on the acceptability to passengers of changing trains during long-distance journeys. This seems to support the view that the adoption of standards of interchange and connecting train that is common in European practice could be acceptable as an alternative to current practice.

Passenger Focus research on changing of trains

Introduction:

The Intercity Express Programme (IEP) review team is interested in evidence of passenger views on changing trains on the National Express East Coast (NXEC) and Great Western routes.

We have identified two specific pieces of research which give information on interchanges; our National Passenger Survey and our West Coast Main Line research. Both surveys ask questions on changing trains. The key findings have been summarised in the subsequent sections.

Whilst the majority of connections on long-distance routes were handled adequately, the additional passenger concerns on making timely connections and the information provided may reduce passenger satisfaction. This could even deter some passengers from travelling by train.

National Passenger Survey (NPS)

- The NPS is conducted twice a year; in the spring and autumn. We ask two questions about connections in the spring wave of the NPS every year.

- Based on the last spring 2009 results, 990 passengers (equivalent to 46% of passengers) travelling on NXEC trains and on FGW long-distance services made a train connection.

- The majority of passengers (87%) making a connection felt that all aspects of the connection (from planning through to actually changing trains) were handled adequately.

- Only 13% stated that the connection was not handled adequately and this was primarily because of the lack of information at the connecting station (35%). Other reasons provided were:
  - Had too much time between trains (32%)
  - Not enough time between trains (25%)
  - Had difficulty finding connection train (19%)
  - Not enough information at station where started journey (13%)
Passengers who felt their needs were handled adequately were more satisfied with the overall journey (90% satisfied) than those who did not (69% satisfied). This lower satisfaction score is likely to be influenced by other factors, as well as their experience of changing trains.

**West Coast Mail Line Route Utilisation Strategy (RUS) research**

- A survey of 4106 passengers was undertaken in November 2009 across 6 routes on the West Coast Main Line. This research was undertaken to form our response to the RUS.
- Of those passengers who did not have to change trains (55%), nearly half (44%) stated they would not travel by train if direct services were no longer available for the journey they were making (see Table 1).
- Passengers making shorter journeys (Table 1 – see route 4, 5 and 6) were less likely to consider rail if there were no direct trains available.
- When changing trains, passengers were mostly concerned about making their change on time (93%) and the waiting time that would increase their overall journey time (90%). See Table 2.

**Table 1:**

| Q: If there were no direct trains and you had to change trains, how likely would you be to still travel by train on this route? |
|---|---|---|---|---|---|---|
| **Total** | **Route 1** | **Route 2** | **Route 3** | **Route 4** | **Route 5** | **Route 6** |
| Unweighted base* | 2259 | 478 | 466 | 281 | 271 | 190 | 573 |
| Very likely | 22% | 24% | 28% | 28% | 15% | 20% | 18% |
| Quite likely | 29% | 32% | 33% | 26% | 25% | 29% | 26% |
| Not very likely | 26% | 22% | 26% | 23% | 31% | 29% | 26% |
| Not at all likely | 18% | 15% | 9% | 20% | 25% | 17% | 25% |
| Not sure | 4% | 6% | 3% | 4% | 4% | 4% | 5% |

*The “unweighted base” row refers to the actual number of people who responded to the question:

1 The six routes surveyed on the WCML are:
Route T - Passengers making journeys on TPE or Virgin Trains services between Lancaster and Carlisle, Edinburgh/Glasgow.
Route 2 - Passengers making journeys on Virgin Trains services between London Euston and Manchester/Liverpool.
Route 3 - Passengers making journeys on ATW between Chester and Llandudno/Bangor.
Route 4 - Passengers making journeys on Northern Rail services between Crewe and Wilmslow.
Route 5 - Passengers making journeys on Virgin Trains or LM services between Northampton and Tamworth.
Route 6 - Passengers making journeys on Virgin Trains or LM services between London Euston and Milton Keynes Central.
Table 2:
Q: In the future if you had to change trains during this journey, how concerned would you be with each of the following issues?

<table>
<thead>
<tr>
<th>% stating Very/Fairly concerned</th>
<th>Total</th>
<th>Route 1</th>
<th>Route 2</th>
<th>Route 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unweighted base*</td>
<td>2339</td>
<td>1050</td>
<td>738</td>
<td>551</td>
</tr>
<tr>
<td>Being able to make connection on time</td>
<td>93%</td>
<td>92%</td>
<td>94%</td>
<td>93%</td>
</tr>
<tr>
<td>Unweighted base*</td>
<td>2289</td>
<td>1039</td>
<td>728</td>
<td>522</td>
</tr>
<tr>
<td>Having to wait and adding time to journey</td>
<td>90%</td>
<td>87%</td>
<td>94%</td>
<td>91%</td>
</tr>
<tr>
<td>Unweighted base*</td>
<td>2246</td>
<td>1018</td>
<td>718</td>
<td>510</td>
</tr>
<tr>
<td>Availability of station facilities at the interchange</td>
<td>53%</td>
<td>50%</td>
<td>53%</td>
<td>57%</td>
</tr>
<tr>
<td>Unweighted base*</td>
<td>2241</td>
<td>1016</td>
<td>720</td>
<td>505</td>
</tr>
<tr>
<td>Journey information at the station</td>
<td>77%</td>
<td>74%</td>
<td>78%</td>
<td>82%</td>
</tr>
<tr>
<td>Unweighted base*</td>
<td>2200</td>
<td>999</td>
<td>711</td>
<td>490</td>
</tr>
<tr>
<td>Mobility assistance/moving luggage</td>
<td>30%</td>
<td>28%</td>
<td>28%</td>
<td>36%</td>
</tr>
</tbody>
</table>

*The “unweighted base” row refers to the actual number of people who responded to the question.

Note: This question was only asked on routes 1, 2 and 3.

The review team also received from East Coast recent passenger counts on the Anglo-Scottish services which supported the view that an appropriate smaller capacity train could be used for the sections north of Edinburgh. One stakeholder had commented that there were a number of through-journeys from the North East to Aberdeen but it has not been possible to investigate the issue to this level of detail. It may well be that a connecting service could be better placed to run from Newcastle rather than Edinburgh.

