

Leeds City Region
Partners

**Leeds City Transport
Strategy**

Agglomeration Benefits -
Delivering Low Carbon
Connectivity to Promote
Faster Economic Growth

FINAL ISSUE

Leeds City Region
Partners

**Leeds City Transport
Strategy**

Agglomeration Benefits -
Delivering Low Carbon
Connectivity to Promote
Faster Economic Growth

September 2009

Ove Arup & Partners Ltd
St James's Buildings, Oxford Street, Manchester M1 6EL
Tel +44 (0)161 228 2331 Fax +44 (0)161 236 1057
www.arup.com

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party

Job number 121525-36

Job title	Leeds City Transport Strategy	Job number	121525-36
-----------	-------------------------------	------------	-----------

Document title	Agglomeration Benefits - Delivering Low Carbon Connectivity to Promote Faster Economic Growth	File reference	
----------------	---	----------------	--

Document ref

Revision	Date	Filename	LCR_Agglomeration_DRAFTFINAL.doc		
Draft 1	15/06/09	Description	First draft		
			Prepared by	Checked by	Approved by
		Name	Tom Congrave, Stephen Bussell	Tom Congrave	
		Signature			
Draft 2	27/07/09	Filename	LCR_Agglomeration_DRAFTFINAL_v2.doc		
		Description			
			Prepared by	Checked by	Approved by
		Name	Jonathan Burton	Iain Mobbs	
		Signature			
Final Issue	16/09/09	Filename	LCR_Agglomeration_DRAFTFINAL_v2.doc		
		Description			
			Prepared by	Checked by	Approved by
		Name	T Congrave, S Bussell, J Burton	Iain Mobbs	Tom Bridges
		Signature			
		Filename			
		Description			
			Prepared by	Checked by	Approved by
		Name			
		Signature			

Issue Document Verification with Document

Contents

		Page
1	Background	1
	1.1 Introduction	1
	1.2 Wider Economic Benefits (WEBs) in Leeds City Region	1
	1.3 Structure of the Document	2
2	Methodology to Estimate Agglomeration	3
	2.1 Methodology	3
	2.2 Spatial Representation	3
	2.3 Employment Data	3
	2.4 Employment Classification	3
	2.5 Journey Time Data	5
	2.6 Calculation of Benefits	5
	2.7 Modelling Methodology	5
	2.8 Presentation of Results	5
3	Estimates of Agglomeration for Leeds City Region	6
	3.1 Change in Effective Density	6
	3.2 Quantifying the Agglomeration Benefits	7
4	Conclusions and Next Steps	9

