Economic Growth and Social Benefit potential from Modernisation of rail services in North Wales

Phase 2 Report

Greengauge 21

for

Denbighshire County Council
on behalf of
North Wales Economic Activity Board,
Mersey Dee Alliance
and Merseytravel

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Executive Summary

1. This report by Greengauge 21 was commissioned by Denbighshire County Council on behalf of the North Wales Economic Activity Board, Mersey Dee Alliance and Merseytravel. It provides evidence on the social and economic effects of investment in rail in North Wales and adjoining areas, and considers the wider case for route electrification specifically.[1]

2. There are well-established techniques for appraising transport project benefits, but they concentrate on measuring benefits to transport users. In doing so, not all benefits to businesses and to workers are estimated and the assumption is generally made that patterns of economic activity are unchanged by the investment in question. So they fail to identify an area of great interest to stakeholders – the likely impact locally in terms of employment, the economy and across social groups. This report extends recently developed techniques to address these impacts.

3. It takes into account wider developments with the rail network that, while not yet necessarily committed, combine to form a useful background assumption. Rail demand has been growing steadily – in North Wales and its borders as well as more widely, and the rail industry and Government has made plans accordingly. Reflecting these plans, it was assumed in this work that – over the next 10-30 years:

- HS2 is developed, with a hub station at Crewe
- The existing Llandudno – Manchester service is doubled in frequency from hourly to every 30 minutes
- Two new hourly services would be in operation over a re-established Halton Curve, providing for direct trains between Liverpool, Chester, Wrexham and the North Wales coast
- A London service from the North Wales coast increased to an hourly service frequency.

4. These changes – which do not rely on route electrification – bring significant improvements over today's mix of train services, and we refer to them in this report as a 'Do Minimum' case. While they are primarily a response to growing demand/capacity challenges, they will in themselves

[1] In a Phase1 study, carried out for *TAITH,* Greengauge 21 set out the broad case for improving service frequencies and providing better connectivity , along with other measures that would better integrate rail services with local bus networks and with international airports and with an initial assessment of the prospects for increased freight on rail.

bring connectivity benefits and – to generalise from the analysis of the specific investment options examined in this study – will bring economic and social benefits to North Wales and adjoining parts of North West England. These benefits are *not* included in the assessment of electrification options that follows.

Investment Options Examined

5. There is a substantial programme of electrification in hand across the wider network, with schemes to serve South Wales (and the Valley Lines), and a series of lines across North West England and across the Pennines. The case for electrification, in practice, relies to a significant extent on the operational economies that become possible with electric traction – in particular with reduced fuel/energy costs and lower rolling stock maintenance costs. In general, the busier the route under consideration, the stronger the investment case – and the increased service frequencies based on known industry plans in the Do Minimum specification are helpful in that respect. The work reported here addresses benefits; it will be for the rail industry to assess costs.

6. We examined three scenarios against the do minimum case, each (for comparative assessment purposes) assumed to be in place by 2024:

Scenario	Routes electrified	Service changes (vs Do Minimum)
1 Holyhead Electrification	Runcorn/Warrington/Crewe – Holyhead	None
2 Chester limit to electrification	Runcorn/Warrington/Crewe – Chester	All electrified services from east of Chester terminate at Chester; connecting diesel services in North Wales terminate at Chester. Holyhead – Birmingham/Cardiff service retained as a through (diesel) service
3 Wider electrification and service development	As Scenario 1 plus Chester – Wrexham – Shrewsbury – Birmingham/Cardiff	London service operated over HS2 in alternate hours Hourly train to Manchester Airport *via* Crewe (from Wrexham/Bangor) Llandudno - Manchester

		service doubled in frequency to every half hourly and extended eastwards from Manchester to Leeds Wrexham-Bidston service frequency doubled to half hourly and extended to Liverpool

7. Scenario 1 took the 'do minimum' train service plan and assumed that the main lines to Holyhead are electrified (from both Manchester and London). Train services run slightly faster as a consequence but in this case (and in the other electrification scenarios):

- No allowance is made for the wider appeal of electric trains (quieter, cleaner) nor the carbon benefits of electric traction
- No account is taken of the higher level of reliability that electric traction brings, with fewer train cancellations as a consequence
- No assumption is made about line of route rationalisations and improvements that could improve journey times further.

8. In Scenario 2, it was assumed that a train service plan is designed to get best use out of an extended North West England electrification programme and avoid extended running of through diesel trains along electrified routes. In Scenario 3, the aim was to test improving connectivity fully. Electrification is assumed for the Chester – Wrexham – Shrewsbury – Wolverhampton/Newport (Gwent) lines, allowing more electrified services in North Wales; the opportunity is also taken to exploit North Wales electrification more fully with both new services and frequency enhancement.

9. Separately, we examined the case for a new station to be opened on the North Wales Coast line at Broughton and the benefits of improving interchange at Chester (which, regardless of the pattern of service development, will remain a key interchange point between the six routes that converge there).

Findings: conventional transport benefits

10. Scenario 1 was specified in part to serve as a benchmark against a conventional transport appraisal already carried out by Network Rail. In our and Network Rail's analyses, the present value (PV) of conventional benefits of

Scenario 1 was found to be £311m - £313m. The primary sources of benefit (in declining order of value) are: time savings – electric trains are slightly faster than diesels; additional passenger revenues; reduced congestion and environmental impacts on the surrounding road network.

11. The effect of Scenario 2, which results in a need for a very high level of passenger transfer at Chester between electric and diesel train services, is a significant level of *dis*benefit, a *loss* estimated at a present value of £590m (PV).

12. The Scenario 3 case, with a wider set of service enhancements building on North Wales electrification and extending it to the border lines, results in much higher benefits totalling £1,488m PV.

13. A comparison of Scenarios 2 and 1 revealed that the incremental benefit of extending electrification from Chester to Holyhead if the routes east of Chester had already been electrified (and services were re-structured accordingly, with a high level of passenger interchange at Chester) would be £902m PV.

14. The separate examination of Chester station showed that a reduction in interchange time at the station (or more specifically, the perception of the interchange penalty at Chester) would be worth £10m/minute saved.

15. The analysis of a new station at Broughton showed that, based on achieving a rail market share similar to those that have been achieved at equivalent stations serving major business parks, it would bring additional benefits, even after allowing for the losses from the small extension to journey times for those services calling there.

16. Overall the analysis suggests that material conventional transport benefits could be gained by electrifying routes and enhancing connectivity to, from and within North Wales. Depending on the package of electrification and/or service enhancements, these benefits range from around £300m to £1,500m PV measured over a 60 year period.

Wider Economic and Social Benefits

Business to Business (B2B) Benefits

17. With better transport connectivity, more business opportunities arise, leading to greater business productivity and this in turn can drive both local economic and social benefits. These connectivity benefits to businesses are additional to the conventional transport user benefits, and the effects for each Scenario are as follows:

Scenario	**Scenario 1 £ PV**	**Scenario 2 £ PV**	**Scenario 3 £ PV**
Total Transport Benefits	£313m	-£590m	£1,488m
B2B Connectivity Benefits	£90m	-£476m	£454m

18. In the cases of Scenarios 1 and 3, the B2B benefits are worth around a further 30% of economic value on top of the conventionally measured transport benefits. The substantial loss of B2B benefits in Scenario 2 is consistent with the priorities stated by businesses of the importance of maintaining direct links to major business centres.

19. While - as would be expected – much of the B2B benefit arises in the major employment centres of Manchester, London and Birmingham, 41% of the B2B benefits in Scenario 1 arise in Wales, and these are widely spread (Prestatyn – Colwyn Bay £8.5m PV; Llandudno £7m PV; Bangor £6.3m PV Anglesey £2.8m and Wrexham £4m PV). These benefits increase in value (but not in proportion to the transport user benefits) significantly in the Scenario 3 case, with Wrexham, for example, increasing its value of B2B benefits to £31m PV.

(i) International Benefits

20. While there is no agreed methodology by which the benefits of better international connectivity can be quantified, North Wales is particularly poorly connected by rail to international airports. Road congestion on the M56, in the vicinity of Manchester International Airport, is already a peak period issue, and is expected to get worse according to the Highways Agency. Stakeholders from growing small/medium enterprises in North Wales stressed to us that – just as with larger industrial concerns – they trade in world markets and need good airport access, as do the key higher educational establishments, such as

Bangor University. Direct rail links can boost international trade by re-shaping access to markets and providing a reliable, quicker means of airport access.

21. While currently, access by rail to Manchester International Airport accounts for only around 6% of air passengers travelling to/from Wales, evidence from other locations with direct rail services suggests this proportion could be increased by a factor of four/five. The Halton curve route will open up access to Liverpool John Lennon Airport, and, of course, Holyhead remains a valued connecting point for Ireland.

Labour Market Benefits

22. A further benefit not scored in conventional transport appraisal, although it *does* pick up conventional journey time benefits to rail commuters, is to labour markets. This wider benefit arises from extending journey to work catchments, of benefit to employer and employee (and potentially, job seeker) alike. Using data recently abstracted from the 2011 census, the labour market benefits add a further 2-4% to the benefits of Scenarios 1/3, with value of £6m PV (Scenario 1) and £57m PV (Scenario 3). This sharp difference reflects the much more significant connectivity changes in Scenario 3.

23. In the case of Scenario 1, only 17% of labour market benefits accrue to Welsh residents and few of these are in NW Wales: the commuting times to major work opportunities are simply too long, and in Scenario 3 the proportion is lower still, and these results reflect in part the relatively limited use of rail for commuting in North Wales (compared with in the existing Liverpool and Manchester journey to work catchments, for example). Nevertheless, it is noteworthy that the cost of commuting by rail over longer distances from say Rhyl and Prestatyn to the Deeside employment areas is less than the cost of driving such distances to work.

Tourism Benefits

24. Through interrogation of tourism volume and spend data bases, an expenditure level of GB residents of £1.6bn exists in North Wales (2012 data). Rail accounts for 8% of North Wales visits with an overnight stay, but only 2% of day visits (where car dominates). North West England is the source of many visitors, and the highest proportion of rail-based visitors is from London.

25. There is significant investment in new tourism attractions in North Wales, and volumes can be expected to rise as a result. With growing road congestion, this represents a real opportunity for additional rail travel that can add to the benefits of service enhancement. Re-establishing direct rail services from Liverpool, for instance, could have a disproportionately large impact. Direct rail links from international airports could bring another boost.

26. Analysis of travel databases led to a conclusion that under Scenario 1, there could be a modest increase in rail-based visits to North Wales (up by c 10,000 per annum) but that Scenario 3, with its new direct services, would result in much larger uplift (of about +70,000 trips per annum). Applying Scenario 2, on the other hand, would lose North Wales 50,000 tourism visits annually.

27. Rail tourists to North Wales currently spend £59m per annum in the local economy and this would rise – modestly under Scenario 1 but by over £5m per annum under Scenario 3. This in turn would help support an estimated extra 130 jobs in North Wales (Scenario 3), spread widely east and west.

Conclusions

28. The overarching finding is that there is firm evidence of significant economic benefits that would result from the electrification of main line rail services in North Wales.

29. The wider economic and social benefits that have been quantified here add around £100m (around one third) to the estimated 'conventional' transport benefits of electrification.

30. Further connectivity and frequency improvements on the rail network become possible once the North Wales coast line is electrified – in particular, the route along the borders and between Shrewsbury and Wolverhampton – both routes that could have strong investment cases in their own right and that offer substantial benefits to many parts of Wales. Such developments, together with full exploitation of HS2 add substantially to the case. Conventional transport benefits would then be worth almost £1.5bn, almost 5 times the value of simply electrifying the North Wales line alone and with no service enhancements.

31. In this circumstance, econometric modelling has found that a further £450m of GDP benefits could accrue in agglomeration gains to firms from

better Business to Business connections, and £50m from labour market benefits. There are two important caveats to work in this area, which represents evolving methodology:

- the assumption of causality of relationships between connectivity and productivity performance
- the addition of agglomeration and labour market benefits to each other remains subject to a model co-variance caveat.

