Highlands and Islands Enterprise

Highlands and Islands Rail Traffic Growth Projections

Phase 2: Economic Appraisal of Upgrade Options

June 2006

Halcrow Group Limited

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Contents

1 Study Objectives and Report Structure

1.1 General

This study has been conducted by Halcrow on behalf of Highlands and Islands Enterprise (HIE) in order to give advice on future rail traffic growth and demand in the Highlands and Islands.

This report presents findings from the second (and final) stage of the study, which has the following objectives:

- To produce a demand forecast and economic appraisal of improvements to services on the Highland Mainline, including journey time reductions, frequency enhancements, and calling services at Edinburgh Airport; and

- To produce a demand forecast and economic appraisal of the likely impact of a 40 minute journey time reduction between Tain and Golspie resulting from a new rail bridge over the Dornoch Firth.

The findings of this work are intended to be used to support the HIE and industry steering group in the process of developing their strategic objectives and policies for rail. It is also envisaged that work undertaken for this study will be used to assist the continued development of the Scottish Planning Assessment – a project commissioned by the Scottish Executive to help inform the process of devolution of rail powers from the UK Government to the Scottish Executive.

The report is presented in eight chapters. The background and context of this study is discussed in chapter two. Chapter three documents the methodology used in the development of the rail demand forecasts and economic appraisals. Chapters four to seven present the demand forecasts and economic appraisals for the options. Finally, chapter eight draws from previous experience in the rail industry to outline how the stakeholders, in particular the incumbent operator, can deliver the levels of demand that are forecast.

2 Study Background and Context

2.1 *Background*

The report on phase one of this study provided a detailed review of the background and context of the work that has been undertaken, in particular focusing on the changing nature of Scottish Railways and the challenges that are faced as the Scottish Executive prepares for rail devolution. It also covers the roles of railways in the Highlands and Islands, a brief summary of this is given below. For the full text on this the reader is referred to chapter 2 of the phase one study report.

2.2 *The Role of the Railways in the Highlands and Islands*

The Highlands and Islands face a number of geographical, social and economic issues almost exclusively unique to the area.

The population density of the region is 0.08 people per hectare and large parts of the Highlands and Islands are more than two hours drive from a major town or city. Add to this the 96 inhabited islands lying off the mainland, and the need for a high quality and far-reaching network of transport infrastructure - of which rail must form a key part - becomes clear.

Transport provides people with essential access to employment and services – including health and education – and allows people the freedom of opportunity. As well as benefiting local people in the Highlands and Islands, proficient transport links also encourage visitors to the area from outside the region, thus boosting the local economy.

An effective and efficient transport system is central to achieving the targets set out in the HIE's '*A Smart Successful Highlands and Islands*' strategy, which include the creation of 20,000 new jobs and raising real incomes by between 10% and 15% over the next twenty years. A rail network which serves the needs of both people and business is essential in meeting these demanding targets.

Railways play an increasingly important role in encouraging social inclusion and preventing migration out of the region. This particularly applies with regard to residents who travel from the islands and most remote parts of the region and who have no access to private transport. Rail also has the potential to contribute to the achievement of many of the national transport objectives, particularly with regard to achieving a modal shift from private cars to public transport.

2.3 *Summary of Study Phase One*

Phase two of this study has been conducted using the 15 year baseline rail passenger projections that were produced during the first phase. These forecasts are summarised below.

Phase one of this study involved the production of baseline rail passenger projections up to 2020 for the whole of the Highlands and Islands rail network. These projections provide a high and low range for the forecast number of rail passenger journeys, driven by exogenous factors and committed service improvements. Specific drivers of demand that were considered include population growth, committed new developments, economic performance and the planned level of future rail service provision. The forecasts provide the baseline demand data that is required to undertake detailed pre-feasibility assessments of bespoke improvements to the provision of services on the route.

On the basis of the optimistic and pessimistic scenarios the number of passenger trips on the Highland and Islands rail network is forecast to grow by between 67% and 43% over the next 15 years with the largest growth occurring between the present day and 2011.

Stage two of this study is concerned solely with the Highland Mainline and the Far North Line, which account for 31% and 10% of all passenger trips on the Highlands network respectively. Table 2.1 below presents the high and low demand projections for the Highland Mainline scenario, and Table 2.2 presents the high and low projections for the Far North Line.

Table 2.1. Baseline Rail Demand Projections for the Highland Mainline.

	High Growth Scenario		Low Growth Scenario	
	Passenger Trips	Annual Growth	Passenger Trips	Annual Growth
Base Year	478,833		478,833	
2005/06	501,179	4.7%	495,949	3.6%
2006/07	511,458	2.1%	500,869	1.0%
2007/08	533,241	4.3%	516,870	3.2%
2008/09	560,222	5.1%	534,946	3.5%
2009/10	586,460	4.7%	554,203	3.6%
2010/11	613,974	4.7%	574,168	3.6%
2011/12	633,716	3.2%	589,891	2.7%
2012/13	654,110	3.2%	606,051	2.7%
2013/14	675,178	3.2%	622,660	2.7%
2014/15	696,942	3.2%	639,730	2.7%
2015/16	718,445	3.1%	651,091	1.8%
2016/17	738,259	2.8%	668,527	2.7%
2017/18	758,634	2.8%	685,926	2.6%
2018/19	779,587	2.8%	703,781	2.6%
2019/20	801,135	2.8%	722,104	2.6%
Total		67.3%		50.8%

The most recent *National Rail Trends Yearbook (2004-05)*, published by the Strategic Rail Authority (now DfT Rail), report a 7 year growth trend of around 2.8% per annum for regional railways. If this compound trend is applied over 15 years it produces a total growth rate of around 51%. The growth range forecast for the Highland Mainline is therefore slightly higher than the national trend, however the high levels of recent economic growth in the Inverness area explain this.

Table 2.2. Baseline Rail Demand Projections for the Far North Line.

	High Growth Scenario		Low Growth Scenario	
	Passenger Trips	Annual Growth	Passenger Trips	Annual Growth
Base Year	156,478		156,478	
2005/06	169,560	8.4%	165,245	5.6%
2006/07	179,917	6.1%	171,180	3.6%
2007/08	195,169	8.5%	180,826	5.6%
2008/09	212,619	8.9%	191,701	6.0%
2009/10	223,381	5.1%	197,201	2.9%
2010/11	234,716	5.1%	202,886	2.9%
2011/12	242,779	3.4%	206,998	2.0%
2012/13	251,126	3.4%	211,209	2.0%
2013/14	259,767	3.4%	215,520	2.0%
2014/15	268,713	3.4%	219,935	2.0%
2015/16	277,975	3.4%	224,456	2.1%
2016/17	286,093	2.9%	229,085	2.1%
2017/18	293,384	2.5%	234,878	2.5%
2018/19	300,863	2.5%	240,243	2.3%
2019/20	308,533	2.5%	245,736	2.3%
Total		97.2%		57.0%

The growth range forecast for the Highland Mainline is somewhat higher than the national trend. This is explained by high levels of recent economic growth experienced in the Inverness area, the only large urban conurbation and main economic centre on the line.

3 Study Methodology

3.1 ***Overview***

The demand forecasts and economic appraisals have been produced using the baseline demand projections detailed in the previous chapter, thereby providing a high and low scenario for each option. All the forecasts have been produced by using an extension of the spreadsheet model produced in phase one of the study, and supplementary forecasts for options have been produced using the specialised MOIRA software. The methodology used to produce the forecasts and appraisals is outlined in greater detail below.

3.2 ***Forecasting Methodology***

The passenger demand forecasts for each option were produced using a five-stage methodology.

<u>Stage One. Production of a spreadsheet demand model</u>

During the first phase of the project a spreadsheet model was produced. A version of this was used in phase two to enable the quantification of variances arising in the number of passenger trips on the Highland Mainline and Far North Line in relation to improvements to the timetable, frequency and stopping pattern.

<u>Stage Two. Estimate the Generalised Journey Time (GJT) for the journeys in the baseline demand matrix</u>

This is the perceived cost by the passenger of making the trip and is calculated as the sum of the journey time, cost and frequency all converted into monetary terms.

The data for the journey times, frequencies and costs was taken directly from First Scotrail. The values of time and wait time are the recommended values from Department for Transport's Transport Analysis Guidance (TAG) Unit 3.5.6.

Stage Three. Estimate the GJT for the same set of journeys with the improvements

The new GJT is estimated on the same basis, with the improved times and/or timetable frequencies and stopping patterns incorporated.

Stage Four. Calculate the difference in GJT

The difference between the two GJTs is taken to calculate the difference produced by the improvements. The impact on demand is calculated by applying the elasticity parameters from Passenger Demand Forecasting Handbook (PDFH).

Stage Five. Calculate the year on year demand growth

The methodology outlined in stages one to four produce the forecast increase in demand for a single year after the improvement options have been introduced. In order to extend the demand forecast to the whole appraisal period the underlying passenger growth rates from phase one of the study were applied. A best and worse case (optimistic and pessimistic forecast) was calculated for each option.

Supplementary Stage. Use of the MOIRA software

Supplementary high and low forecasts have been produced using the MOIRA software, rather than the PDFH based spreadsheet model detailed in stages two to four. This has been undertaken because PDFH has sometimes been found to underestimate the impact that timetable improvements can have on demand when the existing level of services are irregular and infrequent. The MOIRA model can account for this by using an iterative approach which is more detailed than that which can reasonably be achieved using a spreadsheet/PDFH approach.

The drawback with MOIRA is that it cannot cope with entirely new stations on the network; for this reason it has not been possible to use MOIRA to estimate the demand impact from calling services at Edinburgh Airport

3.3 *Appraisal Methodology*

The economic appraisal of all the options has been carried out using a standard STAG Transport Economic Efficiency (TEE) analysis. There were three stages to this process.

Stage One. Calculation of Benefits

The first part involved estimating the transport benefits produced by the service improvements, by multiplying the number of passengers forecast by the unit value for each type of benefit, for example, the standard DfT value of in-vehicle time.

Depending on the UK public sector organisation there are several different ways of presenting the benefits that are generated by transport schemes, although there are three generic headings for the types of benefits that would normally be expected:

User Benefits. These are the benefits that existing and new transport users gain directly. They are made up of travel time savings for new and existing users and cost savings for those who switch from other modes. New users only gain half of the benefits from the improved service times and timetable frequencies compared with existing users.

Non User Benefits. These are benefits that people who don't use the improved service gain, such as decongestion benefits which are calculated using the values from the SRA Appraisal Criteria and the road distance between the stations.

