

**Cost and Commercial Viability: Cost and Revenue  
Identification Update**

**Heathrow Airport North West Runway**

**30 June 2015**

**Document Control Sheet****BPP 04 F8**

Version 16; October 2013

**Project:** Airport Operations, Logistics and Engineering Support  
**Client:** Airports Commission **Project No:** B1988000  
**Document title:** Cost and Commercial Viability: Cost and Revenue Identification  
Update Heathrow Airport North West Runway  
**Ref. No:** HAL04

**Jacobs U.K. Limited**

This document has been prepared by a division, subsidiary or affiliate of Jacobs U.K. Limited ("Jacobs") in its professional capacity as consultants in accordance with the terms and conditions of Jacobs' contract with the commissioning party (the "Client"). Regard should be had to those terms and conditions when considering and/or placing any reliance on this document. No part of this document may be copied or reproduced by any means without prior written permission from Jacobs. If you have received this document in error, please destroy all copies in your possession or control and notify Jacobs.

Any advice, opinions, or recommendations within this document (a) should be read and relied upon only in the context of the document as a whole; (b) do not, in any way, purport to include any manner of legal advice or opinion; (c) are based upon the information made available to Jacobs at the date of this document and on current UK standards, codes, technology and construction practices as at the date of this document. It should be noted and it is expressly stated that no independent verification of any of the documents or information supplied to Jacobs has been made. No liability is accepted by Jacobs for any use of this document, other than for the purposes for which it was originally prepared and provided. Following final delivery of this document to the Client, Jacobs will have no further obligations or duty to advise the Client on any matters, including development affecting the information or advice provided in this document.

This document has been prepared for the exclusive use of the Client and unless otherwise agreed in writing by Jacobs, no other party may use, make use of or rely on the contents of this document. Should the Client wish to release this document to a third party, Jacobs may, at its discretion, agree to such release provided that (a) Jacobs' written agreement is obtained prior to such release; and (b) by release of the document to the third party, that third party does not acquire any rights, contractual or otherwise, whatsoever against Jacobs and Jacobs, accordingly, assume no duties, liabilities or obligations to that third party; and (c) Jacobs accepts no responsibility for any loss or damage incurred by the Client or for any conflict of Jacobs' interests arising out of the Client's release of this document to the third party.

## Executive Summary

This report sets out the assessment of the capital cost of developing the Heathrow Airport North West Runway scheme, updated to take account as appropriate of responses to consultation. The assessment has been carried out in accordance with the Commission’s appraisal framework (see Airports Commission: Appraisal Framework). It provides the cost assumptions used in the financial analysis to assess the commercial viability and financeability of the scheme.

The scheme includes an additional runway, taxiways, and terminal infrastructure. The assessment has been undertaken in general accordance with HM Treasury’s The Green Book - Appraisal and Evaluation in Central Government, which advises the adjustment of base cost estimates to include risk and optimism bias.

The revised cost estimate for the scheme, summarised in the table below, is £17.6 billion with mitigated optimism bias applied, compared to the previous estimate of £18.6 billion.

Scenario	Pre-consultation	Post-consultation
Assessment of Need Carbon Capped	18,583	17,644
Assessment of Need Carbon Traded	18,583	17,644
Low Cost is King Carbon Traded	18,583	17,644
Global Fragmentation Carbon Capped	18,583	17,644

***Total Scheme Capital Expenditure by Demand Scenario (2014 prices, £’million, including mitigated optimism bias)***

The report also sets out the updated estimates of the wider costs and revenues, including the underlying airport infrastructure that would be required irrespective of the third runway investment; the ongoing maintenance and replacement of the existing and developed asset; the ongoing operational expenditure relating to the existing and developed asset; the non-aeronautical revenue the existing and developed asset would generate; and the surface access works and associated ongoing costs required to facilitate the scheme.

## Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
<b>2</b>	<b>Methodology</b>	<b>3</b>
2.1	Definitions	3
2.2	Scheme Capital Cost	3
2.3	Risk and Optimism Bias	4
2.4	Phasing	6
<b>3</b>	<b>Revisions Following Consultation</b>	<b>8</b>
<b>4</b>	<b>Revised Scheme Capital Expenditure Post Consultation</b>	<b>9</b>
4.1	Airports Commission Demand Scenarios: Capex Profiles	10
4.2	Annual Scheme Capital Expenditure Summaries	11
	Appendix A Glossary	
	Appendix B Optimism Bias	
	Appendix C Scheme Capital Cost Estimate Breakdown	
	Appendix D Approach to Core and Asset Replacement Capital Expenditure	
	Appendix E Core and Asset Replacement Capital Expenditure Summary	
	Appendix F Operational Expenditure	
	Appendix G Non-Aeronautical Revenue	
	Appendix H Surface Access Capital Expenditure, Operational Expenditure and Maintenance Cost	

## 1 Introduction

This report presents the revised estimate of the capital cost of developing the Heathrow Airport North West Runway scheme (hereafter “the scheme”). The report is an update to the report issued for consultation, *Appraisal Framework Module 13. Cost and Commercial Viability: Cost and Revenue Identification Heathrow Airport North West Runway* (HAL03). All costs and revenues are stated in 2014 prices.

Recognising that it is not possible to determine with accuracy a single cost estimate, and that a range of outcomes are possible, the objective was to establish a reasonable estimate to conduct the assessments within the Appraisal Framework Module 13: Cost and Commercial Viability. The estimates include separate provision for risk and optimism bias.

Section 2 of this report describes the methodology used to establish capital cost forecasts.

Responses to consultation relating to the cost estimates presented in that report were systematically considered and addressed in one of the following ways:

- *comments highlighting errors in our estimation of a specific cost element, where we have subsequently made an adjustment;*
- *comments raising issues requiring further consideration, where we have subsequently considered it appropriate to make an amendment;*
- *comments making reasonable points concerning the potential under-estimation of cost elements, where we have subsequently reviewed these and consider them to be included in the estimate and/or adequately provided for within the category risk allocation; and*
- *comments and challenges upon which we have reflected, but determined that no change to our forecasts is necessary.*

Section 3 sets out an overview of the revisions made following consultation.

The revised estimates of costs are presented in Section 4.

Details of the Scheme costs and supporting detail are presented in Appendices B and C.

In order to enable the Cost and Commercial Viability study to consider the viability of the investment in the scheme, it was necessary to understand the wider cost and revenue contexts of that investment. Therefore, assessments were also made of the following:

- *the underlying investment in airport infrastructure that would be required irrespective of the second runway investment, referred to as Core works in this report, as discussed in Appendix D;*
- *the ongoing replacement of the existing and developed asset, as also discussed in Appendix D. There are no changes to this section as a result of consultation;*
- *ongoing operational expenditure relating to the existing and developed asset, as also discussed in Appendix F;*

- *non-aeronautical revenue that the existing and developed asset would generate as discussed in Appendix G; and*
- *beyond the airport boundary, the surface access works required by the Scheme along with the operational and maintenance costs of those surface access improvements as discussed in Appendix H.*

Throughout this report a consistent colour scheme has been adopted to present the cost and revenue estimates developed for each relevant demand scenario<sup>1</sup>. The scenarios and their respective colours are as shown in Table 1-1:

Scenario
Assessment of Need Carbon Capped
Assessment of Need Carbon Traded
Global Growth Carbon Traded
Global Fragmentation Carbon Capped

**Table 1-1 Demand Scenario Reference Colours**

---

<sup>1</sup> The relevant scenarios are those included in Cost and Commercial Viability: Funding and Financing

## 2.1 Definitions

Throughout this report consistent nomenclature has been adopted. Estimates were developed for “Core” and “Scheme” costs, where the “Core” works relate to the investment in the airport irrespective of investment in the additional runway works, the additional cost of which is reported as the “Scheme” cost. The Scheme works were established from the promoter’s submission to the Airports Commission as updated based on the approach set out in this report and in response to consultation.

Details of the approach to the Core works and to asset replacement are presented in Appendix D.

## 2.2 Scheme Capital Cost

The approach we adopted prior to consultation remains unchanged and the additional points set out in this section are solely intended to provide clarification following consultation. Our approach was to assess the reasonableness of the estimate provided by Heathrow Airport Ltd (HAL) in order to reach a view as to an appropriate estimate to be used within the Cost and Commercial Viability assessment.

This was undertaken by comparison of the provided costs, or any costs independently determined, with industry expectation. All costs were re-based as necessary to be consistently presented in 2014 values.

We took the following approach:

- *using the material provided by the scheme promoter, we determined the scope of work and disaggregated works into a level of detail reasonably possible and appropriate to this stage of analysis;*
- *for each element of the disaggregated works, we determined the effective unit rate;*
- *we assessed the unit rates to determine whether they were in accordance with our expectation of a reasonable market rate, taking into account the nature, site and location of the works;*
- *by exception we made amendments to rates and quantities as appropriate;*
- *we established the base cost, made adjustments for ‘on costs’ and applied risk and optimism bias as discussed below.*

‘On costs’ include enabling works, operational readiness, and project fees.

- *enabling works and operational readiness costs<sup>2</sup> were identified as separate cost line items, which we distributed in proportion across all other capital cost line items, with the exception of environment and community compensation costs.*

<sup>2</sup> The approach to the costs of enabling works and operational readiness is unchanged from the report of 5 November 2014 but these costs were not separately identified in the methodology section. This commentary is provided for additional clarity following consultation comments.

- *project fees (to allow for design and project management services) were calculated at 15% base cost and were applied to all cost categories.*

Following this methodology, any change in base costs that we have made post-consultation has a proportionate impact on the project fees and on the distribution of enabling works costs between all other cost categories (except environment and community compensation costs).

Scheme base cost estimates are shown in full in Appendix C with on costs itemised separately.

Noting the inherent nature of capital expenditure projects to exhibit risk and uncertainty, the processes and guidance of HM Treasury's The Green Book - Appraisal and Evaluation in Central Government<sup>3</sup>, and supplementary guidance with respect to optimism bias<sup>4</sup> were adopted. The guidance recommends making such adjustments on the basis that there is a demonstrated, systematic tendency for project appraisers to be overly optimistic. A risk premium was applied to address the unknown engineering detail of the identified works which would be expected to lead to an under estimate of the cost despite the scope being reasonably defined. For example, geological surveys may find that the tunnels (such as for baggage or transit systems) need to be bored through much harder rock than previously expected. Risk premiums of 20% on Scheme costs were adopted to take account of the risk of the costs to deliver the identified scope of works increasing. These allowances are in line with our expectation of typical allowances at this stage of project development.

Scheme costs were assessed based upon the extent of information presented by the promoter. Engineering judgement and experience were used to assess whether the detailed item rate, or a higher aggregate planning rate, was appropriate for the element of the works, its engineering context and the operational environment within which the works would be constructed. This judgement was based upon Jacobs's experience of similar airport projects within London and within the UK.

Since there was insufficient information concerning the specific risk premiums added to each line item of capital expenditure, this approach entailed scheme promoters' costs being reduced to what we would consider to be a risk-free rate. After review to ensure that it did not result in unequal treatment of the schemes, we added a risk premium of 20% to this risk-free rate (see Section 2.3.1).

## **2.3 Risk and Optimism Bias**

### **2.3.1 Risk**

Based upon our expectation of a reasonable allowance at this stage of project development, a 20% risk premium was applied. We would note that this allowance could be seen as being optimistic and that a higher allowance would not be considered inappropriate. We note, however, that the individual items of work within base costs (the risk and optimism bias unadjusted costs) make due allowance for the environments in which they will be delivered and/or the complexity of the items of work. Therefore, whilst we would observe 20% to be at the lower end of an expected range for projects at this relatively early stage of development, we

<sup>3</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/220541/green\\_book\\_complete.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/220541/green_book_complete.pdf)

<sup>4</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/191507/Optimism\\_bias.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/191507/Optimism_bias.pdf)



consider it to be a reasonable base upon which to establish a reasonable cost estimate.

### **2.3.2 Optimism Bias**

HM Treasury's Supplementary Green Book Guidance sets out a detailed calculation method to establish the appropriate level of optimism bias to be applied taking into account a number of factors. Noting that these calculations require judgement across a range of factors, most of which are difficult to establish with accuracy from an external assessment to the organisation responsible for project delivery, and noting that those assessments are subjective in nature rather than demonstrably objective, the approach to optimism bias was to establish a reasonable allowance, rounded to the nearest 5%, applied consistently to each scheme.

For consultation, the scheme was characterised as a combination of Standard Buildings and Standard Civils, giving an unmitigated adjustment of 38%. We applied mitigation factors consistently to each scheme, recognising the absence of detailed knowledge on the capability, experience, and approach of each scheme promoter to deliver the Scheme. A mitigated adjustment of 20% was applied for consultation.

In response to consultation comments, we revisited the categorisation of Scheme capital costs and the mitigation factors applied to the derivation of mitigated optimism bias.

The revised approach involved categorising the Scheme works into Standard Buildings, Non-Standard Buildings, Standard Civils, Non-Standard Civils, and Equipment/Development. The categories not previously used (Non-Standard Buildings, Non-Standard Civils, and Engineering & Development) have higher recommended upper bound optimism bias values than Standard Buildings or Standard Civils, according to HM Treasury's Supplemental Green Book Guidance. As a result, the reassessed unmitigated optimism bias for Scheme capital expenditure is higher than the unmitigated optimism bias used at consultation. The re-categorisation of Scheme works resulted in a calculated value for unmitigated optimism bias of 45%, compared with 38% as used prior to consultation. However, the mitigation factors applying to those categories results in a lower value for mitigated optimism bias.

Appendix B sets out the calculation by which the value for mitigated optimism bias was derived. Following this analysis, we adopted an allowance of 15% for mitigated optimism, compared with 20% used at consultation.

The HM Treasury's Green Book Optimism Bias approach is by its nature imprecise, its purpose being to provide an appropriate cost contingency comfort in forecasts for which there is insufficient detail and where available data lack precision. Having regard to the ranges of calculated mitigated optimism bias for Scheme capital expenditure, we have adopted a rounded figure of 15% across all three schemes.