Source: East Coast trains
DfT Strategy

Strategy sets out the long term vision. A clear strategy is especially important in Transport investment programmes as they are commonly characterised by long planning, implementation and operation timescales. A coherent and consistent strategy is particularly critical therefore to ensuring that benefits of major investment programmes are realised.

Strategic change occurs for a number of reasons, and the challenge is to ensure investment programmes adapt appropriately to economic, political and other change.

The following are the key points where DfT strategy has been articulated that are relevant to IEP.

2005 High Speed Trains 2 (HST2) Programme

As summarised by the Office of Government Commerce (OGC) review in March 2006:

The aims of the project:

The objective of the HST2 project has been defined as follows:

“To create a train specification such that on those routes where HSTs (and their equivalents) will need to be replaced, we can be assured that a train service plan can be operated that represents best overall value for money, taking into account government’s perspective on growth and capacity needs.”

Specifically the project Sponsorship Board agreed the following project objectives 16/09/05:

- Delivering increased carrying capacity per train
- Delivering a fast, reliable journey time
- Meeting other customer requirements
- Improving Safety
- Delivering an environmentally sustainable solution
- Minimising Cost
- Offering flexibility of deployment.

The driving force for the project:

The project is consistent with the Governments overall priorities for railways set out in the White Paper “The Future of Rail” published 15/07/04. More widely DfT has a number of PSA targets which are relevant to HST2. Key drivers include:
• Addressing the risk that the current HST fleet (deployed across several franchises) may not be acceptable for safe compliant operations in the medium term
• Get better value out of existing rolling stock and ensure that new build takes into account likely redeployments
• Driving out cost inflating standards before procurement gets underway
• Achieving a cross industry approach sponsored by the DfT
• Minimising the number of different and incompatible fleets in use on the national network
• Understand the consequences of differing fuel/energy price scenarios for rolling stock choice.

"[The] Review Panel finds that the high level outcomes and objectives for the project make the necessary contribution to the Minister’s and DfT Rail overall strategy, subject to the update of this strategy due in Summer of 2007 not being significantly different from the current perspective. The project represents a ground breaking initiative to bring together all of the organisations involved in delivering passenger services to achieve significant improvements in the services."

Source: Department for Transport

2007 Rail White Paper

IEP was progressing in the context of this strategy, which was clear that major network electrification or high-speed lines were not being pursued.

The formal specification and long-term strategy

The formal communication to the Office of Rail Regulation (ORR) appended to this White Paper sets out:
• The High Level Output Specification (HLOS) for the improvements in safety, reliability and capacity the Government wants to buy to 2014;
• Specific programmes of investment to be undertaken between now and 2014, which deliver benefits in the slightly longer term, or benefits (such as station improvements) that cannot be captured in the HLOS; and
• The funding available to secure these improvements.

The Government is satisfied that the improvements it wants to buy are affordable within the funds available. The ORR will determine whether this deal is a fair one, and then ensure it is delivered.
These firm and costed plans for 2014 have been drawn up alongside considerations of the 30-year challenges that the railway may face. This is essential because trains ordered now will still be in service in 30 years’ time, and other assets will last even longer. But while the Government must plan 30 years ahead, it recognises that it is impossible accurately to forecast demand that far into the future. Some cities and regions will grow faster than others. People and firms are likely to respond to the challenge of cutting carbon emissions by changing travel patterns and re-engineering supply chains. The pace of technological change is equally unpredictable.

Forecasts have been wrong before, and any strategy that tried to build a rigid investment programme based on fixed long-term forecasts would inevitably be wrong again. Such an approach could well deliver additional capacity in the wrong place.

To overcome this challenge, the guiding principles in this strategy are:

- To invest where there are challenges now, in ways which offer the flexibility to cope with an uncertain future; and
- To put in hand the right preparatory work so that, as the future becomes clearer, the necessary investments can be made at the right time.

These principles are consistent with the recommendations of the recent Eddington Transport Study, and are illustrated by the preparatory work on a new Intercity Express train, with a design that will give flexibility on power supply and train formation. They are also evident in proposals to prepare for the next generation of signalling that will make a difference in the middle part of the next decade. The Government is investing over £0.4 billion in these preparatory projects alone. But it would not be prudent to commit now to ‘all-or-nothing’ projects, such as network-wide electrification or a high-speed line, for which the longer-term benefits are currently uncertain and which could delay tackling the current strategic priorities such as capacity.

Source: Department for Transport
2007 Letter from Chair of ATOC and Chief Executive of Network Rail to DfT

Many stakeholders considered that the debate about electrification was only taken forward after the publication of a joint letter from the chairman of ATOC and the Chief Executive of Network Rail to the Department. This letter is reproduced here as it is seen to be the starting place for the discussions that led to the July 2009 announcement by the Secretary of State.

Mike Mitchell
Director General, Rail and National Networks
Department for Transport
Great Minster House
76 Marsham St
London, SW1P 4DF
23 October 2007

Dear Mike

White Paper and the Case for Electrification

We are writing to record our support for the broad direction of the White Paper that the Department for Transport (DfT) published in July. We welcome the Government’s commitment for investment in both additional rolling stock and infrastructure to meet growing demand for a successful rail product. However, we would like to raise our concern about the approach towards the subject of electrification.

This is an area that, perhaps above all others in rail strategy, is deserving of a serious and dispassionate analysis of the commercial, economical and environmental benefits of the options. Whilst the White Paper recognises the issue, it appears that consideration of a wider electrification programme – especially of the main lines – is being put off until Control Period 5. We believe that this is wrong. There are real benefits to be gained from doing this now and deferral simply delays the realisation of these benefits.

Given both the age of our existing rolling stock and the expected expansion of the rail system, over the coming years, we will continue to procure new sets of rolling stock. There are many reasons why we should be buying electrically powered trains.

