



A Second Runway for Gatwick Appendix

A14

Quality of Life



Gatwick Airport May Submission to Airport Commission: Quality of Life

May 2014

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Gatwick Airport

May Submission to Airport Commission: Quality of Life

May 2014

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CONTENTS

1	INTRODUCTION	7
1.1	BACKGROUND	7
1.2	DEFINING QUALITY OF LIFE AND HEALTH	7
1.2.1	What is Quality of Life?	7
1.2.2	What is Health?	8
1.3	AIMS OF THE QOLA	8
1.4	SCOPE AND STRUCTURE OF THE QOLA	8
2	APPROACH AND METHODOLOGY	10
2.1	COMPONENTS OF THE ASSESSMENT	10
2.2	ASPECTS OF THE SCHEME THAT COULD INFLUENCE QoL	10
2.3	EVIDENCE BASE	11
2.3.1	Community Profile	11
2.3.2	Benchmarking and Review of Other Airport HIAs and QoLA Studies	11
2.4	ASSESSMENT STAGE	11
2.5	MITIGATION MEASURES	12
2.6	CONSTRAINTS AND LIMITATIONS	12
3	HOW THE SCHEME MIGHT INFLUENCE QOL	13
3.1	SCHEME DESCRIPTION	13
3.2	IDENTIFICATION OF SCHEME ELEMENTS THAT COULD INFLUENCE QOL	13
3.2.1	Introduction	13
3.2.2	QoL Domains and Health Determinants	13
3.2.3	Outcomes	15
3.2.4	Receptors	15
3.3	LINKING THE SCHEME WITH QoL OUTCOMES	16
4	COMMUNITY PROFILE	22
4.1	INTRODUCTION	22
4.2	DEFINING POPULATIONS IMPACTED BY GATWICK	22
4.3	GEOGRAPHICAL PARAMETERS OF COMMUNITY PROFILE	23
4.3.1	Local Authority Areas	23
4.3.2	Community Profile	23
4.3.3	Health Profile	24
4.4	SUMMARY	24
5	EVIDENCE BASE	25
5.1	SOURCES OF INFORMATION	25
5.2	QUALITY OF LIFE IN AIRPORT REGIONS (QLAIR) REPORT	25
5.3	REVIEW OF HIAs OF AIRPORTS	27
6	ASSESSMENT OF EFFECTS	29

6.1	INTRODUCTION	29
6.2	NOISE	29
6.2.1	<i>Evidence</i>	29
6.2.2	<i>Approach</i>	33
6.2.3	<i>Air Noise Assessment</i>	36
6.2.4	<i>Ground Noise Assessment</i>	37
6.3	AIR QUALITY	39
6.3.1	<i>Evidence</i>	39
6.3.2	<i>Assessment</i>	43
6.4	SURFACE ACCESS AND LOCAL TRANSPORT NETWORKS	46
6.4.2	<i>Assessment</i>	51
6.5	LAND TAKE	53
6.5.1	<i>Evidence</i>	53
6.5.2	<i>Assessment of Involuntary Relocation</i>	57
6.5.3	<i>Assessment of Changes to Community Facilities</i>	58
6.6	SOCIAL CAPITAL	59
6.6.1	<i>Evidence</i>	59
6.6.2	<i>Assessment</i>	62
6.7	EMPLOYMENT AND INCOME	64
6.7.1	<i>Evidence</i>	64
6.7.2	<i>Assessment</i>	67
6.8	ACCESS TO LEISURE AND ECONOMIC OPPORTUNITIES OVERSEAS	68
6.8.1	<i>Assessment</i>	68
6.9	SUMMARY OF IMPACTS	70
7	MITIGATION	71
7.1	INTRODUCTION	71
7.2	APPROACH	71
7.3	MITIGATING ADVERSE EFFECTS & ENHANCING QoL	71
1	ANNEX A - COMMUNITY PROFILE	76
1.1	POPULATION	76
1.1.1	<i>Size and Age Distribution</i>	76
1.1.2	<i>Ethnicity</i>	78
1.1.3	<i>Religion</i>	79
1.2	EDUCATION, SKILLS AND TRAINING	80
1.3	EMPLOYMENT AND INCOME	82
1.4	TRANSPORT	84
1.5	HOUSING	85
1.6	CRIME	87
1.6.1	<i>Crime and Health</i>	87
1.7	HEALTH OF THE COMMUNITY	89
1	ANNEX B - REVIEW OF HIAS OF AIRPORTS	1

EXECUTIVE SUMMARY

INTRODUCTION

This Report comprises the Quality of Life (QoL) Assessment of the Second Runway Development (R2) at Gatwick Airport, and associated infrastructure. The need to assess QoL was identified in the Commission's Appraisal Framework (Appendix A, Section 11).

There is no single agreed definition for QoL. However, the World Health Organization (WHO) has provided a description which has been used for the purpose of this assessment ⁽¹⁾. QoL is, therefore, understood to be:

"Individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It is a broad ranging concept affected in a complex way by the person's physical health, psychological state, level of independence, social relationships, personal beliefs and their relationship to salient features of their environment."

THE PREDICTED HOLISTIC IMPACT OF THE PROPOSALS ON QoL

As with any infrastructural development, there are both positive and negative impacts identified with respect to R2 and its predicted impact upon QoL. These impacts will be felt across a range of what are known as domains or determinants, explained further within this report, which influence the aggregate perception and experience of QoL for individuals.

Gatwick has sought to strategically and comprehensively address the impact of R2 upon QoL, systematically identifying measures to ensure that negative impacts have been minimised or mitigated, and identified benefits enhanced. The collective or holistic impact of R2 is, therefore, a reflection of how the scheme has been designed and will be both constructed and operated, to maximise its positive contribution to QoL for local and regional communities.

Both in its own right, and relative to the impacts which could reasonably be objectively predicted to arise in alternative additional runway proposals, it can be asserted that Gatwick is positively contributing to QoL both locally and regionally.

(1) Study protocol for the World Health Organization project to develop a Quality of Life assessment instrument (WHOQOL). Qual Life Res. 1993 Apr;2(2):153-9.

PREDICTED NEGATIVE IMPACTS TO QoL AND THEIR MITIGATION

This assessment has identified a range of beneficial and adverse effects on QoL effects, which are described fully within the body of this Report. The effects on QoL predicted are mainly associated with environmental changes arising through the operational phase of R2. These changes include aircraft noise, emissions to atmosphere and ground noise. Such impacts are standard to the operation of any airport and it is recognised that Gatwick is developing a range of mitigation measures to address these impacts, in addition to those which it currently implements. These measures would substantively minimise effects on people in local communities. It is also noteworthy that the scale of identified impacts is predicted to be limited, especially when viewed in the context of background rates of diseases and health outcomes. Relative to the potential scale of what may arise in connection to other airport proposals they are lower in several important respects.

It is recognised that wider effects on QoL are likely to occur prior to construction, commencing, in particular, in relation to anxiety and concerns over the development and the involuntary relocation process. In the case of R2, however, expansion will mainly occur within safeguarded land, which has been the subject of public knowledge, thus reducing uncertainty around the proposals and helping to mitigate and therefore reduce the potential stress and anxiety associated with the development of the airport. In addition, the Sustainable Construction Strategy and construction standards and protocols being developed, should proactively identify and minimise local impacts, anxieties and concerns.

Gatwick has well established and effective stakeholder engagement mechanisms in place, through which it consistently communicates and engages stakeholders in respect to R2. The ongoing emphasis placed upon dialogue with stakeholders will serve to reduce anxiety and stress arising from R2.

PREDICTED BENEFICIAL EFFECTS ON QoL AND THEIR ENHANCEMENT

The assessment identifies that R2 at Gatwick will result in positive impacts and benefits for QoL across the local community, with respect to the six local districts, as well as at a regional level for the south east of England. Key amongst these benefits will be the enhancement of QoL through the impetus which R2 will bring to sustainable economic growth and regeneration in the local districts, South London and the South East. Such impetus will generate benefits for QoL through, for example, enhanced access to employment, investment and regeneration of areas. The impact of this will be greatest, and most beneficial, in those areas with highest socio-economic deprivation, as identified in the Report.

In addition, changes to the social capital of the area are likely to result in changes in QoL. While it is recognised that these changes will need to be adapted to and that this may take time, the measures that Gatwick is planning will assist in maximising benefits and minimising negative impacts. Existing and committed pledges for future community investment, coupled with stakeholder dialogue have the potential to generate significant benefit in this respect.

It is also recognised that at a regional and wider level, the enhanced access to leisure and economic opportunities overseas and sustainable economic stimulus which enhanced connectivity can bring, will also generate benefits to the QoL of the population.

QOL FOR ALL

Beneficial and negative effects on QoL, and on health in particular, will be felt disproportionately by vulnerable groups in the area. These groups include the elderly and very young, those suffering from mental and physical disabilities or ill health and those economically inactive, or experiencing socio-economic deprivation. Conversely, such groups would also receive greatest benefits from the economic, regeneration and positive social capital elements of the Project. As recognised by Gatwick, targeted mitigation, coupled with strong engagement, and the investment and wider economic boost, offers the opportunity to reduce the potential for any negative impacts to be disproportionately experienced and ensure that communities can capitalise upon the range of potential benefits which R2 brings.

1.1 BACKGROUND

Gatwick Airport Limited (Gatwick) is developing its proposal of the Second Runway Development (R2) at Gatwick Airport, and associated infrastructure. Gatwick has commissioned Environmental Resources Management Ltd (ERM) to undertake an assessment of the effects on Quality of Life (QoL) of R2. This Report forms part of Gatwick's submission to the Airport Commission (the Commission).

The need to assess QoL is identified in the Commission's Appraisal Framework (Appendix A, Section 11). The Quality of Life Assessment (QoLA) considers a range of impacts, importantly including impacts to health and wellbeing, to identify how R2 is likely to impact upon specific determinants or aspects of QoL and the aggregate or collective impact of these.

1.2 DEFINING QUALITY OF LIFE AND HEALTH

1.2.1 What is Quality of Life?

There is no single agreed definition for QoL, however, the World Health Organization (WHO) has developed the following description ⁽¹⁾ which has been used for the purpose of this assessment. QoL is, therefore, understood to be:

"Individuals' perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns. It is a broad ranging concept affected in a complex way by the person's physical health, psychological state, level of independence, social relationships, personal beliefs and their relationship to salient features of their environment."

As such, most organisations and researchers, including the WHO, usually use attributes or domains to measure and determine QoL, which include subjective and objective indicators across a range of topics.

In line with the recommendation of the Commission, set out in its Appraisal Framework, this assessment draws upon the domains proposed by the Office of National Statistics (ONS), Measuring National Wellbeing Programme. Within each domain are a number of measures (41 in total) which are measured at the national level to determine the Wellbeing of England. The measures are both subjective (based on questions of satisfaction) and objective (unemployment rates, voting rates, etc).

(1) Study protocol for the World Health Organization project to develop a Quality of Life assessment instrument (WHOQOL). Qual Life Res. 1993 Apr;2(2):153-9.

From the perspective of the airport development the key domains that will need to be considered in the assessment include the economy, the natural environment and health.

1.2.2 *What is Health?*

Impacts to health from developments are often considered in a separate Health Impact Assessment (HIA). Bearing in the mind the nature and extent of overlap between such an assessment and the requirements of the QoLA, considerations of likely health impacts have been incorporated within this QoLA. As with QoL, 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. The recognised definition of health comes from the WHO which states that health is:

“a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity”⁽¹⁾.

1.3 *AIMS OF THE QOLA*

The aims of the QoLA are outlined in *Box 1.1*.

Box 1.1 Aims of the QoLA

- To determine the potential effects on QoL, including health, of R2 on various groups.
- To assess the nature and extent of these effects .
- To identify recommendations to address these effects.
- To inform the Airports Commission’s request for QoL to be considered holistically as outlined in the Commission’s Appraisal Framework.

1.4 *SCOPE AND STRUCTURE OF THE QOLA*

The scope of the QoLA is determined by the aims listed above, along with the methodology adopted, the temporal and spatial areas of influence as well as existing baseline conditions (based on desk top research).

The remainder of this report is structured as follows:

- *Section 2: Approach and Methodology;*
- *Section 3: How the Scheme Might Influence QoL;*
- *Section 4: Community Profile;*
- *Section 5: Evidence Base;*

(1) World Health Organization, (1948), Preamble to the Constitution of the World Health Organization as adopted by the International Health Conference, New York, 19-22 June, 1946

- *Section 6: Assessment of Effects; and*
- *Section 7: Mitigation.*

This assessment is supported by the Community Profile presented in the Community Assessment developed to respond to Appendix A, Section 12 of the Commission's Appraisal Framework, as well as the data presented in *Annex A* of this assessment.

2.1 COMPONENTS OF THE ASSESSMENT

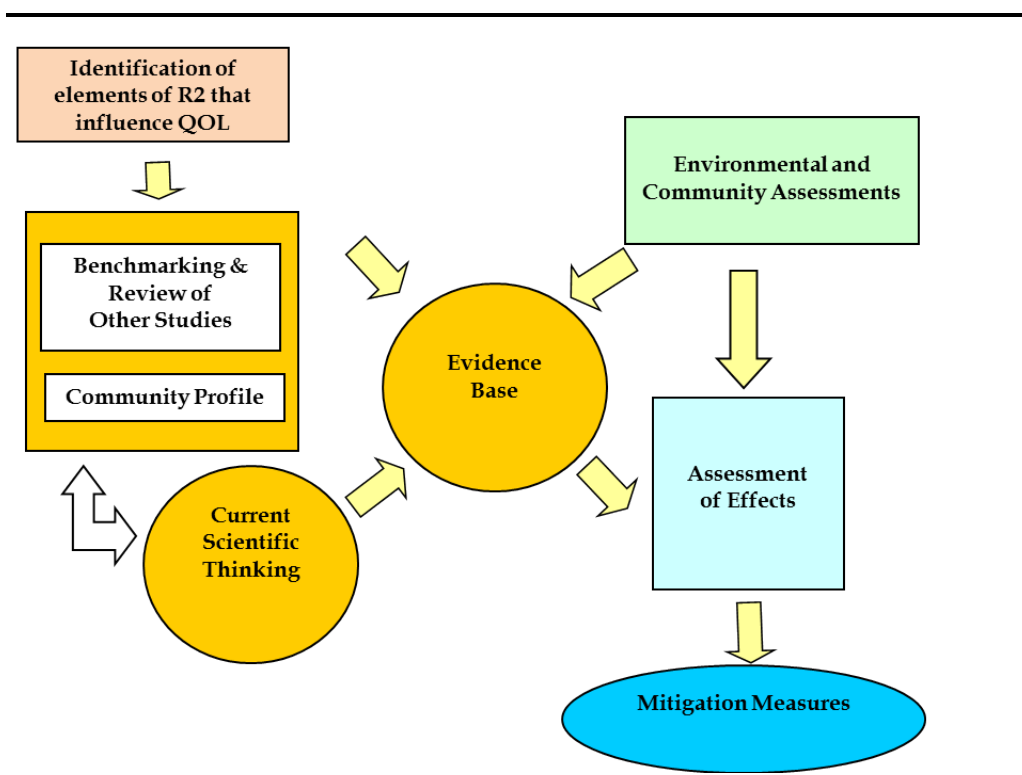
Following the identification of elements of R2 that may impact on QoL the assessment is undertaken. The overarching approach to undertaking the assessment includes the compilation of an evidence base comprising:

- a description of the existing community (community profile);
- review of other QoL assessments and HIAs undertaken; and
- an understanding of the current scientific thinking on key topics.

The evidence base, current scientific thinking and the findings of other assessment strands undertaken to appraise R2 at Gatwick are used as the basis for assessing the likely QoL including health impacts (both positive and negative) of the proposals.

An overview of the approach and its components is presented in *Figure 2.1*.

Figure 2.1 *Approach to Determining what R2 Means for QoL and Health*



2.2 ASPECTS OF THE SCHEME THAT COULD INFLUENCE QoL

The various activities involved in the construction and (initial and mature) operation of R2 which could affect the range of QoL domains have been identified and set out in *Section 3.3*. This stage defines the aspects of the

scheme that may result in potential impacts and the influence these may have upon a range of QoL domains.

2.3 EVIDENCE BASE

2.3.1 Community Profile

The relevant features of the existing population around the airport is described in *Section 4* through the application of national statistics such as the National Census 2011, the Indices of Multiple Deprivation 2010 and the Measures of National Wellbeing (various years), as well as local data sources where available.

The combination of statistics and available survey information develops a picture of existing community susceptibilities and inequalities including pockets of relative deprivation or affluence which is used to inform the assessment and to identify vulnerable groups. It is important to note, however, that this describes the existing community, which will change and evolve over time. As such, it is not appropriate to assess the impact of mature operations against this description. Policies and plans that may contribute to community change are however considered. Elements of the wider population, chiefly airport passengers, that may experience QoL effects, are not described explicitly as it is not possible based on secondary data to describe the socio-economic and health characteristics of this group.

2.3.2 Benchmarking and Review of Other Airport HIAs and QoLA Studies

A high level benchmarking exercise has been undertaken, and described in *Section 5*, which examines other studies of QoL, in particular the Quality of Life in Airport Regions (QLAIR) report ⁽¹⁾, and health in relation to airports that are similar to Gatwick, so as to understand the nature and extent of QoL impacts at other airports and current thinking on potential QoL and health, as a QoL domain, impacts.

2.4 ASSESSMENT STAGE

The assessment stage, presented as *Section 6*, investigates and appraises potential outcomes and benefits, in relation to QoL, incorporating environmental, community and health data to identify groups at risk.

This has been achieved by identifying features of the scheme with identifiable QoL outcomes and applying them in the context of the existing community to assess exposure and sensitivity. Potential impacts were identified and assessed based on the findings of the other appraisal strands (undertaken to

(1) Quality of Life in Airport Regions Report, Main Report December 2009 – Airport Regions Conference Downloaded from <http://arc.techvertising.ro/wp-content/uploads/Main-report-December-20091.pdf>

meet methods within the Commission's Appraisal Framework). The current scientific thinking with regard to the potential QoL impacts associated with the Proposals was considered when undertaking the assessment.

The analysis provides a qualitative judgment, as to the likelihood, magnitude and significance of the potential outcomes.

The assessment is based on a consideration of R2 during construction and in the period 2025- 2050 against the base case of constrained growth in those years. It should be noted, however, that it is not possible to describe accurately the communities (and therefore receptors) in these future years, due to uncertainties of prediction so far into the future. Furthermore, it is not always possible, or appropriate, to outline the nature of an impact during a specific year; rather impacts are predicted to change over time.

Monetisation of potential impacts is presented in the Economic Impact Appraisal.

2.5 *MITIGATION MEASURES*

Section 7 identifies the means of avoiding or minimising negative impacts to promote and maximise any benefits associated with R2. Thus, measures are developed to avoid, minimise, reduce, remedy or compensate for the negative impacts identified, and to create or enhance benefits.

2.6 *CONSTRAINTS AND LIMITATIONS*

There were no major constraints in undertaking the assessment, although the following limitations should be noted;

- Some modelling and environmental analysis is insufficiently developed and detailed at this stage to provide the basis for complete QoL assessment. Such modelling would be commensurate with a full planning application and not the present assessment of proposals.
- The findings of the stakeholder engagement have not been included in this assessment which may have provided additional evidence with regards to community concerns in relation to QoL.

3.1 SCHEME DESCRIPTION

The scheme is described in the 8 Tier 2 documents presented for Gatwick's submission.

This section considers the elements of the scheme which will potentially impact on the QoL of receptors.

3.2 IDENTIFICATION OF SCHEME ELEMENTS THAT COULD INFLUENCE QOL

3.2.1 Introduction

In this section, elements of R2 that could influence QoL including health are identified and presented.

3.2.2 QoL Domains and Health Determinants

R2 may exert an influence on QoL domains and health determinants via 'pathways', which arise from consequences of features of the proposals. Any judgement on the capacity of R2 to influence QoL domains including health determinants has to consider both the levels of exposure in the absence of the scheme and the potential for a change in exposure as a result of the scheme.

QoL Domains

The Office of National Statistics (ONS) Measuring National Wellbeing Programme has identified 10 domains and 41 measures of relevance which determine wellbeing and therefore QoL. The domains are presented in *Figure 3.1* ⁽¹⁾.

(1) Office of National Statistics - Measuring National Wellbeing <http://www.ons.gov.uk/ons/guide-method/user-guidance/well-being/index.html>

Figure 3.1 *ONS Measuring National Statistics - QoL Domains*

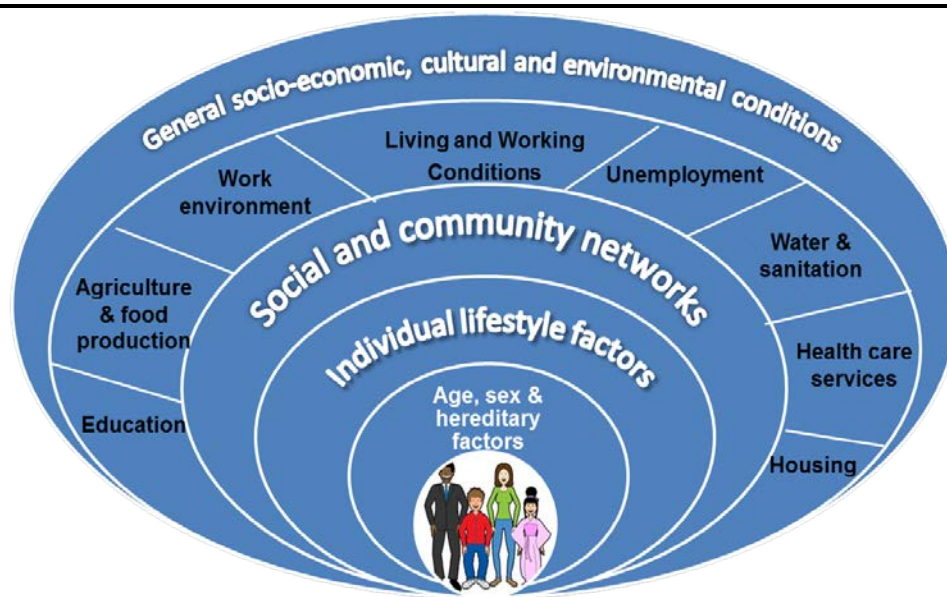


Health Determinants

A health determinant can be any factor which has the potential to influence the health of an individual and/ or the population of a given area. Health determinants are categorised in *Figure 3.2* ⁽¹⁾.

(1) Europa DG Health and Consumer Protection available at http://ec.europa.eu/health/ph_determinants/healthdeterminants_en.htm

Figure 3.2 Health Determinants



3.2.3 Outcomes

Once pathways and their related domains and determinants have been identified, the effect the scheme might have can be evaluated in relation to QoL outcomes.

3.2.4 Receptors

Receptors, referred to as stakeholders in the Commission's framework, define which group(s) of people is most likely to experience the outcome that has been identified. The receptors that have been considered include:

- communities in close proximity to the airport and who experience environmental changes;
- people who experience the social and economic effects of the airport;
- employees at the airport;
- airport users with consideration of type of use (business or leisure); and
- groups that use the various types of surface access with consideration of distance from the airport.

Where appropriate the national level implications of the proposals in terms of QoL are discussed.

