Virgin Trains East Coast

8th February 2016

John Larkinson
Director, Economic Regulation
Office of Rail and Road
One Kemble Street
London
WC2B 4AN

Dear John,

Thank you for the opportunity to review and comment on the CH2M Hill Report "Assessment of Applications for Track Access on the East Coast Main line: Phase 2 Final Report" (the CH2M Report) and the "Systra Revenue and Demand Modelling Audit" (the Systra Report) carried out on the CH2M Hill analysis.

Having now reviewed the content of both reports, this letter highlights our position on some of the assumptions made and conclusions drawn.

The ORR should consider all available evidence in its final decision

As we have emphasised, it is incumbent on the ORR, as a responsible public body and decision-maker, to consider all available evidence before reaching any decision.

We welcome the iterative approach that has been set up between Systra and CH2M. However, two further reports have been issued that should be appraised in more detail within the final Systra report:

- Leigh Fisher "Evidence of Revenue Generation and Abstraction from Historical Open Access Entry and Expansion" (7th January 2016 – the LeighFisher Report) – the report provides a vital analysis of the current performance of Open Access and hard evidence about generation and abstraction. It provides assessment of revenue generated through improvements to journey times, railheading and fares. We submit that this report should provide the backbone to any assessment of applications going forward.

- "SDG Economic Appraisal of ECML Track Access Applications" (December 2015 – the SDG Report)– the Systra report states that they have "briefly reviewed the report" but given that there are some differences in methodology there should be more investigation of the relative merits of each. Given that the results of both reports vary considerably in aspects which are highly relevant to ORR's decision on future access rights, our position is that until these differences are clearly understood, the ORR cannot confidently make any decision. The SDG Report is the only fully Webtag compliant analysis of the options and therefore it should receive as much, if not more,

consideration from the ORR during this process. We suggest that Systra carry out a full review of the SDG Report and compare and contrast the results with the CH2M Hill Report. Any decision taken without understanding these differences would be irrational and unsafe.

We still have serious concerns about the methodology adopted by CH2M Hill

We continue to have serious concerns over a number of the methods and assumptions adopted in the assessment, as detailed in our letter of 12 November. In some cases the methodology seems to have regressed from that applied previously. We have set out the extensive evidence and analysis which underpins these concerns in our attached CH2M Hill and Systra Response report (the VTEC Report).

Before I detail our key technical areas of concern, it is relevant and important to understand CH2M's projections in the context of actual historic results achieved by open access operation. The recent LeighFisher Report concluded that the generation abstraction ratio of existing open access operations ranged between 0.22 and 0.46 – the midpoint being just over 0.3. The majority of the assessment projections provided in the CH2M Report envisage outcomes in which the claimed ratio is far outside this range. Therefore the modelling needs to be very robust, backed up with supplementary evidence of its validity, or at least credible reasoning that shows how such unprecedented results might come about.

CH2M Hill admit that their assessment "...has been an extremely challenging exercise, stretching both the frontiers of current passenger demand forecasting research, and the limits of the data available to us." We believe that the approach taken is incorrect in various areas, including most significantly the approach to the calculation of generation and abstraction from fares. The CH2M Report fails to provide the robust evidence required to demonstrate that these new applications will achieve the generation claimed. Indeed, the analysis attached in our VTEC Report demonstrates that, once flaws in the CH2M Report are corrected, the expected generation / abstraction ratios for these new applications are generally below the 0.3 threshold, meaning that they do not pass the ORR's 'Not Primarily Abstractive' (NPA) test.

One of the biggest differences between this evaluation, and the ORR's evaluation of previous open access applications, is the incorporation of a competitive fares response by the established operator. As far as we are aware, this data has never been considered before by the ORR in previous track access applications. Furthermore the ORR's published Criteria and Procedures for Track Access Applications include a detailed description of the five stage 'not primarily abstractive' test which makes reference (in stage 5) to potential downstream pricing action by the incoming operator, but makes no reference to considering such action by the incumbent. The 0.3 'threshold' for the NPA test is a longstanding but ultimately arbitrary cut-off which has been developed and hitherto applied to analysis which takes no account of possible competitive responses. To start considering the competitive behaviour of the incumbent alters the interpretation of the resulting ratio and therefore throws into doubt the continued validity of the 0.3 threshold. Moreover, the LeighFisher Report stated "we could not find conclusive evidence of lower yields on flows with competition", so to consider such action now would be doubly wrong and irrational - it has not been historically proven, and it is not envisaged in the established Criteria and Procedures for reviewing track access applications.

Not only do we question the principle of making such pricing assumptions, but we believe that the CH2M Hill fares modelling has seriously over-estimated the elasticities of demand to reduction in fares, giving implied elasticities of demand to fare of around -2 whereas the accepted value is around -1. This makes a dramatic difference to the NPA test results (see section 1 of the VTEC Report). We also believe that CH2M Hill have applied a gravity model where it is not appropriate, contrary to PDFH guidance. Moreover, even where it is appropriate, the particular model used appears to give flawed results. We commissioned LeighFisher to carry out an assessment of the demand, revenue generation and revenue abstraction for East Leeds parkway if served by Alliance London services. LeighFisher have deployed their station parkway and railheading model in this assessment. We understand that this railheading methodology and modelling is consistent with that deployed for ORR in reviewing historic open access entry and expansion. The results from this model accord quite closely to the CH2M Report's estimate of total rail demand, but show that the majority of it is abstracted from existing East Coast services at alternative stations (see section 4 of the VTEC Report).

The impact on performance and capacity needs to be given more weight and consideration by the ORR

The CH2M Report ignores the impact on train punctuality of the options assessed. The report acknowledges that "ORR would need to consider separately the performance impact" (section 4.8.1). VTEC remain firmly of the view that further detailed performance analysis is essential for ORR to make a properly informed and reliable decision on the applications. Moreover, as the service level approaches capacity, the timetable of a route is compromised to fit in extra services. These compromises were built into VTEC's bid, but the other applications, which seek to build on VTEC's full bid timetable, have not considered these compromises. We think this will inevitably affect stopping patterns and/ or journey times for some or all of the operators on the route. Again, in the absence of workable timetables (which both First Group and Alliance have failed to deliver), an allowance for this needs to be included in the economic appraisal. This has been highlighted several times by VTEC, most recently in our letter of 24th November. Where the deliverability of aspects of the options are critically dependent on infrastructure enhancement, or a new parkway station, we would expect sensitivity tests to be completed to show the impact were such enhancements to be delivered significantly later than the timing envisaged by the applicants.

Treatment of IEP costs

We note that ORR have instructed CH2M to assume that all costs associated with procuring and maintaining rolling stock for each option are incremental. While this is true for the open access applications and for VTEC's maintenance costs, the procurement costs for IEP are already contracted, and VTEC will have to pay for the fleet whether or not they are used. Should our application for access rights not be successful, it is not practical to move part of the fleet to another operator because no suitable operator exists and there would be significant costs associated with new maintenance facilities which are bespoke to IEP (Agility are currently investing £125m in these facilities). Therefore, the fleet would have to be used sub-optimally on East Coast services or laid up.

The applications need further scrutiny

The recent applications are very different to previous applications, as they focus on attacking the existing franchise core markets. Neither the Edinburgh applications nor the West

Yorkshire part of the Alliance Yorkshire/ Lincolnshire application have the 'new markets' benefit of previous OA entrants (and our Middlesbrough, Harrogate, Bradford and Lincoln proposals). As such these applications deserve less weight in accordance with paragraph 4.37 of ORR's 'Criteria and Procedures for Track Access Applications' ("We recognise that in some cases it may be appropriate to give additional weighting to certain factors such as: (a) the benefits of providing completely new services as against an increase in the frequency of existing services. This is likely to be particularly important where certain passenger markets have particularly poor services").

Overall, the way the applications are presented appears to risk subverting the intention of the ORR procedure by predicating unrealistic timetables and, in the case of First Group, unrealistic fares and load factor assumptions, designed to enable the applications to score well on ORR's tests. We remain concerned that the ORR and CH2M Hill have not been sufficiently rigorous in examining and addressing this risk. When considered alongside the various modelling risks/uncertainties which we have shown mainly to favour the open access applicants; we would urge the ORR to be alive to this overall bias in the CH2M Hill estimates.

That said, we were pleased to see that CH2M Hill evaluated our full timetable as option 8. This confirmed our earlier statement (at the June hearing) that our full timetable was worth more than the sum of its parts, and that it will deliver huge net economic benefits of £379.6m over 10 years, probably the largest of the feasible options once infrastructure costs are taken into account.

Given the very serious nature of our concerns we request a meeting with CH2M Hill and ORR to explain fully the issues in our attached VTEC Report. We submit that this is the fair and proper course for the ORR to adopt. This meeting should be before the industry hearing on 4th March because many of these technical modelling issues are not suitable for discussion in such a large meeting.

In the circumstances, we must continue to keep all our rights reserved.

Yours sincerely

Andy Sparkes
Business Development Director

**VTEC report on the CH2M Report and the Systra Report**

This report summarises VTEC's review of both the CH2M Report "Assessment of Applications for Track Access on the East Coast Main line: Phase 2 Final report" (dated 15th January 2016)and the "Systra Revenue and Demand Modelling Audit" (dated 26th January 2016). This is broken down into the following sections:

1.   Fares elasticities, fares modelling and fares assumptions;
2.   Air competition – journey times and fares
3.   Our concerns regarding the CH2M gravity model
4.   East Leeds Parkway assessment
5.   Unrealistic assessment of the prospects for FirstGroup's assumed 0530 King's Cross departure.
6.   Concerns regarding timetabling assumptions and scenarios
7.   Underestimation of Middlesbrough services and associated additional capacity benefits
8.   CH2M Hill analysis fails to bring out the full benefit of the VTEC Full proposal
9.   Absence of realistic build-up of demand to full fruition
10. Performance and deliverability
11. Requested actions in response to the Systra Report

Indicative impact of the issues discussed in this letter on the NPA ratios

Taking all of the issues discussed in this report together makes a dramatic difference to the assessment of the open access proposals. We have undertaken an indicative estimate of what the impact on the Net Primarily Abstractive (NPA) ratios would be if the above issues were resolved. The waterfall charts below show the relative impacts of each issue and show a significantly reduced NPA ratio (ratio of newly generated revenue to abstracted revenue), certainly well below the ORR's criteria of 0.3. Appendix F explains the calculation of these charts. Each element of the waterfall charts is described in the body of this report in some cases supported with further evidence in technical appendices.