Other Resource Impacts. This includes any further financial impacts of the scheme such as additional revenue that is generated or taxation impacts due to less fuel usage.

Stage Two. Calculation of Costs

The second part of the cost-benefit analysis process involved estimation of the costs of the improvements to the service. This includes new infrastructure, additional staff and vehicle leasing, and other operating costs. Additional fuel and track access charges are included in the other operating costs.

For the Highland Mainline the necessary improvements, along with their accompanying costs, were obtained from the *'Room for Growth Study'* produced by

Scott Wilson. This study contained various options for improvements required to be carried out to produce the overall time savings and frequency improvements required.

The costs for the construction of the Dornoch Bridge and the associated infrastructure were also obtained from the '*Room for Growth*' study.

Stage Three. Production of TEE Tables

The third and final part of the assessment of the costs and benefits was to report the findings of the analysis in a Transport Economics Efficiency Table using procedures set out in STAG. On this basis an appraisal period was set at 60 years with zero passenger growth assumed after 2020 as this is the last year in baseline projections from phase one of the study. All monetary figures have been converted into Net Present Values with a 2005 price base, by taking the standard discount rate of 3.5% per annum for the first 30 years and 3% thereafter.

4 Highland Mainline Journey Time Improvement

4.1 Description of Option

With the exception of additional calls at Edinburgh Airport, all the improvement options for the Highland Mainline have been provided by the '*Room for Growth Study'*. The study has suggested a package of previously identified infrastructure and operational improvements which have the potential to reduce journey times and allow additional services on the route between Inverness and Perth. In response to the aspirations of HIE, three improvements options have been inferred from the work presented in the '*Room for Growth Study'*.

The first of these options is a package of individual infrastructure improvements between Inverness and Perth, which will reduce journey times by around 44 minutes, giving a new Inverness to Edinburgh/Glasgow journey time of approximately 2 hours and 45 minutes.

The infrastructure enhancements that are required are detailed below, and it is estimated in the '*Room for Growth Study'* that the total cost of these works will be around £34.5 million plus or minus 50%. Given that this is a very wide range the central figure has been taken, and optimism bias applied using DfT guidance. To reflect that this study is in the early stage of feasibility work, and that rail projects regularly exceed original cost expectations, an appropriate level of optimism bias has been selected to give a 90% chance that cost forecasts will not be exceeded. This level of optimism bias is 68% which means that the revised total cost of works is estimated at £68.4 million. The list of infrastructure work required is as follows:

- Plain line realignment and recanting along the route;
- Works to underbridges where restrictions exist, namely bridges 90, 91 and 346;
- Works to Kingswood tunnel;

- Formation widening north of Stanley Junction;

- Enhancement work to the S&C at Dunkeld;

- Re-doubling of the entire four-mile length between Culloden and Daviot and Clunes; and

- Building a passing loop at Newtonmore.

This option will also require the lease of a new type of rolling stock which is capable of faster acceleration and higher speed on tight curves than the existing Class 170 units which operate on the route. The new rolling stock is identical to the type in the Edinburgh Airport Rail Link (EARL) business case, and although the scheme promoters have not supplied a unit cost it is estimated that each train will cost around the same as a Super-Voyager. On this basis it is estimated that annual operating costs will be in the region of £2,800,000 over and above the current level.

4.2 Demand Forecast

In order to produce demand forecasts the following assumptions have been made to simplify the analysis:

- The additional services are introduced in 2010 with the required engineering works starting in 2007;

- The HIE exogenous growth projections run to 2020. Beyond this passenger numbers are assumed constant, thereby applying an element of caution to the forecasts;

- The impact of ramp-up has not been taken into account - that is the rate at which new passengers begin to use the services.

The forecast of additional passenger demand produced by the improved journey times is detailed below in table 4.1.

In the optimistic scenario it is expected that in the opening year around 34,600 passenger trips will be generated by the improvements to services, which driven by underlying passenger growth, will rise to 48,800 by 2020. This is equivalent to 6% of the total number of trips forecast for the line each year. Around 41% of the trips would be to or from Inverness and 22% would be to or from Edinburgh or Glasgow.

In the pessimistic scenario it is expected that in the opening year around 32,800 passenger trips will be generated by the improvements to services, which driven by underlying passenger growth, will rise to 43,100 by 2020. This is equivalent to 6% of the total number of trips forecast for the line each year. Similarly to the optimistic scenario around 40% of the trips would be to or from Inverness and 21% would be to or from Edinburgh or Glasgow.

Table 4.1. Annual Demand Forecast for Improved Journey Time Option.

Year	High Underlying Growth		Low Underlying Growth	
	Total	% Growth	Total	% Growth
2009/10	34,620		32,809	
2010/11	36,234	4.7%	33,981	3.6%
2011/12	37,455	3.4%	34,923	2.8%
2012/13	38,718	3.4%	35,892	2.8%
2013/14	40,024	3.4%	36,887	2.8%
2014/15	41,376	3.4%	37,910	2.8%
2015/16	42,731	3.3%	38,783	2.3%
2016/17	43,941	2.8%	39,840	2.7%
2017/18	45,187	2.8%	40,884	2.6%
2018/19	46,469	2.8%	41,956	2.6%
2019/20 Onwards	47,788	2.8%	43,056	2.6%

4.3 *TEE Analysis*

(All figures are Net Present Values, in 2005 prices)

Transport Economic Efficiency tables for the option to increase the frequency of rail services in the optimistic and pessimistic scenarios are detailed below as tables 4.2 and 4.3.

The optimistic scenario has a Net Present Value (NPV) of around -£30.2m and Benefit Cost to Government Ratio (BCR) of 0.51. Figures of this magnitude represent a poor economic return on public investment, as a BCR of 0.51 means that every £1 of cost generates £0.51 of benefits. The TEE table shows that there are some potentially sizable transport benefits, in particular travel time savings which accrue to rail users (£46.3m), and road user benefits (£34.9m, from reduced congestion). The large operating costs of £66.7m and capital costs of £59.6m are to the detriment of this appraisal case.

Since the pessimistic scenario has a lower level of demand forecast the appraisal case is comparatively worse with a NPV of -£40.5m and BCR of 0.34.

In summary, the option for just improving the journey time provides a poor appraisal case due to the large costs involved, relative to the benefits of a journey time reduction alone. However, given that PDFH can sometimes underestimate demand when services patterns are infrequent and irregular a second forecast and appraisal has been produced using the MOIRA software.

Table 4.2. TEE Table for Improved Journey Time: High Scenario.

Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**	**Car**	**Rail**
User Benefits	Travel Time	*Rail = Journey Time Savings Car = Decongestion Benefits*	£81,167,122	£34,882,269	£46,284,854
	User Charges	*Rail = Fares Paid by Users*	-£15,206,146	£0	-£15,206,146
	Vehicle Operating Costs	*Rail = Saving fuel cost saving from modal switch*	£13,026,227	£0	£13,026,227
	Quality / Reliability Benefits	*N/A for this option*	£0	£0	£0
Private Sector Operator Impacts	Investment Costs	*Zero for this option*	£0	£0	£0
	Operating & Maintenance Costs	*Rail = OPEX*	-£66,745,003	£0	-£66,745,003
	Revenues	*Rail = Fares Paid by Users*	£15,206,146	£0	£15,206,146
	Grant/Subsidy payments	*N/A for this option*	£0	£0	£0
Cost to Public Sector					
Item	**Qualitative information**		**Quantitative information**		
Public Sector Investment Costs	*Rail = CAPEX*		-£59,587,614	£0	-£59,587,614
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments			£0	£0	£0
Revenues			£0	£0	£0
Taxation impacts	*Rail = Loss of fuel duty*		-£2,279,590	£0	-£2,279,590
Safety					
Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**		
Accidents	Change in Annual Personal Injury Accidents	*Rail = from modal switch from car to rail*	£4,244,325	£0	£4,244,325
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£4,244,325	£0	£4,244,325

Monetised Summary	
Present Value of Transport Benefits	£31,692,672
Present Value of Cost to Government	-£61,867,204
Net Present Value	-£30,174,532
Benefit-Cost to Government Ratio	0.51

Table 4.3. TEE Table for Improved Journey Time: Low Scenario.

Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**	**Car**	**Rail**
User Benefits	Travel Time	*Rail = Journey Time Savings Car = Decongestion Benefits*	£72,474,364	£31,117,458	£41,356,906
	User Charges	*Rail = Fares Paid by Users*	-£13,571,823	£0	-£13,571,823
	Vehicle Operating Costs	*Rail = Saving fuel cost saving from modal switch*	£11,620,319	£0	£11,620,319
	Quality / Reliability Benefits	*N/A for this option*	£0	£0	£0
Private Sector Operator Impacts	Investment Costs	*Zero for this option*	£0	£0	£0
	Operating & Maintenance Costs	*Rail = OPEX*	-£66,745,003	£0	-£66,745,003
	Revenues		£13,571,823	£0	£13,571,823
	Grant/Subsidy payments	*N/A for this option*	£0	£0	£0
Cost to Public Sector					
Item	**Qualitative information**		**Quantitative information**		
Public Sector Investment Costs	*Rail = CAPEX*		-£59,587,614	£0	-£59,587,614
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments			£0	£0	£0
Revenues			£0	£0	£0
Taxation impacts	*Rail = Loss of fuel duty*		-£2,033,556	£0	-£2,033,556
Safety					
Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**		
Accidents	Change in Annual Personal Injury Accidents	*Rail = from modal switch from car to rail*	£3,786,239	£0	£3,786,239
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£3,786,239	£0	£3,786,239

Monetised Summary	
Present Value of Transport Benefits	£21,135,919
Present Value of Cost to Government	-£61,621,170
Net Present Value	-£40,485,251
Benefit-Cost to Government Ratio	0.34

4.4 *Demand Forecast (MOIRA Model)*

The additional passenger demand generated by the improved journey times when forecast using MOIRA is detailed in table 4.4.

In the optimistic scenario it is expected that in the opening year around 75,000 passenger trips will be generated by the improvements to services, which driven by underlying passenger growth, will rise to 103,500 by 2020.

In the pessimistic scenario it is expected that in the opening year around 73,000 passenger trips will be generated by the improvements to services, which driven by underlying passenger growth, will rise to 95,800 by 2020.