32. The distribution of benefits across North Wales is broad in respect of business to business benefits and the tourism sector. Labour market benefits are more clustered in North East Wales and in NW England.

33. These estimates exclude the benefits arising from the very significant improvements that Network Rail and rail industry partners are working towards such as frequency improvements and the reinstated Halton curve, which are reflected within the Do Minimum scenario.

34. The work also shows that electrification from Crewe and Warrington to Chester but no further holds very significant economic risks. An economic cost penalty of over £1bn is projected for this scenario assuming services are tailored to restrict diesel operation over electrified routes. These costs would lie disproportionately with businesses and individuals in Wales. Conversely, incremental analysis of subsequent extension of electrification westwards to Holyhead, eliminating the need for large-scale passenger transfer at Chester and overcoming this economic loss adds around £900m in transport benefits and a further £430m in wider economic impacts to what would then be a *Chester – Holyhead* electrification case.

35. Nevertheless Chester will remain an important interchange point – more so with higher frequency services – and there is an evident investment case to improve the station for transferring passengers. And we conclude that a new station at Broughton should be studied further.

36. Analysis of existing air business passenger data suggests a potential Welsh rail market of 20,000 trips pa to Liverpool airport and 120,000 to Manchester. Direct rail services to both airports could lead to important additional economic benefits not included in the traditional transport approach.

1. Introduction

Remit

This report by Greengauge 21 was commissioned by Denbighshire County Council on behalf of the North Wales Economic Activity Board, Mersey Dee Alliance and Merseytravel. It provides evidence on the social and economic effects of investment in rail in North Wales and adjoining areas, and considers the wider case for route electrification specifically. The objective of the work is to examine the evidence base of potential wider impacts, extending the scope of conventional WebTAG/WelTAG analysis. In particular, the emphasis required is to understand the potential GVA impacts on local economies and the role that rail investment can play in enhancing economic outcomes.

This work is set in the context of Network Rail's Wales Route Study and the cases for electrification between Crewe and Chester, Warrington and Chester and Chester to Holyhead. Whilst this work is not intended as an investment appraisal in its own right, it does demonstrate the scope of benefits that could be set alongside those measured in standard rail appraisals, as evidence of broader impacts.

Phase 1 Findings

For completeness, there is value in recapping on the findings of the Phase 1 work. This identified a number of *conditional outputs* - conditional in the sense that their realisation depends on an efficient investment programme being developed capable of delivering them. These preliminary conditional outputs centre on the provision of increased service frequency with better connections at the key interchanges of Chester and Crewe and new through services, and would lead to:

- a frequency uplift: more services and some new direct links for north Wales
- direct services to Liverpool and Manchester airports
- better service timings for the tourism sector
- investment to accommodate 9'6 container flows on conventional rail wagons to/from Holyhead port
- faster and more reliable services
- better connectivity between services, with Chester likely to be a hub station of continuing importance
- the opportunity to exploit the transformational service benefits that the recent proposal to progress a new hub station for HS2 at Crewe by 2027 would bring.

Phase 1 also concluded that economic activity rates in North Wales show a distinct west-east split as job opportunities and employment lie mainly in North East Wales. This is explained by differences in age and health structure

and in part also by differences in unemployment. Almost three-quarters of current jobs lie east of Denbighshire and the majority of net employment growth is projected to occur in the border area (Flintshire and West Cheshire and Chester). There is a variation in levels of GVA per head due also to the ability of workers in the east to access high value jobs more readily. Better rail connectivity can help address the economic and social consequences of this situation. It can:

- strengthen the attractiveness of the Strategic Regeneration Area[2] and improve the prospects for local jobs
- improve access from the Strategic Regeneration Area to employment opportunities in NE Wales/NW England.

The key factors to be addressed in understanding the wider benefits that rail investment can bring are:

i. The economic spillover and wider social benefits across North Wales from enhanced accessibility to employment centres that are evidently much stronger in the east than the west
ii. The impact of frequency enhancements in the context of a (relatively) high level of passenger interchange (which begs questions on the scope for integrated interval timetabling)
iii. The economic significance of direct access to airports
iv. The role that rail services can play in developing the tourism sector economy.

Scope of Work

The findings from Phase 1 helped to define the agreed tasks for this Phase 2 work, as follows:

Task 1 Timetable Impacts and Conventional Benefits

This task defines the service scenarios to be tested and uses the industry-standard model (MOIRA) to calculate the Generalised Journey Time (GJT) impact of the service specifications. The GJT impacts are then used to quantify the conventional economic benefits and to inform more detailed analysis of GDP benefits (undertaken in tasks 2 and 3).

Task 2 Quantifying Business to Business Benefits

Understanding the role improved rail connectivity can play in improving business productivity and measuring this improvement in GDP terms. This task uses the econometric modelling framework developed by Network Rail in the

[2] The North Wales Coast Strategic Regeneration Area extending from Prestatyn to Mochdre

Long Distance Market Study[3] and applies it at the North Wales route level to convert connectivity impacts to agglomeration benefits via an increase in rail business travel.

Task 3 Quantifying Labour Market Benefits
Understanding the benefits to workers and employers of improving opportunities to commute by rail and measuring the incremental GDP benefits that would accrue beyond those measured by conventional time-saving effects. This utilises the econometric approach developed by Network Rail in their Urban Regional Market Study[4] to measure the productivity effects of better commuting opportunities by rail.

Task 4 Tourism Impacts
Investigating the current tourism market for North Wales and the role that rail plays in encouraging tourism and supporting jobs in this sector. Analysing bespoke tourism trip data to understand how an improved rail network would encourage tourism and estimating the incremental impact on tourist spend and jobs. This task incorporates business interviews with players in the tourism sector to understand constraints and opportunities.

Task 5 Assessment of International connectivity benefits
Analysis of the number of existing business travellers to/from Manchester and Liverpool John Lennon airports, by rail and by other modes, to understand the potential impact of all day direct airport rail services. This incorporates the interrogation of bespoke CAA data.

Task 6 Initial Assessment of a new station at Broughton
Looking at the potential market (demand) for a new station and the benefits that would accrue, as a first step towards making a business case for such an investment. This task is reported as a stand alone appendix.

3 Long Term Planning Process: Long Distance Market Study. Network Rail. October 2013
4 Long Term Planning Process: Regional Urban Market Study. Network Rail. October 2013

2. Timetable Impacts and Conventional Benefits

Introduction

This Chapter sets out a specification of the Baseline, Do Minimum and option (Do Something) Scenarios that we have modelled as part of the Phase 2 study. It provides a summary of why we have specified each Scenario together with a summary of the services assumptions that have been made in each.

The Chapter continues to set out our analysis of the demand, revenue and conventional transport economic impacts of each Scenario. This includes detail of the analytical framework and the output of that analysis in terms of demand impact and conventional transport benefits.

Option Specification

The following section sets out the specification of options that have been modelled as part of the Stage 2 analysis.

Baseline

The Baseline is the latest timetable and demand data held in the MOIRA model, in this case it is the December 2013 timetable and annual demand to September 2013. The Do Minimum and all Scenario timetables have been compared in Tables 2.2 to 2.4 against this baseline, although the economic impacts quoted are incremental to the Do Minimum case.

The typical hourly services included in the Baseline timetable are summarised in Table 2.1 below.

Table 2.1 Baseline Services Summary - ie based on the December 2013 timetable

Line	Baseline Services
North Wales Coast (Crewe/Wrexham – Holyhead)	1 tph London – Chester (Bangor/Holyhead in some hours)
	1 tph Birmingham/Cardiff (alternate hours) – Wrexham – Chester – Holyhead
	1 tph Manchester Piccadilly – Warrington – Llandudno;
	1 tph Crewe – Chester;
Bidston Line	1 tph Wrexham Central – Bidston
Wirral Line	4 tph Chester – Liverpool Central

Do Minimum

The Do Minimum represents the way in which the rail industry may develop rail services in North Wales in absence of consideration of, or intervention based on, the aspirations of Local Authorities in North Wales. For the Do Minimum we have assumed Network Rail's 2043 Indicative Train Service Specification (ITSS), excluding the impact of electrification which is not currently committed for the North Wales route. The 2043 ITSS forms the basis from which each of the Scenarios is developed. Therefore by comparing each scenario with the Do Minimum we will be able to isolate the benefits of electrification and other enhancements. It should be noted that:

- there is no electrification to Chester (on either route – Crewe or Warrington) in this case
- following recent funding announcements, the Halton Curve is assumed to be open

The service pattern in the 2043 ITSS (Do Minimum), and how this compares to the Baseline, is summarised in the following table. **Bold underlining** illustrates where an existing Baseline service differs in the Do Minimum. The Baseline column notes 'no current services' where the 2043 service is additional to the baseline.

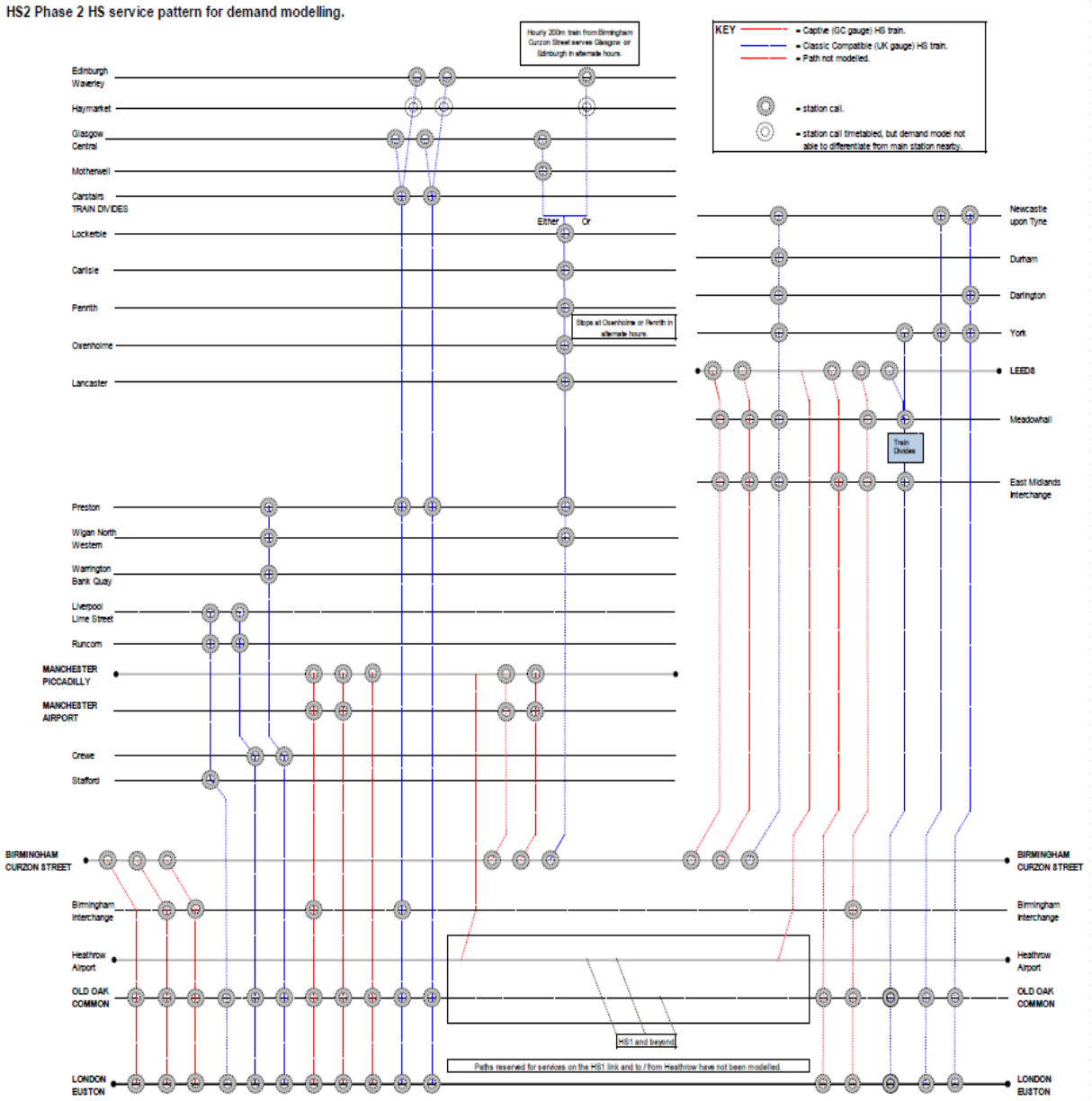
Table 2.2 Do Minimum Service Summary ie based on 2043 Indicative Train Service Specification, including HS2