In summary, the following adjustments for risk and optimism bias were made:

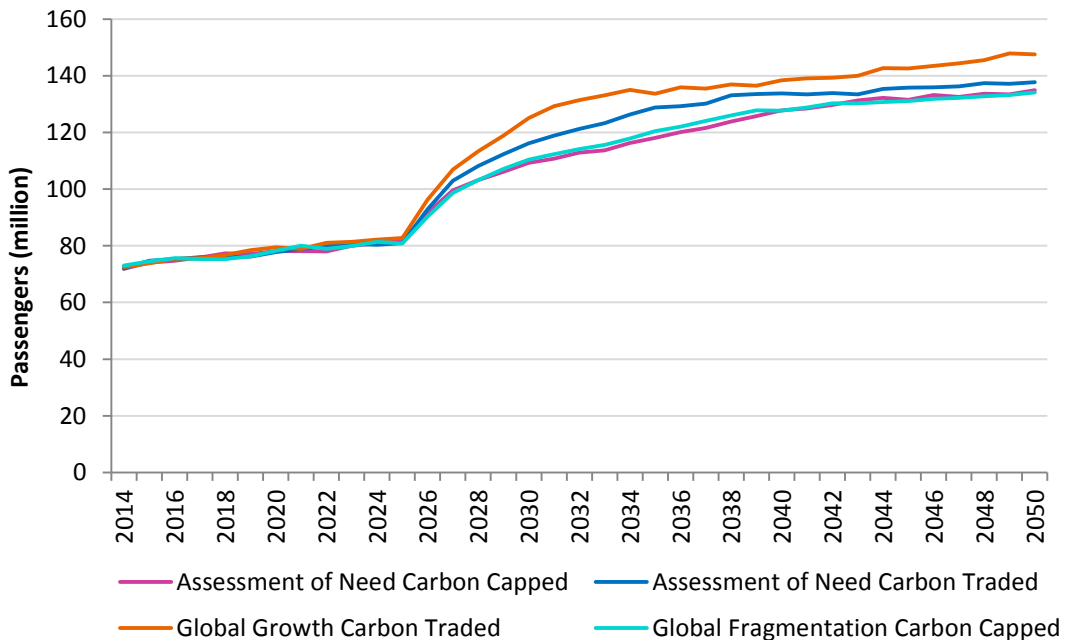
		Scheme	
		Pre-consultation	Post-consultation
<b>Risk</b>		20	20
<b>Optimism Bias</b>	<b>Mitigated</b>	20	15
	<b>Unmitigated</b>	38	45

**Table 2-1 Summary of Risk and Optimism Bias Adjustments to the Base Costs (%)**

## 2.4 Phasing

The Scheme cost estimate was determined in total and by build phase (see Figure 4-2 to Figure 4-5). Reference should be made to the Heathrow Airport North West Runway Appraisal Module 14: Operational Efficiency Ground Infrastructure report for detail of the individual phases. For the purposes of informing the Cost and Commercial Viability assessments, the capital costs of each build phase were triggered by demand against the requirements of four principal demand scenarios and as shown in Figure 2-1:

- *Assessment of Need Carbon Capped*
- *Assessment of Need Carbon Traded*
- *Global Growth Carbon Traded*
- *Global Fragmentation Carbon Capped*



**Figure 2-1 Airports Commission Demand Scenarios**

Opening of the third runway was driven by air transport movement (ATM) demand exceeding the current capacity irrespective of passenger demand. Although certain demand scenarios exceeded the current 480,000 ATM per annum cap of the existing runways before 2026, the earliest the third runway was assumed to be opened was 2026, based upon the Airports Commission’s view of the likely timescale required for regulatory and planning processes.

Each phase was assumed to open at the end of the year before demand was forecast to exceed capacity. With reference to the Operational Efficiency Ground Infrastructure report, the following phase capacities were adopted.

<b>Phase</b>	<b>Capacity (mppa)</b>
<b>Existing</b>	80
<b>With T6 Phase 1</b>	85
<b>With T6 Phase 2</b>	100
<b>With T2 Phase 2</b>	110
<b>With T2D</b>	120
<b>With T2 Phase 3</b>	130

**Table 2-2 Capacity Provision by Phase**

In the years prior to opening of the phase, the forecast cost of the phase was incurred over a period of three to six years depending upon the value of expenditure, following a simplified, but typical sigmoidal curve (S-curve) profile.

### 3 Revisions Following Consultation

Responses to consultation indicated that a few elements of the Scheme capital cost estimate merited consideration and refinement. These are discussed in this section, with the resulting revised total capital estimate presented in Section 4.

A change was made to the calculation of the cost of the tracked transit system connecting the proposed Terminal 6 to its satellites. The length of tunnels and their associated cost have been revised downwards. This change also ensures consistent treatment with respect to the Heathrow Airport Extended Northern Runway scheme. In total, the tracked transit system costs have reduced by £120 million, before project fees, risk, and optimism bias.

There are no other changes to the Scheme capital costs.

Other responses to consultation included concerns that the construction rates differed from those adopted for the Gatwick scheme. We have reviewed the rates used for consultation and consider them to be reasonable, since the cost methodologies adopted by scheme promoters mean that direct comparison of the rates between schemes could give misleading results; e.g. rates are in some cases based on plan area and in other cases based on gross floor area. We have reviewed the cost rates in the context of site specific factors and the level of specification of the scheme as proposed, and consider them to be reasonable.

Responses to consultation highlighted the risk of programme delays to the Scheme resulting in increased costs. We consider this to be a material risk that is adequately provided for within the risk allocation.

Consultation responses also asserted that the cost estimates for land acquisition might be inadequate, making specific reference to the Energy from Waste plant, the British Airways Headquarters, and rail freight infrastructure. We note the uncertainty in the land acquisition costs in the absence of access to a more detailed study into current land ownership and valuations. We consider the proposed costs to be a reasonable allocation at this stage of the process, particularly given the allowance for risk and optimism bias.

Other comments asserted that various key infrastructure works such as the ongoing development of the eastern campus (e.g., Terminal 2 satellites) had been omitted from our cost estimates. These works will be undertaken in any event and as such they were included within Core capital costs, which are presented in Appendix E.

Similarly, consultation responses asserted that the cost of the Southern Rail Connection had been omitted. The cost of this scheme was included within Surface Access costs, shown in Appendix H.

Sensitivity analyses on Community Compensation are as set out in the report *Cost and Commercial Viability: Additional Analysis*. Other sensitivity analyses on costs are included in the report *Cost and Commercial Viability: Funding and Financing Update* and *Cost and Commercial Viability: Additional Sensitivities*.

## 4 Revised Scheme Capital Expenditure Post Consultation

The revised cost is forecast to be £17.6 billion with mitigated optimism bias applied and £22.2 billion with unmitigated optimism bias.

Appendix C presents the resulting build-up of the Scheme works (including mitigated optimism bias) for all phases.

Section 4.1 summarises the forecast Scheme capital expenditure by year against each of the Airports Commission’s demand scenarios.

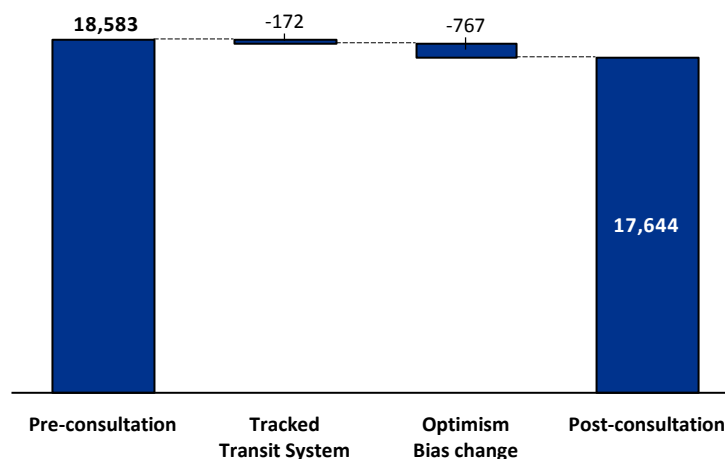
Table 4-2 to Table 4-5 present the data underlying Figure 4-2 to Figure 4-5.

In summary, for each scenario, Scheme capital expenditure is as shown in Table 4-1 with mitigated and unmitigated optimism bias.

Scenario	Pre-consultation	Post-consultation
Assessment of Need Carbon Capped	18,583	17,644
Assessment of Need Carbon Traded	18,583	17,644
Low Cost is King Carbon Traded	18,583	17,644
Global Fragmentation Carbon Capped	18,583	17,644

**Table 4-1 Total Scheme Capital Expenditure by Demand Scenario (2014 prices, £’million, including mitigated optimism bias)**

Note that Figure 4-1 shows each change sequentially from total scheme cost at consultation to the cost post-consultation. The individual revisions to base costs are shown including optimism bias at the rate adopted at consultation stage (i.e. 20%). The final adjustment for the revision to the optimism bias assumption (from 20% to 15%) is stated after adjustment for those individual revisions.



**Figure 4-1 Pre-Consultation to Post-Consultation Scheme Capex Waterfall Chart (2014 prices, £’million, including mitigated optimism bias)**