Both the high and low demand projections estimate around twice the number of additional passenger trips than the PDFH model. Although this seems like a large discrepancy at first glance, when spread over the entire opening year the respective (high growth) PDFH and MOIRA forecasts estimate around 8 and 17 additional passengers per train over whole length of the Inverness – Edinburgh/Glasgow route. Therefore, the difference between the two is only 9 passengers per train. There are two main reasons for the difference between the forecasts:

- As stated previously MOIRA uses an iterative approach to demand forecasting which can be more rigorous when estimating the impact of demand changes when services are irregular and infrequent. Given that the number of additional trips per train estimated are very low and that discrepancy between the two forecasts is less than 10 passengers per train it would not take much of a difference in the way that the behaviour of a small number of passengers is modelled to have a large proportional impact on demand.

- The MOIRA baseline demand matrix includes all passenger trips to and from all stations in Scotland and mainline stations in England, whereas the baseline demand matrix used in the PDFH model includes all trips on Highland rail network and all significant flows onto the network from Scotland. It does not include very small flows onto the Highland network from elsewhere in Scotland or flows onto the network from stations in England, as modelling a large number of very small flows that would be required to do this is beyond the scope of the study. Although the impact of this is likely to be small, part of the discrepancy between the two forecasts may be as a result of this.

Given that both methods conform with standard industry practice and DfT guidelines it is recommended that the MOIRA forecasts are treated as a high scenario, and conversely the PDFH forecasts should be treated as the low scenario.

Again, the additional demand forecast using MOIRA is likely to be as a result of a behavioural change when the lengthy existing journey time is significantly improved. If this is so, then the key to achieving this higher level of demand will be the effective operation and marketing of the new services, to ensure that potential new passengers are aware that the previously lengthy journey times are no longer prohibitive.

Issues with regard to the marketing and operating the new services are covered in chapter 8.

Table 4.4. Annual Demand Forecast for Improved Journey Time Option (MOIRA).

Year	High Underlying Growth		Low Underlying Growth	
	Total	% Growth	Total	% Growth
2009/10	75,000		73,000	
2010/11	78,497	4.7%	75,608	3.6%
2011/12	81,142	3.4%	77,704	2.8%
2012/13	83,878	3.4%	79,860	2.8%
2013/14	86,707	3.4%	82,074	2.8%
2014/15	89,636	3.4%	84,350	2.8%
2015/16	92,571	3.3%	86,292	2.3%
2016/17	95,193	2.8%	88,644	2.7%
2017/18	97,892	2.8%	90,967	2.6%
2018/19	100,669	2.8%	93,352	2.6%
2019/20 Onwards	103,527	2.8%	95,800	2.6%

4.5 TEE Analysis (MOIRA Model)

(All figures are Net Present Values, in 2005 prices)

Transport Economic Efficiency tables for the option to reduce the journey time between Inverness and Edinburgh/Glasgow, are detailed below in tables 4.5 and 4.6 for optimistic and pessimistic growth scenarios respectively.

It has not been possible to estimate all the benefit streams that were presented using the previous model because MOIRA alone cannot provide sufficient information about the nature of journeys that have switched from car to rail. It is possible to get around this by making some simplifying assumptions, but recent advice from the DfT on another Halcrow rail project of this type has been not to attempt this.

The optimistic scenario has a Net Present Value (NPV) of around £25.6m and Benefit Cost to Government Ratio (BCR) of 1.43. Figures of this magnitude represent a relatively good economic return on public investment and a BCR of 1.43 shows that every £1 of cost generates £1.43 of economic benefits. Given that it has not been possible to estimate all the benefit streams, the majority of the economic benefits are from travel time savings (£151.9m).

Since the pessimistic scenario has a lower level of demand forecast the appraisal case is comparatively worse with a NPV of £10.2m and BCR of 1.17. In other words £1 of public investment would produce a return of £1.17 worth of economic benefits.

Table 4.5. TEE Table for Improved Journey Time (MOIRA): High Scenario.

Sub-objective	Item	Qualitative Information	Quantitative Information	Car	Rail
User Benefits	Travel Time	*Rail = Journey Time Savings Car = Decongestion Benefits*	£151,895,863	£0	£151,895,863
	User Charges	*Rail = Fares Paid by Users*	-£29,591,987	£0	-£29,591,987
	Vehicle Operating Costs	*Rail = Saving fuel cost saving from modal switch*	£0	£0	£0
	Quality / Reliability Benefits	*N/A for this option*	£0	£0	£0
Private Sector Operator Impacts	Investment Costs	*Zero for this option*	£0	£0	£0
	Operating & Maintenance Costs	*Rail = OPEX*	-£66,745,003	£0	-£66,745,003
	Revenues		£29,591,987	£0	£29,591,987
	Grant/Subsidy payments	*N/A for this option*	£0	£0	£0
Cost to Public Sector					
Item	**Qualitative information**		**Quantitative information**		
Public Sector Investment Costs	*Rail = CAPEX*		-£59,587,614	£0	-£59,587,614
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments			£0	£0	£0
Revenues			£0	£0	£0
Taxation impacts	*Rail = Loss of fuel duty*		£0	£0	£0
Safety					
Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**		
Accidents	Change in Annual Personal Injury Accidents	*Rail = from modal switch from car to rail*	£0	£0	£0
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£0	£0	£0

Monetised Summary	
Present Value of Transport Benefits	£85,150,860
Present Value of Cost to Government	-£59,587,614
Net Present Value	£25,563,246
Benefit-Cost to Government Ratio	1.43

Table 4.6. TEE Table for Improved Journey Time (MOIRA): Low Scenario.

Sub-objective	Item	Qualitative Information	Quantitative Information	Car	Rail
User Benefits	Travel Time	*Rail = Journey Time Savings Car = Decongestion Benefits*	£136,513,303	£0	£136,513,303
	User Charges	*Rail = Fares Paid by Users*	-£26,416,738	£0	-£26,416,738
	Vehicle Operating Costs	*Rail = Saving fuel cost saving from modal switch*	£0	£0	£0
	Quality / Reliability Benefits	*N/A for this option*	£0	£0	£0
Private Sector Operator Impacts	Investment Costs	*Zero for this option*	£0	£0	£0
	Operating & Maintenance Costs	*Rail = OPEX*	-£66,745,003	£0	-£66,745,003
	Revenues		£26,416,738	£0	£26,416,738
	Grant/Subsidy payments	*N/A for this option*	£0	£0	£0
Cost to Public Sector					
Item	**Qualitative information**		**Quantitative information**		
Public Sector Investment Costs	*Rail = CAPEX*		-£59,587,614	£0	-£59,587,614
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments			£0	£0	£0
Revenues			£0	£0	£0
Taxation impacts	*Rail = Loss of fuel duty*		£0	£0	£0
Safety					
Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**		
Accidents	Change in Annual Personal Injury Accidents	*Rail = from modal switch from car to rail*	£0	£0	£0
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£0	£0	£0

Monetised Summary	
Present Value of Transport Benefits	£69,768,300
Present Value of Cost to Government	-£59,587,614
Net Present Value	£10,180,686
Benefit-Cost to Government Ratio	1.17

5 Highland Mainline Service Reduced Journey Time and Frequency Improvement

5.1 Description of Options

The second option for the Highland Mainline is the journey time reduction detailed in option one and an increase in the current service pattern to give a regular hourly frequency between Inverness and Perth in each direction, with services alternating between Edinburgh and Glasgow thereafter. It is assumed that the first services reach Inverness, Edinburgh and Glasgow by 9.00am.

Similarly to the previous option, all the infrastructure upgrades and operational changes that are required to achieve this have been taken from the '*Room for Growth Study*'.

The reason for combining the frequency improvement with the reduction in journey times is that the infrastructure works and new rolling stock required to reduce the journey times are also required to increase the frequency to hourly. In addition to this a loop at Ballinluig is required which would increase the capital costs to £74.9 million including 68% optimism bias, and an additional train would need to be leased, operated and staffed at an estimated cost of £3.7 million per annum.

5.2 Demand Forecast

In order to produce demand forecasts it was necessary to make the same set of assumptions that are set out in section 4.2.

Table 5.1 shows the additional passenger trips that are forecast to be attracted by the improved journey times and service frequency, in both the high and low growth scenarios respectively.

In the optimistic scenario it is expected that in the opening year around 58,700 passenger trips will be generated by the improvements to the service frequency and journey times, which driven by underlying passenger growth, will rise to 85,000 by 2020. The percentage of trips that either start or end at Inverness and

Edinburgh/Glasgow is 39% and 21% respectively, which is similar to the first option.

In the pessimistic scenario it is expected that in the opening year around 57,400 passenger trips will be generated by the improvements to the service frequency and journey time, which driven by underlying passenger growth, will rise to 76,800 by 2020. The percentage of trips that either start or end at Inverness and Edinburgh/Glasgow is 38% and 21% respectively.

In both the high and low growth scenarios the number of new trips forecast are around twice the number projected when the PDFH model was used to assess the previous option. This implies that the reduction in the Generalised Journey Time from the frequency increase and the journey time improvement is roughly the same.

Table 5.1. Annual Demand Forecast from Improved Journey Times and Service Frequency

Year	High Underlying Growth		Low Underlying Growth	
	Total	% Growth	Total	% Growth
2009/10	58,678		57,436	
2010/11	61,126	4.2%	59,212	3.1%
2011/12	64,166	5.0%	61,222	3.4%
2012/13	67,115	4.6%	63,363	3.5%
2013/14	70,206	4.6%	65,581	3.5%
2014/15	72,545	3.3%	67,377	2.7%
2015/16	74,964	3.3%	69,224	2.7%
2016/17	77,465	3.3%	71,121	2.7%
2017/18	80,052	3.3%	73,071	2.7%
2018/19	82,670	3.3%	74,712	2.2%
2019/20 Onwards	85,028	2.9%	76,751	2.7%

5.3 TEE Analysis

(All figures are Net Present Values, in 2005 prices)

Transport Economic Efficiency tables for the option to reduce the journey time and increase the frequency of rail services in the optimistic and pessimistic scenarios are detailed below as tables 5.2 and 5.3.

The optimistic scenario has a Net Present Value (NPV) of around £32.8m and Benefit Cost to Government Ratio (BCR) of 1.47. Figures of this magnitude represent a reasonably good economic return on public investment as a BCR of 1.47 indicates that every £1 of government funding will produce £1.47 of economic benefits. This is probably sufficient to form the basis of a successful outline business case to the Scottish Executive and unsurprisingly some potentially sizeable transport benefits have been identified. These include travel time savings which accrue to rail users (£94.8m), and road user benefits (£63.8m), from reduced congestion. The operating costs of £87.7m and capital costs of £65.3m are extremely large, but are still outweighed by the sum of the economic benefits.