Line	Baseline Service Assumptions	Do Minimum Service Assumptions
North Wales Coast (Crewe/Wrexham – Holyhead)	1 tph London – Chester (Bangor/Holyhead in some hours)	1 tph London – **Wrexham & Bangor** (in alternate hours)
	1 tph Birmingham/Cardiff (alternate hours) – Wrexham – Chester – Holyhead	1 tph Birmingham/Cardiff (alternate hours) – Wrexham – Chester – Holyhead
	No current service	**1 tph Cardiff/Shrewsbury (alternate hours) – Wrexham – Chester – Liverpool via Halton**
	1 tph Manchester Piccadilly – Warrington – Llandudno	**2 tph** Manchester Piccadilly – Warrington – Llandudno
	No current service	**1 tph Holyhead – Liverpool via Halton**
	1 tph Crewe – Chester	1 tph Crewe – Chester
Bidston Line	1 tph Wrexham Central – Bidston	1 tph Wrexham Central – Bidston
	No current service	**1 tph Wrexham Central – Hawarden Bridge**

Wirral Line	4 tph Chester – Liverpool Central	4 tph Chester – Liverpool Central

The benefit outlook for this analysis is over 60 years and therefore looks beyond the delivery of HS2: it is therefore assumed that connectivity offered by HS2 is included in the Do Minimum case. Given Sir David Higgins' proposition that delivery of HS2 Phase 2 to the North West is accelerated we have assumed the HS2 Phase 2 service level to the North West in our Do Minimum case. The following figure illustrates the HS2 service frequency assumed. (Note we have not shown the HS2 services operating to Yorkshire and the North East).

Figure 2.1 HS2 Service Summary



Scenario 1 – Electrification to Holyhead

This scenario is specified to allow the full economic benefits of electrification from Runcorn/Warrington/Crewe to Holyhead to be valued based on consistent service assumptions to that used in Network Rail's electrification case. This is based on the same timetable assumptions that Network Rail adopted for Options 4/5 of their study – i.e. the 2043 ITSS specified as per the Do Minimum above.

The only difference between the Do Minimum and this Scenario Specification is the journey time improvements secured by electric traction offering quicker acceleration and deceleration.

Scenario 2 – Electrification to Chester / Chester Hub

This scenario reflects a situation where electrification between Runcorn/Warrington/Crewe and Chester is realised and all electrified services terminate at Chester. Diesel shuttle services are assumed to operate between Chester and the North Wales coast, along with the continued operation of the through diesel service from Birmingham International / Cardiff.

It is important to have analysed this scenario to understand the impact that such a scenario might have on existing passengers, and a possible alternative reference case to be used in considering the benefits of North Wales electrification.

The following table provides a summary of the service assumption in this Scenario together with a comparison of the differences with the Do Minimum service assumptions.

Table 2.3 Scenario 2 Service Summary

Line	Do Minimum Service Assumptions	Scenario 2 Service Assumptions
North Wales Coast (Crewe/Wrexham – Holyhead)	1 tph London – Wrexham & Bangor (in alternate hours)	1 tph London – **Chester**
		1 tph **Chester** – Wrexham 1 tph **Chester** – Bangor
	1 tph Birmingham/Cardiff (alternate hours) – Wrexham – Chester – Holyhead	1 tph Birmingham/Cardiff (alternate hours) – Wrexham – Chester – Holyhead
	1 tph Cardiff/Shrewsbury (alternate hours) – Wrexham – Chester – Liverpool via Halton	1 tph Cardiff/Shrewsbury (alternate hours) – Wrexham – **Chester**
		1 tph **Chester** – Liverpool via Halton
	1 tph Holyhead – Liverpool via Halton	1 tph **Chester** – Liverpool via Halton
		1 tph Holyhead - **Chester**
	2 tph Manchester Piccadilly – Warrington – Llandudno	2 tph Manchester Piccadilly – Warrington – **Chester**
		2 tph **Chester** – Llandudno
	1 tph Crewe – Chester	1 tph Crewe – Chester
Bidston & Wirral Lines	Unchanged	

Scenario 3 – Electrification Chester – Cardiff/Birmingham / Expanded Direct Connectivity / Interaction with HS2

Scenario 3 builds on Scenario 1 by assuming further service development including direct connections between North Wales and both Manchester Airport and Yorkshire. It presumes further wider electrification, and assumes services operate via HS2. The following points summarise the assumptions underpinning the specification.

- Electrification of the Chester – Cardiff/Birmingham routes allows services via Wrexham to realise the quicker journey times offered by electric traction;
- Services to Manchester are diverted to operate via Victoria and are cross-linked with services to Leeds via Bradford;
- Greater access to HS2, giving an hourly connection to London / the north, provided by assuming:
    - A portion of a classic compatible HS2 service splits/joins at Crewe to serve Wrexham / Bangor in alternate hours; and
- In alternate half hours there is a Wrexham/Bangor – Manchester Airport service via Crewe – giving improved interchange opportunities to HS2 at Crewe as well as direct North Wales connections to a major international airport.

Table 2.4 below provides a summary of the services assumed in this scenario.

Table 2.4 Scenario 3 Service Summary

Line	**Do Minimum Service Assumptions**	**Scenario 3 Service Assumptions**
North Wales Coast (Crewe/Wrexham – Holyhead)	1 tph London – Chester (Bangor/Holyhead in some hours)	1 tph London – **Wrexham & Bangor** (in alternate hours, **via HS2**)
	No current service	**1 tph Manchester Airport – Crewe – Wrexham & Bangor (in alternate hours)**
	1 tph Birmingham/Cardiff (alternate hours) – Wrexham – Chester – Holyhead	1 tph Birmingham/Cardiff (alternate hours) – Wrexham – Chester – Holyhead
	1 tph Holyhead – Liverpool via Halton	1 tph Holyhead – Liverpool via Halton
	No current service	**1 tph Cardiff/Shrewsbury (alternate hours) – Wrexham – Chester – Liverpool via Halton**
	1 tph Manchester Piccadilly –	**2 tph Leeds** - Manchester

	Warrington – Llandudno	**Victoria** – Warrington – Llandudno
	1 tph Crewe – Chester	Superseded by airport service
Bidston Line	1 tph Wrexham Central – Bidston	**2 tph** Wrexham Central – **Liverpool** (assume a non-electrification solution)
Wirral Line	4 tph Chester – Liverpool Central	4 tph Chester – Liverpool Central

Additionally, as an increment to Scenario 3, we have given consideration to the potential benefit of improved connectivity at Chester station. Chester has an important role as a hub station for North Wales. Following delivery of services on the Halton Curve it will be a hub for six routes serving the Wirral, Liverpool and Runcorn, Manchester and Warrington, London and Crewe, Wrexham, Birmingham and South Wales as well as the North Wales Coast. Reflecting this role there are a large number and range of journeys that require interchange at Chester.

We have valued the benefit that could be realised by reducing passengers' perception of interchange at Chester by one minute. This could be achieved in a number of ways including revising the timetable to optimise connection times and providing enhanced walking routes and facilities within the station for interchanging passengers – or simply by enhancing the passenger experience to reduce the perceived interchange penalty at Chester.

Approach to Valuing the Transport Benefits

We have assessed the benefits of the schemes using standard industry practice. This has involved coding service changes in MOIRA, and then running MOIRA to derive the changes in demand, revenue, passenger miles and generalised journey time (GJT) associated with each scenario. These changes have then been used as the inputs to a spreadsheet-based benefits model, which has applied WebTAG parameters in order to monetise the transport benefits in present value (PV) terms over a 60 year appraisal period.

The following bullet points set out the key assumptions that have been made in the calculation of the economic benefits:

- WebTAG guidance, including specified parameters, has been applied throughout and reflects the most recent (January 2014) update. The main aspects of WebTAG that have been used in the appraisal process are: values of time; car occupancies and marginal external costs of car use; externalities; and indirect tax

- We have valued the generalised journey time benefits associated with improved rail services and connections. This has been calculated on the basis of value of time outputs from MOIRA. We have also valued the non-user benefits that arise as a result of modal switch from road to rail. We have not, however, valued crowding benefits or benefits related to non-traded carbon consumption, as these lie beyond the scope of our analytical approach. The Network Rail electrification study does measure the latter and these are non-negligible . As such, the total of the benefits we have produced does not include all of the benefits that would normally be part of a PVB (Present Value of Benefits) calculation. We have inflated the PVB by 2.5% per annum to account for background demand growth.
- We have calculated the revenue impact of each of the options by taking the revenue impact that MOIRA forecasts. We have assumed that revenue grows at 1% per annum, reflecting an above RPI fares increase and associated suppression of demand
- Since the options are based on infrastructure improvements, we have assumed a 60 year appraisal period. The earliest that the improvements could be delivered would be Control Period 6 (2019-2024), and we have therefore assessed the options on the basis that they are delivered at the end of Control Period 6, in the financial year 2023/24. We have assumed a discount rate of 3.5% until 2043/44 and of 3% thereafter
- Our non-user benefits include the following categories of benefit: noise reduction; greenhouse gas reduction; and highway accident reduction. These have been calculated by applying the appropriate car occupancy and diversion factors, as specified in WebTAG, to the passenger miles outputs from MOIRA for the various tests. We have also included the reduction in highway maintenance costs as a non-user benefit, which is calculated using a similar approach. We have not valued the supply side environmental benefits of replacing diesel trains with electric alternatives.

Value of Demand and Transport Benefits

The following table provides a summary of the current demand and forecast Do Minimum demand together with the incremental demand of each Scenario (excluding Scenario 3 interchange benefits which are set out subsequently). The demand shown is at the year to September 2013 level and excludes any future exogenous demand impacts. The table also provides a breakdown between demand wholly within North Wales and Chester, demand to and

from North Wales and Chester and demand to and from destinations outside North Wales and Chester.

Table 2.5 Do Minimum and Scenarios 1 to 3 Demand Summary

2013 - 000s of single rail trips	**Within North Wales & Chester**	**To/From North Wales & Chester**	**Outside North Wales**	**Total**
Absolute Demand				
Current	1,466	4,207	79,197	84,870
Do Minimum	1,763	4,373	81,897	88,033
Incremental Demand from Do Minimum				
Scenario 1	26	83	54	163
Scenario 2	-20	-117	53	-84
Scenario 3	44	371	294	710

The Do Minimum demand includes all trips where there is a change in demand as a result of timetables modelled. For example, the demand 'Outside North Wales' does not include all other UK rail trips, only those impacted on by the Scenarios modelled. In broad terms this includes trips made wholly outside North Wales but served by trains to and from North Wales.

The table shows that the size of the rail market for trips wholly within North Wales is smaller than the market to and from North Wales, which in turn is notably smaller than the overall rail market outside North Wales, on routes served by trains to and from North Wales. It also shows that the incremental demand impacts are smallest for flows wholly within North Wales, which is in part due to the low level of base demand, but also because there are no frequency enhancements to services within North Wales between the Do Minimum and each Scenario, as frequencies reflect the ITSS aspirations in the Do Minimum.

The exception here is Wrexham services on the Bidston line. However, demand growth is largest within Wales when going from the Base to the Do Minimum which, with the extra one train per hour on the N Wales coast, adds 20% to within Wales demand.

