# **JACOBS**°

# Leigh Fisher

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

**Heathrow Airport Extended Northern Runway** 





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### **Executive Summary**

This report sets out the assessment of the capital cost of developing the Heathrow Airport Extended Northern 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 is £14.4 billion with mitigated optimism bias applied, compared to the previous estimate of £13.5 billion.

Scenario	Pre-consultation	Post-consultation
Assessment of Need Carbon Capped	13,539	14,435
Assessment of Need Carbon Traded	13,539	14,435
Low Cost is King Carbon Traded	13,539	14,435
Global Fragmentation Carbon Capped	13,539	14,435

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

The report also sets out the updated estimate 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.



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#### 1 Introduction

This report presents the revised estimate of the capital cost of developing the Heathrow Airport Extended Northern Runway scheme (hereafter "the scheme"). It should be read in conjunction with the report issued for consultation, *Appraisal Framework Module 13. Cost and Commercial Viability: Cost and Revenue Identification Heathrow Airport Extended Northern Runway* (HHL03). 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 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 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

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



### 2 Methodology

#### 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 Hub Ltd (HH) 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;
- unit rates were aligned between HH and Heathrow Airport Ltd (HAL)<sup>2</sup>;
- 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.

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<sup>&</sup>lt;sup>2</sup> In certain instances the rates proposed or implicit in HH's analysis differed significantly from those determined for HAL for the same element of the scheme. The rates and costs for these elements were aligned between the two schemes



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

- enabling works and operational readiness costs<sup>3</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.
- 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 to the base costs that we have made postconsultation 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>4</sup>, and supplementary guidance with respect to optimism bias<sup>5</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).

<sup>&</sup>lt;sup>3</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.

<sup>&</sup>lt;sup>4</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/191507/Optimism\_bias.pdf



#### 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 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 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:

		Sch	eme
		Pre-consultation	Post-consultation
Risk		20	20
Optimism	Mitigated	20	15
Bias	Unmitigated	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 Extended Northern 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

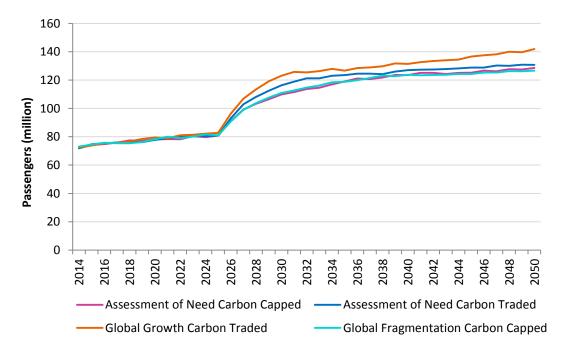


Figure 2-1 Airports Commission Demand Scenarios

Opening of the extended 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 extended 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.

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

Table 2-2 Capacity Provision by Phase

In the years prior to opening of the phase, the estimated 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 has been revised upwards; the number of additional cars required was increased; and the station and maintenance base costs were revised upwards. This change also ensures consistent treatment with respect to the Heathrow Airport North West Runway scheme. In total the tracked transit system costs have increased by £584 million, before project fees, risk, and optimism bias.

Responding to comments raised during consultation, costs allocated to the following items were also reviewed and adjusted to ensure that both Heathrow schemes were treated consistently. The costs below are presented exclusive of risk and optimism bias:

- costs for river diversions and culverts have been included at a cost of £121 million;
- utilities costs, which provide for utilities supply network infrastructure to serve new facilities, have been included at a cost of £198 million;
- landside connectivity which provides for various connections from the enlarged airfield to the local road infrastructure, has been included at a cost of £29 million; and
- flood water mitigation costs have been increased from £88 million to £127 million.

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.

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.

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 estimated to be £14.4 billion with mitigated optimism bias applied and £18.2 billion with unmitigated optimism bias.

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

Section 4.2 summarises the forecast Scheme capital expenditure by year against each of the Airports Commission's demand scenarios considered for this scheme in the cost and commercial viability assessment.

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

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	13,539	14,435
Assessment of Need Carbon Traded	13,539	14,435
Low Cost is King Carbon Traded	13,539	14,435
Global Fragmentation Carbon Capped	13,539	14,435

Table 4-1 Total Scheme Capital Expenditure by Demand Scenario (2014 prices, £'million)

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.

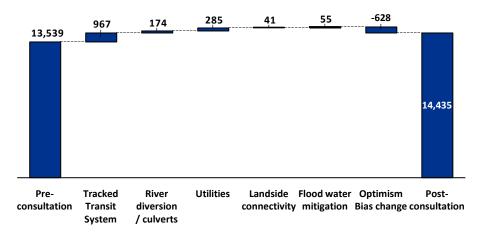


Figure 4-1 Pre-Consultation to Post-Consultation Scheme Capex Waterfall Chart (2014 prices, £'million, including mitigated optimism bias)



# 4.1 Airports Commission Demand Scenarios: Capex Profiles

#### 4.1.1 Assessment of Need Carbon Capped

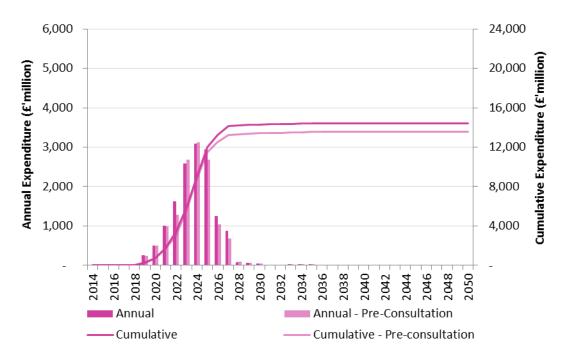


Figure 4-2 Assessment of Need Carbon Capped

#### 4.1.2 Assessment of Need Carbon Traded

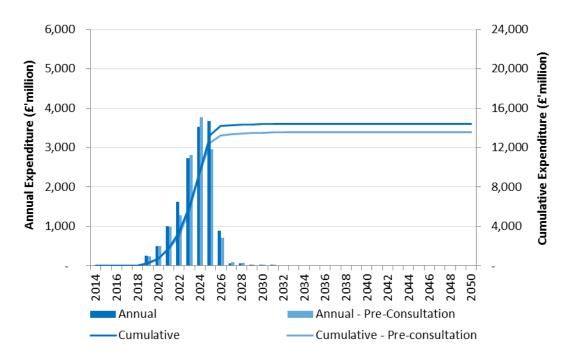


Figure 4-3 Assessment of Need Carbon Traded

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#### 4.1.3 Global Growth Carbon Traded