These are not mutually exclusive populations and, in many cases, are overlapping. For example, many employees not only live in close proximity to the airport, but may also be airport users. The social and economic effects of the airport extend to relatively distant populations, but are also felt locally.

A summary of the features of R2 and their possible influence on QoL domains and where appropriate health determinants is presented in *Table 3.1*. The table does not draw any conclusions on the *likely* scale or nature of the impacts, but instead provides a basis for the assessment in *Section 6*. The receptors are identified based on the existing community profile, as described in *Section 4*.

Based on the table it is possible to determine the QoL Domains which will be most significantly impacted by R2. These domains include:

- natural environment;
- personal wellbeing;
- health;
- what we do;
- where we live;
- personal finance; and
- economy.

These domains are further considered in the various assessments undertaken in *Section 6* below.

Table 3.1 *R2 Features and Pathways*

Project Feature	Pathway	QoL Domain or Health Determinant	Potential Outcome or Effect	Potential Receptors Affected
CONSTRUCTION				
Construction Activities	Noise	<ul style="list-style-type: none"> Natural Environment Where We Live Health-living and working conditions. 	<ul style="list-style-type: none"> Decreased wellbeing Decreased satisfaction with living conditions in particular satisfaction with accommodation Annoyance 	<ul style="list-style-type: none"> Communities close to construction work Employees
	Emissions to air (including dust)	<ul style="list-style-type: none"> Natural Environment Where We Live Health-living and working conditions. 	<ul style="list-style-type: none"> Increased respiratory diseases short and long term Increased cardio-vascular diseases Nuisance and annoyance due to dust deposition Decreased satisfaction with living conditions in particular satisfaction with accommodation 	<ul style="list-style-type: none"> Communities close to construction work
	Construction traffic movements and impacts on traffic flows	<ul style="list-style-type: none"> Natural Environment Transport Where We Live Health-living and working conditions 	<ul style="list-style-type: none"> Annoyance Increased risk of accidents and injuries up to and including deaths Increase in air quality related health outcomes (as above) Noise outcomes (as above) due to vehicle movements Increased traffic congestion where road network is altered 	<ul style="list-style-type: none"> Communities close to construction work Surface access Employees

Project Feature	Pathway	QoL Domain or Health Determinant	Potential Outcome or Effect	Potential Receptors Affected
Employment Opportunities	Employment and procurement	<ul style="list-style-type: none"> Personal Finance Economy Personal Wellbeing Health- unemployment What We Do 	<ul style="list-style-type: none"> Improved health and wellbeing Improved income levels Procurement of goods and services from local area leading to employment opportunities and associated health benefits Increased income to employees Employment opportunities with associated health benefits National income benefits 	<ul style="list-style-type: none"> Crawley District Horsham District Mid Sussex District Mole Valley District Reigate & Banstead District Tandridge District Epsom and Ewell District Croydon District Arun Worthing Adur Brighton and Hove Lewes Wealden Eastbourne
Land take for proposed runway	Displacement and community severance	<ul style="list-style-type: none"> Health- housing, social and community networks Where We live 	<ul style="list-style-type: none"> Decreased wellbeing Decreased satisfaction with living conditions in particular satisfaction with accommodation 	Those which are in the proposed scheme footprint and live around the airport boundary, especially vulnerable communities such as the elderly, those with reduced mobility, mentally ill, economically inactive etc.
	Reduced access to green space and reduced enjoyment of green space	<ul style="list-style-type: none"> Where We Live Natural Environment Health --living and working conditions What We Do 	<ul style="list-style-type: none"> Decreased mental health/wellbeing Changes to levels of physical activity with associated health and wellbeing implications Decreased satisfaction with living conditions in particular satisfaction with accommodation 	
	Loss or displacement of amenities and services (eg shops, petrol stations etc)	<ul style="list-style-type: none"> Where We Live Natural Environment Health – living and working conditions, social and community networks What We Do 	<ul style="list-style-type: none"> Decreased wellbeing Decreased satisfaction with living conditions in particular satisfaction with accommodation 	

Project Feature	Pathway	QoL Domain or Health Determinant	Potential Outcome or Effect	Potential Receptors Affected
OPERATIONS				
Increased air traffic movements	Increased ground and air noise	<ul style="list-style-type: none"> Education and Skills Housing Physical Environment Where We Live Natural Environment Health- living and working conditions Personal Wellbeing What We Do Personal Finance 	<ul style="list-style-type: none"> Annoyance Reading age delay Sleep disturbance Risk of cardiovascular disease wellbeing Satisfaction with living conditions in particular satisfaction with accommodation House price decreases as a result of planning blight. 	Communities under the air and ground noise contours and close to the airport boundary
	Emissions to atmosphere	<ul style="list-style-type: none"> Where We Live Natural Environment Health- living and working conditions 	<ul style="list-style-type: none"> Increased respiratory diseases short and long term Increased cardio-vascular diseases Decreased satisfaction with living conditions in particular satisfaction with accommodation 	Communities around the airport boundary
	Community disruption due to presence of air traffic	<ul style="list-style-type: none"> Where We Live Natural Environment Health-- living and working conditions Personal Wellbeing 	<ul style="list-style-type: none"> Decreased wellbeing Decreased satisfaction with living conditions in particular satisfaction with accommodation 	Communities close to airport
Surface Access and transport network	Changes to use of road and rail networks leading to increased/decreased congestion	<ul style="list-style-type: none"> Where We Live Health - living and working conditions 	<ul style="list-style-type: none"> Satisfaction Wellbeing 	Local communities
	New infrastructure and services leading to increased/decreased connectivity	<ul style="list-style-type: none"> Where We Live Health - living and working conditions, social and community networks 	<ul style="list-style-type: none"> Satisfaction Access to services, leisure 	Passengers, workforce and local communities
	Journey experience	<ul style="list-style-type: none"> Health- living and working conditions 	<ul style="list-style-type: none"> Change in wellbeing 	Passengers, workforce and local communities
	Physical activity	<ul style="list-style-type: none"> Health- living and working conditions, social and community networks 	<ul style="list-style-type: none"> Cardiovascular disease, obesity 	Passengers, workforce and local communities

Project Feature	Pathway	QoL Domain or Health Determinant	Potential Outcome or Effect	Potential Receptors Affected
	Risk of road traffic accident from increased volumes and/or junction layouts	<ul style="list-style-type: none"> Health- living and working conditions 	<ul style="list-style-type: none"> Injuries and mortality 	Passengers, workforce and local communities
	Influence on transport capacity for other non-airport users	<ul style="list-style-type: none"> Where We live 	<ul style="list-style-type: none"> Satisfaction Local economy 	Local communities
Employment and procurement	Employment Opportunities (Direct and Indirect)	<ul style="list-style-type: none"> Economy Personal Finance What We Do Personal Wellbeing Health - living and working conditions, unemployment 	<ul style="list-style-type: none"> Improved health and wellbeing Improved income levels Procurement of goods and services from local area leading to employment opportunities and associated health benefits Increased income to employees Employment opportunities with associated health benefits National income benefits 	<ul style="list-style-type: none"> Crawley District Horsham District Mid Sussex District Mole Valley District Reigate & Banstead District Tandridge District Epsom and Ewell District Croydon District Arun
	Migration, changing social dynamic in the areas around the airport	<ul style="list-style-type: none"> Economy Personal Finance What We Do Personal Wellbeing Health- living and working conditions, unemployment, social and community networks 	<ul style="list-style-type: none"> Changes in wellbeing Changes in satisfaction with living conditions Changes in incomes and employment profile and associated benefits 	<ul style="list-style-type: none"> Worthing Adur Brighton and Hove Lewes Wealden Eastbourne Employees
Presence of airport	Community concerns/ perceptions and beliefs about the airport	<ul style="list-style-type: none"> Natural Environment Personal Wellbeing Health -- living and working conditions, social and community networks 	<ul style="list-style-type: none"> Changes in wellbeing Changes in satisfaction with living conditions Changes in incomes and employment profile and associated benefits 	<ul style="list-style-type: none"> Crawley District Horsham District Mid Sussex District Mole Valley District Reigate & Banstead District Tandridge District

Project Feature	Pathway	QoL Domain or Health Determinant	Potential Outcome or Effect	Potential Receptors Affected
	Opportunities for leisure travel and business travel	<ul style="list-style-type: none"> • Personal Wellbeing • Health - living and working conditions, social and community networks • Economy • Personal Finance • What We Do 	<ul style="list-style-type: none"> • Changes in wellbeing • Changes in satisfaction with living conditions • Changes in incomes and employment profile and associated benefits 	<ul style="list-style-type: none"> • Airport users • National

4.1

INTRODUCTION

R2 has implications for the QoL for people in multiple populations that are not easily defined by simple geographical or administrative boundaries. These populations, as outlined in *Section 3.2.4* can be thought of in simplified terms as follows:

- communities in close proximity to the airport and who experience environmental changes;
- people who experience the social and economic effects of the airport;
- employees at the airport;
- airport users with consideration of type of use (business or leisure); and
- groups that use the various types of surface access with consideration of distance from the airport.

4.2

DEFINING POPULATIONS IMPACTED BY GATWICK

Airport users are assumed to be drawn from a wide geographical area that encompasses much of south-east England. They are assumed to be broadly representative of the population of England.

People working at the airport are, and will be, resident mainly in the surrounding districts towns and villages. For example in 2012, 32% of Gatwick employees lived in Crawley. Some other employees travel from some distance away. (6% of Gatwick employees travelled from Brighton in 2012, for example). The existence of the major north-south rail route allows current and future employees to reside and commute from locations along this transport corridor and from other places well connected to Gatwick by rail.

The economic activity and impact generated or associated with the airport, both now and in the future, spreads over a wide area, including at the regional and national levels. At the extreme, the overseas or international destinations for Gatwick operators can also be considered as affected by R2. It is not feasible to describe or characterise the population affected at these places. However, it is recognised that R2 will impact upon this wider population and the subsequent assessment identifies such impacts at a generalised or qualitative level.

The population living close to the airport, and therefore directly affected by changes to the local environment, can be described using secondary data. Sufficient data exist in the public domain to provide a comprehensive assessment of those characteristics of the local population that are important for QoL and health. These data are, of course, applicable to the recent past and are therefore only a proxy for the community profile in 2025 and beyond.

4.3 *GEOGRAPHICAL PARAMETERS OF COMMUNITY PROFILE*

4.3.1 *Local Authority Areas*

Most people living close to the airport are resident in Crawley to the south and Horley to the north. Land use to the west and east is mostly rural and the area is sparsely populated. The population around the airport exists in six local authority areas:

- Crawley (the local authority in which Gatwick Airport is situated);
- Reigate and Banstead;
- Mole Valley;
- Tandridge;
- Mid Sussex; and
- Horsham.

For reasons of practicality, therefore, this community profile has been constructed chiefly on the basis of the public domain statistics for these local authority areas. Data and analysis to inform this community profile are provided in Annex A of this report and Community Study. This section of the report is a commentary on the salient features of the data for the QoLA.

4.3.2 *Community Profile*

Most of the socio-economic indicators for five of these local authority areas show that they are distinctly better than the national average. The exception for some indicators is Crawley, which has significantly worse than the England average scores for indicators relating to adult obesity, violent crime, educational performance at GCSE level and homelessness. Of all the districts in the area around the airport, it is the most vulnerable. The Indices of Multiple Deprivation (IMD) figures developed for the Community Profile show this distribution across the six districts quite clearly. This spatial pattern is largely replicated for other indicators, such as self-reported health. Areas of highest deprivation in Crawley are the older neighbourhoods of Bewbush, Langley Green and Broadfield.

By comparison with many other areas in the UK, Crawley has typical values for some of the indicators that relate to health and wellbeing. For example, the unemployment rate at 4.5%, is similar to the national average of 4.4% ⁽¹⁾. It is not significantly disadvantaged in absolute terms, in comparison to the national population, but does contain areas of relative deprivation for the Sussex and Surrey region.

The housing profile for Crawley is quite different to the other local authority areas; with a much lower proportion of houses being owner occupied (59%) and with a lower proportion of people living in detached properties (14%). Values for these indicators are also different to the national average, which

(1) Census 2011

are, respectively, 63% and 22% in the 2011 census. Housing in Crawley is characterised by a relatively high percentage of people living in smaller properties rented from the local authority.

It is likely that this profile of housing will change by 2025 and the draft local plan makes provision for another 3,800 homes in Crawley by this date. Approximately 1,900 of these homes will be in a new settlement called the North East Sector, an area bounded by the A2011, the railway line and the M23 and referred to as Pound Hill. This will be close to the expanded airport boundary and will be a community in its own right and therefore important in the context of health and QoL. Other parcels of land allocated for housing are much smaller and distributed throughout the borough. There is also a provision for another 2,600 homes in Horley.

It might also be anticipated that other housing will be added in the other local authority areas by 2025, even on what is designated as green belt land. A current example of this is Kilnwood Vale, a new housing development to the south west of Crawley in Horsham district. Across Crawley, Horsham and Mid Sussex, there is potential for another 15,400 dwellings on approximately 400 hectares. Population growth in Crawley and Horsham has been strong in recent years, exceeding regional and national rates. This influx of people has implications for the affordability of housing and access to housing, as well as social capital.

4.3.3 *Health Profile*

The most recently published health profiles for all of these local authority areas show very clearly that their populations are healthier than the average for England by reference to almost all the indicators. Life expectancy, for example, is higher than average in all the areas. This is consistent with the data on the Indices of Multiple Deprivation, which show that the area is relatively affluent when taken as a whole. The most deprived areas are found in Crawley, including the ward in which the airport is located. Other wards of similar deprivation levels are found in south west parts of the town.

4.4 *SUMMARY*

In summary, the population living within approximately 15 km of the airport is, overall, healthier and has higher values for measures of wellbeing than the national average. There are notable pockets where this is not the case, however, and parts of Crawley are more deprived than the England average for most relevant indicators. These areas would benefit from the economic boost that R2 would provide, but would also be vulnerable to adverse changes in the housing market, for example, restricted access to housing or reduced housing affordability.

5.1 SOURCES OF INFORMATION

The evidence base used to inform the QoLA has been drawn from the scientific literature and previous studies of impacts on QoL and health of with new or expanding airports. Each of the topics assessed in *Section 6* includes a summary of the current understanding of the related science. Numerous Health Impacts Assessments (HIAs) of airports have been undertaken, although there are no QoLAs, as would be understood by the term QoL defined in *Section 1*.

A report entitled 'A Quality of Life in Airport Regions (QLAIR) ⁽¹⁾ has been completed for several European airports, including Gatwick, and is summarised below. In fact, the content of this report is very much concerned with effects on health, and especially those associated with aircraft noise. A number of publically available HIAs undertaken for airports in the last two decades are summarised in Annex B of this report. The main findings of these HIAs, of relevance this QoLA are outlined below.

5.2 QUALITY OF LIFE IN AIRPORT REGIONS (QLAIR) REPORT

The objective of the report was to collect information on practices in various European airport regions, including around Gatwick, to identify best and worst practices, minimum requirements, innovative approaches, the current and potential role of regional authorities and opportunities for a European approach to the challenges of maintaining QoL.

The report highlights how QoL varies between regions, cities and communities, households and individuals. It can be positively affected by means of economic benefits, employment, domestic and international connectivity and environment, as well as a high service level.

The report highlights that QoL in airport regions is dynamic, as a result of globalisation and the integration of European regions, and issues are changing as airports develop.

Key Issues raised in the QLAIR Report?

The key issues raised in relation to QoL are:

- lack of good information on the airport for communities;
- low quality housing;
- depreciation of property value due to aircraft noise and safety;

(1) Quality of Life in Airport Regions Report, Main Report December 2009 – Airport Regions Conference Downloaded from <http://arc.techvertising.ro/wp-content/uploads/Main-report-December-20091.pdf>

- lack of public services and degeneration of housing areas;
- traffic congestion (including parking nuisance); and
- the shortage of good housing for next generation.

Recommendations

The project identifies how instruments for mitigation, compensation and investments can be used in the areas most affected by airports.

Information and Communication: The report highlights that *“the quality of life of all inhabitants, including potential and new inhabitants in airport regions would be strongly improved if they have timely access to information concerning airport operations”*. The report recommends minimum requirements and industry standards be implemented in the airport regions. It further recommends that *“airport regions have a stakeholders forum or consultative committee for communication on a regular basis, involving relevant stakeholders from local to national level”* along with improvements to their websites to increase access to information and a system for registering complaints.

Spatial planning and Air Traffic Management (ATM): The report recognises a need to integrate air traffic management knowledge in regional policymaking. *“Local and regional planning authorities are encouraged to become more aware of ATM issues at a strategic level. At the same time, it is recommended that ATM providers become more aware of land use planning needs and restrictions”*.

Ground Noise: As airports grow, ground noise becomes an increasingly important issue of noise effects, especially for citizens living and working in the immediate vicinity. It recommends that *“all relevant authorities and airports include ground noise in noise reduction policies”* and emphasises that more innovative ground noise reduction solutions can emerge if airport regions stimulate initiatives for further scientific research.

The QLAIR project recommends:

- *“a common definition/harmonisation on EU-level regarding ground noise...;*
- *further research on the negative effects of ground noise (annoyance and health) and on the causes and circumstances;*
- *an analysis of dose-effect;*
- *harmonised methods for measurement/calculation*
- *implementation of tailor made (technical) solutions based on the research based on results of research tailor made (technical) solutions.”*

Governance: The report identifies three main issues that affect QoL in relation to governance which are interlinked and require innovative governance structures.

- optimal land use frameworks;
- the effectiveness of mitigation policies; and
- local investment projects.

It states that improving QoL in airport regions is a matter of governance and provides a number of recommendations for regional authorities and the EU to include QLAIIR issues in current and future policies. *“Land use planning in airport regions optimises economic development potential while ensuring that land-use conflict with airport operations is minimised”*.

“Regional and local authorities are encouraged to improve timely implementation of mitigation policies” and tailor made public investments should be developed to improve social cohesion.

5.3

REVIEW OF HIAs OF AIRPORTS

The publicly available HIAs, as undertaken for a number of airports across a range of geographies and regulatory regimes, were reviewed. Not all the potential impacts raised in these HIAs are of relevance to R2, because they would exert only marginal or no effect on QoL or due to varying regulatory or permitting requirements. The following potential health impacts were consistently identified across the HIAs reviewed and related to the R2 features and pathways presented in *Table 3.1*

- noise associated with the increased aircraft movements leading to annoyance, changes in cognitive performance and changes to children’s reading age development;
- decreased air quality and associated health concerns including cardiovascular and respiratory diseases.
- access to housing;
- house prices;
- changes in access to community facilities and recreational space due to roads etc and severance of communities;
- the need to manage surface access issues;
- increase risk of transport (road, rail and air) related accidents;

- socio-economic benefits at the local and regional level including employment and income opportunities and regional regeneration; and
- decreased wellbeing associated with stress and anxiety and changes in risk perception.

The main recommendations of relevance include:

- Establishing of an airport health impact group as part of the regulatory framework of the airport to advise on health issues and deal with unexpected health outcomes.
- Coordinate community support programmes through health partnerships.
- Monitoring of range of health outcomes including road traffic accidents, respiratory diseases, cardiovascular diseases etc to determine the extent of any change in baseline health following the construction of the airport.
- Supporting the provision of noise insulation in schools and homes to minimise exposure to noise.

The reports also indicate the importance of stakeholder engagement and the need for good information from the airport about plans which is clear and transparent and allows communities and other airport users to prepare for change over time.

6.1 INTRODUCTION

The assessment reports a variety of QoL and health outcomes, ranging from outcomes that can be monetised or quantified to those that are, of necessity, qualitatively described. In response to the anticipated most significant impacts of R2 on QoL, this assessment has focused on air noise, ground noise, air quality, surface access, land take, social capital and employment and income effects. The noise, air quality, place and community workstreams, along with the business case and economic assessments have been drawn upon to inform the QoLA.

The assessment recognises that the QoL and health of a population should be viewed comprehensively across the range of indicators, but the approach chosen represents a practical one, given the complexity of the task.

6.2 NOISE

6.2.1 Evidence

Noise can be defined as unwanted sound, or more precisely as sound that causes disturbance, impairment or health damage. Adverse effects occur when the activities of an individual are disturbed by the intrusion of noise; through its timing, its duration or its intensity. Noise may arouse feelings of disturbance, irritation, displeasure and nuisance, which may be described by the term 'annoyance'. Until relatively recently, annoyance was considered to be the principal adverse health effect resulting from environmental noise, with implications for the mental and social wellbeing of individuals. It has now been established by several researchers that annoyance is likely to be the base of a pyramid of noise-related effects within a population, increasing in severity and with mortality at its apex.

For a given population exposed to sufficient noise, many people will develop adverse feelings, causing stress reactions and sleep state changes. In turn, these may increase risk factors like blood pressure and influence the endocrine system. For a small part of the exposed population, these factors may then result in clinical symptoms such as insomnia and cardiovascular diseases. As a consequence, these effects can increase the mortality rate by a small amount.

This model of health effects is attributable to Babisch ⁽¹⁾ and has been well summarised by the European Environment Agency (EEA) ⁽²⁾.

(1) Babisch W (2002) The noise/stress concept, risk assessment and research needs Noise Health 4(16) 1-11

(2) European Environment Agency (2010) Good practice guide on noise exposure and potential health effects EEA Technical Report No 11

A number of health outcomes have exposure response-relationships with noise that are supported by sufficient evidence to be used in this assessment. These are:

- annoyance;
- sleep disturbance;
- cardiovascular responses (myocardial infarction and hypertension); and
- cognitive responses in school children.

These individual outcomes are considered in turn below.

Annoyance

Annoyance is highly subjective and individual responses will vary markedly across a population. As a result, academics, noise experts and HIA practitioners have found it difficult to devise objective criteria that define the degree of annoyance.

A long-standing relationship between the exposure to aircraft noise and annoyance in an exposed population is the Aircraft Noise Index Study (ANIS), based on the responses of 2097 people in small areas around UK airports in the summer of 1980. This work was commissioned by the Department for Transport (DfT). The results of the survey can be expressed as the percentage of those respondents who were 'very much bothered or annoyed by aircraft noise' related to a measure of noise expressed as Leq 16 hours. When plotted in this way, there is a clear increase in annoyance with exposure to noise, which is approximately linear above 57dB, but was also described mathematically as a logarithmic fit to the data ⁽¹⁾. The ANIS study is the basis for asserting that 57 dB is a lower threshold for annoyance. This assertion has since been challenged by the more recent Attitudes to Noise from Aviation Sources in England (ANASE) study commissioned by DfT and completed in 2007, which suggested that annoyance is experienced at lower noise levels, around 50 dB Leq. Further, the authors of the ANASE study described what they perceived as a shift in attitudes towards noise since the ANIS study, suggesting that tolerance to aircraft noise was diminishing. The conclusions of ANASE have not been universally accepted, although some elements of the findings have been recognised for use by the Interdepartmental Group on Cost and Benefits ⁽²⁾ in relation to the valuation of amenity.

The WebTAG approach to the consideration of noise as an annoyance, and hence as a factor to be evaluated and accounted for in economic terms, suggests that a lower threshold to be used in any assessment is 45 dBLeq 18 hours. This is based on a 'willingness to pay' measure of avoidance on the part of people surveyed. This is largely based on exposure to road and rail noise, however.