Since the pessimistic scenario has a lower level of demand forecast and identical scheme costs, the appraisal case is comparatively worse with a NPV of £12.7m and BCR of 1.18. This is still a positive return on public investment, however could be viewed as marginal by the Scottish Executive, and on this basis it is unclear whether the level of return would be sufficient to support the case for funding.

In summary, the option for improving the journey time and the service frequency would be expected to make a positive return on public investment. On this basis there would be a case for a bid for Scottish Executive funding, although if the level of underlying passenger growth over the next 15 years is towards the lower end of the range, the return on public investment may be marginal.

Similarly to the previous option there is some precedent for PDFH underestimating the likely demand increase when service patterns are currently infrequent and irregular. Given that this is the case at present on the Highland Mainline, the PDFH model is more likely to underestimate the demand increase for this option, (which specifically addresses the service frequency), than any other. In order to address this issue the MOIRA software has been used to produce an alternative demand forecast.

Table 5.2. TEE Table for Improved Journey Time and Frequency: High Scenario.

Sub-objective	Item	Qualitative Information	Quantitative Information	Car	Rail
User Benefits	Travel Time	*Rail = Journey Time Savings Car = Decongestion Benefits*	£158,519,174	£63,766,038	£94,753,136
	User Charges	*Rail = Fares Paid by Users*	-£29,571,436	£0	-£29,571,436
	Vehicle Operating Costs	*Rail = Saving fuel cost saving from modal switch*	£23,812,411	£0	£23,812,411
	Quality / Reliability Benefits	*N/A for this option*	£0	£0	£0
Private Sector Operator Impacts	Investment Costs	*Zero for this option*	£0	£0	£0
	Operating & Maintenance Costs	*Rail = OPEX*	-£87,732,107	£0	-£87,732,107
	Revenues	*Rail = Fares Paid by Users*	£29,571,436	£0	£29,571,436
	Grant/Subsidy payments	*N/A for this option*	£0	£0	£0
Cost to Public Sector					
Item	**Qualitative information**		**Quantitative information**		
Public Sector Investment Costs	*Rail = CAPEX*		-£65,299,556	£0	-£65,299,556
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments			£0	£0	£0
Revenues			£0	£0	£0
Taxation impacts	*Rail = Loss of fuel duty*		-£4,167,172	£0	-£4,167,172
Safety					
Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**		
Accidents	Change in Annual Personal Injury Accidents	*Rail = from modal switch from car to rail*	£7,758,778	£0	£7,758,778
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£7,758,778	£0	£7,758,778

Monetised Summary	
Present Value of Transport Benefits	£102,358,256
Present Value of Cost to Government	-£69,466,728
Net Present Value	£32,891,528
Benefit-Cost to Government Ratio	1.47

Table 5.3. TEE Table for Improved Journey Time and Frequency: Low Scenario.

Sub-objective	Item	Qualitative Information	Quantitative Information	Car	Rail
User Benefits	Travel Time	*Rail = Journey Time Savings Car = Decongestion Benefits*	£141,334,271	£56,732,947	£84,601,324
	User Charges	*Rail = Fares Paid by Users*	-£26,365,894	£0	-£26,365,894
	Vehicle Operating Costs	*Rail = Saving fuel cost saving from modal switch*	£21,186,015	£0	£21,186,015
	Quality / Reliability Benefits	*N/A for this option*	£0	£0	£0
Private Sector Operator Impacts	Investment Costs	*Zero for this option*	£0	£0	£0
	Operating & Maintenance Costs	*Rail = OPEX*	-£87,732,107	£0	-£87,732,107
	Revenues	*Rail = Fares Paid by Users*	£26,365,894	£0	£26,365,894
	Grant/Subsidy payments	*N/A for this option*	£0	£0	£0
Cost to Public Sector					
Item	**Qualitative information**		**Quantitative information**		
Public Sector Investment Costs	*Rail = CAPEX*		-£65,299,556	£0	-£65,299,556
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments			£0	£0	£0
Revenues			£0	£0	£0
Taxation impacts	*Rail = Loss of fuel duty*		-£3,707,553	£0	-£3,707,553
Safety					
Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**		
Accidents	Change in Annual Personal Injury Accidents	*Rail = from modal switch from car to rail*	£6,903,022	£0	£6,903,022
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£6,903,022	£0	£6,903,022

Monetised Summary	
Present Value of Transport Benefits	£81,691,202
Present Value of Cost to Government	-£69,007,109
Net Present Value	£12,684,093
Benefit-Cost to Government Ratio	1.18

5.4 *Demand Forecast (MOIRA Model)*

The additional passenger demand generated by the improved journey times and frequency when forecast using MOIRA is detailed below in table 5.4.

In the optimistic scenario it is expected that in the opening year around 138,000 passenger trips will be generated by the improvements to services, which driven by underlying passenger growth, will rise to 200,000 by 2020.

In the pessimistic scenario it is expected that in the opening year around 134,500 passenger trips will be generated by the improvements to services, which driven by underlying passenger growth, will rise to 179,300 by 2020.

Both the high and low demand projections estimate around 2.3 times the number of additional passenger trips than the PDFH model. This is a slightly larger discrepancy than the previous option which is intuitively correct since PDFH is less effective at fully capturing additional demand from frequency changes when services are currently infrequent and irregular.

Again, it may seem that the discrepancy between the forecasts produced by the two models is relatively large. However, similarly to the previous option the difference between the two equates to less than 20 passengers per train over the length of the Highland Mainline, and it would not take much of a difference in method for this to translate into a large annual difference.

Given that both methods conform with standard industry practice and DfT guidelines it is recommended that the MOIRA forecasts are treated as a high scenario, and conversely the PDFH forecasts should be treated as the low scenario.

Again, the additional demand forecast using MOIRA is likely to be as a result of a behavioural change when the lengthy existing journey time is significantly improved. If this is so, then the key to achieving this higher level of demand will be the effective operation and marketing of the new services, to ensure that potential new passengers are aware that the previously lengthy journey times are no longer prohibitive.

Some potential strategies for marketing and operating the new services are detailed in chapter 8.

Table 5.4. Annual Demand Forecast for Improved Journey Time and Service Frequency Option (MOIRA).

Year	High Underlying Growth		Low Underlying Growth	
	Total	% Growth	Total	% Growth
2009/10	138,035		134,500	
2010/11	143,832	4.2%	138,669	3.1%
2011/12	151,024	5.0%	143,384	3.4%
2012/13	157,971	4.6%	148,402	3.5%
2013/14	165,238	4.6%	153,597	3.5%
2014/15	170,690	3.3%	157,744	2.7%
2015/16	176,323	3.3%	162,003	2.7%
2016/17	182,142	3.3%	166,377	2.7%
2017/18	188,153	3.3%	170,869	2.7%
2018/19	194,362	3.3%	174,628	2.2%
2019/20 Onwards	199,998	2.9%	179,343	2.7%

5.5 *TEE Analysis (MOIRA Model)*

(All figures are Net Present Values, in 2005 prices)

Transport Economic Efficiency tables for the option to reduce the journey time and increase the frequency of services between Inverness and Edinburgh/Glasgow, are detailed below in tables 5.5 and 5.6 for optimistic and pessimistic growth scenarios respectively.

It has not been possible to estimate all the benefit streams that were presented using the previous model because MOIRA alone cannot provide sufficient information about the nature of journeys that have switched from car to rail. It is possible to get around this by making some simplifying assumptions, but recent advice from the DfT on another Halcrow rail project of this type has been not to attempt this.

The optimistic scenario has a Net Present Value (NPV) of around £105.3m and Benefit Cost to Government Ratio (BCR) of 2.61. Figures of this magnitude represent an extremely good economic return on public investment as a BCR of 2.61 shows that every £1 of cost generates £2.61 of economic benefits. Given that it has not been possible to estimate all the benefit streams, the majority of the economic benefits are from travel time savings (£237.4m). The magnitude of these benefits and the return on public investment is almost certainly sufficient to form the basis of a bid to secure funding from the Scottish Executive.

Since the pessimistic scenario has a lower level of demand forecast the appraisal case is comparatively worse with a NPV of £81.4m and BCR of 2.25. However this is still an extremely high return on public funding with every £1 invested securing £2.25 worth of economic benefits. Again this would be sufficient to form the basis of a bid for public funding.

Table 5.5. TEE Table for Journey Time and Frequency (MOIRA): High Scenario.

Sub-objective	Item	Qualitative Information	Quantitative Information	Car	Rail
User Benefits	Travel Time	*Rail = Journey Time Savings Car = Decongestion Benefits*	£237,408,863	£0	£237,408,863
	User Charges	*Rail = Fares Paid by Users*	-£40,115,012	£0	-£40,115,012
	Vehicle Operating Costs	*Rail = Saving fuel cost saving from modal switch*	£0	£0	£0
	Quality / Reliability Benefits	*N/A for this option*	£0	£0	£0
Private Sector Operator Impacts	Investment Costs	*Zero for this option*	£0	£0	£0
	Operating & Maintenance Costs	*Rail = OPEX*	-£66,745,003	£0	-£66,745,003
	Revenues	*Rail = Fares Paid by Users*	£40,115,012	£0	£40,115,012
	Grant/Subsidy payments	*N/A for this option*	£0	£0	£0
Cost to Public Sector					
Item	**Qualitative information**		**Quantitative information**		
Public Sector Investment Costs	*Rail = CAPEX*		-£65,299,556	£0	-£65,299,556
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments			£0	£0	£0
Revenues			£0	£0	£0
Taxation impacts	*Rail = Loss of fuel duty*		£0	£0	£0
Safety					
Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**		
Accidents	Change in Annual Personal Injury Accidents	*Rail = from modal switch from car to rail*	£0	£0	£0
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£0	£0	£0

Monetised Summary	
Present Value of Transport Benefits	£170,663,859
Present Value of Cost to Government	-£65,299,556
Net Present Value	£105,364,303
Benefit-Cost to Government Ratio	2.61

Table 5.6. TEE Table for Journey Time and Frequency (MOIRA): Low Scenario.

