High Speed Rail: Consultation on the route from the West Midlands to Manchester, Leeds and beyond

Sustainability Statement

Appendix E9 – Health Analysis

A report by Temple-ERM for HS2 Ltd

July 2013

CONTENTS

1. INTRODUCTION

1.1.1. This report has been prepared to support the HS2 Phase Two proposed scheme for Consultation Sustainability Statement (the Sustainability Statement, Volume 1), a report which describes the extent to which the Government's proposed scheme for HS2 supports objectives for sustainable development. This document is a technical appendix which summarises the method for the Health analysis, informing the Sustainability Statement main report. The Sustainability Statement places emphasis on the key impacts only. This technical report summarises all the conclusions relating to the Health analysis.

2. SCOPE AND METHOD

2.1. Context

2.1.1. This report draws on the sustainability appraisal work carried out to date as part of the Appraisal of Sustainability (AoS) process, and is designed to identify the relevant issues that any future Health Impact Assessment (HIA) for Phase Two should consider and assess in more detail. Appendix B (AoS Method and Alternatives) provides an explanation of the methodology used for the AoS and the rationale behind it.

2.2. Defining health

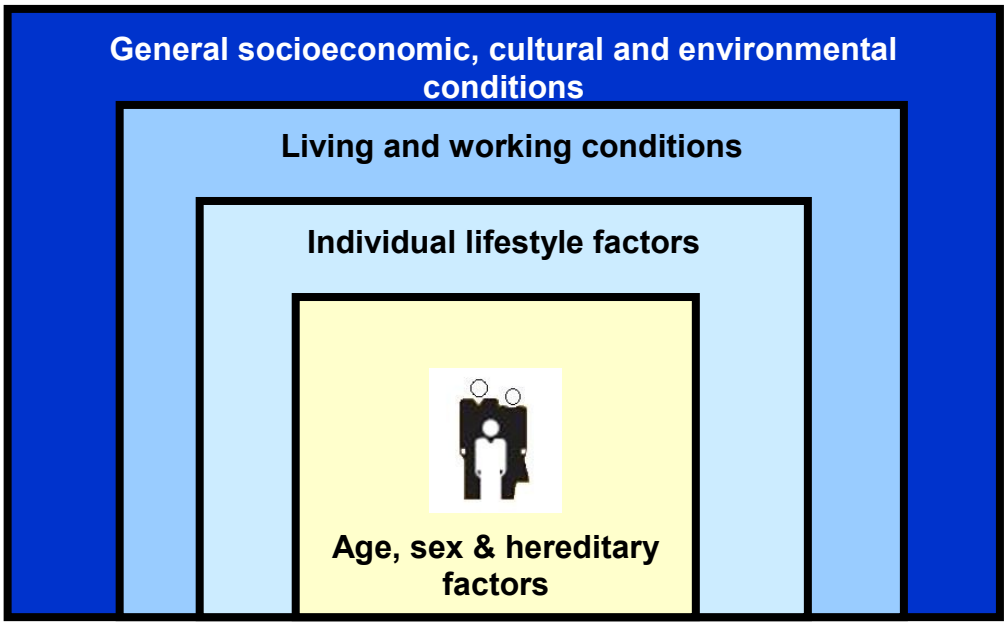
2.2.1. Health, or more importantly what constitutes good health, is difficult to define and measure in all its aspects for a population, not least because perceptions regarding health and expectations of good health vary. Following best practice, this analysis takes the definition of the World Health Organization (WHO), which states that health is;

'a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity' (WHO, 1948).

2.2.2. As a consequence of adopting the WHO definition, the basis of this analysis is a broad socio-economic model of health. For any individual, health is determined by a multitude of factors. There are individual factors that relate to age and genetics, which cannot be changed. In addition, there are lifestyle factors, such as levels of physical activity, alcohol consumption, tobacco smoking, etc. Beyond these factors, a multitude of external factors play a significant part in determining health. These reflect the wider environment and encompass many aspects of the socio-economic context in which individuals live and work. Differences in these factors can contribute to health inequalities between communities.

2.2.3. A common way of summarising these factors is shown in **Figure 2.1**, which illustrates a model of the so-called 'determinants of health'. The core determinants are factors that are specific to an individual, whilst the outer determinants are a function of the socio-economic status and external factors that an individual is exposed to. For example, social and community networks are considered to be important for a person's health and wellbeing. If these networks are strong, evidence suggests that health is improved. Isolated individuals, on the other hand, have poorer health.

Figure 2.1 - Socio-economic Model of Health [1]



2.2.4. The physical environment (e.g. air quality) has a part to play in the health of populations, but is only one influence. Good housing, access to medical services, transport and being employed in a low stress job are also important.

2.3. Policy and guidance framework

2.3.1. The UK Department of Health's Tackling Inequalities – A Programme for Action 2003 and the 2007 Status Report set out plans to tackle health inequalities in the UK and outlines how transport related policies and measures could address health inequalities (2) . For example, people's accessibility to work, key services and the encouragement of exercise could be improved by the development of consistent transport and land use planning policies.

2.3.2. Transport has an important role in ensuring the health and well-being of people and communities. The key objective identified in WHO's 'Collaboration between health and transport sectors in promoting physical activity' report (3) is to increase the provision of sustainable travel to improve the health and well-being of citizens. Although this refers principally to walking and cycling, rail provides an opportunity to support these modes through the integration of stations with cycle and pedestrian networks and provision of facilities such as cycle parks.

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[1] Modified from Dahlgren, G., and M. Whitehead. (1995). Tackling Inequalities: A Review of Policy Initiatives. In Tackling Inequalities in Health: An Agenda for Action, eds. M. Benzeval, K. Judge, and M. Whitehead. London: Kings Fund Institute

[2] Department of Health, 2003: Tackling Inequalities – A Programme for Action 2003

[3] World Health Organisation, 2006: Collaboration between Health and Transport Sectors in Promoting Physical Activity

2.3.3. While there are strong policy drivers around health, there is no specific legislation in the UK which relates to assessing health impacts in the context of planning and new developments. Although considering health as part of the AoS is not a legislative requirement, it is considered to be good practice and also to be in line with precedents set by other major transport projects.

