Making Better Decisions

Assessment of Aspirations for Track Access on the West Coast Main Line

Report for The Office of Rail Regulation

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Contents

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Tables

1 Introduction

1.1 Background

1.1.1 The existing Virgin West Coast franchise and associated Track Access Agreement held by West Coast Trains Limited are both due to expire on 1st April 2012. The Office of Rail Regulation has received several applications for amendments to existing or additional track access rights on the West Coast Main Line (WCML).

1.1.2 ORR wrote to industry parties on 14th May 2010 with the primary objective of seeking to identify operators' future aspirations and requirements. At this initial stage a total of 18 expressions of interest were received by ORR. The responses ranged from maintaining existing rights, through to minor variations and additional track access rights.

1.1.3 In June 2010, Network Rail was commissioned by ORR to review the aspirations for track access. This review adopted a three stage approach:

- Stage 1: Elimination of aspirations that were deemed longer term and required significant infrastructure investment
- Stage 2: Undertaking of a capacity assessment which established remaining West Coast Main Line (WCML) capacity between London Euston and Preston relative to the December 2010 timetable. This included the generation of three scenarios
- Stage 3: Involved the production of a prototype timetable based on a scenario agreed with ORR. This timetable identified nine off-peak paths between London Euston and Preston.

1.1.4 The Network Rail process involved one-to-one meetings with the applicants.

1.1.5 In October 2010 applicants submitted firm proposals for track access on the WCML.

1.1.6 The ORR has a regulatory policy to grant access rights to new competing services only if they pass a "not primarily abstractive" (NPA) test. This test considers the level to which new services are abstractive of incumbents' revenue, without providing compensating economic benefits.

1.1.7 This test was developed to inform the trade-offs faced by the ORR under their duties of Section 4 of the 1993 Railways Act, namely to:

- Promote the use of the railway network to the greatest extent economically practical and promote competition for the benefit of rail users (considered within revenue generation)
- Enable operators to plan for the future with a reasonable degree of assurance and hold regard to the financial position of the Secretary of State (considered within revenue abstraction).

1.1.8 ORR commissioned MVA Consultancy to assess the applications for using the additional paths identified in the prototype timetable as part of the ORR procedures for assessing track access applications. The ten year appraisal covers the impacts on:

- revenue abstraction and generation
- journey time savings and other user benefits
- crowding impacts on demand and revenue
- non user benefits.

1.1.9 This report describes the cost-benefit analysis for each of the applications as required by the ORR together with the results of the NPA test.

1.2 Our Approach

1.2.1 In January 2009, we carried out a similar exercise for the East Coast Main Line (ECML) that assessed different applications for services to make use of an additional path between London Kings Cross and Doncaster. A similar methodology was adopted for this project.

1.2.2 The Terms of Reference (ToR) discussed two existing models that might be used to provide forecasts for the alternative track access applications. It considered MOIRA and PLANET Strategic. In our view neither of these models is adequate by itself. Due to MOIRA not considering fares, service quality or the effect of serving new stations and the implications for rail heading, where applicable and in agreement with ORR, we have adapted MOIRA outputs so as to take account of these effects in our appraisal.

1.2.3 This methodology takes MOIRA outputs for each timetable change and adds a number of modules to deal with the impacts where MOIRA falls short. The approach enhances the outputs from MOIRA (Generalised Journey Time (GJT) and market share) by further considering:

- **Crowding** – using a crowding curve calculated using Passenger Demand Forecasting Handbook (PDFH) crowding values
- **Fares** – an assessment of fare differentials caused by open access operators offering lower walk up fares has been made which has an impact on demand generation and market shares from MOIRA
- **Rail Heading** – a station choice module has been built using National Rail Travel Survey data and uses a LOGIT calculation to predict the likely number of passengers who switch between stations
- **Economic Benefits** - calculated using a standard approach.

2 Summary of the Applications

2.1 Overview

2.1.1 In October 2010, the ORR received a number of competing applications to run services on the WCML from:

- Department for Transport (DfT), on behalf of future franchise operators
- Grand Central Railway Company Limited (GC)
- Alliance Rail Holdings (AL).

2.1.2 London Midland also submitted two applications. These applications have not been appraised as part of this report as they did not relate to the same WCML fast line paths.

2.1.3 This section briefly summarises the applications to be assessed as part of this commission. Additional paths mentioned are mirrored by additional paths in the opposite direction.

2.1.4 To specify the model runs we agreed a number of guiding principles with ORR:

- The period from 2012 to 2022 was to be modelled despite some services not due to start until after 2012
- Where an application does not begin in 2012 benefits would accrue over a reduced timescale
- The applications would be modelled 'as bid' as far as possible making use of data submitted along with the applications
- Where timetables were not available the NR prototype WCML timetable would be used. Where a stop was removed from the prototype timetable 5 mins would be removed from the journey time on the main line and 3 minutes removed when a stop is removed from the routes off the main line
- Weekday timetables only would be modelled
- Flows to and from London, Watford Junction and Milton Keynes would be modelled.

2.1.5 DfT and Grand Central provided timetables along with their applications which were used as the "as bid" runs. In each case, the xx:33 path in the NR prototype timetable was able to be used. However, due to Alliance not providing a timetable with their application, the assumptions shown in the fourth bullet point above were used in their entirety.

2.2 Department for Transport

2.2.1 The DfT application was made on behalf of the future franchise operator. The timetable was specified as follows:

Hourly service to Glasgow with services calling:

- Preston, Penrith, Carlisle OR
- Preston, Lancaster, Oxenholme
- Journey time to Glasgow (on all services) 4hrs 14 mins

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Additional hourly service to Lancaster or Blackpool North:

- Lancaster services (5tpd NB, 5tpd SB) : 2hrs 34 mins
  - Calls MK, Nuneaton, Warr BQ, Wigan NW, Preston, Lancaster
- Blackpool services (5tpd NB, 5tpd SB) : 2hrs 41 mins
  - Calls MK, Nuneaton, Warr BQ, Wigan NW, Preston

2.2.2 It was agreed with ORR that we should assume the future franchise operator maintains the same fare strategy as used today.

2.2.3 The start date for these services is proposed to be April 2012 and be operated by Pendolinos and Voyagers. We have assumed the Blackpool services will be run by Voyagers until 2016 after which the electrification of the Preston to Blackpool line allows the use of Pendolinos to Blackpool.

2.2.4 Table 2.1 summarises the assumptions used to model the DfT application. The DfT provided a timetable to accompany their application and, as agreed with ORR, Option B of this timetable was used. The run includes five trains per day to Blackpool and five extra trains per day to Lancaster. This assumes an extra path compared to the prototype timetable at 06:33. Glasgow services have had stops at Wigan and Warrington removed, served instead by the Blackpool and extra Lancaster services.

2.2.5 Operating costs were provided by DfT on a per train mile and for lease costs and maintenance costs on a per train set basis. The cost per train mile was multiplied by the extra train miles operated and lease and maintenance costs are based on an extra 2 Pendolino 9 car sets being required. Between 2012 and 2016 it has been assumed that the West Coast Trains services to Blackpool will be operated by Voyagers with electrification allowing Pendolinos to run to Blackpool from December 2016 onwards.