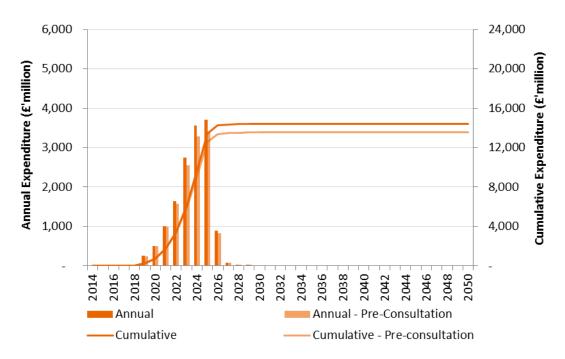


Figure 4-4 Global Growth Carbon Traded

#### 4.1.4 Global Fragmentation Carbon Capped

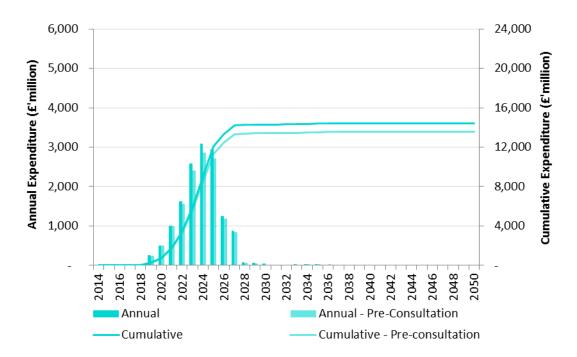


Figure 4-5 Global Fragmentation Carbon Capped

#### 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



Terminal buildings 3,509 269 672 982 971 369 246																																						
Scheme	Total	2014	2015	2016	201	7 201	8 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
Terminal buildings	3,509	-	-	-	-	-	-	-	-	269	672	982	971	369	246	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Plant	590	-	-	-	-	-	-	-	-	50	125	179	168	41	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Tunnels and bridges	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Transit systems	1,033	-	-	-	-	-	3	5	11	78	179	259	269	138	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Runways	269	-	-	-	-	-	13	27	54	54	54	40	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Taxiways and aprons	781	-	-	-	-	-	31	61	123	132	145	127	104	35	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Equipment	999	-	-	-	-	-	-	-	-	47	117	190	246	239	159	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Land	1,233	-	-	-	-	-	62	123	247	247	247	185	123	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Airfield Ancillary	599	-	-	-	-	-	30	60	120	120	120	90	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Car Parks	580	-	-	-	-	-	-	-	-	15	36	58	83	86	84	60	40	30	4	13	26	26	17	-	-	-	-	-	-	-	-	-	-	-	-	-		
Third Party Land Users	74	-	-	-	-	-	4	7	15	15	15	11	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Environment	442	-	-	-	-	-	22	44	88	88	88	66	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Community	352	-	-	-	-	-	18	35	70	70	70	53	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
Optimism Bias	1,883	-	-	-	-	-	33	65	131	213	336	403	385	163	114	11	7	5	1	2	5	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-		
Risk	2,092	-	-	-	-	-	36	73	145	237	374	448	427	182	126	12	8	6	1	3	5	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-		
Total	14.435	-	-	-	-	-	251	502	1.004	1.633	2.578	3.093	2.950	1.253	872	83	56	42	6	18	36	36	24	-	-	-	-	-	-	-	-	-	-	-	-	-		

Table 4-2 Assessment of Need Carbon Capped

cheme	Total	2014	2015	2016	2017	201	8 20	19 2	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	3,509	-	-	-	-	-	-		-	-	269	713	1,105	1,176	246	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant	590	-	-	-	-	-	-		-	-	50	129	193	191	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tunnels and bridges	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Transit systems	1,033	-	-	-	-	-		3	5	11	78	195	305	345	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Runways	269	-	-	-	-	-		13	27	54	54	54	40	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxiways and aprons	781	-	-	-	-	-		31	61	123	132	149	139	123	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment	999	-	-	-	-	-	-		-	-	47	143	270	379	159	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Land	1,233	-	-	-	-	-		62	123	247	247	247	185	123	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Airfield Ancillary	599	-	-	-	-	-		30	60	120	120	120	90	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Car Parks	580	-	-	-	-	-	-		-	-	15	54	100	150	104	45	43	26	26	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Third Party Land Users	74	-	-	-	-	-		4	7	15	15	15	11	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Environment	442	-	-	-	-	-		22	44	88	88	88	66	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Community	352	-	-	-	-	-		18	35	70	70	70	53	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ptimism Bias	1,883	-	-	-	-	-		33	65	131	213	356	460	479	117	8	8	5	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
isk	2,092	-	-	-	-	-		36	73	145	237	395	511	532	130	9	9	5	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
otal	14,435	-	-	-	-	-	2	51	502	1,004	1,633	2,728	3,529	3,672	900	62	60	36	36	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4-3 Assessment of Need Carbon Traded

2014 real prices in £'mi	llion - incl	uding r	nitigate	d optir	nism bia	as																																
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	3,509	-	-	-	-	-	-	-	-	269	713	1,105	1,176	246	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant	590	-	-	-	-	-	-	-	-	50	129	193	191	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tunnels and bridges	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Transit systems	1,033	-	-	-	-	-	3	5	11	78	195	305	345	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Runways	269	-	-	-	-	-	13	27	54	54	54	40	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxiways and aprons	781	-	-	-	-	-	31	61	123	132	149	139	123	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment	999	-	-	-	-	-	-	-	-	47	143	270	379	159	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Land	1,233	-	-	-	-	-	62	123	247	247	247	185	123	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Airfield Ancillary	599	-	-	-	-	-	30	60	120	120	120	90	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Car Parks	580	-	-	-	-	-	-	-	-	25	64	120	174	97	56	26	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Third Party Land Users	5 <b>74</b>	-	-	-	-	-	4	7	15	15	15	11	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Environment	442	-	-	-	-	-	22	44	88	88	88	66	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Community	352	-	-	-	-	-	18	35	70	70	70	53	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Optimism Bias	1,883	-	-	-	-	-	33	65	131	215	358	464	483	116	10	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Risk	2,092	-	-	-	-	-	36	73	145	239	397	516	537	129	11	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	14,435	-	-	-	-	-	251	502	1,004	1,647	2,742	3,557	3,706	890	77	36	24	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 4-4 Global Growth Carbon Traded

ENR Cost and Revenue Identification Update - Final.docx



2014 real prices in £'mil	lion - inc	luding r	nitigate	ed optin	nism bi	as																																
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	3,509	-	-	-	-	-	-	-	-	269	672	982	971	369	246	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Plant	590	-	-	-	-	-	-	-	-	50	125	179	168	41	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tunnels and bridges	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Transit systems	1,033	-	-	-	-	-	3	5	11	78	179	259	269	138	92	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Runways	269	-	-	-	-	-	13	27	54	54	54	40	27	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Taxiways and aprons	781	-	-	-	-	-	31	61	123	132	145	127	104	35	23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Equipment	999	-	-	-	-	-	-	-	-	47	117	190	246	239	159	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Land	1,233	-	-	-	-	-	62	123	247	247	247	185	123	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Airfield Ancillary	599	-	-	-	-	-	30	60	120	120	120	90	60	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Car Parks	580	-	-	-	-	-	-	-	-	15	36	68	93	106	104	40	30	-	-	4	13	26	26	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Third Party Land Users	74	-	-	-	-	-	4	7	15	15	15	11	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Environment	442	-	-	-	-	-	22	44	88	88	88	66	44	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Community	352	-	-	-	-	-	18	35	70	70	70	53	35	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Optimism Bias	1,883	-	-	-	-	-	33	65	131	213	336	405	387	167	117	7	5	-	-	1	2	5	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Risk	2,092	-	-	-	-	-	36	73	145	237	374	450	429	186	130	8	6	-	-	1	3	5	5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	14.435	-	-	_	_	_	251	502	1.004	1.633	2.578	3.107	2.963	1.281	900	56	42	-	_	6	18	36	36	24	_	_	_	_	-	_	_	_	_	_	-	_	-	-

Table 4-5 Global Fragmentation Carbon Capped

ENR Cost and Revenue Identification Update - Final.docx



# 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. Cost

and Commercial Viability: Cost and Revenue Identification

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	
Combined				38.2

CAPEX Contributory Factors	Standard Building optimism bias (%)	Mitigation Factor (0 <x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Non-Standard Building optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Standard Civil Engineering optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Non-Standard Civil Engineering optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Equipment/ Development optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th></x<1)<></th></x<1)<></th></x<1)<></th></x<1)<></th></x<1)<>	Reduction in optimism bias	Mitigated optimism bias (%)	Non-Standard Building optimism bias (%)	Mitigation Factor (0 <x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Standard Civil Engineering optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Non-Standard Civil Engineering optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Equipment/ Development optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th></x<1)<></th></x<1)<></th></x<1)<></th></x<1)<>	Reduction in optimism bias	Mitigated optimism bias (%)	Standard Civil Engineering optimism bias (%)	Mitigation Factor (0 <x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Non-Standard Civil Engineering optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Equipment/ Development optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th></x<1)<></th></x<1)<></th></x<1)<>	Reduction in optimism bias	Mitigated optimism bias (%)	Non-Standard Civil Engineering optimism bias (%)	Mitigation Factor (0 <x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Equipment/ Development optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th></x<1)<></th></x<1)<>	Reduction in optimism bias	Mitigated optimism bias (%)	Equipment/ Development optimism bias (%)	Mitigation Factor (0 <x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th></x<1)<>	Reduction in optimism bias	Mitigated optimism bias (%)
Procurement																				
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	-	-
Project Specific																				
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	-	-
Client Specific																				
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	-	-
Environment																				
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	-	-
External Influences																				
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	-	-
	100			28.6	101			29.9	100			40.6	100			22.2	100			14.7