2.3.4. This report presents an initial analysis of the potential health effects and vulnerabilities along the proposed route. At this relatively early stage of scheme development, this analysis is necessarily not a full Health Impact Assessment (HIA) but takes into consideration the following guidance:

- NHS Executive's A Short Guide to Health Impact Assessment Informing Healthy Decisions (August 2000);
- HUDU Watch Out for Health: A checklist for assessing the health impact of planning proposals; and
- WHO Guidance on HIA.

2.3.5. A full HIA may be undertaken for the scheme at a later stage of development. The initial analysis reported here identifies relevant issues for any future HIA to consider.

2.4. Methodology and criteria

2.4.1. The overarching method applied to this appraisal relies on the compilation of an evidence base consisting of a community profile, evidence from published literature and the results of the AoS. These information sources have been used as the basis for identifying the potential impacts on health and wellbeing (both positive and negative) that may need to be investigated in more detail at a later stage of scheme development.

2.4.2. The initial analysis of health effects has been undertaken as a desk based exercise.

3. LITERATURE REVIEW

3.1. Introduction

3.1.1. A focussed literature review has been undertaken to collect evidence on the potential health impacts associated with the scheme. This was based on a review of literature on health effects associated with the various elements of the scheme and included a review of completed HIAs on rail projects.

3.2. Health baseline

3.2.1. The health baseline has been developed in relation to local authorities whose boundaries fall within 350m of the proposed scheme[4]. Baseline data collected includes Local Authority and Counties 2012 health profiles generated by the NHS and mapping of Index of Multiple Deprivation (IMD) health data.

3.2.2. The combination of statistics and mapping has helped develop a picture of existing community health susceptibilities and inequalities, including pockets of relative

[4] The 350m buffer represents a broad approximation of the area within which scheme impacts are likely to be felt, however the health analysis will consider the likely extent of each impact according to its nature.

deprivation or affluence which is useful in informing the analysis and identifying vulnerable groups.

3.3. Limitations of the analysis

3.3.1. The main constraints in undertaking the analysis of potential health impacts are the limited scheme design information and the limitations of the baseline data. In terms of the scheme design information, the scheme is at a relatively early stage of development and the level of data available is typical of the development stage. With regard to the baseline data limitations, it is recognised that the IMD datasets represent a snapshot view of dynamic spatial information, therefore this data is considered to be a useful indicator rather than representing fixed, long-term or absolute spatial distributions. In addition Local Authority and County Health profiles for 2012 include data as old as 2008 in some cases. Furthermore, it is possible that properties that have been identified as commercial properties and which may be subject to demolition may provide community services.

3.3.2. The analysis is partly spatially-specific (identifying the location of possible impacts where relevant), and partly scheme-wide (where impacts relate to the scheme as a whole, and broad conclusions can be made). A brief justification for the findings is provided, although detailed analysis is not appropriate at this stage of scheme development.

3.3.3. While there are some limitations as described above, the level of detail of the scheme design information and the nature of the baseline data are considered sufficient for the purposes of undertaking an initial analysis to identify relevant issues for any future HIA to consider.

3.4. Literature review

3.4.1. This section sets out the findings of the literature review, which forms the evidence base for understanding potential changes in health determinants and potential health consequences of relevance to the proposed scheme.

3.4.2. The possible effects of a rail project such as the proposed scheme on health have been reviewed in terms of the following topics:

- access to housing;
- access to community facilities;
- access to education;
- access to health centres;
- access to public transport;
- access to green spaces and physical activity
- community severance or isolation;
- safety;
- landscape and visual;
- noise and vibration;
- air quality;

- socio-economic impacts; and
- rail projects and public health case studies.

3.4.3. The information is provided under these headings for ease of reading. However, it should be noted that a number of these elements can interact to affect the health of individuals.

3.5. Access to housing

3.5.1. Demolition, resulting in loss of individuals' houses can cause stress and anxiety thereby impacting on wellbeing whether replacement housing has been identified or not. In addition, the process of relocation itself can cause stress which can lead to adverse effects on health. Relocation can also cause community severance as residents are moved away from their communities and social networks as well as facilities and services.

3.5.2. Housing quality can affect long term health, with those who have experienced overcrowded, cold or damp housing conditions, either as adults or children, being more likely to become ill. This is especially true for vulnerable groups such as children, those with respiratory problems and the elderly.[5] As well as decreased risk of illness, there are also wellbeing and mental health benefits associated with experiencing an improvement in housing conditions and new housing development in deprived areas can therefore bring general wellbeing benefits.

3.5.3. New housing, or improved access to transport, may also trigger gentrification[6] in some areas which could result in negative health impacts for poorer socio-economic sections of a community if there was a resulting increase in house prices and displacement of these groups from an area. Alternatively, house prices can be adversely impacted by the introduction of new infrastructure into areas if there is a perceived reduction in amenity value, which can be a cause of stress for residents and reduce wellbeing.

3.6. Access to community facilities

3.6.1. Community facilities have beneficial impacts for health as they promote wellbeing and social inclusion through promoting a sense of control in one's life and self-worth[7]. They can also result in increases in social capital which may play a complex role in health and wellbeing through access to social and cultural events. Networks and connections can act as a buffer against deprivation, providing access to health resources, support and information[8]. Better social support is associated with lower levels of anxiety and depression, reduced likelihood of common mental illness and increased likelihood of recovery from mental illness[9].Therefore the removal of existing community facilities can have a negative impact on health, which is often felt more strongly by the most

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[5] Marsh A, Gordon D, Pantazic C and Heslop P Home sweet home? The impact of poor housing in health. The Policy Press 1999.

[6] Gentrification is a controversial notion generally considered to refer to adverse effects on communities associated with affluent middle-class households becoming established in working-class, 'de-invested' areas

[7] Health Impact Assessment for Regeneration Projects, Volume 2, Selected Evidence Base, Cave et al., Queen Mary University and Breaking the Cycle, East London and the City Health Action Zone

[8] Campbell, 1999, Gillies 1998 cited in Investigating the links between social capital and health using the British Household Panel Survey, HDA, 2004

[9] Investigating the links between social capital and health using the British Household Panel Survey, HDA, 2004

deprived in a community who often depend more upon the facility to maintain their quality of life.