Firstly, using “diesel” trains as ”mini-power” plants – to generate tractive power is both inefficient and wasteful. Given the size and mobile nature of trains, it is not a particularly

Continued over ...
efficient way to convert fossil fuel into power. It is, surely, better to manage this at a power station level - even after taking into account transmission losses in the distribution system.

And this is even before one takes into account the fact that diesel trains consume significant amounts of energy to simply transport heavy engines and fuel around the network.

Secondly, today, we have absolutely no idea about the source of energy in the future. We can immunise the railway from changing fuels (and, indeed the cost of new fuels) by an electrification programme that puts those decisions elsewhere. For example, it seems extraordinarily incautious to be spending millions of pounds equipping a railway to run on one type of fossil fuel, including the depot works, only to find we - as an industry - have bet on the wrong fuel type.

Thirdly, at present, the cost of nuclear power generation is only slightly below that produced by burning gas, oil or coal. As fossil fuels start to become more expensive, as demand outstrips supply AND the cost of extraction rises, then inevitably nuclear energy will gain a real competitive edge. Without a wider electrification programme, we will be left with rising costs - unable to take advantage of developments in fuel technology.

Fourthly, we must be one of the few countries in the world that have high speed trains that are not electric. As a result, the diesel trains we buy are GB-specific trains - made for exclusive use on our national network, giving an unnecessarily high unit cost.

The business case for the electrification improves as the numbers of people rise. In the past, the economic calculation has been marginal, as the high capital costs of the electrified network need to be spread across the user base. However, as these capital costs are fixed, irrespective of the number of users (unlike fuel which is variable), then as the number of passengers rises the cost per mile (including capitalised elements) decrease.

Two of the three points in the White Paper that argue for a delay on electrification are, we believe, misleading. They are whether diesel fuels will be less carbon intensive, in future, and whether it makes sense to electrify in advance of "in-cab signalling".

For the reasons outlined above, this is not about carbon emissions. It is about the efficiency in the production of electro-motive force. Yes, improvements in the carbon content of diesel fuels are likely to come about in the coming years, but the burning of limited fossil fuels, as opposed to using electricity generated from a wide range of very low or zero carbon emissions, seem unnecessary. Fossil fuels are a limited resource. Using
these to power trains, when other methods are available seems very short sighted. We do recognise the potential of bio fuel, but the technology here is undeveloped and, in any case, does not address the issue of additional weight caused by having engines and fuel on board trains.

In addition, we do not believe that the cost of immunising signalling systems from electrical interference is significant. A recent report by RSSB suggests that this is around 1% of the capital cost of electrification. This, in our view, would not be sufficient justification for deferring the electrification until completion of ERTMS.

From an industry perspective, it would seem to be inconceivable that we could contemplate a thirty-year rail strategy for rail — especially one that is growing, rapidly — which does not foresee a much greater deployment of electrification. And if that is the case, then we need to start planning for it now. Given the disruptive nature of an electrification roll-out programme and the growing demand for increased passenger services (earlier trains, later trains, weekend trains and trains on bank holidays), we will need to do this over a long period of time. We cannot simply conclude at the end of CP4 that we need to electrify the railway (for the reasons above) and then expect the industry to do this in a matter of a few years. A longer term commitment to this will enable the industry to have a ten year, perhaps ever longer programme to electrify the railway.

We are already working together with government and other stakeholders through the Network RUS on opportunities for infill electrification in the relatively short term. We propose that this work is extended to include a thorough technical, economic and environmental assessment of the pros and cons of a wider electrification programme. As part of this, we would consider the economic opportunities of aligning such electrification with the plans for the introduction of new trains.

Yours sincerely

Adrian Shooter
Chairman, ATOC

Iain Coucher
Chief Executive, Network Rail
2007 Letter from DfT to Chair of ATOC and Chief Executive of Network Rail

Dear Iain and Adrian

The Case for Electrification

Thank you for your letter of 23rd October and for your expression of support for the broad direction of the White Paper.

I appreciate you raising the subject of electrification. The White Paper has been widely interpreted as anti-electrification. In reality we have taken a balanced view, driven by overall priorities, particularly for additional capacity. On the one hand it does not make sense to commit now to a very expensive national electrification programme which is not justified in an economic and business sense. On the other, we do recognise that there may be advantages of further electrification on some routes and that we need to work together on the case for more strategic electrification in the long term.

The White Paper took account of the electrification study recently carried out by the industry through the Railway Standards and Safety Board (RSSB), which we believe was a serious and dispassionate analysis. This showed that electrification had a positive business case on some routes and not on others. It also showed on the basis of projected energy costs and environmental benefits, even a radical change in the social cost of carbon as envisaged in the Stern report would not be sufficient to tip the balance in favour of a comprehensive national electrification programme. The White Paper had to consider the affordability implications of electrification, as well as the extent to which electrification might help to deliver additional capacity in Control Period 4 (2009-2014).
The relative efficiency of diesel versus electric trains in terms of both energy and carbon has been solidly established in work by Interfleet Technologies and Lancaster University carried out for RSSB as part of the Sustainability Programme. This builds on earlier work by ATOC and does indeed show that electric trains are more energy and carbon efficient than diesels. This was taken into account in the electrification study mentioned above.

Future power sources are of course a major cause of uncertainty in a world context. However the railway has flexibility that is not shared by other modes. Electric trains can take advantage of any energy source that can be converted in a power station (or wind turbine etc) into electrical energy. It seems clear that the future energy mix will be biased much more towards renewables and sources other than fossil fuels. This argues in favour of electrification. However, portable energy may change as well. For example, conversion of plant waste into biofuel might change the situation, as might a way of using solar energy directly to split hydrogen from water. At this time there is uncertainty on developments in these areas, so it seems unwise to place all bets on electrification as the only possible future. We need to move forward in a pragmatic way and build in flexibility, as we are doing for the Inter-City Express Programme.

The future costs of energy are, as you suggest, highly unpredictable, but we believe that the electrification study carried out by RSSB took the best advice available at the time.

The costs of signalling immunisation quoted are the incremental cost of using immunised components, starting from new. The costs of immunising an existing signalling system are much higher. But again, these costs were taken into account in the electrification study.