Table 2.1 Run 1 (a): DfT Application

Base Timetable	Run Timetable and assumptions	
May 2010	Start Year	April 2012
	Operating Costs	2 x Pendolino 9 car with 3 x Voyager 5 car to Blackpool until 2017 (Voyagers replaced with 3 x Pendolino 9 car from 2017)
	Capacity per train	Pendolino 9 car (439 seats) Voyager 5 car (250 seats)
	Speed	125 mph
	Fares	As West Coast Franchise
	Stopping Pattern	As DfT Option B Timetable

2.3 Grand Central

2.3.1 GC have applied to run four trains per day between London Euston and Blackpool North via Preston.

2.3.2 GC have also applied for one train per day between London Euston and Hartford.

2.3.3 GC are proposing to use Class 67 locomotives with 5 Mk3 coaches from May 2012 until December 2016 when electrification of the line from Preston to Blackpool enables them to run Class 90 locomotives with 6 MK3 coaches, in a timetable based on 110mph running.

2.3.4 GC proposes a flat fare of £[✂] return in the off-peak and £[✂] return in the peak. This has been modelled as a single fare of £[✂]and £[✂] respectively. Using the timetable in their application we have assumed the morning Hartford to London train that arrives at London Euston at 08:05 to be the only peak train. For the stations served by this train the fare offered has been uplifted by giving the £[✂]fare a weighting of 9/10 and the £[✂]fare a weighting of 1/10.

2.3.5 The stopping pattern assumed for the GC to Blackpool North services was as follows:

- London Euston
- Nuneaton
- Tamworth
- Hartford
- Preston
- Kirkham & Wesham
- Poulton le Fylde
- Blackpool North

2.3.6 The one train per day between London Euston and Hartford in each direction was modelled with the following stopping pattern:

- London Euston
- Nuneaton
- Tamworth
- Lichfield TV
- Hartford

2.3.7 Table 2.2 summarises the assumptions used to model the GC application.

Table 2.2 Run 1 (ci) GC to Blackpool at 110mph

Base Timetable	Run Timetable and assumptions	
May 2010	Start Year	May 2012
	Operating Costs	GC application
	Capacity per train	3 x Class 67 with MK3 5 car and 3 x Class 90 with MK3 6 car from 2017
	Speed	110 mph
	Fares	£[✂]flat off-peak return fare, £[✂]peak return fare
	Stopping Pattern	As application

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2.4 Alliance Trains

2.4.1 The AL application proposes to introduce the following passenger services:

- London Euston to Leeds via Crewe, Guide Bridge and Dewsbury alternate hours with the Bradford service (up to five trains per day)
- London Euston to Bradford Interchange via Newton-le-Willows and Rochdale alternate hours with the Leeds service (up to five trains per day)
- London Euston to Blackpool North, alternate hours with the Carlisle service (up to five trains per day)
- Euston to Carlisle via Barrow-in-Furness and the Cumbrian Coast, alternate hours with the Blackpool service (up to four trains per day). However, ORR agreed with Network Rail that the Cumbrian services could not be accommodated. Therefore, MVA were instructed by ORR to not model these services.

2.4.2 Services will be operated by newly built 125mph dual mode rolling stock. At the time that we conducted the analysis, AL had not provided a proposed fare structure or operating costs in their application.

2.4.3 To assess the individual merits of serving Leeds, Bradford and Blackpool each destination has been assessed separately, with the exception of the Carlisle service, which, as noted above, was discarded as it could not be accommodated in the timetable. AL services are not due to begin operation until December 2013. However, the final year of the appraisal has not been extended resulting in these services being appraised over a shorter period.

2.4.4 Operating costs and fares were not provided in the AL application. For operating costs, we have used the costs for running a 9 car Pendolino as provided by DfT. To be consistent with these costs, capacity for each service has also been assumed to be provided by Pendolino 9 car sets, which is higher than the capacity submitted with their application. Lease and maintenance costs are based on an extra three Pendolino 9 car sets being required for the AL Blackpool services and five Pendolino 9 car sets being required for the Bradford, Hebden Bridge and Leeds runs.

2.4.5 In the absence of a fare structure AL fares have been assumed to be 0.7 times that of an any permitted walk up off-peak fare.

2.4.6 The stopping pattern of the Blackpool North services was modelled as follows:

- London Euston
- Kings Langley
- Nuneaton
- Tamworth
- Crewe
- Winsford
- Newton-le-Willows
- Preston

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- Kirkham and Wesham
- Blackpool North

2.4.7 In the Northern version of MOIRA Kings Langley is grouped in with Watford Junction. To ensure that Kings Langley journeys to places north are included in the modelling, Watford Junction has been used as a proxy.

2.4.8 Table 2.3 summarises the assumption used to model the AL application to run services to Blackpool North.

Table 2.3 Run 1 (b): AL to Blackpool North

Base Timetable	Run Timetable and assumptions	
May 2010	Start Year	Dec 2013
	Operating Costs	3 x Pendolino 9 car
	Capacity per train	Pendolino 9 car (439 seats)
	Speed	125 mph
	Fares	0.7 times West Coast Franchise off-peak walk up fare
	Stopping Pattern	As in AL application

2.4.9 The stopping pattern assumed for the AL to Bradford Interchange services was as follows:

- London Euston
- Kings Langley
- Nuneaton
- Tamworth
- Crewe
- Winsford
- Newton-le-Willows
- Eccles
- Manchester Victoria
- Rochdale
- Hebden Bridge
- Halifax
- Bradford Interchange

2.4.10 Table 2.4 summarises the assumptions used to model the AL application to run services to Bradford Interchange.

Table 2.4 Run 2 (a): AL to Bradford Interchange

Base Timetable	Run Timetable and assumptions	
May 2010	Start Year	Dec 2013
	Operating Costs	5 x Pendolino 9 car
	Capacity per train	Pendolino 9 car (439 seats)
	Speed	125 mph
	Fares	0.7 times West Coast Franchise off-peak walk up fare
	Stopping Pattern	As application

2.4.11 Due to the NR prototype timetable not providing timings beyond Hebden Bridge, a further scenario tested this variant of the AL Rail application to Bradford Interchange. Table 2.5 summarises the assumptions used to model this.

Table 2.5 Run 2 (b): AL to Hebden Bridge

Base Timetable	Run Timetable and assumptions	
May 2010	Start Year	Dec 2013
	Operating Costs	5 x Pendolino 9 car
	Capacity per train	Pendolino 9 car (439 seats)
	Speed	125 mph
	Fares	0.7 times West Coast Franchise off-peak walk up fare
	Stopping Pattern	As application but stopping short at Hebden Bridge

2.4.12 The stopping pattern assumed for the AL to Leeds services was as follows:

- London Euston
- Kings Langley
- Nuneaton
- Tamworth
- Crewe
- Alderley Edge
- Stockport
- Guide Bridge
- Huddersfield
- Dewsbury
- Leeds

2.4.13 Table 2.6 summarises the assumptions used to model the AL application to run services to Leeds.

Table 2.6 Run 3: AL to Leeds

Base Timetable	Run Timetable and assumptions	
May 2010	Start Year	Dec 2013
	Operating Costs	5 x Pendolino 9 car
	Capacity per train	Pendolino 9 car (439 seats)
	Speed	125 mph
	Fares	0.7 times West Coast Franchise off-peak walk up fare
	Stopping Pattern	As application

3 Impacts of introducing new services

3.1 A background to the impacts of new services

3.1.1 The addition of a new operator to a market has a number of effects on the overall market, which in turn lead to economic impacts. We have considered the following effects:

- Abstraction from existing services
- Railheading and station access
- Impact of car parking
- Improved journey options generates new rail demand
- Offering cheaper fares generates new rail demand
- Impacts on Crowding of adding additional services
- Economic Benefits

3.1.2 This section gives an overview of the modelling exercise. Where helpful, we have used the introduction of GC Sunderland service on the ECML to illustrate some of these points.