3.7. Access to education

3.7.1. Education is a key influencing factor for health. Levels of education influence a range of additional determinants of health including employment opportunities, levels of income, housing, lifestyle and coping skills. Those who achieve a high standard of education are more likely to find stable, well paid employment and associated benefits such as higher incomes, access to better housing, and a higher quality of life. Poor education is also associated with health inequalities and the cycle of health inequalities, any factor which increases education will help break the cycle of health inequalities related to poor education leading to poor unemployment[10] .

3.8. Access to health centres

3.8.1. Access to health care facilities is a key determinant of health allowing people to seek treatment when suffering from ill health, thereby improving health outcomes and providing reassurance. When access to health care is poor or delayed, health outcomes tend to be worse and wellbeing is affected.[11, 12]

3.9. Access to public transport

3.9.1. Transport plays an important role in promoting health and wellbeing, directly by providing communities with access to a range of services and amenities required to treat ill-health, manage and promote healthy living and indirectly through enabling and maintaining social and family networks which provide emotional, professional and social support aspects of good health and wellbeing, and by enabling access to employment opportunities. Improved rail and access to other modes of transport can also lead to health benefits such as reduced stress due to reduction in congestion on the road networks, improved social networks and reduction in community severance due to busy roads. These positive health impacts are likely to be felt most strongly by those who currently live in areas where there is poor access from most modes of transport.

3.10. Access to greenspaces and physical activity

3.10.1. Regular physical activity provides people of all ages and conditions with a wide range of physical, social and mental health benefits. Physical activity (including walking and cycling) is important in health terms, playing a role in reducing obesity as well as diseases such as diabetes, heart disease and high blood pressure all of which are major public health problems in the UK[13].

3.10.2. Low levels of physical activity are a major risk factor for ill health and mortality from all

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[10] DFEE (2004) 'Youth Cohort Study : the activities and experiences of 16 year olds : England and Wales' Department for Education and Employment Statistical Bulletin, issue no. 8/97, June, London: The Stationery Office

[11] Julia C Prentice and Steven D Pizer; Delayed Access to Health Care and Mortality Health Services Research. 2007 April; 42(2): 644–662.

[12] Joel S. Weissman, PhD; Robert Stern, MD; Stephen L. Fielding, PhD; and Arnold M. Epstein, MD, MA. Delayed Access to Health Care: Risk Factors, Reasons, and Consequences: Ann Intern Med. 1991; 114(4):325-331.

[13] Department of Health (2011). Start Active, Stay Active: A report on physical activity for health from the four home countries' Chief Medical Officers

causes. The benefits from physical activity are transient; therefore exercise is needed throughout life in order to minimise the risk of developing disease.

3.10.3. Proximity to green space has been found to affect the level of usage and in turn health benefits[14]. Greenspaces benefit people in terms of providing a space for rest and relaxation and enable restoration, aiding both mental and physical health. Access to these spaces and increased greenspace is beneficial to health and wellbeing[15].

3.11. Community severance or isolation

3.11.1. Community severance is a term used to describe the separation of different areas within a community and the breaking of networks, leading to loss or decreased access to support networks and decreased social capital.

3.11.2. As well as enhancing connectivity between members of social groups and networks, development of new transport systems, including rail tracks, have the potential to disrupt social networks through the creation of barriers which can prevent or reduce community interaction. The risk and severity of health effects arising from community severance is dependent upon a number of factors and can only be appraised qualitatively.

3.11.3. Rail projects can also create areas of isolation, if the line of a route encloses areas which are already partially bounded by existing infrastructure, residents of dwellings within these areas may experience negative mental health effects associated with a sense of isolation. Older people in particular may be vulnerable to adverse impacts associated with this type of impact.

3.12. Safety

3.12.1. Those in more deprived socio-economic groups are at higher risk of being involved in road traffic accidents, especially children. This can be explained in part by higher traffic volumes and speeds in poorer areas, as well as increased exposure as pedestrians for families that do not own a car. Children are a particularly vulnerable group, with one in three accidents involving a person under 25[16].

3.13. Landscape and visual

3.13.1. Changes in townscape and landscape character and views can become a focus for concern and anxiety. The built environment can impact on public health and the way that people utilise their environment including decreased physical activity. If visual environments deteriorate, so too can the physical and mental health of the people that live in them[17].

3.13.2. Light pollution from the built environment can also have a negative health impact

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[14] Bateman, I, Day, B, Georgiou, S and Lake, I. (2006) The aggregation of environmental benefit values: Welfare measures, distance decay and total WTP, Ecological Economics, 60, 450–460.

[15] Nielson, T and Hanson, K (2007) Do green areas affect health? Results from a Danish survey on the use of green areas and health indicators, Health and Place 13(4) 839-850.

[16] World Health Organization. (2000) Transport, environment and health. WHO Regional Publications, European Series.No.89

[17] Richard Jackson and Chris Kochtitzky, Creating a healthy environment: the impact of the built environment on public health, Centre for Disease Control and Prevention.

through annoyance, discomfort and loss of visual environment and visibility. Artificial lighting (emitted from premises so as to be prejudicial to health or a nuisance) is considered a statutory nuisance under the Environmental Protection Act 1990.

3.13.3. Vulnerable receptors include those living in areas where the landscape is currently undisturbed or where there are high levels of deprivation where people are likely to experience decreased satisfaction in the area they live. A change in townscape, landscape or views, such as the introduction of new infrastructure can provide a physical focus for the risks people perceive and can become a focus for concern and anxiety, causing negative health impacts.

3.14. Noise and vibration

3.14.1. Noise has the potential to affect health in a variety of ways. Some effects can be auditory, resulting in damage to the ear and occur as a direct impact of noise. Acoustic limiting values are recommended to avoid inner ear damage. There are also a range of non-auditory health effects; such as annoyance, night time effects and mental health impacts such as anxiety and stress; associated with exposure to environmental noise.

3.14.2. Annoyance is the most reported non-auditory health effect associated with noise. Vibration can also cause annoyance to those experiencing it. Sleep disturbance associated with noise can cause decreased day time efficiency and cause long term health impairment.

3.15. Air quality

3.15.1. Exposure to outdoor air pollution is associated with both acute and chronic health effects. Particulate matter (PM) mainly generated from engine emissions and construction activities, can adversely affect human health in varying degrees depending on its size, composition, origin and the length of exposure. The public health implications of the long-term effects of exposure to PM are an order of magnitude greater than those of the short-term effects, as measured by life years lost, although it is difficult to disentangle the two entirely. A strong body of epidemiological evidence provides compelling evidence of the association between long-term exposure to PM2.5 and cardiovascular disease, with consequent implications for mortality.