As well as the energy and carbon benefits of electrification, a truly dispassionate analysis needs to consider the advantages of self-powered trains and the non-energy advantages of electrification... Self-powered trains are inherently more flexible and although more complex and less reliable in themselves, simplify the railway as a system. Electrification increases system complexity and vulnerability to weather but can improve capacity. All of these factors were, I believe, taken into account in the industry study referred to above.

We agree that there may be a good case for electrifying some routes, in particular high traffic areas. For rural and lightly used lines, not only does the high current cost of electrification have to be justified over a lower traffic level, but the electrical transmission losses form a higher proportion of the energy budget. It seems unlikely, therefore, that a convincing business case for comprehensive network electrification can be sustained in the foreseeable future.

Although I differ in some respects with your analysis, I agree with your conclusion that the case for further electrification should be taken forward on an ordered and planned basis, driven by business principles but making the best forecast we can of the future. It also needs to be contained within the regulatory settlement and the Statement of Funds Available (SOFA). Certainly the funding set out by the SOFA for Control Period 4 ought to be sufficient to enable the industry to analyse and develop electrification schemes for implementation beyond 2014. So I am
certainly not expecting work on potential electrification schemes to stop during CP4 where there appears to be a good business case.

However, the best way to improve the case for electrification is by reducing costs. You will be aware that Network Rail is, based on earlier discussions with the Department, already working to develop a lower cost approach to main line electrification based on current standards and is also investigating options for a much lower cost system for urban electrification. I understand that part of the basis for cost reduction will depend on continuity of work, so that some form of “rolling programme” is likely to produce business advantages for Network Rail. These developments should form the foundation for the next stage, in which we should look in more detail at the business basis for infill schemes and new route electrification, in both cases using rolling stock renewal and cascade, and resignalling as opportunities to maximise cost-benefit. The relationship between electrification and resignalling is eased considerably by Network Rail’s decision to roll out the European Rail Traffic Management System (ERTMS) on UK main lines, as this potentially solves both signalling system electrical immunisation and signal sighting problems.

I am happy to discuss with you the best way to take this forward. I fully agree with you that any plan for electrification needs to be long term, should minimise the potential for disruption and to be intelligently linked to plans for rolling stock renewal and resignalling. It is also essential that the development of such a study does not divert Network Rail management attention from the core requirements of improving the reliability and resilience of the network. The Network RUS may indeed be an appropriate vehicle, but we also need to ensure that there is a strong linkage with the Technical Strategy Advisory Group, on which both Network Rail and ATOC are represented at senior engineering level and where the subject has already been reviewed and actions set in place. It is also necessary for the Office of Rail Regulation to be involved, as they will need to assess the extent to which electrification schemes contribute towards the HLOS objectives on capacity, performance and safety.

Once again, thank you for your letter and I look forward to a further discussion.

Yours sincerely

Mike Mitchell
Director General of Rail & National Networks

Source: www.railwaysarchive.co.uk/documents/DfT_Electrification09.11.07.pdf
2008 Secretary of State’s National Networks Strategy Group

National Networks Strategy Group
Terms of Reference

Purpose

The Strategic Transport Networks Group will develop a transport strategy along key UK corridors, in the context of the Department’s goals to support the economy and reduce carbon, including by shaping and supporting housing development.

Membership

Andrew Adonis Chair
Senior Civil Servants Department for Transport, HM Treasury
Senior Executives Highway Agency, Network Rail

Terms of Reference

The Strategic Transport Networks Group will:

1. In the context of the Department’s cross-modal approach to identifying transport challenges and options, provide clarity on strategic goals and objectives for transport along key national corridors, taking account of the scope for better integration of housing and transport on an environmentally sustainable basis.
2. In respect of these key national corridors, review and understand the extent to which existing national networks serve the country’s future needs, taking account of spatial plans and future demand.
3. Consider and develop policy and options which will address the identified problems in a way which is both timely and robust.
4. Consider in particular options for meeting projected passenger and freight demand on a sustainable basis, including further rail electrifications, better motorway management and capacity utilisation, new rail lines (including high speed lines), and the better integration of aviation and rail hubs.
5. Identify and consult on the potential solutions and develop a long term affordable investment strategy that gives value for money to the taxpayer and can be effectively financed.

29 October 2008

Source: Department for Transport
2009 – Electrification announced

Foreword

1. A modern railway system is vital to preparing Britain for the future. The Government has decided to embark on a major £1.1bn programme of rail electrification as an integral part of its rail modernisation and carbon reduction strategies. Work will begin immediately on the electrification of the Great Western Main Line between London, Reading, Oxford, Newbury, Bristol, Cardiff and Swansea, to be completed within eight years. In parallel, planning will begin immediately for the electrification of the line between Liverpool and Manchester, to be completed within four years.

2. The Great Western Main Line is the longest non-electrified intercity route in Britain, of vital national strategic importance to both England and Wales. It also includes heavily used commuter lines into London. Electrification will enable the introduction of a predominantly electric high-speed train fleet. These trains will offer faster journey times, more seats, greater reliability, improved air quality and lower carbon emissions than their diesel equivalents, as well as being cheaper to buy, operate and maintain.

3. The electrification of the line from Liverpool to Manchester will allow the introduction of a fast electric service with a journey time of around 30 minutes, compared to a fastest journey time of around 45 minutes today. It will also enable operation of electric train services from Manchester Airport and Manchester Piccadilly to Glasgow and Edinburgh along the West Coast Main Line. As on Great Western, electrification will enable the introduction of modern electric trains which provide a better service for passengers than the more expensive diesel trains which would otherwise be needed to increase capacity on these key routes.

4. The Great Western electrification project will complement the £16bn construction of Crossrail, which will extend electric train services from Essex and the new east-west tunnel through central London to Slough, Heathrow and Maidenhead on the Great Western Main Line by 2017. With electrification now to be extended to Reading, it would be possible for Crossrail to operate to Reading, rather than Maidenhead, from the outset, and this option will now be considered by the Government and Transport

for London. It will also make it easier to improve rail access to Heathrow from the West. Great Western electrification will be integrated with a wider set of enhancements, including the £425m upgrade of Reading station, the installation of in-cab signalling equipment and the introduction of the new Super Express train as the successor to the diesel-powered Intercity 125. The Super Express train will now be predominantly electric powered on the London to Swansea line.