3.2 Abstraction from existing services

3.2.1 Any new service whether it be by an open access operator or a franchised operator will abstract revenue from existing services. For example when GC began stopping services at York the make up of the market at York changed. The addition of their three services attracted some of the passengers who had previously used the NXEC services to London and thereby abstracted revenue from NXEC. These passengers may have been attracted to GC by services that better fit their preferred arrival times, they may have been attracted by the lower fares offered by GC or may simply have turned up a time when the next train to leave was the GC service to London.

3.3 Railheading and station access

3.3.1 In the case of GC, stations such as Eaglescliffe and Hartlepool gained a direct service to London. In the case of Eaglescliffe, the improvement of the service to London will have encouraged passengers who previously used Darlington to switch stations. This will have generated economic benefits for those passengers using the new service through reduced access and/or journey times. The people most likely to have switched will be those people who drove to Darlington from the Eaglescliffe area and beyond. By accessing Eaglescliffe instead they can save themselves a longer access time to Darlington and higher car-parking fees.

3.3.2 The factors influencing the station passengers choose are as follows:

- access time to station
- fares offered at each station
- car park availability, price and security

- service frequency and journey time.

3.4 Impact of car parking

3.4.1 When considering which station to access, a passenger is likely to consider how much it is likely to cost. For passengers who are accessing by car and parking at the station car park, parking cost will be taken into account when choosing their preferred station. For example the passenger may need to balance a good service frequency and high car park cost vs. a lower service frequency and lower car park cost.

3.4.2 Car park capacity also becomes important as the car parks become full. At large stations there is evidence that car parks being at capacity constrain demand for rail travel at the station. Where this was the case at Darlington on the ECML, passengers switching from Darlington to Eaglescliffe released capacity at Darlington. The capacity released could then be assumed to be filled by passenger demand previously suppressed as a result of the limited availability of parking.

3.5 Improved journey options generates new rail demand

3.5.1 Improving the rail service at a station generates demand in two main ways:

- existing passengers travelling more due to the improved service
- new passengers encouraged to travel by rail will fall into two groups:
  - passengers who would have made the journey by another mode (e.g. car)
  - passengers who would not have made the journey at all before.

3.6 Offering cheaper fares generates new rail demand

3.6.1 If cheaper fares enter the market the same generation theories apply as for improved service journey options provision in the preceding section. A lower fare encourages existing passengers to travel more because their money goes further and also encourages passengers to switch mode. Different types of passenger have different sensitivity to fares. Commuters for example are less sensitive to fare than leisure travellers, as they usually have less choice as to whether they make a journey or not.

3.6.2 Offering lower fares also encourages passengers to switch operators. In the case of GC at York, by offering lower walk up fares than the equivalent NXEC fares, passengers were abstracted from NXEC. When appraised, these passengers were judged to have received economic benefits from the fare savings.

3.7 Impacts on Crowding of additional services

3.7.1 Adding services to the network increases the passenger carrying capacity available. As trains become more crowded passengers either decide to endure the crowded conditions, change their time of travel or not to travel by rail at all. The people who decide not to travel by rail due to crowding are said to have been “crowded off”.

3.7.2 The new services will have two impacts on crowding:

- They generate demand and so the overall number of trips on the network is greater, potentially increasing crowding
- However, the new services also provide extra capacity and so the journeys are spread over a larger number of trains.

3.7.3 The crowding impact of the new services is a trade off between the two impacts discussed above.

3.8 Economic Benefits

User Benefits

3.8.1 The majority of the benefits of changes to the timetable come from benefits to the user (i.e. the rail passenger). The aspects appraised are:

- **Value of time savings** – Journey time savings give a benefit to passengers in terms of total minutes saved. This also applies to frequency of service benefits.
- **Value of benefits from generated journeys** – This is calculated using the standard 'rule of a half' (i.e. some passengers are generated by the slightest improvement and receive the full benefit; some experience the whole improvement but receive the same benefit; the average is half).
- **Benefits of lower fares** – Where operators introduce lower fares, existing and new passengers experience a benefit.
- **Crowding Benefits** – An increase in capacity results in a decrease in the number of passengers crowded off. The crowding benefits account for the economic benefits gained by those people now deciding to travel who would otherwise not have travelled by rail.

Non-user Benefits

3.8.2 Non-user benefits have been calculated for each timetable variant. The following aspects have been considered:

- **Car kilometres removed** – This aspect includes the impact on the highway network of generating rail trips. A proportion of the generated trips are likely to have been abstracted from other modes (predominantly car). Removing these vehicle km is likely to have the impact of reducing congestion, accidents, greenhouse gas emissions and improving local air quality. Also included in this calculation is the loss of government taxation in line with WebTAG recommendations.
- **Reduced access by car** – When people choose a station nearer to the origin or ultimate destination of their journey due to the introduction of a direct service, there is a reduction in the distance travelled to access the station. Where this is by car then there are the same types of benefit to the reduction in car traffic in the previous bullet.

4 Methodology

4.1 Outline

4.1.1 The model has been split into five main modules which deal with a different aspect of the impact of introducing new services to the timetable.

- station choice
- fares
- MOIRA GJT generation
- crowding
- economic benefits.