By contrast the incremental demand impact on services to and from North Wales and Chester is greater because of the size of the market and because there is impact on service frequency, journey time and the need to interchange for these trips. For example Scenario 2 causes the majority of passengers between North Wales and the rest of the UK to interchange at Chester, while Scenario 3 provides quicker connections to London (as a result

of connecting to HS2); to Cardiff / Birmingham (due to electrification); and, between Wrexham and Liverpool (direct services via Bidston).

The following table provides a similar breakdown of the demand impact for the Scenario 3 Chester Interchange test. The table shows only the demand where that trip interchanges at Chester station.

Table 2.6 Scenario 3 Chester Interchange Demand Summary

2013 - 000s	**Within North Wales & Chester**	**To/From North Wales & Chester**	**Outside North Wales**	**Total**
Do Minimum Demand	18	381	224	623
Scenario Demand	18	383	225	626
Increment	0	2	1	3

The analysis suggests that a one minute reduction interchange at Chester could increase demand by around 0.5%. The impact here is scalable, so any greater reduction in interchange time will results in increased levels of additional demand.

The following table presents the indicative transport benefits for each of the considered options. It is important to note that sum of the benefits presented in the table would not equate to the WebTAG definition of the Present Value Benefits that make up any Benefit to Cost Ratio. Rail user and non-user benefits would be included in the Present Value Benefits while revenue and indirect tax impacts and highway maintenance impacts would appear as Present Value Costs (together with any capital costs which have not been included in this assessment).

Table 2.7 – Summary of Transport Economic Benefits

Scenario	**SDG Valuation of NR Options 4/5 £m PV**	**Scenario 1 £m PV**	**Scenario 2 £m PV**	**Scenario 3 £m PV**	**Scenario 3 - Chester Interchange Improvements £m PV**
Journey Time	£172.7	£174.9	-£345.8	£709.5	£6.3
Non User (Decongestion) Including environmental imapacts	£54.7	£54.5	-£116.0	£293.8	£1.4
Externalities	£6.4	£6.3	-£13.5	£34.1	£0.2
Indirect Tax	-£18.9	-£18.9	£32.3	-£107.6	-£0.5
Revenue	£95.4	£95.5	-£146.1	£555.9	£2.4
Highway Maintenance Savings	£0.3	£0.3	-£0.7	£1.8	£0.0
Total Transport Benefits	**£310.5**	**£312.6**	**-£589.9**	**£1,487.6**	**£9.8**

The remainder of this Chapter sets out observations from Table 2.7 and the conclusions that can be drawn.

The first column provides a comparison of a valuation of Options 4/5 from Network Rail's electrification study. This is comparable to Scenario 1 defined as part of our analysis. While the scope of the Do Minimum timetable for Network Rail's Options 4/5 and our Scenario 1 differs, the services that are assumed to convert form diesel to electric traction are the same. It is therefore expected that the level of benefit from each Scenario should be broadly similar and this is reflected in the valuation of transport benefit as illustrated in Table 2.7. This is important as it demonstrates consistency between this and Network Rail's study.

The analysis of Scenario 1 shows that there is a material benefit to be gained from electrifying the routes from Runcorn, Warrington and Crewe to Holyhead, in excess of **£300m** (PV, 2010 prices) over a 60 year period.

Scenario 2 values the impact of electrifying the routes from Runcorn, Warrington and Chester only, with through services from electrified routes to North Wales terminated at Chester. The analysis suggests this could result in significant disbenefits as a result of the additional journey time and passengers' negative perception regarding the need to interchange. The analysis suggests that this could result in a disbenefit of around **£600m** (PV, 2010 price) over a 60 year period.

Scenario 3 values the impact of further service enhancements to rail connectivity to and from the North Wales area. The service assumptions assumed:

- Extending electrification from Chester to Cardiff and Birmingham via Shrewsbury with quicker journey times for services on these routes;
- Extending a portion of a HS2 service from Crewe to Wrexham and Holyhead in alternate hours – which compared to today offers around a 30 minute journey time saving between North Wales and London;
- In the opposite hour to the HS2 service a direct Holyhead / Wrexham to Manchester Airport service, which also provides a connection to HS2 services at Chester giving an hourly journey opportunity to London;
- A half hourly direct service from Wrexham Central to central Liverpool via Bidston; and
- Direct services to Yorkshire by connecting services from North Wales and Yorkshire at Manchester Victoria.

The analysis suggests that this Scenario could bring significant additional economic benefits. At around **£1,500m** (PV, 2010 prices) the potential benefits are around five times the benefits identified for Scenario 1.

Scenario 3 has also sought to value the benefit of reducing passenger perception of interchange time at Chester by a single minute. The analysis suggests that improvements to deliver a minute reduction in interchange time could generate economic benefits of up to **£10m** (PV, 2010 prices) over a 60 year period. Such benefits could be realised through better coordination of the timetable or for relatively small cost, for example through enhancing passenger facilities at the station itself.

Incremental Electrification Beyond Chester

The scenarios presented capture the impacts of electrification with the ITSS timetable to Chester only (Scenario 2) and to Holyhead (Scenario 1) both compared to a non-electrified ITSS (the Do Minimum). It is possible the electrification to Chester would be pursued independently to, and in advance of, full electrification of the North Wales route to Holyhead. If this were to happen than the benefits that electrification to Holyhead would generate (Scenario 1) should be calculated using Scenario 2 as a Do Minimum, rather than the Do Minimum Scenario currently considered. This has been calculated by taking the difference between the modelled Scenario 1 and Scenario 2 benefits, with the impact presented in Table 2.8 below.

The analysis suggests that securing electrification beyond Chester to Holyhead, compared against a Scenario where electrification to Chester had already been implemented, would deliver around **£900m** (PV 2010 prices) in benefits over a 60 year period. This reflects the benefit of reinstating direct services between North Wales and locations such as Liverpool, Manchester and London, which were assumed to be split at Chester in Scenario 2. It also represents the benefits of quicker journey times that electrification can bring to services along the North Wales coast.

Table 2.8 – Summary of Transport Economic Benefits – incremental electrification

Scenario	Incremental Electrification Beyond Chester (Scenario 2 – Scenario 1)
Journey Time	£520.7
Non User (Decongestion) Including environmental impacts	£170.4
Externalities	£19.8
Indirect Tax	-£51.2
Revenue	£241.6
Highway Maintenance Savings	£1.1
Total Transport Benefits	**£902.4**

Conclusion

Overall the analysis suggests that material benefits could be gained by electrifying routes and enhancing connectivity to, from and within North Wales. Depending on the package of electrification and / or service enhancements the benefits could range from around £300m to £1,500m over a 60 year period. However securing these benefits would require investment in infrastructure, rolling stock and service provision (financial support for operators). The North Wales authorities therefore need to work with the Rail Industry, including other industry funders, in order to identify affordable and value for money solutions to realise the benefits of a Scenario 3-type solution, and recognise the risks of a Scenario 2 situation.

3. Quantifying Labour Market Benefits

Approach

As highlighted in Chapter 1 above, this task utilises the econometric approach developed by Network Rail[5] to quantify the labour market benefits of improving rail connectivity.

The NR national level model was developed by establishing relationships between the connectivity of the population to businesses and the productivity of those businesses. This approach estimates the relationship between economic output and access to labour. As the perceived cost of travel between population areas and urban centres reduces, people are more likely to commute to a job that better matches their skills, this allows employers to choose from a greater pool of prospective employees and match those employees to the activities that they will be most productive, increasing the productivity of the business and increasing economic output.

Parameters for the model were derived by estimating the supply of labour from empirical sources, and then deriving a 'decay curve' that relates the willingness to commute to generalised journey time. The steepest part of the decay curve lies between 20 and 60 generalised minutes ie. that is the range where changes in connectivity will have most impact upon the propensity to commute.

As the generalised time between two zones decreases, the supply of labour to these zones increases. As the supply of labour to a zone increases the productivity of businesses in that zone will improve. Gross Domestic Product (GDP) per capita is used as a measure of productivity. A relationship between GDP per capita and the supply of labour to a zone has been found. The econometric analysis derived a unit benefit of 0.25p: this means that every additional person in the labour catchment increases the productivity of each employee in that zone by 0.25 pence pa

In order to apply this approach to the rail connectivity improvements considered for North Wales, the parameters developed by NR in their network

[5] This approach was discussed with Chris Judge, Economic Analysis Manager at Network Rail as part of the Phase 1 work:as an appropriate application of the technique set out in Appendix H of the Regional Urban Market Study published in October of 2013.

studies were applied to North Wales. To do this, it was necessary to develop all of the relevant data at a local (route) level and apply the following steps:

- Generalised time changes were extracted for each investment scenario considered within the MOIRA analyses, and compared with the Do Minimum scenario
- Working age population estimates were derived from 2011 census data as a measure of labour supply for origin zones
- Journey to work mode split for rail was also taken from 2011 census data
- Jobs data from 2011 census was used as a measure of labour demand for destination zones
- The decay curve equation was applied to the generalised time changes to estimate the willingness to supply labour, and the unit benefit applied to derive the productivity gain
- Annual GVA benefits were converted to Present Value impacts in line with PV factors used in the conventional benefit analysis reported in Chapter 2.

Results – GVA Benefit summary

The labour market benefits for each scenario are summarised in Table 3.1 below. The scale of conventional transport benefits is also repeated here as a yardstick for the scale of impact.

Table 3.1 – Labour Market Benefit Summary

Scenario	Scenario 1 £m PV	Scenario 2 £m PV	Scenario 3 £m PV
Total Transport Benefits	**£312.6**	**-£589.9**	**£1,487.6**
Labour Market Benefits	**£5.9**	**-£0.8**	**£56.5**
% of transport benefits	**1.9%**	**0.1%**	**3.8%**

The results show that in aggregate, labour market benefits are relatively modest in comparison with total transport benefits. It should be noted, however, that these just measure the labour market productivity gains to firms and workers as a result of changes in labour supply. These are *additional* benefits to those measured in conventional appraisal. The direct benefits to existing commuters are contained within the transport benefits, whether as benefits to rail users or as congestion relief to those commuting by car.
The second point to note is that the relative scale of impact varies significantly by scenario. Scenario 3 generates 10 times the labour market benefit of scenario 1 and twice as much proportionate to transport benefits. This reflects the non-linear nature of the commuting decay curve. It is consistent also with the idea that larger connectivity improvements are more likely to lead to behavioural changes in the labour market (changing jobs and/or changing home location). Scenario 2 exhibits very small labour market disbenefits, suggesting that labour market opportunities for those travelling across Chester are limited by the intervening opportunities offered within that city.

For the incremental test of scenario 1 with scenario 2 as the base, the incremental labour market benefits are estimated as £6.7m PV.

Results - Distribution of benefits

There is value in understanding where benefits are predicted to occur, to understand how far each scenario addresses spatial objectives. This is measured here by worker origin:

Table 3.2 – Distribution of Labour Market Benefits (£000 pa)

Zone	Scenario 1	Scenario 2	Scenario 3
Anglesey	0.3	-0.1	0.7
Bangor	0.4	0.0	1.0
Bidston - North	1.3	-1.0	496.9
Bidston - South	0.2	0.0	22.2
Birmingham	0.0	0.0	-4.6
Chester	30.8	23.8	47.4
N Wales Coast	9.4	-18.6	11.0
Crewe	3.6	-8.2	47.3
Liverpool	6.0	-9.5	201.4
Liverpool S Pwy	0.0	0.0	7.0
Llandudno	4.6	-2.5	5.8
Manchester	22.6	7.2	24.6
Marches	-0.4	0.0	-1.0
Milton Keynes	1.3	1.3	2.6
Newport & Cardiff	0.0	0.0	-1.6
Runcorn	23.3	2.9	65.0

Shotton	3.6	-11.6	11.4
London	0.0	0.0	27.2
Wirral	1.2	1.8	57.2
Wrexham	-0.1	0.2	5.8

Scenario 1

- The distribution of benefits is not evenly spread, with residents in larger towns/cities accounting for most of the benefit
- Around 17% of labour market benefits accrue to residents of Wales (£1m PV) of which the Coast zone (Prestatyn to Colwyn Bay) accounts for about half (£0.52m PV)
- North west Wales has modest benefits, reflecting the fact that the improvements put forward under this scenario are insufficient to open up many new job opportunities as well as the relatively incumbent low rail mode share.