(1) Percent highly annoyed = $100 / (1 + \exp(13.2 - 0.19 \text{Leq [16-hour]}))$

(2) IGCB (2008) An Economic Valuation of Noise Pollution – developing a tool for policy appraisal. First report of the Noise Sub Group. Published by Defra

Sleep Disturbance

Sleep disturbance is a form of annoyance, but is also more directly related to physical symptoms of ill health and also impaired performance the following day; in the workplace, for example. Repeated disturbance can also result in insomnia.

Sleep can be affected in a number of ways. The most obvious is awakening, which is the most easily measurable, but the structure and quality of sleep is also important for health. Sleep is thought to provide an important restorative function and interference with sleep, or deprivation of sleep, is likely to have an impact on the health of an individual. From a lay perspective, it is easy to recognise that any impact on sleep will have consequences for physical or mental health, although the precise mechanisms for any effects are not yet fully understood and evidence is hard to acquire. Individual responses to noise are highly variable and measuring the response to external noise presents some difficulties for researchers. These difficulties have not prevented many studies being carried out, however, and the literature on this subject is extensive. Effects are reported on the basis of measurements made in controlled laboratory conditions as well as self-reported sleep disturbance by volunteers. Part of the complexity lies in the fact that arousal can be measured as a full awakening or as a change of electrical activity in the brain. Another factor is that it is normal for most people to 'awaken' during the course of a night's sleep regardless of external stimuli.

Establishing exposure-response relationships for sleep disturbance is not straightforward and there is no universally agreed method of quantifying the effect, although such relationships do exist. One form of relationship adopts the average noise exposure over the night time period as the metric for noise exposure, as used by the European Commission ⁽¹⁾ on the basis of results reported by Miedema ⁽²⁾. Even this work, however, recognises that it is actually noise events that trigger a response and another metric for noise would be the sound exposure level (SEL) associated with the passage of an aircraft overhead. There is some consensus that a noise level of around 90 dB SEL is the threshold at which measurable arousal during sleep occurs for most people.

Cardiovascular Responses

Disturbance of sleep may be one pathway by which noise may affect the cardiovascular system, through increases in blood pressure, for example. As noted earlier, there may also be pathways relating to annoyance causing stress and in turn influencing blood pressure. These linkages are biologically plausible. More importantly, there is also a growing body of epidemiological evidence that relates exposure to noise with cardiovascular health outcomes, as recorded by the health care system. One such major study was the HYENA

(1) European Commission (2004) Position Paper on Dose Effect Relationships for Night Time Noise Working Group on Health and Socio-economic Aspects

(2) Miedema H M E and Vos H (2004) Self reported sleep disturbance caused by aircraft noise TNO-INRO Delft

project ⁽¹⁾, (Hypertension and Exposure to Noise near Airports) in which the incidence of hypertension was examined in 4861 residents around six major European airports (one of which was Heathrow). This study demonstrated that the odds ratio for hypertension increased with noise, measured as Leq 16 hours and Lnight, both for road traffic and aircraft noise, with a stronger relationship for aircraft and at night.

This result has been since been corroborated by other studies, as reported in the EEA Good Practice Guide ⁽²⁾. An association between hypertension and noise would be one pathway that could explain the observed associations between exposure to noise and coronary related health outcomes, notably acute myocardial infarction, ischaemic heart disease and strokes. A recently published study on the incidence of coronary heart disease, cardiovascular disease and stroke around Heathrow airport has shown a statistically significant relationship with exposure to aircraft noise. The study used statistics on hospital admissions and mortality at the super output area level and census area level to investigate the association with exposure to aircraft noise, as modelled by the Civil Aviation Authority (CAA) using a 10m x 10m grid size. Significant, positive relative risks were found for coronary heart disease, cardiovascular disease and strokes, as measured by hospital admissions and mortality. The relative risk became more apparent at daytime noise levels of approximately 60 dB Leq 16 hr and above, being about 1.2 and greater for noise levels in the range 60-70 dB. This result is consistent with earlier work reported by Babisch ⁽³⁾ on myocardial infarction and traffic noise.

Cognitive Responses in School Children

Another aspect of aircraft noise and health that has been the subject of extensive research is the effect on children's cognitive performance at schools. The hypothesis is that the noise event caused by an aircraft passing over a school is sufficient to cause a distraction and thereby disrupt the learning process. Several notable studies have investigated this aspect of aircraft noise, including the switching of airport location at Munich (1998), the West London Schools Study (2000) and the Schools Environment and Health study around Heathrow airport (2001). Perhaps the largest and most influential is the RANCH project, which examined the performance of primary age schoolchildren around three airports (Heathrow, Madrid and Schipol). This cross sectional study enrolled a total of 2844 pupils aged 9-10 years at 89 schools, some of which were exposed to aircraft noise and some of which were in 'control' schools away from the airports. The key result ⁽⁴⁾ was a clear linear association between reading comprehension and exposure to aircraft noise. A similar effect was not observed for exposure to road noise,

(1). Jarup et al Hypertension and Exposure to Noise near Airports – the HYENA study Environmental Health Perspectives 116 329 -333

(2) Good Practice Guide on Noise Exposure and Potential Health effects ISSM 1725-2237 EEA Technical Report No 11/2010 European Environment Agency

(3) Babisch W et al (2005) Traffic noise and risk of myocardial infarction Epidemiology 16(1) 33-40

(4) Stansfeld et al (2005). Aircraft and road traffic noise and children's cognition and health: a cross national study. The Lancet 365: 1942-49

suggesting that a constant source of noise has a lesser or no impact on cognitive performance.

The outcome of the RANCH study, supported by the previous studies, indicates that the effects of aircraft noise could be quite important for children's learning, which in turn is important as a long-term determinant of health. It is not yet known if the observed effects are permanent or can be reversed at a later stage in education. A follow up study was carried out of the London schoolchildren involved in RANCH, aged 15-16 years ⁽¹⁾. The results of this study are inconclusive with regard to reading comprehension; no association with exposure to aircraft noise was found. The authors believe this to be a function of the relatively small sample size compared with original cohort used.

6.2.2 *Approach*

Overview

The Airports Commission appraisal framework for noise requires the following health impacts to be quantified and then monetised in the Economic Impact Assessment prepared for R2.

- Annoyance
- Sleep disturbance
- Acute Myocardial Infarction (AMI), and hypertensive strokes and dementia.

The assessment appears in the aircraft noise appraisal and the key points are replicated here. Impacts on cognitive performance impacting learning in schools should also be quantified, in light of the evidence base summarised above.

The methodology used to estimate the changes in annoyance, sleep disturbance, AMI, hypertension, strokes and hypertensive dementia follows that set out in the Airports Commission appraisal framework.

The key assumptions made in applying these methods are outlined in the relevant sections below for each health outcome.

Additional noise from R2 has been assessed for the future year, 2040. It is recognised that the populations living around the airport will increase in the future, but with the exception of the Crawley NE Sector that has been included in the base case 2040 population, it has not been possible to account for changes in the future populations within the various noise exposure bands.

(1) Clark C et al (2013) Longitudinal effects of exposure to aircraft noise on children's health and cognition: a six year follow up study of the UK RANCH cohort Journal of Environmental Psychology 35 1-9

Annoyance

Annoyance has been estimated using the dose response relationship for aircraft given in WHO Burden of Disease from Environmental Noise report ⁽¹⁾ (WHO 2011). The relationship estimates the percentage of people Highly Annoyed (HA) as a function of noise exposure in terms of Lden. Noise levels above Lden 55 dB have been used.

It is likely that in many locations, such as in northern Crawley, ambient noise levels will be above the levels of aircraft noise. In these locations, the additional annoyance response from aircraft would be reduced.

Sleep Disturbance

The degree of sleep disturbance has been estimated by calculating the number of people Highly Sleep Disturbed (HSD) using the dose response relationship for aircraft given in WHO 2011, as specified in the Airports Commission's appraisal framework. The method provides a dose response relationship; HSD as a function of L_{Night}. Noise levels above L_{Night} 45 dB have been used. The dose response curve is based on self-reported sleep disturbance and may not accurately reflect the effects of sleep loss (because people's perception of sleep loss tends not to be particularly accurate). Individual noise events (which can trigger instantaneous effects such as arousals, awakenings and elevated motility) may be used to define a more reliable dose response relationship than L_{Night}.

Acute Myocardial Infarction

The likely number of AMIs due to the increase in aircraft noise exposure has been calculated using the method laid out in Environmental Research and Consultancy Department (ERCD) report 1209 ⁽²⁾ as specified in the Airports Commission appraisal framework. The method draws on research from Babisch and research reported by the WHO and gives a dose response function as an odds-ratio (OR) for AMI from L_{Aeq 16 hr} 55.5 to 67.5 dB. This OR is then multiplied by a generic AMI risk of 0.059% per year for the affected population (in 3 dB noise exposure level bands) to predict AMIs per year as a result of the additional noise due to R2.

Hypertension

The likely increase in hypertensive strokes and dementia due to the increase in aircraft noise exposure has been calculated using the method laid out in ERCD report 1209 as specified in the Airports Commission appraisal framework. Reference was also made to further research on quantifying the links between noise and related hypertension health effects referred to therein.

(1) Burden of Disease from Environmental Noise. Quantification of healthy life years lost in Europe. World Health Organisation 2011.

(2) ERCD Report 1209. Proposed Methodology for Estimating the Cost of Sleep Disturbance from Aircraft Noise. Environmental Research and Consultancy Department. TSO 2013.

The ERCD report gives a general odds-ratio for hypertension as a function of L_{Night} above a threshold of 50dB. It also gives a threshold of L_{DEN} 55dB for such effects and gives separate equations for hypertensive strokes and hypertensive dementia as a function of noise level above this base threshold. The ERCD report gives a dose/response for each effect for a generic sex/age population that is considered a reasonable approximation in this case. The effects have been calculated for the populations in 5 dB bands in the range L_{den} 55 – 75 dB, to predict the additional cases of strokes and hypertensive dementia as a result of the additional noise due to R2. Additional cases of each effect that could arise in people already suffering from hypertension are mentioned in reference 10 of the ERCD report, but not required in the ERCD report, so have not been included.

Learning in Schools

The Airports Commission appraisal framework does not suggest a method for assessing this effect. This aspect of aircraft noise and health has been the subject of extensive research as outlined above.

The outcome of the RANCH study, supported by the previous studies, indicates that the effects of aircraft noise could be quite important for children's learning, as measured by reading age, which in turn is important as a long term determinant of health. To apply this research directly to R2 requires an assumption that the difference in noise levels indicated by the comparison of the "with development", and "without development" scenarios is brought about over a much shorter time period than would actually be the case. This assumption implies that the effects on reading age are likely to be worst case.

The key output from the RANCH study shows an influence on reading score over the range 40 dB to 70 dB L_{eq} . At noise levels below 50 dB L_{eq} it is difficult, in practice, to distinguish accurately aircraft noise from background noise. In addition, at noise levels approaching 40 dB L_{eq} the uncertainty in the aircraft noise model predictions increases. It is not possible, therefore, to apply this methodology for schools experiencing an exposure of L_{eq} 50 dB or less without introducing major uncertainties in the results. Only schools, therefore, which are exposed to air noise levels of 50 dB or more are included in the assessment.

Schools where the change in noise exposure is less than 2 dB are discounted from the assessment.

- *QoL Domain:* Natural Environment, Where We Live, Education and Skills, and Health.
- *People Affected:* Some communities in proximity to the airport and who experience significant changes in noise exposure and Employees.
- *Link to other AC Framework Modules:* Noise (Air Noise).
- *Duration of Impact:* initial and mature operations.
- *Summary:* The predicted changes in aircraft noise arising from increased flights would lead to small increases in the number of people experiencing a range of health impacts, including annoyance, sleep disturbance, AMIs, hypertension and cognitive learning in schools. These impacts are small in relation to the background incidence of these health outcomes and would be far less than for an additional runway in a more densely populated area.

The assessment of additional noise from R2, for the future year 2040, is summarised below. Further details are provided in section 3.4 of the Air Noise Report ⁽¹⁾ which gives details of the analysis of health effects, in most cases tabulating the population exposure in the relevant noise bands and quantifying the effects in 2040, relative to the constrained growth scenario. These can be summarised as follows.

Annoyance

The analysis indicates that R2 would create an increase in the population described as 'Highly Annoyed' by aircraft noise of approximately 4,200 people. This result should be taken in context that the main source of annoyance for these people from noise in the study area is currently road traffic.

The Air Noise report gives an analysis indicating the effect for the proposed third runway at Heathrow would be several times higher due to the smaller number of people that reside under the noise contour, notably the 57dB noise contour.

Sleep Disturbance

The analysis indicates that R2 would create an increase in the population described as 'Highly Sleep Disturbed' of approximately 2,300 people. As with the annoyance results, this estimate should be taken in context of the effects of other noise eg road traffic noise on nearby roads in the base case.

(1) Gatwick Airport. May Submission to Airport Commission: Air Noise. 2014

Acute Myocardial Infarction

The analysis indicates that R2 would create an increase in the annual number of AMIs due to aircraft noise by approximately 0.1 (or one additional AMI every 10 years). This estimate should be taken in the context of the overall incidence of AMIs in the south east of England, which was 82 per 100,000 in 2010, according to the British Heart Foundation.

Hypertension

The analysis indicates that R2 would create an increase in the annual number of hypertensive strokes due to aircraft noise of approximately 0.6.

The analysis indicates that R2 would create an increase in the annual number of people with hypertensive dementia due to aircraft noise of approximately 0.9.

As with AMI, these estimates should be taken in the context of the base levels of these effects in the study area. The additional effects due to noise are small because noise exposure is increased in low level exposure bands where the dose-response relationship is weak ie in areas where the existing noise levels are low and predicted increases in noise do not result in significant increases (see the Air Noise Report for details). Hypertensive effects become more prevalent at much higher noise levels, then those predicted for R2, such as those that are experienced by residents living close to a main road.

Cognitive Learning in Schools

There are 20 schools where predicted noise levels in 2040 with R2 are expected to be above $L_{eq\ 16\ hr}$ 50dB. The Air Noise Report lists these.

There are 14 schools where the predicted noise increase would be sufficient (more than 5dB) to imply at least 2 months delay in reading age development. These comprise one junior school, 3 primary schools, 1 infant school, 1 pre-school and 8 pre-schools/nursery/playgroups. Whether or not these schools are all sensitive to noise (for example, nurseries and those on noisy roads may not be), should be considered in future studies.

6.2.4

Ground Noise Assessment

- *QoL Domain:* Natural Environment, Where We Live, Education and Skills, and Health.
- *People Affected:* Communities in proximity to the airport and who experience environmental changes and Employees.
- *Link to other AC Framework Modules:* Noise (Ground Noise)

- *Duration of Impact:* construction, initial and mature operations.
- *Summary:* Construction would generate some additional noise, but it is envisaged that the impacts can be managed adequately. R2 will unavoidably increase the overall numbers of properties and residents exposed to ground noise, as compared to the existing single runway. To the northwest, however, ground noise is predicted to be significantly less for the R2 development cases than for the 2040 Base Case.

In addition to noise produced by aircraft in flight and on the main runway, noise from ground level activities, 'Ground Noise' has been modelled and assessed, and reported in the Ground Noise Report that accompanies the Gatwick submission.

The road traffic noise assessment predicts impacts out to around 400m from the line of the A23 diversion. Many, if not all, of the properties within this distance will have qualified for additional noise insulation and other forms of compensation for increased air noise, so reducing the potential health impacts.

The aircraft ground noise assessment shows that to the northwest of the airport aircraft ground noise is predicted to be significantly less for the R2 development cases than for the 2040 Base Case.

In many areas to the south of the airport, aircraft ground noise is predicted to be significantly higher with R2. However, most of these areas will benefit from the proposed noise bunds around the western end of the airport and the noise wall around the south eastern corner of the airport in addition to the enhanced noise insulation and additional financial compensation schemes, so reducing the potential health impacts.

The package of embedded and additional mitigation proposed by Gatwick Airport Limited is more generous and more affordable than any similar package currently offered at any other airport in England. This is partly a consequence of the generally higher noise efficiency of Gatwick Airport because of its favourable location.

Whilst the construction work to build the new runway facilities would inevitably generate some additional noise, it is envisaged that the impacts can be managed adequately.

Considered overall, while it must be acknowledged that R2 will unavoidably increase the overall numbers of properties and residents exposed to ground noise as compared to the existing single runway airport, the absolute numbers of properties and residents likely to be exposed would be far less than for an additional runway in a more densely populated area, such as Heathrow. The health impacts will also be far smaller.

Sources of Evidence

The scientific evidence for exposure to air pollutants being responsible for health effects has advanced considerably in the last two decades, stimulated by a large body of epidemiological evidence. Such studies, by their nature, reveal associations between exposure and health outcomes, rather than causality, and the search for causal mechanisms continues. Nevertheless, for the purposes of considering health outcomes within the QoLA, the evidence base for some pollutants is considerable and the practice of quantification is now well established.

The scientific literature on this subject is much too large to review here. Fortunately, a number of authoritative reviews exist from which the key points can be summarised. The Committee on the Medical Effects of Air Pollutants (COMEAP) has carried out a series of thorough analyses of the literature and has recommended values for the relative risk of certain health outcomes associated with exposure to air pollutants, notably PM_{2.5} and premature mortality. The most recent of these reports quantified the health burden of exposure to PM_{2.5} at a national level and also the future benefit of reducing PM_{2.5} concentrations ⁽¹⁾. Following publication of this Report, COMEAP has made a helpful statement on the application of this methodology at a local level ⁽²⁾. Very recently, the methodology has been applied to all local authority areas of the UK on behalf of Public Health England (PHE)³.

Prior to these documents being published, COMEAP also produced a report ⁽⁴⁾ that reviewed the available evidence on the mortality effects of long term exposure to all pollutants, including PM₁₀, CO, NO₂ ozone and sulphates. PM_{2.5} was found to be the dominant influence and much of the review is devoted to the science showing the effect of this pollutant.

A panel of leading experts in the field has reviewed the evidence on health effects of the most common air pollutants for the WHO. Their findings have been published as part of the Review of Evidence on Health Aspects of Air Pollution (REVIHAAP) project ⁽⁵⁾. This comprehensive review of the literature has examined many aspects of the health effects of short term and long term exposure to a variety of pollutants in a format that addresses 26 questions of

(1) COMEAP (2010) The Mortality Effects of Long-Term Exposure to Particulate Air Pollution in the United Kingdom. A report prepared by the Committee on the Medical Effects of Air Pollutants. Available at: <http://www.comeap.org.uk/>

(2) COMEAP (2012) Statement on Estimating the Mortality Burden of Particulate Air Pollution at a Local Level. Available at: <http://www.comeap.org.uk/>

³ Gowers A M Miller B J and Stedman J R (2014) Estimating Local Mortality Burdens Associated with Particulate Air Pollution A report prepared for Public Health England (PHE-CRCE 010)

(4) COMEAP (2009) Long Term Exposure to Air Pollution: Mortality Effects Available at: <http://www.comeap.org.uk/>

(5) WHO (2013) Review of Evidence on Health Aspects of Air Pollution – REVIHAAP Project. A Technical Report. The WHO European Centre for Environment and Health, Bonn.

relevance to policy makers. In particular, it is notable for examining the evidence relating to NO₂ and the role this pollutant has in acting directly on human health. For quite some time, many researchers have speculated that NO₂ does not of itself exert any effects on health and that, instead, any health outcomes associated with NO₂ exposure in epidemiological studies are observed because NO₂ is acting as a marker for other pollutants.

Quantifying Effects

Concentrations of NO₂ are strongly related to road transport emissions, as are other pollutants such as PM_{2.5} and ultrafine particles. Isolating the effect of a single pollutant therefore becomes very difficult to do in an unambiguous way. A number of plausible mechanisms have been proposed that would explain why PM_{2.5} causes mortality, especially through promotion of cardiovascular disease. It is much less obvious why NO₂ should be a similar agent of damage to the cardiovascular system or be the cause of cancers.

The WHO review provides an opinion on the role that NO₂ plays and is clear that the basis for the current WHO guidelines for NO₂ concentrations is strengthened. The authors were less persuaded, however, that NO₂ is as responsible for mortality effects as is PM_{2.5}. They concluded that there was some evidence that NO₂ was associated with respiratory hospital admissions for short term exposure. There was more uncertainty regarding all-cause mortality (short term exposure), bronchitic symptoms in asthmatic children and still more uncertainty for cardiovascular hospital admissions, asthma prevalence and all-cause mortality (long term exposure).

This study is concerned primarily with those pollutants that will be emitted in significant quantities from R2 and which have potential consequences for human health effects. These are PM_{2.5}, PM₁₀ and NO_x (which produces NO₂). Other pollutants would be present only in very small additional concentrations that would have no adverse consequences for human health.

Methodologies for quantifying the health effects of these pollutants have become well established and rely on the increase in relative risk of the incidence of certain health outcomes for a given level of additional exposure. As referred to above, the most convincing evidence relates to the mortality effect of the long term exposure to PM_{2.5}. Based on the studies carried out by the American Cancer Society, but supported by many other similar studies around the world, COMEAP proposes that the risk coefficient for all-cause mortality for long term exposure to an additional 10 µg m⁻³ of PM_{2.5} is 1.06, ie a 6% increase in the underlying all-cause mortality rate for every additional 10 µg m⁻³.

COMEAP recommends that the outcome is best expressed as a loss of life years, rather than simply as attributable deaths, because the effect of the exposure is to shorten life and it is not the sole cause of death for a specific number of individuals. The deaths are also more likely to occur at ages for typical deaths and not in young adults. The resulting estimate is one of total mortality in a population, but can be expressed as 'an effect on mortality

equivalent to X deaths at typical ages', if this is preferred. A typical shortening of life for such people is estimated at nearly 12 years. (COMEAP estimates that the total loss of 'life survival time' for the Great Britain population is 340,000 years for the current anthropogenic concentration of PM_{2.5} averaged across the country in 2008. This loss of life years is estimated as being equivalent to 29,000 deaths in 2008, but this is not the same as saying that 29,000 people died in 2008 as a consequence of exposure to PM_{2.5}. PM_{2.5} contributes to, rather than causes entirely, the deaths of individuals.)

Another way of expressing the risk coefficient is to say that it is equivalent to a loss of life expectancy of approximately 20 days for each member of a birth cohort exposed to an increase in long term PM_{2.5} of 1 µg m⁻³ (over a lifetime). This allows for a simple calculation to be made of the mortality impact of the additional PM_{2.5} from R2, if the resulting additional concentration is expressed as a population weighted mean over a particular area and the result expressed purely for that population on a per person basis. Making certain simplifying assumptions, this could be aggregated as a loss of life years for that population.

For the other pollutants, relative risk coefficients have also been proposed and used in quantification studies. Those recommended by COMEAP are summarised below in *Table 6.1*

Table 6.1 *Coefficients for Quantifying Health Outcomes, as recommended by COMEAP*

Health Outcome	Increase (based on Relative Risk) ⁽¹⁾	Pollutant	Exposure increase
<i>Particulate Matter</i>			
Change in mortality hazard	6%	PM _{2.5}	10 µg m ⁻³ as long term average
All cause mortality	0.75%	PM ₁₀	10 µg m ⁻³ as a 24 hour mean
Cardiovascular hospital admissions	0.8%	PM ₁₀	10 µg m ⁻³ as a 24 hour mean
Respiratory hospital admissions	0.8%	PM ₁₀	10 µg m ⁻³ as a 24 hour mean
<i>Nitrogen Dioxide</i>			
Respiratory hospital admissions	2.5%	NO ₂	50 µg m ⁻³ as a 24 hour mean
1) Relative Risk: The relative risk estimates the magnitude of an association between exposure and disease and indicates the likelihood of developing the disease in an exposed group relative to those who have not been exposed. It is defined as the ratio of the incidence of disease in the exposed group divided by the corresponding incidence of disease in the non-exposed group.			

