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Appraisal Framework for Integrated Transport

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1 Introduction

This working paper outlines an appraisal framework for the Integrated Transport project. The project examined the demand implications from the introduction of a Taktfahrplan timetable onto the east coast mainline rail route. The Taktfahrplan concept is frequently referred to as an *interval timetable* and is based on trains leaving stations at the same time past the hour throughout the operational day. A stated preference exercise was conducted to estimated what values people placed on such a timetable and these values were added to the more conventional elements of generalised cost to obtain the changes in demand that would result from the introduction of a Taktfahrplan.

The working paper is divided into a number of sections that will highlight,

- the key implications to arise from the Integrated Transport project;
- the demand model;
- the appraisal framework;
- the data sources used within the appraisal framework; and
- the results of the appraisal framework.

Interested readers are also referred to the a conference paper that will be presented at the European Transport Conference in Strasbourg later this year (Wardman et al, 2003).

2 Key Implications from the Integrated Transport Project

The key aim of the Integrated Transport project has been to redesign the current rail network timetable around a Taktfahrplan system. The key attribute of a Taktfahrplan system is that trains depart from a station at the same time past the hour every hour of the operational day. Achieving such a design has involved the,

- Closing of certain rail stations;
- Removal of some rail services; and the,
- Streamlining of some rail services in terms of frequency and the stations they serve.

There are obviously a number of implications stemming from this that include,

1) How does it affect existing rail passengers?

    - will the generalised cost of rail travel fall or increase?
    - will they switch to other modes or continue to use rail;
    - will they make additional use of the railways;

2) How will it affect non-rail passengers?

- will they be attracted to rail;
- will they be affected by higher levels of road congestion?

3) How will other public transport operators be affected

- will their revenues be reduced or increased;
- will services increase or decrease;
- will operating costs change;
- what levels or road congestion will they face;
- will there be journey time increases or decreases?

4) How will the government be affected?

- will rail subsidies increase or decrease?

5) How will this impact on externalities?

- Local air quality;
- Greenhouse gases;
- Noise; and
- Safety.

6) What will be the social consequences in terms of social exclusion and distributional impacts?

In order to appraise these implications we will need to ensure that we have the correct information to calculate the likely impacts and the correct appraisal framework to present them. In the next section the appraisal framework is presented.

3 The Appraisal Framework

3.1 The GOMMMS Framework Outlined

The appraisal framework that has been developed is largely based upon the GOMMMs (Guidance on the Methodology for Multi-Modal Studies) appraisal framework which are used by the Highways Agency for appraising new road building/enhancement projects.

The GOMMMS framework attempts to examine the impacts of transport proposals in terms of the impact such proposals have on all modes of travel. The main objective of a GOMMMS assessment is to examine the strategic implications of a scheme and it therefore tends to concentrate on objectives that are relevant to Central Government as opposed to Local Government.

The key objectives of a GOMMMS assessment reflect the five criteria outlined in “A New Deal for Transport” (DETR, 1998),

"

- *integration – ensuring that all decisions are taken in the context of our integrated transport policy;*
- *safety – to improve safety for all road users;*
- *economy – supporting sustainable economic activity in appropriate locations and getting good value for money;*
- *environmental impact – protecting the built and natural environment; and*
- *accessibility – improving access to everyday facilities for those without a car and reducing community severance."*

The results of the GOMMMS appraisal are presented in an Appraisal Summary Table. This is a one page table that summarises the impacts of a scheme and provides decision makers with a clear and transparent basis to make judgements. The AST presents a range of impact data in various forms, namely, financial (transport economic efficiency), quantitative (tonnes of CO2) and qualitative (landscape).

3.2 An Adapting GOMMMS Framework

The GOMMMS assessment framework provides a clear and concise presentation of the financial and social costs and benefits. As such it makes an idea blueprint framework for the Integrated Transport project. However, a full GOMMMS appraisal is not required for this project and we have instead produced a framework that focuses on just the key indicators and presents them as an AST (Table 3.1).

Table 3.1 Integrated Transport AST

Appraisal Summary Sheet	**Enhancement**	**Route Type**	**Measurement Period**	**Modes Considered**	
Date: 11/08/03	Timetable A	Intercity	Weekly	Rail and Car	
Objective		**Quantitative Impacts**		**Financial Costs/Benefits**	
1. The Environment				**Low**	**High**
1.1 Noise					
1.2 Local Air Quality					
1.3 Greenhouse Gases					
1.4 Safety					
Total					
2. Modal Shift & The Economy					
2.1 User Benefits					
Rail Users	Gen. Cost				
Car Users	Congestion				
Bus Users	Congestion				
2.2 Private Transport Providers					
	Revenues				
	Costs				
	Profits				
2.3 Government	Indirect Tax				
	Rail Subsidy				
Total					
CBA Measure					

We now outline briefly the key impacts that will are included in the Integrated AST.