## 4.1 Airports Commission Demand Scenarios: Capex Profiles

### 4.1.1 Assessment of Need Carbon Capped

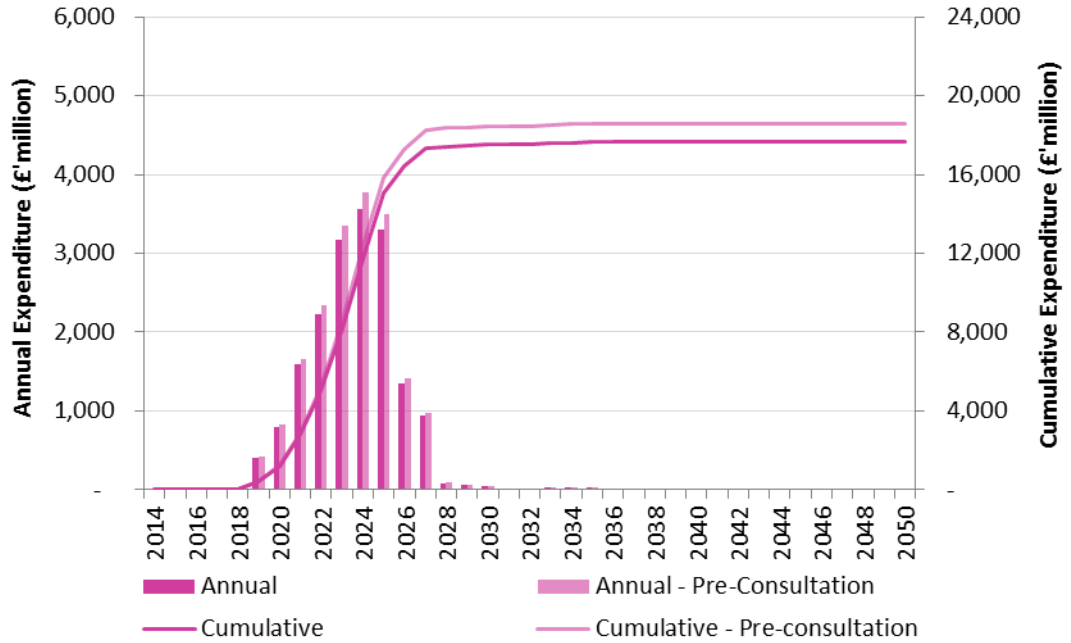


Figure 4-2 Assessment of Need Carbon Capped

### 4.1.2 Assessment of Need Carbon Traded

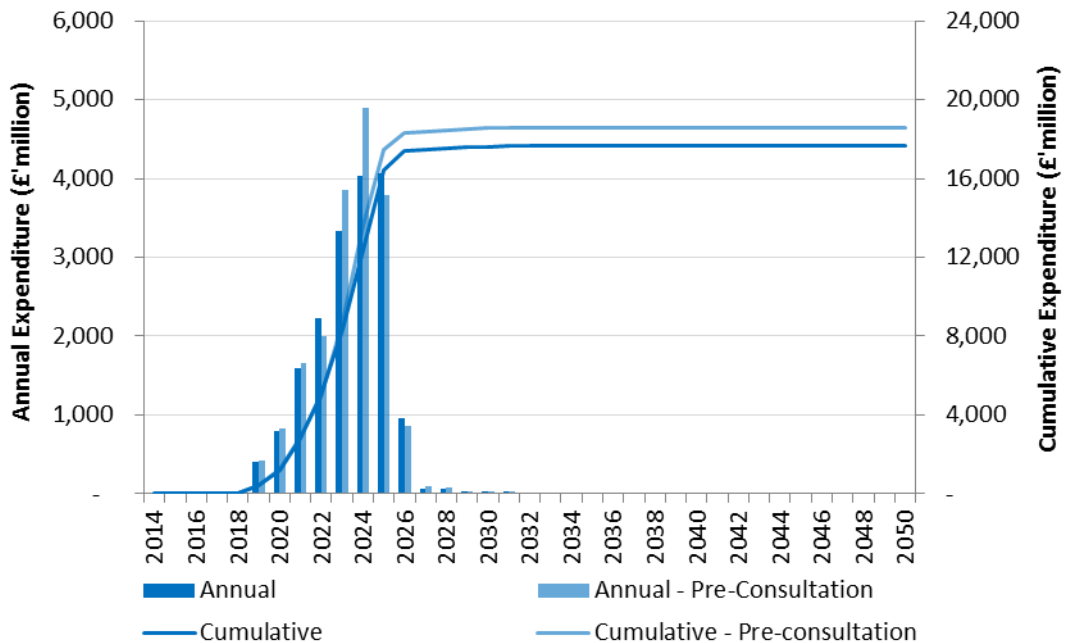


Figure 4-3 Assessment of Need Carbon Traded

### 4.1.3 Global Growth Carbon Traded

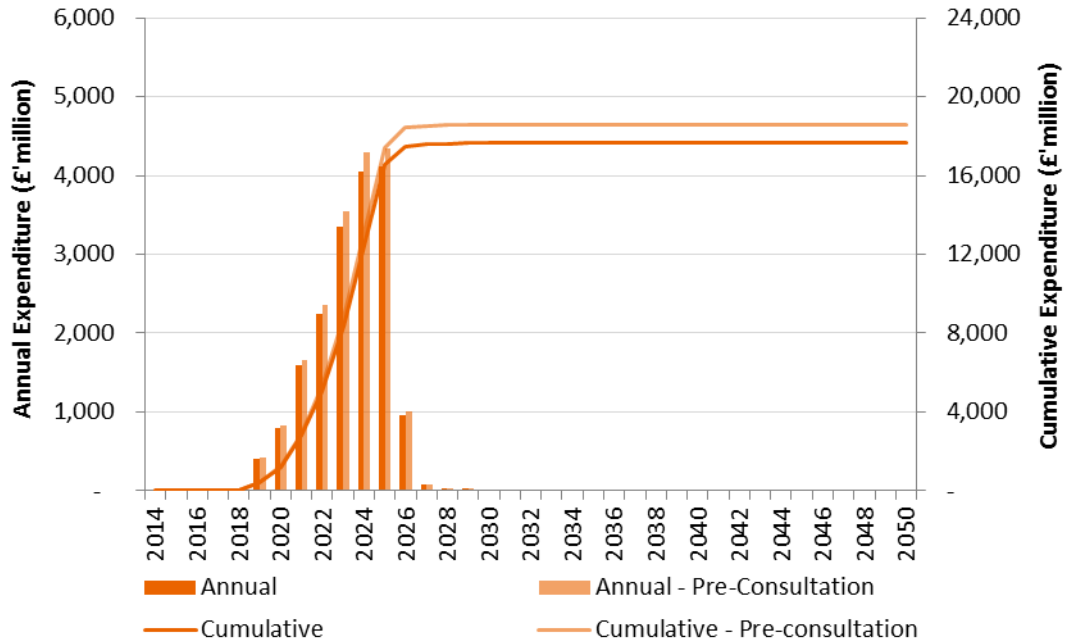


Figure 4-4 Global Growth Carbon Traded

### 4.1.4 Global Fragmentation Carbon Capped

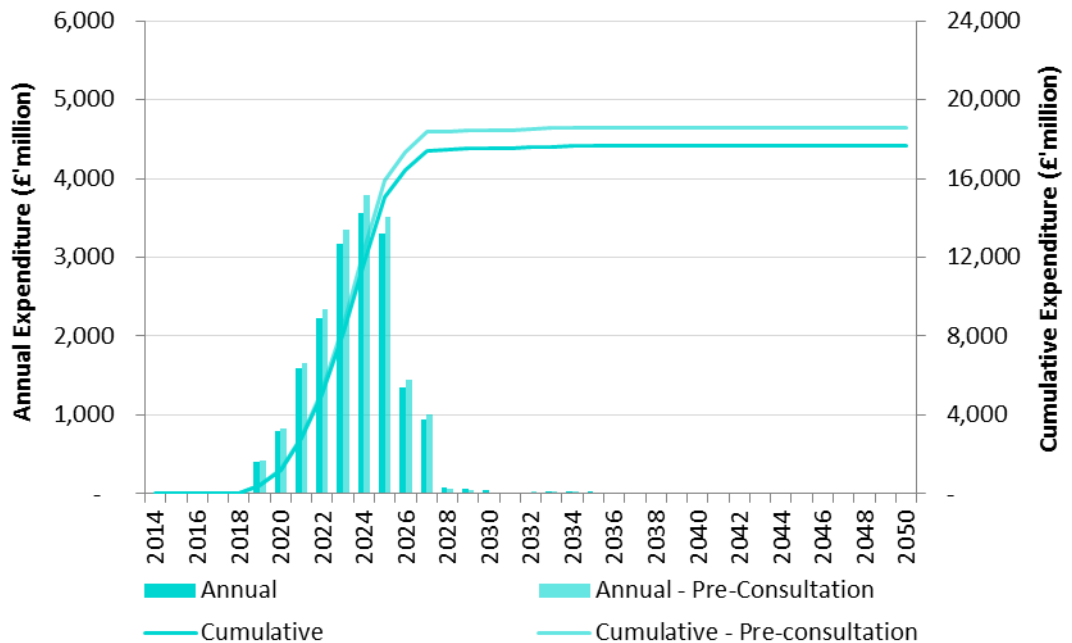


Figure 4-5 Global Fragmentation Carbon Capped

## 4.2 Annual Scheme Capital Expenditure Summaries

Table 4-2 to Table 4-5 on the following pages present the data underlying the previous figures with mitigated optimism bias. These tables are based upon the detailed breakdown presented in Appendix C, but, for the purpose of enabling the assessment of depreciation, summarises the total expenditure into the following

headings. General costs itemised separately within the breakdown presented in Appendix C (enabling works, project management on-cost, etc.) are distributed across the headings below in proportion to their contribution to the total.

- *Terminal buildings: passenger terminal buildings including piers and satellites*
- *Plant: building plant (e.g. air conditioning, etc.) including utilities and power generation*
- *Transit systems: passenger transit systems above or below ground*
- *Runways: runway and associated instrument landing systems*
- *Taxiways and aprons: taxiways, aprons and their associated systems*
- *Equipment: mobile equipment and baggage handling installations*
- *Land: acquisition of land including commercial businesses and residential properties*
- *Airfield ancillary: other infrastructure elements, for example control tower, rescue and firefighting facilities, fencing, airside roads, etc.*
- *Car parks: all car parks whether multi-storey or surface*
- *Third party land users: provision of serviced plots for third party development*
- *Environment: river diversions and environmental compensation and mitigation*
- *Community: community impact compensation*



2014 real prices in £million - including mitigated optimism bias

Scheme	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	
Terminal buildings	3,481	-	-	-	-	-	-	-	-	266	665	972	962	370	247	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Plant	730	-	-	-	-	-	17	34	69	98	143	159	141	41	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Tunnels and bridges	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Transit systems	1,232	-	-	-	-	-	6	13	25	112	241	334	320	109	72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Runways	182	-	-	-	-	-	9	18	36	36	36	27	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Taxiways and aprons	642	-	-	-	-	-	20	41	82	82	82	73	87	105	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment	1,142	-	-	-	-	-	-	-	-	59	147	233	287	250	167	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Land	2,882	-	-	-	-	-	144	288	576	576	576	432	288	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Airfield Ancillary	757	-	-	-	-	-	34	68	136	140	146	117	87	18	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Car Parks	579	-	-	-	-	-	-	-	-	14	36	58	83	86	84	60	40	30	4	13	26	26	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Third Party Land Users	91	-	-	-	-	-	5	9	18	18	18	14	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Environment	668	-	-	-	-	-	33	67	134	134	134	100	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Community	399	-	-	-	-	-	20	40	80	80	80	60	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Optimism Bias	2,301	-	-	-	-	-	52	104	208	291	415	464	430	176	122	11	7	5	1	2	5	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Risk	2,557	-	-	-	-	-	58	116	231	323	461	516	478	196	136	12	8	6	1	3	5	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total	17,644	-	-	-	-	-	399	798	1,595	2,229	3,179	3,560	3,299	1,349	937	83	56	42	6	18	36	36	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table 4-2 Assessment of Need Carbon Capped

2014 real prices in £million - including mitigated optimism bias

Scheme	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	
Terminal buildings	3,481	-	-	-	-	-	-	-	-	266	706	1,095	1,168	247	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Plant	730	-	-	-	-	-	17	34	69	98	147	173	164	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Tunnels and bridges	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Transit systems	1,232	-	-	-	-	-	6	13	25	112	253	370	381	72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Runways	182	-	-	-	-	-	9	18	36	36	36	27	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Taxiways and aprons	642	-	-	-	-	-	20	41	82	82	93	108	146	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment	1,142	-	-	-	-	-	-	-	-	59	174	316	426	167	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Land	2,882	-	-	-	-	-	144	288	576	576	576	432	288	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Airfield Ancillary	757	-	-	-	-	-	34	68	136	140	147	123	97	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Car Parks	579	-	-	-	-	-	-	-	-	14	54	100	150	104	45	43	26	26	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Third Party Land Users	91	-	-	-	-	-	5	9	18	18	18	14	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Environment	668	-	-	-	-	-	33	67	134	134	134	100	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Community	399	-	-	-	-	-	20	40	80	80	80	60	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Optimism Bias	2,301	-	-	-	-	-	52	104	208	291	436	525	532	126	8	8	5	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Risk	2,557	-	-	-	-	-	58	116	231	323	484	584	591	140	9	9	5	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Total	17,644	-	-	-	-	-	399	798	1,595	2,229	3,339	4,029	4,075	964	62	60	36	36	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table 4-3 Assessment of Need Carbon Traded

2014 real prices in £million - including mitigated optimism bias

Scheme	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Terminal buildings	3,481	-	-	-	-	-	-	-	-	266	706	1,095	1,168	247	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant	730	-	-	-	-	-	17	34	69	98	147	173	164	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tunnels and bridges	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Transit systems	1,232	-	-	-	-	-	6	13	25	112	253	370	381	72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Runways	182	-	-	-	-	-	9	18	36	36	36	27	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxiways and aprons	642	-	-	-	-	-	20	41	82	82	93	108	146	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment	1,142	-	-	-	-	-	-	-	-	59	174	316	426	167	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Land	2,882	-	-	-	-	-	144	288	576	576	576	432	288	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Airfield Ancillary	757	-	-	-	-	-	34	68	136	140	147	123</																										

2014 real prices in £million - including mitigated optimism bias

Scheme	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Terminal buildings	3,481	-	-	-	-	-	-	-	-	266	665	972	962	370	247	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant	730	-	-	-	-	-	17	34	69	98	143	159	141	41	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tunnels and bridges	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Transit systems	1,232	-	-	-	-	-	6	13	25	112	241	334	320	109	72	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Runways	182	-	-	-	-	-	9	18	36	36	36	27	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxiways and aprons	642	-	-	-	-	-	20	41	82	82	73	87	105	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment	1,142	-	-	-	-	-	-	-	-	59	147	233	287	250	167	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Land	2,882	-	-	-	-	-	144	288	576	576	576	432	288	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Airfield Ancillary	757	-	-	-	-	-	34	68	136	140	146	117	87	18	12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Car Parks	579	-	-	-	-	-	-	-	-	14	36	68	93	106	104	40	30	4	13	26	26	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Third Party Land Users	91	-	-	-	-	-	5	9	18	18	18	14	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Environment	668	-	-	-	-	-	33	67	134	134	134	100	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Community	399	-	-	-	-	-	20	40	80	80	80	60	40	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Optimism Bias	2,301	-	-	-	-	-	52	104	208	291	415	466	432	180	126	7	5	1	2	5	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Risk	2,557	-	-	-	-	-	58	116	231	323	461	518	480	200	140	8	6	1	3	5	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<b>Total</b>	<b>17,644</b>	-	-	-	-	-	<b>399</b>	<b>798</b>	<b>1,595</b>	<b>2,229</b>	<b>3,179</b>	<b>3,574</b>	<b>3,313</b>	<b>1,377</b>	<b>964</b>	<b>56</b>	<b>42</b>	<b>6</b>	<b>18</b>	<b>36</b>	<b>36</b>	<b>24</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Table 4-5 Global Fragmentation Carbon Capped

## Appendix A Glossary

Core	Investment in the airport irrespective of investment in the additional runway works
Demand scenarios	Please refer to the Economics and Strategic Fit Workstream for further details
GAL	Gatwick Airport Limited
mppa	million passengers per annum
Optimism bias	Please refer to Cost and Commercial Viability: Additional Analysis for further technical details and references
Post-consultation	Refers to assumptions and costing taking account of consultation responses
Pre-consultation	Refers to assumptions and costing as provided in 13. <i>Cost and Commercial Viability: Cost and Revenue Identification</i>
Q6	Quinquennium 6 (2014 to 2018)
Q7	Quinquennium 7 (2019 to 2023)
Scheme	Investment in the additional runway works
TTS	Tracked transit system

## Appendix B Optimism Bias

Upper bound values for combined projects

Project Type	CAPEX (%)	Upper Bound OB (%)	OB Contribution (%)	Resulting OB (%)
Standard Buildings	70	24	17	
Non-Standard Buildings	0	51		
Standard Civils	25	44	11	
Non-Standard Civils	0	66		
Equipment & Development	5	200	10	
<b>Combined</b>				<b>38.2</b>

CAPEX Contributory Factors	Standard Building optimism bias (%)	Mitigation Factor (0<x<1)	Reduction in optimism bias	Mitigated optimism bias (%)	Non-Standard Building optimism bias (%)	Mitigation Factor (0<x<1)	Reduction in optimism bias	Mitigated optimism bias (%)	Standard Civil Engineering optimism bias (%)	Mitigation Factor (0<x<1)	Reduction in optimism bias	Mitigated optimism bias (%)	Non-Standard Civil Engineering optimism bias (%)	Mitigation Factor (0<x<1)	Reduction in optimism bias	Mitigated optimism bias (%)	Equipment/Development optimism bias (%)	Mitigation Factor (0<x<1)	Reduction in optimism bias	Mitigated optimism bias (%)
<b>Procurement</b>																				
Complexity of Contract Structure	-	0.8	-	-	1	0.8	0.8	0.2	-	0.8	-	-	-	0.8	-	-	7	0.8	5.6	1.4
Late Contractor Involvement in Design	2	0.95	1.9	0.1	2	0.95	1.9	0.1	3	0.95	2.9	0.2	-	0.95	-	-	7	0.95	6.7	0.4
Poor contractor Capabilities	9	0.95	8.6	0.5	5	0.95	4.8	0.3	-	0.95	-	-	-	0.95	-	-	4	0.95	3.8	0.2
Dispute and Claims Occurred	29	0.7	20.3	8.7	11	0.7	7.7	3.3	21	0.7	14.7	6.3	-	0.7	-	-	-	0.7	-	-
Information Management	-	0.8	-	-	-	0.8	-	-	-	0.8	-	-	-	0.8	-	-	5	0.8	4.0	1.0
Other (specify)	-	0.8	-	-	-	0.8	-	-	-	0.8	-	-	2	0.8	1.6	0.4	-	0.8	-	-
<b>Project Specific</b>																				
Design Complexity	1	0.9	0.9	0.1	3	0.9	2.7	0.3	-	0.9	-	-	8	0.9	7.2	0.8	10	0.9	9.0	1.0
Degree of Innovation	4	0.8	3.2	0.8	9	0.8	7.2	1.8	-	0.8	-	-	9	0.8	7.2	1.8	17	0.8	13.6	3.4
Environmental Impact	-	0.5	-	-	-	0.5	-	-	22	0.5	11.0	11.0	5	0.5	2.5	2.5	-	0.5	-	-
Other	-	0.5	-	-	5	0.5	2.5	2.5	18	0.5	9.0	9.0	-	0.5	-	-	-	0.5	-	-
<b>Client Specific</b>																				
Inadequacy of the Business Case	34	0.8	27.2	6.8	23	0.8	18.4	4.6	10	0.8	8.0	2.0	35	0.8	28.0	7.0	18	0.8	14.4	3.6
Funding Availability	-	0.8	-	-	-	0.8	-	-	-	0.8	-	-	5	0.8	4.0	1.0	-	0.8	-	-
Project Management Team	1	0.9	0.9	0.1	2	0.9	1.8	0.2	-	0.9	-	-	2	0.9	1.8	0.2	5	0.9	4.5	0.5
Poor Project Intelligence	2	0.8	1.6	0.4	6	0.8	4.8	1.2	7	0.8	5.6	1.4	9	0.8	7.2	1.8	4	0.8	3.2	0.8
Other - omitted (<1)	-	0.8	-	-	2	0.8	1.6	0.4	-	0.8	-	-	-	0.8	-	-	-	0.8	-	-
<b>Environment</b>																				
Public Relations	2	0.5	1.0	1.0	1	0.5	0.5	0.5	9	0.5	4.5	4.5	-	0.5	-	-	-	0.5	-	-
Site Characteristics	2	0.8	1.6	0.4	1	0.8	0.8	0.2	3	0.8	2.4	0.6	5	0.8	4.0	1.0	-	0.8	-	-
Permits/Consents/Approvals	-	0.8	-	-	3	0.8	2.4	0.6	-	0.8	-	-	-	0.8	-	-	-	0.8	-	-
<b>External Influences</b>																				
Economic	11	0.2	2.2	8.8	13	0.2	2.6	10.4	7	0.2	1.4	5.6	3	0.2	0.6	2.4	-	0.2	-	-
Legislation/Regulations	3	0.7	2.1	0.9	7	0.7	4.9	2.1	-	0.7	-	-	8	0.7	5.6	2.4	5	0.7	3.5	1.5
Technology	-	0.95	-	-	5	0.95	4.8	0.3	-	0.95	-	-	8	0.95	7.6	0.4	18	0.95	17.1	0.9
Other	-	0.5	-	-	2	0.5	1.0	1.0	-	0.5	-	-	1	0.5	0.5	0.5	-	0.5	-	-
<b>TOTAL</b>	<b>100</b>			<b>28.6</b>	<b>101</b>			<b>29.9</b>	<b>100</b>			<b>40.6</b>	<b>100</b>			<b>22.2</b>	<b>100</b>			<b>14.7</b>