1 Background

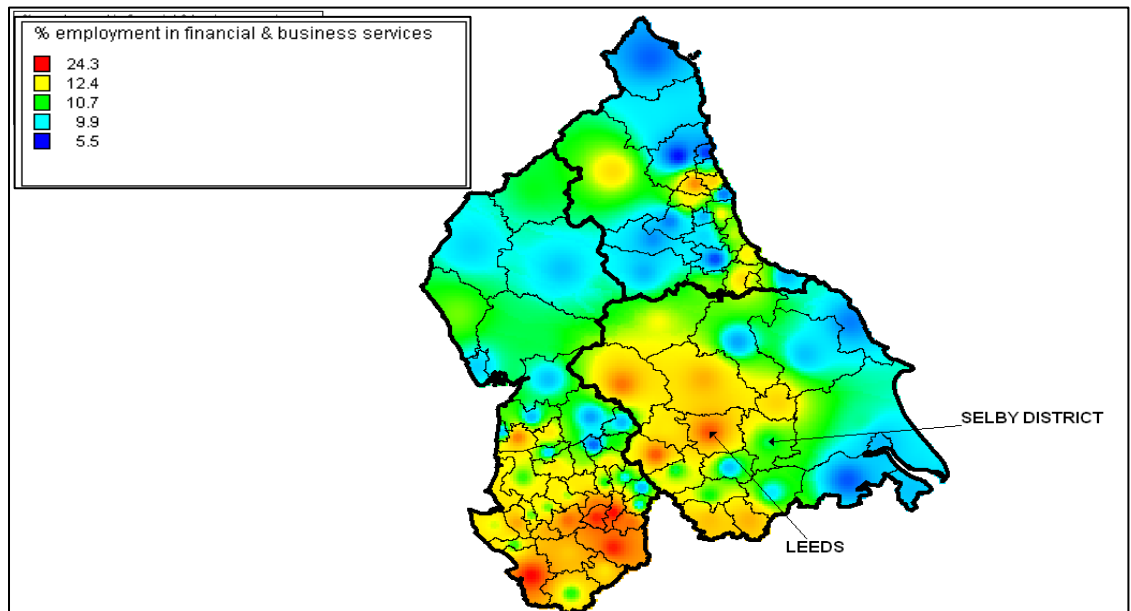
1.1 Introduction

To complement the Leeds City Region Transport Strategy, the study partners have commissioned two additional pieces of work. The first study examines the potential reduction in carbon consumption if the various measures outlined in the Transport Strategy were implemented. The results of the Carbon study are presented in a separate technical report. The second study is a high level assessment of the potential wider economic benefits that could be delivered by the improvements. The remainder of this technical report describes the context for WEBs in the Leeds City Region, the data inputs and methodology, plus the emerging results from the study.

1.2 Wider Economic Benefits (WEBs) in Leeds City Region

Interventions established in the Transport Vision will have the potential to deliver significant wider economic benefits (WEBs). In considering these wider economic benefits, we have focussed our assessment on those impacts expected to be the strongest - agglomeration effects. There are several reasons why agglomeration benefits are expected to be significant and the wider economic benefit of greatest magnitude for the Transport Strategy. In particular, the strengths of the Leeds City Region in sectors that research¹ shows possess greater elasticities of productivity with respect to changes in effective density (such as the Financial and Business Services sector whose strength is illustrated in the figure below). The city region is also projected to experience significant employment and housing growth. Figure 1.1 illustrates the higher concentration of financial services located in Leeds District, and the lower percentage in other Districts, for example, Selby.

Figure 1.1: Strength in Financial Services – Leeds City Region



Source: Arup analysis, June 2009.

Using case studies in the Leeds City Region, Centre for Cities research² has shown the significant agglomeration benefits that transport schemes can deliver – especially when new schemes deliver faster and better access to job-rich city centres. This analysis shows that up to 25% of the potential benefits of major transport investments in Leeds are currently un-

¹ Including that of Dr Dan Graham (2005) for DfT.

² 'The case for better transport investment: Agglomeration and growth in the Leeds City Region', A. Marshall & C. Webber, Centre for Cities (November 2007).

counted. The evidence presented in the research suggests that targeted improvements to urban transport networks could add tens of millions of pounds to a city's economic 'bottom line' each year.

Discussions with DfT in formulating our approach confirmed that agglomeration benefits are expected to be the most significant and therefore the focus of assessment of WEBS generated by the Transport Vision.

1.3 Structure of the Document

A short technical report has been produced, illustrating the data inputs used to develop an initial assessment of the potential agglomeration benefits that could be generated by the delivery of improvements identified in the Leeds City Region Transport Strategy. Chapter 2 describes the spatial representation of the modelling, and the data sources used to populate the model. Chapter 3 describes the results, and presents the projected increase in effective density for each spatial sub-area to illustrate the impact of the proposed Transport Strategy. Chapter 4 presents the conclusions, and suggests some possible next steps.

2 Methodology to Estimate Agglomeration

2.1 Methodology

We have estimated agglomeration benefits that could be generated by the Transport Strategy using a simplified methodology based on the principles of the approach outlined in DfT guidance³. The methodology has also been discussed and agreed with DfT, at a meeting with the Department held during February 2009. This estimation process involves some simplified assumptions, but offers sufficient robustness to assess the magnitude of agglomeration benefits in Leeds City Region at a strategic level. It enables an indicative range of agglomeration benefits to be estimated.