Source: <http://www.comeap.org.uk/air/public-health-and-policy-development/100-quantifying-the-health-effects-of-air-pollution>

As discussed above, the basis for quantifying mortality effects from the lifetime exposure to PM_{2.5} is strong and well established, based on 'cohort' studies, ie carefully following the status of a large number of individuals over a long period of time. COMEAP is of the view that these studies do not reveal anything about the effects of long term exposure on other health outcomes,

other than death. Further work is needed to understand the possible relationship between exposure to fine particles and the prevalence of chronic respiratory disease. A very recent example of a meta-analysis of data relating acute events to long term exposure is the European Study of Cohorts for Air Pollution Effects (ESCAPE), which has enrolled 100,166 people in several countries between 1997 and 2007. Of this cohort, 5157 participants experienced a coronary event. The meta-analysis has been reported by Cesaroni et al ⁽¹⁾. The authors identify significant associations of coronary events with PM_{2.5} and PM₁₀, but not with NO₂.

The association of acute effects with exposure to a number of air pollutants has been extensively investigated through 'time series' studies, in which health events are correlated with peaks in air pollutant concentrations. These events are most easily identified as hospital admissions and deaths. Other measures have been investigated by some researchers, such as GP consultations and working days lost, but these are more uncertain in their relationship with air pollution and COMEAP does not recommend any coefficients for such measures of morbidity.

The coefficients given above in *Table 6.1* for acute events are also those used by COMEAP in its 1998 quantification of health effects ⁽²⁾. By making the assumption that the relationships were linear and without a threshold of effect, they were applied to annual average concentrations maps of PM₁₀ and NO₂ across urban areas of Great Britain in order to quantify the number of additional deaths and hospital admissions attributable to these pollutants. With some qualifications, this methodology can also be applied at the local scale for a particular development.

Economic Impacts

The underlying thinking and evidence on the effects of air pollution on health has been used by Defra and HM Treasury in devising damage costs associated with emissions of NO_x and PM₁₀ ⁽³⁾. These are intended to be applied directly to estimates of emissions, which are less precise than estimates of concentrations in terms of their applicability to affected populations. An emission of a primary pollutant has the greatest effect on air quality close to the source and the magnitude of the health effect is dependent on the number of people exposed. In a densely populated area, this will naturally be greater than in a sparsely populated urban area.

In economic terms, the greatest impact results from mortality, which is why the costs per tonne are higher for PM₁₀. Emissions of NO₂ are not directly linked to mortality, except as a contributor to secondary particles which have a long range impact far from the source. PM₁₀ and PM_{2.5} are associated with

(1) Cesaroni et al (2014) Long term exposure to ambient air pollution and incidence of acute coronary events: prospective cohort study and meta-analysis in 11 European cohorts from the ESCAPE Project *BMJ* 384.f7412

(2) COMEAP (1998) Quantification of the Effects of Air Pollution on Health in the United Kingdom

(3) Dickens R, Gill J, Rubin A and Butterick M (2013) Valuing Impacts on air quality- Supplementary Green Book guidance. HM Treasury and Defra

mortality through long term and short term exposure and the damage costs are up to 2 orders of magnitude greater than for NO₂.

6.3.2

Assessment

- *QoL Domain:* Natural Environment, Where We Live and Health.
- *People Affected:* Communities in proximity to the airport and who experience environmental changes, the regional and national population and Employees.
- *Link to other AC Framework Modules:* Air Quality.
- *Duration of Impact:* construction, initial and mature operations.
- *Summary:* It is envisaged that construction impacts can be managed adequately. The health impacts resulting from the additional emissions to atmosphere are likely to be small and not significant in public health terms, because of the relatively low public exposure around the airport and the very small changes to the local concentrations of the key pollutants. There will be some small impacts on the wider population through exposure to the secondary particles formed from the NO_x emissions, as would be case for any new airport in south east England.

Oxides of Nitrogen

The chief pollutants of interest for human health are oxides of nitrogen (NO_x) and particulate matter, especially PM_{2.5}. Other pollutants would be emitted from R2, but these would either be of low impact (eg carbon monoxide) or be emitted in relatively small quantities (eg various hydrocarbons) and can be discounted as being not significant.

The pollutant emitted in the greatest quantity is NO_x, chiefly from the aircraft movements. By 2040, it is estimated that the airport will be emitting 2,613 tonnes annually, relative to 1,592 tonnes in a scenario of constrained growth. (These compare with emissions of 1570 tonnes estimated on the same basis for 2010.) In other words, approximately 1000 tonnes of additional NO_x would be emitted as a consequence of R2 for this year. This has two pathways for health effects. Firstly, it will cause an increase in NO₂ concentrations around the airport and secondly it will lead to the formation of secondary particulate matter at a regional level. This latter pathway is addressed in the damage costs provided by Defra and HM Treasury for use in estimating the economic impact of air pollution ⁽¹⁾.

The damage cost used by Defra for NO_x is £955 per tonne as a central estimate (at 2010 prices). This impact takes into account the additional effects on

(1) HM Treasury and Defra (2013) Valuing Impacts on Air Quality: Supplementary Green Book guidance

morbidity and mortality that are associated with the direct effects on health of NO₂ and the health effects of the secondary particulate matter, which contribute to additional mortality. It is assumed in the damage cost for NO_x that the health impact per tonne is 0.082 years of life lost and only 0.002 additional hospital admissions. (The damage cost does not take into account the health impacts of excess tropospheric ozone, for which no similar methodology exists yet.) On this basis, the loss of life years over 100 years going forward from the additional NO_x emissions in 2040 would be approximately 80 for the whole of the exposed population, which is much of England. This is a very approximate number, since the Green Book methodology assumes a 'pulse' change occurring at a point in time, whereas the change in airport emissions would be more gradual over a period of time. It should also be noted that this health impact, and its associated costs, on a national scale is likely to be broadly similar if the additional NO_x emissions were instead at Heathrow, not Gatwick.

The damage costs suggested by the Green Book are, of necessity, based on some assumptions regarding the emission's location and the resulting public exposure to the pollutant. The damage cost for NO₂ is accounting for health effects, which in monetary terms is dominated by the value assigned to the loss of life years from long term exposure to PM_{2.5}. Since this is attributable to the assumed secondary particulate matter resulting from the NO_x emission, this will be accounting for health effects on a regional or national basis and far away from the airport. The population exposure is therefore based on the likely distribution of people on a national basis and can be taken as reasonably accurate in this case.

Any local impacts on health from the additional NO_x emissions will be experienced as the additional hospital admissions arising from the exposure to additional NO₂ concentrations. In practice, these impacts would be extremely small. Any increases in NO₂ concentrations would be confined to very small numbers of people living close to the airport. The additional concentrations would reduce rapidly with distance from the perimeter and are negligible beyond 1 km. The numbers of people living close to the airport at present and in the future are quite limited and so the additional exposure is also small. One of the populated areas close to the airport is the southern part of Horley, close to the A23. Dispersion modelling predicts that NO₂ concentrations will increase by approximately 2 µg m⁻³ or less in many of the locations within about 500 m of the airport perimeter. Base case concentrations are predicted to be 25-30 µg m⁻³ in this area. For this size of population, the effect on the rate of hospital admissions would be negligible at these exposure levels.

Particulate Matter

For particulate matter, there are some contrasting characteristics to NO₂ that influence the health impacts. The principal health impact in monetary terms is again mortality, but the impact that PM_{2.5} has is much greater per tonne of pollutant and it is felt directly. Thus, whilst there is also a regional effect that cannot be discounted, a significant proportion of the effect on mortality will

occur within several kilometres of the airport. The increased severity of the impact is reflected in the Green Book damage cost, which is expressed for PM₁₀ for road transport by National Transport Model areas. For Gatwick it is most appropriate to take the value as the 'Transport Average', because Gatwick has a mixture of urban and rural areas around it. This value has a central estimate of £48,517 per tonne at 2010 prices (a small element is included for building soiling). This is mostly based on a value for the years of life lost over 100 years of approximately 2.44 per tonne, with a very small value attributable to additional hospital admissions (0.04).

For the year 2040, the emissions inventory used for the dispersion modelling has a PM₁₀ emission for the airport of 33.8 tonnes in the case of constrained growth and 59.2 tonnes with R2, ie a difference of 25.4 tonnes.

The assumptions underlying the damage costs given by the Green Book for mortality imply a health impact of 14.15 years of life lost over 100 years going forward from 2040 for the exposed population around Gatwick, based purely on the emissions. A more accurate estimate is obtained by considering the exposure of the local population to the increases in PM_{2.5} concentrations and using the well-established hazard coefficient proposed by COMEAP for mortality, ie a 0.6% increase in the rate of all-cause mortality for a long term increase in annual average concentration of 1 µg m⁻³. As noted previously, PHE has used this result to calculate the mortality attributable to PM_{2.5} in the year 2010. Some results of relevance are extracted below in *Table 6.2*.

Table 6.2 *Results for the Burden of Mortality in 2010 Associated with PM_{2.5} (extracted from Public Health England Report 2014)*

LA area	Mean anthropogenic PM _{2.5} (µg m ⁻³)	Attributable fraction of deaths (%)	Number of deaths (age 25+)	Associated life years lost
Reigate & Banstead	9.9	5.6	69	596
Crawley	9.7	5.5	41	497
Tandridge	9.5	5.4	41	416
Mole Valley	9.6	5.4	44	446
Mid Sussex	8.8	5.0	63	549
Horsham	8.7	4.9	57	553
Hounslow	12.7	7.1	99	1167
Slough	12.1	6.8	51	714
Hillingdon	11.6	6.5	118	1335
Spelthorne	11.1	6.3	50	538

Some observations on these results are relevant here. The attributable fraction of deaths is a straightforward function of the PM_{2.5} concentration, according to the methodology. The number of deaths and the associated life years lost are dependent also on the numbers of people exposed and the age profiles of those populations. This is illustrated by the much larger values for these outcomes for the densely populated areas of Hounslow and Hillingdon.

Concentration increases of PM_{2.5} in 2040, relative to the case of constrained growth, are no more than about 0.1 µg m⁻³ in the residential parts of Horley near to the airport perimeter, according to the modelling results. Base case concentrations are predicted to be about 11 µg m⁻³ in 2040. Some properties very close to the airport perimeter and the A23 might experience increases of up to 0.2 µg m⁻³, but these would be very few in number. Most of the population within 1-2 km of the airport would only experience increases of the order of 0.001 µg m⁻³ or less. At this level of exposure the loss of life expectancy for each member of a cohort for 2040 would be approximately 30 minutes, if this additional exposure were maintained for a lifetime.

Comparison with the PHE results presented above for 2010 also indicates that an exposure to these levels of PM_{2.5} would constitute very small effects on the attributable fraction of deaths on the associated life years lost.

In summary, the health impacts resulting from the additional emissions to atmosphere are likely to be small and not significant in public health terms, because of the relatively low public exposure around the airport and the very small changes to the local concentrations of the key pollutants.

6.4

SURFACE ACCESS AND LOCAL TRANSPORT NETWORKS

The Acheson report in 1997 ⁽¹⁾ stated that:

“The primary function of transport is in enabling people to access goods and services. In doing so it promotes health indirectly through the achievement and maintenance of social networks. Some forms of transport, such as cycling and walking, promote health directly by increasing physical activity and the reduction of obesity. Lack of transport may damage health by denying access to people, goods and services and by directing resources from other necessities. Furthermore, transport may damage health directly, most notably by accidental injury and air pollution”.

This view is supported by the WHO; which proposes that transport plays a vital role in the health and wellbeing of communities by providing access to a range of services and amenities required to treat, manage and promote healthy living. Transport facilitates access to jobs, education and markets and plays a key role in the economy of most countries ⁽²⁾.

Transport policies and infrastructure can also have a negative impact on health in terms of injuries and deaths associated with transport accidents, noise pollution and air pollution, resulting in cardiovascular and respiratory

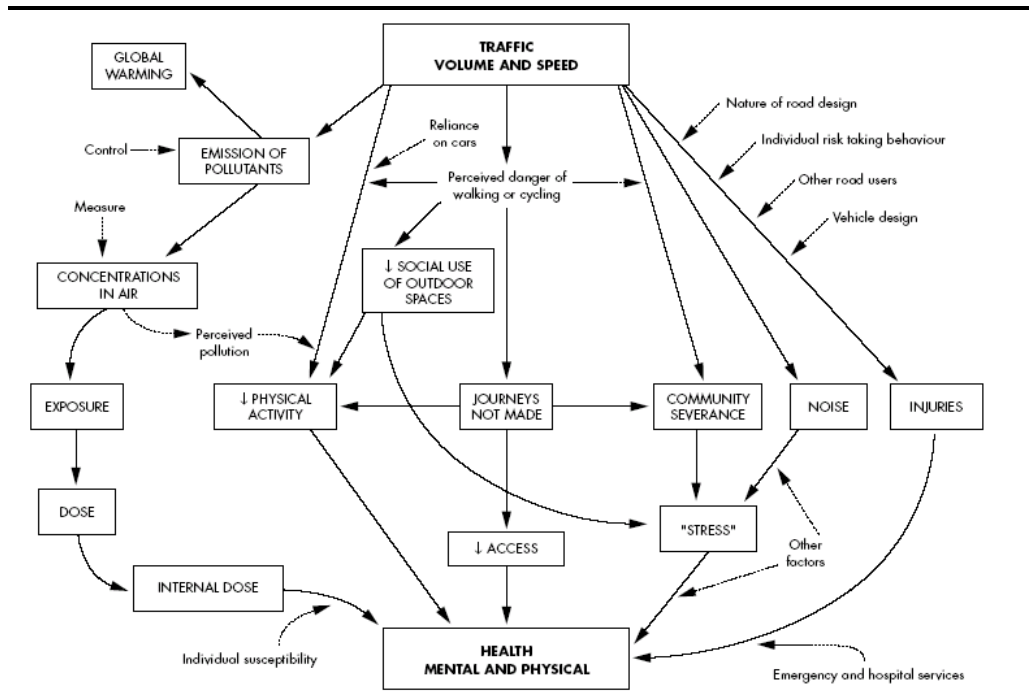
(1) Acheson D (1998). Independent inquiry into inequalities in health report. The Stationery Office

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

deaths. A more sedentary lifestyle (resulting in non-communicable diseases and early mortality) is also associated motor vehicle usage ⁽¹⁾.

The pathways by which these health impacts can occur is shown in *Figure 6.1*. This reveals the complex interactions between various aspects of transport and how this affects population health.

Figure 6.1 *Pathways from Transport Policies and Health Outcomes*



Source: M Joffe and J Mindell, A framework for the evidence base to support Health Impact Assessment, *Journal of Epidemiology and Community Health*, Feb 2002; 56: 132 - 138

Transport Accidents and Injury

Road accidents account for the most significant share of all transport accidents both in terms of the absolute number of deaths and the number of deaths per km travelled. In the EU almost 50 times as many people die on the road as in rail accidents ⁽²⁾. In terms of passenger km travelled, death rates are highest by road, then rail, while deaths by air and sea are much lower still ⁽³⁾.

Road traffic accidents tend not to be evenly distributed across populations and geography. In fact, they vary according to the mode of transport and the relative age and socio-economic status of individuals.

Most accidents happen in built-up areas (65%), with 35% outside these areas, of which 4-5% occur on motorways (although the risk of dying in a motorway accident is two to three times higher than on other roads). The areas of

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

(2) Transport in figures- statistical pocketbook. 2nd edition. Luxembourg, Eurostat,1997

(3) Transport in figures- statistical pocketbook. 2nd edition. Luxembourg, Eurostat,1997

highest risks for vulnerable road users such as pedestrians and cyclists are minor roads and their intersections with arterial roads ⁽¹⁾. In terms of relative impacts, children from lower socio-economic groupings suffer a higher susceptibility to serious road accidents than the more affluent ⁽²⁾.

Road traffic accidents can also have an effect on the psychological health of those involved; studies into this have found that some 14% of survivors suffer from post-traumatic stress disorders and 25% have some psychiatric problems one year later ⁽³⁾. Even after 18 months one third has clinically significant symptoms of post-traumatic stress disorder ⁽⁴⁾. One in three children involved in road traffic accidents suffered from post-traumatic stress disorder when interviewed 22 and 79 days afterwards. The child's perception of the accident (if it was life threatening or not) was the main determining factor ⁽⁵⁾.

Rail

A range of health benefits are associated with improving rail services, including improving the health and wellbeing of surrounding communities and commuters through:

- reductions in stress and anxiety through reductions in congestion⁽⁶⁾;
- reduced risk of accident and injury; and
- a modal shift from roads ⁽⁷⁾.

In contrast, rail transport related health risks to communities, sensitive groups, rail users and workers occur along all surface sections of track and at stations.

Walking and Cycling

Walking and cycling as a form of transport is associated with two important health benefits:

- reducing the use of motorised transport and therefore noise, air pollution and accident rates; and

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

(2) Health Development Agency (2005)

(3) Goldberg and Gara. (2000) A typology of psychiatric reactions to motor vehicle accidents. *Psychopathology* 23:15-20. World Health Organization. Transport, environment and health. WHO Regional Publications, European Series. No.89

(4) Green MM *et al.* (2000) Undiagnosed post traumatic stress disorder following motor vehicle accidents. *Medical Journal of Australia* 159: 529-544 reproduced in World Health Organization. Transport, environment and health. WHO Regional Publications, European Series. No.89

(5) Stallard P *et al.* (2000) Prospective study of post traumatic stress disorder in children involved in road accidents *BMJ* 1988 317:1619-1623 reproduced in World Health Organization. Transport, environment and health. WHO Regional Publications, European Series. No.89

(6) World Health Organization (2000). "Transport, environment and health". World Health Organization, Regional Office for Europe, Copenhagen.

(7) World Health Organization (2000). "Transport, environment and health". World Health Organization, Regional Office for Europe, Copenhagen.

- increasing levels of physical activity with benefits for health and wellbeing.

Increased Physical Activity

There is no evidence in the literature to suggest that passengers walk or cycle to airports, on a regular basis. Individuals do walk and cycle to their place of work or to access public transport, however, and therefore a health benefit could occur if these means of transport were promoted, especially in relation to staff commuting to the airport⁽¹⁾.

Constraints on Mobility Access and Independence

Increased intensity in road traffic can have a restricting impact on cycling and walking, by reducing the number of access routes and increasing the fear of accidents. This impact has not been quantified, although observers have argued that the impact is similar to that of tobacco on heart disease ⁽²⁾.

Fear of accidents has in part reduced the number of miles that people walk. For example, in the UK there has been a 17% decline in the miles walked between the years 1975/6 and 1994 ⁽³⁾.

The perception of dangerous road traffic for pedestrians and cyclists can lead to reduced physical activity, and therefore reduced fitness.

Transport and Wellbeing

There is a demonstrable link between strong social networks and health, where good social networks can provide emotional, professional and social support vital to good health and wellbeing. Transport can disrupt such social networks through the creation of barriers preventing or reducing community interaction. This may be as a consequence of new roads separating communities or through an increase in road traffic through existing areas. This can also occur when new rail corridors or airport runways are built which alter community interaction by placing a physical barrier in communities.

Regular exposure to traffic and congestion can impair health and satisfaction with life. Congestion constrains movement and leads to increased stress and frustration, and aggression, which in turn can lead to increased likelihood of a crash or accident ⁽⁴⁾. Traffic noise can also cause nervousness, depression, sleeplessness and irritability.

(1) World Health Organization (2000). "Transport, environment and health". World Health Organization, Regional Office for Europe, Copenhagen

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

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

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

For commuters, the ONS has also produced some research on their wellbeing, as part of the Annual Population Survey ⁽¹⁾, which suggests that all aspects of personal wellbeing are negatively affected relative to non-commuters. The degree of effect is complex, however, and depends on the length of commute and transport mode, with people using rail as a method of transport for less than 30 minutes showing no adverse effects on wellbeing.

Social Inclusion

Access to transportation allows for social inclusion; if people are unable to access transport due to a lack of public transport, cost or difficulties in access then social exclusion can result. This lack of access to transport options is referred to as transport poverty and as a consequence people have a lack of choice of destinations, activities and access to amenities, jobs and health care facilities.

Transport and Vulnerable Groups

Most of the health impacts of transport occur in urban areas, including accidents to pedestrians and cyclists and the effects of noise and air pollution. This is in part because most of the population lives in urban areas. Those in lower socio-economic groups are also at a higher risk of being involved in a road traffic accident, especially for children. This can be explained in part by higher traffic volumes and speeds in poorer areas, as well as increased exposure if families do not have cars. Children are a particularly vulnerable group with one in every three accidents involving a person under 25 ⁽²⁾.

It can therefore be seen that poorer socio-economic groups, children, women and the elderly are most likely to suffer from negative health effects of transport, especially if they are frequent pedestrians or cyclists.

(1) <http://www.ons.gov.uk/ons/rel/wellbeing/measuring-national-well-being/commuting-and-personal-well-being--2014/art-commuting-and-personal-well-being.html>

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

- *QoL Domain: Where We Live and Health.*
- *People Affected:* Communities in proximity to the airport, employees, airport users (business or leisure), and groups that use the various types of surface access with consideration of distance from the airport.
- *Link to other AC Framework Modules:* Surface Access.
- *Duration of Impact:* construction, initial and mature operations.
- *Summary:* Minor adverse implications due to the diversion and closure of some local roads around the airport perimeter, due to the land take required for R2. The increased volumes of road traffic and the number of journeys locally could have potential adverse impacts on QoL. Substantial benefits would accrue through increased capacity, separation of airport and non-airport traffic, reduced congestion, increased connectivity and the encouragement to cycling, all of which would benefit QoL. The committed additional funds should also help facilitate the provision of additional capacity. The local transport network is a critical part of the QoL for the communities living near the airport and ensuring that it functions properly is an integral feature of R2.

Gatwick airport does not exist in isolation from the existing or future transport network. R2 will have an influence on the capacity of the local network and will also provide some additional infrastructure. These changes will have effects on the QoL and health of airport users, airport workers and people in local communities.

The key changes to the infrastructure can be summarised as follows.

- Junction 9 of the M23 will be improved so that its capacity is doubled;
- the A23 will be diverted to east of the airport, so that it is separated from airport traffic;
- there will be local road diversions and changes affecting Balcombe Road, Ifield Road and Lowfield Heath Road/Charlwood; and
- the railway station will undergo a major upgrade, to increase its capacity and connectivity, so that it is central to the 'Gatwick Gateway'.

These changes will have several effects on the QoL for users of the transport network. The increase in the capacity of the road network and the improvements to several junction layouts should reduce congestion and thereby improve journey satisfaction for road users. It will also decrease the risk of road traffic accidents for this part of the network, despite the increase

in volume of traffic. Separation of airport and non-airport traffic on roads around the airport will also assist in reducing delays. These are positive influences on the health and QoL for people in the local communities of Crawley and Horley, as well as for airport users. The effect is positive in improving satisfaction with the local environment and access to work and services. Reducing congestion is also a positive influence in reducing the stress associated with driving.

