Appendix H: First Edinburgh, faster journey times (Option 16)

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DATE:	24th March, 2016
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1 Background

1.1 Disclaimer

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1.2 Purpose of this appendix

Having reviewed the evidence presented prior to and during the Rail Industry Hearing on 4th March 2016, ORR has requested that CH2M undertake some further analysis of the application for track access submitted by FirstGroup (First). This takes the form of an additional option, option 16, that has journey times comparable with that of the equivalent VTEC fast services. ORR has requested this test on the basis that may have more realistic journey times than those set out in the First application. This appendix, which is an addendum to our final report dated 15th January 2016, presents this additional analysis.

All assumptions and methodology in this report relate specifically to the further analysis requested by ORR. All assumptions and methodology not covered in this appendix are the same as those presented in our January report.

The remainder of this appendix is structured as follows:

- **Section 2** summarises the key assumptions made in the analysis

- **Section 3** presents our revenue projections

- **Section 4** presents our economic appraisal

2 Key assumptions

ORR has requested that an additional option is tested on the basis of some specific modelling assumptions.

2.1 Base timetable

The base timetable for this additional option is the VTEC full timetable, which is option 8 in our January report. Details of this timetable have been shared previously with stakeholders, including the relevant MOIRA spg files.

2.2 Journey times

In this option First's London – Edinburgh services achieve comparable journey times to VTEC's fast hourly London – Edinburgh service operated by class 800/801 trains, once stopping patterns are accounted for.

Typical weekday journey times for First's services are shown below in table 1. The MOIRA spg files for this option covering Weekdays, Saturdays and Sundays have been issued to applicants and to DfT along with this note.

In producing this base timetable we tested whether the change in journeys and revenue forecast using MOIRA were sensitive to the order that First services and VTEC's limited stop services depart London King's Cross and Edinburgh Waverley, and also to the length of the assumed journey time penalty associated with station calls.

In using MOIRA to test these particular sensitivities we note the potential to overstate the swing in revenue between the operators as a substantial proportion of passengers are likely to travel using operator-specific tickets. However, we view MOIRA as a useful sense-check to any obviously large sensitivities to timetabling assumptions.

On the basis of the MOIRA analysis conducted there appeared to be little sensitivity to these issues, with the maximum potential change in generated and abstracted revenue estimated to be substantially lower than £1m per annum.

Table 1. Indicative weekday northbound journey times, additional First option

	King's Cross - Edinburgh
First service, **calling Stevenage, Newcastle, Morpeth**	4 hrs 5
First service, **calling Newcastle and Morpeth**	4 hrs 2
VTEC service, **calling York and Newcastle**	4 hrs 2
VTEC service, calling Newcastle only	3 hrs 59

2.3 In scope demand

On the basis of discussions with ORR and Systra, we have excluded journeys using certain ticket types from our demand and revenue analysis, as explained below:

- All first class journeys and revenue are excluded. This is because First intends to offer only standard class accommodation on its proposed services.
- Standard class full fare journeys and revenue purchased on the day of travel are excluded. This is because although First would accept passengers who travel without a seat reservation, in practice there would be limited space available for these passengers, given our assessment of First's load factors for the options tested previously. We have therefore excluded full fare journeys and revenue purchased on the day of travel, as passengers with these tickets are unlikely to have a seat reservation. Based on the same National Passenger Survey dataset used elsewhere in our analysis, we estimate that around 79% of full fare tickets are purchased on the day of travel, although this is very small proportion of estimated revenue and journeys for First's services.

The above journeys and revenue were excluded from our revenue projections, by removing proportions of journeys and revenue from the output of our MOIRA analysis. These proportions were estimated using the same Lennon dataset used elsewhere in our analysis.

Table 2 below shows ORR the proportion of total journeys and revenue removed using this approach. This data is commercially sensitive and has therefore been redacted from the version of this appendix issued to stakeholders.

Table 2. Proportion of total journeys and revenue removed from our assessment

	Excluded as a percentage of total journeys	Excluded as a percentage of total revenue
All first class	[REDACTED]	[REDACTED]
Full fare standard class purchased on the day of travel	[REDACTED]	[REDACTED]
Total exclusions	[REDACTED]	[REDACTED]

2.4 Fares modelling

Under the approach presented in our January report we examined estimated train loads produced by the crowding model. If these loads were higher than a level that is likely to be manageable in the longer term we increased fares to reduce passenger numbers. Fares were increased on this basis in option 15.

