

HITRANS

Appraisal of New Rail Services between Elgin
and Inverness, and a Possible Park and Ride
Facility at Dalcross: Transport Economic
Efficiency Analysis

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Contents

1	Study Background, Context and Objectives.	7
	1.1 <i>Background</i>	7
	1.2 <i>Context</i>	7
	1.3 <i>Study Overview</i>	8
	1.4 <i>Report Structure</i>	8
2	Enhanced Service Frequency	9
	2.1 <i>Description of Option</i>	9
	2.2 <i>Methodology</i>	9
	2.3 <i>Demand Forecast</i>	11
	2.4 <i>TEE Analysis</i>	13
3	Dalcross Rail Station and Park and Ride Site, with the Enhanced Service Frequency.	18
	3.1 <i>Description of Option</i>	18
	3.2 <i>Methodology</i>	18
	3.3 <i>Demand Forecast</i>	19
	3.4 <i>TEE Analysis</i>	23
	3.5 <i>Impact of Variable Station Costs</i>	27
4	Impact of New Developments	28
	4.1 <i>Background</i>	28
	4.2 <i>Impact of New Developments on Transport Options</i>	28
5	Conclusion	30
	5.1 <i>Focus of Further Feasibility Work</i>	30
6	Appendix A. Exogenous Growth Projections.	30

1 Study Background, Context and Objectives.

1.1 *Background*

The city of Inverness has witnessed a rapid expansion in economic growth and development activity in recent years. This has been particularly apparent in the east of the city with a significant increase in residential and commercial properties along the A96 corridor through Nairn, Forres, Elgin and beyond.

The expansion in economic activity has coincided with an increasing working population along the corridor and, with it, significant growth in the demand for transport services. This is reflected in the rising level of congestion on the road network serving Inverness. In addition, there are potential plans for further development along the corridor. This includes the major housing and leisure development at Whiteness and the new town at Tornagrain which would accommodate up to 10,000 new households.

This extensive level of development is likely to put additional pressure on the existing road network and increase the need for public transport services, particularly in the peak periods. As a consequence there is an aspiration to facilitate improvements on the Inverness – Aberdeen Line, either through enhancements to the level of service provision or through upgrades to the infrastructure of the route.

Unlike the rest of the Highland rail network the characteristics of the Inverness to Aberdeen Line resemble what would typically be expected from a suburban railway. There are large peak period commuter flows into Aberdeen from as far West as Elgin, and into Inverness from Elgin, Nairn and Forres. The line is used by business travellers and there is a significant amount of inter-line leisure traffic at all times of the day between the smaller conurbations, as well as larger leisure-based flows into Aberdeen and Inverness.

1.2 *Context*

Highlands and Islands Enterprise in association with HITRANS, the Highland Rail Partnership and Transport Scotland have recently commissioned the production of baseline rail passenger projections until 2020 for the whole of the Highlands and Islands rail network. These projections provide a high and low

range for the exogenously driven growth in the number of rail passenger journeys. These drivers of demand include population growth, committed new developments, economic performance and the planned level of future rail service provision. The forecasts provide the level of baseline data required to undertake detailed pre-feasibility assessments of bespoke improvements to the provision of services on the route.

1.3

Study Overview

This study has been commissioned to conduct a demand forecast and Transport Economic Efficiency Appraisal (TEE) of two significant improvements to the western section Inverness – Aberdeen Line. These are:

- 1) **Increased Rail Services** between Inverness and Elgin, and;
- 2) **A New Station and Park and Ride Site at Dalcross**, adjacent to Inverness Airport.

The TEE analysis is compliant with the Scottish Executive's STAG guidance, however the study does not consider in detail the Executive's other objectives for transport investment: safety, environment, integration and social inclusion and accessibility.

As the HIE baseline demand projections for the Highlands and Islands reported a high and low forecast, this study has followed the same approach and produced a high and low appraisal for each option. At this pre-feasibility stage it is thought that the provision of a range of forecasts will be more useful than a single central business case of the type needed to achieve full approval of transport schemes.

1.4

Report Structure

This report presents the results of the feasibility work detailed above and as such is split into four more chapters. The second chapter presents the forecasting method, demand projections and TEE appraisal for the increased rail services. The third chapter presents the forecasting method, demand projections and TEE appraisal for the new station at Dalcross along with the enhanced rail services. The fourth chapter outlines the implications of potential new developments near Inverness Airport for the two options, and the fifth chapter highlights areas for further work.

2 Enhanced Service Frequency

2.1 *Description of Option*

The enhanced service frequency option has been produced by HITRANS partnership with a sub-consultant. The option is for an additional 5-6 services per day depending on the stopping pattern in each direction between Inverness and Elgin, increasing the frequency from between 10 and 11 trains per day to 16-17 trains per day. This represents a significant improvement to the current level of service provision.

The option will require the lease of an additional class 158 unit as well as eight extra train crew, and on the basis of the costing provided by the Highland Rail Partnership will have an annual operating cost of around £445,000 to £455,000 in 2005 prices.

2.2 *Methodology*

The first part of the methodology involved forecasting the likely impact on demand caused by the improvements to the service frequency between Inverness and Elgin. There were four stages to this process:

- **Production of a spreadsheet demand model**, using the baseline Inverness – Aberdeen passenger forecasts from the HIE study;
- **Estimation of the Generalised Journey Time (GJT) for the journeys in the baseline demand matrix**. Put simply this is the cost of making the trip as perceived by passengers, and is an aggregate of the journey time, cost, and wait time based on the frequency and regularity of services;
- **Estimation of the GJT for the same set of journeys**, when the service frequency is increased, and;

- **Calculation of the difference in GJT** that the improvements will produce, and estimation of the impact on demand by applying elasticity parameters from *PDFH*.¹
- **Application of the exogenous/underlying growth projections** from the HIE study to forecast the change in passenger numbers over time. The optimistic and pessimistic projections are summarised in Appendix A.