Scenario 2

- Whilst there are benefits for workers in England, these are outweighed by significant disbenefits to workers in Wales, reflecting the requirement to interchange at Chester
- The largest negative impacts are for workers on the North Wales coast and at Shotton, although Liverpool residents also lose out by not having direct services to jobs in Wales
- Chester itself benefits as it retains good connectivity both east and west

Scenario 3

- Only around 5% of benefits would accrue to workers from Wales (£3.1m PV)
- Within Wales, the Bidston South zone (north of Wrexham) shows most benefit of around £1.2m PV, reflecting the proposed improvements to the Wrexham-Bidston line.
- Benefits are spread across a larger area, including Liverpool and Manchester.

4. Quantifying Business to Business (B2B) Benefits

Approach

An analogous approach was employed to measure the productivity gains that businesses accrue through being closer to each other in time terms. The econometric model developed by Network Rail to quantify agglomeration benefits has been applied here, again after discussion with Network Rail. This approach is set out in Appendix B of the Long Distance Market Study published in October of 2013, which states:
"The principles and methodology are compliant with the transport appraisal guidance set out by the Department for Transport."[6]

This approach estimates the relationship between economic output and business to business connectivity. As the cost of travel between locations reduces, businesses are more likely to engage with each other. This increases business opportunities between regions and leads to increased economic activity. Cost here reflects the monetary cost of travel and of time, as measured by *Generalised cost (£).* An empirical 'decay curve' is again employed to assess the relationship between business travel and generalised cost, with travel most responsive when generalised cost changes within the range £20-50 per trip.

The decay curve helps to define business to business connectivity, which is measured by the "effective density" of places, i.e. the employment accessibility of a location. Effective density measures the number of employees in two locations and the willingness of the employees to travel from one location to the other for business purposes (as defined by the decay curve). The number of employees is a proxy of the volume of business activities and trading undertaken between two places.

Regression analysis then allowed further analysis to be undertaken to establish the relationship between economic output and business to business connectivity (i.e. effective density). This econometric analysis showed that there is a statistically significant positive link between effective density (a proxy for business to business connectivity) and economic outputs, which is measured in Gross Domestic Product (GDP) per worker.

[6] Appendix B p72.

To apply this approach to the Do Something scenarios in this study, the following steps were undertaken:

- Generalised cost changes were extracted for each investment scenario considered within the MOIRA analyses, and compared with the Do Minimum scenario
- Employment estimates for both origin and destination zones were estimated from 2011 census outputs
- Rail mode share for business travel was derived from National Travel Survey data (2012)
- Willingness to travel was estimated from the decay curve for given o-d pair changes in generalised cost
- Effective density was estimated using the parameters from Network rail's econometric model
- Unit GDP benefits are derived and grossed up by employment estimates at destination zones and again grossed to PVs in line with the conventional benefit work.

Results – Aggregate

Table 4.1 below summarises the model results at the aggregate scenario level.

Table 4.1 – B2B Connectivity Benefit Summary

Scenario	Scenario 1 £m PV	Scenario 2 £m PV	Scenario 3 £m PV
Total Transport Benefits	**£312.6**	**-£589.9**	**£1,487.6**
B2B Connectivity Benefits	**£89.7**	**-£476.3**	**£453.8**
% of transport benefits	**28.7%**	**80.7%**	**30.5%**

These results show that the scale of B2B GDP impacts is an order of magnitude greater than for labour market impacts. This is consistent with findings from Wider Impacts analysis that normally shows agglomeration effects as accounting for the majority of benefits of improved connectivity. The proportion of benefits for investment scenarios 1 and 3 are also in the

range expected under Wider Impacts analysis – all be it at the upper end of the previously-observed range of such effects. This suggests that these effects are significant and important evidence of the scale of economic benefit that would accrue beyond that measured in conventional appraisal. For scenario 3, this extends to more than £450m GDP benefit across the 60 year life of the investment.

The findings for Scenario 2 show that there would be very significant negative impacts on the productivity of businesses, beyond those time, wait and interchange penalties measured in conventional appraisal. This 80% mark-up on disbenefits is evidence of the disproportionate effect of cutting direct services at Chester. It is consistent with priorities stated by businesses of the importance of maintaining direct links to major business cities.

For the incremental test of scenario 1 with scenario 2 as the base, the incremental B2B productivity benefits are estimated as £423m PV.

Results - Distribution of agglomeration benefits

Scrutiny of where B2B productivity impacts would occur is set out in Table 4.2 below by scenario. These are set out by trip (and therefore business) origin although benefits will accrue to businesses at both ends of the trip. The analysis is done by single trip, so business trip opportunities in each direction are accounted for.

Table 4.2 – Distribution of B2B Benefits (£000 pa)

Zone	Scenario 1	Scenario 2	Scenario 3
Anglesey	51	-539	218
Bangor	114	-627	330
Bidston - North	-111	-396	346
Bidston - South	68	-203	339
Birmingham	179	-165	552
Chester	124	119	1,278
N Wales Coast	155	-1,491	422
Crewe	22	-58	107
Liverpool	73	-119	406
Liverpool S Pwy	47	17	128
Llandudno	127	-841	282
Manchester	257	-485	429
Marches	18	32	105
Milton Keynes	85	-307	-378
Newport & Cardiff	-2	-5	303
Runcorn	41	-100	96
Shotton	91	-251	171

London	209	-2,399	2,470
Wirral	11	8	84
Wrexham	72	-849	563

Scenario 1

- Unsurprisingly, much of the benefit accrues to businesses in the main employment centres including Manchester (£14m PV), Birmingham (£10m PV) and London (£11m).
- However, around 41% of B2B benefits (£37m PV) would accrue to businesses in Wales of which the Coast zone (Prestatyn to Colwyn Bay) is worth £8.5m PV and Llandudno £7m PV
- North west Wales has important benefits in relation to the size of the local economy. Benefits for Bangor would be worth £6.3m across the 60 year life of the project and for Anglesey £2.8m.
- Wrexham would also benefit by around £4m PV.

Scenario 2

- Although net disbenefit for this scenario is around £476m, a majority (56%) would fall to businesses in Wales (£264m PV negative impact)
- Those hardest hit in Wales would be the business communities of Coast (£82m PV); Wrexham (£47m PV); and, Llandudno (£46m PV)
- In absolute terms, the London economy would be most adversely affected to the tune of £132m across the 60 year life of the project, as it is hampered in doing business with firms in North Wales.

Scenario 3

- £145m of GDP benefit would accrue to Welsh businesses across the whole life of the investments (32% of total B2B benefits)
- Welsh business benefits are relatively evenly spread, with the most significant positive impacts accruing to Wrexham (£31m PV) and Coast (£23m PV)
- London (£136m PV) and Chester (£70m PV) are the locations which would gain most B2B benefits from this scenario.

International Connectivity Benefits

The rail enhancements examined in this study incorporate direct new services to Liverpool John Lennon Airport (via Liverpool South Parkway) and Manchester Airport. An agreed task is to examine the potential rail market for airport access. To do this, bespoke survey data was purchased from the CAA to understand business passenger access to Liverpool (2010 survey) and Manchester (2012 survey) airports.

Liverpool John Lennon

The key points arising from the analysis are:

- There are around 20,000 business trips pa to/from Wales
- There is negligible rail use currently, reflecting the difficulty of making trips via Crewe or Liverpool Lime St
- The biggest Welsh markets are for Flintshire 8,000; Wrexham and Powys each 3,000
- The total potential rail market from the North Wales coast + Wrexham is around 15,000 trips pa.

Manchester

- There are more than 120,000 business trips pa to/from Wales, reflecting the much greater current importance of Manchester as a business airport
- There is a 6% current rail mode share for access trips by business users
- The largest Welsh markets are 30,000 to/from each of Flintshire and Conwy; 20,000 to/from Wrexham
- The vast majority of business trips from Wales are from the North Wales coast or Wrexham: a total of 113,000 trips representing the potential rail market.

Additional Benefits

The Eddington report recognised that international connectivity was an important means by which transport infrastructure could contribute to national economic performance, and that the benefits were not always fully captured in investment appraisal methods. However, unlike agglomeration and labour market benefits, no proven method has yet been developed that adequately captures these additional benefits.

As the MOIRA database reflects existing rail travel, the analysis in Chapter 2 will not fully reflect the incremental benefit of direct services to the airports. In particular, as there are negligible current rail trips to Liverpool John Lennon, the benefits of the Halton Curve will be under represented. As an indication, if LJL were to secure equivalent rail mode share to Manchester currently for Welsh business trips, this would lead to around an additional 1,000 rail trips per annum.

Furthermore, there is a body of evidence that direct rail services to airports lead to a significantly higher level of usage. Air passengers have a high interchange penalty which in part relates to luggage and in part to the stress of uncertainty in changing trains. The existing 6% rail share from Wales is consistent with other data on longer-distance access to Manchester airport where a change of trains is required. The evidence (for example York-Manchester Airport) further suggests that a direct equivalent service could lead to rail patronage 4-5 times as high.

5. Tourism Impacts

Introduction

In this chapter we introduce the North Wales tourism market, examining its size, nature and trends, and then consider the impacts of rail improvements.

Market Overview

Two data sources have been used to profile the North Wales tourist market:

- The GB Tourist survey (GBTS); and
- The GB Day Visits survey (GBDVS).

Both these surveys are conducted by TNS on behalf of Visit Wales, Visit England and Visit Scotland. For this study, bespoke analysis of these surveys was commissioned to provide outputs specifically for the North Wales region (standard outputs only provide results for Wales as a whole).

Market size

The overall market for domestic tourism to North Wales is 29.5m visits worth £1,610m expenditure (based on 2012 data). Note that the 29.5m visits is equivalent to 59m one-way trips to or from North Wales, and approximately 43m visitor days in North Wales (see Table 5.1 for details).