3.2.1 Environment

a) Noise

Noise levels vary by traffic levels, type of traffic, speed of traffic, road type, time of day, existing noise levels and the type of environment the traffic is located in. The latter factor is what drives the different values as that will determine how many people (residents, workers, shoppers etc...) are affected by changes in noise levels, e.g. additional traffic on a rural motorway will have a negligible impact on the population, whilst additional traffic on an urban motorway will have a significant impact on the population.

b) Local Air Quality

Local air quality (LAQ) can have significant health impacts upon those people exposed to them. The most significant emissions are PM_{10} and NO_2 which can be particularly high in urban areas and very problematic when combined with poor atmospheric dispersion. Again the key factor is the number of people experiencing a change in pollution levels

c) Greenhouse Gases

The Kyoto summit recognised six greenhouse gases but singled out carbon dioxide emissions (CO_2) as the most important greenhouse gas. This makes it the most important indicator of global warming. It can be calculated directly from changes in fuel consumption using emission factors providing in DMRB and is measured in tonnes.

d) Accidents

Accidents result in a number of impacts that affect both individuals (casualties and non-casualties) and organisations. The impacts are outlined below:

- medical and healthcare costs;
- lost economic output;
- pain and suffering;
- material damage;
- emergency services costs;
- insurance administration; and,
- legal and court costs.

The number of accidents and the number of casualties disaggregated by the severity of the accident on casualties (fatal, serious and slight), the road type and the vehicle type drive the impact of accidents. When combined with monetary values for each impact they produce monetary values for accidents. These monetary values are contained in DMRB Volume 13 and the Highways Economics Note 1.

3.2.2 Modal Shift & The Economy

a) Modal Shift

Modal shift impacts upon a number of impacts within the Integrated Appraisal AST and these are listed below.

- change in time and money costs to users existing and generated;
- change in operating costs and revenues;
- change in externalities;
- change in road user costs; and,
- change in accident costs.

Modal shift can see passenger switch between all the transport modes, all of which need to be taken into account.

b) Economy

Rather than present a single measure of economic worth the Integrated Transport AST breaks the results of the appraisal into a number of components parts in order to highlight the different impacts on different groups. The components parts are listed below and are discussed in turn:

- Users;
- Private sector transport providers; and,
- Other Government impacts.

1. <u>Users</u>

User benefits in this case are calculated for rail passengers as changes in generalised cost, with the rule of the half applied in each case. The key components of the generalised cost include,

- Changes in travel attributes – wait time, IVT etc; and,
- Changes in user charges – fares.

For car and coach travellers the changes in user benefits take the form of changes in congestion costs and the rule of a half is not applied.

2. <u>Impacts on Private Transport Providers</u>

Several indicators can be used to calculate the impact on the private sector but may not be significant, they include, 1) revenues, 2) investment costs and 3) operating costs.

3. Calculation of Other Government Impacts

The indicators used to measure other government impacts are changes in indirect tax revenue (fuel duties and VAT on fuel) and grants/subsidies (to train operating companies).

With the appraisal framework outlined the next section now concentrate on how the impacts can be calculated and the data inputs required for those calculations.

4 Data Requirements and Calculations Outlined

The general data requirements for calculating the impacts outlined in the appraisal framework fall into two categories,

- Drivers – changes in vehicle kilometres (all modes and road type), changes in trips (all modes) and diversion factors (all modes).
- Factors – factors which are applied to the drivers to calculate the value of the impacts – emission values per vehicle kilometre (vkms), accident values per vkms , congestion values per vkms, fare values per vkms, generalised cost values per vkms and indirect tax values etc.

In the next two sub-sections we discuss the *drivers* and the *factors* respectively.

4.1 Drivers

The key driver for the whole appraisal is the change in passenger trips that is forecast as a direct result of the introduction of the new Taktfahrplan timetable. The modelling process is described below and was based upon a model developed by Lythgoe (Lythgoe, 2003). The modelling takes into account the changes between the base timetable and the new Taktfahrplan timetable and also the values attached to Taktfahrplan attributes such as roundnumberedness (ie memorability) and clockfaceness.

4.1.1 The Demand Model & Forecasting Passenger Trips

In order to carry out an evaluation of the benefits of Taktfahrplan we needed to generate forecasts of the changes in demand and revenues for Origin Destination (OD) pairs on a selected part of the network. The case study chosen was the East Coast Mainline.

The forecasting is based on the Lythgoe model, which generates predicted volumes for flows based on access times and distances to, fares, journey times and distances from, and timetable characteristics (ie TAKT indices) for services from the origin and competitor stations to a destination station. The forecasting tool uses the same dataset, parameters and form as the Lythgoe model. It generates forecasts by applying user specified changes to variables including fares, Generalised Journey Times (GJTs) and TAKT indices to the calibrated parameters in the model.

In order to generate the forecasts required for our case study, the forecaster requires:

- A list of OD pairs specifying the flows for which forecasted volumes will be generated
- A set of Generalised Journey Times (GJTs) containing one for each OD pair
- A set of TAKT indices, 8 for each OD pair (although in the final calibration of the model only two of these were used).

If new sets of GJTs and TAKT indices for a selected OD pair are not specified, the forecasts are based on default values used in the calibration of the Lythgoe model. In this way the forecaster can generate the 'base' ie, 'as now', predicted volumes for selected OD pairs.

In our East Coast Mainline case study, the introduction of the Taktfahrplan produces a new timetable which generates changes in GJTs and TAKT indices. The new values of GJTs and TAKT associated with the new 'Tyler' timetable are then used to generate forecasts of predicted demand between each of the significant OD pairs on the ECML network. The base and predicted forecasts generated form the basis of the subsequent evaluation exercise.