The second stage of the work was to produce the TEE analysis of the service improvements. There were two parts to this process.

The first part involved estimating the quantifiable transport benefits produced by the frequency improvements. These are all a function of the increase in rail patronage and include the following:

- **User Benefits.** These are the benefits that accrue directly to existing and new transport users. The main source is usually travel time savings and other benefits such as cost savings from transport users switching to a less expensive mode or benefits resulting from less on-train crowding. In addition the provision of additional services can produce a benefit from reduced (current and future) on-train crowding.
- **Non User Benefits.** These are benefits that indirectly accrue to people who are not using the improved rail services. The source of these benefits is a modal switch from car to public transport producing benefits such as road congestion relief.
- **Other Resource Impacts.** This is the financial impact of the scheme, in particular the additional revenue generated as well as any impact on taxation paid to the government.

The second part involves estimating the cost of the service improvements, which in this case have been provided by the Highland Rail Partnership.

¹ *Passenger Demand Forecasting Handbook version 4.1*

2.3

Demand Forecast

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

- The additional services are introduced in 2007/08;
- 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 been taken into account, this is the rate at which new passengers begin to use the services, namely that the potential demand for the new scheme isn't realised immediately as it takes time for people's travel patterns to change, and indeed for the existence of new services to become common knowledge. To reflect this the forecast level of demand for the first three years has been factored in line with observed profiles of patronage take up:

Year 1 demand = forecast x 0.75

Year 2 demand = forecast x 0.85

Year 3 demand = forecast x 0.95

The forecast of additional passenger demand produced by the increased service frequencies in the optimistic and pessimistic growth scenarios are detailed below in tables 2.1 and 2.2.

In the optimistic scenario by 2019/20 it is expected that around 16,900 passenger trips per annum will be generated by the improvements to services, increasing from an initial demand of around 7,300 trips in 2006/07. Initially the majority of the trips will be exclusively attracted by the new services, however by 2019/20 up to 42% of trips will be from underlying or exogenous growth on the new demand. Around 61% of the trips are Inverness based leaving a significant additional flow between the smaller stations.

In the pessimistic scenario, by 2019/20 9,200 extra passenger trips are expected, rising from 4,800 in 2006/07. Again, initially most of the demand will be newly attracted by the improvements and by 2019/20 this will have reduced such that 30% of new trips will be from underlying growth on the new demand.

In contrast to the optimistic scenario a slightly higher proportion of around 68% of all trips are Inverness based.

In general it is likely that the split of the forecast growth in passenger trips by journey type will largely reflect the current trend to the west of Elgin, although given economic projections for Inverness, and that some of the additional services are in the peak, an increase in the number of commuter journeys would be expected.

Table 2.1. Annual Demand Forecast from Increased Service Frequency: Optimistic Scenario

Year/Station	Elgin	Forres	Nairn	Inverness	Total	Source of Growth	
						Initial Take Up	Underlying
2007/08	887	875	1,100	4,459	7,321	7,321	0
2008/09	1,066	1,049	1,335	5,396	8,845	8,297	548
2009/10	1,268	1,243	1,601	6,458	10,570	9,273	1,297
2010/11	1,423	1,388	1,811	7,287	11,909	9,761	2,148
2011/12	1,515	1,473	1,915	7,752	12,655	9,761	2,894
2012/13	1,590	1,539	1,984	8,072	13,185	9,761	3,424
2013/14	1,655	1,595	2,056	8,370	13,676	9,761	3,915
2014/15	1,722	1,652	2,130	8,680	14,184	9,761	4,423
2015/16	1,792	1,712	2,206	9,000	14,710	9,761	4,949
2016/17	1,865	1,775	2,286	9,333	15,259	9,761	5,498
2017/18	1,939	1,837	2,362	9,657	15,795	9,761	6,034
2018/19	2,015	1,901	2,441	9,993	16,350	9,761	6,589
2019/20 Onwards	2,095	1,967	2,523	10,340	16,925	9,761	7,164

Table 2.2. Annual Demand Forecast from Increased Service Frequency: Pessimistic Scenario

Year/Station	Elgin	Forres	Nairn	Inverness	Total	Source of Growth	
						Initial Take Up	Underlying
2006/07	573	366	602	3,277	4,818	4,818	0
2007/08	667	428	708	3,844	5,647	5,460	187
2008/09	769	497	824	4,459	6,548	6,103	446
2009/10	834	544	903	4,876	7,157	6,424	733
2010/11	861	565	940	5,066	7,432	6,424	1,008
2011/12	884	582	969	5,203	7,638	6,424	1,214
2012/13	910	601	1,000	5,364	7,875	6,424	1,451
2013/14	934	620	1,031	5,509	8,094	6,424	1,670
2014/15	959	639	1,062	5,658	8,318	6,424	1,894
2015/16	985	659	1,095	5,810	8,549	6,424	2,125
2016/17	1,007	675	1,124	5,930	8,736	6,424	2,312
2017/18	1,029	690	1,151	6,058	8,928	6,424	2,504
2018/19	1,054	707	1,179	6,207	9,147	6,424	2,723

2.4

TEE Analysis

In order to conduct the Transport Economic Efficiency appraisal the following assumptions have been made:

- Life expired rolling stock can be replaced at an identical cost to the current units, this means that using an appraisal period of 60 years from scheme opening is appropriate;
- A price base of 2005 has been used;
- Figures have been converted into Net Present Values by discounting at 3.5% per annum for 30 years and 3% per annum thereafter. This reflects the STAG guidance, and;
- In line with the assumed static demand levels post 2020 no growth in economic benefits is assumed thereafter.