First Group Edinburgh
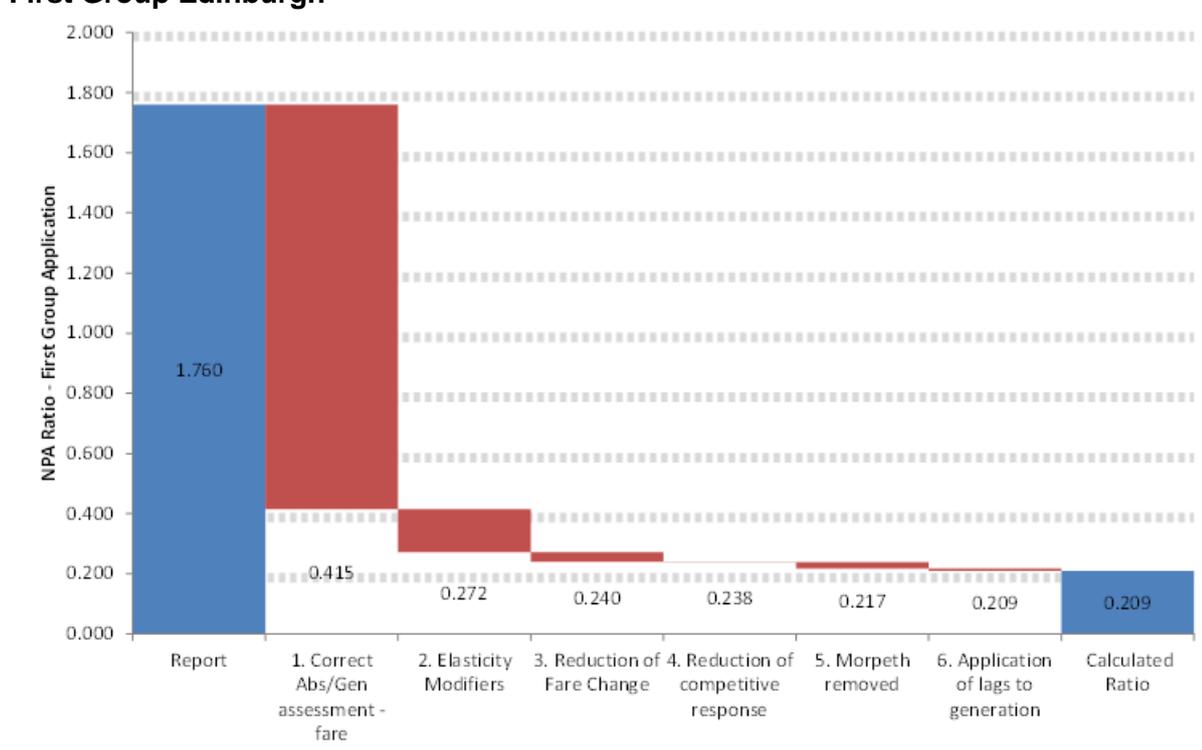
Alliance West Yorkshire/Cleethorpes
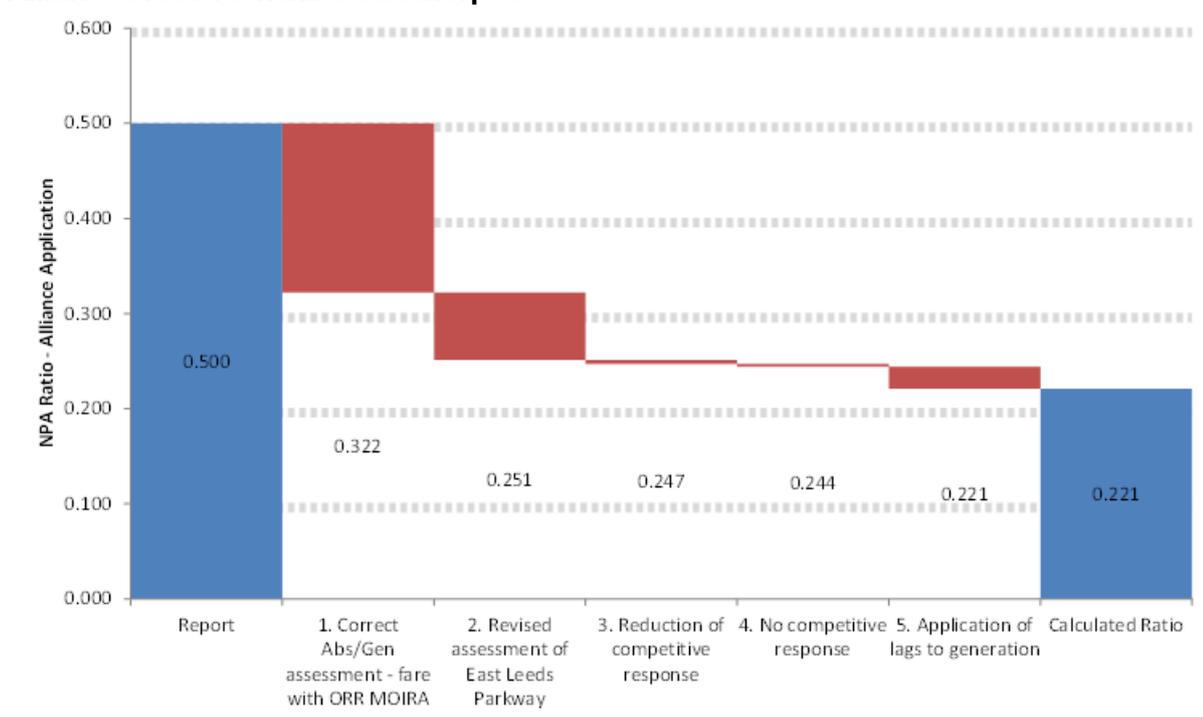
1.   Fares elasticities, fares modelling and fares assumptions

Without associated revenue generation from their fares proposal, the FirstGroup Edinburgh service does not come close to passing the NPA test. We find it baffling that ORR would consider approving track access rights on the basis of a fares strategy. FirstGroup have spotted an opportunity to stretch the limits of PDFH and risk subverting the intention of the ORR procedures to enable them go head to head with VTEC. In reality, we consider this proposed service to be highly abstractive of franchise revenue and would set a dangerous precedent going forward.

1.1.   Incorrect calculation of the NPA ratio including negative abstraction

Our analysis indicates that the treatment of fares in calculating the NPA ratios is wrong, and is inconsistent with the methodology detailed in Appendix C of the CH2M Report. We cannot understand why there would be net negative abstraction due to fares from any of the applications. This incorrect treatment leads to grossly overestimated NPA ratios. The CH2M Report's analysis of the sensitivity test results given for Option 1 (Alliance West Yorkshire and North Lincolnshire application) which implies an implausibly high overall rail fares elasticity of -2.15 for the Leeds – London market. This suggests an error has been made in the modelling.

Action: CH2M to amend fares modelling to reduce sensitivity to fare in line with PDFH

1.2.   Fares modelling of such applications is complex and breaches the limits of PDFH elasticities

PDFH elasticities have been estimated based on relatively small changes in fares. To then apply these elasticities and approaches to changes in fare greater than 10% is wrong. With fare changes of up to 50% being proposed we strongly suggest that there is too much uncertainty around the results to be able to approve the rights simply on this basis.

We note the findings in section 5.2 of the recent LeighFisher Report (7th January 2016) for ORR concluded that to model fares in the context of open access would need the development of a bespoke methodology to capture all of the effects and that no widely accepted methodology does this. This methodology would need to include operator choice, ticket type choice and advance fares to capture the effects of the proposals discussed in the current applications.

The fares elasticities used in the CH2M model are inappropriate for the specific market characteristics of the flows in question. Section B3.6.3 of PDFH v5.1 provides specific guidance on how to adjust elasticities for particular flows, depending on the average pence/mile cost. Applying this guidance, the elasticities for the London – Edinburgh market should be 20% lower than the average elasticities stated in PDFH. Furthermore, PDFH provides additional guidance as to how to apply elasticities to large fare changes, and we understand that this guidance has been ignored by CH2M with no explanation given.

LeighFisher also note that the fares formula taken from the "ECML Track Access Applications Assessment" report produced by MVA Consultancy in 2009 (MVA Report) and adopted by CH2M only considers walk-up fares. Given that the Open Access applicants and VTEC themselves propose to retail significant numbers of Advance fares (and the fact that Advance fares represent over 50% of all fares sold) we find it is misguided to pin so much generation on something that is far more complicated than the simplistic modelling used in this report. To do so would lead to an unsafe decision.

Action: CH2M to highlight how the NPA Ratio results rely on unsophisticated fares modelling techniques which have a high degree of uncertainty.
Action: ORR to ensure they consider the high degree of uncertainty around the fares modelling approaches deployed in their decision making.

1.3. **Inclusion of a competitive response is wrong and appears to bias the test in favour of the new entrant**
In CH2M's assessment, a revised VTEC fares strategy is assumed as a competitive response and this is used to credit the new applicant proposals with further generation of revenue due to the elasticities. We do not accept the principle of forcing such a fares elasticity and fares level assumption to boost the generation ratio in the option tests as being reliable or fair because we already have such fares available in the Base Case.

Action: CH2M to remove the incumbent competitive response from the central case.

1.4. **Revenue generated by lower fares by the new entrant is allocated to the incumbent operator**
We remain convinced that CH2M's methodology is flawed where they erroneously allocate some of the growth caused by an open access operator offering lower fares to the incumbent operator. This will overstate the generation ratio result. It would appear that the methodology has not been changed to correct for this but that the illustrated example in the note accompanying the CH2M Report has been changed to an example where the problem is not apparent! Paragraph 4.2 of my letter of 12 November provides detail of the issue. The impact of this perversity is to bias the NPA test in favour of the new entrant.

Action: CH2M to ensure any revenue generated by lower fares is allocated to the operator offering them.

1.5. **Like for like fare differentials will be significantly less than the 45% proposed by First Group**
It is not clear from the report how CH2M have treated fares by ticket type. However, a number of VTEC customers pay a premium for additional service quality, which would not be available to them on a First Group train. Examples include:
- First Class accommodation (including complimentary meals);
- Flexible walk-up tickets for a frequent service;
- A comfortable seat in Standard Class; and,
- The ability to travel at busy times of the day.