The following sections describe the data preparation required in order to generate these forecasts of changes in demand for flows on the East Coast Mainline following the introduction of Taktfahrplan.

Selection of Stations and Flows for Calibration:

The Lythgoe model is based flows greater than 461 per year, ie the top 10%. This cut-off point yields 12,253 flows. From these flows, we had information on 438 stations.

In order to incorporate TAKT indices into the Lythgoe model, we needed the complete set of opportunities to travel (OTTs) for the existing timetable. This was provided by the AEAT. AEAT provided data on OTTs between 178,727 OD pairs based on 538 stations. The common set of stations between the Lythgoe dataand the AEAT data was 358

The list of common OD pairs is then used to filter out the relevant OTTs for calibration from the AEAT timetable data. This yields 10,324 flows for which there are OTTs (and thus, potentially TAKT indices) and that feature in the Lythgoe dataset. These were the flows used for the calibration of the model.

East Coast Main Line Case Study:

Stations on which the ECML case study was based were the following list of 35 (see Table 4.1)

Table 4.1 Stations Used in the Flow Estimation

BDT	Bridlington	MPT	Morpeth
BEV	Beverley	MUB	Musselburgh
BIA	Bishop Auckland	NCL	Newcastle
BWK	Berwick- upon-Tweed	NTR	Northallerton
CAR	Carlisle	PBO	Peterborough
CLS	Chester-le-Street	RCC	Redcar
DAR	Darlington	RET	Retford
DHM	Durham	SBY	Selby
DON	Doncaster	SCA	Scarborough
EDB	Edinburgh Waverley	SEM	Seamer
GRA	Grantham	SUN	Sunderland
GRF	Garforth	SVG	Stevenage
HEX	Hexham	TBY	Thornaby
HPL	Hartlepool	XLD	London Kings Cross
HUL	Hull	XNW	Newark
LDS	Leeds	XWF	Wakefield Westgate
MBR	Middlesbrough	YRK	York
MCE	MetroCentre		

Of these, Garforth (GRF), Musselburgh (MUB), Seamer (SEM), and Thornaby (TBY) did not appear in the MOIRA list of stations used by the Lythgoe model. Flows based on these stations could not be forecasted.

Calculation of GJTs:

In order to generate GJTs from the new 'Tyler timetable', Viriato was used to scope the new timetable, and then MOIRA converted the stopping patterns generated from the new timetable into journey opportunities and GJTs.

1009 instances of GJTs were derived, based on flows where changes the OTTs set should be 'complete and real'. However, they were in the form of GJTs for full, reduced and in some cases, season individual ticket types. Also, because the MOIRA GJTs were averaged over the two directions, they only appeared for one direction.

The 1009 GJTs supplied were found to correspond to 858 flows. Of these, 124 did not appear in the Lythgoe dataset.

An average GJT weighted by the share of each ticket type for each flow was calculated, and specified in two directions, so that they could be used as inputs into the forecasting tool.

Of the remaining 734 flows, 10 flows only contained GJT information for full fares, and 9 only contained GJT information for reduced fares. For these flows, the volumes from the Lythgoe dataset for the missing ticket were negligible, so we simply used the 1 ticket GJT to represent the weighted average GJT. Where there are missing, ie zero, volumes from the Lythgoe dataset for one ticket type, we simply take the average GJT of the two ticket types.

Bearing in mind the volumes are different for a pair of flows in opposite directions, although the ticket specific GJTs will be the same, the weighted average is likely to be different for the two directions.

The forecasting program was checked against predicted values from the Lythgoe model and it was found to replicate the same results, given the same data inputs. However, because of the irreconcilable difference in GJTs between those used in the Lythgoe model and those generated from the runs of MOIRA based on the existing timetable, we decided that in order for consistency between the GJTs used in the base and those used in the forecasting we would estimate the base using the MOIRA GJTs.

However, because the Lythgoe model is based on competition between stations, some of the competitor origin stations do not appear in the ECML study. In these cases we retain the GJTs used in the calibration of the Lythgoe model.

TAKT information for the existing timetable:

The 10,324 flows are then selected from the AEAT dataset and used as inputs into the '*autotakt'* program written by Peter Wightman. This program creates values for a variety of TAKT indices for each of the flows. These TAKT measures included various indices capturing the degree of clockfaceness of services' departure and arrival times, measures of 'evenintervalness', and 'roundnumberedness' of a service.

After various sensitivity tests, we found that continuous versions (ie not simply 0/1 dummies based on a threshold level), of the 0,5,10 minute roundnumberedness (ie memorability) and the departure clockfaceness indices were the most significant determinants of demand, so were included in the variables for the calibration of the model. These two indices could also be used in conjunction with values from the stated preference study carried out for this project, which gave values to clockfaceness and memorability in terms of minutes, which could then be included in the calculation of generalised cost.

Takt indices for the new timetable:

As described above, TAKT indices were calculated for the existing timetable, based on the OTTs provided for us by AEAT. However, given the use of the memorability, or round numberedness index, as an explanatory variable in the calibrated Lythgoe model, we also had to generate these indices for the new timetable.