4.1.2 Figure 4.1 shows a schematic layout of the model.

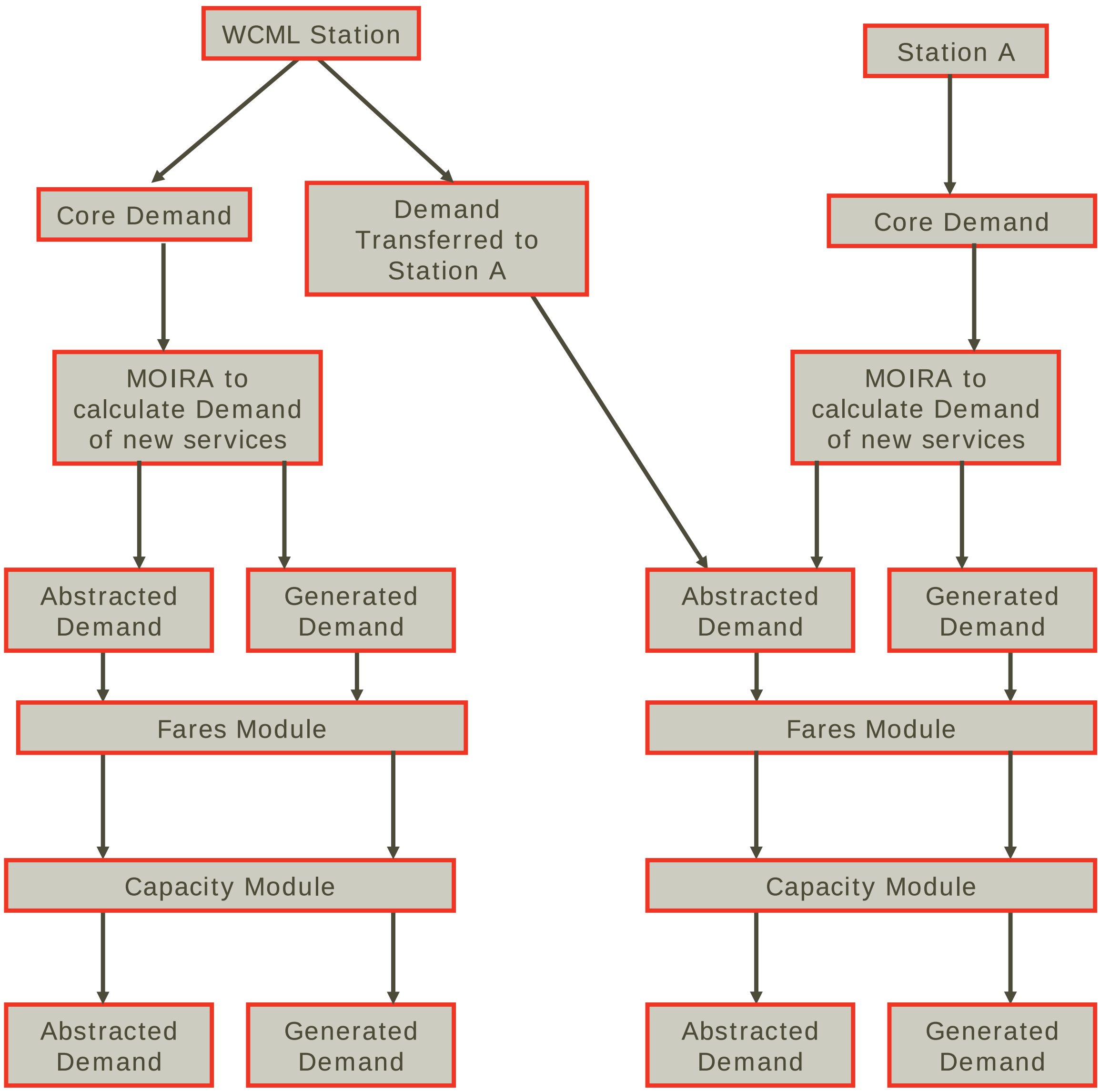

Figure 4.1 Model Layout and Interactions

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4.1.3 Network Rail have developed a new off-peak standard pattern timetable for weekdays. To reflect this, our model only deals with weekday demand. Weekends are excluded from the analysis and modelling, although the results are uplifted so as to give values for the whole year.

4.1.4 The model forecasts demand and revenue for trips to and from London and also from Watford Junction and Milton Keynes to places north to model interconnectivity between intermediate stations. After modelling, revenue from these flows account for more than 94% of total revenue.

4.2 Data Sources used in the demand and revenue modelling

4.2.1 The data sources used for the modelling are:

- MOIRA - May 2010 Northern
- LENNON ticket sales data
- West Coast Trains Passenger Count Data
- National Rail Travel Survey data
- Fare Information – as published or obtained from the applicant (when presented)
- Cost Information – obtained from the applicant (when presented).

4.3 Base data extraction from MOIRA

4.3.1 Base demand was extracted from the May 2010 version of MOIRA. For each station, annual demand and revenue was extracted for each station in scope. The stations include all the main stations served by the West Coat Trains franchise on the WCML up to Glasgow and the stations to be served by open access operators.

4.4 Using MOIRA to forecast the impact of new services

4.4.1 MOIRA has been used to forecast the basic impact of introducing new services to the WCML. For each station, MOIRA is used to:

- Assess the change in market share of each operator at each station
- Forecast the change in Generalised Journey Time (GJT) at each station, which this is used to drive the estimates of generation and also feeds into the station choice model

4.4.2 The prototype timetable, which assumes 125mph running, was used to compile timetables where the applicant did not provide a timetable in their application. Where the stopping pattern in the prototype timetable was different to the stopping pattern proposed by the applicants, timings from the prototype timetable were changed. If an additional stop was needed, an additional five minutes was added to the journey time on the mainline and three minutes off the mainline to account for slowing down, stopping and acceleration. The opposite was assumed if a stop needed to be taken out of the prototype timetable.

4.5 Determining the GJT elasticities to use

4.5.1 MOIRA was designed to forecast the impact of relatively small changes in service. There are genuine concerns that MOIRA underestimates the growth of new markets which causes a problem when assessing the applications. PDFH recommends considering higher elasticities when the rail service is poor, which is the case at some stations to be served by the new services.

4.5.2 For our work on the ECML track access appraisals[1] (January 2010) we developed an evidence-based approach to solving this problem. This included analysis of Hull Trains over its life span. Using a combination of MOIRA and the National Rail Travel Survey (NRTS) we were able to provide an improved estimate of the likely generation that has been seen by these services. In the absence of a WCML equivalent case study we have used this analysis to assess the WCML applications.

4.5.3 The outcome of our analysis was the formula shown below:

Elasticity to GJT = - (0.9 + 2.5 * % change in GJT)

4.5.4 For small changes the formula is equivalent to the MOIRA elasticity of -0.9.

4.5.5 This formula has been used to calculate the impact of GJT changes on demand at each station in the model that does not have a direct service to London in the base timetable.

4.6 Station Choice Module

4.6.1 To forecast the potential switching between stations, a station choice model has been developed. The model uses MOIRA to provide estimates of GJT for each station flow to and from London and Watford Junction and Milton Keynes to places north. It combines this with an estimate of fares and access time to create a generalised cost.

[1] http://www.rail-reg.gov.uk/upload/pdf/ecml-cap2_MVA_finrep_red.pdf

Table 4.1 Pairings of WCML primary stations and secondary stations

Open Access Secondary Station	Competing Primary Station
Alderley Edge	Wilmslow
Blackburn	Wigan North Western
Blackpool North	Preston/Wigan North Western
Dewsbury	Wakefield
Eccles	Manchester Piccadilly
Guide Bridge	Manchester Piccadilly
Halifax	Wakefield
Hartford	Crewe
Hebden Bridge	Manchester Piccadilly
Huddersfield	Wakefield
Kirkham & Wesham	Preston
Littleborough	Manchester Piccadilly
Manchester Victoria	Manchester Piccadilly
Newton-Le-Willows	Wigan North Western/Warrington Bank Quay
Poulton Le Fylde	Preston
Rochdale	Manchester Piccadilly
Winsford	Crewe

4.6.2 Primary WCML stations have been identified as likely to have passengers abstracted to other stations due to the Open Access Operators. Table 4.1 shows the list of primary stations and competing secondary stations where open access operators may serve.

NRTS Data Extraction

4.6.3 Relevant NRTS data was extracted and used to calculate the current access times to each Primary Station and Competing Secondary Stations. The list of Primary Stations and potentially Competing Secondary Stations are shown in Table 4.1. The respondents in NRTS travelling to and from London and Watford Junction and Milton Keynes to places north from each primary station were used to represent the current demand at the primary station. The location from where they accessed the station (not always home if they were on business for example) was plotted in an accessibility planning software package, ACCESSION, which was used to calculate access time by car to each station.