Transport Economic Efficiency tables for the option to increase the frequency of rail services in the optimistic and pessimistic scenarios are detailed below in tables 2.3 and 2.4.

The optimistic scenario has a Net Present Value (NPV) of £1.2m and Benefit Cost to Government Ratio (BCR) of 2.22. Figures of this magnitude represent good value for money with respect to both public and private investment and would normally be sufficient to justify funding. The TEE table shows that there are also some potentially sizable transport benefits, in particular travel time savings which accrue to rail users (£6.1m), road user benefits (£2.6m, from reduced congestion), and on train crowding relief in future years when baseline demand in the peak is forecast to exceed the seating capacity (£2.5m).

Since the pessimistic scenario has a lower level of demand forecast the appraisal case is worse with an NPV of -£2.9m and a BCR of -2. This does not represent good value for money and would not be sufficient to justify public investment.

The main reason that this scenario is significantly worse than the optimistic case is that the underlying levels of growth predicted do not indicate that there will be a significant level of overcrowding on peak services, and the crowding relief benefit is around five times (£2m) lower as a result.

In summary, purely on the basis of transport benefits from the TEE framework, it is possible to make an economic case for the lease and operation of an additional Class 158 unit and 8 on train staff required to improve the level of service frequency between Elgin and Inverness. However, the appraisal case is sensitive to the underlying level of passenger demand on the line - in the most optimistic scenario the BCR is around 2, whereas in the most pessimistic the BCR is -2. As a BCR of 1 represents the point of indifference, where £1 of public money spent produces economic benefits of £1, the option will begin to have a positive appraisal case at approximately three quarters of the way towards the most optimistic case.

It is important to emphasise that in addition to the transport benefits presented above there may also be other benefits that are not captured in the TEE framework. These include positive environmental impacts due to improvements in local air quality (modal shift). It is also clear that the new services would meet other Scottish Executive objectives for transport such as accessibility and

integration. It has not been possible to assess the extent of these benefits within the timetable and budget, but these are likely to provide additional support to the economic welfare benefits measured in the TEE analysis.

Table 2.3. TEE Table for Increased Service Frequency: Optimistic Scenario.

Sub-objective	Item	Qualitative Information	Quantitative Information	Car	Rail
User Benefits	Travel Time	Rail = Journey Time Savings Car = Decongestion Benefits	£8,786,652	£2,646,509	£6,140,143
	User Charges	Rail = Fares Paid by Users	-£2,219,887	£0	-£2,219,887
	Vehicle Operating Costs	Rail = Saving fuel cost saving from modal switch	£1,015,969	£0	£1,015,969
	Quality / Reliability Benefits	Rail = Reduced on train crowding in peak period	£2,521,426	£0	£2,521,426
Private Sector Operator Impacts	Investment Costs	Zero for this option	£0	£0	£0
	Operating & Maintenance Costs	Rail = OPEX	-£11,262,445	£0	-£11,262,445
	Revenues		£2,219,887		£2,219,887
	Grant/Subsidy payments	Rail = Revenue support for the first three years of operation	£821,162	£0	£821,162
Cost to Public Sector					
Item	Qualitative information		Quantitative information		
Public Sector Investment Costs			£0	£0	£0
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments	Rail = Revenue support for the first three years of		-£821,162	£0	-£821,162
Revenues			£0	£0	£0
Taxation impacts	Rail = Loss of fuel duty		-£177,795	£0	-£177,795
Safety					
Sub-objective	Item	Qualitative Information	Quantitative Information		
Accidents	Change in Annual Personal Injury Accidents	Rail = from modal switch from car to rail	£330,292	£0	£330,292
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£330,292	£0	£330,292
Monetised Summary					
Present Value of Transport Benefits	£2,213,055				
Present Value of Cost to Government	-£998,956				
Net Present Value	£1,214,099				
Benefit-Cost to Government Ratio	2.22				

Table 2.4. TEE Table for Increased Service Frequency: Pessimistic Scenario.

Sub-objective	Item	Qualitative Information	Quantitative Information	Car	Rail
User Benefits	Travel Time	Rail = Journey Time Savings Car = Decongestion Benefits	£6,914,166	£2,082,401	£4,831,766
	User Charges	Rail = Fares Paid by Users	-£1,746,788	£0	-£1,746,788
	Vehicle Operating Costs	Rail = Saving fuel cost saving from modal switch	£799,413	£0	£799,413
	Quality / Reliability Benefits	Rail = Reduced on train crowding in peak period	£547,877	£0	£547,877
Private Sector Operator Impacts	Investment Costs	Zero for this option	£0	£0	£0
	Operating & Maintenance Costs	Rail = OPEX	-£11,262,445	£0	-£11,262,445
	Revenues		£1,746,788		£1,746,788
	Grant/Subsidy payments	Rail = Revenue support for the first three years of operation	£821,162	£0	£821,162
Cost to Public Sector					
Item	Qualitative information		Quantitative information		
Public Sector Investment Costs			£0	£0	£0
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments	Rail = Revenue support for the first three years of operation		-£821,162	£0	-£821,162
Revenues			£0	£0	£0
Taxation impacts	Rail = Loss of fuel duty		-£139,897	£0	-£139,897
Safety					
Sub-objective	Item	Qualitative Information	Quantitative Information		
Accidents	Change in Annual Personal Injury Accidents	Rail = from modal switch from car to rail	£259,889	£0	£259,889
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£259,889	£0	£259,889
Monetised Summary					
Present Value of Transport Benefits	-£1,919,938				
Present Value of Cost to Government	-£961,059				
Net Present Value	-£2,880,997				
Benefit-Cost to Government Ratio	-2.00				

3 Dalcross Rail Station and Park and Ride Site, with the Enhanced Service Frequency.

3.1 *Description of Option*

This option is for a new station with park and ride facilities at Dalcross on a site that is broadly adjacent to Inverness Airport, and operating the increased rail timetable described above.