It will not be possible to obtain these benefits on First Group's proposed service. Through analysis of Lennon and reservations data, we have shown that if First Group were to offer a

45% discount on East Coast's average yield, this would only result in a 30% discount on a "like-for-like" basis (i.e. taking account of time of day and removing First Class fares), for the Newcastle-London and Edinburgh-London routes. In the absence of any specific modelling of service quality, it would be appropriate to assess the application on the basis of this lower overall yield discount (including the air competition model). In fact it could be argued that the "like-for-like" discount should be even smaller. This is because First Group's standard class seats will not be as spacious as VTEC's and no table seating will be available. Systra also flag this up in their audit report (section 4.1.4). We have set out in Appendix D the Edinburgh – London low priced fares already offered by VTEC.

Action: CH2M to include a "like for like" discount compared to VTEC and include a penalty for FirstGroup's high density seating layout.

1.6. Systra concerns regarding fares modelling

We note that in para 3.4.3 bullet 3 of the Systra Report some fares calculations have been carried out offline and therefore not reviewed by Systra. Given that this is an important area for some of the applications it is critical that Systra do further work to identify the likely range of impacts around these values so that the risk to the forecasts can be assessed.

Para 3.4.3 bullet 3 states that the provenance of the open access yields used has not been verified. It is critical that these are verified as part of this work. Analysis carried out in the LeighFisher report into historical Open Access should give Systra the detail that they need.

Please see Appendix A for details of our technical analysis of these fares modelling issues.

2. Air competition – journey times and fares
2.1. Concerns that abstraction levels are being understated

We raised concerns (see section 5 of my letter of 12th November) in relation to the approach taken to model air competition effects in response to rail journey time and fares, and sought clarification on how the model was being used. We have not seen any evidence of acknowledgement, consideration or revision and still await a response to the specific issues, clarification questions, and concerns that we raised. We remain concerned that abstraction levels are being artificially understated in the journey time modelling and that the fares modelling is exaggerating the increase in rail market share.

See Appendix B for details.

Action: CH2M to provide evidence in response to issues raised in my letter of 12th November.

2.2. Systra need to undertake a review of the CH2M LOGIT model

There are a number of flaws with the fares air competition overlay. In the independent audit undertaken by Systra, it is stated that the approach has been derived from "existing analysis submitted by First" (section 3.5.3). The audit goes on to state that "some of the input data and the derivation of model parameters to the LOGIT model is confidential", and that "we have not been able to independently verify the provenance of this source data due to confidentiality restrictions". The Systra Report also states that "some of the input data and the derivation of the model parameters to the LOGIT model is confidential". We find it staggering that ORR appears to be relying on a model developed and provided by the applicant, which cannot be audited, for the applicant to pass the NPA test.

If the LOGIT model is to remain confidential and cannot be verified by Systra, it cannot be relied upon. Both sets of results (with LOGIT model switched on and off) need to be shown in the CH2M Report so that the impact of each approach can be seen.

3.   Our concerns regarding the CH2M gravity model

3.1.   Inappropriateness of use of a simple gravity model according to PDFH

We remain deeply concerned that a "gravity model" has been used to assess revenue uplifts instead of standard rail industry demand forecasting methodology. I set out in section 1 of my letter of 12th November details of specific concerns. There is no justification for an alternative approach to MOIRA in most cases, i.e. in 11 out of the 14 flows according to PDFH guidance. We expect ORR to require its modelling to adhere to this industry standard except where it can clearly be shown to be inappropriate.

It is important to note that since previous applications were approved the PDFH guidance suggests an increase of Generalised Journey Time (GJT)[1] elasticity of 50% which has been used by CH2M in this assessment. This will increase such revenue impacts by 50% compared with the values used to assess previous applications. To put this into context, an NPA ratio 0.2 calculated with PDFH 4.1 elasticities would increase to 0.3 if the PDFH 5.1 fares elasticities are adopted. This increase negates the need to account for MOIRA's deficiencies that the gravity model is seeking to address.

Action: CH2M to remove the gravity model impacts for stations other than Middlesbrough, East Leeds Parkway and Kirkstall Forge.

3.2.   Validation of the gravity model

It is unclear whether any validation of the gravity model formula has been carried out, i.e. to demonstrate how well it predicted against actual results for a similar case, e.g. Sunderland open access. The CH2M Report illustrates the correlation between demand levels and train service provision but does not prove causation and is not a reliable basis for predicting outcome levels of demand for a step up in train service. We would suggest that train services have developed to meet market demand.

3.3.   Systra concerns regarding the gravity model

Systra note that the previous MVA appraisal of track access applications used a station choice model that has now been replaced in the CH2M approach by a gravity model. We expect that a comparison of the methodologies is carried out to understand where the differences lie.

Systra also note in para 3.6.3 that the approach "allocates some demand to generated when it is actually abstracted from other operators at other stations". This is a fundamental flaw in the methodology and it effectively acknowledges that the NPA ratio will be overstated. Whilst Systra expects the impact of this to be small, we believe that it is important for these issues to be addressed. Gravity models are appropriate for instances where stations do not have overlapping catchments which is not the case in the instance of East Leeds Parkway. A rail heading model is the most suitable way of modelling abstraction from one station to another and the LeighFisher analysis shows that the impact on the NPA ratio is very significant (see section 4 below).

The report notes that it was impossible to check the calculations in this model as some values were hard coded and this data is confidential to VTEC. We would be happy for Systra to have access to this raw data for this audit process on the condition that it was not distributed to other applicants.

3.4.   Concerns surrounding changes to North Lincolnshire catchment areas

We note that Scunthorpe, Habrough, Grimsby town and Cleethorpes appear to have been modelled as "Category 2 i.e. town or city, frequent services to London, highly accessible wider catchment. The catchment population is defined as the population located within a 35 minute drive of the station". This seems to be inconsistent with model parameters and with

---

[1] A mathematical construct that combines journey time with a penalty for frequency of service and number of interchanges required

the definitions on page 6 section 2.2 of appendix E, where they are defined as "Category 1 i.e. town or city with few services to London. The catchment area is defined as a population located within a 15 minute drive of the station." Including the inconsistently larger catchment areas will have the effect of pushing up the NPA ratio.

Action: CH2M to revert to Category 1 catchments for Scunthorpe, Habrough, Grimsby town and Cleethorpes.

4. East Leeds Parkway assessment
4.1. Significant uncertainty around the scheme going ahead
This new parkway station remains a possibility for the future. The scheme is at an early stage of development such that it is far from certain when and whether it will be built. Our assessment (based on Table 10 of the CH2M Report) would be that the Alliance West Yorkshire application would reduce the NPA test result to approximately 0.38 were East Leeds Parkway impacts to be removed. When considering East Leeds Parkway station it is important to consider the likelihood of this station being built. There is no basis to assume that the open access service would make the station any more likely to be built. Our own intention is that, were VTEC to gain the access rights and paths to operate our proposed additional 2-hourly Leeds – London trains via Hambleton, then we would call at the East Leeds parkway station were it to be built, however we have deliberately left open the question of whether this service would travel via Wakefield or Hambleton because of the doubts over capacity on the route via Hambleton.

Action: We consider given the uncertainty, that the impact of East Leeds Parkway station calls in relevant application(s) should be explored by CH2M using scenarios both with and without the station being provided.

4.2. LeighFisher assessment of demand using their railheading model
We commissioned LeighFisher to carry out an assessment of the demand, revenue generation and revenue abstraction for East Leeds Parkway if served by Alliance London services. LeighFisher have deployed their station parkway and railheading model in this assessment. We understand that this railheading methodology and modeling is consistent with that deployed for ORR in reviewing historic open access entry and expansion. A railheading model is more appropriate than a gravity model in circumstances where station catchment areas overlap and so passengers have a clear choice of stations to use. A gravity model would not naturally model this interaction as it would focus primarily on the demand for the new station as opposed to the impact on surrounding stations.

This work informs our view that the implication of Alliance trains calling at this proposed station would be to abstract VTEC demand mainly from Leeds station, but also Wakefield and York. This model accords quite closely to CH2M's estimate of total rail demand (£7m compared with £8.2m for CH2M), but shows a much lower level of generation (£2.7m compared with £5.9m for CH2M) giving an NPA ratio for this station alone of 0.62 compared with 1.75 for CH2M. Given that the LeighFisher model has been calibrated against historic data, whereas CH2M's model is desk top conjecture, we suggest that it would be unsound for ORR to take a decision using a clearly flawed model.

Action: CH2M to undertake a more appropriate methodology such as use of a rail heading model.

Please see Appendix C for details of our parkway modelling assessment.

5. FirstGroup 0530 King's Cross to Edinburgh departure
Our view, based on our benchmarked assessment, is that the level of passenger demand for the 0530 departure departing Stevenage is overclaimed by an order of magnitude in the FirstGroup application. See Appendix E for details.

We note the point that an all-night London underground tube service is proposed. This is irrelevant because the all night tube service is only proposed for the weekends and FirstGroup's departures are later on Saturday (0600) and much later on Sunday (0903) than those proposed for weekdays. Therefore, the FirstGroup services are not planned to run at times when they would benefit from the all-night services.

C2HM appear to have adopted FirstGroup's forecast of demand for the 0530 departure rather than scaling it back to reflect the fact that it will be difficult to access King's Cross at a time of the morning when there are no tube services, although no basis is provided for this view. We consider this suggests a too ready acceptance of First Group's claims.

Action: CH2M to consider the likely achievement of FirstGroup load factor claims.

6. Concerns regarding timetabling assumptions and scenarios
6.1. FirstGroup's slow journey times assumed on Edinburgh – London trains

We strongly urge ORR to take account of more realistic journey time assumptions for the FirstGroup Edinburgh services. The applicant appears to have achieved the effect of artificially reducing apparent abstraction impacts by padding out running times and artificially presenting a pause at Darlington for overtaking. As detailed in my letter of 12th November we are concerned that in practice applying Decision Criteria in Part D of the Network Code would result in Network Rail offering non-overtaken and much faster paths. We note the Sensitivity Test carried out by CH2M removing the overtaking assumption and the impact that would have.

We urge ORR to revisit the central case assessment of the abstractive effect of FirstGroup's London - Edinburgh trains on a more realistic assumption of shorter journey times generally. To make a decision based on an "indicative timetable" designed to pass the NPA test by deflating the levels of abstraction due to sub optimal journey times and wholly unnecessary overtaking moves would be manifestly absurd.

Action: Further sensitivities must be developed by ORR/CH2M, including but not limited to an optimal journey time and departure time from King's Cross / Edinburgh based on achievable IEP timings. We suggest a xx00 departure from King's Cross and our fast service following this at xx03. Note that Systra raised concerns in their audit report about the coding of First Group's services in MOIRA, and this test would allow those concerns to be tested.