#### 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	
Combined				10.8

Rounded to 10% for all schemes

Figure B-1 Core Works

B-1 ENR Cost and Revenue Identification Update - Final.docx



#### Upper bound values for combined projects

Project Type	CAPEX (%)	Upper Bound OB (%)	OB Contribution (%)	Resulting OB (%)
Standard Buildings	51	24	12	0
Non-Standard Buildings	5	51	3	0
Standard Civils	31	44	14	0
Non-Standard Civils	5	66	3	0
Equipment & Development	8	200	16	0
Combined				48.1

CAPEX Contributory Factors	Standard Building optimism bias (%)	Mitigation Factor (0 <x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Non-Standard Building optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Standard Civil Engineering optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Non-Standard Civil Engineering optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Equipment/ Development optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th></x<1)<></th></x<1)<></th></x<1)<></th></x<1)<></th></x<1)<>	Reduction in optimism bias	Mitigated optimism bias (%)	Non-Standard Building optimism bias (%)	Mitigation Factor (0 <x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Standard Civil Engineering optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Non-Standard Civil Engineering optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Equipment/ Development optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th></x<1)<></th></x<1)<></th></x<1)<></th></x<1)<>	Reduction in optimism bias	Mitigated optimism bias (%)	Standard Civil Engineering optimism bias (%)	Mitigation Factor (0 <x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Non-Standard Civil Engineering optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Equipment/ Development optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th></x<1)<></th></x<1)<></th></x<1)<>	Reduction in optimism bias	Mitigated optimism bias (%)	Non-Standard Civil Engineering optimism bias (%)	Mitigation Factor (0 <x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th><th>Equipment/ Development optimism bias (%)</th><th>Mitigation Factor (0<x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th></x<1)<></th></x<1)<>	Reduction in optimism bias	Mitigated optimism bias (%)	Equipment/ Development optimism bias (%)	Mitigation Factor (0 <x<1)< th=""><th>Reduction in optimism bias</th><th>Mitigated optimism bias (%)</th></x<1)<>	Reduction in optimism bias	Mitigated optimism bias (%)
Procurement																				1
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	-	-
Project Specific																				
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	-	-
Client Specific																				
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	-	-
Environment																				
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	-	-
External Influences																				
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	-	-
Weighted Total	100			33.1	101			34.9	100			45.9	100			28.8	100			17.4

#### Adjusted Optimism Bias

Project Type	Percentage of CAPEX (%)	Mitigated OB (%)	OB contribution (%)	Resulting OB (%)
Standard Buildings	51	7.9	4.0	
Non-Standard Buildings	5	17.8	0.9	
Standard Civils	31	20.2	6.2	
Non-Standard Civils	5	19.0	1.0	
Equipment & Development	8	34.7	2.8	
Combined				15.0

Rounded to 15% for all schemes

Figure B-2 Scheme Works

B-2



## **Appendix C** Scheme Capital Cost Estimate Breakdown

The table on the following pages (C-2 to C-4) sets out the revised Scheme capital cost estimates following comments received during consultation. Total costs for all phases of construction are shown. 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.

ENR - Consultation Values						ENR - R	evised Value	s	
Cost Category		Unit	Qty	Rate	Cost (£)	Qty	Rate	Cost (£)	Difference
01.01.05.0003.	TTS Tunnels				100,095,552			220,273,696	120,178,144
01.01.05.0003.0050	TTS Tunnels Civils	m	1,200	57,856	69,426,624	2,600	57,856	150,424,352	80,997,728
01.01.05.0003.0070	TTS Tunnels Fit Out	m	1,200	22,157	26,588,928	2,600	22,157	57,609,344	31,020,416
01.01.05.0003.0080	Additional TTS Cars	nr	2	2,040,000	4,080,000	6	2,040,000	12,240,000	8,160,000
01.01.05.0004.	TTS Station / Depot				156,983,946			621,183,675	464,199,729
01.01.05.0004.0050	TTS Stations	nr	1	74,190,476	74,190,476	1	296,761,906	356,114,287	281,923,811
01.01.05.0004.0060	TTS Station Fit Out	sum	0.34	107,795,918	36,650,612	1.20	107,795,918	129,355,102	92,704,490
01.01.05.0004.0080	TTS Maintenance Ba	sum	0.34	103,142,857	35,068,571	1.00	103,142,857	103,142,857	68,074,286
01.01.05.0004.0090	TTS Maintenance Ba	sum	0.34	32,571,429	11,074,286	1.00	32,571,429	32,571,429	21,497,143
	Total				257,079,498			841,457,371	584,377,873

Table C-1 Revised Tracked Transit System Costs



Ref No	Description	Quantity Unit	Unit Rate	Total (£)
HHL	Heathrow Hub (Jacobs Estimate)			14,435,339,806
01.	Investment Costs			14,435,339,806
01.01.	Airport Infrastructure Construction			7,930,965,328
01.01.01.	Enabling Works			1,064,784,817
01.01.01.0001.	Advanced Enabling Works, Clearing Site and Preparation			1,064,784,817
01.01.01.0001.0010		358.16 ha	156,326.82	55,990,201
	Demolition / Enabling works	0.91	170,612,244.90	154,456,920
01.01.01.0001.0030	<u> </u>	192.79 ha	454,974.30	87,714,495
	Ground stabilisation works	102.10	10 1,01 1.00	01,111,100
	Earthworks, cut, fill, grading of imported fill	21,903,520.00 m3	35.00	766,623,200
01.01.01.0002.	Landscaping	, ,		0
01.01.01.0002.0120	Grassed Areas & carriage drainage	m2		
01.01.01.0002.0130		m2		
01.01.02.	Airfield			557,642,572
01.01.02.0001.	Runway			81,630,792
	Runway including shoulders	221,600.00 m2	368.37	81,630,792
01.01.02.0002.	Taxiways & Aprons			210,766,948
01.01.02.0002.0030	Parallel Taxiway Links, Rapid Exit Taxiway (RETs), Taxiway Hold incl. fillets to support new runways.	185,576.00 m2	368.37	68,360,631
01.01.02.0002.0040		386,585.00 m2	368.37	142,406,316
01.01.02.0003.	Stands	300,300.00 1112	300.07	220,724,112
01.01.02.0003.0050		460,830.77 m2	478.97	220,724,112
01.01.02.0004.	Airfield Instrumentation			44,520,720
	Navigational Equipment / Lighting	1,463,053.58 m2	30.43	44,520,720
01.01.03.	Airfield Ancillary Facilities	.,,		203,787,733
01.01.03.0001.	Air Traffic Control			
01.01.03.0002.	Security			18,579,184
01.01.03.0002.0090	Fencing and CCTV to Terminal Area	7,700.00 m	600.00	4,620,000
01.01.03.0002.0100	Police Facilities	0.00 item	15,300,000.00	0
01.01.03.0002.0110	Control posts	1.00 item	13,959,183.67	13,959,184
01.01.03.0003.	Rescue and Fire Fighting			3,060,000
01.01.03.0003.0030	Fire Station	1.00 Nr	3,060,000.00	3,060,000
01.01.03.0004.	Fuel Systems			49,219,049
01.01.03.0004.0060	Fuel Farm	7.00 Nr	7,031,292.78	49,219,049
01.01.03.0004.0070	Diversion of existing fuel line	0.00 m	2,040.00	0
01.01.03.0005.	De-Icing & Snow Clearance			20,000,000
01.01.03.0005.0050		1.00 item	20,000,000.00	20,000,000
01.01.03.0006.	Serviced areas for ancillary facilities e.g. Hotels,			34,969,500
01 01 03 0006 0010	Offices, Cargo Buildings, Hangars, etc Serviced areas for ancillary facilities e.g. Hotels,	349,695.00 m2	100.00	34,969,500
01.01.03.0000.0010	Offices, Cargo Buildings, Hangars, etc	349,093.00 1112	100.00	34,808,300
01.01.03.0007.	Surface Water Drainage			29,160,000
01.01.03.0007.0030	Balancing Ponds incl. equipment, pumping, controls *	97.20 ha	300,000.00	29,160,000
	instrumentation, oil interceptors, pipework, etc			
01.01.03.0008.	Noise Control Measures			48,800,000
01.01.03.0008.0080		4,800.00 m	6,000.00	28,800,000
	Boundary Treatment - Environmental bund	4,000.00 m	5,000.00	20,000,000
01.01.04.	Terminal Buildings			3,350,360,417
01.01.04.0001.	Terminals	07.005.000	0.570.05	1,559,368,141
	T6 Terminal building, Substructure	67,605.00 m2	3,572.65	241,529,003
	T6 Terminal building, Superstructure	67,605.00 m2	6,732.20	455,130,381
	T6 Terminal building, Fit Out Piers & Satellites	67,605.00 m2	12,761.02	862,708,757
01.01.04.0002.	Satellite Substructure	53,081.00 m2	2,684.16	1,600,083,184
	Satellite Superstructure	53,081.00 m2	8,128.90	142,477,897 431,490,141
01.01.04.0002.0020		53,081.00 m2	5,612.37	297,910,212
01.01.04.0002.0030		21,780.00 m2	33,434.57	728,204,935
01.01.04.0002.0040		0.00 m2	33,434.57	728,204,933
01.01.04.0002.0050		0.00 m2	33,434.57	0
01.01.04.0002.0000		0.00 m2	33,434.57	0
01.01.04.0002.0070		0.00 m2	33,434.57	0
01.01.04.0003.	Fixed Links, VCC, Rotunda/Nodes, PCA and Airbridges	0.00 1112	55,454.57	190,909,091
				.00,000,007
01.01.04.0003.0030	VCC, Airbridge, PCA, nodes and fixed links to new	60.00 Nr	3,181,818.18	190,909,091
	stands			