Sub-objective	Item	Qualitative Information	Quantitative Information	Car	Rail
User Benefits	Travel Time	*Rail = Journey Time Savings Car = Decongestion Benefits*	£213,463,042	£0	£213,463,042
	User Charges	*Rail = Fares Paid by Users*	-£35,773,875	£0	-£35,773,875
	Vehicle Operating Costs	*Rail = Saving fuel cost saving from modal switch*	£0	£0	£0
	Quality / Reliability Benefits	*N/A for this option*	£0	£0	£0
Private Sector Operator Impacts	Investment Costs	*Zero for this option*	£0	£0	£0
	Operating & Maintenance Costs	*Rail = OPEX*	-£66,745,003	£0	-£66,745,003
	Revenues	*Rail = Fares Paid by Users*	£35,773,875	£0	£35,773,875
	Grant/Subsidy payments	*N/A for this option*	£0	£0	£0
Cost to Public Sector					
Item	**Qualitative information**		**Quantitative information**		
Public Sector Investment Costs	*Rail = CAPEX*		-£65,299,556	£0	-£65,299,556
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments			£0	£0	£0
Revenues			£0	£0	£0
Taxation impacts	*Rail = Loss of fuel duty*		£0	£0	£0
Safety					
Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**		
Accidents	Change in Annual Personal Injury Accidents	*Rail = from modal switch from car to rail*	£0	£0	£0
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£0	£0	£0

Monetised Summary	
Present Value of Transport Benefits	£146,718,039
Present Value of Cost to Government	-£65,299,556
Net Present Value	£81,418,483
Benefit-Cost to Government Ratio	2.25

6 Edinburgh Airport Rail Link

6.1 *Description of Options*

The third improvement option for the Highland mainline is for an hourly service for the Edinburgh Airport Rail Link (EARL) to and from Inverness/Perth. This is in addition to the journey time reduction and frequency improvements from the previous options.

Part of the EARL business case is for an hourly service to and from Perth, with an extension to and from Inverness. On this basis it is assumed that any additional infrastructure, and operating costs associated with calling services at the airport are funded by the EARL project. This means that the costs for this option are the same as for option two.

The diversion and loss of speed required to stop services at Edinburgh Airport would increase the end to end journey time by approximately 5 minutes, and whilst it is assumed that this will not compromise the pattern of services elsewhere on the route, there will be a small loss of economic benefits through increased journey times for existing passengers.

6.2 *Demand Forecast*

Along with the general assumptions outlined in chapter 2 it has been necessary to make some more specific assumptions about the existing number of Edinburgh Airport passengers that currently use the Highland rail network, namely:

- Official Scottish Executive tourism figures show that there were 480,000 overseas tourists to the Highlands in 2004. The Scottish Executive also reports that between 2004 and 2005 there was an increase in overseas tourists of 35%. This percentage increase was applied to the figure of 480,000 giving an estimated total 648,000 visitors.

- The percentage of visitors arriving at Edinburgh Airport, then travelling on the Highland Mainline by all modes was obtained from the Highland Visitor Survey. This was applied to the total figure of 648,000 visitors to give the estimated current annual number of passenger trips from Edinburgh Airport on the Highland Rail Network. The share of these passenger trips made on the Highland Mainline was just under 6000 in 2004/05.

It is acknowledged that this is a broad estimate, however it has not been possible to obtain any more detailed baseline demand figures from the EARL scheme promoters.

Tables 6.1 summarises the total passenger demand for this option in both the high and low underlying growth scenario, and highlights the amount of these trips that are likely to be as a result of the stop at the airport.

In the optimistic scenario it is expected that in the opening year around 69,200 passenger trips will be generated by the improvements to the service frequency and journey times, which driven by underlying passenger growth, will rise to 95,300 by 2020.

In the pessimistic scenario it is expected that in the opening year around 65,300 passenger trips will be generated by the improvements to the service frequency and journey time, which driven by underlying passenger growth, will rise to 85,400 by 2020.

Only around 2% of the new passenger trips produced by this option are expected to be to or from Edinburgh Airport. However, this represents more than a 20% increase in the number of airport passengers that currently use the Highland Mainline, which is particularly large increase considering that the majority of arriving passengers spend some time visiting Edinburgh first.

Table 6.1. Demand Forecast for Reduced Journey Times, Improved Service Frequency and Calls at Edinburgh Airport.

Year	High Underlying Growth				Low Underlying Growth			
	All Trips	**% Growth**	**Airport Trips Only**	**% Growth**	**All Trips**	**% Growth**	**Airport Trips Only**	**% Growth**
2009/10	69,176		1,320		65,305		1,249	
2010/11	72,370	4.6%	1,382	4.7%	67,592	3.5%	1,293	3.5%
2011/12	74,782	3.3%	1,427	3.3%	69,445	2.7%	1,328	2.8%
2012/13	77,275	3.3%	1,474	3.3%	71,350	2.7%	1,365	2.8%
2013/14	79,854	3.3%	1,523	3.3%	73,307	2.7%	1,402	2.8%
2014/15	82,520	3.3%	1,574	3.3%	75,319	2.7%	1,441	2.8%
2015/16	85,213	3.3%	1,623	3.2%	76,934	2.1%	1,425	-1.1%
2016/17	87,637	2.8%	1,665	2.5%	79,031	2.7%	1,462	2.6%
2017/18	90,131	2.8%	1,707	2.5%	81,108	2.6%	1,498	2.5%
2018/19	92,699	2.8%	1,751	2.5%	83,240	2.6%	1,535	2.5%
2019/20 Onwards	95,342	2.9%	1,795	2.5%	85,428	2.6%	1,573	2.5%

6.3 *TEE Analysis*

(All figures are Net Present Values, in 2005 prices)

Transport Economic Efficiency tables for the option to call at Edinburgh Airport station, increase the frequency of rail services and improve the timetable in the optimistic and pessimistic scenarios are detailed below in tables 6.2 and 6.3.

The optimistic scenario has a Net Present Value (NPV) of around £62.6m and Benefit Cost to Government Ratio (BCR) of 1.90. In other words £1 of government funding will produce £1.90 of economic benefits. This is a good return on investment and would probably be sufficient to justify funding. The scheme is forecast to produce a number of large benefit streams including travel time savings for rail users (£100.4m), and road user benefits (£65.9m), from reduced congestion. The operating costs of £66.7m and capital costs of £65.3m are fairly large but the benefits sufficiently outweigh them to give a positive appraisal case.

Since the pessimistic scenario has a lower level of demand forecast and identical scheme costs the appraisal case is comparatively worse with a NPV of £41.3m and BCR of 1.60. This still represents relatively good value for money and should be sufficient to form the basis of a bid for public funding.

In summary, the option for improving the journey time, service frequency and calling services at Edinburgh Airport would be expected to generate a positive return on public investment if underlying passenger growth over the next 15 years irrespective of whether the higher or lower underlying growth projections are realised. The magnitude of the potential returns however, is dependent on the level of this growth.

Similarly to the previous option there is some precedent for PDFH underestimating the likely demand increase when service patterns are currently infrequent and irregular. Given that this is the case at present on the Highland Mainline, the PDFH model is more likely to underestimate the demand increase for this option, (which specifically addresses the service frequency). In order to address this issue the MOIRA software has been used to produce an alternative demand forecast.

Table 6.2. TEE Table for Improved Journey Time, Frequency and EARL Stop: High Scenario.

Sub-objective	Item	Qualitative Information	Quantitative Information	Car	Rail
User Benefits	Travel Time	*Rail = Journey Time Savings Car = Decongestion Benefits*	£166,293,634	£65,924,548	£100,369,086
	User Charges	*Rail = Fares Paid by Users*	-£30,784,732	£0	-£30,784,732
	Vehicle Operating Costs	*Rail = Saving fuel cost saving from modal switch*	£24,618,472	£0	£24,618,472
	Quality / Reliability Benefits	*N/A for this option*	£0	£0	£0
Private Sector Operator Impacts	Investment Costs	*Zero for this option*	£0	£0	£0
	Operating & Maintenance Costs	*Rail = OPEX*	-£66,745,003	£0	-£66,745,003
	Revenues	*Rail = Fares Paid by Users*	£30,784,732	£0	£30,784,732
	Grant/Subsidy payments	*N/A for this option*	£0	£0	£0
Cost to Public Sector					
Item	**Qualitative information**		**Quantitative information**		
Public Sector Investment Costs	*Rail = CAPEX*		-£65,299,556	£0	-£65,299,556
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments			£0	£0	£0
Revenues			£0	£0	£0
Taxation impacts	*Rail = Loss of fuel duty*		-£4,308,233	£0	-£4,308,233
Safety					
Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**		
Accidents	Change in Annual Personal Injury Accidents	*Rail = from modal switch from car to rail*	£8,021,417	£0	£8,021,417
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£8,021,417	£0	£8,021,417

Monetised Summary	
Present Value of Transport Benefits	£132,188,520
Present Value of Cost to Government	-£69,607,789
Net Present Value	£62,580,731
Benefit-Cost to Government Ratio	1.90

Table 6.3. TEE Table for Improved Journey Time, Frequency and EARL Stop: Low Scenario.

Sub-objective	Item	Qualitative Information	Quantitative Information	Car	Rail
User Benefits	Travel Time	*Rail = Journey Time Savings Car = Decongestion Benefits*	£148,155,900	£58,604,530	£89,551,370
	User Charges	*Rail = Fares Paid by Users*	-£27,422,959	£0	-£27,422,959
	Vehicle Operating Costs	*Rail = Saving fuel cost saving from modal switch*	£21,884,928	£0	£21,884,928
	Quality / Reliability Benefits	*N/A for this option*	£0	£0	£0
Private Sector Operator Impacts	Investment Costs	*Zero for this option*	£0	£0	£0
	Operating & Maintenance Costs	*Rail = OPEX*	-£66,745,003	£0	-£66,745,003
	Revenues	*Rail = Fares Paid by Users*	£27,422,959	£0	£27,422,959
	Grant/Subsidy payments	*N/A for this option*	£0	£0	£0
Cost to Public Sector					
Item	**Qualitative information**		**Quantitative information**		
Public Sector Investment Costs	*Rail = CAPEX*		-£65,299,556	£0	-£65,299,556
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments			£0	£0	£0
Revenues			£0	£0	£0
Taxation impacts	*Rail = Loss of fuel duty*		-£3,829,862	£0	-£3,829,862
Safety					
Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**		
Accidents	Change in Annual Personal Injury Accidents	*Rail = from modal switch from car to rail*	£7,130,748	£0	£7,130,748
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£7,130,748	£0	£7,130,748

Monetised Summary	
Present Value of Transport Benefits	£110,426,573
Present Value of Cost to Government	-£69,129,418
Net Present Value	£41,297,155
Benefit-Cost to Government Ratio	1.60

6.4 *Demand Forecast (MOIRA Model)*

The MOIRA software is unable to estimate the number of passengers that would use an entirely new station on the rail network, so the demand forecast for this option is simply the MOIRA forecast for option two added to the number of Edinburgh Airport trips from the PDFH model. The number of passengers trips forecast under both the high and low underlying growth scenarios is detailed below in table 6.4.