The Highland Rail Partnership have estimated that the full cost of constructing the station will be approximately £750,000 (+25% optimism bias).

3.2 *Methodology*

Similarly to the previous option the methodology consisted of a demand forecast and economic appraisal. Since there is currently no station at Dalcross there is no existing rail demand from the site. As a consequence, in order to produce a demand forecast it was necessary to estimate the number of passengers that are likely to switch to rail services from the station; either from road transport (car and bus), or from other rail stations. Two models were produced to estimate this demand:

- **Mode Split Model.** Existing road vehicle data was taken from Annual Average Daily Flow (AADF) traffic counters placed at regular intervals on the A96. This data was fed into a spreadsheet based logit model and the Generalised Journey Time (GJT) was estimated for each trip that is made by the current mode (either car or bus) or by rail at the new station. The GJT for each highway and rail trip was broken down into component parts; cost, in vehicle journey time, access time, and wait time, and weights from PDFH and the DfT were attached to each of these in order to estimate the value of each. Transport users' choice of mode were then assigned on the basis of the relative GJT for each, i.e. the mode with the lowest GJT for any given trip was selected. By summing all the mode choices in the model it was possible to estimate the percentage split for each mode, and consequently produce a demand forecast for rail.

- **Station Choice Model.** Given the location of the proposed station at Dalcross it was deemed possible that a proportion of the current passengers using Nairn station may reside in the Dalcross catchment area. In order to ascertain whether this was the case around 90 passengers were interviewed at Nairn station, which is over 60% of average number daily originating passengers. Respondents were asked to indicate their full postcode origin as well as frequency of usage and journey purpose. Using this data a logit model was built which assigned a station choice of either Nairn or Dalcross based on the lower of the two respective Generalised Journey Times.

Similarly to the previous option, once the demand forecasts had been completed the associated costs and benefits were quantified and a TEE appraisal was produced.

3.3

Demand Forecast

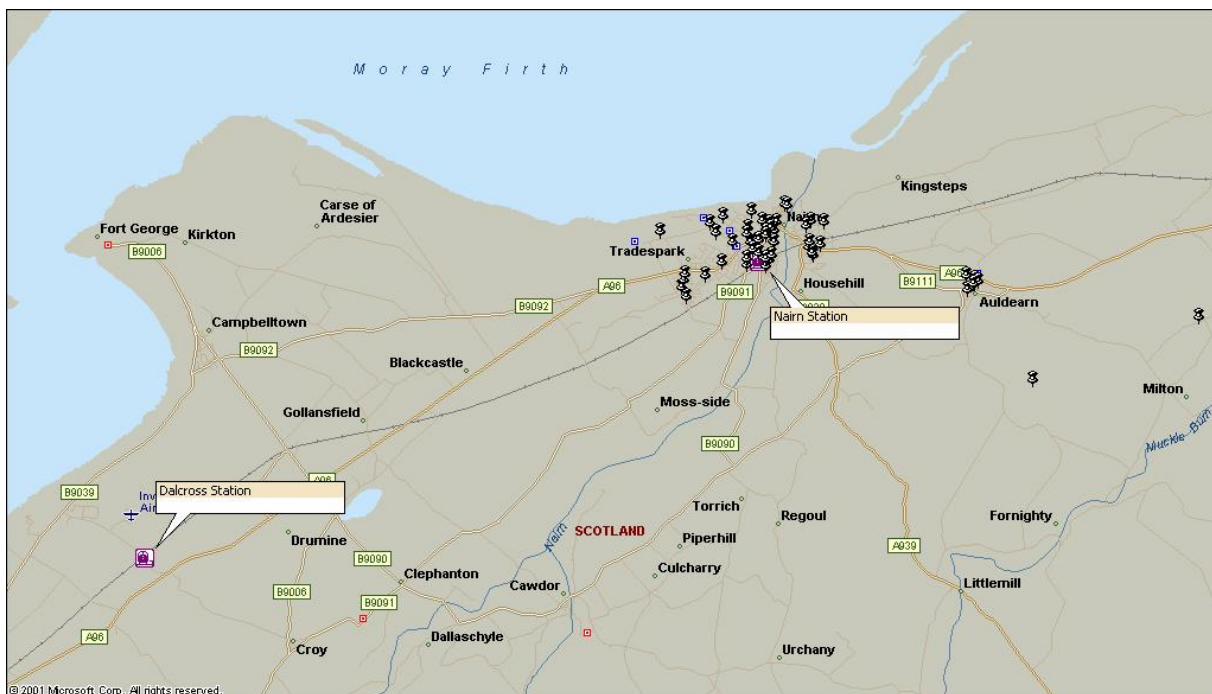
In order to produce demand forecasts the following assumptions have been made to simplify the analysis:

- The AADF traffic counts did not provide any information on the local origin or destination of road transport users. To overcome this difficulty the total number of trips were spread across the catchment area on the basis of Inverness Airport passenger projections and local population and employment statistics. On this basis it was estimated that around 40% of all trips were to or from the airport (including a 30% allowance for airport staff), and 60% were from the centres of populous within the study area;
- The AADF traffic counts did not distinguish the vehicle type so the existing mode split was estimated using *Transport Statistics Great Britain 2005*. On this basis it was estimated that 82% of trips were car, 8% were bus and 10% were road freight;
- The opening year for the station is assumed to be 2007/08;
- The HIE exogenous growth projections run to 2020. Beyond this passenger numbers are assumed constant, thereby applying an element of conservatism to the forecasts;

- The impact of ramp-up is assumed to be the same as in the previous option
- The impact of newly generated trips has not been considered. In general around 5%-15% of trips are generated so the forecast produced may slightly underestimate the demand for the station.