In order to calculate the new TAKT indices, a new set of OTTs needed to be generated. This was a two stage process:

Firstly, with reference to the net graph and the MOIRA input files, details of each service, including stopping stations, and arrival and departure times, were keyed in two excel spreadsheets.

Secondly, these excel files were used as input files to a program which generated a stopping patterns file for all these services based on a representative eight hour operating window. As services repeated the same pattern throughout the day under the new timetable, correct TAKT indices could be calculated from a representative sample of departure times reducing run-times. This generates a ‘stopping patterns’ file.

‘PRAISE’ contains a module, again written by Peter Wightman, which constructs OTTs based on stopping patterns, so, after 2.5 days of processing time, a new set of OTTs were created for the new timetable for ECML. These OTTs were fed into *‘autotakt’* as before and TAKT indices of the same form as for the original timetable were created.

As was the case for GJTs, for non-ECML flows, new TAKT data would be missing, so we used the TAKT indices from the base, eg in the case of Wakefield to York, Sheffield is a competitor station to Wakefield, but no TAKT information is available from the MOIRA input files.

4.1.2 Diversion Factors, Vehicle Kilometres and Passenger Trips

Diversion Factors & Passenger Trips:

The change in rail passenger trips can be used to calculate the modal shift between rail, car, coach and not travel or new journeys. An integral part of these calculations are the application of diversion factors to the change in passenger trips. For example, if the number of rail trips are assumed to have increased by 10,000 per year, diversion factors can be used to ascertain where those journeys have come from. In the appraisal the following diversion factors (Table 4.1) were used to estimate the sources of new rail journeys and vice versa (see Table 4.1).

Table 4.1 Diversion Factors & Sources of New Rail Journeys

Diversion Factors	%	Sources of New Rail Journeys	%
Car	68%	Car	6,800
Bus	24%	Bus	2,400
New	8%	New	800

From the table it is clear that 6,800 of the the 10,000 new rail journeys are being made by people who used to travel by car; that 2,400 trips are made by former coach passengers; and, that 800 journeys are new in that they weren’t made previous to the introduction of the new timetable. This information can be taken forward and used to calculate a number of the impacts outlined in the appraisal framework.

Diversion Factors & Vehicle Kilometres:

To calculate the modal shift in terms of car and bus vehicle kms requires the average loadings of both car and bus vehicles to be taken into account, alongside the length of the trips made by both modes. In the case of car a loading factor of 1.6 has been used and in the case of coach a loading factor of 12.1 has been used (both loading factors are taken from TEN, DfT, 2003). This allows the number of car and coach journeys to be calculated (see Table 4.2)

Table 4.2 Calculating Modal Switch in Terms of Journeys

	Modal Switch (journey)Calculations	Modal Switch (journeys)
Car	6,800/1.6	4,250
Bus	2,400/12.1	198

To calculate the total number of car and coach vehicle kms that has been switched the total distance of the trip needs to be factored in. For out appraisal this process has been taken a step further and the total distance has been disaggregated into three road types,

- Motorways;
- Trunk and Principal Roads; and,
- Other Roads

If it is assumed that all the journeys relate to one flow between Leeds and London then the modal switch in relation to car and coach vehicle kms can be calculated using the following disaggregated distances,

- Motorways – 301.44 kms
- Trunk and Principle Roads – 18.18 kms
- Other Roads – 0 kms

These figures then need to be factored by the number of journeys for each mode to calculate the total modal switch in terms of vehicle kms.

Table 4.3 Total Modal Switch – In Terms Vehicle Kms

Mode	Total Number of Journeys	Total Motorways Vkms	Total Trunk & Principle Vkms	Total Other Vkms	Total Vkms
Car	4,250	1,281,120	77,265	0	1,358.385
Bus	198	59,685	3,600	0	63,285
Totals	4,448	1,340,805	80,865	0	1,421,670

This information can be taken forward and used to calculate a number of the impacts outlined in the appraisal framework.

4.2 Factors

In this section we outline the factors used in the calculation of the impacts listed in Table 3.1 and the methodologies employed to calculate them.

4.2.1 The Environment

All the factors used for the calculation of the environment have been taken directly from a report carried out by ITS for the DETR which examined surface transport costs and charges for Great Britain for 1998 (Sansom et al, 2001). The report calculated the costs per vehicle kilometre for road and rail travel, disaggregating (for road) by 11 area types, 3 road types, 5 vehicle types and 2 time periods. For rail the disaggregation is by passenger service type (3 categories). We present two sets of figures for each type of environmental impact. The first set outline National UK average values which do not disaggregate to any detail. The second set disaggregates values by type of road and peak and off peak.