5. Further work is ongoing to assess the detailed costs and benefits of electrification on other routes. The rail industry recently published for consultation its Network Route Utilisation Strategy: Electrification². The Government will carefully consider the costs and benefits of wider electrification, with particular reference to the Midland Main Line between London and Derby, Nottingham and Sheffield, as well as the routes between Manchester and Preston, and Liverpool and Preston.

6. As with other rail investments, the cost of electrification will be funded by Network Rail and supported by the Government. Over the medium term this £1.1bn investment in electrification will be self-financing, paying for itself through lower train maintenance, leasing and operating costs. This means that this investment can take place without reducing already planned infrastructure enhancement work.

7. This electrification programme radically affects the requirements for train rolling stock over the next decade. In particular, there will be far less need for diesel trains and a greater requirement for electric trains. The Government will publish a new rolling stock plan in the autumn, taking account of these changed circumstances.

[Signed]

Rt. Hon. Andrew Adonis
Secretary of State for Transport
July 2009

Source: Department for Transport
1. 2010 Strategy

As the recent Liberal Democrat – Conservative Coalition Agreement makes clear, and as reiterated in the Chancellor’s speech on 17 May, “Deficit reduction and continuing to ensure economic recovery is the most urgent issue facing Britain.” In this context, any investment decisions are likely to be under ever greater scrutiny. IEP, along with all other major investment programmes, will have to compete for limited funding. A backdrop of such rigorous and pervasive fiscal austerity is perhaps the most significant of many strategic changes to impact IEP since the programme commenced.

Source: http://www.hm-treasury.gov.uk/press_02_10.htm
DfT Value for Money Protocol

Introduction

Value for money (VfM) considers the level of costs and benefits we can expect from a proposal.

A VfM assessment includes a range of impacts that transport interventions may have and, based upon these, gives advice to ministers about whether a proposal should go ahead.

Rationale for VfM

VfM is an important part of the decision making process:

- It ensures that economic and social welfare impacts of a policy have been fully considered.
- It provides a consistent method of assessing schemes to ensure that all modes and types of intervention are treated equivalently.
- It improves decision making by presenting information clearly highlighting any key risks or sensitivities.

VfM assessment

A VfM assessment is required for both spending proposals and impact assessments.

For spending proposals, VfM assessments place the proposal in one of five categories:

- poor
- low
- medium
- high
- very high

Whilst VfM is only one of the factors that decision makers consider (others include deliverability and acceptability), advice should reflect the presumption that we should generally pursue:

- no proposals that offer poor VfM
- very few low VfM proposals
- some but not all medium VfM proposals
- most, if not all, high and very high VfM proposals

For impact assessments, VfM assessments place a proposal in one of two categories:
• net benefits to society
• net costs to society

Once again, VfM is only one of the factors that decision makers consider but advice should reflect the presumption that we are generally inclined to pursue:

• no proposals that impose net costs
• all proposals that offer net benefits

Guidance on VfM assessment

The format of a VfM assessment varies depending on the nature of the proposal being put forward. The assessment could fall in to one of two broad categories:

• VfM of traditional spending schemes
• VfM of proposals subject to an impact assessment

In all cases it is necessary for the VfM statement in a submission to explain what category the proposal falls into and highlight any risks and sensitivities in a balanced and succinct fashion.

Clearance

The Strategic Transport Analysis and Review (STAR) division must clear all submissions containing an assessment of VfM or referring to the benefit cost ratio (BCR) of a proposal.

VfM: assessment of spending proposals

Introduction

All spending proposals, including transport projects that are funded by the Department or require the Department's approval, require a VfM assessment.

This VfM assessment should be included in any submission to investment boards or ministers and should be cleared with Strategic Transport and Analysis and Review (STAR).

Making a VfM Assessment

All spending proposals should be accompanied by a business case consistent with the Departmental appraisal guidance in NATA. Using this business case, it is possible to present the NATA benefit cost ratio (BCR) of the scheme.

The NATA guidance does not propose the monetisation of all costs and benefits of a transport intervention. The NATA BCR represents, therefore, an incomplete picture of the relative merits of a scheme.
A VfM BCR is constructed which attempts to monetise some of the wider impacts considered in NATA. This VfM BCR provides a starting point for assessing which VfM category a spending proposal falls in to:

- poor VfM if the BCR is less than 1.0
- low VfM if the BCR is between 1.0 and 1.5
- medium VfM if the BCR is between 1.5 and 2.0
- high VfM if the BCR is between 2.0 and 4.0
- very high VfM if the BCR is greater than 4.0

Following this initial assessment it is necessary to consider all other impacts that have not been monetised. Depending upon the magnitude of these impacts, it may be necessary to adjust the VfM category.

**Writing a VfM Statement**

A VfM statement should be included within the body of the submission. This section should include:

- the VfM category of the scheme
- the VfM BCR
- a description of any non-monetised impacts that have influenced the VfM category
- a description of any risks or sensitivities that may mean the VfM category presented may not be achieved

The VfM statement should be written in the context of the submission as a whole.

It is also important that the VfM statement is clear and concise to ensure it maintains its impact with senior officials and ministers.

If it is not possible to present a succinct analysis in the body of the text, it may be appropriate to include an annex.

See **Examples of good practice for VfM statements**.

**Clearance**

Local economists and TAR should clear the VfM statement in accordance with the clearance guidelines.

**Source:** Department for Transport
Benefit to Cost Ratios (BCRs)

A business case for IEP has provided economic appraisals of the project since it began. A number of data sources are inputted to a model. A number of assumptions about the future (number of passengers, cost of fuel, etc) are inputted also, with the output providing an assessment of the likely costs and benefits of the project. The ratio of benefits to costs is expressed in a Benefit to Cost Ratio (BCR). This is used to signify the value for money of the scheme.