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01.01.05.	0001	Airside Infrastructure				1,079,564,593
01.01.05.0		Access Roads	F 000 00		4 000 00	112,697,250
		Service / Circulatory roads within airport	5,000.00		4,080.00	20,400,000
01.	.01.05.0001.0070	Airside roads, perimeter track (actually access road)	103,250.00	m2	153.00	15,797,250
01	01 05 0001 0080	Airside Road - C&C Tunnel	1,000.00	m	76,500.00	76,500,000
01.01.05.0		Baggage Tunnels	1,000.00		10,000.00	125,409,972
		Baggage Tunnels Civils	1,200,00	m	30.864.14	37,036,968
		Baggage Tunnels Fit Out	1,200.00		73,644.17	88,373,004
01.01.05.0		TTS Tunnels	1,200.00	111	73,044.17	220,273,696
		TTS - Tunnel Civils	2,600.00	P0	57,855.52	150,424,352
			2,600.00		22,157.44	
		TTS - System and Fit-out Additional TTS Cars	*			57,609,344
			6.00	INF	2,040,000.00	12,240,000
01.01.05.0		TTS Station / Depot	4.20	Nim	206 764 006 00	621,183,675
	01.05.0004.0030		1.20		296,761,906.00	356,114,287
		TTS Station Fit Out		sum	107,795,918.37	129,355,102
		TTS Maintenance Base Substructure		sum	103,142,857.14	103,142,857
		TTS Maintenance Base Fit Out	1.00	sum	32,571,428.57	32,571,429
01.01.05.0		Facilities				0
	.01.05.0005.0070	Coaching Facility - Terminal		item	3,876,000.00	0
01.01.06.		Landside Infrastructure				802,376,217
01.01.06.0		Connectivity				25,000,000
01.	01.06.0001.0040	Landside connectivity systems	1.00	sum	25,000,000.00	25,000,000
01.01.06.0	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
01.01.06.0	0003.	Power Generation				0
01.	.01.06.0003.0020	Energy and Infrastructure	0.00	sum	0.00	0
01.01.06.0	0004.	Utilities				172, 163, 265
01.	01.06.0004.0030	Utilities	1.00	sum	172,163,265.31	172,163,265
01.01.06.0	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
01.01.07.0	0001.	De-Icing & Snow Clearance Equipment				
01.01.07.0		Rescue & Fire Fighting				
01.01.07.0		Baggage Handling Systems				729, 755, 102
		Baggage Equipment Terminal	1 00	sum	299,346,938.78	299,346,939
		Baggage Equipment Satellite		sum	430,408,163.27	430,408,163
01.01.08.		Operational Commissioning			,,	139,591,837
01.01.08.0	0001	Operational Commissioning				139,591,837
		Operational Commissioning	0.80	sum	155,102,041.00	124,081,633
		Operational Readiness		sum	19,387,755.10	15,510,204
01.01.09.	01.00.0001.0020	Operational Handover	0.00	Suili	19,307,733.10	3,102,041
01.01.09.0	0001	Operational Handover				3,102,041
		Operational Handover	0.00	sum	3,877,551.00	3,102,041
01.02.	.01.09.0001.0010	Purchase of Land & Existing Infrastructure	0.00	Sulli	3,677,331.00	
01.02. 01.02.01.		-				<b>579,326,988</b> 579,326,988
		Purchase of Land & Existing Infrastructure  Purchase of Land & Existing Infrastructure				
01.02.01.0		Purchase of Land & Existing infrastructure				579,326,988
	02.01.0001.0010			sum		0
	02.01.0001.0020			sum		0
	02.01.0001.0030			sum	579,326,988.00	579,326,988
01.04.		Environmental Compensation & Mitigation				279,700,000
01.04.01.		Airport Infrastructure Construction				218,500,000
01.04.01.0		Airport - Ecology / Environmental / Archaeological				193,000,000
01.	.04.01.0001.0010	Ecology - allowance for mitigation and monitoring of ecological impact	1.00	sum	51,000,000.00	51,000,000
01	04 01 0001 0020	Air quality - allowance for monitoring and mitigation	1 00	sum	0.00	C
		Noise - allowance for noise monitoring		sum	0.00	C
		Allowance for costs associated with Archaeological		sum	0.00	0
		<del>-</del>				
		Noise mitigation measures to nearby houses	4,000.00		8,000.00	32,000,000
		Flood water mitigation	1.00	sum	110,000,000.00	110,000,000
01.						25,500,000
01.		M25 Diversion / Other Road Works - Ecology /				
01. 01.04.01.0	0002.	Environmental / Archaeological	1 00	item	25 500 000 00	25 500 000
01. 01.04.01.0	0002.		1.00	item	25,500,000.00	25,500,000
01. <mark>01.04.01.</mark> 0 01.	0002. 04.01.0002.0010	Environmental / Archaeological Ecology - Allowance for mitigation and monitoring of	1.00		25,500,000.00 0.00	
01. <mark>01.04.01.0</mark> 01.	0002. 04.01.0002.0010 04.01.0002.0020	Environmental / Archaeological Ecology - Allowance for mitigation and monitoring of ecological impact				0
01. 01.04.01.0 01. 01.	0002. 04.01.0002.0010 04.01.0002.0020 04.01.0002.0030	Environmental / Archaeological Ecology - Allowance for mitigation and monitoring of ecological impact Air quality - Allowance for monitoring	0.00		0.00	25,500,000 0 0