One of the features of R2 of significance with regard to local transport is the diversion of the A23 and the access to the New Terminal. This has been designed to minimise any additional road traffic activity in and around the North and South terminals. It will also prevent any increase in road traffic along the A23 at Horley, which is important in the context of local air quality and will positively contribute to minimising congestion and the associated stress.

The proposed enhancements to the rail station, as part of the Gatwick Gateway, will increase capacity for airports users and the local community alike, enabling more journeys of a higher quality than is currently the case. This will also encourage a modal shift from road to rail and improve connectivity significantly, thereby providing greater opportunities to use the transport system to access places of employment, services and leisure.

Greater connectivity is achieved by the rail station acting as a hub for increased bus and coach services throughout the day and night, providing another alternative to private car use. This additional capacity will allow airport workers to commute from places other than along the rail line and it will also benefit the local community, in that it will provide additional public transport options on a 24 hour basis, potentially improving access to leisure activities further afield.

In and around the airport, R2 makes provision for 9 km of additional cycle ways and improved pedestrian routes that are better linked with each other and protected from conflicts with road vehicles. These features will contribute to increased physical activity and its associated health benefits.

In summary, the changes to the local transport network have some minor adverse implications in respect of the diversion and closure of some local roads around the existing airport perimeter, but these are outweighed considerably by the opportunities for increased capacity, separation of airport and non-airport traffic, reduced congestion, increased connectivity and the encouragement to cycling.

The increased volumes of road traffic and the number of journeys locally could have potential adverse impacts on QoL and health for people in Crawley and Horley, but these adverse impacts will be balanced by benefits if the design objectives of greater capacity and improved junctions are achieved. The need to provide adequate capacity on the local roads is especially important in the context of the projected population increases in Horley and

Crawley, not least with regard to the North East sector development. The committed additional funds, to be made available through Public Transport Levy and the Local Highway Development Fund, should also help facilitate the provision of additional capacity, or enhancement of existing capacity. The local transport network is a critical part of the QoL for the communities living near the airport and ensuring that it functions properly is an integral feature of R2.

6.5 *LAND TAKE*

This section address the effect of land take on involuntary relocation of houses and community facilities.

6.5.1 *Evidence*

Involuntary relocation refers to the physical displacement of people from their home and /or land. Relocation is considered to be involuntary when affected individuals or communities do not have the right to refuse land acquisition. Involuntary relocation can occur in cases of expropriation and through negotiated settlements when the buyer can resort to expropriation if negotiations fail ⁽¹⁾.

In the UK, involuntary relocation occurs in the context of compulsory purchase powers which enable the compulsory purchase of land by acquiring authorities, to carry out a function which Parliament has decided is in the public interest. There are two commonly used powers of compulsory purchase: 1) Compulsory Purchase Order (CPO) based on a specific Act of Parliament, and 2) an Order under the Transport and Work Act 1992.

Two groups are entitled to apply for compensation once a CPO has been issued as set out in the Compulsory Purchase Act of 1965 and the Land Compensation Act of 1961 and 1973:

- Individuals who are not subject to compulsory purchase, but whose land is adversely affected by construction activity and use of development works are entitled to compensation. These individuals may also benefit from a voluntary blight scheme introduced by the promoter of the development, in addition to their statutory rights to compensation. Voluntary blight schemes guarantee the value of properties, whose value may otherwise have decreased as a result of the development.
- Individuals who face relocation as a result of the development project. This relocation is involuntary, especially if objections to the project have been raised and overruled by those concerned. Compensation for lost land is based on the principle of equivalence, that is to say, the individuals facing relocation are not supposed to be any better or any worse off as a

(1) International Finance Corporation, (2012) Performance Standards on Social and Environmental Sustainability

result of relocation. Those relocated are expected to undertake their own re-housing. When no suitable alternative accommodation is available, however, the local housing authority has a duty to re-house residents. ⁽¹⁾

Much of the evidence of the impacts of involuntary relocation on communities and individuals comes from a developing world context, but are considered to be likely to occur within a developed world context, including in relation to R2.

Key issues include:

- *Landlessness*: land expropriation can remove the basis for productive system upon which livelihoods are constructed. ⁽²⁾
- *Loss of access to common property and services*: Loss of access to the common property assets and services can result in deterioration of livelihoods as well as education levels, health care etc. ⁽³⁾
- *Social disarticulation*: involuntary relocation can disperse and fragment communities, dismantling patterns of social organisation and interpersonal ties. There is a net loss of social capital and the loss of reciprocity networks increases vulnerability both for those relocated and those who have remained.
- *Joblessness*: the risk of losing employment exists in involuntary relocation, if access to place of employment becomes challenging, or if employer properties are also part of the land take. ⁽⁴⁾
- *Worsening in housing standards* or even temporary homelessness, linked for example to inability to find suitable affordable housing. ⁽⁵⁾
- *Marginalisation*: occurs when families lose power and status and spiral on a “downward mobility” path. Marginalisation can be economic, social and psychological. ⁽⁶⁾

These risks may have an indirect effect on health and wellbeing. Health effects of involuntary relocation have also been identified in literature on the developed world and include:

(1) Office of the Deputy Prime Minister, (2004)Compulsory Purchase and Compensation, Compensation to Residential Owners and Occupiers,

(2)Prof. M. Cernea, (2000) Impoverishment Risks, Risk Management, and Reconstruction: A Model of Population Displacement and Resettlement, World Bank,

(3) Mathur (1998) cited in Prof. M. Cernea, (2000) Impoverishment Risks, Risk Management, and Reconstruction: A Model of Population Displacement and Resettlement, World Bank,

(4)Prof. M. Cernea, (2000) Impoverishment Risks, Risk Management, and Reconstruction: A Model of Population Displacement and Resettlement, World Bank

(5)Prof. M. Cernea, (2000) Impoverishment Risks, Risk Management, and Reconstruction: A Model of Population Displacement and Resettlement, World Bank

(6) Fernandes (2000) cited in Prof. M. Cernea, (2000) Impoverishment Risks, Risk Management, and Reconstruction: A Model of Population Displacement and Resettlement, World Bank

- *Mortality*: The most dramatic relocation effects reported have been increases in mortality rates for institutionalised elderly and for profoundly mentally challenged residents. However, not all research findings corroborate this evidence, and some studies found no link at all. ⁽¹⁾
- *Behavioural changes*: For elderly patients in institutions, this includes pessimism with regard to health outlook, decreased level of social activity, changes in mental health, self-care and social capacities. Other effects include a short-term decrease in behavioural functioning of mentally ill residents. Other studies have not, however, reported any change at all.
- *Susceptibility to degradation of physical health*: There is some evidence that separation from familiar surroundings, objects or people can precipitate the onset of disease ⁽²⁾.
- *Emotional symbolic loss* involuntary relocation often triggers strong emotional responses because it is linked to the emotional significance of the home due to the history people have in their homes and the loss of sense of control. The loss of a house is therefore more than a material loss; it is an emotional, symbolic loss ⁽³⁾. This loss can result in stress, feeling of mistrust and insecurity and feeling of powerlessness and grief ⁽⁴⁾.

Involuntary relocation often leaves those forced to relocate in a vulnerable position, as they may face all the impacts identified above and potential adverse health impacts simultaneously. The intensity of the vulnerability varies, and health impacts can be more significant for some groups than others. Research suggests that the differences depend on “*individual and environmental differences and cognitive mediators in the adaptation process*” ⁽⁵⁾.

Characteristics that may determine capacity to deal with the impacts of involuntary relocation include:

- *Age*: The elderly are particularly vulnerable to relocation ⁽⁶⁾. Research also suggests children can be affected by relocation. Relocation has been identified as a possible cause for child problem behaviour due to a breakdown of social networks such as the extended family, friends and neighbours, which help regulate a child’s behaviour. ⁽⁷⁾

(1)Heller (1982) The Effects of Involuntary Residential Relocation: A Review, *American Journal of Community Psychology*, Volume 10, No. 4

(2)Heller (1982) The Effects of Involuntary Residential Relocation: A Review, *American Journal of Community Psychology*, Volume 10, No. 4

(3) House: loss, refuge and belonging, *Forced Migration Review*, 2004

(4)Ekstrom (1994) Elderly People’s Experiences of Housing Renewal, and Forced Relocation: Social Theories and Contextual Analysis in Explanations of Emotional Experiences, , *Housing Studies*, Volume 9, Issue 3

(5) Heller (1982) The Effects of Involuntary Residential Relocation: A Review, *American Journal of Community Psychology*, Volume 10, No. 4,

(6)Heller (1982) The Effects of Involuntary Residential Relocation: A Review, *American Journal of Community Psychology*, Volume 10, No. 4,

(7)DeWit *et al.*, (1998) The Relationship between Geographic Relocation and Childhood Problem Behaviour, Applied Research Branch, Strategic Policy, Human Resources Development Canada,

- *Physical health:* Relocation has the worst impact on those who are already in poor health amongst the elderly and the mentally disabled.
- *Income:* Poorly educated and low-income people are more vulnerable to the adverse effects of relocation. ⁽¹⁾
- *Gender:* Some research suggests women suffer more severe impacts. ⁽²⁾

There is some evidence that post- relocation adjustment depends on the degree to which residents are "psychologically prepared" for the change. Several institutional relocation programmes which did not find any adverse transfer effects provided individualised supportive services, preparatory counselling, site visits, and realistic information about the new setting. ⁽³⁾

Environmental variables, both objective and subjective, that may affect personal reaction to involuntary relocation include ⁽⁴⁾:

- *The degree of environmental change:* The extent to which residential relocation results in changes in the social environment as well as the physical one and the degree of attachment to the old area.
- *The quality of the old and new environment:* A better adjustment to relocation is expected when the move is to a "higher" quality environment, although it is hard to conceptualise what is a "higher environment" and what are the environmental variables that are linked to behaviour.

It is also important to note that some literature ⁽⁵⁾ in the developed world context emphasises that involuntary relocation does not necessarily always have adverse effects, and can even be beneficial. In particular, involuntary relocation may:

- Provide stimulation and enjoyment through a new environment;
- Facilitate changes in individual social and intellectual functioning; and
- Provide opportunity for economic advancement, better housing, or more pleasant physical surroundings.

(1)Heller (1982) The Effects of Involuntary Residential Relocation: A Review, *American Journal of Community Psychology*, Volume 10, No. 4,

(2) Feeney (1995) cited in Prof. M. Cernea (2000) Impoverishment Risks, Risk Management, and Reconstruction: A Model of Population Displacement and Resettlement, , World Bank,

(3) Heller (1982) The Effects of Involuntary Residential Relocation: A Review, *American Journal of Community Psychology*, Volume 10, No. 4,

(4) Heller (1982) The Effects of Involuntary Residential Relocation: A Review, *American Journal of Community Psychology*, Volume 10, No. 4,

(5)Heller (1982) The Effects of Involuntary Residential Relocation: A Review, *American Journal of Community Psychology*, Volume 10, No. 4,

- *QoL Domain:* Where We Live, Health, Natural Environment, What We Do, and Personal Finance.
- *People Affected:* Communities in proximity to the airport.
- *Link to other AC Framework Modules:* Place and Community.
- *Duration of Impact:* construction.
- *Summary:* Any relocation process is likely to be stressful and will negatively impact on QoL in the short term (during the approvals process and relocation process) for the affected households and to a lesser extent the communities. The QoL of such households' can be restored with sufficient support and communication.

The assessment below summarises the QoL impacts associated with involuntary relocation, drawing on the findings of the assessment undertaken for Community and Place. As the land take will take place prior to construction all impacts will occur prior to and during the construction phase.

Involuntary relocation resulting from land take can generate strong emotional responses ranging from stress to feelings of grief, which can significantly affect wellbeing and affected households QoL. Impacts include effects to health including increases in mortality rates and behaviour changes in some groups and the precipitation of the onset of disease. Relocation can also negatively influence people's sense of where they live, both for those relocated and those left behind. The nature and extent of these impacts is influenced by:

- capabilities and resources;
- perceptions and expectations;
- degree of environmental change; and
- the quality of the old and new environments.

The differences in capabilities and resources of affected households are not known and will influence the nature and extent of any effects. As outlined in the evidence section the elderly and people with mental and or physical disabilities may experience more severe impacts. Support provided by Gatwick in the event of a relocation process, however, will go some way to minimise these differences and therefore mitigate the negative impacts on the QoL of those being relocated. To mitigate this, the Home Owners Support Scheme and Property Market Bond Scheme agreements are in place surrounding known and agreed purchases of land/property.

In relation to R2, houses that are subject to relocation are located in Crawley and Horsham districts and are mainly located within the existing safeguarded

land for the airport. As such, the households are likely to be aware of the potential for the land to be acquired for R2, minimising the uncertainty and associated anxiety which this gives rise to. This has allowed for Gatwick to provide clear and early communication regarding the relocation to help manage perceptions and expectations; thus making involuntary relocation less stressful, by allowing more time for planning and preparing for the move ⁽¹⁾.

The combination of legal protections for home owners which will ensure timely payment of compensation and the measures Gatwick are implementing would ensure that there was support for affected households to resettle. Individuals will have the right to choose their new environment and can therefore make decisions which will best support their QoL in the future, in particular in relation to the natural environment, where they live and their personal wellbeing.

While it is recognised that any relocation process is likely to be stressful and will negatively impact on QoL in the short term (during the approvals process and relocation process), it is possible for affected households' QoL to be restored with sufficient support and communication.

6.5.3

Assessment of Changes to Community Facilities

- *QoL Domain: Where We Live, Health, Natural Environment and What We Do.*
- *People Affected: Communities in proximity to the airport.*
- *Link to other AC Framework Modules: Place and Community.*
- *Duration of Impact: construction and initial operations.*
- *Summary: Loss of community facilities is likely to impact on the QoL of those individuals and groups that use these resources. While such facilities can be replaced at alternative accessible locations, the loss of these facilities is likely to result in short term decreases in wellbeing and therefore QoL for those who use the facilities. People affected are likely to adapt changes over time.*

The loss of community facilities are outlined in the Community Report. It should be noted, however, that as with the involuntary relocation the loss of community resources is likely to result in impacts to QoL for affected individuals (and their households) prior to and during construction. In particular, the anticipated loss of a residential care home as a result of R2 is likely to result in increased stress and decreased wellbeing for those living in

(1)Ekstrom (1994) Elderly People's Experiences of Housing Renewal, and Forced Relocation: Social Theories and Contextual Analysis in Explanations of Emotional Experiences, , *Housing Studies*, Volume 9, Issue 3,

the home and their families. Such individuals, and their families, are generally more vulnerable than the general population and less able to adapt to changes. As such, any impacts on their QoL are likely to be experienced disproportionately, relative to the wider community. While it is recognised that alternative facilities may be available in the area those living in the facility are likely to be less able to adapt to change and more susceptible to decreased wellbeing.

Similarly the loss of nursery facilities as a result of R2 is also likely to impact negatively on the QoL of those households that utilise these facilities. Again, while alternatives may exist and while these services may be replaced in the nearby area for affected families adapting to such changes, at least in the short term, is likely to result in stress and anxiety. It is recognised, however, that these effects are limited in terms of the population size affected.

Loss of green space and recreational land could negatively impact on physical activity. There are, however, as outlined in the Chapter 12 Community, alternative resources available in the local area. Furthermore, Gatwick's master plan allows for the provision of new greenspace that is likely to offset any negative impact through the early years of operation. Gatwick has also committed to a net biodiversity gain, to be achieved through the design, construction and operational lifetime of the airport. As such, as operations mature towards 2040-2050 any negative impacts are likely to reduce. On the other hand, R2 may impact on level of satisfaction with the natural environment around the airport and therefore decrease the QoL for users of these spaces. This is most likely to occur during construction and following significant uplifts in aircraft movements, but over time people are likely to adapt to changes and negative impacts on QoL are likely to decline whilst positive impacts such as biodiversity gain and associated access to green space, will emerge.

6.6 *SOCIAL CAPITAL*

6.6.1 *Evidence*

No single definition of social capital exists. It is generally accepted, however, that social capital represents the degree of connectedness in communities and the quality and quantity of social relations in a given population. It refers to the processes between people that establish networks, norms and social trust, and facilitate coordination and cooperation for mutual benefit.

The Organisation for Economic Co-operation and Development (OECD) describes social capital as “networks together with shared norms, values and understandings that facilitate co-operation within or among groups” ⁽¹⁾. This definition is commonly used in the UK and has been adopted by the Office for National Statistics.

(1) Cited in Social Capital, A Review of the Literature, Office for National Statistics, 2001

As such, the accepted elements of social capital are outlined as follows:

- A sense of belonging to the local community, community cooperation, reciprocity and trust, and positive attitudes to community institutions that include participation in community activities or civic engagement. ⁽¹⁾
- The existence of networks and connections: the individual's contact with these networks and connections results in exchange, obligations and shared identity that provides potential support and access to resources. ⁽²⁾
- As a resource of social relations between families and members of a community ⁽³⁾.

These definitions and concepts have resulted in three types of social capital being distinguished ⁽⁴⁾:

- *Bonding social capital* refers to trusting and co-operative relations between members of a network who are similar in terms of social identity (eg ethnicity);
- *Bridging social capital* refers to connections between those who are unlike each other "yet are more or like each other in terms of their status and power" ⁽⁵⁾ eg horizontal ties in society; and
- *Linking social capital* refers to "the norms of respect and networks of trusting relationships between people who are interacting across explicit, formal, or institutionalised power or authority gradients in society" eg vertical ties in society ⁽⁶⁾.

Each type has a role to play in determining social capital but the value of each type may vary depending on an individual's socio-economic status and role in society.

Social capital is most often measured through surveys and the most commonly used indicator is trust ⁽⁷⁾. More detailed surveys ⁽⁸⁾ look both at what people do and what people feel with regards to their local community. This reflects the fact that social capital comprises a behaviour/activity

(1) Putnam (1993, 1995), cited in Assessing People's Perception of their Neighbourhood and Community Involvement, (2001) HDA

(2) Bourdieu (1986), cited in Assessing People's Perception of their Neighbourhood and Community Involvement, (2001) HDA

(3) Coleman (1988), cited in Assessing People's Perception of their Neighbourhood and Community Involvement, (2001) HDA,

(4) Kawachi *et al*, (2004) Reconciling the three accounts of social capital, International Epidemiological Association, **Volume 33**, no.4,

(5) Szreter and Woolcock, cited in Kawachi *et al*, (2004) Reconciling the three accounts of social capital, *International Journal of Epidemiology*, **Volume 33**, no.4,

(6) Szreter and Woolcock, cited in Kawachi *et al* (2004) Reconciling the three accounts of social capital, *International Journal of Epidemiology*, **Volume 33**, no.4, 2004

(7) Social Capital Community Benchmark Survey 2001 USA

(8) The Office for National Statistics <http://www.statistics.gov.uk/cci/nugget.asp?id=286>

component (eg participation) and a cognitive/perceptual component (eg trust): these components are referred to as structural and cognitive capital respectively ⁽¹⁾.

In 2003, the National Statistics Office published a paper recommending measuring social capital around the following five areas:

- civic participation: the propensity to vote, to take action on local or national issues;
- social networks and support: contacts with friends and relatives;
- social participation: involvement in groups and voluntary activities;
- reciprocity and trust: giving and receiving favours, trust of other people and institutions such as the government and police; and
- views about the area: not strictly a measure of social capital, but required for the analysis and interpretation of the social capital measures, and includes satisfaction with living in the area and problems in the area⁽²⁾.

Some of these elements are captured in the Measures of National Wellbeing, particularly in those representing 'Our Relationships', 'Where We Live' and 'Governance'.

Policy based on the body of academic research has been developed since the late 1990s, with a view to finding ways of reducing the health gap between the better and the worse off in society. From using the construct of social capital to explain health within its social context, different bodies have attempted to use the concept "actively", ie exploring how tackling the erosion of social capital could have beneficial health outcomes, and the extent of which this is the case.

Outcomes Associated with Social Capital

Research correlates high social capital with desirable health and QoL outcomes including:

- facilitate higher levels of, and growth in, GDP;
- facilitate the more efficient functioning of labour markets;
- facilitate educational attainment;
- contribute to lower levels of crime;
- lead to better health; and
- improve the effectiveness of institutions of government ⁽³⁾.

(1)De Silva *et al* (2005) Social and mental illness: a systematic review., *Journal of Epidemiology and Community Health*, Volume 59

(2) Office for National Statistics 2005 Measurement in social capital in the UK

(3) Social Capital, A Discussion Paper, Performance and Innovation Unit, The Cabinet Office, 2002

Communities where social capital is abundant are often characterised by high levels of trust between friends and neighbours, shared norms and values and local people engaging in civic and community life⁽¹⁾.

Although the majority of studies recognise the desirability of high levels of social capital, critics point out that some undesirable outcomes may also arise in communities with high level of social capital, for example exclusion or intolerance of other groups or group norms which are not necessarily conducive to individual welfare ⁽²⁾.

Social capital and mental health

With regards to mental health, research ⁽³⁾ has found a link between low levels of social capital and common mental illness. It has been hypothesised that social capital could reduce the effects of negative life events (eg loss of job) and long term difficulties (eg poor physical health).

Social participation, networks and support

Social capital has been found to reduce the likelihood of an onset of common mental illness and, it has been associated with higher chance of recovery for those with poor self-rated health. However, it has also been suggested that social capital play only minor roles in the processes leading to the onset of and recovery from common mental illness and poor self-rated health ⁽⁴⁾.

Furthermore, social capital may have a direct effect in promoting a sense of control in one's life and self-worth. 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.⁽⁵⁾

6.6.2

Assessment

- *QoL Domain:* Personal Wellbeing, Where We Live, Health, Natural Environment and What We Do.
- *People Affected:* Communities in proximity to the airport.
- *Link to other AC Framework Modules:* Place and Community.
- *Duration of Impact:* construction and initial operations.
- *Summary:* social capital is likely to decrease during construction and initial operation, with impacts on QoL due to concerns around real and perceived changes. Determining the extent of any impact on social capital

(1) Investigating the links between social capital and health using the British Household Panel Survey, HDA, 2004

(2) Social capital, A Literature Review, the Office for National Statistics, 2001

(3) Investigating the links between social capital and health using the British Household Panel Survey, HDA, 2004

(4) Investigating the links between social capital and health using the British Household Panel Survey, HDA, 2004

(5) Investigating the links between social capital and health using the British Household Panel Survey, HDA, 2004

as a result of mature operations is difficult, because of the increased housing and regeneration activities that will take place in the area. It is anticipated that over time communities will adapt to any changes and that Gatwick's Community Investment program has the potential to lead to enhancements in social capital, particularly as the quantity of money invested will increase as a direct result of R2.

The assessment below summarises the QoL impacts associated with social capital, drawing on the findings of the assessment undertaken for Community and Place.

The construction phase may have an effect on reciprocity and trust and views about the area for residents of the six local districts. These aspects of social capital will be affected mainly because of likely perceived changes to the area. These effects are likely to be greatest amongst long term residents of the area and potentially the elderly, who can be less able to adapt to changes. Construction of the airport may result in increased levels of mistrust and fear of increased crime and decreased linking social capital. The construction activity is also likely to reduce people's pleasure of living in the area, through the visual effects of seeing the construction, ground noise effects and any nuisance and annoyance associated with diversion and changes to road infrastructure. The knowledge and fear of the operational phase of the airport to follow will also play a part. Construction will be limited in duration, although activity is currently expected to continue for a 19 year period. This is not unusual activity for the airport, as various projects have added infrastructure on a near continuous basis over the airport's history. In addition, proactive communication and stakeholder engagement can assist impacted individuals and communities in understanding what the construction phase will entail.