Table 5.1: Trips, nights and spend in North Wales by GB residents

	Visits (m)	Expenditure (£m)	Nights (m)	Expenditure per visit (£)
Tourism day visits (1)	26	986		37.9
Tourism visits (2)	3.5	624	13.9	180.6
Total	29.5	1610	13.9	54.7

Sources / notes

(1) The GB Day Visitor 2012

(1) definition = 3 hour + day visits by GB residents involving a leisure activity, not undertaken 'very regularly', and in a different place to where the respondent lives

(2) The GB Tourist 2012

(2) definition = any journey by a GB resident made away from home lasting one or more nights to any destination in GB

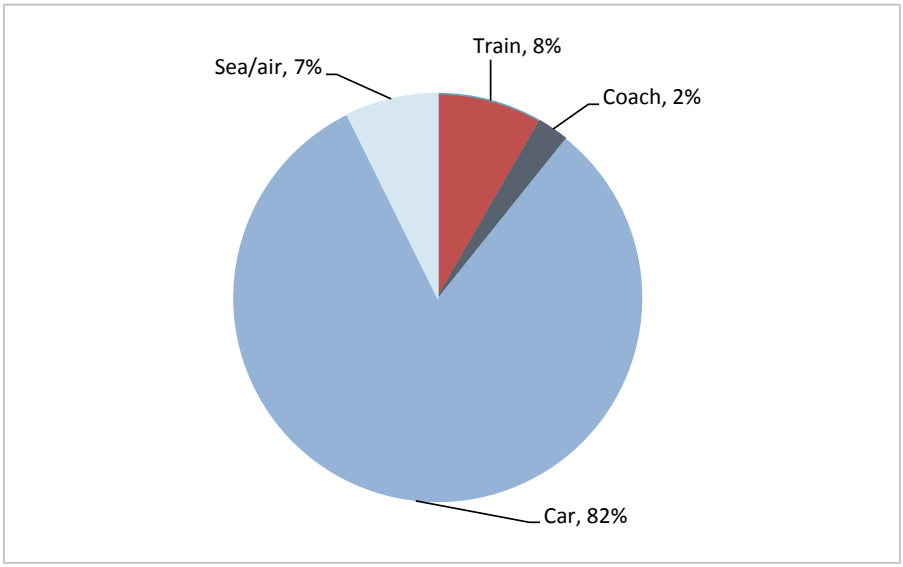
(2) note: GB Tourist report does not have a regional breakdown for North Wales, so this has been estimated by using the North Wales % of trips/nights/spend applied to the Welsh total

Mode share

The share of main modes used to travel to North Wales is shown in Figures 5.2 and 5.3 for tourism visits and day visits respectively. For both markets car is

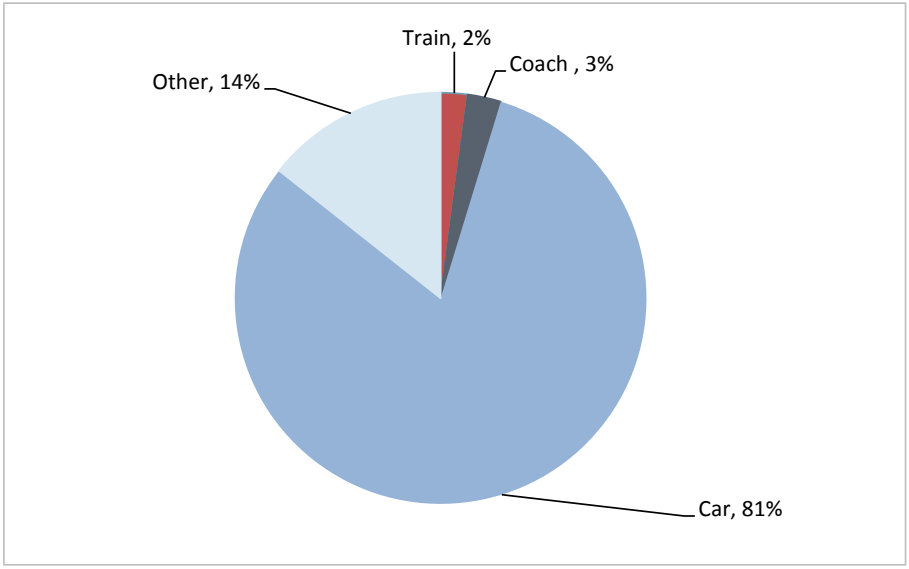
dominant, but the rail share is 8% for overnight tourism trips and 2% for day visits (similar or slightly lower than the coach share).

Figure 5.1: Mode share of travel to North Wales: tourism visits



Source: GBTS (2013)

Figure 5.3: Mode share of travel to North Wales: day visits



Source: GBDVS (2011-13)

Overnight tourism market characteristics

In summary:

- By far the most common origin region for tourist trips to North Wales by rail is the North West of England, which accounts for a third of all origins. This is a somewhat lower proportion than for trips to North Wales by all modes, largely because of the dominance of rail for trips from London: London origins represent 12% of rail tourist trips to North Wales, but just 2% of trips by other modes.

- Nearly half (47%) of tourist trips by rail to North Wales are for a holiday trip and a further 26% for a holiday trip to meet friends or relations. This compares with 74% and 11% respectively for trips to North Wales by all modes, indicating that rail is more likely to be used when visiting friends or relations. This picture is reinforced when looking at the type of accommodation being used: 44% of trips by rail involved staying with friends and relatives compared with 21% of all trips. Nevertheless, around a fifth of overnight trips to North Wales by rail involve staying in a hotel.
- Train is much more likely to be used for smaller travelling parties: this is illustrated by the fact that the proportion of rail trips made by someone travelling alone is 42%, compared with 13% of trips by all modes. In the same way, while 24% of travelling parties using rail include a child under 15, 41% of all travelling parties do so.
- The most popular months of the year for travelling by train to North Wales are April through to October: compared with the market as a whole, the season has a reasonably flat profile. This is consistent with the relatively low number of family trips involving children using rail compared with car.
- The age profile of rail tourists to North Wales is quite well distributed across the age bands, including 18% who are aged 16-24, and 15% are aged 65+.
- In terms of lifestage, rail appears to be more attractive to the younger couples group (16-34, unmarried, no children). This is evident from the fact that this group represents a much higher proportion of the rail market (19%) than the market as a whole (9%). Conversely rail is less attractive to the families with children group (35-54, with children), this group representing 15% of rail but 26% of all tourists to North Wales.

Day trip tourism market characteristics

In summary:

- Two fifths (38%) of day trips by train to North Wales are from the North West region, 28% from elsewhere in Wales and 16% from London. This differs somewhat from the market as a whole, with around half of all day trips to North Wales originating from another region of Wales, and most of the remainder from the North West. The only other significant origin region is the West Midlands (12% of the whole market and 5% of the rail market).
- For 39% of the rail day trips the main activity was a 'general day out'. This was true of only 16% of the market as a whole, for which outdoor leisure activities was far more important (14% of the whole market but just 2% of the rail market). On the other hand, for taking part in sports

the reverse seems to be the case: this accounted for 12% of rail day trips but just 2% of all day trips.

- Nearly a third (30%) of rail day trips were by tourists travelling on their own: this compares with 13% of all day trips. On the other hand, while for the market as a whole around half were made by a couple travelling together this was the case for just 31% of rail day trips. Around a quarter of rail day trips included one or more children, a similar percentage to the market as a whole.
- A third of rail day trips to North wales are to a large town/city (for Wales as a whole it is around one-half), with rail clearly taking a larger share of this market as only 11% of all day trips to North Wales are to a large town/city. Conversely, rail has a lower share of the market to seaside and countryside destinations.
- In terms of traveller characteristics, rail has a particularly high share of the 16-24 market which represents over a third (36%) of all rail day trips to North Wales, compared with 15% of the market as a whole. Conversely it does less well in the 55+ market (19% of rail day trips compared with 39% of all day trips).

Executive interviews

Key emerging points from the executive interviews with representatives of the North Wales tourism market are provided below.

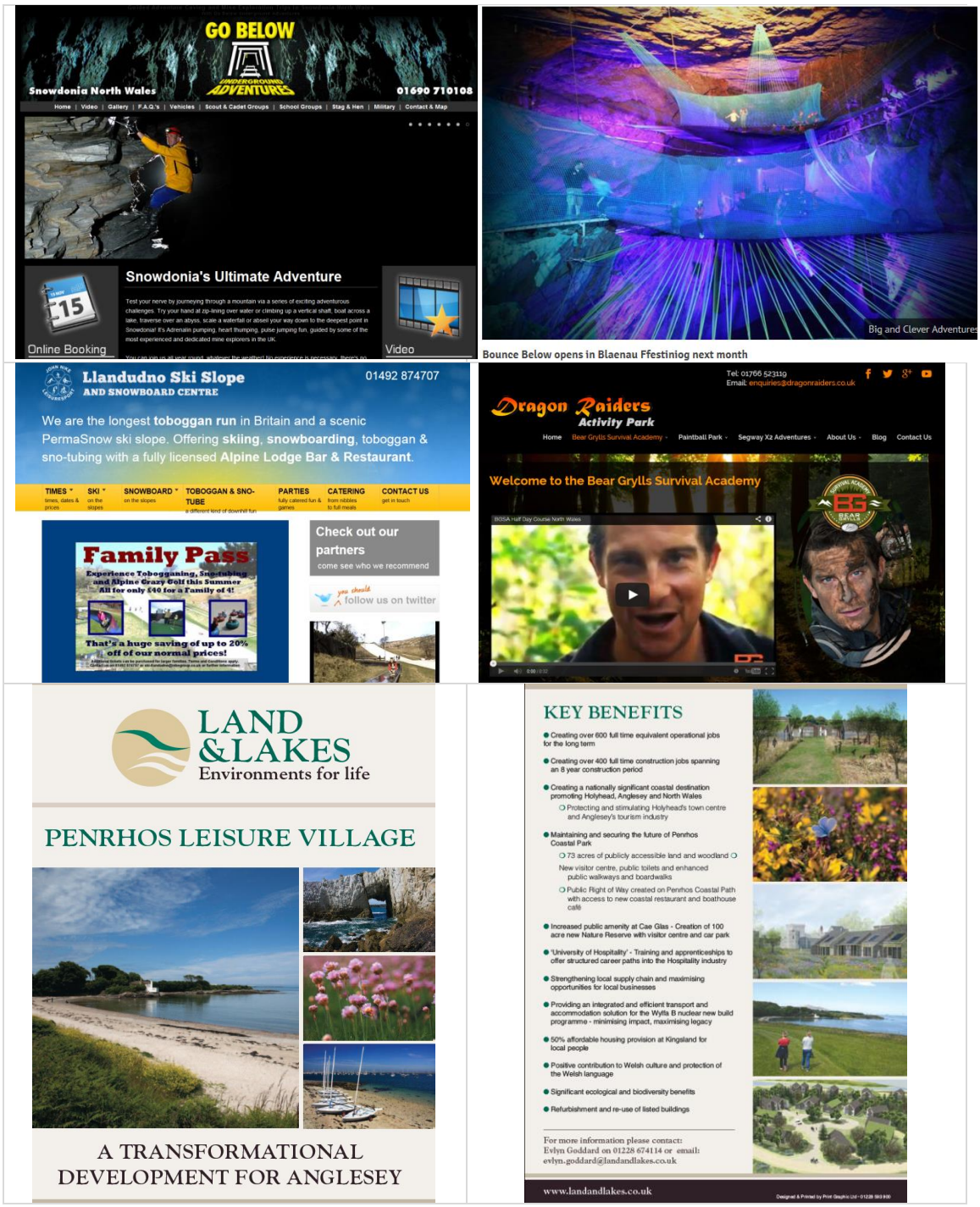
State of the market

The overall state of the tourism market to North Wales was seen by all the tourism representatives as positive. It was perceived to be growing and benefiting from:

- Investment in new attractions (see Figure 5.4);
- Effective marketing by Visit Wales, local authorities, the destinations themselves, and the train operators;
- The 'staycation' trend (more domestic holidays).

A trend which North Wales is managing to take advantage of is the growth in activity and adventure holidays (illustrated by some of the new attractions such as Go Below, Bounce Below, the surf reef in Conwy and the Bear Grylls survival academy).

Figure 5.4: Newer destinations in North Wales



Importance of rail and the need for improvements

Although rail has a relatively small share of the market, it is seen to be important, and the view is also that there is potential for growth in the use of rail. Key factors holding the use of rail back are:

- Not enough direct services / too much interchanging (a particular barrier for overnight tourists with their luggage, and family groups);

- Slow journeys once in North Wales (i.e. Chester – Bangor);
- Poor connectivity with local public transport;
- Trains which are not designed for tourists;
- Poor experience on the train and at many stations (which, for example, lack staff to welcome or help tourists);
- Generally poor perceptions of the quality of service.

One idea was to try running themed charter trains with, for example an Alice in Wonderland theme (building on its links with Llandudno), or Welsh dragons. The basic idea would be to make the train journey part of the holiday, and to promote the idea of rail travel more generally.
It was thought that although there had been significant progress, more could still be done in terms of a co-ordinated approach involving all parties to promote rail travel to and within North Wales. This co-ordination would encompass marketing communications, information and ticketing.

Tourist Impacts

This section provides an assessment of the current tourist related trips to North Wales that rail supports and the potential change in tourist trips due to the impacts of each of the modelled Scenarios. The following paragraphs set out the assumptions made in undertaking this assessment.