01.04.02.	Accesisted Dead Wester			25,500,000
01.04.02.	Associated Road Works Airport - Ecology / Environmental / Archaeological			25,500,000
	Ecology - allowance for mitigation and monitoring of	1.00 s	um 25,500,000.00	
01.04.02.0001.0010	ecological impact	1.00 S	25,500,000.00	25,500,000
01.04.02.0001.0020	Air quality - allowance for monitoring and mitigation	1.00 s	um 0.00	0
01.04.02.0001.0030	Noise - allowance for noise monitoring	1.00 s	um 0.00	) (
01.04.02.0001.0040	Allowance for costs associated with Archaeological	1.00 s	um 0.00	) (
01.04.03.	Southern Rail Access - T5 to Staines			14,280,000
01.04.03.0001.	Airport - Ecology / Environmental / Archaeological			14,280,000
01.04.03.0001.0010	Ecology - allowance for mitigation and monitoring of ecological impact	1.00 s	um 14,280,000.00	14,280,000
	Air quality - allowance for monitoring and mitigation	1.00 s		
	Noise - allowance for noise monitoring	1.00 s		
01.04.03.0001.0040	Allowance for costs associated with Archaeological	1.00 s	um 0.00	) (
01.04.04.	Southern Rail Access - M25 Junction 13 to Ruxbury Road Junction			21,420,000
01.04.04.0001.	Airport - Ecology / Environmental / Archaeological			21,420,000
	Ecology - allowance for mitigation and monitoring of ecological impact	1.00 s		
	Air quality - allowance for monitoring and mitigation	1.00 s		
	Noise - allowance for noise monitoring	1.00 s		
	Allowance for costs associated with Archaeological	1.00 s	um 0.00	_
01.05.	Community Impacts			306,000,000
01.05.01.	Community Impacts			306,000,000
01.05.01.0001.	Community Impacts			306,000,000
01.05.01.0001.0010		1.00 s		
	Community Infrastructure Levy	1.00 s	um 51,000,000.00	
01.06.	Project / Design Team Fees			1,364,398,847
01.06.01.	Project / Design Team Fees	1500		1,364,398,847
01.06.01.0001.	Project / Design Team Fees	15%		1,364,398,847
	Project / Design Team Fees on 01.01			1,189,644,799
	Project / Design Team Fees on 01.02			86,899,048
	Project / Design Team Fees on 01.03			(
	Project / Design Team Fees on 01.04			41,955,000
	Project / Design Team Fees on 01.05			45,900,000
03.	Risks & Optimism Bias			3,974,948,642
03.01.	Risks (Design, Construction & Employer Risk)			2,092,078,233
03.01.01.	Risks (Design, Construction & Employer Risk)	000/		2,092,078,233
03.01.01.0001.	Risks (Design, Construction & Employer Risk)	20%		2,092,078,233
	Risk Contingency on 01.01			1,824,122,025
	Risk Contingency on 01.02			133,245,207
	Risk Contingency on 01.03			0
	Risk Contingency on 01.04			64,331,000
	Risk Contingency on 01.05			70,380,000
03.02.	Optimism Bias			1,882,870,409
03.02.01.	Optimism Bias	. = 0.		1,882,870,409
03.02.01.0001.	Optimism Bias	15%		1,882,870,409
	Optimism Bias on 01.01			1,641,709,823
	Optimism Bias on 01.02			119,920,687
	Optimism Bias on 01.03			C
	Optimism Bias on 01.04			57,897,900
03.02.01.0001.0050	Optimism Bias on 01.05			63,342,000



# 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 HH and 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 extended runway Scheme works. However, recognising the Green Book guidance to correct for the systematic tendency for project appraisers to be overly optimistic, HAL and HH's estimates post Q6 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 it 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 as 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 asset condition and capacity;
- periodic major investment to restore the assets' deteriorated condition and capacity; and



 investments 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 £285 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.



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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	13,394	-	-	10	20	26	95	226	461	588	737	1,163	1,386	1,347	1,306	1,141	752	487	118	590	972	986	709	273	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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	12,653	614	702	668	534	534	211	214	214	214	220	218	221	249	271	283	291	300	305	311	313	320	325	331	330	333	338	338	342	342	340	342	342	346	345	349	349	352
Risk	1,920	-	-	-	-	-	42	43	43	43	44	44	44	50	54	57	58	60	61	62	63	64	65	66	66	67	68	68	68	68	68	68	68	69	69	70	70	70
Optimism Bias	1.728	_	_	_	_	_	38	38	39	39	40	39	40	45	49	51	52	54	55	56	56	58	59	60	59	60	61	61	62	62	61	62	62	62	62	63	63	63
opaniisiii bias	1,720													40	40	31	32	J-4				30	33	00	33	00	UI	01	02	02			02		02	03	33	03

Table E-1 Assessment of Need Carbon Capped

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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
otal	13,394	-	-	10	20	26	95	360	621	752	1,105	1,542	1,782	1,702	1,418	1,000	987	992	709	273	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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	12,931	614	702	668	534	534	208	213	216	218	221	220	221	254	282	296	308	318	325	332	332	337	338	341	341	340	344	347	348	349	350	351	352	352	356	356	358	358
Risk	1,976	_	_	_	_	_	42	43	43	44	44	44	44	51	56	59	62	64	65	66	66	67	68	68	68	68	69	69	70	70	70	70	70	70	71	71	72	72
Optimism Bias	1.778	_	_	_	_	_	38	38	39	39	40	40	40	46	51	53	55	57	59	60	60	61	61	61	61	61	62	63	63	63	63	63	63	63	64	64	64	64
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Table E-2 Assessment of Need Carbon Traded

ENR Cost and Revenue Identification Update - Final.docx



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 2
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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
otal	13,394	-	-	10	20	26	143	469	666	799	1,214	1,826	1,954	2,270	2,007	1,001	714	273	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
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 2
•	13,373	614	702	668	534	534	215		216	222	222	225	226	263	292	310	326	337	344	343	345	350	346	351	353	355	360	359	363	365	366	368	374	376	378	383	382
Risk	2.064	-	-	-	-	-	43	43	43	44	44	45	45	53	58	62	65	67	69	69	69	70	69	70	71	71	72	72	73	73	73	74	75	75	76	77	76
Optimism Bias	1.858	_	_	_	_	_	39	39	39	40	40	40	41	47	53	56	59	61	62	62	62	63	62	63	63	64	65	65	65	66	66	66	67	68	68	69	69
	_,550													.,		50		0.1			-	05		0.5	0.5	٠.	05	05	0.5				0,	-	50		

Table E-3 Global Growth Carbon Traded

ore	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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fransit 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	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ptimism Bias	1,213	-	-	-	-	-	9	21	42	54	68	107	134	148	137	117	44	11	54	88	90	64	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
isk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
otal	13,394	-	-	10	20	26	95	229	464	596	744	1,177	1,471	1,632	1,505	1,288	487	118	590	972	986	709	273	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
														****		****								****								***						
	Total					2018		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		2049	2050
set Replacement	12,650	614	702	668	534	534	209	214	219	216	219	223	221	248	271	284	294	303	308	314	318	324	325	328	332	337	336	338	337	338	338	340	340	343	343	345	345	347
sk	1,920	-	-	-	-	-	42	43	44	43	44	45	44	50	54	57	59	61	62	63	64	65	65	66	66	67	67	68	67	68	68	68	68	69	69	69	69	69
otimism Bias	1,728	-	-	-	-	-	38	39	39	39	39	40	40	45	49	51	53	55	55	56	57	58	58	59	60	61	60	61	61	61	61	61	61	62	62	62	62	62
otal	16,297	614	702	668	534	534	288	295	302	298	302	308	306	343	374	391	406	419	425	433	438	447	448	452	458	465	463	467	466	467	467	469	469	473	473	477	477	4

Table E-4 Global Fragmentation Carbon Capped

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# 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 Extended Northern Runway scheme following consultation (see Table F-3).

#### F.2 Revisions to Operating Cost Forecasts

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

- the allowance for Optimism Bias has increased as a result of 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% cumulatively).
- a correction has been made to the capacity assumptions applied to the Global Fragmentation Carbon Capped demand scenario. This leads to a minor change in the years 2027, 2029, and 2032-2034 (0.1% cumulatively).

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.