Previously this adjustment was applied subsequently to the crowding model analysis. In our analysis of option 16 we have applied the adjustment prior to the crowding model analysis. This is because train loads are likely to be unmanageably high given the combination of the timetable modelled and First's proposed fares. We therefore assume that First would realise this, and would seek to offer fares from the outset that would result in manageable train loads.

In setting the initial fare we aimed to constrain the number of journeys made using FirstGroup operator-specific tickets to the equivalent of an approximate 60% average train load. Specifically, 60% of seats occupied at the busiest point on each train's journey. We selected a factor of 60% as we understand that

this is a load factor typically experienced by long distance GB rail operators. The calculated load factor at this stage of the modelling is an initial estimate calculated before the crowding model assessment and before the calculation of a competitive fares response from VTEC.

2.5 Competitive fares response

The analysis presented in our January paper includes an estimated reduction in VTEC's average London – Edinburgh and London – Newcastle fares, in response to the discounted fares offered by First. We modelled two scenarios to provide ORR with a range of the potential impact on the revenue projections and economic appraisal. Both approaches estimated the competitive response as a function of the estimated number of empty seats on VTEC's London – Newcastle – Edinburgh services which operate immediately before or after services operated by First.

Our January report flagged this modelling as a potential uncertainty, stating that the approach relied on our own assumptions, and that other legitimate modelling approaches may be available. Our report also highlighted that the fares data supplied to us by VTEC was limited.

Having reviewed stakeholders' responses, and having listened in particular to VTEC's testimony during the 4th March rail industry hearing, we believe there is better evidence to support the modelling of VTEC's competitive response than was available previously. Having discussed the key issues with ORR and with ORR's auditors Systra, we now believe that the most appropriate method to assess the competitive response for this particular option is to assume that VTEC would offer a number of additional fares at the price offered by First, equivalent to the difference in the number of empty seats before and after the introduction of First's services. This method for calculating the new average fare that VTEC would offer is:

New VTEC average fare = ((First Group fare x change in empty seats) + ((option journeys – change in empty seats) x existing fare)) / (option journeys)

Where:
- Change in empty seats is the estimated number of additional empty seats on London – Newcastle – Edinburgh services following the introduction of First's services.
- Option journeys is the forecast daily number of journeys made on VTEC's services, prior to the calculation of the competitive response. This is taken from the crowding model, to be consistent with the measure of empty seats.
- Existing fare is the modelled VTEC average fare prior to the calculation of the competitive response.

To be clear, this is a method of calculating the new average fare that VTEC would offer and not the implied average fare following the modelled demand response to these fares. As with the methods described in our January paper, this is an area where PDFH[1] does not offer advice and other legitimate methods for calculating the size of the response may be available.

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[1] Passenger Demand Forecasting Handbook (version 5.1).

2.5 PDFH fares spread parameter

ORR asked us to compare the value of the spread parameter from our fares modelling which is taken from PDFH5.1 section B11.4, with the values estimated by Leigh Fisher in its recent study for ORR. This is to understand any potential impacts of varying this parameter value.

Using Leigh Fisher's reported values by distance and ticket type, we estimate that the weighted average spread parameter for the flows affected by First's proposed services is 0.0407. This is very close the PDFH value of 0.04 used in our analysis.

Given the closeness of these values, ORR has not asked us to test the impact of varying this parameter in the context of First's application.

2.6 Economic appraisal of overcrowding impacts

Following discussions with ORR and with Systra we have calculated the impact of the PDFH crowding penalties associated with estimated train loads for First services in terms of the value of time dis-benefit to passengers travelling with First. The dis-benefit is included in the economic appraisal of option 16.

We have taken this approach because the estimated train load factors for First are significantly higher than for other options relating to the other applicants, and at a level where PDFH indicates crowding penalties would apply.

The approach taken to model this impact was recommended to us by Systra. Systra also made a similar recommendation in its January 26th audit report.

Section 3.3 of this appendix shows the estimated crowding penalty.

3 Revenue projections

3.1 Introduction

This section presents our revenue projections for the additional option tested. In comparing these results with the results from our January report it is useful to consider the changes to the modelling assumptions described above.