3.15.2. Groups that are particularly vulnerable to exposure from air pollution include foetuses, young children, the elderly and those with cardio-respiratory disease, as well as social-economically deprived people.

3.15.3. Dust emissions and subsequent deposition arising from construction activities can cause annoyance. Dust can also irritate the eyes and aggravate pre-existing respiratory problems, such as asthma.

3.15.4. Construction sites can cause a localised and temporary increase in exposure to pollutants for those in close proximity. Exposure to nitrogen dioxide (NO_2) and particulate matter (PM_{10}) at sufficiently high concentrations causes inflammation to airways. $PM_{2.5}$ can cause respiratory and cardiovascular effects in those exposed.

3.16. Socio-economic impacts

3.16.1. Employment and income are regarded as the key determinants of health, influencing where an individual lives, the education received, access to healthcare and even lifestyle and behaviour.

3.16.2. Ethnic minorities, young people and disabled people generally face the highest levels of unemployment. These groups are more likely to be found in more insecure employment and be poorly paid, therefore having low socio economic status. Impacts on inequalities are addressed in the Equality Analysis (Appendix A).

3.16.3. Unemployment is associated with poor health, with unemployed individuals being more likely to report poor physical health and injury as well as worse mental health including depression and feeling demoralised[18]. Health outcomes associated with unemployment include physical health effects, mental health effects, suicide, reduced wellbeing, reduced role functioning (understanding of role in society), poor self-reported health and increased mortality.

3.16.4. Increased employment opportunities, can have a positive influence on health through increasing social contact, involvement in a collective effort or activity and by forming social relationships. All of these contribute to wellbeing. In addition, those in insecure employment are more likely to have poorer mental health than those in secure employment. It has also been found that those in routine occupations are nearly four times more likely to become ill than those in professional and managerial roles[19].

3.16.5. Employment and income together contribute to a person's socio economic status. In broad terms, the greater the income, the better the health; however, this relationship is not strictly linear.[20, 21] Above a certain level, higher income is less proportionally related to improved health. Employment-related health benefits with be greatest for those who are currently unemployed, who are in short term temporary employment or who are living in more deprived areas.

3.16.6. Limited health benefits may be felt by employees who gain temporary employment during construction of a scheme. Construction-related employment is unlikely to confer long term health benefits on individuals or the community as a whole.

3.17. Rail project case studies

3.17.1. A number of health impact assessments have been carried out on rail infrastructure developments previously and their findings are summarised and presented in Table 3.1. These findings provide an indication of the types of health impacts which may arise from the scheme. However, the analysis set out in this report takes account of the differences between the projects that which the reviewed HIAs relate to, and the current scheme.

[18] Mathers C.D. and Schofield DJ (1998) The health consequences of unemployment: the evidence. Medical Journal of Australia 168; 178-182

[19] Bartley M and Owen C (1996) Relation between socioeconomic status, employment and health during economic change 1973-93 British Medical Journal: 445-449

[20] Marmot M (2002) The influence of income on health: views of an epidemiologist. Health Affairs; 31-46.

[21] Ecob B, Davey Smith G (1999). Income and health: what is the nature of the relationship? Social Science and Medicine; 48: 693-705.

Table 3.1 – Key Findings from Rail Health Impact Assessments

Scheme	Potential health impacts identified
Mersey Tram	Increased temporary employment. Increased temporary work related accidents and injury. Increased mobility. Reduced noise levels in some areas and increased noise levels in other areas. Improved access to all services increased including health services. Marginal decease in air pollution.
Tees Valley Metro	Improved access linking communities to employment, housing, health care, social network, recreation and leisure opportunities. Environmental improvements brought on by a modal shift away from roads (air quality noise and road safety). Increased opportunities for physical activity. Regeneration. Decrease in local air quality. Increase in noise. General disruption to communities in proximity to the rail corridor.
Crossrail	Improved perception of local urban and natural environment. Increased access to education and training. Increased employment opportunities. Increased access to facilities, amenities and services. Increased access and accessibility to affordable housing. Reduced long-term local levels of depression, anxiety and mental illness. Improved quality of life and well-being. Increased level of community participation, community development and the strengthening of community groups. Reduced environmental quality during demolition and construction. Dust generation and emissions during construction. Noise generation during construction. Increased risk of accident from construction traffic on roads. Land take resulting in a temporary loss of green space and services.

4. HEALTH BASELINE

4.1.1. Evidence suggests that different communities have varying susceptibilities to health impacts and benefits as a result of ethnicity, social and demographic structure and relative deprivation. This health baseline provides an insight to how potential impacts might act disproportionately upon some communities and vulnerable people. The aim of the baseline review is to understand the differing susceptibilities to health impacts of communities located along the proposed scheme as a result of variations in social and demographic factors and relative deprivation in communities. The baseline review has informed the analysis of impacts set out in Section 5.

4.2. Summary of Health Profile Data

4.2.1. **Table 4.1** provides a summary of the health statistics for key indicators provided in the Health Profiles of the local authorities which lie within 350m of the proposed scheme (local authority boundaries outlined in **Figure 4.1**). Those numbers in **Table 4.1** that are highlighted in red correspond to the indicators for which local authorities have a significantly poorer profile than England as a whole. The numbers highlighted in green correspond to the indicators for which local authorities have a significantly better profile

than England as a whole. The numbers which are not highlighted relate to health indicators that are in line with the average for England.

4.2.2. Along the western leg it can be seen that Manchester, Salford and Wigan are more deprived in terms of a number of key health statistics than England and the rest of the local authorities along the route. Manchester and Salford in particular have extremely high levels of deprivation, children living in poverty and early deaths from heart disease and stroke. The health profiles along the eastern leg are more varied, with Nottingham, Sheffield, Barnsley, Wakefield and Leeds all having a significantly worse health profile than the England average.