6.2. Unrealistically fast journey times in Alliance's Edinburgh timetable

As stated in our letter of 12th November, the journey times assumed for Alliance are unrealistic. We note that you have modelled the impact of non tilt journey times on this service as a sensitivity test, which shows how dependent their proposal is on the claimed journey time. However you have consistently ignored our explanation of how the claimed journey time with tilt selectively reduces Network Rail's standard performance and engineering time, without giving any justification for continuing to use this comparison.

Action: CH2M to update their assumed journey times for Alliance.

7. Underestimation of Middlesbrough services and associated additional capacity benefits

We are surprised by the poor NPV result calculated for Option 6 which includes the VTEC services to Middlesbrough as well as significant journey time improvements to Newcastle and Edinburgh and crowding relief across all VTEC services. We believe these benefits have not been fully taken into account.

VTEC is fully committed to delivering this direct service to an important city in the North of England. During the bid we had a number of meetings with stakeholders who were very much in support of our proposals. Of the 20 largest towns and cities in the UK, only

Middlesbrough does not have a direct rail service to London. It would be a national disgrace if the people of Middlesbrough were to lose out of the benefits of a direct service to London at a time when the Northern Powerhouse project was due to relaunch the north as a centre of commerce through better integration of transport links.

8. **CH2M Hill analysis fails to bring out the full benefit of the VTEC Full proposal**
   The VTEC Full timetable was put together as a whole package. Picking and choosing various parts of the timetable for appraisal runs the risk of diluting the benefit to customers and the revenue result. However, to explain the various building blocks that we used during the bid to formulate this timetable should help you see that the benefits of this train path are far in excess of those currently calculated by CH2M.
   a. **Timetable benefits:** This should not be seen as a benefit solely for Middlesbrough. The addition of a train every two hours enables:
      - Removal of a York stop from the Edinburgh service to create a super-fast service to Scotland from London
      - Removal of a Peterborough stop from the Newcastle service to improve journey times to the North East
      - Removal of a Northallerton stop to benefit journey times to the North East further still.
      - Access to direct services for thousands of students living in Middlesbrough and Stockton on Tees (Durham University Campus) where we plan to stop at Thornaby
   b. **Abstraction from air:** Both the Edinburgh and Newcastle markets compete directly with the air market. Improvements to journey times should be passed through an air competition model to account for MOIRA underestimating this abstraction.
   c. **Additional capacity:** We are baffled to see that the CH2M results include £1.6m revenue loss from an increase in crowding. Given that an extra train every two hours adds considerable passenger carrying capacity to the franchise, we are struggling to understand how crowding would increase. In reality, crowding benefits will be felt across all the other six trains per hour operated by VTEC. We strongly suggest that the CH2M crowding model is checked to ensure that the benefits from the increase in capacity enable benefits to be felt across all services by spreading capacity benefits across the services (e.g. reflecting our demand management using advance purchase train specific tickets) rather than simply concentrating on the new Middlesborough path.
   d. **Generation from delivering a direct service to Middlesborough:** The CH2M gravity model generates additional revenue for the Middlesborough – London flow over and above the MOIRA timetable model of about £800k. We suggest this is significantly below the level that will be achieved in reality. Putting this into context, the CH2M approach gives First Group a revenue uplift of £1.7m at Morpeth. Given that Middlesborough is a key northern city with a population of over 135,000 this intuitively feels an order of magnitude wrong. Moreover the CH2M revenue uplift seems to ignore walking access to Stockton town centre (population 82,880) and the Queens Campus of Durham University via a stop at Thornaby (population 23,000). By contrast the population of Morpeth is only 14,000!

   Action: CH2M to take on board our comments above regarding timetable benefits, abstraction from air, capacity and generation at Middlesbrough.

9. **Demand build-up to full fruition**
   The introduction of new train services, routes and parkway stations result in passenger demand response that takes a considerable time to reach full fruition. Typically abstracted demand reassigning from existing services and stations occurs relatively soon after launch whereas generated demand for rail, whether as the result of switching to rail from other modes or created travel would take much longer to build up, potentially taking up to six years to reach full fruition, therefore in the early months and years of operation, the generation / abstraction ratio would be expected to be significantly lower.

The LeighFisher report looking back at previous open access introduction for ORR found clear evidence of a build- up of demand taking considerable time. There is no evidence that CH2M assessment of these open access applications has factored in demand build-up effects – they appear to assume instantaneous full fruition of benefits – we consider it essential to address this omission and factor in build- up effects with a lag to generative demand.

PDFH provides guidance on how demand build up should be factored into assessment of demand and revenue effects for new services and new parkway stations. To ignore these effects in the assessment is totally unrealistic and in our view substantially overstates generation/ abstraction ratios.

Action: CH2M to report average NPA ratios for the period of access rights being sought.

10. **Performance and deliverability**
The CH2M Report ignores the impact on train punctuality of the options assessed. The report acknowledges that "ORR would need to consider separately the performance impact". VTEC remains firmly of the view that further detailed performance analysis is essential for ORR to make a properly informed and reliable decision on the applications.

Action: ORR to undertake an assessment of Performance.

Moreover, as the service level approaches the capacity of a route the compromises necessary to fit in extra services increase. These compromises were built into VTEC's bid, but the other applications which seek to build on VTEC's full bid timetable will inevitably lead to compromises in stopping patterns and/ or journey times for some or all of the operators on the route. This has been highlighted several times by VTEC, most recently in our letter of 24th November. While we realise that detailed timetabling is a matter for the industry's timetable development process, supported by an Event Steering Group, we believe that the fact that neither Alliance or First Group could find clean paths for their additional services despite having sight of our proposed timetable, illustrates very clearly the compromises that would be necessary if one tries to fit 8tph LDHS services or more onto the ECML.

Action: An allowance for the economic and revenue damaging impacts of these timetable compromises must be built into the CH2M analysis in order to reach a fair conclusion.

Action: Where deliverability of aspects of the options is critically dependent on infrastructure enhancement, or a new parkway station, then we would expect CH2M to carry out sensitivity tests to show the impact were such enhancement to be delivered significantly later than the timing envisaged by the applicants, or not at all.

11. **Requested actions in response to the Systra Report**
We are fully supportive of the brief to carry out a methodology check rather than simply a calculation audit. This is sensible given the magnitude of the decision to be made. We are not surprised that Systra's report has found flaws in CH2M's analysis, however they seem to have missed a number of issues which become very evident when looking at the results (as set out in our response to the CH2M Report) and it is important that ORR addresses all of these matters before taking a decision.

We expect the following actions to be undertaken:

- Systra to undertake a comparison between the MVA station choice model approach used on previous applications (MVA Report), the CH2M gravity model and the new LeighFisher combined demand and accessibility choice model (which we believe is a similar approach to the previous MVA one)

- Systra should be commissioned to undertake an assessment of costs as part of this audit
- CH2M to address flaws identified in the CH2M gravity model
- CH2M to test a First Group application scenario where the First Group service is timed to depart King's Cross ahead of the VTEC service
- Systra to identify the possible impact on the forecasts of the hard coded values discussed in para 3.4.3 bullet 3
- Verification of the open access yields discussed in Para 3.4.3 bullet 3
- CH2M Report should show results with and without the Air Competition LOGIT model
- CH2M should include a sensitivity test on the impact of a high density seating layout.

Can we please request a copy of the Systra Report appendix covering the Issues Log to enable us to better understand some of the discussion points.

APPENDIX A: FARES ISSUES

This technical appendix provides details of a number of issues we believe are apparent from the modelling of fares by CH2M. The issues we have identified include:

Abstraction and Generation due to fares appear to have been calculated incorrectly

The spread parameter used in calculating abstraction due to fares has not been calibrated

The incumbent operator fares strategy as modelled is not appropriate, and is not calculated correctly

Elasticity guidance in PDFH v5.1 appears to have been misinterpreted, and has not been correctly applied to the specific market characteristics of the cases that the CH2M Report is assessing.

Please note: Appendix B: "Air Competition Modelling", details those issues we have identified specific to the Air Competition model with relation to Fares.

Incorrect Abstraction and Generation Calculations

We are convinced that the generation and abstraction calculations given in the CH2M Report are fundamentally flawed. This is because there appears to be net negative abstraction attributed to fares (for example, in figure 2 of the CH2M Report, copied below).

Figure 2: Option 1 total annual revenue and projections, split by source
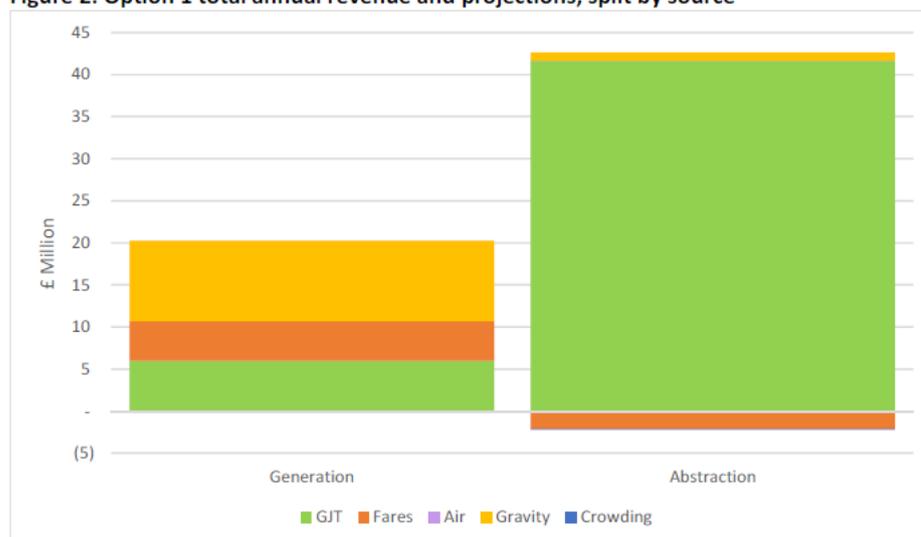
This indicates a net negative abstraction of c£2m due to fares effects related to this application. We see no way that a net negative abstraction should feature in the calculation of the Generation to Abstraction ratio (NPA Ratio). The bar on the right of the graph appears to sum to the £40,497 quoted in Table 10 as total abstraction, which is used in the calculation of the NPA Ratio.

We find it helpful to show the NPA Ratio in terms of a ratio of generation to abstraction as follows:

NPA Test Ratio	=	(Modelled National Rail Revenue − Base National Rail Revenue)
		(Base Incumbent Operators Revenue − Modelled Incumbent Operators Revenue)

This definition is consistent with that used by the MVA report into applications for track access on the West Coast Mainline[1].