2.2 Spatial Representation

We have modelled impacts the likely impacts of the Transport Strategy based on 17 sub areas of Leeds City Region⁴. These are areas are recognisable as sub-areas in terms of operation as locations for employment and housing. This spatial scale of assessment is the main simplification associated with the estimates produced. While the approach does not offer the level of detail that would be afforded in a modelling of each individual transport zone, it is judged an appropriate approach when looking at the city region as a whole. The model focuses on movements within the Leeds City Region, movements between Leeds City Region and other city regions are not included. This enables a more manageable model and captures the emphasis of the potential improvements that could be delivered as part of the Transport Strategy. Figure 2.1 illustrates the spatial zones adopted for the analysis.

2.3 Employment Data

Employment in the city region has been forecast using data shown in the Transport Strategy report. The methodology also uses trends in employment by industrial sector from 2007 Annual Business Inquiry (ABI) data to define the composition of employment within each spatial zone.

2.4 Employment Classification

We present the impact of agglomeration in terms of annual impact on Gross Domestic Product (GDP). Base Gross Domestic Product (GDP) per worker figures by local authority and industrial sector have been drawn from DfT/ONS sources. The impact of agglomeration on GDP per worker has been estimated over time for the 'do minimum' and 'intervention' scenarios. The estimation process uses the latest methodology incorporating productivity elasticities and decay factors (alpha) by sector provided by DfT.

In line with most recent guidance, analysis is conducted using a breakdown of employment into the four broad sectors of manufacturing, construction, consumer services and producer services.

³ Transport, Wider Economic Benefits and Impacts on GDP, DfT (July 2005).

⁴ These are Craven, Selby, Leeds, EASEL, Aire Valley, Bradford, Airedale, Huddersfield, South Dewsbury/North Kirklees, Bradford/Leeds corridor, York, York North West, Wakefield, Coalfield Regeneration, Barnsley, Harrogate, Halifax.

2.5 Journey Time Data

We have estimated generalised travel times for both the current and future scenarios including the impact of potential measures. In the absence of a formal network model, these timings have been estimated using a simplified method. Current timings have been collated using journey planning software. Forecast timings for each origin / destination pair have been generated by assuming a linear relationship between traffic growth rates and the change in overall journey times. In reality, the forecast journey times may increase over time, as the additional traffic levels will have a greater impact on the overall journey times. Therefore the agglomeration benefits may be under-estimated.

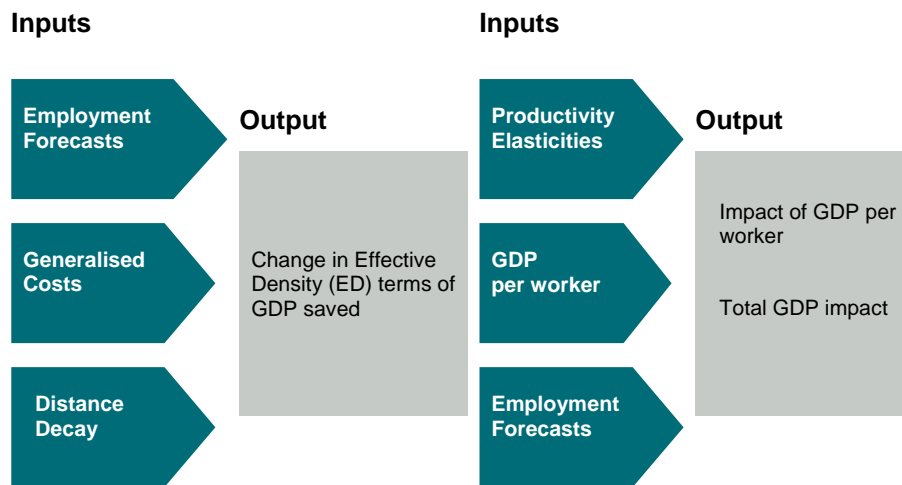
2.6 Calculation of Benefits

Our estimation process focuses on the impact of the interventions outlined in the Transport Strategy and its impact on the effective density of employment. Effective density has been calculated for each zone and year for the 'do minimum' (without possible measures outlined in the Transport Strategy) and 'intervention' (Transport Strategy) scenarios. The model uses estimates of employment and generalised costs of travel for both road and rail, to calculate the benefits.

2.7 Modelling Methodology

A more detailed account of assumptions underlying estimates is provided in the appendix. Figure 2.2 provides an illustrative overview of our approach.