Adjusted Optimism Bias

Project Type	Percentage of CAPEX (%)	Mitigated OB (%)	OB contribution (%)	Resulting OB (%)
Standard Buildings	70	6.9	4.8	
Standard Civils	25	17.8	4.5	
Equipment & Development	5	29.3	1.5	
<b>Combined</b>				<b>10.8</b>

Rounded to 10% for all schemes

Figure B-1 Core Works

Upper bound values for combined projects

Project Type	CAPEX (%)	Upper Bound OB (%)	OB Contribution (%)	Resulting OB (%)
Standard Buildings	57	24	14	0
Non-Standard Buildings	4	51	2	0
Standard Civils	25	44	11	0
Non-Standard Civils	8	66	5	0
Equipment & Development	7	200	13	0
<b>Combined</b>				<b>45.0</b>

CAPEX Contributory Factors	Standard Building optimism bias (%)	Mitigation Factor (0<x<1)	Reduction in optimism bias	Mitigated optimism bias (%)	Non-Standard Building optimism bias (%)	Mitigation Factor (0<x<1)	Reduction in optimism bias	Mitigated optimism bias (%)	Standard Civil Engineering optimism bias (%)	Mitigation Factor (0<x<1)	Reduction in optimism bias	Mitigated optimism bias (%)	Non-Standard Civil Engineering optimism bias (%)	Mitigation Factor (0<x<1)	Reduction in optimism bias	Mitigated optimism bias (%)	Equipment/Development optimism bias (%)	Mitigation Factor (0<x<1)	Reduction in optimism bias	Mitigated optimism bias (%)
<b>Procurement</b>																				
Complexity of Contract Structure	-	0.7	-	-	1	0.7	0.7	0.3	-	0.7	-	-	-	0.7	-	-	7	0.7	4.9	2.1
Late Contractor Involvement in Design	2	0.95	1.9	0.1	2	0.95	1.9	0.1	3	0.95	2.9	0.2	-	0.95	-	-	7	0.95	6.7	0.4
Poor contractor Capabilities	9	0.95	8.6	0.5	5	0.95	4.8	0.3	-	0.95	-	-	-	0.95	-	-	4	0.95	3.8	0.2
Dispute and Claims Occurred	29	0.7	20.3	8.7	11	0.7	7.7	3.3	21	0.7	14.7	6.3	-	0.7	-	-	-	0.7	-	-
Information Management	-	0.7	-	-	-	0.7	-	-	-	0.7	-	-	-	0.7	-	-	5	0.7	3.5	1.5
Other (specify)	-	0.6	-	-	-	0.6	-	-	-	0.6	-	-	2	0.6	1.2	0.8	-	0.6	-	-
<b>Project Specific</b>																				
Design Complexity	1	0.8	0.8	0.2	3	0.8	2.4	0.6	-	0.8	-	-	8	0.8	6.4	1.6	10	0.8	8.0	2.0
Degree of Innovation	4	0.9	3.6	0.4	9	0.9	8.1	0.9	-	0.9	-	-	9	0.9	8.1	0.9	17	0.9	15.3	1.7
Environmental Impact	-	0.5	-	-	-	0.5	-	-	22	0.5	11.0	11.0	5	0.5	2.5	2.5	-	0.5	-	-
Other	-	0.5	-	-	5	0.5	2.5	2.5	18	0.5	9.0	9.0	-	0.5	-	-	-	0.5	-	-
<b>Client Specific</b>																				
Inadequacy of the Business Case	34	0.7	23.8	10.2	23	0.7	16.1	6.9	10	0.7	7.0	3.0	35	0.7	24.5	10.5	18	0.7	12.6	5.4
Funding Availability	-	0.7	-	-	-	0.7	-	-	-	0.7	-	-	5	0.7	3.5	1.5	-	0.7	-	-
Project Management Team	1	0.9	0.9	0.1	2	0.9	1.8	0.2	-	0.9	-	-	2	0.9	1.8	0.2	5	0.9	4.5	0.5
Poor Project Intelligence	2	0.7	1.4	0.6	6	0.7	4.2	1.8	7	0.7	4.9	2.1	9	0.7	6.3	2.7	4	0.7	2.8	1.2
Other - omitted (<1)	-	0.6	-	-	2	0.6	1.2	0.8	-	0.6	-	-	-	0.6	-	-	-	0.6	-	-
<b>Environment</b>																				
Public Relations	2	0.2	0.4	1.6	1	0.2	0.2	0.8	9	0.2	1.8	7.2	-	0.2	-	-	-	0.2	-	-
Site Characteristics	2	0.5	1.0	1.0	1	0.5	0.5	0.5	3	0.5	1.5	1.5	5	0.5	2.5	2.5	-	0.5	-	-
Permits/Consents/Approvals	-	0.2	-	-	3	0.2	0.6	2.4	-	0.2	-	-	-	0.2	-	-	-	0.2	-	-
<b>External Influences</b>																				
Economic	11	0.2	2.2	8.8	13	0.2	2.6	10.4	7	0.2	1.4	5.6	3	0.2	0.6	2.4	-	0.2	-	-
Legislation/Regulations	3	0.7	2.1	0.9	7	0.7	4.9	2.1	-	0.7	-	-	8	0.7	5.6	2.4	5	0.7	3.5	1.5
Technology	-	0.95	-	-	5	0.95	4.8	0.3	-	0.95	-	-	8	0.95	7.6	0.4	18	0.95	17.1	0.9
Other	-	0.6	-	-	2	0.6	1.2	0.8	-	0.6	-	-	1	0.6	0.6	0.4	-	0.6	-	-
<b>Weighted Total</b>	<b>100</b>			<b>33.1</b>	<b>101</b>			<b>34.9</b>	<b>100</b>			<b>45.9</b>	<b>100</b>			<b>28.8</b>	<b>100</b>			<b>17.4</b>

Adjusted Optimism Bias

Project Type	Percentage of CAPEX (%)	Mitigated OB (%)	OB contribution (%)	Resulting OB (%)
Standard Buildings	57	7.9	4.5	
Non-Standard Buildings	4	17.8	0.6	
Standard Civils	25	20.2	5.1	
Non-Standard Civils	8	19.0	1.4	
Equipment & Development	7	34.7	2.3	
<b>Combined</b>				<b>14.0</b>

Rounded to 15% for all schemes

**Figure B-2 Scheme Works**

**Appendix C Scheme Capital Cost Estimate Breakdown**

The table on the pages C-2 and C-3 set out the revised Scheme capital cost estimates following comments received during consultation. Base costs are presented exclusive of 'On costs', risk, and optimism bias which are itemised separately. The components of 'On costs' include enabling works (01.01.01), operational readiness (01.01.08 and 01.01.09), and project fees (01.06). Their treatment is described in Section 2.2.

As described in Section 3, the changes to Scheme costs concern the quantities used to calculate the cost of the civil works and fit out of the Tracked Transit System tunnels. These are shown in Table C-1 below.

NWR - Consultation Values					NWR - Revised Values			Difference	
Cost Category	Unit	Qty	Rate	Cost (£)	Qty	Rate	Cost (£)		
01.01.05.0003.	TTS Tunnels			504,081,648			400,064,800	- 104,016,848	
01.01.05.0003.0050	TTS Tunnels Civils	m	6,300	57,856	364,489,776	5,000	57,856	289,277,600	- 75,212,176
01.01.05.0003.0070	TTS Tunnels Fit Out	m	6,300	22,157	139,591,872	5,000	22,157	110,787,200	- 28,804,672
	<b>Total</b>			<b>504,081,648</b>			<b>400,064,800</b>	<b>- 104,016,848</b>	

**Table C-1 Revised Tracked Transit System Costs**

Ref No	Description	3R Quantity	Unit	Unit Rate	Total (£)
<b>HAL</b>	<b>Heathrow Airport (Jacobs Estimate)</b>				<b>17,643,676,387</b>
<b>01.</b>	<b>Investment Costs</b>				<b>12,785,272,744</b>
<b>01.01.</b>	<b>Airport Infrastructure Construction</b>				<b>8,068,797,517</b>
01.01.01.	Enabling Works				394,478,438
01.01.01.0001.	Decants / Demolitions				239,408,228
01.01.01.0001.0010	Site Clearance	543	ha	156,326.82	84,951,308
01.01.01.0001.0020	Decants / Demolitions	0.91	sum	170,612,244.90	154,456,920
01.01.01.0002.	Enabling Works				155,070,210
01.01.01.0002.0010	Earthworks	3,932,524	m3	8.21	32,286,023
01.01.01.0002.0020	Site Levelling and Soil Remediation / Stabilisation	270	ha	454,974.30	122,784,187
01.01.02.	Airfield				655,157,015
01.01.02.0001.	Runway				96,697,125
01.01.02.0001.0010	Runways including shoulders	262,500	m2	368.37	96,697,125
01.01.02.0002.	Taxiways & Aprons				315,604,681
01.01.02.0002.0015	Taxiways and Taxi Lanes	856,760	m2	368.37	315,604,681
01.01.02.0003.	Stands				199,248,210
01.01.02.0003.0020	Code C/D Stands	717	m2	448.24	321,388
01.01.02.0003.0030	Contact Stands to satellites	380,580	m2	418.78	159,379,292
01.01.02.0003.0040	Remote Stands	66,836	m2	591.71	39,547,530
01.01.02.0004.	Airfield Instrumentation				43,606,999
01.01.02.0004.0100	Navigational Equipment / Lighting	1,433,027	m2	30.43	43,606,999
01.01.03.	Airfield Ancillary Facilities				329,314,433
01.01.03.0001.	Air Traffic Control				60,000,000
01.01.03.0001.0090	Control Tower	1	sum	60,000,000.00	60,000,000
01.01.03.0002.	Security				19,387,755
01.01.03.0002.0120	Site Security Fence	1	sum	5,428,571.43	5,428,571
01.01.03.0002.0130	Control Posts	1	sum	13,959,183.67	13,959,184
01.01.03.0003.	Rescue and Fire Fighting				3,060,000
01.01.03.0003.0010	Fire Station	1	Nr	3,060,000.00	3,060,000
01.01.03.0004.	Fuel Systems				49,219,049
01.01.03.0004.0080	Fuel Fams	7	Nr	7,031,292.78	49,219,049
01.01.03.0005.	De-Icing & Snow Clearance				29,352,522
01.01.03.0005.0010	De Icing Pads	1	sum	29,352,521.74	29,352,522
01.01.03.0006.	Serviced areas for ancillary facilities e.g. Hotels, Offices, Cargo Buildings, Hangars, etc				70,650,300
01.01.03.0006.0010	Serviced areas for ancillary facilities e.g. Hotels, Offices, Cargo Buildings, Hangars, etc	706,503	m2	100	70,650,300
01.01.03.0007.	Surface Water Drainage				24,960,000
01.01.03.0007.0060	Balancing Ponds incl. equipment, pumping, controls * instrumentation, oil interceptors, pipework, etc	83	ha	300,000	24,960,000
01.01.03.0008.	Noise Control Measures				72,684,807
01.01.03.0008.0130	Noise Bund	1	sum	72,684,807	72,684,807
01.01.04.	Terminal Buildings				3,329,441,907
01.01.04.0001.	Terminals				1,559,368,141
01.01.04.0001.0010	T6 Terminal building, Substructure	67,605	m2	3,572.65	241,529,003
01.01.04.0001.0020	T6 Terminal building, Superstructure	67,605	m2	6,732.20	455,130,381
01.01.04.0001.0030	T6 Terminal building, Fit Out	67,605	m2	12,761.02	862,708,757
01.01.04.0002.	Piers & Satellites				1,560,073,765
01.01.04.0002.0040	Satellite Substructure	50,644	m2	2,684.16	135,936,599
01.01.04.0002.0050	Satellite Superstructure	50,645	m2	8,128.90	411,688,141
01.01.04.0002.0060	Satellite Fit Out	50,646	m2	5,612.37	284,244,091
01.01.04.0002.0090	T2E Satellite	21,780	m2	33,434.57	728,204,935
01.01.04.0003.	Fixed Links, VCC, Rotunda/Nodes, PCA and Airbridges				210,000,000
01.01.04.0003.0070	VCC, Airbridge, PCA, nodes and fixed links to new stands	66	Nr	3,181,818	210,000,000
01.01.05.	Airside Infrastructure				1,536,090,731
01.01.05.0001.	Access Roads				332,693,878
01.01.05.0001.0050	Airside Roads & Tunnels	1	sum	332,693,877.55	332,693,878
01.01.05.0002.	Baggage Tunnels				250,819,944
01.01.05.0002.0010	Baggage Tunnels Civils	2,400	m	30,864.14	74,073,936
01.01.05.0002.0040	Baggage Tunnels Fit Out	2,400	m	73,644.17	176,746,008
01.01.05.0003.	TTS Tunnels				412,304,800
01.01.05.0003.0050	TTS Tunnels Civils	5,000	m	57,855.52	289,277,600
01.01.05.0003.0070	TTS Tunnels Fit Out	5,000	m	22,157.44	110,787,200
01.01.05.0003.0080	Additional TTS Cars	6	Nr	2,040,000.00	12,240,000
01.01.05.0004.	TTS Station / Depot				540,272,110
01.01.05.0004.0050	TTS Stations	1.00	Nr	296,761,905.80	296,761,906
01.01.05.0004.0060	TTS Station Fit Out	1.00	sum	107,795,918.37	107,795,918
01.01.05.0004.0080	TTS Maintenance Base Substructure	1.00	sum	103,142,857.14	103,142,857
01.01.05.0004.0090	TTS Maintenance Base Fit Out	1.00	sum	32,571,428.57	32,571,429