For example, if the modelled impacts of a new market entrant were:

An increase in total UK rail revenue of £5m; and,
A decrease in revenue for incumbent operator of £25m

Then the appropriate NPA Ratio would be 0.2.

The effects of fares abstraction, in a case where lower fares are being offered by the new market entrant, cannot possibly have a net-positive impact on incumbent operator revenue (i.e. a negative impact on the denominator of the equation.) But this is precisely what appears to be occurring in the CH2M Report's assessment (e.g. as in figure 2 shown above).

A further example of this issue concerns the way in which the sensitivity test detailed in table 11 has been modelled. This seeks to test the impact of a smaller competitive response from the incumbent specifically in relation to the London-Leeds market. The competitive responses tested are reductions of 5% and 2.5% in average yield for the main and the sensitivity model runs respectively. It is possible to calculate an implied fare elasticity from these results. The table below shows this to be implausibly high at -2.15.

Quantity	Value	Notes
London - Leeds: Base Revenue (£000s, 2014/15)	87,647	*Source: MOIRA, 2014/15*
London - Leeds: New NR Revenue (£000s, 2014/15)	90,614	*Our MOIRA Timetable Runs for application*
Alliance Share of Leeds Revenue (£000s, 2014/15)	22,364	*Our MOIRA Timetable Runs for application (ORCATS effect only)*
Generation Option 1 Base Case (£000s, 2014/15)	20,103	*Source: Page 6-32, Table 11 CH2M Report*
Generation Option 1 Sensitivity Test (£000s, 2014/15)	18,105	*Source: Page 6-32, Table 11 CH2M Report*
Revenue impact of changing from 5% reduction to 2.5% reduction	-1,998	*Implied from the results given in CH2M Report*
Yield Index base case weighted	0.962	*5% reduction quoted in section 3.3.1.4 of the CH2M Report, weighted to only apply to VTEC Revenue*
Yield Index Sensitivity Case	0.981	*2.5% reduction for sensitivity, weighted*

1 http://orr.gov.uk/__data/assets/pdf_file/0010/3007/mva-wcml-assessment-feb11.pdf, Section 4.14

		to only apply to VTEC revenue
Yield Index Sensitivity vs Base Case	1.01957	*Index applied in elasticity calculation*
Elasticity required to give the implied revenue impact*	-2.15	*This elasticity is far higher than PDFH recommendations, of an average of -0.8 for business and -1.25 for leisure.*
The elasticity value above is calculated using the excel solver functionality, to estimate the elasticity needed to give a revenue change of -£-1,998k. The calculation is based on: *Revenue change = (Base Revenue * (Yield Index ^ elasticity) * Yield index) – Base Revenue*		

This implausibly high overall fares elasticity of -2.15, suggests that CH2M are using a method to quantify abstraction and generation effects from fares modelling, which is not consistent with the NPA test definitions of generation and abstraction. We obtain similar results for the First Group "low competitive response" scenario detailed in Table 26. It would appear that CH2M are treating the yield reduction as abstraction and the associated demand uplift as generation. We believe that this distorts the generation and abstraction results skewing the results in favour of generation.

Inappropriateness of Spread Parameter

The spread parameter for calculating abstraction from other TOCs used in the CH2M Report is obtained from PDFH v5.1 section B11.4. This PDFH formulation is predicated on a walk-up fare differential and not average yields. PDFH states that "when applying this formula to different situations it may be necessary to calibrate a new spread parameter using data from a similar situation to that being modelled". In our view, it would therefore be appropriate to calculate new spread parameters for the assessment of the Alliance application to Leeds and North Lincolnshire, and the First Group Edinburgh application, because they rely heavily on Advance Purchase (AP) tickets. Recalibration should be on the basis of average yield so that the change in market share can be assessed accurately across all ticket types. We copy the formulation from PDFH below, for ease of reference.

S = Market Share from MOIRA
S^1 = New Market Share
d = walk up differential
λ = spread parameter

$$S^1 = \frac{1}{1 + e^{-\lambda d}\left(\dfrac{1}{s} - 1\right)}$$

It is not clear from the CH2M Report how this formulation has been applied. They could either have:

Applied the formulation to walk-up tickets and assume that AP demand behaves in the same way; or

Applied the formulation to the average yields of all tickets combined.

Approach i)

If this methodology has been applied on the basis of walk-up fares, this provides potential operators with an opportunity to "game" the system. This could be done by

proposing operator-specific walk-up fares which are only very slightly lower than the walk-up fare, but at the same time proposing a high number of very cheap AP fares. This increases generation (through the application of an overall elasticity to significantly lower average yields), but limits abstraction (as the walk-up fare differential, from which abstraction is calculated, is very small). A hypothetical example of a potential fares strategy is given below.

Operator	Walk-up fare	Average Yield
Incumbent	£80	£50
Potential new market entrant	£79	£20

In this example the modelled abstraction would be minimised by the low walk-up fare differential, however the modelled generation effects would be large. We would consider the modelled results to be unrealistic giving much lower levels of abstraction than would occur in reality.

Approach ii)

If the spread parameter has been applied on the basis of average yield data rather than walk-up fares, however, this is entirely inappropriate. As the formula used by PDFH v5.1 Section B11.4 uses the absolute difference in fare, this also may result in inaccurate modelling of abstraction. This inaccuracy is a result of the fact that walk-up fare differential and the average yield differential are likely not of the same magnitude. As stated previously the spread parameter has been calibrated on the basis of walk-up fare differential rather than average yield.

The CH2M Report has looked at LeighFisher's [2] work in recalibrating the spread parameter used when deploying this methodology. Recalibrating the spread parameter to apply the formulation to the difference in average yield rather than walk-up fare does not appear to have been part of LeighFisher's brief. Instead, LeighFisher have undertaken a revised calibration based on walk-up tickets. However, when referring to the LeighFisher Report, the CH2M Report is not entirely correct in stating that the "initial spread parameter estimates from this study are similar or slightly smaller than the PDFH value". LeighFisher in fact provide a range of estimates, depending on trip distance and type of walk-up fare.

CH2M have produced examples of how the formulation given by PDFH can be applied. Looking at the example given in figure 1 of appendix C of the CH2M Report, we give a worked example of how the use of a spread parameter of 0.07 instead of the 0.04 value assumed by the CH2M Report would change the NPA Ratio result. 0.07 is the spread parameter given by LeighFisher for journeys of 165-180 miles, for reduced tickets, and is contained in Table 16 of the LeighFisher Report. This is the type of ticket most similar to the AP tickets that will predominantly be offered by First Group and Alliance.

Quantity	Spread Parameter = 0.04	Spread Parameter = 0.07
New Entrant ORCATS share	15%	15%
Fare discount	-20%	-20%

---

2 The LeighFisher Report, Chapter 8.2.4

New operator market share LOGIT (journeys)	20.8%	26.3%
NPA Test Result	0.38	0.27

The scale of differences obtained in the NPA test results above demonstrate that recalibration of the spread parameter is required.

Incumbent Operator Fares Strategy assumed is inappropriate

We have found CH2M's approach to calculating the incumbent operator fares strategy to be flawed. This is because:

The methodology used to calculate the competitive response is inaccurate, and appears skewed to result in a higher competitive response; and,
Review of previous studies does not provide conclusive evidence that there would necessarily be a significant competitive response.

Methodology

The methodology for determining the level of competitive response assumed for VTEC is described in the CH2M Report Appendix C, Section 2.4.1.

CH2M assumes that VTEC sells all the remaining seats on the trains competing with the new entrant trains, at a yield equivalent to that of the new entrant's service. The yield change is then calculated from the weighted average of the new fares offered, and the existing option journeys which are assumed to have the same average yield, using the formula given below:

((open access fare x empty seats) + ((option journeys – empty seats) x existing fare)) / (option journeys)

We contest CH2M's method because:

The approach seems to suggest that VTEC would target and achieve a 100% load factor on the trains which directly compete with the new entrant services. However, section 6.10.4.1 of the CH2M Report acknowledges that a 100% load factor for First Group services would be unsustainable, and First Group would raise fares in response to these high load factors to bring loads down to 80%. VTEC would have a higher proportion of passengers will travel on walk-up tickets, and therefore a load factor of around 70% would appear optimal.

[Redacted]

There are obvious flaws in CH2M's evaluation of the competitive response VTEC would offer.

Previous Study Evidence

In the LeighFisher Report, they concluded that:

"*We have found no evidence of historical ICEC franchisees having a consistent strategy of reducing yields on flows with competition, relative to those without*"[3]

We are aware of another recent study which claims to have found evidence of a competitive response from other operators, undertaken by Arup/Oxera for the

---

3 LeighFisher Report, Section 5.2.3

Competition and Markets Authority[4]. This report states three pieces of evidence to support this claim:

The introduction of a carnet product by the incumbent operator at the same time as the market entry of Hull Trains;

An increase in the number of AP fares offered by the incumbent operator; and,

A reduction in the average yield on competitive flows.

However, none of these points should be interpreted as evidence of competitive response by the incumbent operator, because:

Carnet tickets do not form a significant share of VTEC's revenue, and they are offered on other routes not affected by competition anyway;

There were large increases in the number of AP fares offered by all TOCs throughout the 2000s, unrelated to competition; and,

The reduction in average yield can easily be explained by the new market entrant offering lower fares than the incumbent. This is not evidence to suggest a competitive response by the incumbent.

The LeighFisher study differs from the Arup/Oxera study in that LeighFisher were given access to the LENNON data of individual TOCs. They were therefore able to look for evidence of competitive response from the incumbent, and were unable to find such evidence. Furthermore, the charts given in Section 5.2.3 of the LeighFisher Report suggest that there has definitely not been a competitive response. Given this obvious uncertainty, and the superior service quality which will be offered by VTEC when compared to First Group's proposed high density seating layout, it is far from clear that a competitive response could be expected.

Elasticity Guidance in PDFH Not Followed Correctly

We have concerns about the way fare elasticities are treated in the CH2M Report, in particular:

Evidenced by the levels of generation observed in the First Group application, elasticity modifier advice given in PDFH v5.1 section B3.6.3 has been ignored; and,

We do not believe the large fares reductions applicable for the new market entrants have been treated appropriately, and in line with PDFH v5.1 guidance for large fare changes.

We also think that the PDFH v5.1 fares elasticities, calibrated for use with rail travel, are inappropriate for use applied to the entire rail and air market. See Appendix B (air competition overlay) for further analysis on this issue.