Table 4.1 - Local Authority Key Health Profile Indicators

District	Deprivation [1]	Proportion of Children in Poverty [2]	Life Expectancies [3]		Early deaths: heart disease and stroke [4]	GCSEs achieved (5A*-C including English and Maths [5]	Long Term Unemployment [6]
			Men	Women			
England Average	19.8	21.9	78.6	82.6	67.3	58.4	5.7
Western Leg							
Lichfield	3.8	14.2	78.8	81.8	58.7	57.4	2.6
Stafford	5.1	12.6	79.1	83.3	54.0	57.1	2.6
Newcastle-under-Lyme	14.1	18.9	78.3	81.8	70.3	58.4	3.8
Cheshire East	7.3	13.2	79.5	82.9	60.2	64.3	3.0
Cheshire West and Chester	15.3	16.7	79.2	82.3	62.9	59.5	3.8
Trafford	10.8	15.9	78.8	83.1	70.3	69.8	4.9
Manchester	64.8	51.8	74.1	79.1	123.2	51.8	9.2
Salford	46.1	29.9	74.8	79.9	105.8	52.9	8.3
Warrington	16.3	15.1	78.0	81.6	82.3	64.3	4.1
1. Wigan	29.6	20.6	76.5	80.7	86.7	57.1	7.5
Eastern Leg							
North Warwickshire	4.9	15.3	77.9	88.2	66.6	49.1	3.0

(1) % people in this area living in 20% most deprived areas in England, 2010

(2) % children (under 16) in families receiving means-tested benefits & low income, 2009

(3) At birth, 2008-2010

(4) Directly age standardised rate per 100,000 population aged under 75, 2008-2010

(5) % at Key Stage 4, 2010/11

(6) Crude rate per 1,000 population aged16-64, 2011

Eastern Leg							
Tamworth	13.3	20.7	78.8	82.7	73.6	48.9	3.6
North West Leicestershire	3.3	14.5	79.0	82.2	74.3	55.5	3.6
Rushcliffe	0.0	8.4	80.5	83.7	52.3	74.5	2.7
Erewash	15.8	19.7	79.1	82.8	65.6	56.0	7.6
Broxbourne	2.3	19.7	80.4	84.4	54.1	58.8	5.0
Nottingham	51.1	36.6	75.5	80.7	95.8	46.0	10.6
Ashfield	23.7	23.9	76.9	81.3	70.2	54.8	5.9
Bolsover	27.3	23.8	77.0	80.8	80.4	51.0	6.1
Chesterfield	25.2	22.2	76.9	82.6	77.7	57.3	6.9
North East Derbyshire	9.8	16.3	79.6	82.6	58.8	67.1	4.9
Sheffield	34.1	25.0	78.1	81.8	72.8	49.4	7.9
Barnsley	32.4	25.0	76.8	80.4	84.7	44.4	8.2
Wakefield	28.9	22.3	77.0	81.1	85.5	57.4	5.3
Leeds	28.6	23.5	77.9	82.2	75.6	53.7	6.1
Selby	1.7	12.8	79.9	83.4	55.6	59.1	4.3

4.3. Summary of IMD maps

4.3.1. IMD deprivation information provides a ranking of areas in England using a range of information across a number of subject domains, including Health and Disability Deprivation. This measure is made up of four indicators about a range of health issues to give an overall score for the level of health deprivation experienced in a small area[28]. **Figure 4.1** and **Figure 4.2** map this IMD deprivation indicator in the local authorities within 350m of the western and eastern leg[29] and provides additional context to the information in **Table 4.1.**

4.3.2. **Figure 4.1** shows that the majority of the western leg has generally low levels of deprivation in terms of health. However, the route terminates in areas of high health deprivation. Health deprivation levels vary across Wigan although the proposed route passes through a number of the 20% most deprived wards in England. Manchester has high levels of health deprivation, with the whole district being within the 20% most deprived in terms of health in England

4.3.3. **Figure 4.2** highlights that the key areas of health deprivation along the eastern leg are Nottingham, Sheffield, Barnsley, Wakefield and Leeds. All these local authorities include some of the 20% most deprived wards in terms of health. Chesterfield, Bolsover and Ashfield also have areas which are in the 20-40% most deprived category in terms of health.

[28] The indicators used in this domain are Years of Potential Life Lost (YPLL), Comparative Illness and Disability Ratio, measures of acute morbidity derived from Hospital Episode Statistics and the proportion of adults under 60 suffering from mood or anxiety disorders based on prescribing, suicide mortality rate and health benefits data.

[29] Office for National Statistics, 2011 Census: Digitised Boundary Data (England and Wales) [computer file]. UK Data Service Census Support. Downloaded from: http://edina.ac.uk/ukborders. Census output is Crown copyright and is reproduced with the permission of the Controller of HMSO and the Queen's Printer for Scotland under Open Government Licence http://www.nationalarchives.gov.uk/doc/open-government-licence/open-government-licence.htm

Figure 4.1 - Western Leg IMD Health Deprivation and Disability (2010)