Table 6.4. Demand Forecast for Reduced Journey Times, Improved Service Frequency (MOIRA) and Calls at Edinburgh Airport (PDFH).

	High Underlying Growth				**Low Underlying Growth**			
Year	**All Trips**	**% Growth**	**Airport Trips Only**	**% Growth**	**All Trips**	**% Growth**	**Airport Trips Only**	**% Growth**
2009/10	139,355		1,320		135,749		1,249	
2010/11	145,214	4.2%	1,382	4.7%	139,962	3.1%	1,293	3.5%
2011/12	152,451	5.0%	1,427	3.3%	144,712	3.4%	1,328	2.8%
2012/13	159,445	4.6%	1,474	3.3%	149,767	3.5%	1,365	2.8%
2013/14	166,761	4.6%	1,523	3.3%	154,999	3.5%	1,402	2.8%
2014/15	172,264	3.3%	1,574	3.3%	159,185	2.7%	1,441	2.8%
2015/16	177,946	3.3%	1,623	3.2%	163,428	2.7%	1,425	-1.1%
2016/17	183,807	3.3%	1,665	2.5%	167,839	2.7%	1,462	2.6%
2017/18	189,860	3.3%	1,707	2.5%	172,367	2.7%	1,498	2.5%
2018/19	196,113	3.3%	1,751	2.5%	176,163	2.2%	1,535	2.5%
2019/20 Onwards	201,793	2.9%	1,795	2.5%	180,916	2.7%	1,573	2.5%

6.5 *TEE Analysis (MOIRA Model)*

(All figures are Net Present Values, in 2005 prices)

Transport Economic Efficiency tables for the option to reduce the journey time, increase the frequency of services between Inverness and Edinburgh/Glasgow, and call services at Edinburgh Airport are detailed below in tables 6.5 and 6.6 for optimistic and pessimistic growth scenarios respectively.

As MOIRA is unable to estimate demand for a new station the economic benefits from the stop at Edinburgh Airport have been calculated using the PDFH model, whereas the rest have been calculated using MOIRA.

It has not been possible to estimate all the benefit streams that were presented using the previous model because MOIRA alone cannot provide sufficient information about the nature of journeys that have switched from car to rail. It is possible to get around this by making some simplifying assumptions, but recent advice from the DfT on another Halcrow rail project of this type has been not to attempt this. Furthermore, although these benefits have been calculated for the stop at Edinburgh Airport using the PDFH model, they have been excluded to ensure consistency.

The optimistic scenario has a Net Present Value (NPV) of around £11.8m and Benefit Cost to Government Ratio (BCR) of 2.71. Figures of this magnitude represent a very good economic return on public investment as a BCR of 2.71 shows that every £1 of expenditure generates £2.71 of economic benefits. Given that it has not been possible to estimate all the benefit streams, the majority of the economic benefits are from travel time savings (£243.0m). The magnitude of these benefits and the return on public investment are almost certainly sufficient to form the basis of a robust business case.

Since the pessimistic scenario has a lower level of demand forecast the appraisal case is comparatively worse with a NPV of £86.4m and BCR of 2.32. However, this is still a very high return on public funding with every £1 invested securing £2.32 worth of economic benefits. Again this would probably be sufficient to form the basis of a robust business case.

Table 6.5. TEE Table for Improved Journey Time, Frequency (MOIRA) and EARL Stop (PDFH): High Scenario.

Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**	**Car**	**Rail**
User Benefits	Travel Time	*Rail = Journey Time Savings Car = Decongestion Benefits*	£243,024,813	£0	£243,024,813
	User Charges	*Rail = Fares Paid by Users*	-£41,328,308	£0	-£41,328,308
	Vehicle Operating Costs	*Rail = Saving fuel cost saving from modal switch*	£806,061	£0	£806,061
	Quality / Reliability Benefits	*N/A for this option*	£0	£0	£0
Private Sector Operator Impacts	Investment Costs	*Zero for this option*	£0	£0	£0
	Operating & Maintenance Costs	*Rail = OPEX*	-£66,745,003	£0	-£66,745,003
	Revenues	*Rail = Fares Paid by Users*	£41,328,308	£0	£41,328,308
	Grant/Subsidy payments	*N/A for this option*	£0	£0	£0
Cost to Public Sector					
Item	**Qualitative information**		**Quantitative information**		
Public Sector Investment Costs	*Rail = CAPEX*		-£65,299,556	£0	-£65,299,556
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments			£0	£0	£0
Revenues			£0	£0	£0
Taxation impacts	*Rail = Loss of fuel duty*		£0	£0	£0
Safety					
Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**		
Accidents	Change in Annual Personal Injury Accidents	*Rail = from modal switch from car to rail*	£0	£0	£0
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£0	£0	£0

Monetised Summary	
Present Value of Transport Benefits	£177,085,871
Present Value of Cost to Government	-£65,299,556
Net Present Value	£111,786,315
Benefit-Cost to Government Ratio	2.71

Table 6.6. TEE Table for Improved Journey Time, Frequency (MOIRA) and EARL Stop (PDFH): Low Scenario.

Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**	**Car**	**Rail**
User Benefits	Travel Time	*Rail = Journey Time Savings Car = Decongestion Benefits*	£218,413,089	£0	£218,413,089
	User Charges	*Rail = Fares Paid by Users*	-£36,830,941	£0	-£36,830,941
	Vehicle Operating Costs	*Rail = Saving fuel cost saving from modal switch*	£0	£0	£698,913
	Quality / Reliability Benefits	*N/A for this option*	£0	£0	£0
Private Sector Operator Impacts	Investment Costs	*Zero for this option*	£0	£0	£0
	Operating & Maintenance Costs	*Rail = OPEX*	-£66,745,003	£0	-£66,745,003
	Revenues	*Rail = Fares Paid by Users*	£36,830,941	£0	£36,830,941
	Grant/Subsidy payments	*N/A for this option*	£0	£0	£0
Cost to Public Sector					
Item	**Qualitative information**		**Quantitative information**		
Public Sector Investment Costs	*Rail = CAPEX*		-£65,299,556	£0	-£65,299,556
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments			£0	£0	£0
Revenues			£0	£0	£0
Taxation impacts	*Rail = Loss of fuel duty*		£0	£0	£0
Safety					
Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**		
Accidents	Change in Annual Personal Injury Accidents	*Rail = from modal switch from car to rail*	£0	£0	£0
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£0	£0	£0

Monetised Summary	
Present Value of Transport Benefits	£151,668,085
Present Value of Cost to Government	-£65,299,556
Net Present Value	£86,368,529
Benefit-Cost to Government Ratio	2.32

7 Dornoch Bridge

7.1 Description of Option

This is a separate option from the three that are detailed above, and involves the construction of a rail bridge over the Dornoch Firth as well as additional track and signalling to connect with the existing line. It is anticipated that this would reduce the journey time between Golspie and Tain by around 40 minutes.

The new bridge has the potential to allow a variety of options for the service frequency, however the option that has been tested is for 4 trains per day in each direction using the new bridge, and 1 train per day in each direction on the original route. On the basis of the existing pattern of passenger trips on the line it is expected that, without the need for any additional rolling stock, the combination of four trains via the new route and one train via the old route would maximise the additional demand, whilst ensuring passengers from stations between Ardgay and Rogart inclusive will not face a complete removal of services.

The infrastructure works and allied costs for this option are outlined in table 7.1 below. The '*Room for Growth*' study reported a total cost of £72m, excluding the signalling[1] and station at Dornoch. The '*Room for Growth'* study cited a confidence level of ±50%, which means that the actual cost could vary between £37m and £109m. As this is a very wide range the central figure has been taken and an optimism bias figure of 68% has been applied in line with DfT guidance for this type of scheme and stage of the feasibility work. On this basis the total costs of the scheme would be around £121m

[1] Signalling costs cannot be readily estimated due to the unknown condition of the existing signalling infrastructure and the amount of time and expenditure required to produce an accurate estimate is beyond the scope of this study.

Table 7.1. Dornoch Bridge costs

Item	Cost Estimate (£m, 2005 prices)
Permanent Way	13
Bridges	35
Retaining Walls	1
Earthworks and Fencing	7
Land Costs	3
Industry Costs	13
Signalling	n/a
Sub Total	**72**
Optimism Bias	49
Total	**121**

The '*Room for Growth*' study also included costs for the building of a new station at Dornoch, this option is beyond the scope of the current study so the associated costs have been ignored.

There is no requirement for additional rolling stock or staffing, however the change to the pattern of services does imply a small increase in the total mileage travelled, which is estimated to cost an additional £23k per year.

7.2 Demand Forecast

The projected number of passengers for both the high and low growth scenarios are detailed below in table 7.2.

In the optimistic scenario it is expected that in the opening year around 7,300 additional passenger trips will be attracted as a result of the 40 minute reduction in journey times between Golspie and Lairg, and the revised service frequency. Driven by underlying passenger growth, will rise to 10,300 by 2020.

In the pessimistic growth scenario it is expected that in the opening year around 5,900 additional passenger trips will be attracted, and when driven by underlying passenger growth, this will rise to 7,400 by 2020.

In both scenarios the increase in demand represents a rise of around 4% over the baseline, which is a sizable proportion for this type of scheme.

In recognition that PDFH based models can sometime underestimate the additional demand for this type of scheme, a second forecast has been produced using the MOIRA software. The discussion of this starts in section 7.4.

Table 7.2. Annual Demand Forecast for the Dornoch Bridge Option.

Year	High Underlying Growth		Low Underlying Growth	
	Total	**% Growth**	**Total**	**% Growth**
2009/10	7,250		5,911	
2010/11	7,701	6.2%	6,099	3.2%
2011/12	8,000	3.9%	6,217	1.9%
2012/13	8,310	3.9%	6,337	1.9%
2013/14	8,633	3.9%	6,460	1.9%
2014/15	8,968	3.9%	6,587	2.0%
2015/16	9,317	3.9%	6,716	2.0%
2016/17	9,584	2.9%	6,848	2.0%
2017/18	9,807	2.3%	7,011	2.4%
2018/19	10,036	2.3%	7,183	2.5%
2019/20 Onwards	10,270	2.3%	7,360	2.5%

7.3 *TEE Analysis*

(All figures are Net Present Values, in 2005 prices)

The Transport Economic Efficiency tables for the construction of the bridge over the Dornoch Firth are detailed in tables 7.3 and 7.4 below.