Elasticity Modifier Application

As discussed in PDFH v5.1 Section B3.6.3, "fare elasticities will vary with the level of fare and with the value for money that it provides". If a product is priced at a level where increasing the price will result in more revenue, this does not necessarily mean that increasing the price endlessly will continue to result in revenue increasing. There will be an optimum price, where the price elasticity has risen to -1, at which further price rises result in lower revenues.

PDFH v5.1 Section B3.6.3 gives detailed guidance on average fare levels in pence per mile. In particular, it states that the elasticities values given in the chapter should be treated as averages only, including the values of -0.8 for business travel and -1.25 for leisure travel given in table B3.3. We have conducted analysis on the Newcastle and Edinburgh flows of applying these elasticity modifiers. The application has required that we adjust for inflation and for GDP per capita levels, for this we have used ONS data.

4 Impact Assessment of the CMA's Options for Increasing On-Rail Competition, Arup/Oxera, December 2015

We have also made use of 2014/15 MOIRA data for the Edinburgh – Total London and Newcastle – Total London routes. The results of our analysis are given in the table below:

Segment	Business	Leisure
PDFH Average long distance London (PDFHv5.1 Table B3.3)	-0.800	-1.250
Newcastle – Total London	-0.796	-1.243
Edinburgh – Total London	-0.632	-0.987

This demonstrates that while the Newcastle – London elasticities are close to the sector averages, elasticities for Edinburgh – London should be over 20% lower than the average recommendations. While air competition is being treated separately in a different model to the fares overlay, it is wrong not to use these lower elasticities.

Elasticity formulation for large fare changes

We note that PDFH v5.1 section B3.1 recommends that constant elasticities are only appropriate for small fare changes of up to +/- 10%. The reason for this is that as the fare changes by large amounts, so the elasticity changes. This is in a similar way to the elasticity modifiers described above. The First Group application will exceed these thresholds, particularly for Newcastle-London and Edinburgh-London.

Chapter B3.6.3 of PDFH v5.1 points to Appendix D2, and in chapter D2.7 an alternative elasticity formulation is recommended:

Formula 4: $D = \exp\{ (e/m).[(F)^m - 1] \}$

Where:

D = Demand Index

e = fare elasticity

m = elasticity modifier (in the case of fares this is 0.6)

F = fare index

This would be a more appropriate methodology for dealing with the large fare changes which form part of First Group's proposal. A hypothetical example below shows the large differences which emerge when this more robust approach is deployed.

Quantity	PDFH v5.1 recommendation for small changes	PDFH recommendation for large changes (Appendix D2.7)
Base Demand	1,000	1,000
Base Revenue	£20,000	£20,000
Elasticity	-1.05	-1.05
Fare Change	-40%	-40%
Fare index	0.6	0.6
Elasticity Modifier	0.6	0.6
Demand Index	1.709	1.587
New Revenue	£20,517	£19,046
Change	£517	-£954

In this example, as the fare is being reduced to below the "optimum price", the correct application of elasticity modifiers results in a reduction in revenue, and therefore revenue abstraction. This is despite a fare elasticity of -1.05. Given the large changes in fare being proposed, it is essential that this methodology is applied and revised results included in an updated report.

APPENDIX B: AIR COMPETITION MODEL

This technical appendix aims to give detail of a number of issues apparent from the modelling of air competition by CH2MHill, specifically relating to fares.

The issues we will detail in this technical appendix are:

Model input data, and its suitability; and,
Use of fares elasticities in the model, and their appropriateness.

Please note: Appendix A: "Fares Issues" gives further detail on flaws in the fares overlay model.

Model input data, and its suitability

We have serious concerns about the suitability of the inputs to the model, and in particular their accuracy and reliability:

Air Fares are estimated from "airline websites". This appears to suggest that the average airline yields are estimated based on a screen-scraping exercise (quite possibly undertaken by FirstGroup staff). Airline fares are complex, with different fares offered through multiple different agents at different price points simultaneously. Demand for aviation is also highly seasonal, creating natural peaks and troughs in prices. Furthermore, like for rail, there is a significant difference between fare and average yield for airlines, owing to the prevalence of child discounts and loyalty schemes (air miles). We think that given these complexities, reaching a balanced view of airline yields from this snapshot fare data would be extremely challenging.   No details are mentioned in the CH2M Report of how this data has been split by journey purpose for aviation.

Access and egress times are included in the model. However, it is concerning that access and egress costs have not been included, as these would form a significant portion of overall costs. This would particularly be the case for a departure at 05:30 in the morning.

Car parking charges are obtained from "airport websites", rather than using airport car park average yields, which are often published in airport annual reports. These would give a more valid overall assessment of costs.

Rail car-parking costs do not appear to have been factored into account

No mention is made of quantifying an average trip length, an important determinant of car parking costs.

The model has only been calibrated based on Newcastle and Edinburgh, and there is no validation of the approach undertaken on other routes. The magnitude of the "mode specific constant" needed has not been specified, which would give an impression of the accuracy of the model.

However, what is even more concerning is that the Systra Report states the following:

"Further to this we note that the approach to model air abstraction using competition on fares has been derived from existing analysis submitted by First, and therefore some of the input data and the derivation of model parameters to the Logit model is confidential. During the audit we have reviewed these and as stated above we deem the approach to be appropriate however we have not been able to independently verify the provenance of this source data due to the confidentiality restrictions."[1]

We accept that the use of some data provided by applicants is inevitable, and VTEC has provided confidential data to ORR to aid the process. However, we do not think that the

---

1 The Systra Report, Paragraph 3.5.3

provision of "model parameters" by an applicant is an appropriate basis for a model when PDFH doesn't offer specific guidance. Furthermore, we see no reason why the analysis and modelling undertaken by First Group could not be independently reproduced, sense-checked, and verified. This should form part of the role of the ORR and their technical advisor(s).

Fares elasticities used in the model, and their appropriateness

In order to calculate the effects of whole market generation, CH2MHill have used "PDFH v5.1 Fares elasticities". This is inappropriate, as PDFH elasticities are calibrated based on rail markets, not the total travel market. Importantly, the majority of rail markets do not have significant competition.

As discussed in appendix A, in a non-competitive environment, where the operator is the main provider of transport services, the optimum fare level will be the one at which the price elasticity is equal to -1. At this optimum price, raising fares will start to lose the operator money (as the elasticity changes and the market becomes more price sensitive). Similarly, lowering fares will also start to lose the operator money (as the elasticity changes making the market less price sensitive). It would be reasonable to assume that in such a system the overall elasticity will be approximately -1.

However, in a competitive situation, the market will reach equilibrium at a far lower price. This is because individual operators are incentivized to lower prices to increase their market share. These competitive market dynamics mean that the average price across the market will be far lower than that which maximizes revenue for the total market. As there is competition on price between rail and a multitude of different airlines on the Newcastle – London and Edinburgh – London routes, we could expect the appropriate elasticity to be of the order of -0.5 in magnitude. This is further evidenced by the fact that, as detailed in Appendix A, rail fares in pence per mile on the Edinburgh to London route are far lower than the average stated by PDFH. Evaluation of an appropriate elasticity would require a thorough recalibration of the "combined rail and air market" elasticity. This is a fundamental flaw in CH2M's methodology.

APPENDIX C: EAST LEEDS PARKWAY

In Option 1 Alliance has proposed to run seven trains per day between London King's Cross and West Yorkshire, calling at Doncaster, East Leeds Parkway, Leeds, Kirkstall Forge and Bradford. Table 10 of the CH2M Report details the revenue projections associated with Option 1. A large proportion of the revenue is from East Leeds Parkway (£8.3m), with £5.8m of this claimed to be newly generated revenue. It is unclear how these abstraction and generation proportions have been calculated. This has a large impact on the overall NPA Ratio for this option (0.5 overall but 1.75 at East Leeds Parkway). We commissioned LeighFisher to carry out an assessment of the demand, revenue generation and revenue abstraction for East Leeds parkway if served by Alliance London services.   LeighFisher have deployed their station parkway and railheading model in this assessment. We understand that this railheading methodology and modelling is consistent with that deployed for ORR in their recent study into the NPA test.

We have developed a combined demand and accessibility choice model to measure the impact of running the proposed direct services between London and East Leeds Parkway. This type of model is suitable for assessing the generative and abstractive demand impacts of running direct London services to a new station, and this model has been calibrated against past open access outcomes on the East Coast Main Line, so can be relied on to be much more accurate than a simple gravity model. The model uses a Logit calculation to give a probabilistic choice between stations and routes, based on the generalised cost of making a journey via that station. This includes the journey time and cost of accessing the station, and the journey time, frequency and cost of the rail journey. The model was calibrated to replicate the existing share of London travel demand between stations in the catchment area. It was then used to model the impact of calling services at East Leeds Parkway in terms of generated and abstracted demand and revenue.