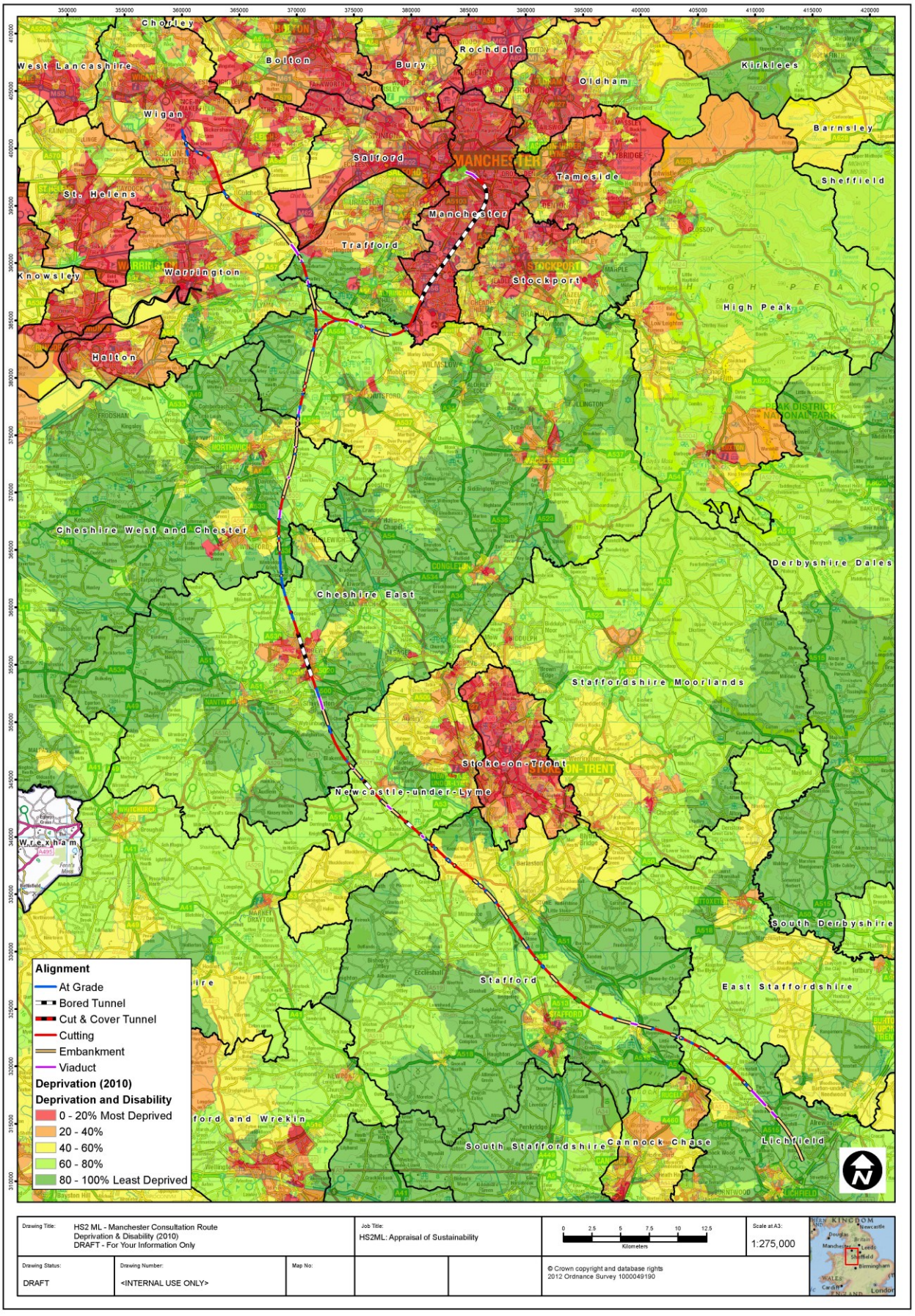
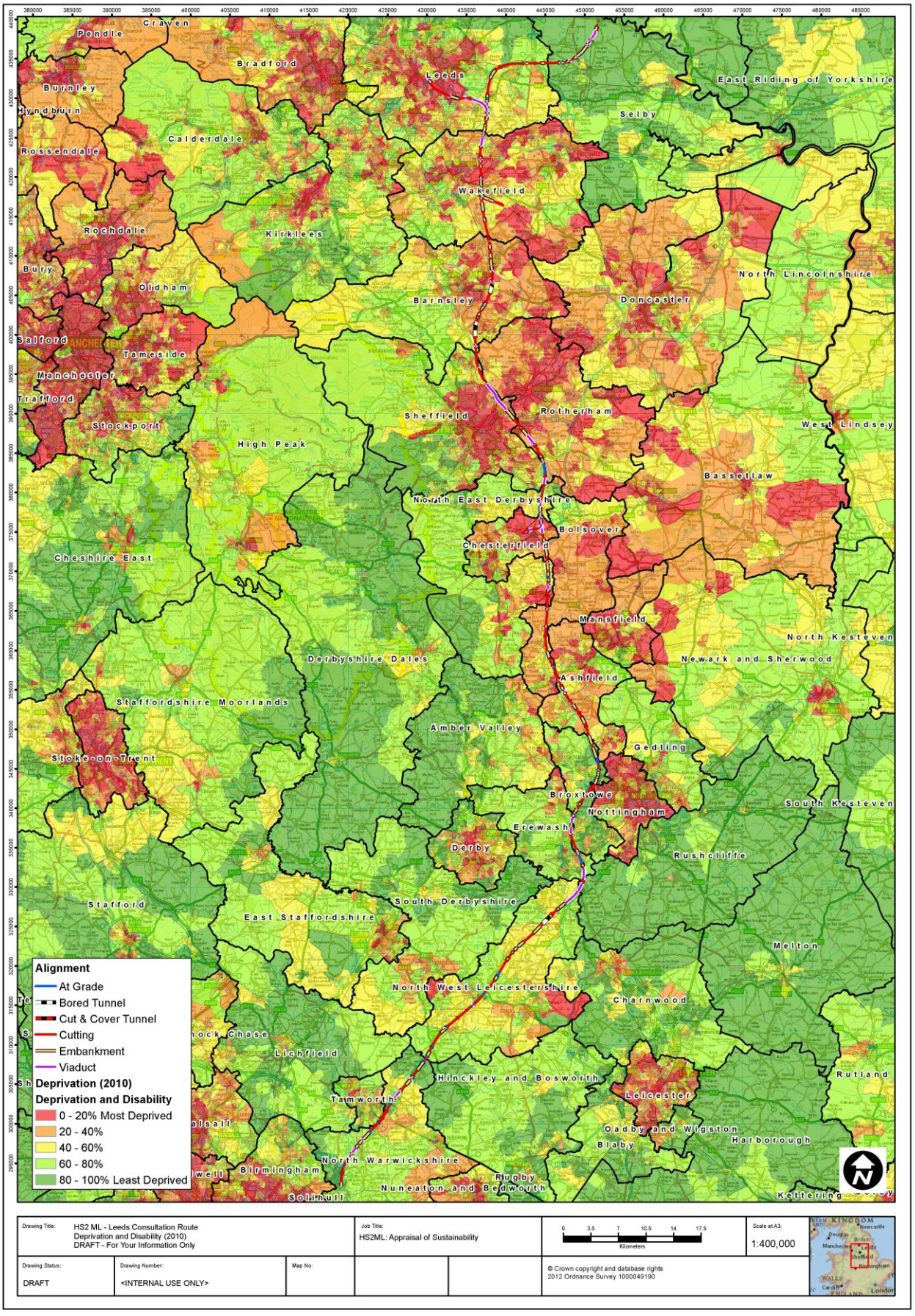


Figure 4.2 - Eastern Leg IMD Health Deprivation and Disability (2010)



5. FINDINGS

5.1.1. Potential impacts on health and wellbeing that could be associated with the proposed scheme are outlined in **Table 5.1.** The table outlines, for each topic, the aspects of the scheme of relevance (scheme feature) and the potential implications for health.