Tourist Visits to North Wales by Rail

We have access to a number of potential sources of data to determine the number of tourist visits by rail to North Wales. For the purpose of this assessment we have considered two sources; an assumption based on rail demand data and data from the GB Tourism and Day Visits surveys (referred to as tourist data).

In using the rail demand data we have assumed that all leisure and business trips to North Rail with an origin outside of North Wales constitute a tourist visits. The total number of current rail trips into North Wales has been taken from MOIRA data. According to analysis based on the National Rail Travel Survey journey purpose splits, and demand by ticket type to and from North Wales, 53% of journeys to and from North Wales are made for leisure or business purposes. This percentage was applied to the total number of trips from the MOIRA data to estimate the number of tourist visits, which suggests that around 290,000 tourist trips per year are made by rail to North Wales.

We have also considered the number of rail based tourist trips to North Wales from the tourist data. This suggests that there are around 760,000 rail trips to

North Wales per year. There is quite a large gap between these two estimates, thought there are two key factors that can help explain this difference.

The proportion of rail trips assumed to be for leisure and business purposes, 53%, is based on UK average journey purpose splits. Although no data is available specifically for North Wales, it is possible that the proportion of commuter trips on the route is much lower than the national average and therefore the resulting leisure and business proportion is an underestimate.

The tourist data considers a tourist (specifically day trips) to be someone that makes a journey to a destination for a period in excess of three hours, and where that destination is not routinely visited (for example regular shopping trips or family visits). It is likely therefore that there is a number of tourist visits within North Wales that are not captured in the selection of rail demand trips, for example Wrexham to Llandudno.

For the purpose of this analysis we have adopted the tourist data as the source of rail based tourist trips to North Wales. In order to calculate the additional tourist trips to North Wales for each scenario we have applied the percentage increase in demand to North Wales observed from the MOIRA analysis. Table 5.2 below provides a summary of the increase in tourist trips by rail from the current timetable to the Do Minimum and separately from the Do Minimum to each Scenario.

Table 5.2 Impact on Tourist Trips by Rail

2013 – 000s	**Percentage increase in rail visits**	**Tourist Visits (absolute)**	**Tourist Visits (incremental)**
Current	-	760	-
Current to Do Min	7%	820	60
Do Min to:			
Scenario 1	2%	830	10
Scenario 2	-6%	770	-50
Scenario 3	8%	890	70

The analysis suggests that the step from the current timetable to the Do Minimum Scenario could generate an additional 7% of rail trips to and from North Wales, equating to an increase in tourist trips by around 60,000 trips per year.

Compared to the Do Minimum the analysis suggests that Scenario 1 could generate up to 10,000 additional tourist trips to North Wales per annum, while under Scenario 3 that could increase to as much as 70,000 additional tourist trips. Conversely in Scenario 2, where many trips would need to interchange at Chester to reach North Wales, around 50,000 tourist trips could be lost from North Wales.

Quantification of Tourist Spend and Job Impacts

The National Tourism Survey suggests that the average spend of a day visitor to North Wales is £38. Visitors staying overnight spend around £180 per visit, with average length of stay being 4 days.

For the purpose of this study, the total expenditure by tourists per visit was calculated as a weighted average of the expenditure of daily visitors and overnight visitors. Considering the proportions of day and overnight visitors, and the average length of stay, has led to an average expenditure of £78 per visit. The next table show the expenditure expected from tourists in each scenario, based on the estimated demand impact and average expenditure.

Table 5.3 Impact on Rail Based Tourist Spend

2013 £m	**Incremental Tourist Spend pa**
Current (Absolute)	£59.0
Current to Do Min	£4.7
Do Min to:	
Scenario 1	£0.8
Scenario 2	-£3.9
Scenario 3	£5.4

The table suggests that the tourist trips by rail to North Wales contribute around £59m to the economy per year. Analysis suggests the Do Minimum Scenario could increase tourist spend in North Wales by around £4.7m per year. Compared to the Do Minimum, Scenario 1 could generate increased tourist spend by around £0.8m per year, while Scenario 3 could increase spend by as much as £5.4m per year. Conversely in Scenario 2, tourist spend could reduce by around £3.9m per year.

Information from the Visit Britain suggests that the tourist sector on average employs one person per £41,000 of tourist spend[7]. Based on this assumption

[7] http://www.visitbritain.org/insightsandstatistics/visitoreconomyfacts/

and the forecast impact on tourist visits and therefore tourist spend, the following table summarises the estimated tourist jobs that rail access supports and the impact of each Scenario.

Table 5.4 Impact on Rail Supported Tourist Employment

2013 m	**Incremental Employment**
Current (Absolute)	1,440
Current to Do Min	110
Do Min to:	
Scenario 1	20
Scenario 2	-90
Scenario 3	130

The table suggests that the tourist trips by rail to North Wales currently support around 1,440 jobs. Analysis suggests the Do Minimum Scenario could increase the number of jobs supported by around 110. Compared to the Do Minimum, Scenario 1 could support an additional 20 jobs, while Scenario 3 could support as many as 130 additional jobs. Conversely in Scenario 2, tourism related jobs could reduce by around 90.

6. Conclusions

This chapter sets out some key points, in draft, that can be concluded from the work.

The overarching finding is that there is firm evidence of significant economic benefits that would result from the electrification of rail services to North Wales and additional connectivity and frequency improvements on the rail network. In terms of conventional transport benefits, these would be worth almost **£1.5bn** across the life of the project, almost 5 times the impact of simply electrifying the North Wales line alone. In addition, econometric modelling has found that a further **£450m** of GDP benefits could accrue in agglomeration gains to firms and **£50m** of further labour market benefits, subject to the following:

- recognising that the econometric modelling uses an innovative approach, based upon models developed by Network Rail, and discussed with the Department for Transport
- the causality of relationships between connectivity and productivity performance
- the additivity of agglomeration and labour market benefits to each other remains subject to a model co-variance caveat
- that the timing of investments has not been fine-tuned: all has been modelled to be in place by 2024
- and, that there are no additional electrified or new rolling stock benefits incorporated within the estimates.

These estimates exclude the very significant improvements that Network Rail are working towards as part of the conditional output specification, such as journey time and frequency improvements and the reinstated Halton curve, all of which are reflected within the Do Minimum scenario.

The work also shows that electrification from Crewe and Warrington to Chester alone holds very significant economic risks (that have also been recognised, in discussion, by Network Rail). An economic cost of over **£1bn** is projected by our models against this scenario. Whilst the costs of this would lie disproportionately with businesses and individuals in Wales, the zone with the largest absolute negative business impacts would be London as businesses would lose direct rail connectivity to north Wales. Conversely, incremental analysis of extending that scenario to Holyhead demonstrates significant economic benefits of around **£900m** in transport benefits and a further **£430m** in wider economic impacts.

The work concludes that additional frequencies and services such as those using the Halton curve represent a redesign opportunity for Chester station whatever pattern of future rail services comes forward. Our modelling suggests that saving 1 minute of perceived time in interchange or facility benefits could generate an additional **£10m** in transport benefits, with additional economic effects.

Analysis of existing air business passenger data suggests a potential Welsh rail market of 20,000 trips pa to Liverpool airport and 120,000 to Manchester. Direct rail services are modelled to both airports and could lead to important additional economic benefits not included in the traditional transport approach.

The tourism market in North Wales is buoyant and there is the potential to capitalise on this by linking rail service improvements to the needs of the tourist market.

This phase 2 work has not looked in detail at rail freight opportunities, but phase 1 concluded that electrification would provide an opportunity to secure gauge clearance improvements that would be important to freight market decisions to/from Holyhead port.

Initial evidence from analysis of a new station at Broughton suggests that demand may be sufficient to justify a new station, and to outweigh significantly the disbenefits to through passengers.

Annex A

Broughton New Station Evidence

Introduction

This Appendix provides a set of initial evidence to inform a debate as to whether it is worth pursuing more detailed analysis to understand the case for a new station at Broughton. As illustrated in Figure A1, it is assumed that a new station at Broughton would be located where the B5129 crosses the North Wales Coast line between Chester and Shotton.

Figure A1 – Location of Broughton Station

It is understood the objectives for the proposed station are two-fold, namely to provide:

- Improved rail access to the higher value employment opportunities found at business parks surrounding Chester Hawarden Airport (particularly from the North Wales coast); and
- Park and ride access to Chester.
- The remainder of this Appendix sets out a range of evidence collated to inform the case for a new station at Broughton together with the conclusions that can be drawn from that evidence. Specifically the evidence includes:
- Analysis of the potential use of Broughton Station to access employment opportunities;

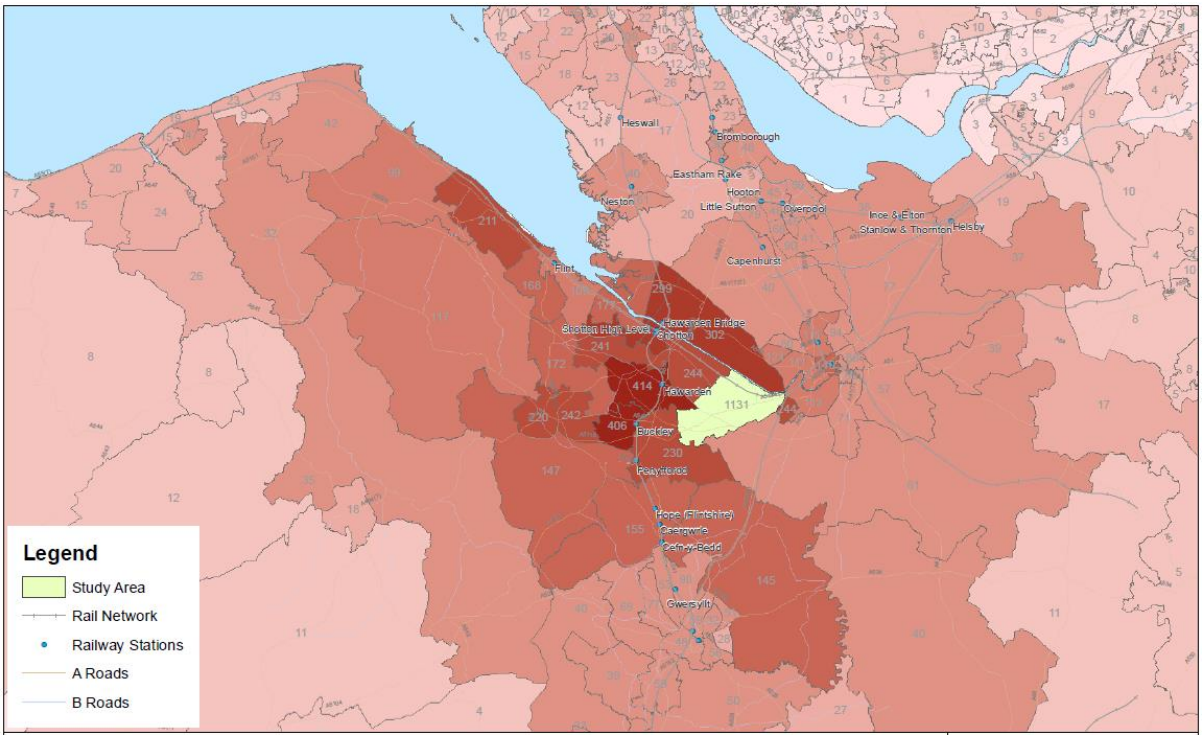
- Comparison of the attractiveness of Broughton Station for park and ride in comparison to existing park and ride sites serving Chester;
- An initial analysis of the potential demand at Broughton Station; and
- An initial analysis of the possible impact on through as a result of the longer through journey times caused by stopping additionally at Broughton station.

Employment Access via Broughton Station

One objective for the proposed Broughton Station is to provide a sustainable access option to the high-value jobs in the vicinity of Chester Hawarden Airport. This would permit growth with less impact on employers' car parking requirement and on congestion on the surrounding highway network. It would also give a realistic commuting opportunity for those from areas of high unemployment (eg Rhyl) who do not have access to a car. This would provide benefits to those looking for work or higher value work, and to employers who would have access to a wider pool of skilled and unskilled labour.