4.6.4 Each respondent forms a separate record in the station choice model and allocated an expansion factor to expand up to the overall demand at the primary station. If a respondent accesses the Primary Station from somewhere nearer the Primary than any of the Secondary Stations in scope we have assumed they will not consider switching stations. The NRTS sample sizes for each primary station are shown in Table 4.2.

Table 4.2 NRTS Sample Size at each primary station

Primary Station	NRTS Sample Size
Crewe	692
Manchester Piccadilly	1,525
Preston	407
Wakefield	731
Warrington Bank Quay	322
Wigan North Western	221
Wilmslow	59

Modelling Station Choice

4.6.5 A set of GJTs have been calculated for each respondent from NRTS accessing the primary station. A respondent is then allocated to each station/fare type using a LOGIT model. There are in principle four choices:

- Primary Station, walk-up fare
- Primary Station, advance fare
- Secondary Station, walk-up fare
- Secondary Station advance fare.

4.6.6 To model the station that passengers are likely to choose, the generalised cost of each option open to them has been calculated. The components of the Generalised Journey Time (GJT) used are:

- Access time to station
- GJT from MOIRA (includes In Vehicle Time (IVT), frequency penalty and interchange penalty)
- Fares
- Car park cost

4.6.7 The LOGIT model also calculates a composite generalised cost which enables generation to be calculated using an elasticity to generalised cost. An elasticity to Generalised Cost of -2.4 has been used for this purpose. We have calculated this elasticity by taking the ratio of the generalised cost and GJT at the Primary Stations and multiplying this value by a GJT elasticity of -0.9 as recommended by PDFH.

Access Time Weighting

4.6.8 PDFH dictates that access time should be given a weighting of two times IVT on average. We do not have separate access cost factors, so the effect of this needs to be included within the GJT. Furthermore, the access time estimated from the ACCESSION software are the free flow conditions and so an adjustment is needed for more typical network conditions. For the ECML study a comparison was carried out of the journey times forecasts using the NRTS data in ACCESSION and journey times predicted by an online journey planner. The adjustment for road congestion, petrol costs and PDFH access time weightings gives an overall access time weighting of 3.5. We have also used this value in relation to the WCML applications.

Station Choice Spread Parameter

4.6.9 The LOGIT model spread parameter was calibrated using the NRTS data. Access times calculated using the NRTS data were plotted against the probability that passengers choose Preston instead of nearby competing stations (Blackpool North, Poulton le Fylde, Kirkham & Wesham and Blackburn) at different access time differentials. The result of this analysis has been plotted in Figure 4.2.

4.6.10 This curve was used to calculate the spread parameter used in the station choice model. A best fit LOGIT curve was applied to the data which gives a spread parameter of 0.26. and converted into the spread parameter to be used in the model dividing by the access time weighting (3.5); giving a spread parameter of 0.07.

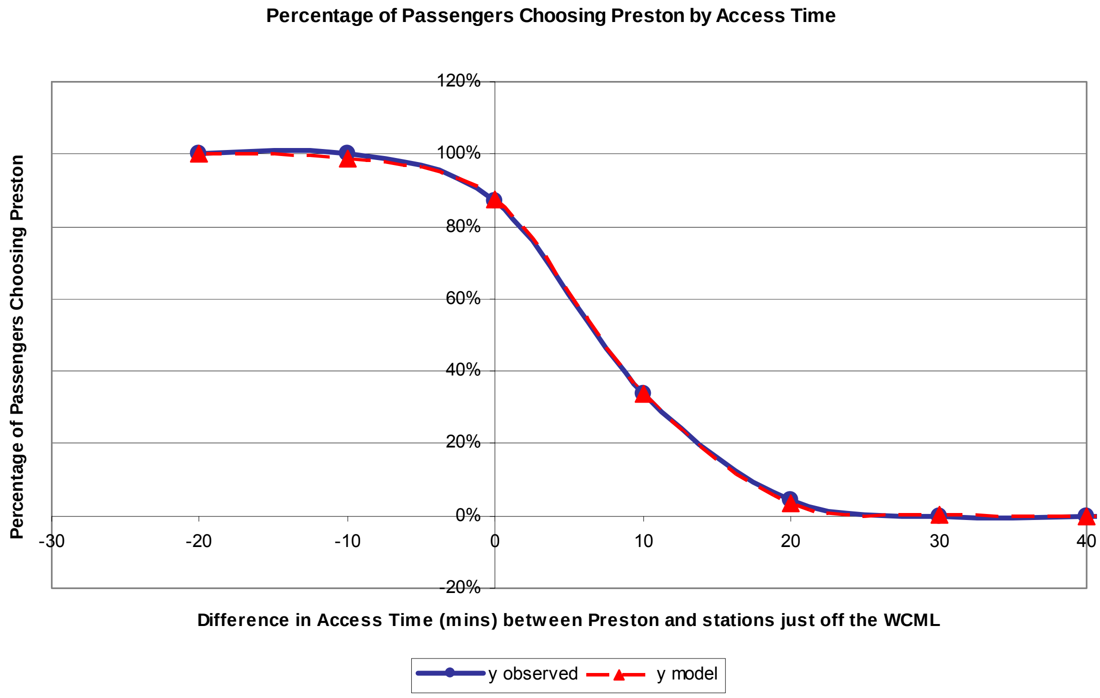

Figure 4.2 Percentage of Passengers Choosing Preston by Access Time

Car parks

4.6.11 Station choice can be significantly influenced by availability and cost of parking at stations. The station choice calculation includes the daily cost of parking at each station[2]. The station choice model did not take account of car park capacity in determining passengers' station choice. However, the daily increase in numbers generated would suggest that this could be within operators' ability to provide (see para 5.4.1).

4.7 Abstraction of demand from Primary WCML stations

4.7.1 The station choice model is designed to forecast the volume of passengers willing to switch from the primary WCML stations. The available car park capacity at each primary station is

[2] Source: National Rail Enquiries and en.parkopedia.co.uk/

likely to be suppressing demand for rail. When demand is abstracted from the primary station the released capacity will allow some of the passengers previously dissuaded from travelling to use the primary station.

4.7.2 The station choice model allows for this adjustment by assuming that of the proportion of demand abstracted that parks at the primary station (obtained from NRTS data) half of this demand is refilled due to the release of capacity.

4.8 Adjusting the MOIRA outputs to take account of different fare levels

4.8.1 MOIRA estimates the demand and market share impact of introducing a new operator at a given station but it assumes that fares remain unchanged. In reality the new operator is likely to offer lower fares. This will affect the market shares of each operator at the station and if the fare is lower is likely to also generate new demand over and above that predicted by MOIRA.

4.8.2 The following formula (which is the standard LOGIT model) has been used to adjust the market share at each station to take account of the differential fares offered. The current West Coast Trains off-peak fares have been compared to the off-peak fare proposed by the open access operators. This allows a like for like comparison of the fare differentials and keeps the calculations relatively straightforward.