Table 5.1 - Health Analysis findings

Topic	Scheme feature	Analysis
Access to housing	Demolition of dwellings and potential for new dwellings	**Demolition of dwellings (direct housing impacts)** Western Leg Demolition of an estimated 139 dwellings predominantly on the Manchester spur and at Manchester Piccadilly station. Eastern Leg Demolition of an estimated 139 dwellings, mainly single properties or small clusters of properties, but including 60 at Sheffield Meadowhall station. **Potential for new dwellings (indirect housing impacts)** Western Leg Up to 4,100 new dwellings are expected to be built around Manchester Piccadilly station, as a result of the proposed scheme. Eastern Leg Up to 3,500 new dwellings are expected to be built around the three new stations on the eastern leg. There are likely to be some adverse health impacts arising from the proposed scheme due to stress and anxiety associated with demolition of dwellings. Displaced residents near Manchester Piccadilly station on the western leg, and the new Sheffield Meadowhall and Leeds New Lane stations on the eastern leg are likely to be particularly vulnerable to these effects, as there are high levels of health deprivation in these areas. Overall, however, there are likely to be substantially more new houses provided as a result of the scheme than the number of houses expected to be demolished. Provision of new houses in relatively deprived areas could provide health benefits for local residents, if people currently experiencing poor housing standards are able to access improved housing conditions as a result.
Access to community facilities	Demolition of community facilities	Western Leg Potential demolition of a community hall near Manchester Piccadilly station. Eastern Leg Potential demolition of three community properties along the eastern leg, including a bingo hall near Leeds New Lane Station. The extent of any negative health impacts associated with the demolition of community facilities would depend on the nature of the services provided by these facilities, and whether services were reprovided. Manchester Piccadilly in particular has high levels of health deprivation therefore adverse impacts may be felt particularly strongly in this location.
Access to education	Improved access to higher education facilities	Entire Route Improved train connections between London, Birmingham, Manchester, Nottingham, Sheffield, Manchester and Leeds. In general, the proposed scheme is not likely to make a difference to people's access to education on a daily basis (such as daily

Topic	Scheme feature	Analysis
		journeys to and from school). However, the scheme may deliver some health benefits in this regard by improving accessibility to centres of learning such as Universities, Business Schools and other higher education establishments in the cities served by the proposed scheme, as well as wider locations through connections with the high speed rail network.
Access to health centres	Demolition of healthcare facilities	Western Leg The AoS process has not identified any healthcare facilities that are likely to be demolished on the western leg. Eastern Leg Potential demolition of pharmacy at Toton. The extent of any negative health impacts associated with the demolition of healthcare facilities along the route will depend on the nature and extent of current usage, and any reprovision by the local authority. Where such facilities are required it is likely that they would be reprovided.
Access to public transport	Provision of new stations, improving access to other existing modes of transport	Western Leg Manchester Piccadilly station would offer direct interchange with the national rail network and the Metrolink at Piccadilly, and is within walking distance of Oxford Road station. It would create new opportunities for pedestrian routes through the undercroft, reducing severance, and would open up the northern end of the station with a new access road. Manchester Airport High Speed Station would improve access to the airport, while also linking with existing transport systems, including the M56 and the proposed Metrolink. Eastern Leg The East Midland Hub would provide an opportunity for interchange with national rail services into Nottingham, Derby, Leicester and Loughborough and would accommodate an extension of the NET tramway. Sheffield Meadowhall station would offer interchange opportunities with national rail services and the Sheffield Supertram. Leeds New Lane station would offer interchange with the national rail network. Overall, it is likely that there would be potential beneficial health effects associated with improved transport interchanges at all five new stations, by offering increased access to services and facilities. The benefits of improved interchange would be felt over a wide area around each station; associated health benefits would be greatest in areas of health deprivation surrounding all five new stations.
Community severance or isolation	Isolation or severance of residential properties	Entire Route HS2 Ltd would aim to avoid stopping up existing rights of way where possible, and to maintain access across the railway through the on-going design of the scheme. This would involve working with local people, local authorities and relevant organisations to determine the best way of achieving this where feasible Western Leg A sense of isolation may affect an estimated 57 dwellings at a number of locations, most notably at Wrinehill and just to its north, the

Topic	Scheme feature	Analysis
		northern edge of Crewe, North Lowton, and the east of Edge Green around the proposed depot at Golborne. Eastern Leg A sense of isolation may affect an estimated 234 dwellings at a number of locations, most notably at Whateley (also affected by severance), Worthington, Red Hill, West Killamarsh, Swaithe, Methley Lanes and Church Fenton. Adverse health impacts associated with community severance and isolation are expected to be avoided during the operational stage through the maintenance of access roads and paths, where possible. The extent of any adverse impacts that may be experienced during scheme construction would need to be assessed at a later stage. A sense of isolation may be experienced at a number of locations on both the western and eastern legs, and may have a particular adverse impact on disabled and older people in these areas. As set out in the Equality Analysis (Appendix A), the areas listed above do not correspond to the areas where individual clusters of older people have been identified, therefore adverse impacts associated with this are likely to be limited.
Access to green spaces and physical activity	Intersection of cycle paths, footpaths and green spaces	Entire Route HS2 Ltd would aim to avoid stopping up existing rights of way where possible, and to maintain access across the railway through the on-going design of the scheme. This would involve working with local people, local authorities and relevant organisations to determine the best way of achieving this where feasible No intersection of open access areas by the scheme. Adverse health impacts associated with reduced access to green spaces, or reduced opportunity for physical activity as a result of footpath or cycle path severance are expected to be avoided during the operational stage through the reinstatement or diversion of access roads and paths, where possible. Adverse impacts associated with direct impacts on open access areas will be avoided by the proposed scheme.
Safety	Operational safety implications	Entire Route The scheme is expected to encourage a modal shift from road to rail, which is likely to have a positive impact in terms of a reduction in fatalities as rail is a safer transport option. There may, however, be an increased risk of injury to pedestrians and cyclists associated with increased traffic around station areas. Careful station design could reduce this risk.
	Risk of injury associated with scheme construction	Entire Route During construction, the likelihood of construction-site injury or accident involving a member of the public is low, as the majority of construction activities will take place within site boundaries with limited access to non-project employees. The risk of accident associated with construction traffic is likely to be greater, although it is not possible to assess this at this stage. It is recommended that consideration be given to the ways in which risk of accident associated with construction vehicle movements can be minimised. Similarly, it is not possible at this stage to assess the risk of injury to rail users and workers; assessment of this would need to be undertaken at a later stage in scheme design.
Landscape and visual	Landscape and visual impact during construction	Entire Route Locations where construction activity is likely to be highly visible are not defined at this stage.