R2 with associated involuntary relocation and the loss of community resources has the potential to disrupt social support and networks, as a result of the movement of people away from the immediate area and the potential for perceived changes to the area. This would be exacerbated if those not directly affected by involuntary relocation chose to move away following implementation of R2. These impacts are likely to be felt most during construction and the initial years of operation (from 2020 onwards) as people adapt to changes in the area. Again, longer term residents, the elderly and those suffering from mental or physical disabilities whose reliance on social support networks can be greater and who are less able to adapt to change are likely to be disproportionately affected. Any decline in people's views of the area in which they live may increase the negative health effects of social capital from loss of control and a perception or real sense of physical and social isolation.

Overall, social capital is therefore likely to decrease during construction and operation and therefore could result in health effects for parts of the affected

communities. Determining the extent of any impact on social capital over the longer term (2040-2050) is difficult and will be complicated by the presence of newcomers into the area who will have different views and perceptions of the expanded airport. Further, before or once operations have reached their peak (2040-2050), there is the potential for people to adapt to the changes.

Social capital has the potential to be enhanced through Gatwick's Community Investment program, such as the Gatwick Airport Trust and Gatwick Foundation, which will continue to make targeted contributions to eligible communities, the quantity of which will increase as a result of R2.

6.7 *EMPLOYMENT AND INCOME*

6.7.1 *Evidence*

Evidence suggests that those who are unemployed have poorer health than those in employment ⁽¹⁾. There is little evidence of the health benefits of moving from unemployment to employment. It is assumed that the relationship between unemployment and poor health is reversible (therefore becoming employed and employment is associated with good health).

Two hypotheses have been proposed to describe the relationship between unemployment and health:

- the health selection hypothesis ⁽²⁾ proposes that those suffering from poor health are more likely to be in low paid jobs or be unemployed; and
- the socio-economic explanation of health inequalities proposes that those in worse economic conditions are more likely to suffer from poor health ⁽³⁾.

Studies ⁽⁴⁾ suggest that the health selection hypothesis is less likely (although it has not been disproved) or that health selection operates but is too small to account for all the association between poor health and unemployment.

Health Effects

Unemployed individuals are more likely to report illness and injury as well as psychological symptoms such as demoralisation. Negative outcomes that have been associated with unemployment or unfavourable employment include:

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

(2) Dahl E. (1993) High Mortality in lower salaried Norwegian men; the healthy worker effect, *Journal of Epidemiology and Community Health* **47** 192-194

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

(4) Chandola *et al* (2003) Health selection in the Whitehall II study, UK. *Social Science and Medicine* **56** 2059-2072

- increased number of physical health effects;
- increased number of mental health effects;
- increased risk of suicide;
- decreased well being;
- decreased role functioning in relation to work, family life etc;
- poor self-reported health;
- increased mortality; and
- decreased life expectancy.

Conversely, the WHO identifies a number of ways in which employment can have a positive effect including:

- structuring time – the absence of which can be a psychological burden;
- social contact – with colleagues and friends;
- involvement in a collective effort or activity; and
- regular activity.

Employment is also thought to help define an individual's role in society and help form social relationships.

Studies in several countries have shown that unemployed people are less healthy and have higher mortality than employed people ⁽¹⁾. Even men who lost employment for reasons unrelated to health were at a raised risk of dying from both cancer and cardiovascular disease after controlling for lifestyle factors.

This suggests that non-employment, even in apparently healthy men, was associated with increased mortality and that there is a causal relationship between unemployment and mortality. This evidence for causality is further strengthened by the fact that neither health related behaviour nor social factors explained the differences in mortality that were seen and that relative risks were similar in non- manual and manual workers ⁽²⁾ ⁽³⁾.

Studies have also shown that living in deprived neighbourhoods is related to higher mortality rates independent of individual socio-economic characteristics. The mechanism of action is not understood however ⁽⁴⁾.

Research has shown the importance of unemployment, job security and employment conditions on health and in particular on chronic disease aetiology. A study by Bartley *et al* concluded that:

(1) Morris *et al* (1994) Loss of employment and mortality *BMJ* **308**:1135-1139

(2) Morris *et al* (1994) Loss of employment and mortality *BMJ* **308**:1135-1139

(3) Gerdtham *et al* (2003) A note on the effect of unemployment on mortality, *Journal of Health Economics* **22** 505-518

(4) Van Lenthe *et al* (2005) Neighbourhood unemployment and all cause mortality: a comparison of six countries *Journal of Epidemiology and Community Health* **59** 231-237

"Having secure employment in favourable working conditions greatly reduces the risk of healthy people developing limiting illness. Secure employment increases the likelihood of recovery."

This conclusion was based on the finding that men and women in the least favourable socio-economic conditions (routine occupations) are nearly four times more likely to become ill than those in the most favourable (professional and managerial). It was also suggested that deterioration in job security may be an important reason for the increasing prevalence of limiting illness ⁽¹⁾.

Duration of unemployment is related to the health effects. Health capital scores (a measure of health based on physical activity, Body Mass Index, diet, exercise and smoking habits) have also found to be significantly poorer in those with long periods of unemployment (37 months or longer) by age 33 ⁽²⁾. Recent unemployment may be more strongly related to mental health than accumulated unemployment because of the distress of becoming unemployed ⁽³⁾.

It is widely accepted that income affects health, with increased income often cited as being beneficial to health. There are many studies that show that those with low incomes have poorer health than those in high income groups ⁽⁴⁾⁽⁵⁾ and that this is graded the greater the income, the better the health. Above a middle threshold, however, higher income is less proportionately related to improved health.

Furthermore, evidence shows that income inequalities across countries or regions are not strongly associated with life expectancy; as differences seen in life expectancy and mortality can be explained away by individual level factors ⁽⁶⁾ such as individual income and lifestyle risk factors such as smoking^{(7) (8)}.

A review of longitudinal studies ⁽⁹⁾ concluded that long-term income may be more important for health than short-term income and that income change has a smaller effect on health than income level. Interestingly, decreases in

(1) Bartley *et al* (2003) Employment status, employment conditions and limiting illness: prospective evidence from the British Household panel Survey 1991-2001 *Journal of Epidemiology and community health* **58** 501-506

(2) Wadsworth *et al* (1999) The persisting effect of unemployment on health and social wellbeing in men in working life, *Social Science and Medicine* **48** 1491-1499

(3) Montgomery SM, Cook DG, Bartley MJ, Wadsworth ME (1999) Unemployment pre-dates symptoms of depression and anxiety resulting in medical consultation in young men. *International Journal of Epidemiology*. Feb; **28**(1):95-100.

(4) Marmot M (2002) The influence of income on health: views of an epidemiologist. *Health Affairs*; 31:46.

Ecob B, Davey Smith G (1999). Income and health: what is the nature of the relationship? *Social Science and Medicine*; **48**: 693-705. Benzeval M, Judge K (2001). Income and health: the time dimension. *Social Science and Medicine*; **52**: 1371-1390.

Deaton A. (2002) Policy implications of the gradient of health and wealth. *Health Affairs*; **21**:13-28.

(5) Osler *et al* (2002) Income inequality, individual income and mortality in Danish Adults: analysis of pooled data from two cohort studies *BMJ* **324** 13-17

(6) Mackenbach (2002) Income inequality and population health, Evidence favouring a negative correlation between income inequality and life expectancy has disappeared *BMJ* **324** 1-2

(7) Osler *et al* (2002) Income inequality, individual income and mortality in Danish Adults: analysis of pooled data from two cohort studies *BMJ* **324** 13-17

(8) Sturm *et al* (2002) Relations of income inequality and family income to chronic medical conditions and mental health disorders: national survey *BMJ* **324** 20-25

(9) Benzeval M, Judge K (2001). Income and health: the time dimension. *Social Science and Medicine*; **52**(9):1371-90.

income seem to be related to declining health but increases in income are less clearly related to health improvement ⁽¹⁾. Reversibility of the relationship cannot therefore be assumed. Data on increases in income and health change have not been published.

6.7.2

Assessment

- *QoL Domain:* What We Do, Personal Wellbeing, Health, Economy and Personal Finance.
- *People Affected:* Communities in proximity to the airport, employees, people who experience the social and economic effects of the airport.
- *Link to other AC Framework Modules:* Economy Impacts and Local Economy Impacts.
- *Duration of Impact:* construction, initial operation and mature operations.
- *Summary:* R2 will increase employment opportunities during construction and operational phases, as well as providing significant generation of new employment opportunities within the supply chain with associated benefits for health and QoL. R2 would also support the regeneration of the area through the development of new housing in the area and Gatwick's commitments to employment and training as well as the increased connectivity that is likely to result.

Gatwick is a major employer within the local area, predominantly for people residing within the local communities within which Gatwick is situated, but also across the Gatwick Study Area. R2 will increase employment opportunities during construction and operational phases, as well as providing significant generation of new employment opportunities within the supply chain for Gatwick and through the economic stimulus which R2 is anticipated to generate. Economic benefits to UK economy (ie those additional to the benefits to users and providers of aviation services) for R2 are predicted to be £8billion compared with £5billion for a third runway at London Heathrow ⁽²⁾. The overall, present value benefits of R2 are £38billion (excluding wider impacts) and £46billion (including wider impacts) and it has a total resource cost (excluding operating cost) of £7billion ⁽³⁾. Productivity growth of 1-2% a year has been assumed, in line with past trends, yielding gross employment increases by 2050 of around 22,000, of which between 16,000-18,000 jobs would be filled by people living in the local area. Using relevant local estimates of Gross Value Added per head, the increase in employment would add £1.73 billion to the local economy. This includes

(1) Benzeval M, Judge K (2001). Income and health: the time dimension. *Social Science and Medicine*; 52(9):1371-90.

(2) Assessing Gatwick R2 An Economic Appraisal March 2014 Oxera

(3) Ibid

displacement effects. Thus, catalytic effects could add substantially to this number. In particular, these benefits are likely to be experienced within the areas of south London and specifically places such as Croydon, where R2 has the potential to enhance investment appeal and stimulate regeneration, a recognised planning and policy priority. It should also generate direct and indirect benefit in areas such as Crawley, where, as previously discussed, there is relative socio-economic deprivation.

R2 would also support the development of new housing in the area which would also contribute to the regeneration and rehabilitation of the area, in particular deprived areas. As a result of the economic benefits of R2, around 9,300 new households would be required by 2050 which would be directly attributable to R2. Any activities that increase access to secure long term employment opportunities is likely to have beneficial impacts on the health and wellbeing, and general QoL, of those individuals as well as their households. In addition, regeneration is likely to result in benefits for both the local and regional community associated with increased satisfaction with where people live and the natural environment. Such benefits are likely to commence in construction and increase as operations mature.

To further enhance the positive contribution which Gatwick can generate through R2, a series of employment pledges have been created, such as Gatwick's commitment to develop an employment, training and education strategy to support training establishments and provide recruitment programmes.

More broadly, it is reasonable to project that R2 will enhance connectivity; further opening up domestic and international markets for trade and supporting the growth of 'UK Plc'. Again, this is considered to be a greater effect for R2 at Gatwick (£8billion), as compared with a third runway at Heathrow (£5billion), resulting in greater benefits to QoL associated with economics and finances across the UK.

6.8 ACCESS TO LEISURE AND ECONOMIC OPPORTUNITIES OVERSEAS

6.8.1 Assessment

- | |
|---|
| <ul style="list-style-type: none"> • <i>QoL Domain:</i> Personal Wellbeing, Health, Economy and Personal Finance What We Do. • <i>People Affected</i> Airport users (business or leisure). • <i>Link to other AC Framework Modules:</i> Economy Impacts and Local Economy. • <i>Duration of Impact:</i> initial operation and mature operations. • <i>Summary:</i> R2 will increase connectivity for both business and leisure users |
|---|

with associated benefits for QoL including increased wellbeing through access to leisure, family and friends overseas and by supporting economic activities of business users.

The Annual Population Survey highlights a continuing trend of access to overseas travel, with a 4% increase in January 2014 compared to January 2013 ⁽¹⁾ and in the 12 months to January 2014 the number of visits abroad by UK residents grew 2% when compared with a year earlier.

Visits to North America and Europe both increased by 2% and visits to other countries rose by 3%. Visits to friends or relatives grew by 5%, holiday visits grew by 2% but business visits fell by 1%. This would suggest that individuals are increasingly using enhanced connectivity to access social networks that exist not only within the UK but also globally. Access to such networks is an important contributor to an individual's QoL and, in particular, in relation to wellbeing and enhancement of social capital and, therefore, health.

Such accessibility not only benefits those in the local area (6 districts described in the community profile above) but also individuals living across London and the south east of England and beyond. People will benefit from the additional surface access connections as well as the increased variety of destinations made possible through R2. Gatwick as a provider of regular flights to Europe is well placed to continue to serve those individuals in south east England who are looking for easily accessible affordable flights to Europe and beyond. Likewise, access to leisure opportunities is important to the QoL of individuals and families by improving wellbeing and personal satisfaction.

In relation to business travel, while there has been an overall decline in business travel according to the annual population survey, flexible, easily accessible flights are essential for those who do need to travel for business. For many business travellers in the 6 districts as well as in Kent and West and East Sussex, surface access links to Gatwick are a key driver to selecting Gatwick airport as their airport of choice.

A third runway at Heathrow will also provide additional access to flights for business and leisure, but the geographical area that will benefit will vary, relative to R2. The 2+2 approach will ensure that destinations are served from both Heathrow and Gatwick, enabling improved connectivity from the London system and the south east in general and providing greater choice.

(1) Annual Population Survey: Overseas Travel and Tourism, Provisional Results for January 2014.
<http://www.ons.gov.uk/ons/rel/ott/overseas-travel-and-tourism---monthly-release/january-2014/stb-monthly-overseas-travel-and-tourism--provisional-results-for-jan>

Such benefits will be felt initially during 2025 when additional capacity becomes available at Gatwick and are likely to increase towards 2050 as operations mature and additional flights become available.

6.9

SUMMARY OF IMPACTS

This assessment has identified a range of QoL effects. Based on the assessment, the negative effects on QoL are mainly associated with environmental changes including aircraft noise, emissions to atmosphere and ground noise. These will have some identifiable health effects. It should be noted, however, that these health effects are likely to be relatively small, especially when viewed in the context of background rates of diseases and health outcomes. Moreover, the adverse effects are likely to be considerably lower than would be the case of expanding Heathrow airport. In addition, Gatwick is committed to developing and implementing mitigation measures that will minimise the potential effects: its existing mitigation measures will be expanded, and some enhanced, to cover impacts associated with R2.

Some of the adverse QoL impacts are likely to occur prior to construction commencing. In particular, anxiety related to concerns over the development and the involuntary relocation process. The fact that R2 will mainly occur within safeguarded land will reduce uncertainty around the proposals and help to mitigate the potential stress and anxiety associated with the development of the airport.

R2 will also result in positive benefits to the QoL across the six local districts as well as south east England, not least associated with the socio-economic and regeneration opportunities that R2 will bring to the region as a whole as well as to the more deprived areas. In addition, changes to the social capital of the area are likely to result in changes in QoL. While it is recognised that these changes will require adaptation and that this may take time, the measures that Gatwick is planning will again assist in maximising benefits and minimising negative impacts.

It should be noted that QoL and, in particular, health effects will be felt disproportionately by vulnerable groups in the area, such as the elderly and very young and those suffering from mental and physical disabilities or ill health. Areas with higher levels of deprivation are also likely to be more vulnerable to some negative impacts. Conversely, such groups would also receive greatest benefits from the economic, regeneration and positive social capital elements of R2.

7.1 INTRODUCTION

The preceding sections have explained how QoL effects associated with R2 have been identified and assessed. The purpose of this section is to consider how the adverse effects can be minimised and the beneficial effects maximised in order to maintain or enhance QoL.

7.2 APPROACH

There a number of factors to account for when considering appropriate mitigation and enhancement measures. These can be summarised as follows:

- Effects, however, temporary will be experienced during construction phases and where possible, should be minimised and mitigated to protect QoL during these phases.
- Most of the identified effects will not be experienced until operations commence. This does not, however, argue for inactivity in managing effects until this time period occurs. Mitigation can be planned and subsequently implemented, to reduce such effects, wherever possible.
- Some of the effects are associated with features of R2 that cannot be adjusted without changing the purpose of the development itself. For example, exposure to air noise obviously could be reduced by decreasing the number of ATMs. Inevitably, this means that some effects are more amenable to management than are others.
- Adverse effects will be experienced disproportionately by some members of the community and the management of these effects needs to be focussed on where the effects will occur and to whom.
- In addition to minimising negative effects, measures to proactively enhance QoL should be identified and integrated into the R2 proposals

7.3 MITIGATING ADVERSE EFFECTS & ENHANCING QOL

Specific measures for mitigating and enhancing QoL impacts in relation to R2 are as follows:

Construction Phase

- A Sustainable Construction Strategy and Code of Construction Practice is being developed which will incorporate best practice management

approaches and standards, coupled with localised assessment, to identify the optimal approach to undertaking construction with least disruption and impact to quality of life of local communities.

Engagement and Communication

- Gatwick have developed and will implement a comprehensive Stakeholder Engagement strategy for R2. This strategy will meet and exceed regulatory requirements, the Commissions requirements as well as Gatwick's internal standards. As such, the engagement will seek to ensure that all stakeholders are able to effectively comment on R2 and ensure that Gatwick are able to address specific through design, form, scale and give reasons why other consultation issues have not been incorporated into the final application.
- A specific Engagement Charter is being developed to define how Gatwick will engage with the local community, local stakeholders and existing owners and occupiers of land that will be affected. This Charter will set out clearly what stakeholders can expect by way of engagement and detail the mechanisms by which people can engage and consult with Gatwick.
- Gatwick is also working with local stakeholders to introduce a Community Flood Risk Forum, to provide ongoing communication and dialogue with our local communities

Land-Take and Blight

- Gatwick has designed the perimeter and alignment of roads to minimise land take and the loss of listed buildings, ancient woodland and ancient monuments. Where land additional to the existing footprint of the airport is required, this will be taken from safeguarded zones i.e. land marked for redevelopment for the airport.
- Where this impacts on community amenities or assets, reprovion or support for relocation will occur. This includes reprovion of the local rugby club and ancient woodland (providing a net gain) as well as support for commercial and residential dwellings affected. Working with local authorities and companies Gatwick will support the relocation of care homes and nurseries to ensure that the transition is handled sensitively and with minimal disruption.
- The Home Owners Support Scheme would be expanded to support owners of properties which, if development went ahead, would be newly exposed to medium-to-high levels of noise (66 decibels Leq). The voluntary scheme means that people will not have to wait until any new development has opened for any support or assistance against blight, as they would usually have to if Gatwick only fulfilled its legal obligations. Eligible property owners can require Gatwick to purchase their property for its unblighted market value (as if no runway development had been

proposed) if Gatwick announces its intention to proceed with construction (having received the necessary consents).

- The Property Market Support Bond provides support or compensation against blight prior to development consent. People who take part in the scheme may sell their property to Gatwick, if Gatwick decides to apply to build R2, at market value. This scheme covers houses in land that would be needed for the new runway development.

Noise Insulation and Management

- Gatwick will make an annual contribution to the Council Tax of residents most affected by noise and increased aircraft movements. Eligible Council Tax payers living within an independently defined noise contour would be able to apply for a £1000 per year payment toward the cost of their Council Tax. In order to be eligible, Council Tax payers would have to be resident and registered for Council Tax when the scheme is introduced, and their homes would have to be within the boundary of a 57 dBA LAeq 16 hour noise contour, which is the Department for Transport's contour for the onset of noise annoyance.
- A range of noise management and mitigation measures have been developed as part of the Noise Environmental Action Plan 2013-2018. In addition, Gatwick has committed to work with Gatcom (stakeholder group) to explore the potential for a ground run pen, to further reduce noise exposure. Provision of noise bunds, walls and landscaping in sensitive areas of the boundary will also to be undertaken in accordance with best practice.

Supporting Sustainable Communities

- Gatwick is undertaking targeted partnership working and investment in identified regeneration priority areas, where the stimulus to local economic development and quality of life can be greatest.
- Local procurement and partnership working with Councils, skills and development agencies will be undertaken to capitalise upon and maximise local uptake of these employment opportunities
- Gatwick is creating a Life Long Employability Programme to engage and up-skill working age sections of the community to position them to capitalise upon employment and career development opportunities
- The activities of the Gatwick Community Trust, which supports the development of young people, the arts, sporting facilities, environmental improvement and conservation, improvements to community facilities, volunteering, the elderly and the disabled, will be expanded if R2 is successful. This will be complemented by a new Community Foundation to support the Trust.

- Gatwick is developing a new 'Community Asset' initiative which maximises the benefit which the airport can generate to local communities for example, through providing amenity space for events and reaffirming Gatwick's approach to being part of its communities and a good neighbour.
- Investment in biodiversity and greenspace will be expanded through R2, to continue enjoyment of this leisure and environmental asset for local communities
- A new sustainable transport interchange is being created in the form of the Gatwick Gateway for local and passenger use, and there will be enhanced provision of bus routes, cycle and foot paths for community use.

It is also noted that Gatwick has committed to further working with stakeholders to identify further opportunities to enhance QoL wherever possible through both construction and operational phases.

Annex A

Community Profile

A Second Runway at Gatwick is proposed on the southern side of the existing Gatwick Airport in the district of Crawley, West Sussex. The Airport is located in relatively close proximity to the districts of Reigate & Banstead (R&B), Mole Valley, Tandridge, Mid Sussex and Horsham all of which are in West Sussex. Three counties, East Sussex, Surrey and Kent are also located close to the airport. The closest built up areas to the Airport are Crawley, to the south, and Horley, to the north.

Information on the six districts and four counties, named above, has been gathered to be able to profile the communities that are most likely to be impacted by the expansion. The aim of this profile is to understand the differing susceptibilities to health impacts and receiving of benefits as a result of variations in social and demographic status and relative deprivation in the communities profiled.

1.1 POPULATION

1.1.1 Size and Age Distribution

Table A1.1 below presents the breakdown of the population by gender within the surrounding areas. All of the districts and counties mirror the gender ratio in England with a slightly higher percentage of females than males in all areas. Crawley, where the proposed project lies, has a population of 106,597, which is smaller than the adjacent districts of Horsham, Mid Sussex and R&B, but greater than the number of people living in Mole Valley or Tandridge.

Table A1.1 Population Data by Gender (2011)

Area	Males (%)	Females (%)	Total
Crawley District	49.4	50.6	106,597
Horsham District	48.6	51.4	131,301
Mid Sussex District	49.0	51.0	139,860
Mole Valley District	48.9	51.1	85,375
Reigate & Banstead District	48.9	51.1	137,835
Tandridge District	48.4	51.6	82,998
West Sussex County	48.4	51.6	806,892
East Sussex County	48.2	51.8	526,671
Surrey County	49.0	51.0	1,132,390
Kent County	48.9	51.1	1,463,740
South East	49.1	50.9	8,634,750
England	49.2	50.8	53,012,456

Source: Census 2011 – www.statistics.gov.uk

The age structure of a population indicates the current and future socio-economic and health requirements of an area. A younger population, for

example, may require additional access to schools, safe recreation play facilities and the development of future employment opportunities, while aging populations are likely to require a greater focus on health care, living support, accessibility and social networks. The age structure of the surrounding districts and counties in which the Project is situated in or close to is shown below in *Table A1.2*.