Figure 2.2: Overview of approach



Source: Arup analysis, June 2009

2.8 Presentation of Results

Given that the assessment has been undertaken at a strategic rather than individual scheme appraisal level, agglomeration benefits are presented as an annual value for the year 2020 in 2009 prices rather than a Net Present Value (NPV) in totality over a longer time horizon. Whilst agglomeration benefits will accrue over a longer time horizon, more detailed data would be required to maintain the robustness of estimates going forward in time.

3 Estimates of Agglomeration for Leeds City Region

3.1 Change in Effective Density

Overall employment growth in Leeds City Region is expected to be around 8% between 2009 and 2020. Some areas (Bradford, Airedale, Craven, Selby, Harrogate, Halifax and York North West) are expected to experience growth rates above this average.

The Transport Strategy will deliver benefits to transport users in the form of reduced generalised cost of travel between key sub areas in Leeds City Region. By linking areas of housing growth and employment more effectively through a package of measures, it will support a more integrated market for businesses and labour. The projected impacts on generalised travel times are estimated to be significant and therefore produce a substantial increase in the effective density of employment.

Across all the sub areas, total effective density is estimated to increase by just over 23% by 2020. Effective density is expected to increase by more than this in some sub areas – for example, Bradford (+30%), Aire Valley (+25%) and Leeds (+25%). The highest average increases for the four individual industrial groups include 31.3% for consumer services and 29.9% for producer services). The changes for manufacturing and construction are 18.7% and 26.6% respectively.

The changes in effective density are substantial. To a large extent, their magnitude reflects the significant expected reductions in generalised travel time associated with the interventions that could be delivered as part of the Transport Strategy. Table 3.1 presents the results for sub-area for effective density, whilst Table 3.2 presents the average values. This increase in effective density will promote agglomeration effects and associated increase in GDP per worker.

Table 3.1: Projected Increase in Effective Density (ED), 2020

Sub-area	% increase in ED 2020 (over reference case)			
	Manufacturing	Construction	Consumer Services	Producer Services
Craven	8.3%	11.8%	14.1%	13.2%
Selby	19.1%	26.2%	29.7%	30.0%
Leeds	20.8%	29.5%	34.9%	32.3%
EASEL	19.1%	26.7%	31.5%	29.6%
Aire Valley	19.0%	26.4%	31.1%	29.4%
Bradford	24.2%	35.5%	42.4%	39.8%
Airedale	15.1%	21.6%	25.4%	23.5%
Huddersfield	18.1%	27.6%	33.0%	31.4%
South Dewsbury/North Kirklees	17.1%	25.4%	27.9%	29.0%
Bradford / Leeds Corridor	18.1%	26.7%	31.9%	29.9%
York	19.5%	23.1%	28.6%	26.0%
York North West	18.4%	19.9%	20.3%	20.0%
Wakefield	18.0%	29.5%	34.1%	34.9%
Coalfield regeneration	18.3%	28.1%	33.2%	32.4%
Barnsley	24.0%	36.9%	44.9%	43.4%
Harrogate	20.7%	27.3%	32.6%	29.2%
Halifax	20.7%	30.1%	37.1%	34.8%
Average for Industrial Sector	18.7%	26.6%	31.3%	29.9%

Source: Arup analysis, June 2009.

Table 3.2: Projected Increase in Effective Density (ED), 2020

Sub-area	% increase in ED 2020 (over reference case)	Sub-area	% increase in ED 2020 (over reference case)
Craven	9.7%	Bradford / Leeds Corridor	23.2%
Selby	22.0%	York	21.9%
Leeds	25.3%	York North West	19.3%
EASEL	23.6%	Wakefield	23.8%
Aire Valley	24.9%	Coalfield regeneration	23.0%
Bradford	30.1%	Barnsley	30.3%
Airedale	17.5%	Harrogate	23.7%
Huddersfield	22.2%	Halifax	25.3%
South Dewsbury/North Kirklees	21.3%	Average Leeds CR	23.4%

Source: Arup analysis, June 2009.