The review team have been provided with BCR information which demonstrated a reduction over time from exceptionally high to the threshold of medium-to-high. This information is considered by DfT to be commercially confidential and it has therefore not been included.
International comparisons

The following information on French Bi-modes was submitted by the IEP team at the Department for Transport.

French Bi-modes: Autorail Grande Capacité

French Bi-modes

Background

SNCF established the TER Transport Express Régional in 1984, to provide medium-distance services within the French regions. The routes generally radiate out from regional centres, including Paris, and serve mainly commuting markets. There is generally strong demand in the morning peak in the ‘up’ direction and in the evening ‘down’ direction, reflecting the mostly commuter-nature of these routes. Some of the routes are marketed as les trains touristiques, though generally demand is low outside of the peaks.

Rolling Stock

Since 1997 there has been a programme of new rolling stock purchase, with new multiple-units replacing older locomotive-hauled trains and Multiple Units. Between 1997 and 2007 SNCF purchased 1,000 trains (consisting of around 2,500 vehicles). They have entered service throughout France and today 50% of stock on the TER is either brand new or modernised. Four trains are in Deutsche Bahn livery and operate across the border near Strasbourg.

An order for 500 multiple units was awarded to Bombardier in December 2001, of which around 100 were to be bi-modes. The trains were manufactured at the Crespin factory near Valenciennes and are equipped with a pantograph for electric running under 1.5kV DC and two onboard 600kW 12-cylinder diesel engines for off-wire running. The engines provide 1.3MW at 1.2kV AC for the traction motors. Some units are also equipped with a transformer to permit running under 25kV AC. The units are capable of 160 km/h (100 mph) in both electric and diesel modes and have high acceleration, though acceleration is slightly lower when running on diesel power and in the longer formations.

Sets which are designed for operation under 1.5kV DC have one pantograph, but sets which can also operate under 25kV AC have a second. Only one pantograph is raised at a time. Acceleration is marginally higher under 25kV than under 1.5kV.

Seating capacities range from 120 (3-car) to around 250 (4-car), with a crushload capacity of around 440. Internally, the sets are fitted out with a variety of
specifications, from a commuter-type ‘InterCité’ interior, suitable for journeys up to 90 minutes in length, up to ‘Grand Confort’, which is suitable for interurban journeys up to four hours in length. Each département has specified its own bespoke interior, though the differences tend to be around provision of wheelchair-spaces, refreshment facilities and seat upholstery. All trains have two toilets and large, accessible doors.

**Routes Served**

Eight départements placed orders for bi-modes in the initial batch. The départements which placed orders are:

- Midi-Pyrénées – 7
- Bourgogne – 12
- Centre – 5
- Rhône-Alpes – 19
- Languedoc-Roussillon – 4
- Aquitaine – 14
- Provence-Alpes-Côte d’Azur – 17
- Limousin – 12

The bi-mode sets tend to operate routes which radiate from major towns and cities, usually operating down main lines, but then continuing up lighter-used un-electrified branches. The bi-mode version is able to switch from electric to diesel power without stopping, though it is not clear whether it can do the reverse.

After the success of the concept on lighter-used lines, orders were placed for 24 bi-mode sets for service on the Transilien service in Paris. Line P sees bi-mode sets running from Gare de l’Est as far as Gretz under electric power (a distance of around 50km), where the overhead line ends. From Gretz the trains continue a similar distance under diesel power to Provins, where they terminate. These trains are single class and have been very successful, posting punctuality figures of around 95%. The reduction in journey time has been between 5 and 10 minutes to Provins, reducing the journey from 90 minutes to 80. They have resulted in a ‘revolution’ on the line.

They were co-financed by SNCF (65%) and STIF (35%), which co-ordinates all Parisian transport services. The total order value was €136M (£117M), or €5.7M (£4.9M) per set.

**References**

The work above is based upon several articles appearing in the French railway press, all of which have been provided to the Review Team.

Source: Department for Transport
Dutch High Speed Line – HSL-Zuid

Review of the HSL-Zuid Project as requested by the Sir Andrew Foster review team.

Background
The Dutch rail network is extremely dense, with a total of 2,809 route-km in an area the size of Wales. Distances between major towns and cities are generally short and as such, an emphasis is placed on the frequency of service, rather than headline journey times. Maximum speeds reached on the conventional network in the Netherlands are of the order of 140 km/h (or 87 mph), though on minor lines, the prevailing limit can be much lower.

In 1984 the PBKA (Paris, Brussels, Köln, Amsterdam) group was set up to investigate a high-speed network linking the cities. After numerous false-starts and changes of scope, the construction of the Dutch portion of the network between the Belgian border, near Antwerp and Amsterdam was begun around the turn-of-the-century, with Belgium also committed to linking Brussels, via a reconstructed Antwerp station with new low-level through platforms to the Dutch border. The Dutch route was defined at 125 km in length, with most on dedicated high-speed track, though with some running on ‘conventional’ lines. The track was specified to a high standard and suitable for 300 km/h running on the dedicated sections.

The rationale for the line changed numerous times, though its overarching goal of connecting the Netherlands into the European high speed network remained at the fore. The final route chosen connected Amsterdam Central, Schiphol, Rotterdam Central to the Belgian line to Antwerp and thence to Brussels and the wider European network. It was originally envisaged that full public services would commence in 2007, though the inaugural train did not run until September 2009.

The signalling system chosen for the new lines in the two countries was ERTMS, Level 2, with different signalling suppliers each side of the border. There was a system upgrade specified during the implementation phase (from version 2.2.2 to version 2.3.0) which caused some implementation delays.

The Dutch government directly managed the infrastructure construction but competitively tendered a 15 year franchise for the main operation of passenger services both within Holland and to Brussels while the through trains to Paris would divert from the existing route onto the new line and continue to be operated by the international ‘Thalys’ consortium, with the TGVs being modified to be ERTMS compatible. A consortium of KLM (10%) and the Dutch State Railway (90%), named HSA (High Speed Alliance) won the tender and took on the responsibility for services and for the specification and operation of new trains, with exclusive rights to operate the new line in Holland. This franchise was let on the basis of the payment of a premium payment of some €uro 150 m p.a. from the franchisee to the government – primarily because of relatively low access charges being applied.