01.01.06.	Landside Infrastructure				967,376,217
01.01.06.0001.	Connectivity				96,938,776
01.01.06.0001.0040	Landside connectivity systems	1.00	sum	96,938,775.51	96,938,776
01.01.06.0002.	Car Parks				500,204,082
01.01.06.0002.0020	Car Park - Surface & Multi Storey Parking	1.00	sum	500,204,081.63	500,204,082
01.01.06.0003.	Power Generation				93,061,224
01.01.06.0003.0020	Energy and Infrastructure	1.00	sum	93,061,224.49	93,061,224
01.01.06.0004.	Utilities				172,163,265
01.01.06.0004.0030	Utilities	1.00	sum	172,163,265.31	172,163,265
01.01.06.0005.	River Diversion / Culverts				105,008,870
01.01.06.0005.0020	Culverts	1.00	sum	28,460,347.83	28,460,348
01.01.06.0005.0030	Waterways	1.00	sum	76,548,521.74	76,548,522
01.01.07.	Equipment				729,755,102
01.01.07.0003.	Baggage Handling Systems				729,755,102
01.01.07.0003.0001	Baggage Equipment Terminal	1.00	sum	299,346,938.78	299,346,939
01.01.07.0003.0002	Baggage Equipment Satellite	1.00	sum	430,408,163.27	430,408,163
01.01.08.	Operational Commissioning				124,081,633
01.01.08.0007.	Development Process Costs				124,081,633
01.01.08.0007.0010	Consents	0.80	sum	135,714,285.71	108,571,429
01.01.08.0007.0020	Operational Readiness	0.80	sum	19,387,755.10	15,510,204
01.01.09.	Operational Handover				3,102,041
01.01.09.0001.	Operational Handover				3,102,041
01.01.09.0001.0030	Aerodrome Manual	0.80	sum	3,877,551.02	3,102,041
01.02.	Purchase of Land & Existing Infrastructure				2,225,973,913
01.02.01.	Purchase of Land & Existing Infrastructure				2,225,973,913
01.02.01.0001.	Purchase of Land & Existing Infrastructure				2,225,973,913
01.02.01.0001.0010	Residential property compulsory purchase	1.00	sum	267,652,173.91	267,652,174
01.02.01.0001.0020	Commercial property compulsory purchase	1.00	sum	1,552,382,608.70	1,552,382,609
01.02.01.0001.0030	Land Purchase	1.00	sum	405,939,130.43	405,939,130
01.04.	Environmental Compensation & Mitigation				476,069,043
01.04.01.	Environmental Compensation & Mitigation				476,069,043
01.04.01.0001.	Ecology				12,222,783
01.04.01.0001.0010	Ecology	1.00	sum	12,222,782.61	12,222,783
01.04.01.0002.	Landscape				138,019,304
01.04.01.0002.0010	Habitat Reprovision	1.00	sum	26,497,565.22	26,497,565
01.04.01.0002.0020	Landscape	1.00	sum	111,521,739.13	111,521,739
01.04.01.0003.	Surface water flood mitigation				137,840,870
01.04.01.0003.0010	Surface Water Flood Mitigation	1.00	sum	120,175,826.09	120,175,826
01.04.01.0003.0050	Sundries	1.00	sum	17,665,043.48	17,665,043
01.04.01.0004.	Listed Building Decants				45,500,870
01.04.01.0004.0010	Listed Building Decants / Relocations	1.00	sum	21,412,173.91	21,412,174
01.04.01.0004.0020	Archaeology	1.00	sum	24,088,695.65	24,088,696
01.04.01.0005.	Energy / Water / Waste (Sustainability)				43,900,000
01.04.01.0005.0010	Energy / Water / Waste (Sustainability)	1.00	sum	43,900,000.00	43,900,000
01.04.01.0006.	Noise Mitigation				98,585,217
01.04.01.0006.0010	Noise Bunds	1.00	sum	77,262,260.87	77,262,261
01.04.01.0006.0020	Local Road Resurfacing	1.00	sum	14,453,217.39	14,453,217
01.04.01.0006.0030	Acoustic fence	1.00	sum	6,869,739.13	6,869,739
01.05.	Community Impacts				346,788,000
01.05.01.	Community Impacts				346,788,000
01.05.01.0001.	Community Impacts				346,788,000
01.05.01.0001.0010	Noise Insulation and Compensation	1.00	sum	223,043,478.26	223,043,478
01.05.01.0001.0020	Community Infrastructure Levy	1.00	sum	53,262,782.61	53,262,783
01.05.01.0001.0030	Other Community	1.00	sum	70,481,739.13	70,481,739
01.06.	Project / Design Team Fees				1,667,644,271
01.06.01.	Project / Design Team Fees				1,667,644,271
01.06.01.0001.	Project / Design Team Fees	15%			1,667,644,271
01.06.01.0001.0010	Project / Design Team Fees on 01.01				1,210,319,628
01.06.01.0001.0020	Project / Design Team Fees on 01.02				333,896,087
01.06.01.0001.0030	Project / Design Team Fees on 01.03				0
01.06.01.0001.0040	Project / Design Team Fees on 01.04				71,410,357
01.06.01.0001.0050	Project / Design Team Fees on 01.05				52,018,200
03.	Risks & Optimism Bias				4,858,403,643
03.01.	Risks (Design, Construction & Employer Risk)				2,557,054,549
03.01.01.	Risks (Design, Construction & Employer Risk)				2,557,054,549
03.01.01.0001.	Risks (Design, Construction & Employer Risk)	20%			2,557,054,549
03.01.01.0001.0010	Risk Contingency on 01.01				1,855,823,429
03.01.01.0001.0020	Risk Contingency on 01.02				511,974,000
03.01.01.0001.0030	Risk Contingency on 01.03				0
03.01.01.0001.0040	Risk Contingency on 01.04				109,495,880
03.01.01.0001.0050	Risk Contingency on 01.05				79,761,240
03.02.	Optimism Bias				2,301,349,094
03.02.01.	Optimism Bias				2,301,349,094
03.02.01.0001.	Optimism Bias	15%			2,301,349,094
03.02.01.0001.0010	Optimism Bias on 01.01				1,670,241,086
03.02.01.0001.0020	Optimism Bias on 01.02				460,776,600
03.02.01.0001.0030	Optimism Bias on 01.03				0
03.02.01.0001.0040	Optimism Bias on 01.04				98,546,292
03.02.01.0001.0050	Optimism Bias on 01.05				71,785,116



## Appendix D Approach to Core and Asset Replacement Capital Expenditure

### D.1 Core Works

The approach to the Core works and Asset Replacement estimates was based upon the estimates provided by HAL. This approach recognised that HAL has greater knowledge relating to the condition of the current assets and the detail of its plans in the absence of the second runway Scheme works. However, recognising The Green Book guidance to correct for the systematic tendency for project appraisers to be overly optimistic, HAL's estimates were adjusted for optimism bias.

As published in January 2015, a revision to the underlying indexation of Core capital expenditure has been made to bring cost estimates into 2014 Q1 prices. Total Core capital expenditure has increased by £290 million excluding optimism bias.

Following consultation, it was determined that the Southern Road Tunnel project, which had previously been included within surface access costs, should instead be included under Core airport capital expenditure. The Southern Road Tunnel is a Core project (i.e., it is planned regardless of airport expansion) and the works are located within the existing airport perimeter. The project's forecast cost before optimism bias is £520 million.

In response to comments received during consultation, we have revisited the categorisation of Core capital costs and the mitigation factors applied to the derivation of mitigated optimism bias.

For consultation, Core works were categorised as 50% Standard Buildings and 50% Standard Civils. Following consultation, the works have been reassessed and categorised 70% Standard Buildings, 25% Standard Civils, and 5% Equipment/Development.

As a result, the mitigated optimism bias assumption for Core capital expenditure following the Q6 period (rounded to the nearest 5%) has reduced to 10% from the 15% previously used. The detailed calculation is shown in Appendix B.

Unmitigated optimism bias is unchanged at 15% for all schemes.

The HM Treasury's Green Book Optimism Bias approach is by its nature imprecise, its purpose being to provide comfort in forecasts for which there is insufficient detail and where available data lack precision. Having regard to the ranges of calculated mitigated optimism bias for Core capital expenditure, we have adopted a rounded figure of 10% across all three schemes.

### D.2 Asset Replacement

The allowance for asset replacement sought to cover expenditure relating to:

- *routine maintenance of the asset condition and capacity;*
- *periodic major investment to restore the assets' deteriorated condition and capacity; and*
- *investment in improvements to condition and capacity of the existing infrastructure.*

As published in January 2015, a revision to the underlying indexation of Asset Replacement capital expenditure has been made to bring it into 2014 Q1 prices. Q6 capital expenditure, which was classified under Asset Replacement, had already been inflated to 2014 prices for consultation; therefore only Asset Replacement costs after Q6 were adjusted. Consequently, under the Assessment of Need Carbon Capped demand scenario, total Asset Replacement costs have increased by £290 million before optimism bias.

The Asset Replacement forecast is assumed to include adequate provision for the Southern Road Tunnel and no adjustment has been made accordingly.

In line with the approach taken for consultation, Asset Replacement expenditure following the Q6 period is treated similarly to Scheme capital expenditure with regard to risk and optimism bias. Therefore, asset replacement costs are adjusted by 20% for risk and by 15% for mitigated optimism bias or 45% for unmitigated optimism bias.

**Appendix E Core and Asset Replacement Capital Expenditure Summary**

The tables on the following pages summarise the annual capital expenditure relating to the Core and asset replacement works under each of the demand scenarios set out in Section 1. The summaries are presented with mitigated optimism bias applied.

2014 real prices in £million - including mitigated optimism bias

Core	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Terminal buildings	7,033	-	-	-	-	-	-	25	53	103	408	652	742	839	735	333	107	79	474	816	836	605	225	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Plant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Tunnels and bridges	520	-	-	-	-	-	87	173	173	87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Transit systems	967	-	-	-	-	-	-	-	-	55	116	150	182	189	151	72	45	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Runways	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Taxiways and aprons	1,328	-	-	10	20	26	-	32	108	126	138	132	107	64	-	237	265	-	27	23	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Equipment	636	-	-	-	-	-	-	3	7	9	11	12	26	136	152	40	26	22	36	46	47	39	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Land	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Airfield Ancillary	1,442	-	-	-	-	-	-	-	93	229	319	339	290	172	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Car Parks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Third Party Land Users	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Environment	256	-	-	-	-	-	-	16	34	46	50	48	39	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Community	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Optimism Bias	1,213	-	-	-	-	-	9	21	42	53	67	106	126	122	119	104	68	44	11	54	88	90	64	25	-	-	-	-	-	-	-	-	-	-	-	-	-	
Risk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<b>Total</b>	<b>13,394</b>	<b>-</b>	<b>-</b>	<b>10</b>	<b>20</b>	<b>26</b>	<b>95</b>	<b>226</b>	<b>461</b>	<b>588</b>	<b>737</b>	<b>1,163</b>	<b>1,386</b>	<b>1,347</b>	<b>1,306</b>	<b>1,141</b>	<b>752</b>	<b>487</b>	<b>118</b>	<b>590</b>	<b>972</b>	<b>986</b>	<b>709</b>	<b>273</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>		

Asset Replacement	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Asset Replacement	12,831	614	702	668	534	534	211	214	214	213	219	221	223	251	272	282	290	299	303	309	311	318	323	328	332	339	344	350	351	355	359	361	360	364	363	366	365	369
Risk	1,956	-	-	-	-	-	42	43	43	43	44	44	45	50	54	56	58	60	61	62	62	64	65	66	66	68	69	70	71	72	72	72	73	73	73	73	74	
Optimism Bias	1,760	-	-	-	-	-	38	38	38	38	39	40	40	45	49	51	52	54	55	56	56	57	58	59	60	61	62	63	63	64	65	65	65	66	65	66	66	66
<b>Total</b>	<b>16,547</b>	<b>614</b>	<b>702</b>	<b>668</b>	<b>534</b>	<b>534</b>	<b>291</b>	<b>295</b>	<b>295</b>	<b>295</b>	<b>302</b>	<b>305</b>	<b>308</b>	<b>346</b>	<b>376</b>	<b>390</b>	<b>401</b>	<b>412</b>	<b>418</b>	<b>426</b>	<b>429</b>	<b>439</b>	<b>446</b>	<b>453</b>	<b>459</b>	<b>467</b>	<b>475</b>	<b>482</b>	<b>485</b>	<b>490</b>	<b>496</b>	<b>499</b>	<b>496</b>	<b>503</b>	<b>500</b>	<b>505</b>	<b>504</b>	<b>509</b>

Table E-1 Assessment of Need Carbon Capped

2014 real prices in £million - including mitigated optimism bias

Core	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Terminal buildings	7,033	-	-	-	-	-	-	25	61	84	364	717	1,011	1,060	720	509	816	836	605	225	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Plant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Tunnels and bridges	520	-	-	-	-	-	87	173	173	87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Transit systems	967	-	-	-	-	-	-	-	4	60	119	179	212	200	143	45	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Runways	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Taxiways and aprons	1,328	-	-	10	20	26	-	32	108	126	138	132	107	64	237	292	23	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Equipment	636	-	-	-	-	-	-	3	7	9	11	26	41	142	165	64	54	52	39	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Land	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Airfield Ancillary	1,442	-	-	-	-	-	-	-	93	196	284	326	298	201	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Car Parks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Third Party Land Users	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Environment	256	-	-	-	-	-	-	16	34	46	50	48	39	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Community	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Optimism Bias	1,213	-	-	-	-	-	9	33	56	68	100	140	162	155	129	91	90	90	64	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Risk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<b>Total</b>	<b>13,394</b>	<b>-</b>	<b>-</b>	<b>10</b>	<b>20</b>	<b>26</b>	<b>95</b>	<b>360</b>	<b>621</b>	<b>752</b>	<b>1,105</b>	<b>1,542</b>	<b>1,782</b>	<b>1,702</b>	<b>1,418</b>	<b>1,000</b>	<b>987</b>	<b>992</b>	<b>709</b>	<b>273</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>		

Asset Replacement	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Asset Replacement	13,232	614	702	668	534	534	208	213	216	218	221	220	221	254	281	296	307	318	325	332	337	346	352	353	356	364	365	366	365	366	365	370	371	372	373	376	375	377
Risk	2,036	-	-	-	-	-	42	43	43	44	44	44	44	51	56	59	61	64	65	66																		