The UK average values for environmental factors are presented in Table 4.4, whilst the disaggregated values are presented in Tables 4.5 and 4.6

Table 4.4 UK Average Values of Environmental Factors (£s in 1998 Prices and Values)

Impact Type	**Bus**	**Car**
Noise	0.0009	0.0001
LAQ	0.0316	0.0018
Greenhouse Gases	0.0056	0.0012
Safety	0.0374	0.0079

Table 4.5 Disaggregated Values of Environmental Factors (£s in 1998 Prices and Values)

Impact Type – BUS	**Peak**	**Off Peak**	**Combined**
Rural Motorways:			
Noise	0.0001	0.0001	0.0001
LAQ	0.0076	0.0076	0.0076
Greenhouse Gases	0.0042	0.0042	0.0042
Safety	0.0119	0.0119	0.0119
Trunk & Principal:			
Noise	0.0015	0.0015	0.002
LAQ	0.0392	0.0392	0.039
Greenhouse Gases – from London	0.0065	0.0059	0.006
Greenhouse Gases – to London	-	-	0.006
Greenhouse Gases - Regional	-	-	0.006
Safety	0.0042	0.0042	0.004

The key values in Table 4.5 are the combined values which are used in the appraisal. In most cases the values for the peak and off-peak are the same. When this isn't the case we have had to calculate three values to reflect the peak and off-peak splits of train journeys that are coming from London, are going to London or that are regional in nature. The same calculations also apply to Table 4.6.

Table 4.6 Disaggregated Values of Environmental Factors (£s in 1998 Prices and Values)

Impact Type – CAR	**Peak**	**Off Peak**	**Combined**
Rural Motorways:			
Noise	0	0	0
LAQ	0.0011	0.0011	0.0011
Greenhouse Gases	0.0013	0.0013	0.0013
Safety	0.0001	0.0001	0.0001
Trunk & Principal:			
Noise	0.0002	0.0002	0.0002
LAQ – from London	-	-	0.003
LAQ – to London	-	-	0.002
LAQ – Regional	-	-	0.003
Greenhouse Gases – from London	-	-	0.001
Greenhouse Gases – to London	-	-	0.001
Greenhouse Gases - Regional	-	-	0.001
Safety	0.0168	0.017	0.017

When presenting the change in environmental costs in the appraisal table, the car and coach impacts are added together.

4.2.2 Modal Shift and the Economy

User Benefits

For rail the change in user benefits can be reflected in the change in the generalised costs to existing users of the rail service following the change in the timetable. The model outlined in 4.1.1 calculates the change in generalised cost and this has been subjected to the rule of a half to obtain the change in user benefits for rail users.

For car and coach travellers the change in user benefits is reflected by the change in congestion costs that they incur. The costs of congestion are outlined in Tables 4.7 for average UK values and in Tables 4.8 and 4.9 for disaggregated values. The key values are the combined values which are used in the appraisal. In most cases the values for the peak and off-peak are the same. When this isn't the case we have had to calculate three values to reflect the peak and off-peak splits of train journeys that are coming from London, are going to London or that are regional in nature.

Table 4.7 UK Average Values of Congestion (£s in 1998 Prices and Values)

Impact Type	**Bus**	**Car**
Congestion	0.1522	0.0898

Table 4.8 Disaggregated Values of Congestion (£s in 1998 Prices and Values)

Impact Type – BUS	**Peak**	**Off Peak**	**Combined**
Rural Motorways:			
Congestion – from London	-	-	0.0626
Congestion – to London	-	-	0.0619
Congestion – Regional	-	-	0.0624
Trunk & Principal:			
Congestion – from London	-	-	0.208
Congestion – to London	-	-	0.192
Congestion - Regional	-	-	0.205

Table 4.9 Disaggregated Values of Noise (£s in 1998 Prices and Values)

Impact Type – CAR	**Peak**	**Off Peak**	**Combined**
Rural Motorways:			
Congestion – from London	-	-	0.004
Congestion – to London	-	-	0.004
Congestion – Regional	-	-	0.004
Trunk & Principal:			
Congestion – from London	-	-	0.139
Congestion – to London	-	-	0.128
Congestion - Regional	-	-	0.137

4.2.3 Private Transport Providers

We have assumed that the number of rail services has not changed following the introduction of the new rail timetable. Rails costs are therefore assumed to have remained constant Coach services on the other hand are assumed to have fallen and the following cost factors per vehicle kilometre are assumed (Sansom et al, 2001)

- Motorway – 19 pence
- Trunk & Principal – 10 pence
- Other – 10 pence.

In terms of rail revenue change the model outlined in section 4.1.1 predicts the change in rail revenue following the introduction of the new timetable. However, the change in coach revenue was based upon half the return standard fare according to the national express website (www.nationalexpress,com) and the change in coach passenger trips. The fares used are outlined in Table 4.10. The routes listed are the ones chosen to be appraised, namely the top 10 (by passenger flow) non-London rail routes and the top 10 (by flow by passenger flow) London routes.

Table 4.10 National Express Standard Fares (£s – 2003)

Journey	Standard Return Fare	Halved Fares
Non-London Routes		
York-Edinburgh	29.50	14.75
Hull-Leeds	8.00	4.00
Scarborough-York	8.50	4.25
Doncaster-Leeds	8.00	4.00
Edinburgh-Newcastle	22.00	11.00
Darlington-Newcastle	7.00	3.50
Newcastle-York	17.50	8.75
Newcastle-Edinburgh	22.00	11.00
Leeds-York	7.00	3.50
York-Leeds	7.00	3.50
London Routes		
Doncaster-London	22.50	11.25
Peterborough-London	16.00	8.00
London-York	29.50	14.75
Edinburgh-London	36.00	18.00
York-London	29.50	14.75
London-Newcastle	33.50	16.75
London-Leeds	22.50	11.25
London-Edinburgh	36.00	18.00
Newcastle-London	33.50	16.75
Leeds-London	22.50	11.25

4.2.3 Government Impacts

The impact of indirect tax directly affects government revenues. For cars the government levies fuel duty and VAT on fuel duty. For coaches it is the VAT not paid that has to be calculated. Values per average UK vehicle kms have been taken from the Sansom et al (2001) publication and are presented in Tables 4.