3.2 Quantifying the Agglomeration Benefits

The agglomeration benefit to Leeds City region has been estimated as an annual value for 2020, expressed in 2009 prices. This provides a forecast of the expected productivity benefits once the measures in the Transport Strategy have been delivered. As explained earlier, an annual forecast may be a better indicator than a NPV value over a longer time horizon since the assessment being undertaken is at a strategic level rather than a detailed scheme appraisal.

It is also emphasised that the work undertaken for this assessment has focussed on changes occurring up until 2020. Beyond 2020, there are a number of factors changing over time which will influence the benefits. Table 3.3 presents an estimate of agglomeration expected to accrue to the Leeds City Region as a result of the Transport Strategy. The benefit is expressed both as a percentage of Gross Domestic Product (GDP) and Gross Value Added (GVA) in the Leeds City Region and presented as a range based on lower and upper confidence bounds of 5% from the central estimated value.

Table 3.3: Agglomeration Benefit to LCR, 2020 Forecast (2009 prices)

Annual Agglomeration benefit	Value
As % of GDP, 2020	1.2% - 1.4%
As % of GVA, 2020	1.4% - 1.5%
Projected GVA – Leeds CR, 2020 £m	61,719
Equivalent value of annual agglomeration benefit, 2020 £m	849 - 939

Source: Arup analysis, June 2009.

Annual agglomeration benefits are expected to reach between 1.2% and 1.4% of total output (GDP) in Leeds City Region by 2020 – a significant productivity gain. This percentage grows a little higher when considered in the context of GVA. Placing these estimates in the context of Experian/Yorkshire Futures projections of annual GVA for Leeds City Region in 2020 suggests a contribution equivalent to between £850m and £940m. Breaking down the agglomeration benefits into the four industrial groups, around three-quarters of agglomeration benefits are generated in the Producer Services sector (which comprises Financial Intermediation; Transport Storage & Communications; and Real Estate, Renting and Business Activities sectors). This is likely to reflect the previously identified strength of the city region in these sectors.

Overall, these results demonstrate the potential for substantial agglomeration benefits to accrue in Leeds City Region. If the Transport Vision delivers the assumed reduction in

generalised travel times between key sub centres in the city region, this will deliver powerful agglomeration benefits to the city region economy. Capturing these benefits will be crucial in achieving a competitive economy.

4 Conclusions and Next Steps

Arup has applied a high level methodology to quantify the potential agglomeration benefits that could be delivered if the interventions described in the Leeds City Region Transport Strategy were delivered. The methodology was discussed with the DfT, and it was agreed the approach used was appropriate for an initial, high level study. The data inputs including the employment forecasts and journey time assumptions used to calculate the agglomeration benefits were consistent with the outputs emerging from the wider Transport Strategy. The majority of results are expressed as a percentage change compared with the base, and this approach recognises further work is needed to refine the data inputs and assumptions.

The results demonstrated Barnsley, Bradford, Halifax and Leeds would benefit from the largest percentage in effective density, if the package of improvements outlined in the Transport Strategy were delivered. The deliver of these improvements would help to increase GVA by 1.2%-1.4% per annum, or an equivalent agglomeration value of £850m-£940m per annum.

Further work is recommended to refine the estimates of agglomeration benefits, for example, using data from other transport models (Leeds multi-modal model), and quantifying the scheme impacts in a more detailed manner.

A1 Assumptions

Parameter	Assumption	Source
Employment projections		
Projections	Projections	TEMPRO Experian
Industrial composition	Trends	2007 Annual Business Inquiry (ABI)
Agglomeration elasticities (Productivity)		
Manufacturing	0.021	DfT
Construction	0.034	DfT
Consumer Services	0.024	DfT
Producer Services	0.083	DfT
Decay factors (alpha)		
Manufacturing	1.097	DfT
Construction	1.562	DfT
Consumer Services	1.818	DfT
Producer Services	1.746	DfT
GDP per worker		
Output per worker (by LA and industry)	Adjusted to 2009	DfT 2006 figure deflated to 2002
Underlying productivity growth	1%	Arup
GVA to GDP ratio	1.125	Treasury Blue Book 2007
Generalised Cost of Travel		
Generalised journey times	Current / Projections	Arup