Given that the magnitude of the additional demand forecast in the previous section is relatively modest, the impact on freight services has been examined to establish if there are any benefits to freight operators that could be captured as part of the TEE analysis. Unfortunately the relatively sparse freight services on the Far North Line would not be affected by the Dornoch Bridge.

The optimistic scenario has a Net Present Value (NPV) of around -£97m and Benefit Cost to Government Ratio (BCR) of 0.08. Figures of this magnitude represent an extremely poor economic return on public investment, as a BCR of 0.08 means that every £1 of funding generates as little as eight pence of benefits. This is because the low level of existing and additional passenger demand that is forecast is only expected to produce around £8m of economic benefits versus comparatively enormous scheme costs of £105m.

Since the pessimistic scenario has a lower level of demand forecast the appraisal case is comparatively worse with an NPV of -£99m and BCR of 0.06.

In summary, the appraisal case presented above is very poor and on the basis the forecast levels of return on public investment, there would be virtually no chance of securing public funding. However, given that PDFH can sometimes underestimate demand when services patterns are infrequent and irregular a second forecast and appraisal has been produced using the MOIRA software.

Table 7.3. TEE Table for Dornoch Bridge: High Scenario.

Sub-objective	Item	Qualitative Information	Quantitative Information	Car	Rail
User Benefits	Travel Time	*Rail = Journey Time Savings Car = Decongestion Benefits*	£7,728,651	£2,221,855	£5,506,796
	User Charges	*Rail = Fares Paid by Users*	-£859,044	£0	-£859,044
	Vehicle Operating Costs	*Rail = Saving fuel cost saving from modal switch*	£829,716	£0	£829,716
	Quality / Reliability Benefits	*N/A for this option*	£0	£0	£0
Private Sector Operator Impacts	Investment Costs	*Zero for this option*	£0	£0	£0
	Operating & Maintenance Costs	*Rail = OPEX*	-£524,376	£0	-£524,376
	Revenues	*Rail = Fares Paid by Users*	£859,044	£0	£859,044
	Grant/Subsidy payments	*N/A for this option*	£0	£0	£0
Cost to Public Sector					
Item	**Qualitative information**		**Quantitative information**		
Public Sector Investment Costs	*Rail = CAPEX*		-£105,451,239	£0	-£105,451,239
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments			£0	£0	£0
Revenues			£0	£0	£0
Taxation impacts	*Rail = Loss of fuel duty*		-£145,200	£0	-£145,200
Safety					
Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**		
Accidents	Change in Annual Personal Injury Accidents	*Rail = from modal switch from car to rail*	£270,346	£0	£270,346
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£270,346	£0	£270,346

Monetised Summary	
Present Value of Transport Benefits	£8,304,337
Present Value of Cost to Government	-£105,596,439
Net Present Value	-£97,292,102
Benefit-Cost to Government Ratio	0.08

Table 7.4. TEE Table for Dornoch Bridge: Low Scenario.

Sub-objective	Item	Qualitative Information	Quantitative Information	Car	Rail
User Benefits	Travel Time	*Rail = Journey Time Savings Car = Decongestion Benefits*	£5,809,420	£1,615,162	£4,194,258
	User Charges	*Rail = Fares Paid by Users*	-£602,320	£0	-£602,320
	Vehicle Operating Costs	*Rail = Saving fuel cost saving from modal switch*	£603,157	£0	£603,157
	Quality / Reliability Benefits	*N/A for this option*	£0	£0	£0
Private Sector Operator Impacts	Investment Costs	*Zero for this option*	£0	£0	£0
	Operating & Maintenance Costs	*Rail = OPEX*	-£524,376	£0	-£524,376
	Revenues	*Rail = Fares Paid by Users*	£602,320	£0	£602,320
	Grant/Subsidy payments	*N/A for this option*	£0	£0	£0
Cost to Public Sector					
Item	**Qualitative information**		**Quantitative information**		
Public Sector Investment Costs	*Rail = CAPEX*		-£105,451,239	£0	-£105,451,239
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments			£0	£0	£0
Revenues			£0	£0	£0
Taxation impacts	*Rail = Loss of fuel duty*		-£105,552	£0	-£105,552
Safety					
Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**		
Accidents	Change in Annual Personal Injury Accidents	*Rail = from modal switch from car to rail*	£196,526	£0	£196,526
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£196,526	£0	£196,526

Monetised Summary	
Present Value of Transport Benefits	£6,084,727
Present Value of Cost to Government	-£105,556,791
Net Present Value	-£99,472,064
Benefit-Cost to Government Ratio	0.06

7.4 *Demand Forecast (MOIRA)*

The number of additional passengers forecast for both the high and low underlying growth scenarios are detailed below in table 7.5.

In the optimistic scenario it is expected that in the opening year around 13,300 additional passenger trips will be attracted as a result of the 40 minute reduction in journey times between Golspie and Lairg, and the revised service frequency. Driven by underlying passenger growth, this will rise to 18,900 by 2020.

In the pessimistic growth scenario it is expected that in the opening year around 12,600 additional passenger trips will be attracted, and when driven by underlying passenger growth, will rise to 15,800 by 2020.

Similarly to the options for the Highland Mainline, the demand forecast using the MOIRA model is approximately twice the amount forecast using the PDFH model. Again, this can be explained by a more rigorous iterative approach used by MOIRA, which is more suitable for assessing demand when existing services are infrequent and irregular.

This higher level of demand represents a rise of around 8% over the baseline, which is sizable proportion for this type of scheme. Despite this the total number of additional trips is still unlikely to produce the magnitude of economic benefits required to offset the large potential capital costs.

Table 7.5. MOIRA Annual Demand Forecast for the Dornoch Bridge Option.

Year	High Underlying Growth		Low Underlying Growth	
	Total	% Growth	Total	% Growth
2009/10	13,340		12,638	
2010/11	14,167	6.2%	13,042	3.2%
2011/12	14,719	3.9%	13,290	1.9%
2012/13	15,294	3.9%	13,542	1.9%
2013/14	15,890	3.9%	13,800	1.9%
2014/15	16,510	3.9%	14,076	2.0%
2015/16	17,154	3.9%	14,357	2.0%
2016/17	17,651	2.9%	14,644	2.0%
2017/18	18,057	2.3%	14,996	2.4%
2018/19	18,472	2.3%	15,371	2.5%
2019/20 Onwards	18,897	2.3%	15,755	2.5%

7.5 *TEE Analysis (MOIRA Model)*

(All figures are Net Present Values, in 2005 prices)

Transport Economic Efficiency tables from using the MOIRA for the Dornoch Bridge option, are shown below in tables 7.6 and 7.7 for the optimistic and pessimistic growth scenarios respectively.

As stated previously it has not been possible to estimate all the benefit streams that were presented using the previous model because MOIRA alone cannot provide sufficient information about the nature of journeys that have switched from car to rail. It is possible to get around this by making some simplifying assumptions, but recent advice from the DfT on another Halcrow rail project of this type has been not to attempt this.

The optimistic scenario has a Net Present Value (NPV) of around -£83.0m and Benefit Cost to Government Ratio (BCR) of 0.21. Figures of this magnitude represent a very poor economic return on public investment and a BCR of 0.21 shows that every £1 of investment only generates £0.21 of economic benefits. Given that it has not been possible to estimate all the benefit streams, the majority of the economic benefits are from travel time savings (£22m), although these are very small when compared to scheme costs of £105m.

Since the pessimistic scenario has a lower level of demand forecast the appraisal case is comparatively worse with a NPV of -£86.0m and BCR of 0.18. In other words £1 of public investment would produce a return of £0.18 worth of economic benefits.

Given that the appraisal results are particularly unfavourable the TEE analysis was conducted a second time in order to establish whether removal of the optimism bias from the construction cost would significantly improve the case. The results of this are detailed in 8.1 and even in the most optimistic growth scenario (using MOIRA) the maximum BCR achieved was still extremely low at 0.35.

In summary, although the TEE analysis produced using the MOIRA forecast is an improvement on the PDFH version, and although it has not been possible to quantify all the benefit streams using MOIRA, the scheme to build a rail link over the Dornoch Firth still represents an extremely poor return on public investment. On this basis it is very unlikely that the Scottish Executive would grant funding unless the number of passengers using the route increases dramatically.

Table 7.6. TEE Table for Dornoch Bridge (MOIRA): High Scenario.

Sub-objective	Item	Qualitative Information	Quantitative Information	Car	Rail
User Benefits	Travel Time	*Rail = Journey Time Savings Car = Decongestion Benefits*	£22,977,289	£0	£22,977,289
	User Charges	*Rail = Fares Paid by Users*	-£643,661	£0	-£643,661
	Vehicle Operating Costs	*Rail = Saving fuel cost saving from modal switch*	£0	£0	£0
	Quality / Reliability Benefits	*N/A for this option*	£0	£0	£0
Private Sector Operator Impacts	Investment Costs	*Zero for this option*	£0	£0	£0
	Operating & Maintenance Costs	*Rail = OPEX*	-£524,376	£0	-£524,376
	Revenues	*Rail = Fares Paid by Users*	£643,661	£0	£643,661
	Grant/Subsidy payments	*N/A for this option*	£0	£0	£0
Cost to Public Sector					
Item	**Qualitative information**		**Quantitative information**		
Public Sector Investment Costs	*Rail = CAPEX*		-£105,451,239	£0	-£105,451,239
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments			£0	£0	£0
Revenues			£0	£0	£0
Taxation impacts	*Rail = Loss of fuel duty*		£0	£0	£0
Safety					
Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**		
Accidents	Change in Annual Personal Injury Accidents	*Rail = from modal switch from car to rail*	£0	£0	£0
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£0	£0	£0
Monetised Summary					
Present Value of Transport Benefits	£22,452,913				
Present Value of Cost to Government	-£105,451,239				
Net Present Value	-£82,998,325				
Benefit-Cost to Government Ratio	0.21				

Table 7.7. TEE Table for Dornoch Bridge (MOIRA): Low Scenario.