Table 4.11 UK Average Values for Indirect Taxes Per Vehicle Kms (£s-1998)

Mode	Fuel Duty	VAT on Fuel Duty	VAT Not Paid
Car	0.0386	0.0068	na
Bus	na	na	0.1278

With regards to subsidy we have assumed that rail vehicle kilometres remain constant and so there will not be any affect on subsidy payments.

4.3 Summary

This section has outlined the main drivers and the factors they are applied to in order to calculate the impacts outlined in the appraisal table (Table 4.1). The next section presents the findings of the appraisal that was carried out for the top ten non-London flows and the top ten London flows.

5) Appraisal Results & Conclusions

In this section the results of the appraisals are outlined. The full model estimated the change in flows from a change in the East Coast mainline route timetable. For the purposes of this exercise it was felt appropriate that only a selection of flows should be analysed. As such only the top 10 London and non-London flows (ranked according to passenger flows) are examined. The routes selected are outlined in Table 4.12.

Table 5.1 Routes Selected for Appraisal

Non-London Routes	**Ranking**
York-Edinburgh	10
Hull-Leeds	9
Scarborough-York	8
Doncaster-Leeds	7
Edinburgh-Newcastle	6
Darlington-Newcastle	5
Newcastle-York	4
Newcastle-Edinburgh	3
Leeds-York	2
York-Leeds	1
London Routes	**Ranking**
Doncaster-London	10
Peterborough-London	9
London-York	8
Edinburgh-London	7
York-London	6
London-Newcastle	5
London-Leeds	4
London-Edinburgh	3
Newcastle-London	2
Leeds-London	1

The appraisal results are outlined in Tables 5.2 to 5.5 and outline appraisals that have been carried out using both average UK and non-average UK values. The appraisal results measure the costs or benefits of the introduction of the new Taktfahrplan rail timetable system. As such they are measuring the costs or benefits associated with the change in rail, car and coach trips that the introduction of such a timetable will bring. The change in rail passenger trips is indicated in both the Tables and in most circumstances we would expect a reduction in rail passengers to bring about a negative appraisal value since the costs of externalities will increase due to modal switch. However, this might not be the case if the new timetable has reduced rail generalised costs for existing rail users. When interpreting the impacts it should be remembered that benefits are represented as positive integers and costs as negative integers.

Table 5.2 Appraisal Results for Non-London Flows – Using Average UK Values

Impact	York-Edinburgh	Hull -Leeds	Scarborough -York	Doncaster-Leeds	Edinburgh-Newcastle	Darlington-Newcastle	Newcastle-York	Newcastle-Edinburgh	Leeds-York	York-Leeds
Change in Rail Passenger Trips	-1,870	17,221	12,440	21,724	12,432	23,953	16,501	20,221	70,518	76,992
1. The Environment										
1.1 Noise	-35	99	50	65	127	83	143	207	186	203
1.2 LAQ	-803	2,295	1,147	1,511	2,928	1,918	3,302	4,791	4,303	4,698
1.3 Greenhouse Gases	-356	1,019	509	671	1,300	851	1,465	2,126	1,910	2,085
Safety	-2,352	6,724	3,360	4,426	8,578	5,620	9,673	14,035	12,605	13,763
Total	-3,545	10,136	5,066	6,673	12,923	8,472	14,583	21,159	19,004	20,748
2. Modal Shift & The Economy										
2.1 User Benefits										
Rail – GC	53,552	70,583	30,581	77,550	66,005	82,538	84,627	152,889	127,243	160,912
Car – Congestion	-21,815	62,371	31,171	41,060	79,571	52,132	89,729	130,193	116,933	127,668
Bus – Congestion	-1,760	5,032	2,515	3,313	6,420	4,206	7,240	10,504	9,434	10,300
2.2 Private Transport Providers										
Rail Revenues	-21,1961	52,026	27,188	35,725	93,183	44,397	68,271	136,989	128,625	137,315
Rail Costs	0	0	0	0	0	0	0	0	0	0
Rail Profits	52,026	52,026	27,188	35,725	93,183	44,397	68,271	136,989	128,625	137,315
Coach Revenue	6,701	-16,739	-12,848	-21,116	-33,230	-20,372	-35,085	-54,051	-59,976	-65,482
Coach Costs	-8,537	24,407	12,198	16,.068	31,138	20,401	35,113	50,948	45,758	49,959
Coach Profits	-1,836	7,668	-650	-5,048	-2,092	29	28	-3,103	-14,218	-15,523
2.3 Government										
Indirect Tax	11,029	-31,533	-15,759	-20,758	-40,228	-26,357	-45,364	-65,822	-59,118	-64,545
Rail Subsidy	0	0	0	0	0	0	0	0	0	0
Total	17,208	166,147	75,047	131,841	202,858	156,946	204,532	361,650	308,900	356,129
Overall Total	13,663	176,284	80,112	138,514	215,790	165,418	219,115	382,808	327,904	376,877