Construction then commenced and although this project ran into a multitude of problems, which included a two-year delay in the opening of the infrastructure itself, along with major scope and thus cost overruns, it was successfully completed and fitted out with the new signalling in autumn 2007.

Having let the train franchise, the Dutch government believed that it had absorbed itself of the responsibility to monitor the train project and to integrate it with the construction one so that there could be commencement of operation at the time of infrastructure completion. It was only as a last minute move, just before the infrastructure handover, that the Ministry gave the successful Project Director for the infrastructure the additional role in relation to overseeing the commencement of train services!

Comment from Mr Kee, former executive secretary of board HSL-Zuid - The HSL-systems integration team had been monitoring the HSA-train project right from the start and foresaw many system integration and train delivery risks. The Dutch government however believed that it had absorbed itself of the responsibility to monitor the train project and to integrate it with the route construction.

Train Delivery Issues
The HSA team developed a train specification and tendered for the new trains for the route. The order for rolling stock was placed with AnsaldoBreda, an Italian consortium and the understanding given to the author of this note is that the tender evaluation criteria were primarily based on price and that ‘deliverability’ did not weigh heavily in the evaluation. This was regrettable – at the time it was widely known that the order for Inter City trains for Denmark from the same manufacturing facility was severely delayed (four years at the time of the HSA contract and now over 10 years delayed against the plan for full scale Danish deployment).
The HSA order was for 19 V250 sets, capable of 250 km/h, to enter service along with the line itself in 2007.

As of April 2010, only one prototype test train (lacking an interior fit-out) has been delivered, with no firm commitment as to the delivery of the remaining sets. It is currently estimated that the trains will enter service ‘in Q4 2010’, although there is no substantive evidence that this will be achieved.

In the interim, since September 2009, some Angel Trains-owned electric locomotives and refurbished coaches commenced a very basic hourly service at 160 km/h over the new line between Rotterdam and Amsterdam only and with ERTMS level 1 in operation as a short term expedient because of ERTMS level 2 interface problems with the conventional Dutch signalling and with the electric locomotives.

Thalys trains have only since December 2009 diverted from the much slower old line to the new one. This delay was due to the fitment of ERTMS to the TGV sets being delayed. Despite the train and route being designed for 300 km/h, they can only operate at 160 km/h between Rotterdam and Amsterdam because of the Level 1 ERTMS operation on this section to suit the interim domestic trains. Level 1 ERTMS is inadequate for high speed operation.

The author of this note was asked in November 2007 to visit the project and assist with suggestions to achieve early implementation of services. Accompanied by a UK expert in the field of train implementation and signalling, this was done in December 2007. The suggestion was made that the line be fitted with enough conventional Dutch signals as an interim measure to allow any dual voltage Dutch electric train or Thalys trains to start using the line in Spring 2008, with, say, a 10 minute 160 km/h headway. This suggestion was agreed as technically workable but since the franchise consortium had reassessed its bid and found that it had overbid the contract, the franchisee was not incentivised to start operations as it could claim ‘force majeure’ for the train delays and thus avoid paying the franchise premium. The Dutch government was also unwilling to renegotiate the terms of the franchise, hence the resultant stalemated and ongoing delays.

Conclusions

1. Governments take ultimate accountability, as funder, for the actions or inactions of franchisees and their suppliers.
2. As a result they should make sure that they are fully aware of major issues or delays which could affect them and have intervention powers to implement contingency arrangements.
3. Projects should be managed as a whole, rather than as fragmented components.
4. Deliverability should be a key factor in the assessment criteria for tenders.
APPENDIX – SUMMARY OF HSL ZUID AS CONCEIVED
(Source: Netlips review of HSL-Zuid in summer 2007)

The HSL-Zuid project’s scope consists of the realisation of a high speed railway line from Amsterdam to the Belgian border with stops at Amsterdam, Schiphol and Rotterdam. Part of the project is a shuttle connection between The Hague and Breda. At the Belgian border, the HSL connects to the Belgian and European network of high speed lines.

As can be seen in the table below, travelling times between stations will drop considerably when travelling with a high speed

<table>
<thead>
<tr>
<th>Stops</th>
<th>Train (h:mm)</th>
<th>HSL-South (h:mm)</th>
<th>Car (h:mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amsterdam CS – Rotterdam CS</td>
<td>1h 00m</td>
<td>0h 30m</td>
<td>0h 54m</td>
</tr>
<tr>
<td>Amsterdam CS – Breda</td>
<td>1h 41m</td>
<td>0h 57m</td>
<td>1h 13m</td>
</tr>
<tr>
<td>Amsterdam CS – Antwerp</td>
<td>2h 09m</td>
<td>1h 10m</td>
<td>1h 41m</td>
</tr>
<tr>
<td>Amsterdam CS – Brussels South</td>
<td>3h 37m</td>
<td>1h 40m</td>
<td>2h 41m</td>
</tr>
<tr>
<td>Breda – Bvisselse South</td>
<td>1h 55m</td>
<td>1h 01m</td>
<td>1h 25m</td>
</tr>
<tr>
<td>Amsterdam CS – Paris</td>
<td>4h 09m</td>
<td>3h 13m</td>
<td>4h 58m</td>
</tr>
</tbody>
</table>

Project travelling times (source: www.hslzuid.com)

Modernisation of the train stations is not part of the scope of the HSL project. The project includes the reconstruction of the A4 highway and a realignment of the A16 highway.

The High Speed Line – Zuid (HSL - Zuid) is a two track high speed railway that spans over 125 kilometers. 85 kilometers of the line is newly built high speed rail track, the other 40 kilometers are the upgrade of existing track. The new tracks are built using high grade technology for the foundation, electrification and safeguarding of the track. The design and use of this technology makes it possible for high speed trains to travel on the track with speeds of 300 km/h. Unique for the project is its construction on the soft Dutch soil and the 170 civil structures such as tunnels, bridges, fly overs, dive unders and aquaducts that facilitate trains travelling at high speed.