Table A1.2 **Population Data by Age (2011)**

Area	0-14 (%)	15-19 (%)	20-29 (%)	30-44 (%)	45-59 (%)	60-74 (%)	75+ (%)
Crawley District	19.6	5.9	14.9	23.8	18.5	10.7	6.7
Horsham District	17.4	6.0	8.8	19.2	22.2	16.9	9.4
Mid Sussex District	18.2	5.8	10.0	20.4	20.9	15.8	9.0
Mole Valley District	17.2	5.9	8.6	18.9	21.9	17.3	10.3
Reigate & Banstead District	18.5	5.6	11.0	22.1	20.2	14.2	8.4
Tandridge District	18.1	6.0	9.5	19.6	21.6	16.3	9.0
West Sussex County	16.9	5.7	10.6	19.4	20.2	16.8	10.5
East Sussex County	16.1	6.0	9.9	17.2	20.5	18.7	11.5
Surrey County	18.1	6.0	10.9	21.2	20.5	14.7	8.6
Kent County	18.0	6.6	11.7	19.3	19.8	16.0	8.5
South East	17.8	6.2	12.3	20.4	19.9	15.0	8.3
England	17.7	6.3	13.7	20.6	19.4	14.6	7.8

Source: Census 2011 – www.statistics.gov.uk

Table A1.2 shows that, broadly speaking, the age structure of the population in the surrounding districts and counties are generally similar to that of England as a whole. However, variations can be seen at district and county level.

Crawley District, where the airport is located, has a relatively young population, with a notably high proportion of under 14s (19.6%) and fewer over 75s (6.7%) when compared to the regional (17.8% and 17.7%) and England average (8.3% and 7.8%). The second largest town in close proximity to the project is to the north, in Horley, located in R&B District. R&B also has a higher than average proportion of under 14s (18.5%).

Horsham and Mole Valley districts both have notably few people within the 20-29 age groups (8.8% and 8.6% respectively). Crawley has a higher than average proportion of people in the 30-44 age group (23.8%) and a markedly lower than average proportion who are between 60-74 (10.7%). All districts, apart from Crawley, have a higher than average proportion of people over 75 than the England average (7.8%), particularly Mole Valley (10.3%).

At County level, both West Sussex (in which the project site lies) and East Sussex have ageing populations, with a high proportion of the population over the age of 75 in 2011, compared to both the regional and England average.

Population density provides a measure of the number of people living in an area. It is higher in urban areas, and lower in rural areas. *Table A1.3* shows

that the districts in which the two closest towns sit, Crawley and R&B, both have significantly higher than regional and England average population densities, highlighting their urban nature (23.7 and 10.7 compared to 4.5 and 4.1 respectively). On the contrary, Horsham, Mole Valley and Tandridge have lower population densities than the England average (2.5, 3.3 and 3.3 respectively), indicating their more rural nature.

The four counties mirror more closely the regional and England average, but population density is slightly lower in East Sussex (3.1) and higher in Surrey (6.8).

Table A1.3 *Population Density (2011)*

Area	Persons per hectare
Crawley District	23.7
Horsham District	2.5
Mid Sussex District	4.2
Mole Valley District	3.3
Reigate & Banstead District (R&B)	10.7
Tandridge District	3.3
West Sussex County	4.1
East Sussex County	3.1
Surrey County	6.8
Kent County	4.1
South East	4.5
England	4.1

Source: Census 2011 – www.statistics.gov.uk

1.1.2 *Ethnicity*

Epidemiological evidence suggests that minority groups often experience fewer socio-economic and physical health benefits; this may be a result of discrimination, levels of education, or even language barriers ⁽¹⁾.

Table A1.4 shows that with the exception of Crawley District, all other districts and counties surrounding the development are dominated by white people, with, on average, less than four to ten percent of the population being black or from another ethnic minority compared to the England average (14.7%). The Districts with the least black or another ethnic minority groups are Horsham (4.2%), Mid Sussex (5%) and Mole Valley (6%). Members of these ethnic minorities are therefore more likely to experience feelings of isolation and exclusion from society as a whole. The four surrounding counties and the south-east region reflect this same pattern.

Conversely, the population south of the Airport in Crawley District has a higher than average percentage of non-white inhabitants, predominantly people of Asian or British Asian and Black or Black British and Mixed ethnicities.

(1) Samje C (1995) *Heath, Race and Ethnicity: Making Sense of the Evidence*. King's Fund Institute: London

Table A1.4 Ethnicity (2011)

Area	White (%)	Asian or Asian British (%)	Mixed (%)	Black or Black British (%)	Chinese or Other Ethnic Group (%)
Crawley District	79.8	12.5	2.9	3.3	1.6
Horsham District	95.8	1.7	1.4	0.5	0.8
Mid Sussex District	95.0	2.3	1.4	0.6	0.7
Mole Valley District	94.9	2.1	1.5	0.5	0.9
Reigate & Banstead District	90.5	4.5	2.2	1.6	1.4
Tandridge District	93.5	2.1	2.2	1.1	1.1
West Sussex County	93.6	3.1	1.5	0.9	0.8
East Sussex County	95.8	1.4	1.4	0.6	0.9
Surrey County	90.2	4.8	2.1	1.1	1.8
Kent County	93.4	2.8	1.5	1.1	1.2
South East	90.5	4.6	1.9	1.6	1.4
England	85.3	7.0	2.3	3.5	1.8

Source: Census 2011 – www.statistics.gov.uk

1.1.3 Religion

The concept of a minority group can also be applied to religions, as with ethnicity. Those in minority religions may experience feelings of exclusion and a loss of social networks and support that comes from shared religious celebrations and worship.

Table A1.5 shows the proportion of individuals professing different types of faith in the study area. The significant majority of the population is Christian in all cases, with the second highest majority stating no religion. There is a markedly high percentage of Muslim and Hindu residents in Crawley District (7.2% and 4.6% respectively). The districts of Horsham, Mid Sussex, Mole Valley, R&B and Tandridge all have lower percentages of minority religious (Buddhist, Hindu, Jewish, Muslim and Sikh) residents than the English average. Mid Sussex District and East Sussex County have a high proportion of residents stating ‘other religion’ compared to the surrounding districts and counties, and the regional and English average. With the exception of Sikhs in East Sussex, all other religious groups (included in the 2011 census) are represented in the areas.

Table A1.5

Religion (2011)

Area	Christian (%)	Buddhist (%)	Hindu (%)	Jewish (%)	Muslim (%)	Sikh (%)	Other religions (%)	No religion (%)	Religion not stated (%)
Crawley District	54.2	0.4	4.6	0.1	7.2	0.7	0.4	26.0	6.4
Horsham District	63.5	0.3	0.3	0.2	0.5	0.1	0.4	26.9	7.9
Mid Sussex District	62.7	0.4	0.6	0.2	0.8	0.1	0.7	26.6	7.9
Mole Valley District	64.3	0.4	0.7	0.2	0.8	0.1	0.4	25.2	7.9
Reigate & Banstead District	61.9	0.4	1.4	0.2	1.9	0.1	0.3	26.3	7.4
Tandridge District	64.9	0.4	0.7	0.2	0.7	0.1	0.3	25.3	7.5
West Sussex County	61.8	0.4	0.9	0.2	1.6	0.1	0.5	26.9	7.7
East Sussex County	59.9	0.4	0.3	0.2	0.8	0.0	0.7	29.6	8.1
Surrey County	62.8	0.5	1.3	0.3	2.2	0.3	0.4	24.8	7.4
Kent County	62.5	0.5	0.7	0.1	1.0	0.7	0.4	26.8	7.3
South East	59.8	0.5	1.1	0.2	2.3	0.6	0.5	27.7	7.4
England	59.4	0.5	1.5	0.5	5.0	0.8	0.4	24.7	7.2

Source: Census 2011 – www.statistics.gov.uk

1.2

EDUCATION, SKILLS AND TRAINING

Education is an important determinant of health and influences almost every aspect of health including lifestyle, coping skills, future employment prospects and subsequent income, quality of housing and healthcare. Improving the quality and level of education is therefore a national imperative. The percentage of the population of the districts and counties potentially affected by the Airport expansion with various levels of qualifications are shown in Table A1.6.

Table A1.6

Education and Qualification Levels (2011)

Area	Total number of schoolchildren and full-time students aged 16-74	People aged 16-74 with no qualifications (%)	People aged 16-74 who attained level 1 (%)	People aged 16-74 who attained level 2 (%)	People aged 16-74 who attained apprenticeships (%)	People aged 16-74 who attained level 3 (%)	People aged 16-74 who attained level 4 / 5 (%)	People aged 16-74 with other qualifications / level unknown (%)
Crawley District	106,758	16.3	13.3	17.8	3.4	12.7	32.6	4.0
Horsham District	112,755	14.8	13.4	17.3	3.4	13.2	33.6	4.2
Mid Sussex District	85,971	21.3	14.3	17.4	3.7	12.5	26.0	4.8
Mole Valley District	69,580	16.0	11.7	16.1	2.8	11.3	37.9	4.2
Reigate & Banstead District	110,725	16.6	13.2	16.6	2.9	12.0	34.0	4.8
Tandridge District	66,922	17.1	13.4	17.5	2.9	12.3	33.0	3.9
West Sussex County	661,937	20.0	14.2	17.0	3.6	12.3	27.8	5.2
East Sussex County	435,515	22.6	14.1	16.8	3.5	12.0	26.2	4.7
Surrey County	913,899	15.9	12.2	15.3	2.9	12.3	36.2	5.1
Kent County	1,180,186	22.5	14.7	16.9	3.8	12.3	24.7	5.1
South East	6,992,666	19.1	13.5	15.9	3.6	12.8	29.9	5.2
England	42,989,620	22.5	13.3	15.2	3.6	12.4	27.4	5.7
Level 1: 1-4 O Levels/CSE/GCSEs (any grades), Entry Level, Foundation Diploma, NVQ level 1, Foundation GNVQ, Basic Skills / Essential skills. Level 2: 5+ O Level Passes/CSEs (Grade 1)/GCSEs (Grades A*-C), School Certificate, 1 A Level/ 2-3 AS Levels/VCEs, Intermediate/Higher Diploma, Welsh Baccalaureate Intermediate Diploma, NVQ level 2, Intermediate GNVQ, City and Guilds Craft, BTEC First/General Diploma, RSA Diploma. Level 3: 2+ A Levels/VCEs, 4+ AS Levels, Higher School Certificate, Progression/Advanced Diploma, Welsh Baccalaureate Advanced Diploma, NVQ Level 3; Advanced GNVQ, City and Guilds Advanced Craft, ONC, OND, BTEC National, RSA Advanced Diploma. Level 4/5: Degree (for example BA, BSc), Higher Degree (for example MA, PhD, PGCE), NVQ Level 4-5, HNC, HND, RSA Higher Diploma, BTEC Higher level, Professional qualifications (for example teaching, nursing, accountancy). Other Qualifications: other vocational / work-related qualifications and non-UK / foreign qualifications.								

Source: Census Data 2011 – www.statistics.gov.uk

With the exception of East Sussex County, all districts, and the counties that they lie within, show a lower proportion of their population having no qualifications than across England as a whole. This is particularly true of Horsham, Mole Valley, Crawley, and R&B districts where less than 17% of the population have no formal qualifications, compared to 22.5% in England. East Sussex mirrors the English average very closely. Mid Sussex's educational profile, however, has a much higher proportion of people with no qualifications than the surrounding districts.

In addition to the low level of unqualified residents in the surrounding districts, they further deviate from the English average by showing a much higher proportion of people with the highest level of qualifications (level 4/5) than the England average. The exception to this is Mid Sussex district, in which only 26% of the population have level 4/5 qualifications- lower than the English average of 27.4%. At county level, however, with the exception of Surrey, and the region as a whole, percentages of those with the highest qualifications are much closer to the English average.

All districts have a relatively sizable populace of schoolchildren and full time students, Especially Horsham, R&B and Crawley.

1.3

EMPLOYMENT AND INCOME

Income and employment influence a range of factors including access to housing, education, services and social networks as well as diet, lifestyle and coping skills. These in turn are key determinants of a variety of physical and mental health impacts and ultimately health and well-being.

Table A1.7 shows the level of economic activity in the area. All six districts have a higher overall proportion of people in full or part time employment, or people who are self-employed compared to the England average. Employment levels in the six districts range from 67.8% -69.7%, compared with the England average of 62.1%. At county level, only East Sussex has a smaller percentage of their population in employment (61.6%) compared to the England average. The regional employment rate is 65.2%.

Levels of unemployment range from 2.4%-2.8% in all districts, except Crawley, where 4.5% are unemployed. This is notably lower than England as a whole (4.4%). Moreover, in all districts and counties, except East Sussex, the percentage of people long term sick/ disabled is lower than the England average. The proportion of the population looking after home or family however is broadly in line with England as a whole at district, county and regional level.

The retirement population is significantly lower in Crawley (9.5%) and R&B (12.4%) than the regional and England averages (both 13.7%). Retirement populations are more concentrated in Mole Valley, Horsham, Mid Sussex and Tandridge (ranging between 14.1% & 15.7%).

There are fewer economically active and inactive students in all of the districts compared to England as a whole.

Table A1.7

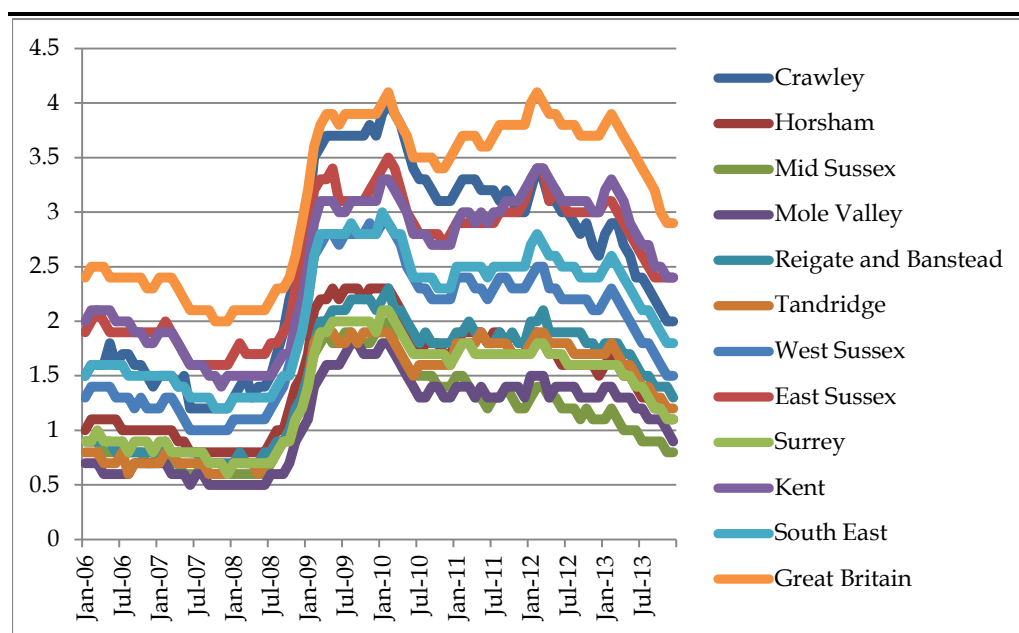
Economic Activity of the Population aged 16-74 (2011)

Area	Full-time employed (%)	Part-time employed (%)	Self Employed (%)	Unemployed (%)	Economically active student (%)	Retired (%)	Economically inactive student (%)	Looking after home / family (%)	Long term sick / disabled (%)	Other Economically inactive (%)
Crawley District	47.2	14.4	7.8	4.5	3.1	9.5	3.3	4.9	3.2	2.1
Horsham District	40.3	14.8	12.9	2.7	2.7	15.5	3.5	4.2	2.2	1.3
Mid Sussex District	42.2	15.1	12.4	2.4	2.6	14.2	3.6	4.0	2.0	1.4
Mole Valley District	39.2	13.9	14.7	2.5	2.4	15.7	3.8	4.4	2.1	1.4
Reigate & Banstead District (R&B)	44.0	13.5	12.3	2.9	2.5	12.4	3.5	4.4	2.3	2.1
Tandridge District	40.7	13.5	14.2	2.8	2.2	14.1	4.3	4.3	2.2	1.6
West Sussex County	39.5	14.8	11.7	3.2	2.9	15.8	3.5	4.1	2.9	1.6
East Sussex County	33.5	14.7	13.4	3.6	2.8	17.8	4.0	4.2	4.1	1.8
Surrey County	42.2	13.0	12.5	2.8	3.1	12.9	5.0	4.7	2.0	1.7
Kent County	37.9	14.1	10.9	3.9	3.1	15.1	4.8	4.7	3.6	1.9
South East	40.4	13.8	11.0	3.4	3.3	13.7	5.2	4.4	2.9	1.8
England	38.6	13.7	9.8	4.4	3.4	13.7	5.8	4.4	4.0	2.2

Source: Census Data 2011 - www.statistics.gov.uk

The graph below shows the percentage of population of working age claiming Job Seekers' Allowance (JSA) between January 2006 and Dec 2013.

Figure A1.1

Job Seekers Allowance Claimant Rates (percentage of resident population 2006-2013)

Note: % is a proportion of resident population of area aged 16-64

Source: ONS claimant count with rates and proportions

<https://www.nomisweb.co.uk/reports/lmp/la/1946157342/report.aspx#tabwab>

The graph shows that all districts and counties surrounding the project have fewer than average JSA claimants compared to England as a whole. Mid Sussex and Mole Valley have the fewest claimants of all the districts, indicative of affluence and access to paid employment. Crawley has the highest percentage of claimants, indicating relative deficit within the labour market compared to its neighbouring areas. At county level, Kent and East Sussex have the highest claimant rates, but they're still markedly less than the England-wide average.

All areas experienced a sharp growth in the number of claimants (circa. July 2008 – May 2009) followed by a sharp drop (circa. March – August 2010). Levels fluctuated and reached a peak in around February 2012. They steadily fell across the next year but peaked again in around February 2013. Since then they've been falling at a comparatively rapid rate. This pattern is seen across all districts, counties and at England level and can be attributed to recent economic instability.

1.4 *TRANSPORT*

Transport plays a vital role in the health and well-being of communities through the provision of access to a range of services and amenities required to treat illness as well as to manage and promote healthy living.

Any activity that promotes a modal shift to public or green transport will contribute to a healthier lifestyle and environment, reduce the reliance on the use of non-renewable fuels, reduce emissions to air, diminish risk from accident and injury, and promote physical activity. Equally those who own their own cars are more able to access jobs and services outside of their local area and are less likely to suffer from social exclusion than those who do not. As can be seen from the evidence base, there is a strong correlation between deprivation and road traffic accidents; childhood pedestrian mortality also shows a steep social gradient ⁽¹⁾. Car ownership roughly correlates with housing ownership and is an indicator of wealth for many areas in the country.

Rural communities are often less well served by public transport than their urban counterparts as these routes may be less profitable; this increases the reliance on the use of cars in rural communities.

The level of car ownership in Crawley, Horsham, Mid Sussex and Mole Valley districts is markedly lower than both the regional and England average. This is reflected most strongly in Crawley, where 25.8% of people don't own a car. Similarly, these districts show a lower level of people owning two or more vehicles compared to England as a whole.

(1) Roberts. (1996). Does the decline in childhood mortality vary by social class. BMJ.

At county level, West Sussex and East Sussex reflect the England average, while in Kent and Surrey a larger proportion of the population own no car (22.4% and 17.8%). Conversely, as a region, the South East shows a higher than average level of car ownership, especially of those owning two or more vehicles.

Table A1.8 *Car Ownership (Percentage of Households 2011)*

Area	No car or van	1 car or van	2 or more cars or vans
Crawley District	25.8	42.2	32.1
Horsham District	18.6	41.7	39.7
Mid Sussex District	21.9	43.3	34.9
Mole Valley District	20.0	42.7	37.3
Reigate & Banstead District	13.1	40.4	46.4
Tandridge District	12.3	39.0	48.7
West Sussex County	13.8	41.5	44.8
East Sussex County	11.8	39.7	48.5
Surrey County	17.8	43.4	38.8
Kent County	22.4	44.8	32.7
South East	11.8	39.6	48.6
England	13.6	42.2	44.2

Source: Census 2011 – www.statistics.gov.uk

1.5 HOUSING

Housing is a frequently underrated determinant of health. It is not only required to provide shelter, security and a family base, but the quality of housing is also associated with economic, social, mental and physical well-being ⁽¹⁾. The health impacts associated with poor housing can include a range of physical illness brought on from poor shelter and subsequent exposure to cold, damp or pollutants ⁽²⁾. The risk of communicable diseases is increased if there is overcrowding, while stress related and mental illness can be brought about through a lack of affordable housing or high rent ⁽³⁾. As a result, deprived communities, children and the elderly ⁽⁴⁾ are particularly sensitive to health outcomes associated with poor housing.

Additionally, home ownership is also an indicator of wealth. The types of households that are available in an area are an indicator of the relative wealth of the area. Factors influencing housing and subsequent health outcomes therefore reflect the quality, distribution, overcrowding, affordability and ownership of homes.

(1) Journal of Social Issues, Vol 59/3, 03.The Residential Context of Health. The European Network for Housing Research

(2) Platt S., Martin C., Hunt S. and Lewis C. (1989). Damp housing, mould growth and symptomatic health state. British Medical Journal, 298:1673-8.

(3) Shaw M., Darling D., Gordon D. and Davey Smith G. (1999). The Widening Gap: Health Inequalities and Policy in Britain. Bristol: The Policy Press.

(4) Savage A. (1988). Warmth in Winter: Evaluation of an Information Pack for Elderly People. Cardiff: Cardiff University of Wales College of Medicine Research Team for the Care of the Elderly.

There are significant differences in housing between Crawley and the other five districts. There are a significantly small percentage of detached houses in Crawley (14%), compared to England as a whole, where the other boroughs contain significantly higher proportions (28.4% - 38.8%). Crawley also has significantly fewer semi-detached houses (20.8%) compared to the England average (31.2%), where the other five districts closely mirror the regional (21.8%) and England averages, ranging from 26.8% - 30%.

With the exception of Horsham (16.6%), all districts have a similar proportion of flats/ apartments as the South East region (20.3%) and England as a whole (21.2%), ranging from (18.4% -24%).

Crawley has a significantly large proportion of terraced housing (41.8%) when compared to any of the surrounding areas and England as a whole (24.5%). All other districts have fewer of these dwelling types (12.5%-17.1%) than the regional (22.5%) or England average. Mole Valley District has a high proportion of mobile or temporary homes, almost four times the England average.

The four counties and the South East region all mirror the England average closely.