Sub-objective	Item	Qualitative Information	Quantitative Information	Car	Rail
User Benefits	Travel Time	*Rail = Journey Time Savings Car = Decongestion Benefits*	£19,960,610	£0	£19,960,610
	User Charges	*Rail = Fares Paid by Users*	-£525,923	£0	-£525,923
	Vehicle Operating Costs	*Rail = Saving fuel cost saving from modal switch*	£0	£0	£0
	Quality / Reliability Benefits	*N/A for this option*	£0	£0	£0
Private Sector Operator Impacts	Investment Costs	*Zero for this option*	£0	£0	£0
	Operating & Maintenance Costs	*Rail = OPEX*	-£524,376	£0	-£524,376
	Revenues	*Rail = Fares Paid by Users*	£525,923	£0	£525,923
	Grant/Subsidy payments	*N/A for this option*	£0	£0	£0
Cost to Public Sector					
Item	**Qualitative information**		**Quantitative information**		
Public Sector Investment Costs	*Rail = CAPEX*		-£105,451,239	£0	-£105,451,239
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments			£0	£0	£0
Revenues			£0	£0	£0
Taxation impacts	*Rail = Loss of fuel duty*		£0	£0	£0
Safety					
Sub-objective	**Item**	**Qualitative Information**	**Quantitative Information**		
Accidents	Change in Annual Personal Injury Accidents	*Rail = from modal switch from car to rail*	£0	£0	£0
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£0	£0	£0
Monetised Summary					
Present Value of Transport Benefits	£19,436,234				
Present Value of Cost to Government	-£105,451,239				
Net Present Value	-£86,015,004				
Benefit-Cost to Government Ratio	0.18				

8 Delivering Growth

8.1 *Summary of Results*

The analysis presented in the previous chapters has produced a range of passenger demand forecasts and resulting economic appraisals for a number of options for improving rail services in the Highlands and Islands. Table 8.1 below provides a summary of the BCR for each option. The figures are colour coded to represent the strength of the appraisal case for each.

It should be noted that this analysis focuses purely on the monetised economic impacts and does not include an assessment of the impact against the government's other objectives for transport investment i.e. environment, social inclusion, integration and safety. All of these impacts are likely to be positive and add general support to the economic case, although without further analysis it is not possible to determine at this stage the extent of these other benefits

Table 8.1. Summary of Benefit Costs Ratios for Options Tested

Option	Description	PDFH Forecast		MOIRA Forecast	
		Low	High	Low	High
1	Journey Time	**0.34**	**0.51**	1.17	**1.43**
2	Journey Time, Frequency	1.18	**1.47**	**2.25**	**2.61**
3	Journey Time, Frequency, Airport Stop	**1.60**	**1.90**	**2.32**	**2.71**
4	Dornoch Bridge	**0.06**	**0.08**	**0.18**	**0.21**
4a	Dornoch Bridge (no optimism bias)	**0.10**	**0.14**	**0.30**	**0.35**

Green = Strong Appraisal Case, Orange = Marginal Appraisal Case, Red = Weak Appraisal Case

For two options in particular some encouraging appraisal results have been identified:

- **Option Two,** namely a revised end-to-end journey time of 2 hours 45 minutes and an hourly frequency on the Highland Mainline. Irrespective of underlying passenger growth and the type of model used, this option is expected to produce a sizeable economic benefit and return on public investment. However, the size of this return is dependant on whether the levels of demand forecast using MOIRA can be achieved in practice.

- **Option Three,** namely the comprehensive option with the journey time and frequency improvements from option two, and incorporation of Edinburgh Airport into an hourly calling pattern. Given that the EARL project is expected to meet any cost requirements that are additional to option two, the scheme is forecast to produce an even larger economic benefit and return on public investment. Again, the magnitude of these is dependent on levels of demand forecast using MOIRA being realised.

To reiterate previous chapters the MOIRA based forecasts should be viewed as the high, and indeed the most likely scenarios, however it is clear from this that achieving the predicted level of demand is of fundamental importance to the success of the options.

Whilst the economic forecasts for each option described above predict passenger growth there are both risks and opportunities attached to the delivering of growth forecasts in practice. The purpose of this section is to scope some of these and refer to best practice that is available to future operators when seeking to achieve passenger growth.

The text is broken into the following sections:

- Highland Mainline, service improvements;

- Highland Mainline, connection to Edinburgh Airport; and

- Far North Line, journey time improvements.

A short market review is undertaken for each, and best practice for achieving growth outlined.

Finally, institutional issues are covered, in so much as they relate to responsibility for growing passenger numbers.

8.2 Service Improvements to the Highland Main Line

Chapters 4 and 5 above outline the potential for service and journey time improvements on for services between Glasgow/Edinburgh and Inverness. A reduction in end to end journey time of some 45 minutes is potentially achievable, leaving an overall Inverness to Glasgow/Edinburgh journey time of around 2 hours and 45 minutes. Service frequencies of two-hourly from Glasgow and from Edinburgh are proposed, giving an hourly frequency over the northern section of the route between Perth and Inverness. As such, the service represents a significant improvement over current levels; in particular, it regularises the current timetable pattern and increases the number of opportunities to travel by around 50%.

Forecast revenue projections are in part based on population and economic growth projections for the Edinburgh, Glasgow, Falkirk and Stirling areas, together with those for the Inverness area. Thus revenue growth is assumed in part to arise naturally.

The problem with economic models is that they tend to assume perfect knowledge amongst consumers. In practice, there is often a time lag in real life between rail service improvements and realisation of growth, as potential consumers only gradually become aware of changes. This can lead to a failure to achieve predicted forecasts during the early stages of service improvements, and can in a worst case, lead to these being reversed before they have really been given a change to prove themselves.

Key markets for the improved services are likely to include:

- Local to line users between Perth and Inverness, using the route for travel to work/travel to college;

- Local to line users between Perth and Inverness, using the route for shopping/leisure/personal business;

- Business travellers between the cities on the route; and

- Leisure travellers either travelling from the north into Edinburgh/Glasgow for days out or in the reverse direction for days out/weekend breaks, including overseas visitors.

There are tried and tested ways of reaching these markets that will be familiar to many readers of this report, and especially to those already involved in promoting rail services. Our experience suggests that the following tools are particularly effective in delivering new rail markets at low cost:

- PR/press launches covering service improvements – target at local communities with local press coverage;

- PR targeting business travellers (this is particularly effective when aimed at the secretaries or office managers who organise travel arrangements on behalf of a senior team) – rail's strengths include directness to the heart of Edinburgh and Glasgow, avoidance of road congestion, and ability to relax on the train;

- Links to existing tourism campaigns (for example, Visit Scotland initiatives) promoting the use of train over that of road transport;

- Link to art events and festivals, including holding arts events on train – an effective way of generating publicity and patronage (we know of one event in the north of England that delivered £2m value of positive PR for local rail services in return for an initial outlay of £3k!); and

- Active Community Rail Partnership – published sources quote a 197% increase in usage of the line between Norwich and Sheringham over the last 8 years as a result of an active CRP - potentially supported by a Development Company (see www.settle-carlisle.co.uk to see the kind of promotional activity that can be delivered).

8.3 *Highland Main line – Airport Connections*

Chapter 6 covers the option to provide an hourly service between Perth and Edinburgh Airport, extended every two hours to Inverness.

Edinburgh Airport offers a range of scheduled flights to major UK and European destinations, as well as major US cities, Moscow and Toronto. However, flight times cover a broad span, with many key departures taking place early morning. Return flights cover a similarly large range, with a number arriving after 10.00pm. We know from experience elsewhere that this can present a real barrier for domestic travellers who want to use rail as an access mode to the airport.

Nevertheless, rail access can be an attractive option (research undertaken following the introduction of rail services to Manchester Airport suggested that a significant proportion of the market was influenced by the availability of rail links when choosing departure airports). There is, therefore, likely to be some domestic demand for connections to international flights from those living at the north end of the rail links (Inverness offers a viable option for those catching internal UK flights), although this is unlikely to be a significantly large market.

Markets for the service are therefore likely to be:

- Domestic users (business);
- Domestic users (leisure); and
- Overseas visitors.

Again, there are tried and tested ways of maximising the use of airport rail links. These include:

- PR campaigns targeted at business travellers (as above, campaigns targeted at the actual buyers are the most effective) – organising activity in conjunction with a major airline can be very cost effective;
- PR campaigns targeted at domestic travel agents (for example, familiarisation trips – organised in conjunction with a major airline the only outstanding cost can be the rail ticket); and
- Campaigns targeted at inbound (overseas) travellers, for example, features in on-board airline magazines and piggy-back campaigns using existing work by bodies such as Visit Scotland.

Price tends to be a relatively low concern for travellers to and from air connections, although punctuality and reliability are key (good back up customer service strategies are essential to provide support in times of service failure). This does give the option to develop extra (more highly priced) services for air travellers, for example, guaranteed seat reservations, taxi service between their homes and the station, on-train refreshments and even first class facilities.

8.4 Far North Line – Journey Time Improvements

Chapter 7 above outlines the potential to improve end to end journey times on the Far North line through the building of a new bridge across the Dornoch Firth.

Although there is not a large potential for traditional TEE transport benefits, it will bring significant benefits for local communities and in particular, facilitate journeys into Inverness for access to public services including education and health, as well as improving journey to work opportunities. Potential markets are likely to include:

- Local to line users using the route for travel to work/travel to college;
- Local to line users using the route for shopping/leisure/personal business; and
- Leisure travellers/overseas visitors/holidaymakers/weekend break.

As for the other cases cited above, development of appropriate, low-cost, promotional and PR campaigns can do much to heighten the profile of the routes and increase the numbers travelling. Methods include:

- PR/press launches covering service improvements – target at local communities with local press coverage; and
- Links to existing tourism campaigns (for example, Visit Scotland initiatives) promoting the use of train over that of road transport.

8.5 Institutional Arrangements

Much of what is written above should be well known to readers. However, the key ingredient to making it all happen is an enthusiastic, dedicated resource, with a sound grasp in marketing and promotional techniques and access to a (small) budget to fund seed-corn campaigns.

The existing Highland Rail Partnership is doing sterling work in making the case for genuine improvements to rail provision and in attracting new business to the routes. However, it may not be resourced to do both this and give full promotional support to the routes. Indeed, the tasks potentially require different skill sets.

Responsibility for promotion of new services could nominally be said to fall to First Scotrail. However, here again, the company carries a wide portfolio of responsibilities. It may be difficult to make a business case for the focussing of attention on services in the Far North of Scotland.

Thought should therefore be given to resourcing promotional support for new services. Human resource could come from a number of different sources – for example, from within the existing Highland Rail partnership or First Scotrail organisations. Funding for seed-corn campaigns can be kept to a minimum by clever use of existing work of others with a stake in a successful transport industry for Scotland, including tourism bodies, local authorities and inward bound carriers such as airlines and even mainline railways. We recommend that appropriate recognition is given to these resource issues when final schemes are under development. Unless this is done, we believe there is a real risk that schemes will not deliver their full potential.