Turing to the station choice model first the postcode origins of current Nairn passengers is detailed below in figure 3.1. This clearly illustrates that all the existing users interviewed originate from close to Nairn, and as a consequence the model forecast zero switch from Nairn to Dalcross.

Figure 3.1. Plot of Trip Origins from Existing Nairn Passengers.



By contrast the mode choice model forecast a sizeable switch from car and bus to rail as a number of the existing origins and destinations are close to Dalcross Station, particularly Inverness Airport. This was added to the demand from the previous option to include the impact of the improved service frequency.

The forecast passenger demand for the optimistic and pessimistic growth scenarios are detailed below in tables 3.1 and 3.2. In the optimistic scenario around 7,300 passenger trips are expected in the opening year, increasing to 56,000 by 2019/20 onwards, of which around 39,000 are to and from the new station and 17,000 are from the increased service frequency. Over 95% of the trips from the new station are expected to either originate or terminate at the airport and almost 90% are to or from Inverness, with the flow between Inverness and the airport accounting for 85% of the total demand for the station. Nairn is the other significant origin and destination with the flow between Inverness Airport and Nairn accounting for nearly 6% of all trips.

Around 48% of the demand for the station is expected to be abstracted from car which is approximately 0.8% of the total number of car trips to and from the catchment. All these trips are either to or from Inverness and Nairn as the Generalised Journey Time by rail cannot compete with car on longer distance trips. The remaining 52% of passengers are abstracted from bus which is around 7.6% of the total flow of bus passenger in and out of the catchment area. Again the majority of trips are to or from Inverness and Nairn however there is also expected to be a significant number of passengers travelling between Dalcross, and Huntly, Elgin and Forres.

By 2020 it is forecast that Inverness Station would have 11% additional trips over the baseline level of demand if the station were built, and Huntly would have 29% more passengers, albeit from a small base.

In the pessimistic scenario the spread of origins and destinations across the Dalcross catchment and the rate of abstraction from bus and car is forecast to be the same as the optimistic scenario. However, the total demand is expected to be slightly lower at around 36,700 passengers per annum by 2020.

Table 3.1. Annual Demand Forecast for Dalcross Station with the Enhanced Service
Frequency: Optimistic Scenario.

Year/Station	Huntly	Elgin	Forres	Nairn	Dalcross	Inverness	Total	Source of Growth	
								Initial Take Up	Underlying
2007/08	0	887	875	1,100	0	4,459	7,321	7,321	0
2008/09	1,136	1,621	1,300	3,149	10,619	15,395	33,220	32,672	548
2009/10	1,388	1,821	1,401	3,156	11,246	18,072	37,083	35,732	1,351
2010/11	1,674	2,011	1,467	2,975	11,866	20,920	40,913	37,787	3,126
2011/12	1,859	2,161	1,535	2,888	12,305	22,922	43,671	36,882	6,789
2012/13	1,920	2,254	1,603	2,989	12,725	23,768	45,258	36,882	8,376
2013/14	1,984	2,339	1,660	3,092	13,160	24,596	46,831	36,882	9,948
2014/15	2,048	2,427	1,720	3,198	13,612	25,454	48,460	36,882	11,578
2015/16	2,116	2,512	1,781	3,309	13,869	26,341	49,928	36,882	13,046
2016/17	2,186	2,606	1,846	3,423	14,306	27,263	51,629	36,882	14,747
2017/18	2,258	2,702	1,909	3,534	14,757	28,182	53,342	36,882	16,460
2018/19	2,295	2,743	1,928	3,589	15,223	28,867	54,645	36,882	17,762
2019/20	2,332	2,785	1,947	3,644	15,703	29,569	55,981	36,882	19,099

Table 3.2. Annual Demand Forecast for Dalcross Station with the Enhanced Service
Frequency: Pessimistic Scenario.

	Huntly	Elgin	Forres	Nairn	Dalcross	Inverness	Total	Source of Growth	
								Initial Take Up	Underlying
2007/08	0	573	366	602	0	3,277	4,818	4,818	0
2008/09	546	762	566	1,779	10,619	11,103	25,375	25,188	187
2009/10	643	912	581	1,633	10,723	12,593	27,085	26,540	546
2010/11	746	995	576	1,365	11,081	14,083	28,844	27,777	1,067
2011/12	815	1,052	581	1,228	11,361	15,129	30,165	28,463	1,703
2012/13	836	1,080	598	1,265	11,672	15,530	30,980	28,463	2,256
2013/14	860	1,112	617	1,303	11,970	15,987	31,850	28,463	2,901
2014/15	883	1,141	637	1,342	12,275	16,412	32,690	28,463	3,536
2015/16	907	1,172	656	1,382	12,591	16,849	33,557	28,463	4,204
2016/17	931	1,203	676	1,423	12,846	17,297	34,375	28,463	4,909
2017/18	951	1,229	693	1,459	13,100	17,671	35,103	28,463	5,527
2018/19	974	1,256	708	1,493	13,381	18,086	35,899	28,463	6,171
2019/20	998	1,284	724	1,529	13,668	18,511	36,714	28,463	6,897

3.4

TEE Analysis

Transport Economic Efficiency tables for the option to build a station at Dalcross and increase the frequency of rail services under optimistic and pessimistic growth scenarios are detailed below in tables 3.3 and 3.4. In order to conduct the Transport Economic Efficiency appraisal the following assumptions have been made:

- The station infrastructure is assumed to last 60 years before any renewals are required, this means that using an appraisal period of 60 years from scheme opening is appropriate;
- Station operating costs of £20,000 per annum have been assumed. This would cover items such as cleaning and maintenance but not station staffing.
- A price base of 2005 has been used;
- Figures have been converted into Net Present Values by discounting at 3.5% per annum for 30 years and 3% per annum thereafter. This reflects the STAG guidance, and;
- In line with the assumed static demand levels post 2020 no growth in economic benefits is assumed thereafter.