2014 real prices in £million - including mitigated optimism bias

Core	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Terminal buildings	7,033	-	-	-	-	-	8	42	77	110	426	955	1,178	1,353	1,218	836	605	225	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Plant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Tunnels and bridges	520	-	-	-	-	-	87	173	173	87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Transit systems	967	-	-	-	-	-	-	4	8	63	148	208	223	192	116	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Runways	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Taxiways and aprons	1,328	-	-	10	20	26	32	108	126	138	132	107	64	264	288	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Equipment	636	-	-	-	-	-	3	7	9	11	26	41	63	173	180	55	45	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Land	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Airfield Ancillary	1,442	-	-	-	-	-	-	93	196	284	326	298	201	43	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Car Parks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Third Party Land Users	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Environment	256	-	-	-	-	-	-	-	16	34	46	50	48	39	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Community	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Optimism Bias	1,213	-	-	-	-	-	13	43	61	73	110	166	178	206	182	91	65	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Risk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<b>Total</b>	<b>13,394</b>	<b>-</b>	<b>-</b>	<b>10</b>	<b>20</b>	<b>26</b>	<b>143</b>	<b>469</b>	<b>666</b>	<b>799</b>	<b>1,214</b>	<b>1,826</b>	<b>1,954</b>	<b>2,270</b>	<b>2,007</b>	<b>1,001</b>	<b>714</b>	<b>273</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>		

Asset Replacement	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Asset Replacement	13,727	614	702	668	534	534	215	217	216	222	222	225	226	263	292	310	325	342	353	359	364	369	366	372	371	375	373	379	380	381	383	390	390	392	395	398	404	404
Risk	2,135	-	-	-	-	-	43	43	43	44	44	45	45	53	58	62	65	68	71	72	73	74	73	74	74	75	76	76	77	78	78	78	78	79	80	81	81	
Optimism Bias	1,921	-	-	-	-	-	39	39	39	40	40	40	41	47	53	56	59	62	64	65	66	66	67	67	67	67	68	68	69	69	70	70	71	71	72	73	73	
<b>Total</b>	<b>17,784</b>	<b>614</b>	<b>702</b>	<b>668</b>	<b>534</b>	<b>534</b>	<b>296</b>	<b>300</b>	<b>298</b>	<b>306</b>	<b>307</b>	<b>310</b>	<b>312</b>	<b>363</b>	<b>403</b>	<b>428</b>	<b>449</b>	<b>472</b>	<b>488</b>	<b>496</b>	<b>503</b>	<b>510</b>	<b>505</b>	<b>513</b>	<b>511</b>	<b>517</b>	<b>515</b>	<b>523</b>	<b>525</b>	<b>526</b>	<b>529</b>	<b>539</b>	<b>538</b>	<b>542</b>	<b>545</b>	<b>549</b>	<b>558</b>	<b>557</b>

**Table E-3 Global Growth Carbon Traded**

2014 real prices in £million - including mitigated optimism bias

Core	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Terminal buildings	7,033	-	-	-	-	-	-	-	25	53	103	417	687	957	1,005	644	107	79	474	816	836	605	225	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Plant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Tunnels and bridges	520	-	-	-	-	-	87	173	173	87	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Transit systems	967	-	-	-	-	-	-	-	-	4	60	119	179	212	200	143	45	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Runways	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Taxiways and aprons	1,328	-	-	10	20	26	-	32	108	126	138	132	107	64	-	237	265	-	27	23	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Equipment	636	-	-	-	-	-	-	3	7	9	11	12	26	41	141	147	26	22	36	46	47	39	23	-	-	-	-	-	-	-	-	-	-	-	-	-		
Land	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Airfield Ancillary	1,442	-	-	-	-	-	-	-	93	229	319	339	290	172	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Car Parks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Third Party Land Users	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Environment	256	-	-	-	-	-	-	-	16	34	46	50	48	39	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Community	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Optimism Bias	1,213	-	-	-	-	-	9	21	42	54	68	107	134	148	137	117	44	11	54	88	90	64	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Risk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
<b>Total</b>	<b>13,394</b>	<b>-</b>	<b>-</b>	<b>10</b>	<b>20</b>	<b>26</b>	<b>95</b>	<b>229</b>	<b>464</b>	<b>596</b>	<b>744</b>	<b>1,177</b>	<b>1,471</b>	<b>1,632</b>	<b>1,505</b>	<b>1,288</b>	<b>487</b>	<b>118</b>	<b>590</b>	<b>972</b>	<b>986</b>	<b>709</b>	<b>273</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>		

Asset Replacement	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Asset Replacement	12,867	614	702	668	534	534	209	214	219	216	219	222	221	247	270	282	293	302	307	312	316	322	330	334	339	344	349	349	352	356	356	357	358	361	362	363	364	367
Risk	1,963	-	-	-	-	-	42	43	44	43	44	44	44	49	54	56	59	60	61	62																		

## Appendix F Operational Expenditure

### F.1 Introduction

This appendix sets out the changes made to the independent forecast of operational expenditure for the period 2014 to 2050 for the Heathrow Airport North West Runway scheme following consultation (see Table F-3).

### F.2 Revisions to Operating Cost Forecasts

Further to consultation, modelling refinements have been made, resulting in the following minor changes to operational expenditure forecasts:

- *the allowance for Optimism Bias has increased as a result from a refinement to the modelling of terminal gross floor area.*
  - *Optimism Bias is only applied to costs associated with operating Scheme infrastructure and not Core infrastructure.*
  - *Previously, the incremental operating costs associated with operating Terminal 6 were being offset by the reduced operating costs associated with the closure of Terminal 3. Refinements to the model allowed the full costs of operating Terminal 6 to be properly attributed to the Scheme, and hence the calculation of optimism bias.*
  - *The result is that while there is no change to base operating costs, the costs including mitigated optimism bias have increased marginally (<1% of the total operational expenditure).*
- *a correction has been made to the capacity assumptions applied to the Global Fragmentation Carbon Capped scenario. This leads to a minor change in the years 2027, 2029, and 2032-2034 (<0.1% of the total operational expenditure).*

The airport operating cost estimate is considered to have adequate provision to cover any costs associated with the inclusion of the Southern Road Tunnel in Core works, and therefore no adjustment has been made.

### F.3 Treatment of Risk and Optimism Bias

There is no change to the approach to calculating risk for operational expenditure.

Responses to consultation raised concerns that applying optimism bias to project operational expenditure is inappropriate, since the operation of the future airport will be substantially the same as at the current airport. We have reflected upon these concerns and consider that the adopted approach of applying mitigated optimism bias is reasonable at this stage of the process, given the potential for the scope of staffing requirements, wage rates, and non-staff costs to vary from current assumptions.

In response to comments received during consultation, we have revisited the mitigation factors applied to the derivation of the mitigated optimism bias allowance for operational expenditure.

As before, all works are categorised under Outsourcing, following the guidance set out in HM Treasury’s Green Book.

The HM Treasury’s Green Book Optimism Bias approach is by its nature imprecise, its purpose being to provide an appropriate cost contingency in forecasts for which there is insufficient detail and where available data lack precision. Having regard to the ranges of calculated mitigated optimism bias, we have adopted a rounded figure of 15% across all three schemes.

Table F-1, below, sets out the revised calculation used to derive an appropriate level of mitigated optimism bias used consistently for all schemes.

OPEX Contributory Factors	Outsourcing optimism bias (%)	Mitigation Factor (0<x<1)	Reduction in optimism bias	Mitigated optimism bias (%)
<b>Procurement</b>				
Late Contractor Involvement in Design	5	0.95	4.8	0.3
Poor contractor Capabilities	15	0.95	14.3	0.8
<b>Project Specific</b>				
Design Complexity	5	0.8	4.0	1.0
Degree of Innovation	5	0.8	4.0	1.0
<b>Client Specific</b>				
Project Management Team	20	0.9	18.0	2.0
Poor Project Intelligence	10	0.7	7.0	3.0
<b>Environment</b>				
Site Characteristics	5	0.5	2.5	2.5
<b>External Influences</b>				
Economic	20	0.2	4.0	16.0
Legislation/Regulations	15	0.5	7.5	7.5
<b>Weighted Total</b>	<b>100</b>			<b>34.0</b>
<b>Adjusted Optimism Bias</b> = 34.0 x 41% Upper Bound				<b>14%</b>

**Table F-1 Revised Optimism Bias Mitigations**

### F.4 Summary of Adjustments

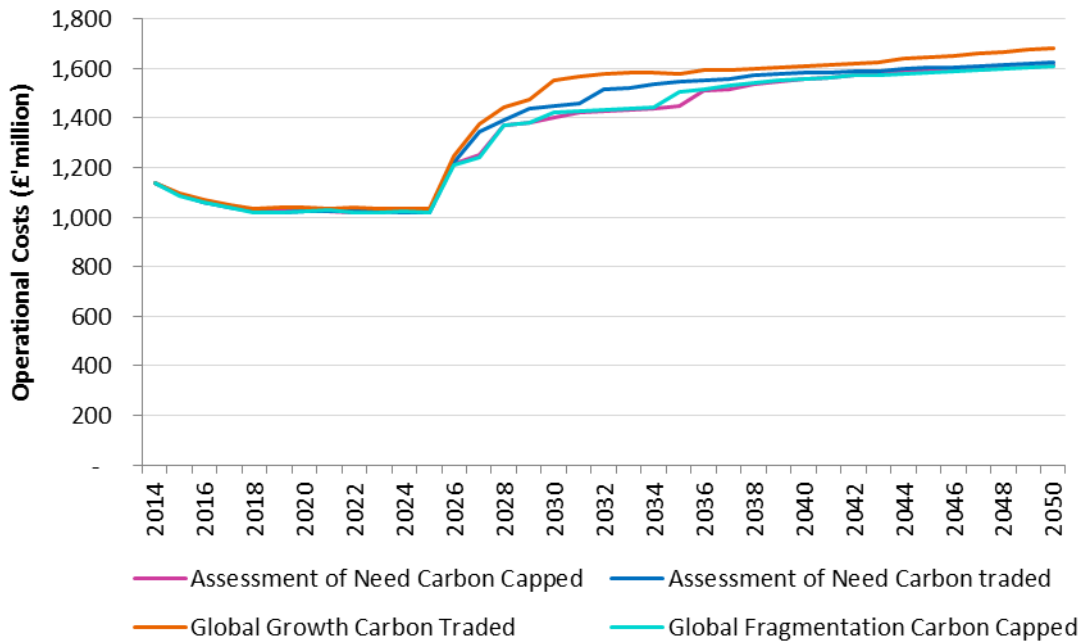
In summary, the following adjustments for risk and optimism bias were made:

		Scheme	
		Pre-consultation	Post-consultation
<b>Risk</b>		20	20
<b>Optimism Bias</b>	<b>Mitigated</b>	20	15
	<b>Unmitigated</b>	41	41

**Table F-2 Summary of Risk and Optimism Bias Adjustments to the Base Costs (%)**

### F.5 Revised Independent Operational Expenditure

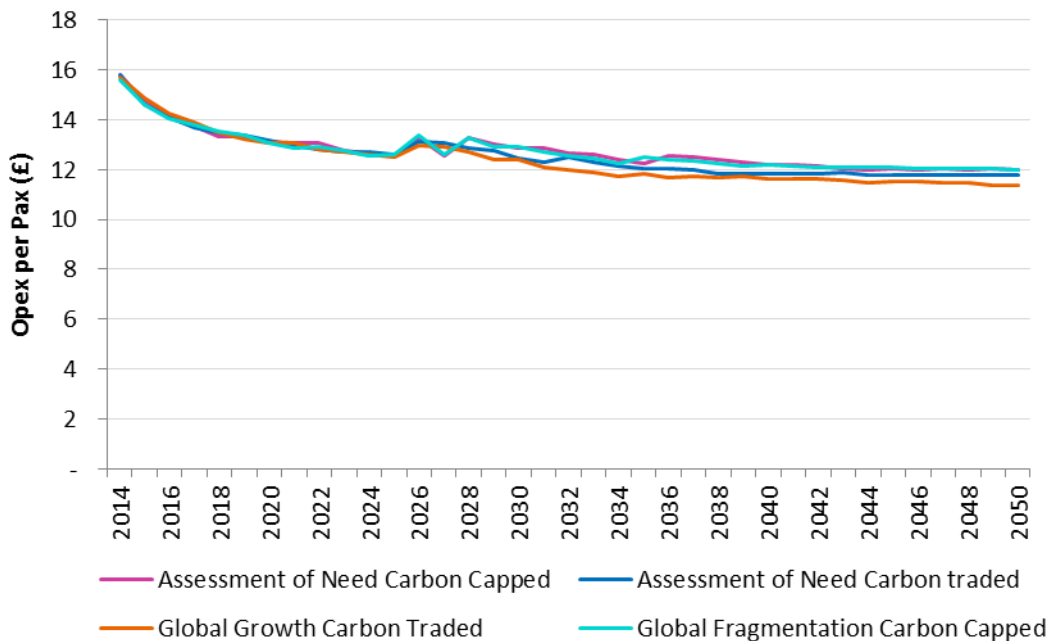
This section presents graphical outputs of the revised independent operating cost model and summary tables.



**Figure F-1 Heathrow Airport North West Runway Scheme Forecast Operating Expenditure (Risk Adjusted and Mitigated)**

On a per passenger basis, operating costs are forecast to decrease over the longer term in all demand scenarios. Figure F-2, below, shows operating costs on a per passenger basis.

Temporary increases occur during the period following the opening of new infrastructure. When new terminal buildings open, there is a marked increase in fixed costs. Over time, as passenger numbers increase to fill the terminal buildings, costs become more efficient on a per passenger basis.