The population catchment area and stations included in the model is shown in the map
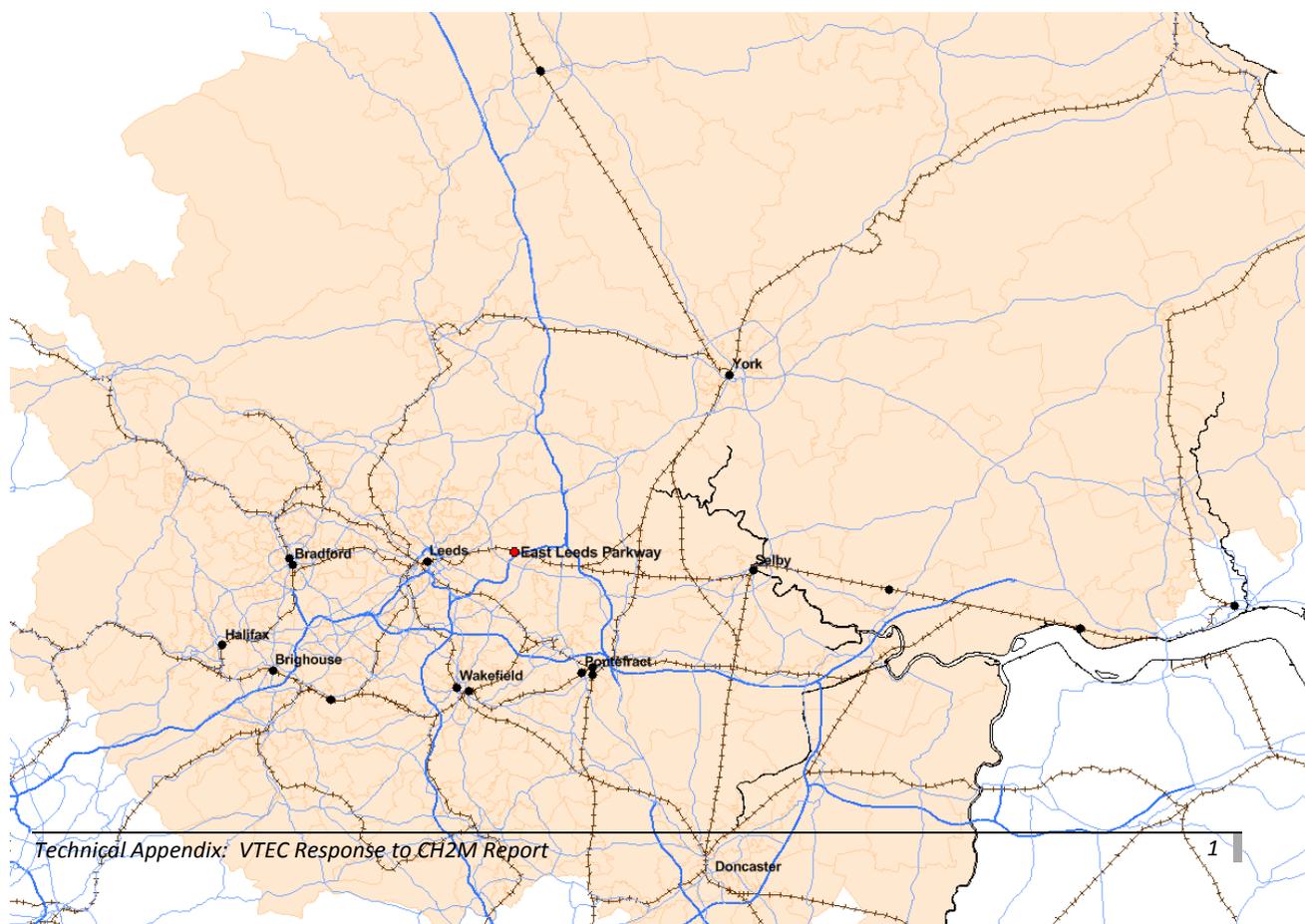
below.

The catchment area is split into zones based on Middle Layer Super Output Area (MSOA) boundaries as defined by the ONS in the 2011 census. The location of the population weighted centroid of each zone was used as the point for calculating journey times to stations. The model covers a greater area than is considered to be the potential catchment areas for the new station, for example the areas North and East of York which would not fall within the East Leeds Parkway catchment area. The population in these areas are included so that the model can be calibrated to match the base demand at the key stations from which abstraction may occur (Leeds, York, Wakefield, Pontefract, Selby, and Doncaster. A maximum station access distance cap of 40km is applied in the model, so that no passenger demand will be allocated to stations more than 40km drive from their home.

The generalised costs from each origin zone to London via each station were calculated to include the following for each 1 way trip:

Driving time by road to access a station, converted to a monetary value using the WebTAG recommended Value of Time. The 2010 WebTAG value is provided by journey purpose, from which we have calculated a weighted average using the NRTS journey purpose split for the region, and uplifted to 2015 prices to give a VoT of £27.08 per hour. PDFH access time factors were applied.

Driving costs, based on the driving distance and a WebTAG vehicle operating cost of £0.12 per km.

Rail Generalised Journey Time, obtained from MOIRA and converted to a monetary value using the VoT.

Rail fare, assumed to be half of a 2015 Off-Peak open return fare. This is considered more appropriate for modelling passenger choice between stations than the MOIRA yield, as the yield between stations is affected by the different weighting of ticket types and journey purposes between stations.

Model Calibration

PDFH recommended parameters are used to determine the share of demand at each station from each zone, based on the distribution of the population, access times and cost from each zone to the stations, and time and fare of the rail journey.

Where:

$$V_{ij} = \sum_a P_{ai} \times \frac{GC_{aij}^{\lambda}}{\sum_k GC_{akj}^{\lambda}} \times \frac{\left(\sum_k GC_{akj}^{\lambda}\right)^{\theta}}{\left(\sum_k GC_{akj}^{\lambda}\right)^{\theta} + e^{U_{nr(ij)}}} \times F_j$$

And
$$F_j = \sum_b P_{bj} E_{bj}^{\delta}$$

The generalised cost for a journey starting at zone A, making a rail trip via origin station K, to destination station J is presented as GC_{akj}. This is inclusive of average rail fare, car operating costs, and journey times for station access and overall travel time.

F_j is the attractiveness of a destination and is a function of population, and drive times raised to an egress elasticity. PDFH states the F_j value for London, given the relativity of size and attractiveness of the city is 1,996,947.

The volume of journeys from a zone using each origin station is proportional to $GC_{akj}{}^{\lambda}$, such that there will be an increase of trips from a given population to a station with increased services when there are fewer competing stations nearby. There will also be more trips when the generalised cost for the total journey is lower. Therefore those living closer to the station with increased service levels will participate in more rail trips than those living further away from a station.

The model was calibrated using MOIRA base demand data (National Revenue journeys) for 2014/15 and MOIRA Generalised Journey Times (GJTs) for the same timetable year. The value of θ represents the propensity to travel and this was calibrated so that the total modelled demand is equal to the total MOIRA demand for all stations in the catchment area. In some cases it was necessary to add an additional station penalty (positive or negative) to the generalised costs for choosing a particular station, in order to achieve station-level calibration for the main catchment area stations (Leeds, York, Wakefield, Selby, and Doncaster).

Parameter	Explanation	Source	Value
λ	Power applied to Generalised Costs in order to determine the share of trips using each origin station	PDFH	-8.229
θ	Power applied to a function of the collective Generalised Costs of the competing origin stations in order to determine the share of the population making rail trips	Calibrated to base demand levels	0.436 (calibrated)
ξ	Parameters used to calculate the 'utility of not using rail'	PDFH	-16.089
η	(calculated as: $U_{nr(ij)} = \xi + \eta \times D_{ij}$)	PDFH	-0.011

Generation and Abstraction

The model calculates both new generated demand, and the change in share of existing demand between stations. The change in revenue at each station is derived from the modelled change in demand using the MOIRA yield. After calibrating the model we ran scenarios with lower GJTs and fares to replicate the introduction of the proposed alliance services.

Improved GJTs due to the IEP timetable and the proposed alliance services, excluding the stop at East Leeds Parkway. Leeds fare assumed to be reduced by 9.5%.

Same as scenario 1 with the services also calling at East Leeds Parkway. Fares at ELP assumed to be 25% lower than the current Leeds fares.

GJTs between East Leeds Parkway and London are approximated in MOIRA using Garforth station as a proxy for the new station. We used the MOIRA SPG files provided by CH2M where these new services are included in the timetable.

By comparing the two scenarios, we were able to assess the expected level of new demand and revenue at East Leeds Parkway, and the proportion of this demand which is generated or abstracted from nearby stations. The model forecasts annual revenue between East Leeds Parkway and London to be £7m, £2.7m of which is new generated revenue. This gives an NPA Ratio of 0.62. The majority of the abstracted revenue is from Leeds (61% of total abstraction) with a significant amount also from York (15%) and

Wakefield (13%). This compares to a ratio of 1.75 obtained using CH2M's gravity model methodology.

Modelled New Demand at East Leeds Parkway

	Revenue 14/15 £m
East Leeds Parkway new demand	7.0
Abstracted revenue	4.3
Generated revenue	2.7
NPA Ratio	**0.62**

Share of abstracted revenue between stations

Station	Annual revenue £k	% of total abstracted revenue
Leeds	-2,641	61%
York	-660	15%
Wakefield	-559	13%
Doncaster	-214	5%
Bradford	-118	3%
Brighouse	-30	1%
Selby	-53	1%
Huddersfield	-35	1%
Halifax	-31	1%
Pontefract	-9	0%

APPENDIX D EDINBURGH – LONDON LOW PRICED FARES ALREADY OFFERED BY VTEC

[Redacted]

APPENDIX E FIRSTGROUP 0530 KINGS CROSS TO EDINBURGH DEPARTURE

[Redacted]

APPENDIX F: REASSESSMENT OF NPA RATIOS

Introduction

To demonstrate the impact of correcting the issues we have identified on the NPA Ratios, we have undertaken some indicative analysis to recalculate these NPA Ratios. Our calculations suggest that both the First Group application and the Alliance Leeds and North Lincolnshire proposals would fail the NPA test.

In order to undertake this assessment we have created a simple model, taking the outputs of our MOIRA runs and applying the CH2M methodology for modelling fares. It has not been possible to replicate every step in CH2M's methodology, because some details have been omitted from the CH2M Report. The results provided should therefore be interpreted as indicative. Nevertheless, our analysis is robust enough to demonstrate that our concerns are material, and could have a material impact on whether applicants pass or fail the NPA test.

For each of the relevant applications, we present:

The results of our analysis, in the form of a waterfall chart
A description of the approach taken, in producing each stage of the waterfall chart.

We have not attempted to remodel the NPA Ratio for the Alliance Edinburgh application at this time.