The optimistic scenario has a Net Present Value (NPV) of £5.7m and Benefit Cost to Government Ratio (BCR) of 3.71. These figures indicate a very good value for money with respect to both public and private investment, and as part of a wider STAG assessment and outline business case would be sufficient to justify funding on the basis of existing guidelines. The TEE table shows that there are some potentially sizable transport benefits, in particular road decongestion benefits (£7.3m), vehicle operating cost savings from the modal switch to rail (£2.8m) and rail travel time savings (£5.3m). When these are set against the construction cost of less than £1 million and operating costs of £11.8m the high NPV is understandable.

The value of transport benefits is slightly reduced by the need to add 2 minutes on to the journey time for services that will stop at Dalcross. This means that a proportion of existing users will have a journey time increase equivalent to a total of around £700,000 over the 60 year appraisal period.

The pessimistic scenario has a slightly reduced NPV and BCR of £0.7 million and 1.61 respectively, with a similar breakdown of individual benefit streams. As a result the same arguments apply as in the optimistic scenario and the scheme would be likely to be approved on this basis. Although a significant reduction on the optimistic scenario, the option still represents a good economic return on public investment. Similarly to the previous option around £2million of the difference in NPV between the two scenarios can be explained by lower overcrowding benefits in the pessimistic scenario.

In summary opening of the station at Dalcross would in effect act as a highly accessible ground transport link between the regional centre of population and a rapidly expanding airport. The high levels of passenger demand that would be expected from this make a compelling appraisal case when set against the relatively low construction costs in particular. In addition there are a number of potential developments along the corridor that are not yet committed. These developments could generate a significant level of demand and the impact of increased demand in the medium and long term is discussed further in the next chapter.

Table 3.3. TEE Table for Dalcross Station with the Enhanced Service Frequency: Optimistic Scenario.

Sub-objective	Item	Qualitative Information	Quantitative Information	Car	Rail
User Benefits	Travel Time	Rail = Journey Time Savings Car = Decongestion Benefits	£12,576,642	£7,284,568	£5,292,075
	User Charges	Rail = Fares Paid by Users	-£7,423,482	£0	-£7,423,482
	Vehicle Operating Costs	Rail = Saving fuel cost saving from modal switch	£2,796,474	£0	£2,796,474
	Quality / Reliability Benefits	Rail = Reduced on train crowding in peak period	£2,521,426	£0	£2,521,426
Private Sector Operator Impacts	Investment Costs	Zero for this option	£0	£0	£0
	Operating & Maintenance Costs	Rail = OPEX	-£11,755,259	£0	-£11,755,259
	Revenues		£7,423,482		£7,423,482
	Grant/Subsidy payments	Rail = Revenue support for the first three years of operation	£821,162	£0	£821,162
Cost to Public Sector					
Item	Qualitative Information	Quantitative information			
Public Sector Investment Costs	Rail = CAPEX		-£811,748	£0	-£811,748
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments	Rail = Revenue support for the first three years of operation		-£821,162	£0	-£821,162
Revenues			£0	£0	£0
Taxation impacts	Rail = Loss of fuel duty		-£489,383	£0	-£489,383
Safety					
Sub-objective	Item	Qualitative Information	Quantitative Information		
Accidents	Change in Annual Personal Injury Accidents	Rail = from modal switch from car to rail	£909,134	£0	£909,134
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£909,134	£0	£909,134
Monetised Summary					
Present Value of Transport Benefits	£7,869,580				
Present Value of Cost to Government	-£2,122,293				
Net Present Value	£5,747,287				
Benefit-Cost to Government Ratio	3.71				

Table 3.4. TEE Table for Dalcross Station with the Enhanced Service Frequency: Pessimistic Scenario.

Sub-objective	Item	Qualitative Information	Quantitative Information	Car	Rail
User Benefits	Travel Time	Rail = Journey Time Savings Car = Decongestion Benefits	£10,113,919	£5,959,389	£4,154,530
	User Charges	Rail = Fares Paid by Users	-£6,096,512	£0	-£6,096,512
	Vehicle Operating Costs	Rail = Saving fuel cost saving from modal switch	£2,287,751	£0	£2,287,751
	Quality / Reliability Benefits	Rail = Reduced on train crowding in peak period	£547,877	£0	£547,877
Private Sector Operator Impacts	Investment Costs	Zero for this option	£0	£0	£0
	Operating & Maintenance Costs	Rail = OPEX	-£11,755,259	£0	-£11,755,259
	Revenues		£6,096,512		£6,096,512
	Grant/Subsidy payments	Rail = Revenue support for the first three years of operation	£821,162	£0	£821,162
Cost to Public Sector					
Item	Qualitative information	Quantitative information			
Public Sector Investment Costs	Rail = CAPEX		-£811,748	£0	-£811,748
Public Sector Operating & Maintenance Costs			£0	£0	£0
Grant/Subsidy Payments	Rail = Revenue support for the first three years of operation		-£821,162	£0	-£821,162
Revenues			£0	£0	£0
Taxation impacts	Rail = Loss of fuel duty		-£400,356	£0	-£400,356
Safety					
Sub-objective	Item	Qualitative Information	Quantitative Information		
Accidents	Change in Annual Personal Injury Accidents	Rail = from modal switch from car to rail	£743,748	£0	£743,748
	Change in Balance of Severity		£0	£0	£0
	Total Discounted Savings		£743,748	£0	£743,748
Monetised Summary					
Present Value of Transport Benefits	£2,759,198				
Present Value of Cost to Government	-£2,033,267				
Net Present Value	£725,932				
Benefit-Cost to Government Ratio	1.36				

3.5

Impact of Variable Station Costs

Previous experience has suggested that the largest single source of variability in the successful delivery of transport infrastructure improvements is the actual cost of completing the improvements, versus the expected cost at the outset of the project. In order to account for this the capital costs in the economic appraisal have had 25% optimism bias included which is reflective of current government guidelines. In addition a series of sensitivity tests have been conducted in order to understand the maximum level of capital costs at selected Benefit Cost Ratios.