**Figure F-2 Heathrow Airport North West Runway Scheme Forecast Operating Expenditure per Passenger (Risk Adjusted and Mitigated Optimism Bias)**



2014 real prices in £million

Assessment of Need Carbon Capped	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	
Staff	16,987	449	425	410	400	395	390	389	385	381	381	378	376	436	447	482	482	483	487	486	483	482	483	501	501	502	503	504	502	502	502	500	497	497	494	493	490	490	
Routine maintenance	6,382	168	161	155	152	150	148	147	146	144	145	144	143	148	152	171	171	184	183	183	184	184	184	184	184	191	192	192	191	191	191	191	191	189	189	188	188	187	187
Utilities	3,844	94	94	93	92	91	90	89	88	87	87	86	85	101	101	113	112	111	112	111	110	109	109	115	115	114	114	113	113	112	112	111	111	110	110	109	109	108	108
Rent and rates	6,303	129	128	127	125	124	124	124	124	124	124	124	124	159	159	182	182	182	187	187	187	187	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Rail	2,110	69	58	57	57	56	56	56	55	55	55	54	54	56	57	58	58	58	58	58	57	57	57	57	57	57	57	57	57	57	57	57	57	56	56	56	56	56	
Other	9,384	228	223	220	217	214	212	211	209	206	206	206	206	235	242	257	259	261	263	264	263	264	266	275	277	279	280	282	283	284	285	286	285	287	286	287	287	288	
<b>Opex</b>	<b>45,010</b>	<b>1,137</b>	<b>1,089</b>	<b>1,061</b>	<b>1,042</b>	<b>1,030</b>	<b>1,020</b>	<b>1,016</b>	<b>1,007</b>	<b>998</b>	<b>997</b>	<b>993</b>	<b>988</b>	<b>1,135</b>	<b>1,157</b>	<b>1,263</b>	<b>1,264</b>	<b>1,279</b>	<b>1,291</b>	<b>1,289</b>	<b>1,284</b>	<b>1,283</b>	<b>1,285</b>	<b>1,334</b>	<b>1,334</b>	<b>1,344</b>	<b>1,347</b>	<b>1,349</b>	<b>1,347</b>	<b>1,347</b>	<b>1,348</b>	<b>1,346</b>	<b>1,340</b>	<b>1,341</b>	<b>1,334</b>	<b>1,334</b>	<b>1,329</b>	<b>1,329</b>	
<b>Opex (incl. Risk &amp; OB)</b>	<b>49,878</b>	<b>1,137</b>	<b>1,089</b>	<b>1,061</b>	<b>1,042</b>	<b>1,030</b>	<b>1,026</b>	<b>1,026</b>	<b>1,022</b>	<b>1,018</b>	<b>1,022</b>	<b>1,023</b>	<b>1,024</b>	<b>1,216</b>	<b>1,249</b>	<b>1,370</b>	<b>1,380</b>	<b>1,404</b>	<b>1,423</b>	<b>1,429</b>	<b>1,431</b>	<b>1,438</b>	<b>1,448</b>	<b>1,508</b>	<b>1,517</b>	<b>1,536</b>	<b>1,547</b>	<b>1,559</b>	<b>1,564</b>	<b>1,572</b>	<b>1,581</b>	<b>1,586</b>	<b>1,586</b>	<b>1,596</b>	<b>1,595</b>	<b>1,603</b>	<b>1,605</b>	<b>1,614</b>	
Opex/pax (£)		15.81	14.70	14.19	13.74	13.31	13.30	13.13	13.08	13.04	12.77	12.65	12.53	13.26	12.54	13.27	13.00	12.85	12.85	12.66	12.59	12.37	12.26	12.55	12.48	12.41	12.30	12.19	12.17	12.11	12.03	12.00	12.06	11.98	12.03	11.99	12.02	11.96	

Assessment of Need Carbon traded	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	
Staff	17,265	449	425	409	399	391	387	387	385	383	381	376	374	437	483	488	497	499	499	516	514	514	516	514	513	515	513	511	507	506	502	503	501	499	497	496	493	491	
Routine maintenance	6,520	168	162	156	152	149	147	147	147	146	145	143	142	149	154	174	188	189	191	191	190	197	197	197	196	197	196	196	194	194	192	193	192	191	190	190	189	188	
Utilities	3,897	94	94	93	92	91	90	89	88	88	87	86	85	101	114	113	115	114	113	119	118	117	116	116	115	115	114	114	113	113	112	111	110	110	109	109	108	108	
Rent and rates	6,390	129	128	127	125	124	124	124	124	124	124	124	124	159	182	182	187	187	187	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Rail	2,148	69	58	57	57	56	56	56	55	55	55	54	54	57	59	60	60	60	60	60	59	59	60	59	59	59	59	59	59	58	58	58	58	58	57	57	57	57	
Other	9,560	228	224	221	217	213	211	210	209	208	207	206	205	236	258	262	267	269	271	279	279	281	283	283	284	287	287	287	287	287	287	289	289	289	289	290	290	291	
<b>Opex</b>	<b>45,780</b>	<b>1,137</b>	<b>1,090</b>	<b>1,062</b>	<b>1,042</b>	<b>1,023</b>	<b>1,016</b>	<b>1,013</b>	<b>1,009</b>	<b>1,004</b>	<b>999</b>	<b>990</b>	<b>984</b>	<b>1,138</b>	<b>1,250</b>	<b>1,279</b>	<b>1,313</b>	<b>1,317</b>	<b>1,319</b>	<b>1,364</b>	<b>1,361</b>	<b>1,368</b>	<b>1,372</b>	<b>1,369</b>	<b>1,368</b>	<b>1,373</b>	<b>1,370</b>	<b>1,366</b>	<b>1,361</b>	<b>1,358</b>	<b>1,352</b>	<b>1,354</b>	<b>1,351</b>	<b>1,347</b>	<b>1,344</b>	<b>1,343</b>	<b>1,338</b>	<b>1,335</b>	
<b>Opex (incl. Risk &amp; OB)</b>	<b>50,792</b>	<b>1,137</b>	<b>1,090</b>	<b>1,062</b>	<b>1,042</b>	<b>1,023</b>	<b>1,021</b>	<b>1,023</b>	<b>1,024</b>	<b>1,024</b>	<b>1,024</b>	<b>1,020</b>	<b>1,019</b>	<b>1,221</b>	<b>1,347</b>	<b>1,391</b>	<b>1,435</b>	<b>1,448</b>	<b>1,458</b>	<b>1,514</b>	<b>1,519</b>	<b>1,536</b>	<b>1,548</b>	<b>1,552</b>	<b>1,559</b>	<b>1,573</b>	<b>1,577</b>	<b>1,581</b>	<b>1,582</b>	<b>1,586</b>	<b>1,586</b>	<b>1,597</b>	<b>1,601</b>	<b>1,604</b>	<b>1,609</b>	<b>1,616</b>	<b>1,617</b>	<b>1,623</b>	
Opex/pax (£)		15.81	14.59	14.10	13.70	13.46	13.39	13.15	12.97	12.83	12.68	12.69	12.59	13.13	13.08	12.86	12.77	12.46	12.27	12.49	12.31	12.15	12.01	12.01	11.97	11.81	11.81	11.81	11.85	11.84	11.88	11.80	11.79	11.80	11.80	11.76	11.79	11.78	

Global Growth Carbon Traded	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Staff	18,059	449	434	421	409	403	402	400	395	396	392	390	387	455	504	518	522	547	549	547	545	542	537	538	535	535	531	532	530	528	526	527	525	523	522	521	522	519
Routine maintenance	6,623	168	161	155	151	149	149	148	146	146	145	144	143	151	156	177	192	196	197	203	203	202	200	200	199	199	198	198	197	196	196	195	195	194	194	194	194	193
Utilities	3,920	94	94	93	92	91	90	89	88	88	87	86	85	101	114	116	115	121	120	119	118	117	116	116	115	115	114	114	113	113	112	112	111	111	110	110	109	109
Rent and rates	6,422	129	128	127	125	124	124	124	124	124	124	124	124	159	182	187	187	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200	200
Rail	2,162	69	58	57	57	56	56	56	55	55	55	54	54	57	59	60	60	61	61	61	61	60	60	60	60	60	59	59	59	59	59	59	58	58	58	58	58	
Other	9,704	228	222	220	216	213	212	211	209	209	207	207	206	238	261	269	272	284	286	287	287	287	286	288	288	289	289	290	291	291	292	294	294	294	295	296	298	
<b>Opex</b>	<b>46,889</b>	<b>1,137</b>	<b>1,096</b>	<b>1,072</b>	<b>1,049</b>	<b>1,036</b>	<b>1,034</b>	<b>1,029</b>	<b>1,018</b>	<b>1,017</b>	<b>1,010</b>	<b>1,005</b>	<b>1,000</b>	<b>1,161</b>	<b>1,276</b>	<b>1,325</b>	<b>1,349</b>	<b>1,410</b>	<b>1,414</b>	<b>1,418</b>	<b>1,413</b>	<b>1,409</b>	<b>1,400</b>	<b>1,403</b>	<b>1,397</b>	<b>1,397</b>	<b>1,391</b>	<b>1,393</b>	<b>1,390</b>	<b>1,386</b>	<b>1,384</b>	<b>1,388</b>	<b>1,383</b>	<b>1,381</b>	<b>1,380</b>	<b>1,379</b>	<b>1,381</b>	<b>1,376</b>
<b>Opex (incl. Risk &amp; OB)</b>	<b>52,093</b>	<b>1,137</b>	<b>1,096</b>	<b>1,072</b>	<b>1,049</b>	<b>1,036</b>	<b>1,039</b>	<b>1,039</b>	<b>1,033</b>	<b>1,038</b>	<b>1,035</b>	<b>1,036</b>	<b>1,035</b>	<b>1,247</b>	<b>1,377</b>	<b>1,443</b>	<b>1,476</b>	<b>1,552</b>	<b>1,565</b>	<b>1,577</b>	<b>1,581</b>	<b>1,584</b>	<b>1,579</b>	<b>1,591</b>	<b>1,592</b>	<b>1,601</b>	<b>1,601</b>	<b>1,611</b>	<b>1,615</b>	<b>1,619</b>	<b>1,624</b>	<b>1,638</b>	<b>1,645</b>	<b>1,652</b>	<b>1,658</b>	<b>1,665</b>	<b>1,678</b>	<b>1,679</b>
Opex/pax (£)		15.68	14.84	14.22	13.88	13.48	13.24	13.08	13.09	12.81	12.72	12.60	12.50	12.95	12.88	12.73	12.42	12.40	12.11	1																		

## Appendix G Non-Aeronautical Revenue

### G.1 Introduction

This appendix sets out the changes made to the independent forecast of non-aeronautical revenues for the period 2014 to 2050 for the Heathrow Airport North West Runway scheme following consultation.

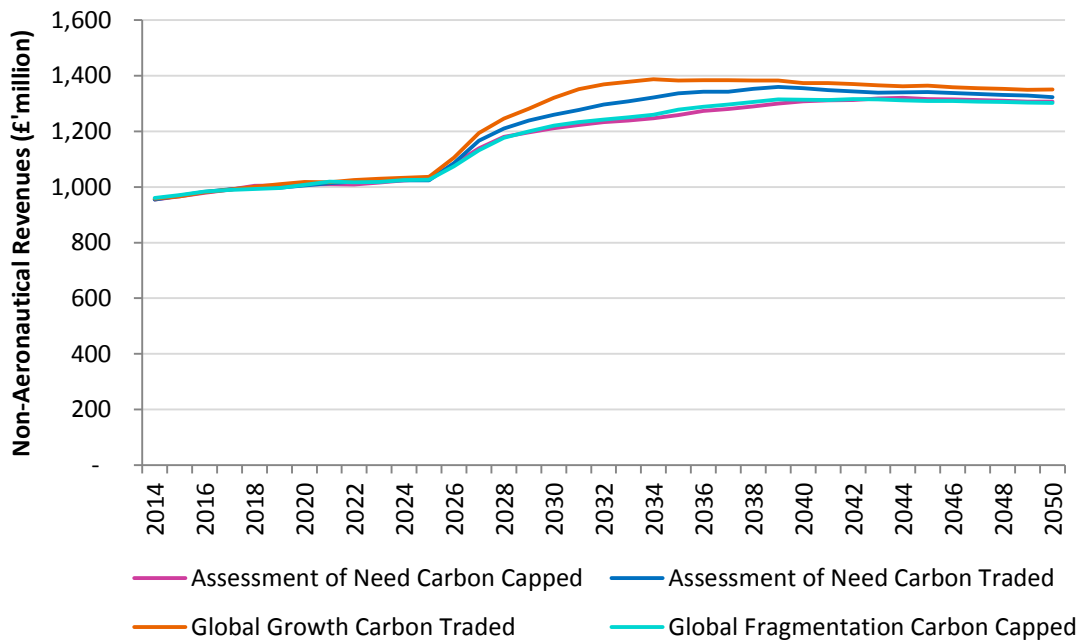
### G.2 Revisions to Non-Aeronautical Revenue Forecasts

During consultation, modelling refinements have been made, resulting in minor changes (less than 0.1%) to non-aeronautical revenue forecasts:

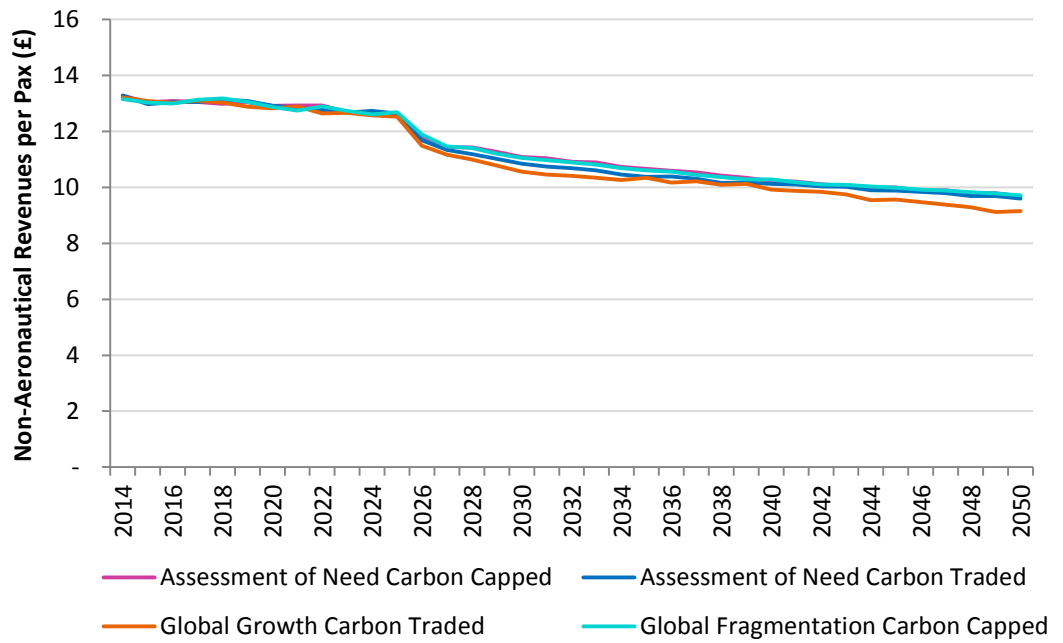
- *certain non-aeronautical revenue categories have been amended so that uplifts are triggered in line with phases of terminal development. This has resulted in the following impacts:*
  - *Global Fragmentation Carbon Capped: new model decreases non-aero revenue in 2027, 2029, and 2032-2034*
- *in the Global Growth Carbon Traded scenario, a correction to passenger numbers has been made for the Q6 period.*

### G.3 Revised Independent Non-aeronautical Revenue Forecasts

This section presents graphical outputs of the revised independent non-aeronautical revenue model (see Figure G-1 and G-2) and summary tables (see Table G-1). We assumed a reduction in the real compounded growth rate of 0.25% per year for risk and a similar reduction of 0.25% for optimism bias.



**Figure G-1 Heathrow Airport North West Runway Scheme Forecast Non-Aeronautical Revenue (Risk Adjusted and Optimism Bias)**



**Figure G-2 Heathrow Airport North West Runway Scheme Forecast Non-Aeronautical Revenue per Passenger (Risk Adjusted and Optimism Bias)**

Table G-1, on the following page, sets out the independent forecast.