Census 2011 journey to work data has been interrogated to understand the distribution and mode share of current journey to work trips to the Airport site and the surrounding area. At the time of writing, the most spatially disaggregate level the Census data can be interrogated is Middle Super Output Areas (MSOAs). The MSOA that includes the airport site is relatively large, and also includes in part other employment sites, e.g. Broughton Retail Park. Notwithstanding this, the distribution of journey to work trips origins for travel to the area including the Airbus site is considered to reflect the distribution of trips likely to be served by a potential station at Broughton. The map in Figure 2 provides an overview of the origin and number of journey to work trips to the MSOA that wold be served by Broughton station. The pale green shaded area shows the Airport MSOA. The shading of the other MSOAs shown indicates the volume of journey to work trips from those areas to the Airport MSOA, with dark shading indicating a greater volume of trips.

Figure A2 – Origin of Journey to Work Trips to the Area Served by Broughton Station



This shows that the greatest density of trips to the Airport MSOA come from the neighbouring areas to the west and south of the airport. There are also trips from areas extending west towards Prestatyn, from the Wrexham area and from the east including Chester and its suburbs, but these flows are less strong. The important initial observation here is that the greatest density of employees travelling to the airport site are from locations where it is likely that car would remain the most attractive mode, namely from the areas immediately west of the airport site. Some journeys may be attracted to rail from longer more distant areas, but these journeys will be at a much lower volume.

To illustrate the challenge in attracting people to travel by rail to work in the area served by Broughton station Table 1 provides a comparison of passengers' perceived car and rail journey time from stations across the study area to an employment location served by the proposed Broughton station.

The assumed car drive times used are typical 'peak' drive times calculated from a GIS drive time tool. The cost of driving is based on the drive distance and a typical cost of driving per mile of £0.308. Given the out of town nature of the sites that would be served by Broughton station, no specific car parking

[8] http://www.theaa.com/resources/Documents/pdf/motoring-advice/running-costs/petrol2014.pdf

charges are assumed, although the assumed mileage based cost does include an allowance for parking charges.

The assumed rail generalised journey time is a passengers' perceived time including the following:

- A typical 10 minute access time to the nearest origin station – weighted by a factor of 2[9];
- A frequency penalty (typically 31 minutes for a hourly service and 23 minutes for a half hourly service)[10];
- The station to station journey time;
- An interchange penalty where appropriate – typically 10 minutes for a journey distance of 15 miles[11]; and
- A typical 10 minute walk time from Broughton Station to the final destination, weighted by a factor of 2.
- Rail cost is based on anytime return to Chester (as proxy from Broughton) (Chester – Broughton assumed as £4.00). Those committing to permanent work would be able to purchase annual season tickets (possible funded with interest free loans). The table therefore also includes the daily cost equivalent of using an annual seasons ticket (calculated assuming an annualisation factor of 228 working days per year)

Table A1 – Comparison of Car and Rail Generalised Journey Times (single trip) and Cost (return trip)

Station	Drive Time (mins)	Drive Cost (Return Trip)	Rail Service Assumption	Total Rail Generalised Time (mins)	Rail Cost (Day Ticket)	Rail Cost (Season Ticket)
Llandudno Junction	45	£24	2 tph direct service	108	£21	£12
Prestatyn	35	£15	2 tph direct service	86	£15	£10
Shotton	10	£2	2 tph direct service	70	£5	£4
Hooton	20	£6	2 tph, change at Chester	107	£4	£3

[9] PDFH 5.1, Table B10.2, General
[10] PDFH 5.1, Table B4.8, Non-London inter-urban
[11] PDFH 5.1, Table B4.10, Season Tickets

Station	Drive Time (mins)	Drive Cost (Return Trip)	Rail Service Assumption	Total Rail Generalised Time (mins)	Rail Cost (Day Ticket)	Rail Cost (Season Ticket)
Chester	15	£4	2 tph direct service	68	£3	£2
Wrexham	20	£10	2 tph direct service	92	£6	£4
Helsby	20	£10	2 tph direct service	82	£5	£4

This journey time analysis suggests that car would still offer the quickest journey time for access to the area served by Broughton. The journey time by car from longer distances origins such as Llandudno and Prestatyn would typically be around half the rail generalised journey time. Car has a proportionally quicker journey time from origins that are closer to Broughton. This is because of the relative highway proportion that that station access times (at origin and destination) and frequency penalties.
The analysis suggests that where a season ticket option is viable the cost of rail travel could be significantly cheaper than car, for example the daily season ticket cost for Llandudno Junction to Broughton could be half the price of a return car journey.

Despite the potential cheaper journeys by rail the time difference in favour of car may make it challenging to attract passengers from car to rail, particularly where the user already owns a car. However, a station at Broughton would be attractive to users that are less time sensitive, or those who are looking for work but are not able to commit to car ownership but may be able to access a an interest free season ticket loan via an employer.

Based on the analysis of employee distribution it is possible that rail would struggle to compete with car to attract a 'mass market' for trips to the area served by Broughton. However it is possible that rail will be attractive for some travelling to the area served by Broughton station. This would be particularly true where specific factors make rail attractive, for example: no access to a car; proximity to an origin station; and, workplace proximity to Broughton Station. This position may change, in favour of rail, should employers consider measures to encourage sustainable access, for example through charging for car parking or offering interest free season ticket loans.

Comparison to Other Park And Ride Sites

A further potential source of demand for a new station at Broughton might be for park and ride access to Chester city centre. In this market the proposed station would compete with bus-based park and ride sites serving Chester. There are currently four bus-based park and ride services into Chester, with the car park sites (blue labels) and the proposed Broughton Station site shown in Figure A3 (point A).

Figure A3 – Chester Park and Ride Sites

The park and ride services that would compete directly with Broughton Station are from the Wrexham Road site (the southerly site in Figure A3.) and Sealand Road (to the west of Figure A3) The following table compares a typical journey time and cost from Shotton (as a common point served by all sites) to Chester city centre.

Table A2 – Comparison of Park and Ride Journey Time and Cost

	Broughton Station	Wrexham Road	Sealand Road
Drive time to Park and Ride	10	20	15
Bus / Train Frequency (Peak)	2	8	5
Frequency Penalty	23	8	12
Journey Time	5	18	10
Total Generalised Journey Time to Chester	38	46	37
Journey Cost	n/a	£2	£2

The analysis in Table A2 is based on the current bus service journey time and cost for the bus park and ride sites. There is assumed to be a half hourly rail frequency from Broughton and a five minute journey time to Chester. The journey cost for rail is unknown (although an indicative fare of £3 was assumed for the employment access analysis).

This would suggest that Broughton could compete with other park and ride sites serving the west of Chester. This would be dependent on the city centre destination, as the bus-based park and ride serves a number of city centre locations, whereas rail on takes you to Chester Station, which is not well located for the City Centre.

However, given the relative journey time difference and fare difference between sites, Broughton would not necessarily be generating new demand for journeys to Chester, rather abstracting it from other locations. It would therefore likely be challenging to justify the new station based on generation of park and ride demand and fulfilling a need for park and ride access.

New Station Demand

Analysis has been undertaken to establish an initial demand projection for a new station at Broughton. The analysis has been based on the possible rail mode share of journey to work trips to the area served by Broughton station. Using census journey to work data for the MSOA that Broughton would serve we have identified the total JTW trips to this area and the proportion of these that currently use rail.

The analysis suggests there are currently around 10,500 journey-to-work trips (i.e. daily return trips) to the MSOA that Broughton Station would serve, with around 0.5% (or 40 trips) made by rail.

A comparison has been made between the rail mode share at Broughton and that at a number of other locations where there is a non-city centre employment park that is served by a rail station. The following table presents the total journey to work trips and rail mode share for these MSOA's. It also converts the journey-to-work trips into single rail trips (using an annualisation factor of 280, and doubling the trips to get single trips) and compares this to the rail demand reported at the station from ORR station usage data.

Table A3 – Journey to Work Trips and Station Demand at Selected Stations

Station	All JTW Trips	Rail JTW Trips	Mode Share	Annual Single JTW Trips	ORR Station Demand	JTW Trip %
Winnersh Triangle	4,304	337	7.8%	153,672	430,720	36%
Filton Abbey Wood	24,857	1,444	5.8%	658,464	852,250	77%
Burnham	15,940	774	4.9%	352,944	1,160,278	30%
Sellafield	13,856	514	3.7%	234,384	236,160	99%

The analysis then suggests that a rail served employment area could see a rail mode share for journey to work trips of between 3.7% and 7.8%. It is difficult to draw any meaningful conclusions from the proportion JTW trips in relation to the total station demand. Winnersh Triangle and Burnham are lower because the stations also serve residential areas with commuting into London, Reading and other intermediate locations. The MSOA at Filton Abbey Wood is also served by Bristol Parkway. So the percentage shown is arguably overstated because some of the JTW trips will be via Bristol Parkway and not Filton. Sellafield station only serves the plant and no real residential centre at all, so the percentage is high. As an indicative value we have assumed that 90% of the demand at Broughton might be JTW trips.

By applying the mode share at other locations, and uplifting for non-JTW trips, the following table provides an initial estimate of potential demand at a station at Broughton.

Table A4 – Possible Journey to Work Trips and Station Demand at Broughton

Broughton Station	All JTW Trips	Rail JTW Trips	Mode Share	Annual Single JTW Trips	Potential Station Demand
Current – No Station	10,590	40	0.4%	18,240	
Low mode share	10,590	393	3.7%	179,137	199,041
High mode share	10,590	829	7.8%	378,110	420,122

The analysis would suggest that a new station at Broughton could generate between 200,000 and 400,000 single trips per year. This level of demand has the potential to be sufficient to justify a new station, subject to the impact on through users as a result of stopping at the station (see below) and subject to an affordable and value for money solution being identified.

However, there are a number of conditions that would need to be met in order to ensure that this level of mode share, and therefore demand, could be realised. For example:

- Local employers would need to adopt a parking strategy that discourages car use, for example through car park charging.
- It assumes that locations within the MSOA are accessible from the station – give the long walk routes around the airport site, it might mean that improvements are made to access from the station to employment sites, eg bus.
- It is dependent on the future distribution of employees being located where using rail is a more attractive option i.e. employees live near stations on routes serving Broughton – for example future employment growth comes from residents on the north Wales coast.
- It is subject to service frequency, journey time and fare being such that rail is an attractive mode.

It must be noted that the DfT / funders would be unlikely to justify a new station based on this strategic analytical approach. More detailed trip end modelling would be required, which may present a different conclusion than this analysis. However the analysis here suggests it may be worthwhile developing a more detailed demand estimate for the new station.

Impact on Through Demand

In considering the case for a new station it is necessary to take into account the demand generated at that station and the demand that might be lost from through services as a result of the additional time taken to stop at a new station.

In order to estimate this impact we have re run the timetable scenarios identified in the North Wales Service Enhancement Phase 2 study through MOIRA but including a 2 minute journey time penalty on the half hourly Llandudno – Manchester services. This assumption implies a half hourly service at Broughton. An increase in service level would attract greater through user disbenefits and vice versa.

Table A5: Loss of Existing Rail Demand

Phase 2 Scenario	Annual Demand Lost (single trips)
Scenario 1	17,000
Scenario 2	25,000
Scenario 3	10,000

This suggests that the demand lost from through users might be between 10,000 and 25,000 pa depending on the scenario considered. The demand here is lower than might be expected because the service assumed to stop at Broughton is a slow service and therefore demand allocated to this service in MOIRA for longer distance journeys will be less, because there are alternative faster services available for many passengers. The demand lost in scenario 2 is greater because more people are allocated to the shuttle services rather than the through services that exist in other scenarios.

Conclusion

The demand analysis suggests there could be sufficient demand to justify a new station, but more detailed analysis would be required to confirm this. The success of a new station would be based on a number of other factors external to the railway being met.