Table 3.5. Sensitivity tests for the cost of Dalcross Station

	High		Low	
BCR	Max station cost with optimism bias	Without optimism bias	Max station cost with optimism bias	Without optimism bias
1	£7,271,687	£6,059,739	£1,704,698	£1,420,581
1.5	£4,363,464	£3,636,220	£685,298	£571,082
2	£2,909,132	£2,424,277	£175,404	£146,170

4 Impact of New Developments

4.1 *Background*

Post 2011 the strategy for the A96 corridor is an ambitious programme of development that if completed would have a projected population growth of between 20,000 and 30,000 over the next 30-50 years. Key to this strategy is the new settlement near Tornagrain which would have a population of over 10,000, and a new residential area and resort at Whiteness with planned housing for up to 3,000 people. In addition to residential developments there is also a potential new business park of over 100,000 square meters close to Inverness Airport.

4.2 *Impact of New Developments on Transport Options*

Since the major developments detailed above are not yet committed, the timescales involved and precise spatial impact are unclear. As a result their effects have not been included in the demand models that have been developed, except to provide an indicative impact on the feasibility of the transport options considered in this study. These likely impacts are detailed below:

Tornagrain. Given the aspiration for a population of 10,000 within 30-50 years and proximity of this site to the proposed station at Dalcross it is likely that the station would have an extremely high level of demand from the development. The increased demand generated by this development would improve further the appraisal case for building a station at Dalcross. Furthermore without the station, the A96 between Inverness and Tornagrain would experience increasing levels of traffic congestion.

The impact of Tornagrain on the enhanced service frequency only option would be minimal as the new development would not be within the catchment of the existing stations.

Whiteness. The mode split model forecast that only a very small proportion of passengers travelling to or from the existing conurbations near the Whiteness site would use the station at Dalcross, as given the geographical location it is faster and less expensive to drive to Inverness and Nairn. As a result it is

unlikely that the development will significantly assist the case for either of the rail options.

Inverness Airport Business Park. Geographically the park would be sufficiently close to Dalcross to provide some additional passenger demand, however the most important factor which will determine whether this happens in practice is where the supply of labour for the park is located. If the workforce is locally based then the majority of people will drive or use the bus, whereas if the majority of the workforce live in Inverness or Nairn then an increase in demand would be expected of a sufficient size to enhance the appraisal case for the option involving the new station.

5 Conclusion

5.1 *Focus of Further Feasibility Work*

This study has provided an initial feasibility assessment of options to enhance the level of rail service provision for the western section A96 transport corridor between Elgin and Inverness. The conclusion of this analysis provides advice on the likely feasibility of these options in particular focussing on a strategy for taking the options forward.

Service Frequency Increase

The level of additional passenger trips forecast as a result of the increased services can be shown to demonstrate sufficient transport benefits to cover the operating costs, in the most optimistic of growth scenarios. Whether or not a positive BCR and NPV is realised is highly dependent on the level of underlying passenger growth that occurs. As a consequence the results of the TEE appraisal could only be used to justify the investment of public funding in the scheme if passenger growth was at least three quarters of the way towards the higher end of the range.

Although sizable the potential new developments at Tornagrain, Whiteness and Inverness Airport Business Park are unlikely to produce a significant additional increase in the number of rail passengers as they are outside the catchment of existing stations on the line. As a consequence the focus of future endeavours to bolster the case for the additional services should be on the wider benefits that may result. These are not normally quantified in the TEE framework and may include wider economic benefits such as improved access to employment markets and key social infrastructure, as well as a contribution towards the strategic spatial objectives for the region. In addition, the introduction to the rail services would provide a positive contribution to the government's objectives for transport, such as environment, accessibility and integration. These impacts have not been assessed as part of this study but should also be considered in any future investment decision. These issues also apply to the station option.

New Rail Station at Dalcross with Park and Ride Provision

The site of the proposed new station is well placed to take advantage of the potentially large demand for ground access to the sizable and rapidly growing Inverness Airport. As a consequence a large number of passenger trips to and from the station are forecast which will produce transport benefits that are well in excess of the modest cost of constructing and operating the station. The TEE appraisal for both the high and low exogenous growth scenarios have demonstrated a Net Present Value and Benefit Cost Ratio that would be sufficient to justify public funding.

As a consequence the appraisal case presented in this paper would be sufficient to justify public investment in the scheme. In addition the potential new developments at Tornagrain and Inverness Airport Business Park would be extremely likely to produce additional passenger numbers that would make the economic case even more robust.

Further feasibility work should be conducted once some or all of the new developments have been committed.

6 Appendix A. Exogenous Growth Projections.

Table A1. Breakdown of Inverness to Aberdeen Line Demand Forecast by Station: Optimistic Scenario.