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

Table F-1 Revised Optimism Bias Mitigations

#### F.4 Summary of Adjustments

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

		Sch	eme
		Pre-consultation	Post-consultation
Risk		20	20
Optimism	Mitigated	20	15
Bias	Unmitigated	41	41

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

#### F.5 Revised Independent Operational Expenditure Forecast

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



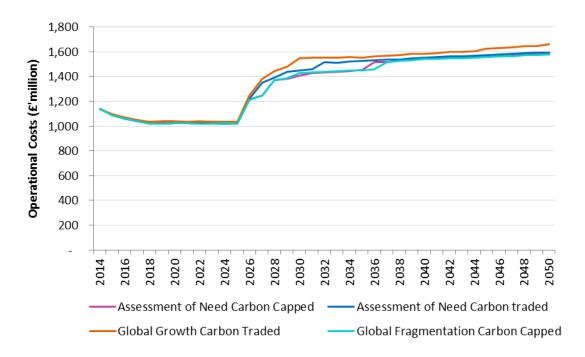


Figure F-1 Heathrow Airport Extended Northern Runway Scheme Forecast Operating Expenditure (Risk Adjusted and Mitigated)

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.

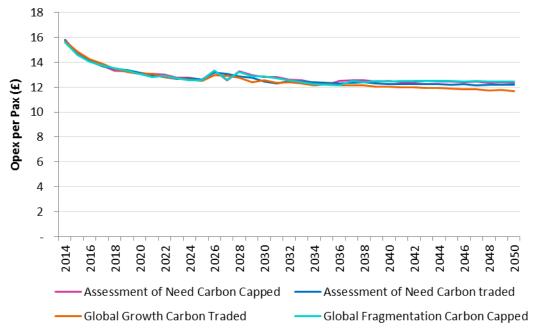


Figure F-2 Heathrow Airport Extended Northern Runway Scheme Forecast Operating Expenditure per Passenger (Risk Adjusted and Mitigated Optimism Bias)