Table A1.9 *Proportion of Different Household Types (2011)*

Area	Detached house or bungalow (%)	Semi-detached house or bungalow (%)	Terraced house or bungalow (including end terrace) (%)	Flat; maisonette or apartment (%)	Mobile or temporary structure (%)
Crawley District	14.0	20.8	41.8	23.3	0.0
Horsham District	38.8	26.8	17.1	16.6	0.7
Mid Sussex District	34.9	30.0	16.2	18.4	0.4
Mole Valley District	38.3	28.2	12.5	19.0	2.0
Reigate & Banstead District (R&B)	28.4	29.9	16.8	24.1	0.6
Tandridge District	36.5	28.4	14.1	20.1	0.8
West Sussex County	29.9	26.6	21.6	21.1	0.6
East Sussex County	32.5	24.8	18.2	23.5	0.5
Surrey County	33.2	29.5	15.8	20.6	0.8
Kent County	25.3	31.3	24.9	17.6	0.6
South East	28.2	28.1	22.5	20.3	0.6
England	22.4	31.2	24.5	21.2	0.4

Source: Census 2011 – www.statistics.gov.uk

Housing tenure is illustrated in *Table A1.10*. With the exception of Crawley, the percentage of people that own their home outright or with a mortgage in all other districts is higher than the England average, indicating relative privilege in terms of housing (range between 73% and 75.9% compared to 63.3% England average. Only 59% of those living in Crawley own their own

home, which is notably less than any of the surrounding counties (67.3% - 72.9%) or region (67.6%), which are also higher than England as a whole.

In Crawley the most common form of rented accommodation is that rented from the council or housing association; it's significantly higher than the England average (23.9% compared to 17.7%). In all other districts the percentages renting from social and those renting from private landlords are much more similar, and below the England average.

At county and regional level, more people own their own homes, and fewer people rent, either privately or from local authority, than England as a whole.

Table A1.10 ***Tenure Type (2011)***

Area	Owns outright or with a mortgage (%)	Shared ownership (part owned and part rented)	Social Rented from Council (local authority) or other (%)	Rented from Private landlord or letting agency or other (%)	Living Rent Free (%)
Crawley District	59.0	1.4	23.9	14.5	1.2
Horsham District	74.5	0.7	11.6	11.8	1.5
Mid Sussex District	74.3	1.0	10.6	12.8	1.4
Mole Valley District	73.6	0.9	12.2	11.9	1.4
Reigate & Banstead District	73.0	1.2	11.9	12.9	0.9
Tandridge District	75.9	0.9	10.8	11.0	1.4
West Sussex County	70.6	0.8	12.8	14.4	1.4
East Sussex County	69.2	0.6	11.0	17.8	1.3
Surrey County	72.9	1.0	11.4	13.5	1.2
Kent County	67.3	1.0	13.9	16.5	1.3
South East	67.6	1.1	13.7	16.3	1.3
England	63.3	0.8	17.7	16.8	1.3

Source: Census 2011 – www.statistics.gov.uk

1.6 ***CRIME***

1.6.1 ***Crime and Health***

The study 'Exploring the Impacts of Crime on Health and Health Services: a feasibility study' ⁽¹⁾ concluded that crime has serious health impacts, both direct and indirect. Violent crime results in physical and psychological injury, which can require emergency treatment and long-term intervention. Furthermore, theft and burglary can materially affect living standards and have psychological effects for the people involved, with consequences for health.

(1) Ro Robinson F, Keithley J, Robinson S, et al. Exploring the impacts of crime on health and health services: a feasibility study. Durham: Department of Sociology & Social Policy, University of Durham, 1998.

Individuals who have been the victims of violence and other forms of crime often suffer damage to their health beyond immediate injuries. Damage to physical health can result from the stress caused by the experience of victimisation: for example, the heart attack suffered by the elderly victim of burglary or the self-harm induced by abuse.

Fear from crime and antisocial behaviour may also have significant effects on health. In particular, older people, women and children may become constrained in their use of public spaces and make more use of car transport. They may withdraw from social life, including interaction with neighbours, and avoid going out at night. They may take protective or defensive action which can in itself pose a threat to health; for example, carrying a weapon, or barricading themselves in their homes ⁽¹⁾.

Violence also disproportionately affects certain groups in society, including young people and those who are deprived. The British Crime Survey shows that these unequal risks extend to other types of crime, such as burglary and vehicle-related theft. In many ways these inequalities mirror those which are found in health, suggesting that crime is likely to be a contributory factor in the substantial and widening health inequalities that exist in contemporary England.

Table A1.11 *Crime - Rate per 1000 resident population 2012/2013*

	Sussex	Surrey	Kent	South East of England	England
Total	30	30	30	30	29
Violence Against the Person	51	42	38	42	41
Sexual offences	32	45	29	31	28
Robbery	23	35	22	26	20
Theft offences	17	17	23	18	17
Criminal Damage and arson	17	14	17	16	16
Drug offences	95	99	97	95	94
Possession of weapons offences	89	86	97	86	88
Public order offences	74	81	68	68	61
Miscellaneous crimes against society	69	61	69	65	70

Source: <https://www.gov.uk/government/publications/crimes-detected-in-england-and-wales-2012-to-2013>

It can be seen from *Table A1.11* that within Sussex, Surrey, Kent and the South East of England the rate of crime is generally slightly higher compared to the England average. Violence against the person and public order offences are

(1) Robinson F, Keithley J, Robinson S, et al. Exploring the impacts of crime on health and health services: a feasibility study. Durham: Department of Sociology & Social Policy, University of Durham, 1998.

particularly high in Sussex. Sexual offences, robbery and public order offences are particularly prevalent in Surrey. Theft and possession of weapons are predominant in Kent. Only the miscellaneous crime rate is lower in all areas than England as a whole. Therefore it may be considered a relatively insecure place to live and theoretically people might well live in fear of crime.

Crime results in physical and psychological injury, which can require emergency treatment and long-term intervention. Fear of crime can lead to a wide range of psychological disorders and self-limited mobility, while exposure to crime may increase the incidence of health-damaging behaviour, such as smoking or excessive alcohol consumption ⁽¹⁾. The level of crime in Mole Valley, Horsham, Tandridge and Mid Sussex districts is likely to be lower than that in Crawley and R&B due to their more rural setting. It is expected that given the urban nature and high population density in Crawley and R&B, this may experience a higher incidence of crime.

The British Crime Survey suggests that crime is likely to be a contributory factor in the substantial and widening health inequalities that exist in England⁽²⁾. From these data it can be seen that these communities are subject to health risks due to crime and fear of crime.

It should be noted that the figures presented in *Table A1.11* only reflect crime that has been reported; under reporting, particularly for domestic crime, is common. The effects of domestic crime are therefore underestimated especially if people are victims multiple times. The health impacts of crime also extend beyond the victims to witnesses and relatives.

1.7

HEALTH OF THE COMMUNITY

The 2011 Census asked people to describe their self-perceived health over the preceding 12 months as 'very good', 'good', 'fair', 'bad' or 'very bad'. This is a subjective measure of health and an indication of general health rather than recorded health events. It is however, a useful tool in obtaining local community perceptions of health and is shown for the districts, counties and region affected by the development in *Table A1.12* below.

(1) Robinson F, Keithley J, Robinson S, et al. Exploring the impacts of crime on health and health services: a feasibility study. Durham: Department of Sociology & Social Policy, University of Durham, 1998.

(2) Mirrlees-Black C, Mayhew P, Percy A. The 1996 British Crime Survey. Home Office Statistical Bulletin. London: Home Office, 1996.

Table A1.12 *The Proportion of the Residents rating themselves in Different Health Categories (2011)*

Area	Very good Health (%)	Good Health (%)	Fair Health (%)	Bad Health (%)	Very bad Health (%)
Crawley District	47.6	35.9	12.1	3.5	1.0
Horsham District	50.6	34.8	11.1	2.7	0.8
Mid Sussex District	51.8	34.0	10.7	2.8	0.8
Mole Valley District	51.5	33.7	11.3	2.9	0.7
Reigate & Banstead District (R&B)	51.5	34.0	10.8	2.8	0.8
Tandridge District	50.5	34.4	11.4	2.9	0.9
West Sussex County	47.0	35.5	13.0	3.6	1.0
East Sussex County	43.8	35.6	14.8	4.5	1.3
Surrey County	52.4	33.6	10.6	2.7	0.8
Kent County	46.7	34.9	13.3	4.0	1.1
South East	49.0	34.6	12.0	3.4	1.0
England	47.2	34.2	13.1	4.2	1.2

Source: Census 2011 – www.statistics.gov.uk

A higher proportion of local residents in all districts consider their health as ‘very good’ or ‘good’ (83.5% - 85.8%) compared to the averages for England (81.4%). At county level, within East Sussex there are fewer people who rate themselves within these two categories (79.4%) than England as a whole, but Surrey, Kent and West Sussex, and the South East region all fare better (81.6%-86%).

The areas show a similar profile in relation to those rating themselves in ‘bad’ or ‘very bad’ health; only East Sussex reflects a slightly higher proportion of people in these categories (5.8%) compared to the England average (5.4%).

The health of people in the area can also be assessed using estimates of life expectancy. Areas with a life expectancy lower than the average tend to have poorer health than areas with higher levels of life expectancy. *Table A1.13* below shows how life expectancy at birth for males and females in all of the districts and counties are similar but slightly higher than that of the England averages, suggesting there is no deprivation in terms of health in the area.

Table A1.13 Life Expectancy at Birth

Area	Life Expectancy (Males)	Life Expectancy (Females)
Crawley District	79.6	83.6
Horsham District	81.8	84.6
Mid Sussex District	81.6	83.9
Mole Valley District	81.8	84.9
Reigate & Banstead District (R&B)	80.4	83.8
Tandridge District	80.9	83.7
West Sussex County	80.2	83.8
East Sussex County	79.5	83.7
Surrey County	81.1	84.5
Kent County	79.4	83.2
England	78.9	82.9

Source: APHO and Department of Health. © Crown Copyright 2013

Life expectancy varies more between males (2.2 years) than females (1.3 years) within the districts. Crawley District and the counties of East Sussex and Kent have lower healthy life expectancies men compared to those surrounding districts/counties. For women, Crawley District has marginally lower life expectancy compared to other districts. The lower life expectancy is associated with higher levels of deprivation and this holds true for the potentially impacted areas.

A particularly important indicator of health is cardiovascular disease, which can develop through a number of physical and 'lifestyle' risk factors such as raised blood lipid levels, smoking, raised blood pressure, diabetes, obesity and physical activity to that effect. Coronary Heart Disease is one of the main health problems associated with cardiovascular disease and includes angina (chest pain on exertion), heart attacks (myocardial infarction) and heart failure.

Table A1.14 shows the mortality levels from coronary heart disease and stroke in the potentially impacted areas. From this it can be seen that all districts and counties have a lower level of life lost due to coronary heart disease and stroke than across England as a whole. This is most prominent in Horsham and Mole Valley.

Table A1.14 *Age Standardised Death Rates from Heart Disease and Stroke per 100,000 Population Under 75, 2009-2011*

Area	Early deaths: heart disease and stroke
Crawley District	54.7
Horsham District	37.8
Mid Sussex District	41.4
Mole Valley District	39.5
Reigate & Banstead District	45.4
Tandridge District	43.6
West Sussex County	47.7
East Sussex County	50.3
Surrey County	43.8
Kent County	58.0
England	60.9

Source: APHO and Department of Health. © Crown Copyright 2013

Incidence of cancers and deaths related to cancer can also indicate deprivation in terms of health. Largely due to the effect of socio-economic deprivation, cancer incidence rates, adjusted for population age distribution, are different in rural and urban areas. Cancer incidence can be influenced by lifestyle practices such as diet and tobacco smoking as well as external environmental causes such as environmental pollutants. Mortality versus survival rates can also reflect provision and access to healthcare. *Table A1.15* shows incidence of early deaths from cancer. With the exception of Crawley, all other districts and counties have fewer early deaths resulting from cancer than the average across England. In Crawley District, age standardised deaths from cancer are considerably more prevalent than the England average (115.6 and 108.1 respectively).

Table A1.15 *Age Standardised Death Rates from Cancer per 100,000 Population Under 75, 2009 - 2011*

Area	Early deaths: cancer
Crawley District	115.6
Horsham District	83.4
Mid Sussex District	91.8
Mole Valley District	86.0
Reigate & Banstead District	89.2
Tandridge District	83.5
West Sussex County	99.7
East Sussex County	103.7
Surrey County	91.4
Kent County	104.8
England	108.1

Source: APHO and Department of Health. © Crown Copyright 2013

A further measure of the health of a population is based on Infant mortality. The infant mortality rate is a widely used indicator of a population's health status because it is associated with education, economic development, and availability of health services. *Table A1.16* shows the mortality rate in infancy in the potentially impacted areas. Between 2009-2011 all areas had a lower infant mortality rate (1.5 - 4) than the England level (4.3). This is largely down to the small sample sizes in these areas giving each incidence of death elevated significance. Such sample sizes have low statistical significance and it is therefore problematic to deduce the relationship between the England and regional infant mortality rates.

Table A1.16 *Mortality Rates in Infancy (Age Under 1 Year) Rate per 1,000 Live Births (2009-2011)*

Area	Infant Mortality
Crawley District	3.8
Horsham District	2.0
Mid Sussex District	2.4
Mole Valley District	1.5
Reigate & Banstead District	3.8
Tandridge District	3.3
West Sussex County	3.6
East Sussex County	4.0
Surrey County	2.8
Kent County	3.3
England	4.3

Source: APHO and Department of Health. © Crown Copyright 2013

Road injuries and deaths have considerable social, health and economic impacts on those involved. Road Traffic Incidences (RTIs) tend to be more prevalent in urban areas and casualties affect mostly economically active persons generating a ripple effect on their dependents, causing suffering and poverty. *Table A1.17* shows that Mole Valley (69.1), Tandridge (65.7), Horsham (60.3) and Mid Sussex (53.3) districts have significantly higher road death rates than the England average (41.9). Crawley and R&B districts have very similar, but slightly lower rates than the England average, 37 and 39.2 respectively. At county level, East Sussex, West Sussex and Surrey have significantly higher rates, and Kent has a significantly lower rate than the England average, 63.1, 53.1, 49.5 and 38.9 respectively.

Table A1.17 Road Injuries and Deaths per 100,000 Population, 2009-2011

Area	Road Injuries and Deaths
Crawley District	37.6
Horsham District	60.3
Mid Sussex District	53.3
Mole Valley District	69.1
Reigate & Banstead District	39.2
Tandridge District	65.7
West Sussex County	53.1
East Sussex County	63.2
Surrey County	49.5
Kent County	38.9
England	41.9

Source: APHO and Department of Health. © Crown Copyright 2013

Annex B

Review of HIAs of Airports

The following table presents the findings of a number of HIAs undertaken for other airport developments:

Table B1.1 *Review of HIAs undertaken for Airport Developments*

Airport	Main methods	Key Issues	Main Conclusions or Recommendations
<p>London City Airport, UK</p> <p>London City Airport Interim Application: Health Impact Assessment. RPS Ltd. 2007</p>	<p>Analysis and review of existing initiatives and studies commissioned by the London City Airport.</p> <p>Integration with parallel assessments, including the Environmental Impact Assessment (EIA) the airport's sustainability appraisal and carbon analysis and on-going community engagement. Community profiling using routine health statistics.</p> <p>Literature review including data from National Health Service (NHS) sources and reports on health and social impacts of airports.</p> <p>Consultation with local Primary Care Trust.</p>	<ul style="list-style-type: none"> • Annoyance • Odour • Cognitive performance • Access to community resources / social capital; • Traffic accidents • Employment and income opportunities • Regional regeneration 	<ul style="list-style-type: none"> • Potential effects of airport expansion eg changes in air quality are not of a level to result in any meaningful adverse health outcomes • Significant socio-economic benefits are anticipated at the local and regional level, including new investment and employment opportunities, expansion of existing companies in the area, potential regeneration, tourism opportunities and reduction of transport requirements for visitors and local communities travelling to and from alternative airport. • Coordinate community support programmes recommended through health partnerships
<p>Manchester International Airport, UK</p> <p>A prospective health impact assessment of the proposed development of the second runway at Manchester International Airport. Will, S., Ardern, K., Spencely, M. and Watkins, S. 1994</p> <p>Written submission to the public inquiry. Manchester and Stockport</p>	<p>Literature review including the following from NHS and non NHS sources: common data set, health service indicators, vital statistics forms, and mortality statistics.</p> <p>Health Impact Assessment grid as a guide for potential health effects linked with development.</p>	<ul style="list-style-type: none"> • Increased employment and economic growth • Negative effects on performance • Mean increase in blood pressure • Negative impact on cognitive development of children • Increase in stress levels and mental illness • Generalised increase in the subjective annoyance levels of local residents 	<ul style="list-style-type: none"> • Conduct a health effects study associated with the further development of the airport • Investigate problems of delayed cognitive development and reduced achievement • Monitor accident figures in the area by studying baseline accident figures and identifying any increases in death and injury as a result of Road Traffic Accidents (RTA's) • Monitor incidence of Myeloid Leukaemia in the impact area to identify any apparent increase in incidence or the occurrence of clustering

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Health Commission.		<ul style="list-style-type: none"> Traffic accidents Benzene levels and risk of leukaemia 	<ul style="list-style-type: none"> Assess baseline accident figures for airport area and monitor situation to identify increases in death and injury as a result of road traffic accidents.
<p>Finningley Airport, UK</p> <p>Health Impact Assessment: Finningley Airport. Doncaster: Doncaster Health Authority and Doncaster Metropolitan Borough Council 2000. (Report)</p>	<p>Policy appraisal of documents relating to the airport.</p> <p>Community profiling using routine health statistics.</p> <p>Stakeholder and key person interviews to establish the views and concerns of the community.</p> <p>Literature review: Literature on health and social impacts of airports regeneration and transport policies.</p>	<ul style="list-style-type: none"> Cancer Cardiovascular disease Respiratory disease Allergies Sleep disturbance Annoyance Anxiety and stress Cognitive performance Risk perception Economic benefits 	<ul style="list-style-type: none"> Employment and regeneration were the main positive impacts. Negative impacts were noise and pollution affecting the local population. Recommendations were made to maximise the positive impacts and minimise the negative. Establishment of an airport health impact group as part of the regulatory framework of the airport to advise on health issues and deal with unexpected health outcomes.
<p>Frankfurt Airport, Germany</p> <p>Aircraft Noise and Quality of Life around Frankfurt Airport. D. Schreckenberg, M. Meis, C.Kahl, C. Peschel and T. Eikmann, International Journal of Environmental Research and Public Health. August 2010</p>	<p>Face-to-face interviews regarding residential situation, health-related quality of life issues, annoyance and disturbances due to aircraft noise.</p>	<ul style="list-style-type: none"> Sleep disturbance Annoyance Residential satisfaction Safety concerns Confidence in authorities' effort for aircraft noise reduction 	<ul style="list-style-type: none"> Aircraft noise annoyance affects quality of life. Aircraft noise is more likely to affect those who have limited resources to cope with noise (eg those who have a pre-existing illness and/or elevated sensibility to noise in general). Limited coping ability also enhances the strain and enables the development of further stress-related health problems and limitations in quality of life. Non-acoustical factors, in particular the expectations with regard to future residential life after airport expansion and the confidence in authorities' effort for aircraft noise reduction,

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			<p>affects how people react to noise and quality of life</p> <ul style="list-style-type: none"> Longitudinal studies recommended to enhance understanding on the causal paths underlying the noise-health relationship.
<p>Schiphol Amsterdam, Netherlands</p> <p>Health Impact Assessment Schiphol Airport. Staatsen, E Franssen and E. Lebreton July 1994.</p>	<p>Analysis of existing data and literature on risk perception and exposure-response relationships.</p> <p>Collection and analysis of routine health statistics</p> <p>Postal questionnaires and interviews on health status and risk perception.</p>	<ul style="list-style-type: none"> Sleep disturbance Annoyance Respiratory diseases Cognitive performance Medication use Cardiovascular diseases Perception of risks and health 	<ul style="list-style-type: none"> Large impact of aircraft related noise exposure on well being Annoyance, sleep disturbance and reduced performance are likely which may lead to increased medication use Hearing loss, increase in respiratory effects and cancer are unlikely Odour annoyance likely Monitoring of the airport to determine its short and long term health effects and changes in environmental quality using questionnaires and small area health data.
<p>Berlin Brandenburg International Airport, Germany</p> <p>Rudolf Welteke, Thomas Classen, Odile Mekel and Rainer Fehr</p>	<p>Ad hoc process that was identified as HIA but was part of the EIA and <i>Planfeststellungsverfahren</i></p>	<ul style="list-style-type: none"> Sleep disturbance Annoyance Pollution by noxious agents Accident risk Impacts on recreation 	<ul style="list-style-type: none"> Impact of aircraft related noise exposure on well-being. Annoyance, sleep disturbance and reduced performance. Odour effects Recreation areas impacts
<p>Billy Bishop Toronto City Airport, Canada</p> <p>Health Impact Assessment: Billy Bishop Toronto City Airport. Golder</p>	<p>Literature review of documents and policies relating to the airport and regulatory agencies.</p> <p>Interviews with Toronto Port Authority</p> <p>Public consultations including public</p>	<ul style="list-style-type: none"> Sleep disturbance Traffic accidents Cardiovascular diseases Respiratory diseases Cancer Cognitive performance 	<ul style="list-style-type: none"> Community members surrounding the airport are already exposed to elevated health risks from background air pollution, noise and traffic in the area. Expansion of the airport would serve to increase most health risks while impacts of

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<p>Associates Ltd. November 2013</p> <p>Note: this was a rapid health impact assessment</p>	<p>meetings, online surveys and telephone polls</p>	<ul style="list-style-type: none"> • Economic benefits • Healthcare costs • Transport costs • Tourism • Property values • Recreational impacts • Access to community services • Perception of community safety 	<p>noise may decrease slightly in some locations.</p> <ul style="list-style-type: none"> • Increase in employment and income but benefits not specific to local residents.
<p>Santa Monica Airport, USA</p> <p>Santa Monica Airport Health Impact Assessment: A health-directed summary of the issues facing the community near the Santa Monica Airport. UCLA Medical Center. February 2010</p> <p>Note: this was a rapid health impact assessment</p>	<p>Empirical and scientific literature reviews</p> <p>Review of public standards, regulations and guidance relevant to airport planning and health</p> <p>Interviews with expert consultants</p> <p>Review and analysis of public comments and testimonies</p> <p>Participation in community forums and meetings</p>	<ul style="list-style-type: none"> • Lack of an airport buffer zone • Respiratory diseases • Cardiovascular disease • Reproductive abnormalities • Cognitive performance • Carcinogenic risk • Hormonal imbalances • Hearing loss. • Annoyance 	<ul style="list-style-type: none"> • Air and noise pollution from aircraft result in decreased wellbeing • Likely increase in the rate of respiratory and cardiovascular diseases and cancer. Disruptions to hormonal balances in adults, reproductive abnormalities, poorer educational performance in children and hearing loss are also likely. • Closure of the airport would eliminate all health risks associated with airport air and noise pollution. • Maintain a runway buffer zone of at least 660 meters to protect surrounding residents from health effects of jet fuel air emissions. • Eliminate / significantly decrease the number of jet take-offs to reduce exposure to air and noise pollution. • Install High Efficiency Particulate Absorbing filters in surrounding schools and residential homes to mitigate the exposure to air pollution. • Soundproof schools

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			<p>and significantly affected homes to protect residents from hearing loss, psychological distress, and learning problems in children.</p> <ul style="list-style-type: none"> • Notify all affected community of the noise and air pollution health risks.

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