Realisation consists of the construction of the substructure as well as the superstructure for the newly built track, as well as the key delivery of the infrastructure to the State. Via ProRail the State is responsible for ensuring the availability of the track for the Train operating company. Contracted carrier for the HSL – Zuid is NS Hispeed (formerly the High Speed Alliance), which estimates to transport over 24 million passengers in 2010 (source: www.nslaispeed.nl).

<table>
<thead>
<tr>
<th>Year of projection</th>
<th>Projected number of passengers</th>
</tr>
</thead>
<tbody>
<tr>
<td>1994 (PKB 1)</td>
<td>8 mln total passengers per year in 2003</td>
</tr>
<tr>
<td>1996 (PKB HSL-South)</td>
<td>6-7 mln total passengers per year in 2004</td>
</tr>
<tr>
<td>2005 (Hispeed)</td>
<td>7 mln international passengers in 2010, 17 mln domestic passengers in 2010</td>
</tr>
</tbody>
</table>

Projected passenger estimates

Project purpose

On a strategic level the HSL - South was and is considered to be of great importance to the Netherlands as a fast and comfortable train connection with other European countries. A high-quality link of the Netherlands to the European network of high speed railway tracks was felt as being indispensable. As the official policy document (PKB 5) on the HSL states:

“The realised high speed connection will accommodate growing mobility and will deliver a contribution to substitution of road- and air traffic to rail traffic.”

Source: Department for Transport
Australian Contract Structure: Rail Corp

RailCorp is a company wholly owned by the New South Wales (NSW) state government in Australia. It manages the rail infrastructure in the state and operates all the passenger services, branded as CityRail for services within the state into Sydney and CountryRail for inter-state long-distance services. The CityRail services operate over a network that is largely electrified at 1,500V DC and using double-deck trains comprising of 3 or 4 vehicles. These also operate in multiple to 6 or 8 vehicles in length and the most recent were introduced in 2002, the “Millennium” trains. However some of the trains were built in the early 1980s and do not have air conditioning, which is far from ideal in such a temperate climate.

In 2004, the state government decided that the older trains should be replaced to provide a safer and improved environment for passengers, and directed RailCorp to start a procurement process for new trains of mixed lengths and mixed single/double deck vehicles. As PPP contracts had been successful in delivering new schools and hospitals, this model was applied to the financing and contracting arrangements whereby the successful supplier would be responsible for design, build, financing and maintenance of the new trains and the depot facilities needed. The only other rail PPP projects at this time were the London Underground Ltd (LUL) contracts awarded to Metronet and Tube Lines.

New train projects in NSW have a history of being delivered late and with products of variable quality. RailCorp therefore ensured that the contractual structure passed as much risk as possible to the supplier with a detailed specification and complex underpinning performance regime. The premise was a “no train, no payment” principle for every train required in service for the 25 year term of the contract. While this is straightforward for a new school or hospital in terms of it being built and maintained, it is significantly more complex for large engineering projects such as building and maintaining new trains or upgrading and maintaining rail stations and infrastructure (such as LUL).

Australia has a small train building capability with 2 main suppliers currently active in the market. Other worldwide suppliers have struggled to win orders other than through joint ventures with these 2 suppliers due to the local needs of the rail companies in Australia, who are mostly state-owned passenger operators and private sector freight operators. The PPP contract was the largest train order ever placed in Australia and when contractual and financial close was reached in December 2006 the requirements had been simplified to 78 8-vehicle double-deck trains plus 2 spares, a total of 626 vehicles at a cost of AUS$2.4bn (£1bn at the time of signature, £1.5bn at today’s exchange rate). The detailed specification and complex contractual structure remained the same however. A comparison of key elements between IEP and the NSW PPP project is below.
## Train types

<table>
<thead>
<tr>
<th>Contract</th>
<th>IEP</th>
<th>NSW PPP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Train types</td>
<td>Long-distance fleet comprising of: 5 vehicle length electric – 46 8 vehicle length electric – 20 5 vehicle length bi-mode – 33 7 vehicle length bi-mode – 14 9 vehicle length bi-mode – 11 10 vehicle length bi-mode – 13</td>
<td>Suburban commuter fleet comprising of 78 double deck electric trains each of 8 vehicles in length (plus 2 spare vehicles)</td>
</tr>
</tbody>
</table>

### Vehicle numbers
- IEP: 888
- NSW PPP: 626

### Term of concession
- IEP: 27.5 years
- NSW PPP: 25 years

### Debt/Equity Ratio
- IEP: 85/15
- NSW PPP: 94/6

### Financing Packages
- IEP: 4 separate financings, 2 on each core route
- NSW PPP: Single financing

### Funding Requirements
- **(Illustrative estimates)**
  - £4,500m debt, £750m equity
  - £981m debt, £60m equity at 2006 exchange rate
  - £1,375m debt, £84m equity at 2010 exchange rate
  - AUS$2,256m debt, $137m equity

The NSW PPP contract is comparable to IEP in terms of the numbers of vehicles, although the different financial circumstances between 2006 and 2010 are obvious with the lower percentage of equity possible in 2006 than today. The contract structure is also near identical. The supplier for the NSW PPP project declared a delay of 5 months at the end of 2009 which came under a great deal of scrutiny by the rating agencies but, at the time, caused no reduction in credit rating. However in March 2010 the credit rating was downgraded due to concerns surrounding the company’s funding profile; the outlook was also declared as negative. This has been interpreted by financial commentators as a reduction from investment grade to junk status.

The PPP project in Australia is a single train type that, although complex in construction terms due to being double deck vehicles, is simpler than the overall mix of trains for IEP. It was also funded before the cost of borrowing increased as the result of the credit crunch. Despite the lower risk arrangements that the PPP project has operated under in comparison to IEP, it has suffered delays and has not been able to maintain its credit rating. This demonstrates the risk of this sort of arrangement for new train projects.