Table 5.3 Appraisal Results for London Flows – Using Average UK Values

Impact	Doncaster-London	Peterborough-London	London-York	Edinburgh-London	York-London	London-Newcastle	London-Leeds	London-Edinburgh	Newcastle-London	Leeds-London
Change in Rail Passenger Trips	34,794	101,844	-3,592	-29,874	-5,370	-13,923	55,319	-49,096	-4,456	72,463
1. The Environment										
1.4 Noise	588	859	-71	-1,201	-106	-377	1,065	-1,972	-121	1,964
1.5 LAQ	13,598	19,877	-1,647	-27,778	-2,462	-8,727	24,647	-45,610	-2,793	45,420
1.6 Greenhouse Gases	6,035	8,822	-731	-12,329	-1,093	-3,874	10,939	-20,244	-1,240	20,160
Safety	39,837	58,233	-4,825	-81,380	-7,214	-25,568	72,207	-133,622	-8,183	133,066
Total	60,058	87,792	-7,274	-122,687	-10,876	-38,546	108,859	-201,447	-12,336	200,609
2. Modal Shift & The Economy										
2.1 User Benefits										
Rail – GC	240,701	306,009	-38,278	-344,714	130,474	-176,462	601,335	-713,542	84,419	594,429
Car – Congestion	369,548	540,200	-44,758	-754,920	-66,921	-237,182	669,831	-1,239,542	-75,906	1,234,388
Bus – Congestion	29,816	43,584	-3,611	-60,908	-5,399	-19,136	54,043	-100,008	-6,124	99,593
2.2 Private Transport Providers										
Rail Revenues	501,840	722,481	-57,657	-428,037	-89,676	-229,772	967,465	-738,700	-67,180	1,177,272
Rail Costs	0	0	0	0	0	0	0	0	0	0
Rail Profits	501,840	722,481	-57,657	-428,037	-89,676	-229,772	967,465	-738,700	-67,180	1,177,272
Coach Revenue	-95,119	-197,985	12,873	130,669	19,247	56,672	-151,227	214,746	18,137	-198,096
Coach Costs	144,612	211,393	-17,515	-295,417	-26,188	-92,815	262,120	-485,061	-29,704	483,044
Coach Profits	49,493	13,954	-4,642	-164,748	-6,941	-36,143	110,893	-270,315	-11,567	284,948
2.3 Government										
Indirect Tax	-186,832	-273,108	22,628	381,663	33,833	119,912	-338,645	626,673	38,376	-624,067
Rail Subsidy	0	0	0	0	0	0	0	0	0	0
Total	1,004,567	1,352,575	-126,317	-1,371,663	-4,630	-578,784	2,064,921	-2,435,434	-37,983	2,766,563
Overall Total	1,064,624	1,440,367	-133,591	-1,494,351	-15,506	-617,330	2,173,781	-2,636,881	-50,319	2,967,172

Table 5.4 Appraisal Results for Non-London Flows - Using Non-Average UK Values

Impact	York-Edinburgh	Hull -Leeds	Scarborough -York	Doncaster-Leeds	Edinburgh-Newcastle	Darlington-Newcastle	Newcastle-York	Newcastle-Edinburgh	Leeds-York	York-Leeds
Change in Rail Passenger Trips	-1,870	17,221	12,440	21,724	12,432	23,953	16,501	20,221	70,518	76,992
1. The Environment										
1.7 Noise	-66	45	94	52	240	54	185	393	344	376
1.8 LAQ	-1,062	1,475	1,518	1,209	3,874	1,402	3,433	6,339	5,595	6,109
1.9 Greenhouse Gases	-376	1,050	538	695	1,373	880	1,532	2,246	2,015	2,200
Safety	-4,130	3042	5,901	3,339	15,063	3,495	11,736	24,647	21,587	23,569
Total	-5,634	5,611	8,050	5,295	20,551	5,831	16,886	33,625	29,542	32,255
2. Modal Shift & The Economy										
2.1 User Benefits										
Rail – GC	53,552	70,583	30,581	77,550	66,005	82,538	84,627	152,889	127,243	160,912
Car – Congestion	-33,281	23,785	47,553	26,541	121,391	27,636	94,140	198,619	173,919	189,886
Bus – Congestion	-2,376	3,139	3,395	2,624	8,666	3,021	7,584	14,179	12,506	13,654
2.2 Private Transport Providers										
Rail Revenues	-21,961	52,026	27,188	35,725	93,183	44,397	68,271	136,989	128,625	137,315
Rail Costs	0	0	0	0	0	0	0	0	0	0
Rail Profits	-21,961	52,026	27,188	35,725	93,183	44,397	68,271	136,989	128,625	137,315
Coach Revenue	6,701	-16,739	-12,848	-21,116	-33,230	-20,372	-35,085	-54,051	-59,976	-65,482
Coach Costs	-8,537	24,407	12,198	16,068	31,138	20,401	35,113	50,948	45,758	49,959
Coach Profits	-1,836	7,668	-650	-5,048	-2,092	29	28	-3,103	-14,218	-15,523
2.3 Government										
Indirect Tax	11,029	-31,533	-15,759	-20,758	-40,228	-26,357	-45,364	-65,822	-59,118	-64,545
Rail Subsidy	0	0	0	0	0	0	0	0	0	0
Total	5,127	125,668	92,309	116,633	246,923	131,264	209,287	433,749	368,958	421,700
Overall Total	-507	131,279	100,359	121,928	267,474	137,095	226,174	467,374	398,500	453,954