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

$$s^1 = \frac{1}{1 + \ell^{-\lambda d}(\frac{1}{s} - 1)}$$

4.8.3 The introduction of Grand Central Sunderland service on the ECML offered a valuable opportunity to calibrate the model to revealed preference data for the assessment of track access applications on the ECML[3]. No such example exists on the WCML and so in the absence of further evidence the spread parameter has been calibrated using GC data at York to give a spread parameter value of 0.04.

4.8.4 In addition to abstraction, offering lower fares will also generate demand for rail travel. The average change (across all operators) in fare offered at the station weighted by market share has been used to assess the level. The fare elasticity applied has been calculated using a mid-point of the PDFH 5 values of -0.8 for business and -1.25 for leisure. PDFH 5 section B0.3 recommends using a split of 30% business and 70% leisure, which provides a weighted elasticity of -1.1 for use in this study on the basis that although this implies some business passengers may be travelling on services with extended journey times, the elasticity greater

[3] http://www.rail-reg.gov.uk/upload/pdf/ecml-cap2_MVA_finrep_red.pdf

than one reflects the majority of the uptake will be by leisure passengers responding to fare discounts.

4.8.5 We discuss the importance fare levels have on the results in the next section.

4.9 Forecasting demand for future years

4.9.1 In order to forecast demand up to 2022 it was necessary to grow the base demand for rail travel accordingly. Exogenous growth has been sourced from the Network Rail RUS[4] as shown in Table 4.3.

Table 4.3 Exogenous Growth

Station	Forecast Growth 2009/10-2024/25	% Compound Annual Growth Rate
Carlisle	48%	2.65%
Glasgow	41%	2.32%
Manchester	62%	3.27%
Outers[5]	33%	1.92%
Trent Valley	29%	1.71%
Staffs Triangle[6]	56%	3.01%

4.9.2 For stations not covered in the RUS, the growth rate of a station located in the adjacent geographical area has been allocated.

4.9.3 Fares have been assumed to increase by RPI+3% until 2015 and RPI+1% thereafter so as to be consistent with the recent Ministerial announcement. This has been applied to the average yields used to calculate the revenue by station, although demand has grown on the assumption of RPI+1 in line with the RUS as noted in 4.9.1.

4.10 Taking account of the crowding impact of introducing new services

4.10.1 New services will not only generate new demand but will add new capacity to the network. This balance has been taken into account in our crowding module. The standard PDFH crowding approach and parameters have been applied.

4.10.2 For each operator the total demand for their services is assessed in conjunction with the total capacity the operator offers. Passengers crowded off the open access operator will either decide not to travel by rail or choose another operator. We would expect a passenger that had switched from an existing operator to the open access operator to switch back to the existing operator if they were crowded off of the open access operator. For a generated passenger, we would expect this trip to be lost to the rail industry.

[4] West Coast Main Line RUS, Network Rail

[5] WCML Outers consist of Hemel Hempsted, Milton Keynes Central, Northampton and Rugby station. p13, Chapter 4, WCML RUS

[6] Staffs Triangle consist of Crewe, Hartford, Macclesfield, Stafford, Stoke-on-Trent and Uttoxeter stations. p13, Chapter 4, WCML RUS

4.10.3 Separating out which passengers are generated and which are abstracted is not straightforward and depends on the generation abstraction ratios for each application. A generation abstraction ratio of 1 suggests 50% of passengers crowded off would return to the existing operators with the other 50% lost to the rail industry. To give an idea of sensitivity to this value a generation abstraction ratio of 0.7 suggests 59% of those crowded off is abstracted and move back to the existing operator. A ratio of 1.3 suggests 43% move back. Given this spread we feel 50% is appropriate to use and has been applied in the crowding module.

4.11 Average Yields

4.11.1 For each of the new operators we have assumed the average yield will be equal to the fare charged by that operator. Depending on validity of discount rail cards this average yield may be less in reality. Without any precedents on the WCML there is insufficient evidence to support an estimation of what this difference is likely to be. In modelling terms this would have the effect of reducing the generation abstraction ratios for the operators who included lower fares in their application.

4.12 Assessing the economic benefits of the new services

4.12.1 Economic benefits have been calculated for each of the aspects listed below:

- Station Choice Generalised Cost
- Value of Time Saving- GJT
- Generation due to GJT at Current Station
- Generation due to Station Choice
- Fares Change Benefits
- Crowding Benefits
- Car travel Removed
- Station Access Car Kilometres Removed

4.12.2 The Value of Time (VOT) used for these calculations has been taken from WebTAG. For appraisal purposes it is appropriate to use the WebTag values of time instead of rail values of time presented in PDFH. This has been weighted by West Coast Trains demand by ticket type and uplifted to 2008 prices (as per WebTAG) to give an average value of time of 17 pence per minute.

Station Choice Generalised Cost

4.12.3 The economic benefits of the change in generalised cost have been calculated using the average change in generalised cost per respondent in the station choice module. This is multiplied by the total demand being contested in the station choice module and then by the value of time.

Value of Time Saving- GJT

4.12.4 The total minutes saved is calculated by multiplying the change in GJT by the base demand. This is then multiplied by the value of time to give the total value of this time saved.

Generation due to GJT at current station

4.12.5 The generation benefits have been calculated using the standard 'rule of a half' (see 3.8.1). This has been calculated by averaging the base and run GJT and multiplying by the number of generated trips and the value of time.

Generation due to station choice

4.12.6 The generation benefits due to station choice are calculated by multiplying the average composite cost at each primary station by the generated journeys. Then, using the rule of a half this is multiplied by 0.5 and the value of time to give the total benefits.

Fares Change Benefits

4.12.7 The benefits due to the introduction of cheaper fares has been split into two categories:

- The benefits experienced by existing rail passengers of the cheaper fares. This has been calculated by multiplying the average change in fare at each station by the base demand. A reduction in fare results in a loss in revenue included in the NPV calculation which is balanced by an increase in the fare benefits to passengers.
- The benefits of the generated demand. This has been calculated using the 'rule of a half'. The average change in fare is multiplied by the generated demand due to fare multiplied by a half.

Crowding Benefits

4.12.8 The crowding benefits have been calculated by taking the change in journeys due to crowding. The crowding impact is then converted into a time equivalent value and multiplied by the base journeys and value of time.

Car travel removed

4.12.9 The amount of car travel removed has been calculated by taking the total change passenger km due to generation, dividing by average car occupancy (1.52 from WebTAG). This value is then multiplied by 50%. This widely used approach assumes that on average, 50% of the generated trips transfer from car. The number is then multiplied by the value of removing one car km to give an estimate of the economic benefit of reducing car travel. The WebTAG values of removing one car km are shown in Table 4.4.

Table 4.4 WebTAG values for removal of a car km (2008 prices)

	Pence per car km
Congestion	13.3
Infrastructure	0.1
Accident	1.6
Local Air Quality	0.6
Noise	0.1
Greenhouse Gases	0.4
Indirect Taxation	-4.7
TOTAL	**11.4**

Station Access Car Kilometres Removed

4.12.10 Using the station choice module the average access time saving per person switching stations was calculated. The average time saving per switcher is then multiplied by the number of switchers to give the total time saving. To calculate the car km removed this time value is multiplied by average road speed. The car km removed is then used in the same way as explained in the previous section to give the value of the car km removed.