Topic	Scheme feature	Analysis
impacts		It is not possible to assess the landscape and visual impacts of construction at this stage. However, it is recommended that consideration be given to the ways in which visual impacts could be limited, such as through the use of appropriate and well-designed hoarding or other shielding devices. In particular, consideration should be given to the visual impacts of station construction, to minimise potential adverse effects on the wellbeing of people living in adjacent areas that already experience high levels of health deprivation.
	Landscape and visual impact from the operational scheme	Entire Route The locations where the likely key adverse landscape or visual impacts may be experienced are set out in the Sustainability Statement (Volume 1). On-going design and appraisal will consider use of mitigation measures (such as blending aspects of the scheme into the landscape as far as possible) and will follow the landscape mitigation philosophy adopted for Phase One (set out within the Sustainability Statement, Volume 1). These measures will serve to minimise or reduce impacts on the landscape and visual environment as much as possible. This will also reduce the likelihood of potential adverse health and wellbeing impacts.
Noise and vibration	Noise and vibration during operation	Entire Route It is not expected that any adverse impacts associated with vibration would arise during the operational phase of the scheme, since any potential significant impacts would be mitigated The locations where moderate residual adverse noise impacts are likely to be experienced are set out in the Sustainability Statement (Volume 1). Receptors that are more susceptible to health impacts associated with noise will be dwellings and noise-sensitive facilities located closest to the route (as discussed in the noise appraisal within this Appendix). Any adverse effects are likely to be felt in particular by young children at school although measures would be taken to mitigate adverse noise effects on learning.
Air quality	Increased levels of dust and vehicle/plant emissions during construction	Entire Route The air quality analysis (Appendix E.13) suggests that the potential for adverse impacts on residential receptors will be primarily associated with construction dust at stations. Standard dust suppression measures employed during construction would help to control dust levels and therefore reduce any potential negative health impacts. Good practice measures would also be used to control emissions from plant used on construction sites and to minimise the effects of emissions from construction traffic. This issue will be assessed further at a later stage of scheme design when more information is available on construction sites, methods and mitigation.
Socio-economic impacts	Direct and indirect job creation during construction and operation	Entire Route Up to 10,000 jobs are expected to be provided during the peak of construction of the proposed scheme. Up to an estimated 1,400 permanent jobs could be required during operation, related to the running of stations and staffing of trains. Western Leg Net increase of up to 700 jobs potentially supported indirectly through regeneration associated with the Manchester Airport High Speed Station.

Topic	Scheme feature	Analysis
		Net increase of up to 42,900 jobs potentially supported indirectly through regeneration associated with the station at Manchester Piccadilly. Eastern Leg Net increase of up to 1,600 jobs potentially supported indirectly through regeneration associated with the East Midlands Hub. Net increase of up to 5,400 jobs potentially supported indirectly through regeneration associated with Sheffield Meadowhall station. Net increase of up to 19,700 jobs potentially supported indirectly through regeneration associated with Leeds New Lane station. The potential extent of jobs supported with both construction and operation of the proposed scheme is likely to provide health benefits associated with employment. Consideration will be given at a later stage to the ways in which new jobs could be made accessible to people living within areas of deprivation such as those around Manchester Airport High Speed Station, Manchester Piccadilly station, Sheffield Meadowhall station and Leeds New Lane station. Health benefits are likely to be greatest in relation to jobs created as a result of operation which are more likely to be permanent.
	Displacement of jobs where business premises are demolished	Entire Route Estimated demolition of 227 commercial or retail properties and 11 industrial properties associated with the whole scheme. Western Leg Estimated demolition of 99 commercial or retail properties and two industrial properties on the western leg. Eastern Leg Estimated demolition of 128 commercial or retail properties and nine industrial properties on the western leg. The number of jobs estimated to be displaced as a result of the potential demolition of commercial/retail and industrial premises is much lower than the number of jobs that could be supported by the proposed scheme. However, the effect of job loss is nonetheless potentially significant. Although displaced jobs are expected to be taken up elsewhere, job loss is likely to be associated with anxiety and stress in the short term for those affected. Displaced companies may need to move out of the area to find suitable alternative premises which may displace some jobs and, if a company does not re-establish operations at all, adverse health effects may be experienced by employees. It is not necessarily the case that those people losing their jobs would find new employment as a direct result of the proposed scheme. Areas of high deprivation where the impact of job displacement would be particularly large include the vicinities of Manchester Piccadilly station, Sheffield Meadowhall station and Leeds New Lane station.

6. SUMMARY

6.1.1. The proposed scheme passes through a number of areas with high levels of health-related deprivation. The western leg is less deprived in terms of health as a whole, although in the north of the route the areas of Manchester, Salford and Wigan are extremely deprived. The eastern leg has mixed levels of health deprivation with greatest deprivation levels experienced in Nottingham, Sheffield, Barnsley, Wakefield and Leeds.

6.1.2. The initial analysis set out in this report indicates that there is the potential for both positive and negative health impacts to arise around the new stations. The main potential negative health impacts relate to displacement of jobs, noise during construction and demolition of housing and community facilities. Positive health impacts relate to increased access to employment, new housing and access to transport which in turn can increase access to education, services and facilities. Both positive and negative health impacts will be felt most strongly by the most vulnerable people (people living in socio-economically deprived areas, older people and young people).

6.1.3. Further HIA appraisal may be undertaken on the preferred route, and in parallel with the EIA, so that this can inform the development of the scheme taken forward. A key part of any future HIA will be to undertake stakeholder engagement to understand people's concerns and perceptions so that these can be taken into account in assessing the potential health impacts of the proposed scheme.