Alliance Application for Leeds and North Lincolnshire

Results

Our reassessment of Alliance's Application is shown below, resulting in a new NPA Ratio of 0.221.
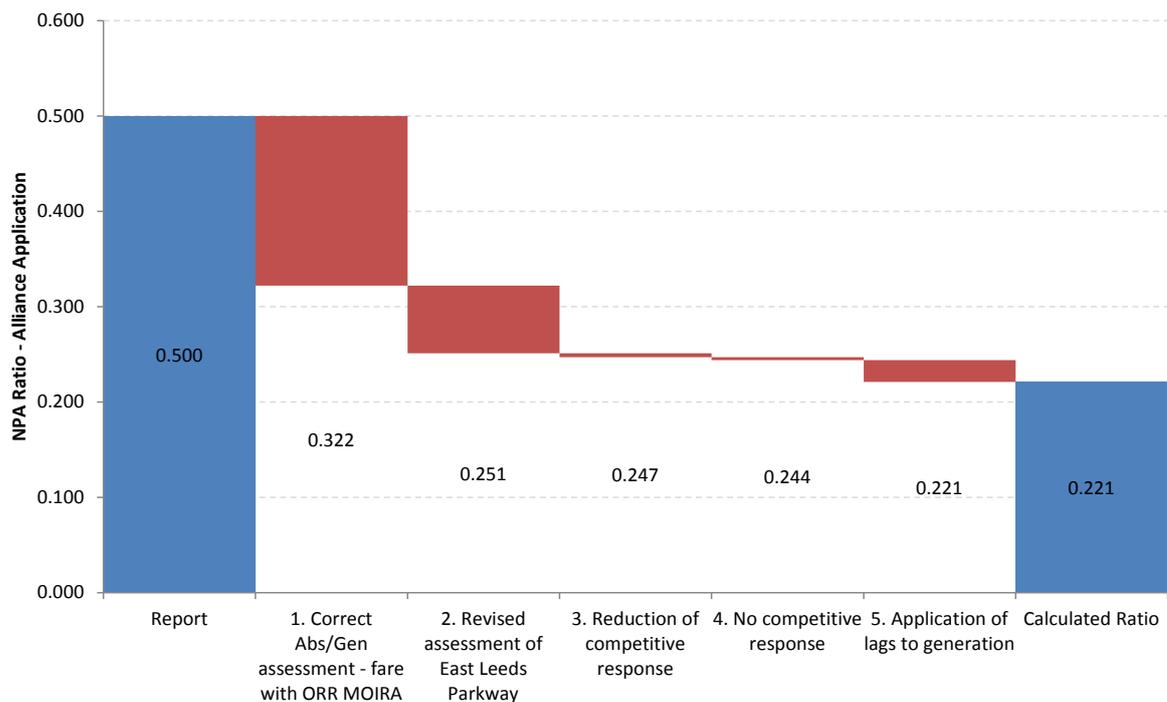
Approach Taken

Our starting point for the calculations is CH2M's estimated NPA Ratio of 0.5. This is given in Table 10 of the CH2M Report.

In assessing the impact of these changes on this application it has been necessary to rely on the CH2M Moira assessment, as the version of MOIRA we have been using does not include a number of relevant stations. We have added our calculated levels of fares generation and abstraction to this. We have then added in the effects of the gravity model. We assume these effects to be as follows in the base case:

	Value (£000s, 2014/15)	Source
Generated Revenue	9,000	Size of yellow bar in figure 2 of the CH2M Report
Abstracted Revenue	3,367	Amount of revenue abstraction listed for "East Leeds Parkway – Total London" flow in table 10 of the CH2M Report

We have then made adjustments in stages:

We have reassessed the NPA test using our model. This attempts to replicate the CH2M calculations. However, as identified in Appendix A (section 1.1), there appear to be issues with the calculation of fares generation and abstraction. Our methodology removes these issues, and ensures that net generation and abstraction are calculated in line with the approach taken in previous assessments.

We have applied our assessment of demand generation and abstraction at East Leeds Parkway to our methodology. To do this we have taken of the revenue levels quoted in Table 10 of the CH2M Report from the "East Leeds Parkway – Total London" flow, and added in our assessment.

	At Step 1. (£000s, 2014/15)	At Step 2. (£000s, 2014/15)
Generated Revenue	9,000	5,818
Abstracted Revenue	3,367	4,333

We have reduced the "competitive response" on the Leeds-Total London flow by 50%. Instead of assuming a 5% incumbent fare reduction, we have assumed a 2.5% fare reduction. This reflects the findings of Appendix A (Section 1.3.1), which demonstrates that the method by which the competitive response has been calculated by the CH2M Report is inappropriate. The change in NPA Ratio results in a much smaller change in the NPA Ratio than CH2M have calculated in table 11 of the CH2M Report. This illustrates the issues with the fares modelling approach adopted by the CH2M Report.

We have removed the "competitive response" from the model. This reflects the finding of Appendix A (Section 1.3.2), which states that recent evidence suggests that there would not be a competitive response.

We have applied lags to the generation effects modelled, and calculated a revised NPA Ratio in PV terms over a ten year period. This reflects the fact that abstraction effects are normally experienced immediately, while generation effects take time to occur. We have applied "major new services" lags from PDFH v5.1 Table B12.2 to generation effects. This takes account of the fact that there are a number of stations included in this proposal that currently have either no direct services to London, or an infrequent service.

First Group Application

Results

Our reassessment of First Group's Application is shown below, resulting in a new NPA Ratio of 0.209.
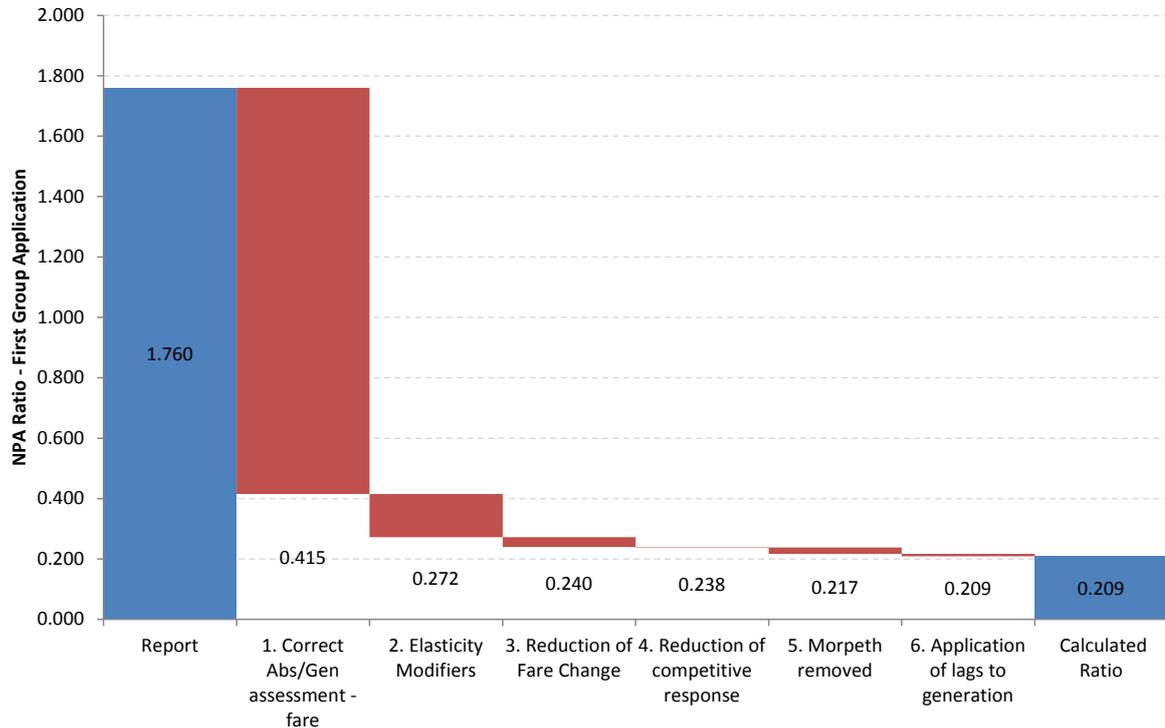
In assessing these results, two points should be noted:

The adjustment required as a result of steps 3 and 4 above appear small. However, the changes would be much larger if no elasticity modifiers had first been applied; and,
The final calculated NPA Ratio would be much lower still without any impact from the air competition overlay, a model which as we have demonstrated in appendix B, does not appear to be particularly robust, and has not been audited by Systra. Without the air competition overlay, the NPA Ratio of 0.209 would fall to 0.066.

Approach Taken

Our starting point for the calculations is CH2M's estimated NPA Ratio of 1.76. This is given in Table 25 of the CH2M Report.

It has not been possible to accurately replicate the fares element of the air competition model. This is because a number of the parameters we would need to replicate this model are not provided by the CH2M Report. In the base position we have assumed the following overlay needs to be added to our assessment of generation and abstraction from timetable (MOIRA) and fares. We assume this is all generated revenue:

	Value (£000s,2014/15)	Source
Air Competition Model	4,500	Size of purple bar in figure 9 of the CH2M Report
Gravity Model (Morpeth)	400	Difference between our assessment of generation at Morpeth due to MOIRA timetable effects and CH2M quoted figure for generation of £865K (Table 25)
Total	4,900	Sum of previous two rows

We have then applied simple adjustments to the size of this overlay to reflect changes we make. We recognise that this is a simplification.

We have made adjustments to the NPA Ratio in stages:

We have reassessed the NPA test using our model. This attempts to replicate the CH2M calculations. However, as identified in Appendix A (section 1.1), there appear to be issues with the calculation of fares generation and abstraction. Our methodology removes these issues, and ensures that net generation and abstraction are calculated in line with the approach taken in previous assessments.

We have applied elasticity modifiers to deal with the large fare changes proposed by First Group. We have done this in two parts:

> We have changed the Edinburgh-London fare elasticity from -1.05 (as quoted by PDFH v5.1 table B3.3) to -0.8. This reflects the findings of Appendix A (Section 1.4.1) that the Edinburgh market has a lower average yield than average in terms of fare per mile, and therefore should have a lower elasticity.

> We have applied the alternative elasticity formulation detailed in Appendix A (Section 1.4.2), which represents a more robust way of dealing with large fare changes.

We have found that when compared "like-for-like", the yield discount of 45% which is offered by First Group is in reality around 30%. We have therefore reduced the fare reduction by 1/3, and have commensurately reduced VTEC's competitive response by 1/3. Furthermore, we have reduced the size of the air competition overlay by 1/3, to reflect this new fare change assumption.

Parameter	At Step 2.	At Step 3.
First Group discount	-45%	-30%
Competitive response (VTEC fare change, Newcastle-London & Edinburgh-London)	-7%	-4.7%
Air Competition Overlay	£4,500k	£3,000k

We have reduced the "competitive response" on the Edinburgh and Newcastle routes to a 2% reduction. This reflects the findings of Appendix A (Section 1.3.1), which demonstrates that the method by which the competitive response has been calculated by the CH2M Report is inappropriate. We also reduce the impact of the air competition model by 2.5%.

Parameter	At Step 3.	At Step 4.
Competitive response (VTEC fare change, Newcastle-London & Edinburgh-London)	-7%	-4.7%
Air Competition Overlay	£3,000k	£2,925k

We have removed the effects of the gravity model at Morpeth, to reflect the fact that we do not consider the GJT change experienced at Morpeth large enough to justify the use of a gravity model.

We have applied lags to the generation effects modelled, and calculated a revised NPA Ratio in PV terms over a ten year period. This reflects the fact that abstraction effects are normally experienced immediately, while generation effects take time to occur. We have applied "improvements in fares or GJT" lags from PDFH v5.1 Table B12.2 to generation effects, as the new service would not constitute a significant enough addition to the service already provided by VTEC to warrant "major new services" lags.