2014 real	prices	in	£'million	
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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	16,894	449	425	410	400	395	390	389	385	381	381	376	375	435	447	482	483	485	489	488	484	484	485	503	500	499	500	497	497	495	491	490	487	487	484	484	481	481
Routine maintenance	6,347	168	161	155	152	150	148	147	146	145	145	143	142	148	152	171	171	185	184	183	185	184	185	185	184	190	190	189	189	188	187	187	186	186	185	184	183	183
Utilities	3,846	94	94	93	92	91	90	89	88	87	87	86	85	101	101	113	112	111	113	112	111	110	109	116	115	114	114	113	113	112	112	111	111	110	110	109	109	108
Rent and rates	6,312	129	128	127	125	124	124	124	124	124	124	124	124	159	159	183	183	183	187	187	187	187	187	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201
Rail	2,078	69	58	57	57	56	55	55	55	54	54	53	53	55	57	57	57	57	57	57	57	57	57	57	56	56	56	56	56	56	55	55	55	55	55	55	54	54
Other	9,330	228	223	220	217	214	212	211	209	207	207	205	205	234	241	258	259	261	264	265	264	265	267	276	276	277	279	278	280	280	279	280	280	281	281	282	282	283
Opex	44,806	1,137	1,089	1,061	1,042	1,030	1,020	1,015	1,007	998	998	987	984	1,133	1,156	1,264	1,266	1,282	1,294	1,292	1,288	1,286	1,289	1,338	1,332	1,338	1,340	1,335	1,336	1,332	1,325	1,323	1,319	1,320	1,315	1,315	1,310	1,310
Opex (incl. Risk & OB)	49,612	1,137	1,089	1,061	1,042	1,030	1,025	1,025	1,022	1,018	1,023	1,017	1,019	1,214	1,248	1,372	1,383	1,407	1,427	1,433	1,436	1,442	1,453	1,513	1,514	1,528	1,538	1,541	1,550	1,553	1,551	1,557	1,559	1,569	1,569	1,578	1,581	1,588
Opex/pax (£)		15.81	14.69	14.18	13.73	13.30	13.28	13.12	13.05	13.00	12.73	12.76	12.60	13.32	12.57	13.27	12.98	12.81	12.80	12.61	12.53	12.33	12.21	12.49	12.54	12.54	12.44	12.47	12.39	12.41	12.48	12.44	12.45	12.38	12.42	12.36	12.39	12.35
Assessment of Need Carbon traded	Total						2019																															
Staff	17,106	449	425	409	399	391	387	387	385	383	381	376	374	437	484	489	498	500	499	516	511	509	507	506	504	501	501	500	498	496	494	492	491	488	488	485	484	481
Routine maintenance	6,460	168	162	156	152	149	147	147	147	146	145	143	142	149	154	174	188	189	191	191	189	195	194	194	193	192	192	192	191	190	189	189	188	187	187	186	185	184
Utilities	3,896	94	94	93	92	91	90	89	88	88	87	86	85	102	114	113	115	114	113	119	118	117	116	116	115	115	114	114	113	112	112	111	111	110	110	109	109	108
Rent and rates	6,399	129	128	127	125	124	124	124	124	124	124	124	124	159	183	183	187	187	187	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201	201
Rail	2,113	69	58	57	57	56	56	55	55	55	55	54	54	56	58	59	59	59	59	59	58	58	58	58	58	57	57	57	57	57	57	56	56	56	56	56	55	55
Other	9,468	228	224	221	217	213	211	210	209	208	207	206	205	236	258	262	267	270	271	279	278	278	278	279	279	279	281	281	282	282	282	283	283	283	284	284	285	285
Opex	45,442	, -	1,090	1,062	1,042	1,023	,	, -	,	1,004	998	989		•	•	•	•	•	•	•	1,355	•	•	1,354	,	•	,	•	•	•	•	•	•	1,325	•	1,321	•	1,315
Opex (incl. Risk & OB)	50,354	1,137	,	•	,	1,023	•		, -	,-	•	•	•	•	•	1,392	•	•	•	1,515	•	•	•	•	1,536	•	•	1,553	,	•	•	,	•	1,576	•	•	•	1,595
Opex/pax (£)		15.81	14.59	14.10	13.70	13.46	13.38	13.15	12.97	12.82	12.67	12.68	12.58	13.14	13.09	12.87	12.78	12.47	12.28	12.49	12.46	12.37	12.35	12.31	12.33	12.37	12.27	12.23	12.22	12.24	12.23	12.23	12.21	12.23	12.16	12.19	12.17	12.19
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
Global Growth Carbon Traded Staff	<b>Total</b> 17,867	<b>2014</b> 449	<b>2015</b> 434	<b>2016</b> 421	<b>2017</b> 409	<b>2018</b> 403	<b>2019</b> 402	<b>2020</b> 400	<b>2021</b> 395	<b>2022</b> 396	<b>2023</b> 392	<b>2024</b> 390	<b>2025</b> 387	<b>2026</b> 455	<b>2027</b> 505	<b>2028</b> 518	<b>2029</b> 523	<b>2030</b> 544	<b>2031</b> 544	<b>2032</b> 537	<b>2033</b> 534	<b>2034</b> 531	<b>2035</b> 526	<b>2036</b> 527	<b>2037</b> 525	<b>2038</b> 523	<b>2039</b> 524	<b>2040</b> 521	<b>2041</b> 520	<b>2042</b> 519	<b>2043</b> 517	<b>2044</b> 515	<b>2045</b> 516	<b>2046</b> 515	<b>2047</b> 513	<b>2048</b> 513		<b>2050</b> 511
Staff	17,867	449	434	421	409	403	402	400	395	396	392	390	387	455	505	518	523	544	544	537	534	531	526	527	525	523	524	521	520	519	517	515	516	515	513	513	510	511
Staff Routine maintenance	17,867 6,552	449 168	434 161	421 155	409 151	403 149	402 149	400 148	395	396	392	390 144	387 143	455 151	505 156	518 177	523 192	544 195	544 195	537 200	534 198	531 197	526 196	527 196	525 195	523 195	524 195	521 194	520 193	519 193	517 192	515 192	516 192	515 191	513 191	513 191	510 190	511 190
Staff Routine maintenance Utilities	17,867 6,552 3,919	449 168 94	434 161 94	421 155 93	409 151 92	403 149 91	402 149 90	400 148 89	395 146 88	396 146 88	392 145 87	390 144 86	387 143 85	455 151 102	505 156 114	518 177 116	523 192 115	544 195 122	544 195 120	537 200 119	534 198 118	531 197 117	526 196 116	527 196 116	525 195 115	523 195 115	524 195 114	521 194 114	520 193 113	519 193 113	517 192 112	515 192 112	516 192 111	515 191 111	513 191 110	513 191 110	510 190 109	511 190 109
Staff Routine maintenance Utilities Rent and rates	17,867 6,552 3,919 6,431	449 168 94 129	434 161 94 128	421 155 93 127	409 151 92 125	403 149 91 124	402 149 90 124	400 148 89 124	395 146 88 124	396 146 88 124	392 145 87 124	390 144 86 124	387 143 85 124	455 151 102 159	505 156 114 183	518 177 116 187	523 192 115 187	544 195 122 201	544 195 120 201	537 200 119 201	534 198 118 201	531 197 117 201	526 196 116 201	527 196 116 201	525 195 115 201	523 195 115 201	524 195 114 201	521 194 114 201	520 193 113 201	519 193 113 201	517 192 112 201	515 192 112 201	516 192 111 201	515 191 111 201	513 191 110 201	513 191 110 201	510 190 109 201	511 190 109 201
Staff Routine maintenance Utilities Rent and rates Rail	17,867 6,552 3,919 6,431 2,136	449 168 94 129 69	434 161 94 128 58 222	421 155 93 127 57 220	409 151 92 125 57 216	403 149 91 124 56 213	402 149 90 124 56 212	400 148 89 124 56 211	395 146 88 124 55 209	396 146 88 124 55 209	392 145 87 124 55 207	390 144 86 124 54 207	387 143 85 124 54 206	455 151 102 159 57 239	505 156 114 183 59	518 177 116 187 60 269	523 192 115 187 60 273	544 195 122 201 60	544 195 120 201 60 284	537 200 119 201 60 282	534 198 118 201 59 281	531 197 117 201 59 281	526 196 116 201 58 280	527 196 116 201 58 282	525 195 115 201 58	523 195 115 201 58 283	524 195 114 201 58 285	521 194 114 201 58 284	520 193 113 201 58 285	519 193 113 201 58 286	517 192 112 201 57 287	515 192 112 201 57 287	516 192 111 201 57 289	515 191 111 201 57	513 191 110 201 57 290	513 191 110 201 57 292	510 190 109 201 57	511 190 109 201 57 293
Staff Routine maintenance Utilities Rent and rates Rail Other	17,867 6,552 3,919 6,431 2,136 9,597 <b>46,503</b>	449 168 94 129 69 228	434 161 94 128 58 222 <b>1,096</b>	421 155 93 127 57 220	409 151 92 125 57 216 <b>1,049</b>	403 149 91 124 56 213 <b>1,036</b>	402 149 90 124 56 212 <b>1,034</b>	400 148 89 124 56 211 <b>1,029</b>	395 146 88 124 55 209	396 146 88 124 55 209 <b>1,017</b>	392 145 87 124 55 207 <b>1,010</b>	390 144 86 124 54 207 <b>1,005</b>	387 143 85 124 54 206 <b>1,000</b>	455 151 102 159 57 239 <b>1,163</b>	505 156 114 183 59 261 <b>1,278</b>	518 177 116 187 60 269	523 192 115 187 60 273 <b>1,351</b>	544 195 122 201 60 283 1,405	544 195 120 201 60 284 <b>1,404</b>	537 200 119 201 60 282 <b>1,399</b>	534 198 118 201 59 281 <b>1,391</b>	531 197 117 201 59 281 <b>1,386</b>	526 196 116 201 58 280 <b>1,378</b>	527 196 116 201 58 282 <b>1,379</b>	525 195 115 201 58 282 <b>1,376</b>	523 195 115 201 58 283 <b>1,375</b>	524 195 114 201 58 285 <b>1,377</b>	521 194 114 201 58 284 <b>1,371</b>	520 193 113 201 58 285 1,371	519 193 113 201 58 286	517 192 112 201 57 287 <b>1,366</b>	515 192 112 201 57 287	516 192 111 201 57 289 <b>1,366</b>	515 191 111 201 57 290	513 191 110 201 57 290 <b>1,362</b>	513 191 110 201 57 292 <b>1,363</b>	510 190 109 201 57 291	511 190 109 201 57 293 <b>1,360</b>