3.2 Overall revenue projections

Table 3 below provides the split of generated and abstracted revenue for the top 10 revenue earning (two-way) flows for First, as well as total estimated revenue generation and abstraction. The top 10 flows are largely the same as those for the First options presented in our January report, although the ordering of some of the lower ranked named flows has changed.

Figure 1 below provides total forecast generated and abstracted split by source of revenue. In this figure we present fares and air as a single source of revenue, as abstraction from air travel in this option is a result of a reduction in fares and not of an improvement in journey times.

The projected level of abstracted revenue is circa £4m greater in absolute terms to the figures presented for option 15 in our January report, which is the option with the closest journey times to those in the new analysis. Whilst all of the new modelling assumptions affect our projections, the main reasons for this increased estimated revenue abstraction is the faster journey times assigned to First's services than modelled previously, and the change in approach to modelling VTEC's fares response. Exclusion of a proportion of base journeys and revenue from our analysis offsets some of the increase in estimated revenue abstraction (see section 2.3).
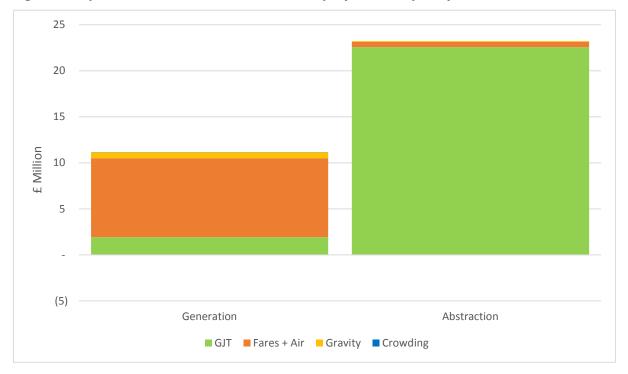
The projected level of generated revenue is £4m lower in absolute terms than the figure for option 15 presented in our January report. This is largely because we have excluded a proportion of base journeys and revenue from our analysis (see section 2.3 also).

The ratio of generated revenue to abstracted revenue is lower than the figures shown in our January paper, although substantially exceeds ORR's threshold ratio of 0.30.

Table 3: Option 16, annual revenue projections, top 10 flows by total revenue (£000)

Rank	Flow	Total revenue to First	Total abstracted revenue	Generated revenue (whole industry)	(Generation)/ (Total Abstraction)
1	Edinburgh - Total London	£14,672	£8,671	£6,001	0.69
2	Newcastle - Total London	£9,988	£8,021	£1,967	0.25
3	Morpeth - Total London	£1,668	£620	£1,048	1.69
4	Edinburgh - Newcastle	£1,072	£921	£151	0.16
5	Stirling - Total London	£764	£356	£408	1.15
6	Dundee - Total London	£635	£389	£246	0.63
7	Sunderland - Total London	£497	£261	£236	0.90
8	Inverness - Total London	£429	£271	£158	0.58
9	Edinburgh - Stevenage	£275	£122	£153	1.25
10	Newcastle - Stevenage	£270	£185	£85	0.46
Sub-total (top 10)		**£30,270**	**£19,817**	**£10,453**	**0.53**
Total (all flows)		**£34,376**	**£23,223**	**£11,152**	**0.48**

Figure 1: Option 16, total annual revenue and projections, split by source

3.3 Analysis of First's fares and train loads

Our crowding assessment indicates that train loads would be unsustainably high on a long term basis at First's proposed fares levels under option 16.

We estimate that train loads would be manageable if the discount offered by First was around 75% of the level proposed in its application to ORR. We have therefore adjusted the fares for First used in our assessment, with modelled fares for First around 60%-70% of the price currently offered by VTEC.

We estimate that VTEC's competitive response would be equivalent to an approximate one percent decrease in VTEC's average London – Edinburgh and London – Newcastle fares for all journeys.

Our crowding model assessment is undertaken prior to the calculation of the competitive fares response. This is a modelling simplification, and First's train loads may be slightly overstated by our crowding model. We have therefore applied a high-level correction to this potential overstatement.

Following this adjustment we estimate that First's average train load at the critical load point for each train would be the equivalent of 71 passengers for every 100 seats (71%).

Whist this average load factor is high compared to current long distance operators, most journeys would be made using Advance fares (with pre-booked seats), which would provide a significant opportunity to manage train loads via the number of Advance fares made available for each train.