	Aberdeen	Dyce	Inverurie	Insch	Huntly	Keith	Elgin	Forres	Nairn	Inverness	Far North	Kyle Line	Highland Main Line	Total	% Growth
Base Year	118,070	19,485	6,775	1,444	4,497	28,051	95,281	42,945	39,608	143,958	1,721	272	10,321	512,429	
2005/06	120,678	20,505	7,125	1,514	4,722	28,730	98,556	44,731	41,988	151,725	1,732	274	10,610	532,890	4.0%
2006/07	121,095	21,136	7,330	1,554	4,849	28,982	100,361	45,888	43,540	156,807	1,705	270	10,736	544,253	2.1%
2007/08	123,920	22,254	7,703	1,629	5,087	29,830	104,341	48,077	46,105	165,484	1,712	271	11,100	567,513	4.3%
2008/09	127,121	23,499	8,119	1,713	5,352	30,785	108,805	50,525	48,971	175,173	1,724	273	11,510	593,569	4.6%
2009/10	130,572	24,840	8,566	1,803	5,636	31,813	113,624	53,164	52,083	185,671	1,738	275	11,947	621,731	4.7%
2010/11	133,967	26,189	9,006	1,891	5,912	32,884	118,658	55,945	54,556	196,132	1,751	277	12,346	649,513	4.5%
2011/12	136,648	27,292	9,339	1,961	6,147	33,863	122,939	58,149	56,301	203,424	1,760	279	12,742	670,843	3.3%
2012/13	138,926	28,375	9,673	2,032	6,384	34,631	126,530	59,988	58,089	210,358	1,768	280	13,049	690,083	2.9%
2013/14	141,254	29,502	10,019	2,105	6,631	35,423	130,249	61,892	59,941	217,543	1,776	282	13,365	709,981	2.9%
2014/15	143,636	30,674	10,379	2,180	6,887	36,241	134,103	63,863	61,858	224,987	1,785	283	13,688	730,562	2.9%
2015/16	146,071	31,893	10,751	2,258	7,147	37,082	137,991	65,904	63,844	232,701	1,794	285	14,019	748,415	2.4%
2016/17	148,476	33,033	11,120	2,337	7,412	37,955	141,926	67,953	65,782	239,967	1,805	286	14,358	769,177	2.8%
2017/18	150,935	34,214	11,503	2,417	7,692	38,876	146,911	70,070	67,784	247,480	1,817	288	14,706	790,618	2.8%
2018/19	153,450	35,438	11,898	2,501	8,000	39,847	152,958	72,259	69,852	255,250	1,829	290	15,063	812,761	2.8%
2019/20	156,023	36,707	12,308	2,588	8,327	40,876	159,067	74,523	71,987	263,286	1,841	292	15,428	835,630	2.8%
15 Year % Growth	32%	88%	82%	79%	46%	45%	61%	74%	82%	83%	7%	7%	49%		63.1%

Table A2. Breakdown of Inverness to Aberdeen Line Demand Forecast by Station: Pessimistic Scenario.

	Aberdeen	Dyce	Inverurie	Insch	Huntly	Keith	Elgin	Forres	Nairn	Inverness	Far North	Kyle Line	Highland Main Line	Total	% Growth
Base Year	118,070	19,485	6,775	1,444	4,497	28,051	95,281	42,945	39,608	143,958	1,721	272	10,321	512,429	
2005/06	119,184	20,145	6,999	1,491	4,653	28,427	97,332	44,051	40,783	148,609	1,726	273	10,516	524,192	2.3%
2006/07	117,659	20,340	7,063	1,504	4,702	28,165	97,178	44,143	41,026	149,898	1,693	268	10,462	524,100	0.0%
2007/08	118,479	20,986	7,283	1,550	4,855	28,477	99,076	45,192	42,163	154,440	1,693	268	10,638	535,100	2.1%
2008/09	119,592	21,716	7,531	1,602	5,028	28,867	101,299	46,404	43,459	159,584	1,698	269	10,848	547,895	2.4%
2009/10	120,861	22,494	7,796	1,657	5,211	29,298	103,701	47,702	44,846	165,088	1,705	270	11,074	561,702	2.5%
2010/11	122,379	23,312	8,080	1,716	5,299	29,619	106,002	49,060	46,298	170,904	1,715	272	11,305	575,961	2.5%
2011/12	123,480	24,002	8,310	1,766	5,472	30,024	108,129	50,111	47,412	175,182	1,721	273	11,525	587,408	2.0%
2012/13	124,835	24,747	8,553	1,819	5,654	30,553	110,714	51,397	48,638	179,921	1,729	274	11,803	600,637	2.3%
2013/14	125,986	25,479	8,797	1,873	5,839	30,981	112,968	52,507	49,816	184,454	1,736	275	12,033	612,744	2.0%
2014/15	127,163	26,234	9,048	1,927	6,029	31,419	115,285	53,646	51,026	189,116	1,744	276	12,267	625,181	2.0%
2015/16	128,366	27,011	9,307	1,984	6,226	31,868	117,666	54,814	52,270	193,910	1,751	278	12,507	637,958	2.0%
2016/17	128,983	27,663	9,529	2,032	6,382	32,096	119,240	55,791	53,351	197,798	1,762	279	12,751	647,656	1.5%
2017/18	129,563	28,307	9,753	2,080	6,541	32,328	120,833	56,773	54,511	201,667	1,773	281	13,006	657,417	1.5%
2018/19	130,386	29,004	9,987	2,131	6,708	32,689	122,909	58,011	55,711	205,961	1,785	283	13,321	668,886	1.7%
2019/20	131,229	29,717	10,228	2,184	6,879	33,059	125,036	59,279	56,939	210,361	1,797	285	13,644	680,637	1.8%
15 Year % Growth	11%	53%	51%	51%	53%	18%	31%	38%	44%	46%	4%	5%	32%		32.8%

Source: Ongoing Highlands and Islands Enterprise Rail Traffic Growth Study.