4.13 Calculating the Net Present Value (NPV) of each application

4.13.1 The NPV has been used to draw together the benefits and costs of the applications into one measure. The NPV has been calculated by discounting each item by 3.5% pa over a ten year appraisal period. The NPV is calculated as:

NPV = Economic Benefits – Net Financial Cost

Net Financial Cost = (Revenue –Operating Costs) x Market Price Adjustment Factor (20.9%)

4.14 Generation Abstraction Ratios

4.14.1 To form the basis of the assessment of the NPA test, generation abstraction ratios were calculated for each application. The formula used was:

$$= \frac{\mathrm{Re}\,venueGenerated}{\mathrm{Re}\,venueAbstracted}$$

- Revenue generated is the overall change in revenue to the rail industry
- Revenue abstracted is the sum of and reduction in revenue from other TOCs.

4.15 Quality Assurance

4.15.1 We have undertaken the analysis in accordance with our Quality Management System. To ensure the model results are robust we have undertaken the following:

- Independent review of the model coding

- A full review of inputs including MOIRA timetables
- Detailed results sheets were set up to cover every aspect of the applications including demand, revenue and economic benefits by station, load factors, generation abstraction ratios and profit and loss assessments
- All assumptions were reviewed by our demand forecasting expert
- Reports and detailed results were delivered to ORR for review
- Reports amended and aspects of the results investigated following ORR comments.

5 Results

5.1.1 This section sets out the results of each of the model runs specified by ORR. This chapter is split into the following sections:

- Assessing each application "as bid"
- Comparing Blackpool North options
- Investigating sensitivity to fare

5.1.2 For each run the following outputs are presented:

- Net Present Value (NPV) which gives a measure of commercial resilience and sustainability of the service
- Generation abstraction ratio showing a comparison of revenue generated vs. revenue abstracted from other operators.

5.2 Results of the "as bid" runs

5.2.1 Figure 5.1 shows the Ten Year Net Present Value (NPV) resulting from each of the applications. These results should be viewed in conjunction with the generation abstraction ratios in Figure 5.2.

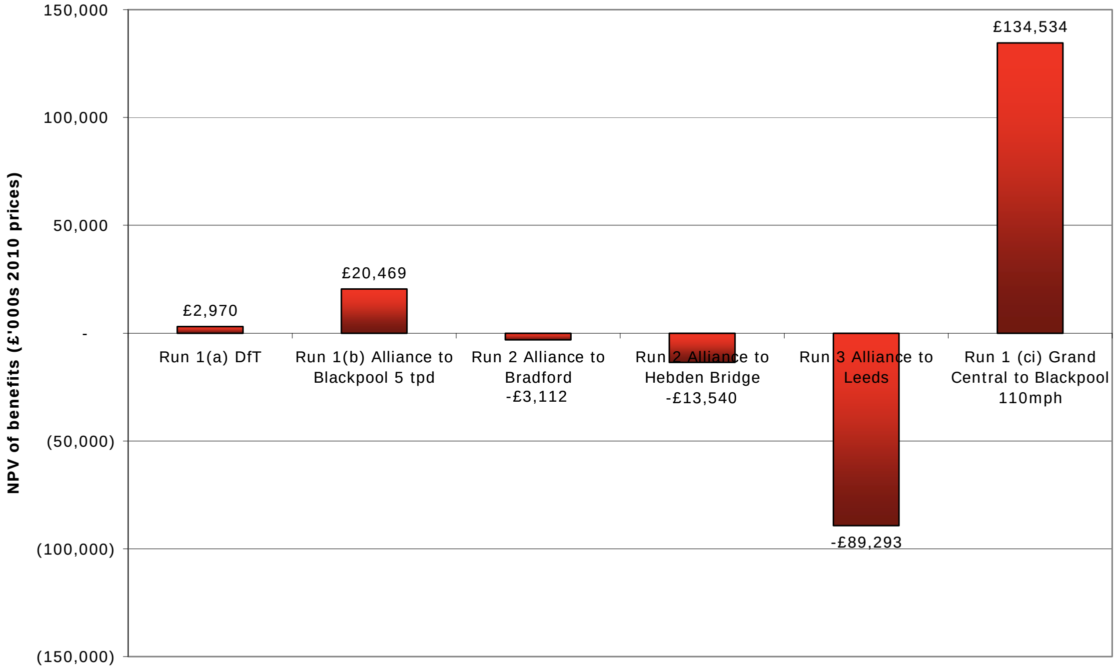

Figure 5.1 Comparison of 10 year NPVs for runs "as bid"

5.2.2 GC to Blackpool results show the highest NPV due to the low fares being offered. However, in the GC application there are crowding problems on the services. Figure 5.2 shows that the significant generation of trips with low fares has resulted in a comparably small revenue gen abs ratio of [✂].

5.2.3 It should be noted that using the timetable supplied by GC their Blackpool services leave London Euston at xx33. However, because they are running at 110 mph the xx30 West Coast Trains service is significantly faster to Preston. This results in market share for Grand Central in the London to Preston market within this scenario of [✂]%. Without the impact of fares this market share is forecast to be only [✂]%. In the 125 mph GC run described below (Table 5.2) the market share with fare impact increases to [✂]%.

5.2.4 The model forecasts revenue for GC running services to Blackpool at 110mph in 2014 of £[✂]million compared to £[✂]million (2010 prices) in the GC business plan. Profit is forecast to be £[✂]million compared to £[✂]million (2010 prices) in the GC business plan.

5.2.5 The NPV and overall operator profit for each run is highly sensitive to the operating costs assumed. Operating costs have been provided by Grand Central for 110mph rolling stock and by DfT for Pendolinos and Voyagers. Therefore for the remaining runs we have made the assumption that the costs will be in line with those supplied by the DfT in relation to 125mph rolling stock (the speed assumption in the remaining runs).

5.2.6 We would recommend that further analysis is undertaken following receipt of more complete cost data from all applicants.

[✂]

Figure 5.2 Comparison of revenue gen abs ratios for runs "as bid"

Note: It is not possible to calculate the generation abstraction ratio for the DfT run in a comparative way because the abstraction of the new services taken from the same operator. Furthermore, in accordance with ORR criteria and procedures, the NPA test would not actually be applied to the franchise operator as it is not possible to abstract from your own services. The gen abs ratio is presented in Figure 5.2 using a different scale to ensure the easy reading of the other runs on the chart.

5.2.7 It is forecast that [✂]% of demand for AL services to Blackpool will come from services from Kings Langley.

5.2.8 The highest revenue gen abs ratio was calculated for AL Trains services to Blackpool although this has the second lowest NPV out of the applications which is in part due to the later start date of December 2013.

5.2.9 There is very little difference in NPV and gen abs between the AL Trains services to Bradford Interchange and the services cut short at Hebden Bridge. It should be noted that Eccles provides a large proportion of this demand ([✂]%) and revenue ([✂]%) for the Bradford Interchange service with only [✂]% of journeys and [✂]% of revenue being contributed by Bradford Interchange.

5.2.10 For the AL London Euston Leeds services it is estimated that [✂]% of demand and [✂]% of revenue will come from Guide Bridge. In 2014, this service is forecast to generate revenue of £[✂]m but make a loss of £[✂]m, given assumed operating costs of running five Pendolinos of £[✂]m. This has resulted in a negative NPV for this service.