We therefore estimate that a small amount of demand would be crowded off, resulting in a minor reduction in First's revenue. Despite the dominance of Advance fares, we do not believe that a material further increase in demand could be accommodated, and therefore in our economic appraisal assume zero journey and revenue growth from 2020 onwards.

Based on our calculated train load factors we estimate that the PDFH crowding penalty would be the equivalent of approximately a 3.2 minute increased journey on average for passengers travelling on First's services. This penalty has been subtracted from the sum of user benefits shown in our economic appraisal.

4 Economic appraisal results

4.1 Introduction

This section presents our economic appraisal results for the additional option tested. In comparing these results with the results from our January paper it is useful to consider the changes to the modelling assumptions described above.

4.2 Economic appraisal results

Table 4 below presents a summary of the appraisal results for option 16.

This option has a significant positive Net Present Value (NPV), albeit at a lower level than those shown for First options in our January report. One key reason for this reduction is the exclusion of a proportion of base journeys and revenue. This means that the benefit of the option, for example in terms of journey time improvements and fares reductions, is applied to a smaller number of passengers than if the whole base market were included.

The reduced size of the modelled competitive fares response from VTEC also reduces overall benefits, as does the crowding penalty applied as a result of First's high train loads.

Table 4: Economic appraisal results

Impact category	(£m 2010)
User benefits	£77.0
Non-user benefits	£68.2
Other Govt impacts	-£20.5
Revenue (GB rail total)	£84.9
Operating Costs	-£125.7
NPV	£83.9
NPV excluding operating costs	£209.6
NPV per train path	**£8.4**
NPV excluding operating costs per train path	**£21.0**

Appendix I: Virgin Trains East Coast's proposed Middlesbrough service (Option 6): revenue projections and economic appraisal excluding the crowding model assessment

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1 Background

1.1 Disclaimer

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1.2 Purpose of this appendix and background

Having reviewed the evidence presented prior to and during the Rail Industry Hearing on 4th March 2016, ORR has requested that CH2M removes the impact of the crowding model from the revenue projections and economic appraisal produced for Virgin Trains East Coast's (VTEC) proposed London – Middlesbrough service (option 6). This appendix, which is an addendum to our report dated 15th January 2015, presents the revised results.

Our January report shows that some of the forecast revenue increase for option 6 is offset by net increases in crowding. Although the associated reduction in revenue due to crowding is small compared to VTEC's overall revenue, it is more significant when compared to the revenue projection for option 6. Crowding impacts also affected the calculation of monetised benefits in the economic appraisal, although the net impact on user and non-user benefits was more marginal.

Whilst our modelling indicated crowding relief on some flows and journey legs, our analysis indicated some overcrowding, particularly between London and York. We believe that this overcrowding is a result of changes to the stopping pattern of services in the base timetable which form part of the option 6 timetable.

Our terms of reference from ORR do not include timetable optimisation. In our January report we offer the following advice to ORR regarding the potential impact of not considering how timetables may be optimised:

"Whilst timetable changes typically result in both revenue increases and decreases at a flow level, in reality there would be an attempt to optimise the network benefits of significant timetable changes. Our assessment is therefore unlikely to capture these impacts fully.

Whilst this is true of all the options considered, it is most likely to affect some of the VTEC options which are significant changes to the current timetable."

Having reviewed VTEC's written response to ORR regarding our January report, we have reflected further on this advice to ORR, and now believe that in practice VTEC would address the projected overcrowding through timetable changes and/or reallocation of its fleet diagrams.

We therefore believe that it is reasonable to present updated revenue projections and economic appraisal for option 6, exclusive of the impact of the crowding model.

All assumptions and methodology for option 6 are the same as those presented in our January report, except that the impact of the crowding model has been removed.

The remainder of this appendix is structured as follows:

- **Section 2** presents our revenue projections

- **Section 3** presents our economic appraisal

2 Revenue projections

2.1 Overall revenue projections

Table 1 below shows annual projected generated and abstracted and total revenue, for option 6. Figure 1 shows total revenue split by source.

The ratio of generated revenue to abstracted revenue is higher than shown in our January report, as revenue suppression from the crowding model assessment has been excluded.

Projected levels of generated revenue are also higher in absolute terms than the figures presented in our January report.