2014 real prices in £million

Assessment of Need Carbon Capped	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Car parking	3,597	65	66	68	70	72	73	74	76	77	79	81	82	88	95	99	101	102	103	104	105	106	107	109	109	110	112	113	113	114	115	116	116	116	116	116	116	116
Total retail	21,810	404	409	417	423	430	435	438	442	443	449	457	462	489	532	560	577	592	605	616	625	636	649	660	671	683	696	706	712	717	724	730	731	734	736	738	740	744
<i>Duty and tax-free</i>	7,818	129	131	135	137	141	143	144	146	147	150	153	156	167	185	197	205	212	217	222	227	231	237	243	248	253	259	263	266	268	271	274	274	275	277	277	278	280
<i>Other retail</i>	11,833	236	238	242	244	247	249	251	253	253	256	259	262	274	293	306	314	321	327	332	336	341	347	352	357	362	368	373	376	378	381	384	384	385	387	387	389	390
<i>Food and beverage</i>	2,159	40	40	41	41	42	42	43	43	43	44	44	45	49	53	56	58	59	61	62	62	63	65	66	67	68	69	70	70	71	72	72	72	73	73	73	73	74
Property rental	4,239	108	111	111	111	111	111	111	111	111	111	111	111	114	114	116	116	116	116	116	116	116	116	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117
Rail	7,603	124	126	130	134	138	140	143	145	146	151	154	158	173	187	194	199	204	208	212	216	220	225	230	234	239	243	248	252	256	261	265	267	271	273	276	278	282
Other revenue	9,886	253	253	253	253	253	253	253	252	252	252	252	252	264	264	272	272	272	274	273	273	273	273	277	277	277	277	277	277	276	276	276	276	275	275	275	275	
<b>Non-aero</b>	<b>47,135</b>	<b>955</b>	<b>966</b>	<b>979</b>	<b>990</b>	<b>1,004</b>	<b>1,011</b>	<b>1,019</b>	<b>1,026</b>	<b>1,029</b>	<b>1,042</b>	<b>1,055</b>	<b>1,065</b>	<b>1,127</b>	<b>1,192</b>	<b>1,241</b>	<b>1,264</b>	<b>1,286</b>	<b>1,306</b>	<b>1,322</b>	<b>1,335</b>	<b>1,351</b>	<b>1,370</b>	<b>1,393</b>	<b>1,409</b>	<b>1,426</b>	<b>1,445</b>	<b>1,460</b>	<b>1,471</b>	<b>1,481</b>	<b>1,494</b>	<b>1,505</b>	<b>1,506</b>	<b>1,513</b>	<b>1,518</b>	<b>1,522</b>	<b>1,526</b>	<b>1,534</b>
<b>Non-aero (incl. Risk &amp; OB)</b>	<b>43,587</b>	<b>955</b>	<b>966</b>	<b>979</b>	<b>990</b>	<b>1,004</b>	<b>1,006</b>	<b>1,009</b>	<b>1,010</b>	<b>1,009</b>	<b>1,016</b>	<b>1,023</b>	<b>1,028</b>	<b>1,083</b>	<b>1,139</b>	<b>1,180</b>	<b>1,196</b>	<b>1,211</b>	<b>1,223</b>	<b>1,233</b>	<b>1,239</b>	<b>1,247</b>	<b>1,259</b>	<b>1,273</b>	<b>1,281</b>	<b>1,290</b>	<b>1,300</b>	<b>1,308</b>	<b>1,311</b>	<b>1,313</b>	<b>1,318</b>	<b>1,321</b>	<b>1,316</b>	<b>1,315</b>	<b>1,313</b>	<b>1,310</b>	<b>1,307</b>	<b>1,307</b>
Non-aero/pax (£)		13.28	13.04	13.08	13.05	12.98	13.04	12.92	12.93	12.92	12.69	12.66	12.58	11.80	11.44	11.43	11.27	11.08	11.04	10.92	10.89	10.73	10.66	10.60	10.53	10.42	10.34	10.23	10.20	10.12	10.03	9.99	10.00	9.87	9.90	9.80	9.79	9.68

Assessment of Need Carbon Traded	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Car parking	3,729	65	66	68	70	71	72	74	76	78	80	81	82	88	97	103	106	108	110	112	113	115	117	118	117	118	119	119	118	118	118	118	119	119	119	119	119	119
Total retail	22,490	404	411	420	424	427	430	435	443	449	455	457	459	491	543	579	602	623	640	655	668	682	698	708	714	726	737	739	739	739	739	743	749	751	752	752	755	754
<i>Duty and tax-free</i>	8,109	129	132	136	138	140	141	143	147	149	152	153	154	167	189	205	216	225	232	239	245	251	258	263	266	271	277	277	277	278	278	279	282	283	283	283	285	285
<i>Other retail</i>	12,144	236	239	243	245	246	247	250	253	256	258	260	260	274	298	315	326	335	343	350	356	362	369	374	376	382	387	388	388	388	390	392	393	394	393	395	394	
<i>Food and beverage</i>	2,238	40	41	41	42	42	42	42	43	44	44	44	44	49	55	59	61	63	65	66	67	69	70	71	71	73	73	73	73	73	74	75	75	75	75	75	75	
Property rental	4,247	108	111	111	111	111	111	111	111	111	111	111	111	114	116	116	116	116	116	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	
Rail	7,887	124	127	131	134	136	138	142	146	150	153	154	156	174	193	203	210	216	222	228	233	239	246	248	251	256	260	261	262	265	267	271	275	277	280	284	286	289
Other revenue	9,926	253	253	253	253	253	253	253	253	252	252	252	252	264	272	273	274	274	274	278	278	278	278	278	278	278	278	277	277	277	277	276	276	276	276	275	275	
<b>Non-aero</b>	<b>48,279</b>	<b>955</b>	<b>969</b>	<b>983</b>	<b>992</b>	<b>998</b>	<b>1,003</b>	<b>1,015</b>	<b>1,029</b>	<b>1,040</b>	<b>1,050</b>	<b>1,055</b>	<b>1,060</b>	<b>1,130</b>	<b>1,221</b>	<b>1,273</b>	<b>1,309</b>	<b>1,338</b>	<b>1,363</b>	<b>1,390</b>	<b>1,410</b>	<b>1,432</b>	<b>1,456</b>	<b>1,469</b>	<b>1,477</b>	<b>1,496</b>	<b>1,510</b>	<b>1,513</b>	<b>1,513</b>	<b>1,516</b>	<b>1,517</b>	<b>1,526</b>	<b>1,536</b>	<b>1,540</b>	<b>1,543</b>	<b>1,547</b>	<b>1,552</b>	<b>1,553</b>
<b>Non-aero (incl. Risk &amp; OB)</b>	<b>44,629</b>	<b>955</b>	<b>969</b>	<b>983</b>	<b>992</b>	<b>998</b>	<b>1,005</b>	<b>1,013</b>	<b>1,019</b>	<b>1,024</b>	<b>1,023</b>	<b>1,024</b>	<b>1,086</b>	<b>1,167</b>	<b>1,211</b>	<b>1,239</b>	<b>1,260</b>	<b>1,277</b>	<b>1,296</b>	<b>1,308</b>	<b>1,322</b>	<b>1,337</b>	<b>1,342</b>	<b>1,343</b>	<b>1,353</b>	<b>1,360</b>	<b>1,355</b>	<b>1,349</b>	<b>1,344</b>	<b>1,339</b>	<b>1,340</b>	<b>1,342</b>	<b>1,338</b>	<b>1,335</b>	<b>1,331</b>	<b>1,329</b>	<b>1,323</b>	
Non-aero/pax (£)		13.28	12.97	13.04	13.05	13.14	13.09	12.92	12.83	12.76	12.68	12.73	12.64	11.68	11.34	11.19	11.02	10.84	10.74	10.69	10.60	10.46	10.38	10.38	10.31	10.16	10.18	10.12	10.10	10.04	10.03	9.90	9.88	9.84	9.79	9.69	9.69	9.60

Global Growth Carbon Traded	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Car parking	3,890	66	66	68	70	71	73	76	77	79	80	82	83	91	101	108	112	116	119	122	123	124	123	123	123	123	122	122	123	123	124	125	125	125	126	127	127	
Total retail	23,006	405	410	418	424	429	437	444	446	452	458	463	468	503	559	600	630	659	686	703	715	726	730	735	742	746	753	748	751	753	752	748	754	752	752	749	755	
<i>Duty and tax-free</i>	8,343	129	132	135	138	140	144	147	148	150	154	156	158	172	197	214	227	240	251	259	265	270	272	275	278	280	284	282	283	284	283	286	285	285	286	285	288	
<i>Other retail</i>	12,359	236	238	242	244	247	250	254	255	257	260	262	264	280	306	325	338	352	364	372	377	382	384	386	390	391	394	391	393	393	390	393	392	392	391	389	392	
<i>Food and beverage</i>	2,303	40	40	41	41	42	43	43	43	44	45	45	45	51	57	61	64	68	70	72	73	74	74	74	75	75	75	75	75	75	75	75	75	75	75	75	75	
Property rental	4,249	108	111	111	111	111	111	111	111	111	111	111	111	114	116	116	116	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117	117		
Rail	8,237	125	126	131	133	137	142	145																														

## Appendix H Surface Access Capital Expenditure, Operational Expenditure and Maintenance Cost

### H.1 Introduction

This appendix sets out the changes made to the independent forecast of non-aeronautical revenues for the period 2014 to 2050 for the Heathrow North West Runway scheme following consultation (see Tables H-1 and H-2).

### H.2 Adjustment for Risk and Optimism Bias

There is no change to the adjustment for risk and optimism bias.

### H.3 Capital Expenditure and Asset Replacement

Following consultation, it was determined that the Southern Road Tunnel project, which had previously been included within surface access costs, should instead be included under Core airport capital expenditure. The Southern Road Tunnel is a Core project (i.e., it is planned regardless of airport expansion) and the works are located within the existing airport perimeter.

Surface access costs have been reduced by £520 million plus 44% Optimism Bias (Total: £748 million).

### H.4 Operational Expenditure

Operating expenditure associated with the Southern Road Tunnel has been removed, reducing costs by £6 million.

### H.5 Asset Replacement

Asset replacement associated with the Southern Road Tunnel has been removed, reducing costs by £12 million.

### H.6 Outputs

Tables H-1 and H-2, on the following page, set out summaries of the capital, operational and asset replacement costs by road and rail project, including adjustments for risk and optimism bias.

HAL	Highway/Local Road/Rail	Route	Length (km)	Unit Cost (£ million per km)	Estimated Cost (£ million)	Risk	Optimism Bias	Total (£ million)	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050		
Highway	M4 J3 to J4		3.8	50.0	190	-	84	274	-	-	-	-	63	63	63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Highway	M4 Airport Spur		2.8	50.0	140	-	62	202	-	-	-	-	70	70	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Highway	M4 J2 to J3		17.6	50.0	880	-	387	1,267	-	-	-	-	293	293	293	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Highway	M4 J4 and J4B		4.7	50.0	235	-	103	338	-	-	-	-	-	118	118	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Highway	M4		-	150.0	150	-	66	216	-	-	-	-	-	75	75	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Highway	M4		-	40.0	40	-	18	58	-	-	-	-	-	20	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Highway	M4		-	40.0	40	-	18	58	-	-	-	-	-	20	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Highway	M25		4.0	100.0	400	-	176	576	-	-	-	133	133	133	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Local Road	Diversion of A4 Road alignment, dual carriageway		3.5	25.0	88	-	39	126	-	-	-	-	44	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Local Road	Diversion of A3044 Road alignment, dual carriageway		1.0	25.0	25	-	11	36	-	-	-	-	13	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Local Road	Airport Way/Southern Perimeter Road Interchange, grade separated junction and flyover/bridge structures		1.0	35.0	35	-	15	50	-	-	18	18	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Local Road	Southern Road Tunnel/Southern Perimeter Road Interchange		1.0	10.0	10	-	4	14	-	-	5	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Local Road	One way system for western campus		1.0	2.0	2	-	1	3	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Rail	SRA to Staines		-	487.5	488	-	322	809	-	-	-	163	163	163	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
<b>Total</b>					<b>2,722</b>	-	<b>1,305</b>	<b>4,027</b>	-	-	<b>32</b>	<b>494</b>	<b>1,157</b>	<b>1,493</b>	<b>850</b>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Highway Maintenance	Source: Highways Agency website inflated from 2011/12		32.9	0.046	1.51	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Local Road Maintenance	Source: Highways Agency website inflated from 2011/12		7.5	0.056	0.42	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<b>Total Road Asset Renewal /year</b>			-	-	<b>1.93</b>	-	<b>0.85</b>	<b>2.78</b>	-	-	-	-	<b>0.16</b>	<b>0.16</b>	<b>0.97</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>	<b>2.78</b>
Highway Opex	Source: DfT COBA (2006), road type 11, inflated from 2002 to 2014		32.9	0.0	1.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Local Road Opex	Source: DfT COBA (2006), road type 6, inflated from 2002 to 2014		7.5	0.0	0.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
<b>Total Road Opex /year</b>			-	-	<b>1.7</b>	-	<b>0.8</b>	<b>2.5</b>	-	-	-	-	<b>0.1</b>	<b>0.1</b>	<b>0.7</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	<b>2.5</b>	
Rail Asset Renewal /year	Source: LeighFisher analysis		-	1.75	1.75	-	1.16	2.91	-	-	-	-	-	-	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91
Rail Opex /year	Source: LeighFisher analysis		-	19.80	19.80	-	8.12	27.9	-	-	-	-	-	-	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9	27.9

Table H-1 Summary Costs

HAL	Total 2014-50	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050			
<b>Roads</b>																																									
Capex	2,234.5	-	-	-	-	-	-	-	22.5	155.8	616.3	849.8	590.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Asset Replacement Capex	49.2	-	-	-	-	-	-	-	-	-	0.1	0.1	0.7	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9	1.9
Opex	43.3	-	-	-	-	-	-	-	-	-	0.1	0.1	0.5	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
<b>Rail</b>																																									
Capex	487.5	-	-	-	-	-	-	-	162.5	162.5	162.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Asset Replacement Capex	45.5	-	-	-	-	-	-	-	-	-	-	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Opex	514.8	-	-	-	-	-	-	-	-	-	-	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8	19.8
Risk on Capex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Optimism Bias on Capex	1,356.6	-	-	-	-	-	-	9.9	175.8	378.4	481.2	261.1	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	
Risk on Opex	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Optimism Bias on Opex	230.1	-	-	-	-	-	-	-	-	-	0.0	0.0	8.3	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	
<b>Total Capex (inc. Risk &amp; OB)</b>	<b>4,173.4</b>	-	-	-	-	-	-	-	<b>32.4</b>	<b>494.2</b>	<b>1,157.3</b>	<b>1,493.6</b>	<b>853.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>	<b>5.7</b>		
<b>Total Opex (inc. Risk &amp; OB)</b>	<b>788.2</b>	-	-	-	-	-	-	-	-	-	<b>0.1</b>	<b>0.1</b>	<b>28.6</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>	<b>30.4</b>		

Table H-2 Summary Outputs