5.3 Comparing Blackpool North options

5.3.1 Each of the three applicants being assessed proposes to run services to Blackpool North. By comparing each of the applicants' services to Blackpool North an assessment can be made of the stopping pattern proposed by each applicant and the different fare structures proposed. To do this on 'a level playing field', a number of assumptions have been made which differ to those in the original applications.

5.3.2 The following three runs are designed to show the effect of fare differentials and stopping patterns. To do this we have set the starting date, operating costs, capacities and timetable speed to the same values as shown in Table 5.1. The five DfT services to Blackpool have been isolated from the Glasgow services to enable direct comparison with the AL and GC services to Blackpool. The timetable and assumptions for the AL services to Blackpool are identical to those in Table 2.3 so have not been repeated here.

Table 5.1 Run 1 (ai): DfT to Blackpool North

Base Timetable	Run Timetable and assumptions	
May 2010	Start Year	Dec 2013
	Operating Costs	3 x Voyager 5 car to Blackpool until 2017 (Voyagers replaced with 3 x Pendolino 9 car from 2017)
	Capacity per train	Pendolino 9 car (439 seats)
	Speed	125 mph
	Fares	As West Coast Franchise
	Stopping Pattern	As DfT Option B timetable to Blackpool – no other changes compared to May 2010

Table 5.2 Run 1 (c): GC to Blackpool North

Base Timetable	Run Timetable and assumptions	
May 2010	Start Year	Dec 2013
	Operating Costs	3 x Voyager 5 car to Blackpool until 2017 (Voyagers replaced with 3 x Pendolino 9 car from 2017)
	Capacity per train	Pendolino 9 car (439 seats)
	Speed	125 mph
	Fares	£[✂] flat off-peak return fare, £[✂] peak return fare
	Stopping Pattern	As in GC Application (4 trains to Blackpool and 1 train to Hartford)

5.3.3 Figure 5.3 shows the GC to Blackpool services are significantly ahead of the other scenarios in terms of NPV. This is due to the low fares on offer by GC. Without the Glasgow extensions and five services to Lancaster, the DfT NPV of the services to Blackpool only is the lowest.

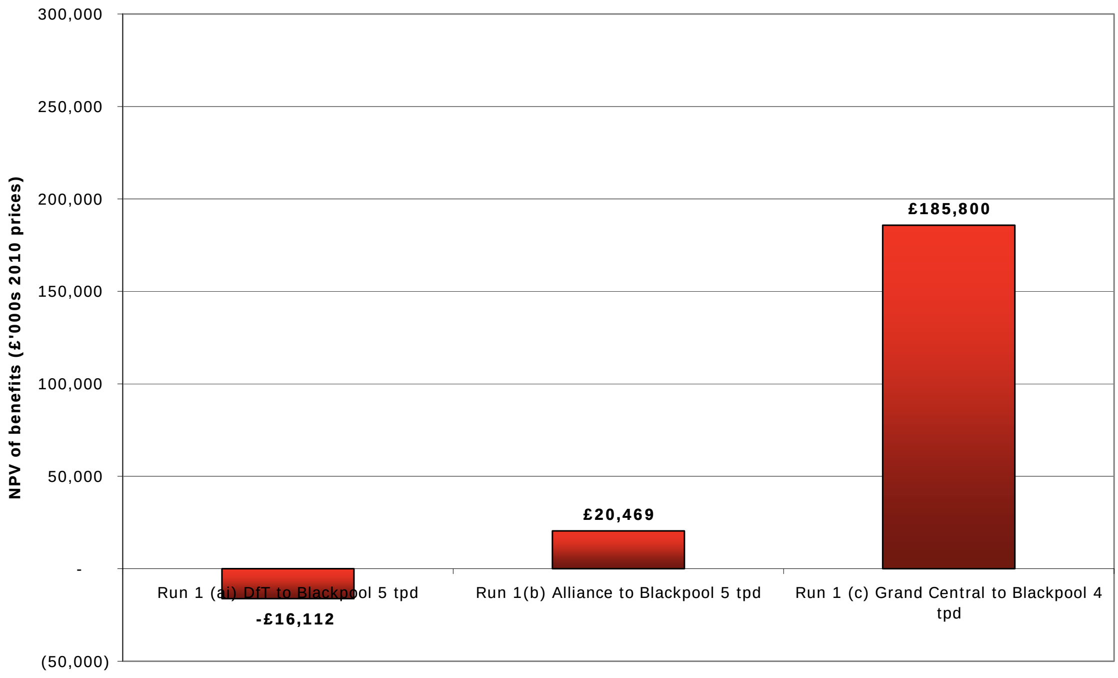

Figure 5.3 Comparison of NPV for each variant of London Euston to Blackpool

5.3.4 The GC to Blackpool run shown in Figure 5.3 includes an off-peak fare of £[✂] return. This fare generates a significant amount of demand and accounts for [✂]% of the economic benefits of that service. A further [✂]% of the economic benefits are from abstracting passengers from using car for their journey. This is also driven in part by the generation due to the low fares.

5.3.5 The GC Blackpool services in Run 1(c) are capacity constrained by 2014. The unconstrained load factor is forecast to be [✂]% which results in [✂]k journeys being crowded off and half of these transferring back to the existing operators. In this run the capacity is assumed to be that of a 9 car Pendolino, which is greater than that proposed in their application. Using stock with less capacity would result in more passengers being crowded off and the NPV value reducing significantly.

5.3.6 Figure 5.4 shows the highest revenue gen abs ratio to be for AL to Blackpool. The large trip generation in the GC application is not reflected in the revenue generation due to the low fares the passengers will pay on most of the services.

[✂]

Figure 5.4 Comparison of Revenue Gen Abs Ratio for each variant of London Euston to Blackpool in 2014

5.3.7 The DfT Blackpool run shown in Figure 5.4 shows it to be more abstractive than the AL run, but less so than the GC equivalent runs. However, it should be noted that most of this abstraction will be from West Coast Trains. This service is forecast to be profitable. The low revenue NPV for the DfT Blackpool run shown in Figure 5.3 is a symptom of the run not generating as many new trips as the other two runs shown here.

5.4 Parking at secondary stations

5.4.1 Where stations gain a through service to London demand at these stations is forecast to increase significantly. The ability of passengers to park at these stations could have an impact on whether they choose to use the new services. To sense check the results, we have calculated the average car park requirement at these stations to be 27 spaces with the largest requirement at Eccles of 93 spaces. In the case of Eccles there are a number of car parks within the area that would help absorb this demand.

5.5 Fare sensitivity

5.5.1 The results from the Blackpool runs indicate that the fare differentials between the applications are important when determining the gen abs ratio, but most importantly in driving the NPV value due to the benefits of low fares to passengers.

5.5.2 Figure 5.5 shows the influence of fares levels through applying different sensitivities to the fares offered by GC. For the purposes of this analysis the run described in Table 5.2 has been used. If the GC as application run in Table 5.2 was used, capacity constrains the demand more leading to a levelling off of demand at around the £ [✂] mark.

Figure 5.5 GC to Blackpool Fare Sensitivity

[✂]

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