The flow with the largest increase in revenue is Middlesbrough – London. Our previous assessment suggested high loads on VTEC's London – Middlesbrough service, particularly between London and York. This resulted in lost revenue to/from locations north of York. Removal of the impact of the crowding model assessment excludes this lost revenue.

Levels of abstracted revenue at Eaglescliffe have also increased significantly with the removal of revenue suppression due to crowding on VTEC's London – Middlesbrough service.
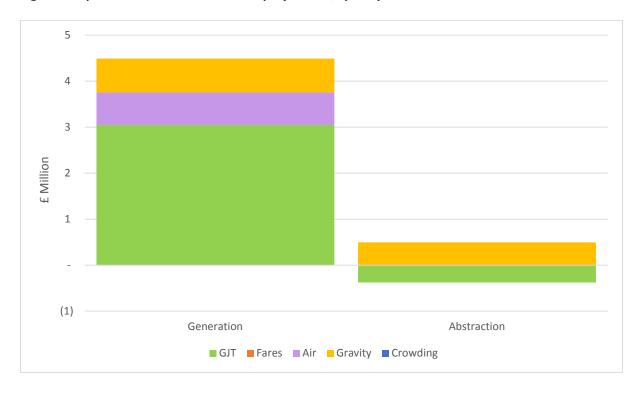
Table 1: Option 6 annual revenue projections, top 10 flows by total VTEC revenue, top 10 flows by lost industry revenue (£000)

Rank	Flow	Total VTEC revenue increase	Total abstracted revenue	Generated revenue (whole industry)	(Generation)/ (Total Abstraction)
1	Middlesbrough - Total London	£2,100	£277	£1,824	6.58
2	Edinburgh - Total London	£755	£1	£754	620.33
3	Newcastle - Total London	£733	£65	£668	10.28
4	Newark N Gate - Total London	£503	£0	£503	n/a
5	Northallerton - Total London	£456	£241	£215	0.89
6	Stevenage - Total London	£292	£3	£288	92.23
7	Grantham - Total London	£278	£9	£269	28.95
8	Middlesbrough - York	£254	£201	£53	0.26
9	Lincoln Central - Total London	£223	£143	£80	0.56
10	Darlington - Total London	£172	£49	£123	2.52
	Sub-total (top 10 VTEC increases)	£5,765	£989	£4,776	4.83
1	Eaglescliffe - Total London	£104	£599	-£495	n/a**
2	Edinburgh - York	-£790	n/a**	-£294	n/a**
3	Newcastle - York	-£594	n/a**	-£187	n/a**
4	Total London - York	£138	n/a**	-£73	n/a**
5	Grantham - Peterborough	-£109	n/a**	-£42	n/a**

6	Newcastle - Peterborough	-£25	n/a**	-£25	n/a**
7	Newcastle - Northallerton	-£124	n/a**	-£22	n/a**
8	Northallerton - Stevenage	-£23	n/a**	-£20	n/a**
9	Edinburgh - Newcastle	-£207	n/a**	-£18	n/a**
10	Newark N Gate - Peterborough	-£18	n/a**	-£17	n/a**
Sub-total (top 10 industry decreases)		-£1,648	n/a**	-£1,191	n/a**
Total (all flows)		**£4,607**	**£118**	**£4,489**	**38.02**

** Significant transfer of revenue from VTEC to other TOCs as a result of changes to stopping patterns at Peterborough and York in particular. Revenue abstraction (VTEC increase minus generation) is not reported at a flow level when industry generation is negative.

Figure 1: Option 6 total annual revenue projections, split by source

3 Economic appraisal results

3.1 Economic appraisal results

Table 2 below presents a summary of the appraisal results.

The NPV has improved significantly from the value published in our January paper. This is driven by the removal of lost revenue and demand from the crowding model assessment.

Total user benefits are the same to one decimal place as shown in our January report. This is because the impact of the crowding model assessment on this category of benefit was neutral.

Table 2: Economic appraisal results

Impact category	(£m 2010)
User benefits	£17.0
Non-user benefits	£11.2
Other Govt impacts	-£5.9
Revenue (GB rail total)	£37.8
Operating Costs	-£56.9
NPV	**£3.3**
NPV excluding operating costs	**£60.2**
NPV per train path	**£0.3**
NPV excluding operating costs per train path	**£4.6**