Table 5.5 Appraisal Results for London Flows – Using Non-Average UK Values

Impact	Doncaster-London	Peterborough-London	London-York	Edinburgh-London	York-London	London-Newcastle	London-Leeds	London-Edinburgh	Newcastle-London	Leeds-London
Change in Rail Passenger Trips	34,794	101,844	-3,592	-29,874	-5,370	-13,923	55,319	-49,096	-4,456	72,463
1. The Environment										
1.10 Noise	113	1,015	-111	-356	-166	-511	149	-581	-229	2,660
1.11 LAQ	7,040	19,560	-1,914	-15,734	-2,861	-9,303	12,138	-2,5804	-3,696	48,416
1.12 Greenhouse Gases	6,190	9,204	-768	-12,668	-1,148	-4,053	11,209	-20,799	-1,309	21,096
Safety	8,492	64,432	-6,983	-24,941	-10,441	-32,303	11,901	-40,777	-14,370	168,115
Total	21,835	94,211	-9,775	-53,698	-14,616	-46,170	35,397	-87,961	-19,604	240,286
2. Modal Shift & The Economy										
2.1 User Benefits										
Rail – GC	240,701	306,009	-38,278	-344,714	130,474	-176,462	601,335	-713,542	84,419	594,429
Car – Congestion	63,350	516,103	-56,152	-191,228	-83,958	-259,272	86,402	-312,568	-115,800	1,349,350
Bus – Congestion	14,628	43,063	-4,253	-33,048	-6,360	-20,580	25,060	-54,190	-8,267	107,106
2.2 Private Transport Providers										
Rail Revenues	501,840	722,481	-57,657	-428,037	-89,676	-229,772	967,465	-738,700	-67,180	1,177,272
Rail Costs	0	0	0	0	0	0	0	0	0	0
Rail Profits	501,840	722,481	-57,657	-428,037	-89,676	-229,772	967,465	-738,700	-67,180	1,177,272
Coach Revenue	-95,119	-197,985	12,873	130,669	19,247	56,672	-151,227	214,746	18,137	-198,096
Coach Costs	144,612	211,393	-17,515	-295,417	-26,188	-92,815	262,120	-485,061	-29,704	483,044
Coach Profits	49,493	13,408	-4,642	-164,748	-6,941	-36,143	110,893	-270,315	-11,567	284,948
2.3 Government										
Indirect Tax	-186,832	-273,108	22,628	381,663	33,833	119,912	-338,645	626,673	38,376	-624,067
Rail Subsidy	0	0	0	0	0	0	0	0	0	0
Total	683,181	1,327,957	-138,354	-780,111	-22,627	-602,317	1,452,510	-1,462,642	-80,019	2,889,038
Overall Total	705,016	1,422,168	-148,129	-833,810	-37,243	-648,487	1,487,907	-1,550,603	-99,623	3,129,324

5.1 General Comments on the UK Average Value Appraisal Values

It is interesting to note that in terms of the change in rail passenger trips the move towards a Taktfahrplan timetable appears to very beneficial for non-London flows (9 of the 10 routes experience an increase in passenger trips) and non-beneficial for London flows (6 of the 10 routes experience a reduction in passenger trips). This may reflect the more variability of current regional flows and that the Taktfahrplan timetable tends to reduce the number of services for certain London based flows compared with current levels. In particular the long distance London based flows seem to be particularly adversely affected (Edinburgh and Newcastle) compared to those under 200 miles (Leeds, Doncaster and Peterborough).

The impact of environmental benefits tends to be overshadowed by the impacts arising from modal shift and the economy. There also seems to be a disproportionate affect from coach costs compared with coach revenue. This may reflect the assumption used for calculating the change in coach vehicle kilometres.

Changes in rail revenue and car congestion also have an influential role in the appraisal, especially for the London based flows where fares are higher and journeys longer.

5.2 General Comments on the Non-Average UK Values

The use of non-average UK values tends to have different impacts upon the London and non-London flows. For the London flows the use of non-average UK values produces final appraisal values that are lower 70% of the time in comparison to when average UK values are used.. For non-London flows the figure is more balanced with 40% of the flows producing lower values.

The areas of difference are in the environment sub-impact and the change in user benefits.

5.3 Conclusions

It would appear that the introduction of a Taktfahrplan timetable is very beneficial for regional routes that currently experience a large variation in when services depart from stations. For London based flows the evidence is mixed. There appear to be benefits for short and medium distance London based flows when the service frequency is not drastically reduced. For long-distance flows the evidence would suggest that the benefits of a Taktfahrplan timetable will be outweighed by the increase in generalised costs if the current services is reduced or reconfigured away from the current passengers ideal.

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