Staff Routine maintenance Utilities Rent and rates Rail Other Opex	17,867 6,552 3,919 6,431 2,136 9,597 <b>46,503</b>	449 168 94 129 69 228 1,137	434 161 94 128 58 222 1,096	421 155 93 127 57 220 1,072	409 151 92 125 57 216 1,049	403 149 91 124 56 213 1,036	402 149 90 124 56 212 <b>1,034</b>	400 148 89 124 56 211 1,029	395 146 88 124 55 209 1,018 1,033	396 146 88 124 55 209 1,017	392 145 87 124 55 207 1,010	390 144 86 124 54 207 1,005	387 143 85 124 54 206 1,000	455 151 102 159 57 239 1,163 1,248	505 156 114 183 59 261 1,278	518 177 116 187 60 269 1,327 1,446	523 192 115 187 60 273 1,351	544 195 122 201 60 283 1,405 1,545	544 195 120 201 60 284 1,404 1,552	537 200 119 201 60 282 1,399 1,553	534 198 118 201 59 281 1,391 1,553	531 197 117 201 59 281 <b>1,386</b> <b>1,555</b>	526 196 116 201 58 280 1,378 1,551	527 196 116 201 58 282 1,379 1,561	525 195 115 201 58 282 1,376 1,566	523 195 115 201 58 283 1,375 1,572	524 195 114 201 58 285 1,377 1,583	521 194 114 201 58 284 1,371 1,583	520 193 113 201 58 285 1,371 1,589	519 193 113 201 58 286 1,369 1,596	517 192 112 201 57 287 1,366 1,601	515 192 112 201 57 287 <b>1,363</b> <b>1,606</b>	516 192 111 201 57 289 1,366 1,622	515 191 111 201 57 290 1,364 1,629	513 191 110 201 57 290 1,362 1,635	513 191 110 201 57 292 1,363 1,645	510 190 109 201 57 291 1,358 1,646	511 190 109 201 57 293 1,360
Staff Routine maintenance Utilities Rent and rates Rail Other Opex Opex (incl. Risk & OB) Opex/pax (£)	17,867 6,552 3,919 6,431 2,136 9,597 <b>46,503</b> <b>51,596</b>	449 168 94 129 69 228 1,137 1,137	434 161 94 128 58 222 <b>1,096</b> <b>1,096</b>	421 155 93 127 57 220 1,072 1,072	409 151 92 125 57 216 1,049 1,049	403 149 91 124 56 213 1,036 1,036 13.48	402 149 90 124 56 212 1,034 1,039	400 148 89 124 56 211 <b>1,029</b> <b>1,039</b> 13.08	395 146 88 124 55 209 <b>1,018</b> <b>1,033</b> 13.08	396 146 88 124 55 209 <b>1,017</b> <b>1,038</b> 12.81	392 145 87 124 55 207 <b>1,010</b> <b>1,035</b> 12.72	390 144 86 124 54 207 <b>1,005</b> <b>1,036</b> 12.60	387 143 85 124 54 206 <b>1,000</b> <b>1,035</b> 12.50	455 151 102 159 57 239 <b>1,163</b> <b>1,248</b>	505 156 114 183 59 261 <b>1,278</b> <b>1,379</b> 12.89	518 177 116 187 60 269 <b>1,327</b> <b>1,446</b> 12.73	523 192 115 187 60 273 <b>1,351</b> <b>1,479</b>	544 195 122 201 60 283 <b>1,405</b> <b>1,545</b>	544 195 120 201 60 284 <b>1,404</b> <b>1,552</b> 12.34	537 200 119 201 60 282 1,399 1,553 12.38	534 198 118 201 59 281 1,391 1,553 12.29	531 197 117 201 59 281 <b>1,386</b> <b>1,555</b> 12.16	526 196 116 201 58 280 <b>1,378</b> <b>1,551</b> 12.24	527 196 116 201 58 282 <b>1,379</b> <b>1,561</b> 12.15	525 195 115 201 58 282 <b>1,376</b> <b>1,566</b> 12.14	523 195 115 201 58 283 <b>1,375</b> <b>1,572</b> 12.11	524 195 114 201 58 285 <b>1,377</b> <b>1,583</b> 12.01	521 194 114 201 58 284 <b>1,371</b> <b>1,583</b> 12.04	520 193 113 201 58 285 <b>1,371</b> <b>1,589</b> 11.98	519 193 113 201 58 286 1,369 1,596 11.96	517 192 112 201 57 287 <b>1,366</b> <b>1,601</b>	515 192 112 201 57 287 <b>1,363</b> <b>1,606</b> 11.94	516 192 111 201 57 289 <b>1,366</b> <b>1,622</b> 11.87	515 191 111 201 57 290 <b>1,364</b> <b>1,629</b> 11.84	513 191 110 201 57 290 1,362 1,635 11.82	513 191 110 201 57 292 1,363 1,645 11.74	510 190 109 201 57 291 <b>1,358</b> <b>1,646</b> 11.78	511 190 109 201 57 293 <b>1,360</b> <b>1,658</b> 11.68
Staff Routine maintenance Utilities Rent and rates Rail Other Opex Opex (incl. Risk & OB) Opex/pax (£)  Global Fragmentation Carbon Capped	17,867 6,552 3,919 6,431 2,136 9,597 46,503 51,596	449 168 94 129 69 228 1,137 1,137 15.68	434 161 94 128 58 222 1,096 1,096 14.84	421 155 93 127 57 220 1,072 1,072 14.22	409 151 92 125 57 216 1,049 1,049 13.88	403 149 91 124 56 213 1,036 1,036 13.48	402 149 90 124 56 212 1,034 1,039 13.24	400 148 89 124 56 211 1,029 1,039 13.08	395 146 88 124 55 209 1,018 1,033 13.08	396 146 88 124 55 209 <b>1,017</b> <b>1,038</b> 12.81	392 145 87 124 55 207 1,010 1,035 12.72	390 144 86 124 54 207 1,005 1,036 12.60	387 143 85 124 54 206 <b>1,000</b> <b>1,035</b> 12.50	455 151 102 159 57 239 <b>1,163</b> <b>1,248</b> 12.96	505 156 114 183 59 261 <b>1,278</b> <b>1,379</b> 12.89	518 177 116 187 60 269 1,327 1,446 12.73	523 192 115 187 60 273 1,351 1,479 12.42	544 195 122 201 60 283 <b>1,405</b> <b>1,545</b> 12.55	544 195 120 201 60 284 <b>1,404</b> <b>1,552</b> 12.34	537 200 119 201 60 282 1,399 1,553 12.38	534 198 118 201 59 281 <b>1,391</b> <b>1,553</b> 12.29	531 197 117 201 59 281 <b>1,386</b> <b>1,555</b> 12.16	526 196 116 201 58 280 <b>1,378</b> <b>1,551</b> 12.24	527 196 116 201 58 282 1,379 1,561 12.15	525 195 115 201 58 282 <b>1,376</b> <b>1,566</b> 12.14	523 195 115 201 58 283 1,375 1,572 12.11	524 195 114 201 58 285 1,377 1,583 12.01	521 194 114 201 58 284 <b>1,371</b> <b>1,583</b> 12.04	520 193 113 201 58 285 <b>1,371</b> <b>1,589</b> 11.98	519 193 113 201 58 286 1,369 1,596 11.96	517 192 112 201 57 287 <b>1,366</b> <b>1,601</b> 11.94	515 192 112 201 57 287 <b>1,363</b> <b>1,606</b> 11.94	516 192 111 201 57 289 1,366 1,622 11.87	515 191 111 201 57 290 <b>1,364</b> <b>1,629</b> 11.84	513 191 110 201 57 290 <b>1,362</b> <b>1,635</b> 11.82	513 191 110 201 57 292 1,363 1,645 11.74	510 190 109 201 57 291 <b>1,358</b> <b>1,646</b> 11.78	511 190 109 201 57 293 1,360 1,658 11.68
Staff Routine maintenance Utilities Rent and rates Rail Other Opex Opex (incl. Risk & OB) Opex/pax (£)  Global Fragmentation Carbon Capped Staff	17,867 6,552 3,919 6,431 2,136 9,597 46,503 51,596	449 168 94 129 69 228 1,137 1,137 15.68	434 161 94 128 58 222 1,096 1,096 14.84	421 155 93 127 57 220 1,072 1,072 14.22 2016 411	409 151 92 125 57 216 1,049 1,049 13.88	403 149 91 124 56 213 1,036 1,036 13.48	402 149 90 124 56 212 1,034 1,039 13.24	400 148 89 124 56 211 1,029 1,039 13.08	395 146 88 124 55 209 1,018 1,033 13.08	396 146 88 124 55 209 1,017 1,038 12.81	392 145 87 124 55 207 <b>1,010</b> <b>1,035</b> 12.72	390 144 86 124 54 207 1,005 1,036 12.60	387 143 85 124 54 206 1,000 1,035 12.50	455 151 102 159 57 239 <b>1,163</b> <b>1,248</b> 12.96	505 156 114 183 59 261 <b>1,278</b> <b>1,379</b> 12.89	518 177 116 187 60 269 1,327 1,446 12.73	523 192 115 187 60 273 1,351 1,479 12.42	544 195 122 201 60 283 1,405 1,545 12.55	544 195 120 201 60 284 <b>1,404</b> <b>1,552</b> 12.34	537 200 119 201 60 282 1,399 1,553 12.38	534 198 118 201 59 281 <b>1,391</b> <b>1,553</b> 12.29	531 197 117 201 59 281 <b>1,386</b> <b>1,555</b> 12.16	526 196 116 201 58 280 <b>1,378</b> <b>1,551</b> 12.24	527 196 116 201 58 282 1,379 1,561 12.15	525 195 115 201 58 282 <b>1,376</b> <b>1,566</b> 12.14	523 195 115 201 58 283 1,375 1,572 12.11	524 195 114 201 58 285 1,377 1,583 12.01	521 194 114 201 58 284 1,371 1,583 12.04	520 193 113 201 58 285 <b>1,371</b> <b>1,589</b> 11.98	519 193 113 201 58 286 1,369 1,596 11.96	517 192 112 201 57 287 <b>1,366</b> <b>1,601</b> 11.94	515 192 112 201 57 287 <b>1,363</b> <b>1,606</b> 11.94	516 192 111 201 57 289 <b>1,366</b> <b>1,622</b> 11.87	515 191 111 201 57 290 <b>1,364</b> <b>1,629</b> 11.84	513 191 110 201 57 290 1,362 1,635 11.82	513 191 110 201 57 292 1,363 1,645 11.74	510 190 109 201 57 291 <b>1,358</b> <b>1,646</b> 11.78	511 190 109 201 57 293 1,360 1,658 11.68
Staff Routine maintenance Utilities Rent and rates Rail Other Opex Opex (incl. Risk & OB) Opex/pax (£)  Global Fragmentation Carbon Capped Staff Routine maintenance	17,867 6,552 3,919 6,431 2,136 9,597 46,503 51,596 Total 16,842 6,300	449 168 94 129 69 228 1,137 1,137 15.68 2014 449	434 161 94 128 58 222 1,096 1,096 14.84 2015 425 161	421 155 93 127 57 220 1,072 14.22 2016 411 155	409 151 92 125 57 216 1,049 1,049 13.88 2017 398 150	403 149 91 124 56 213 1,036 1,036 13.48 2018 390 147	402 149 90 124 56 212 1,034 1,039 13.24	400 148 89 124 56 211 1,029 1,039 13.08	395 146 88 124 55 209 1,018 1,033 13.08 2021 387 146	396 146 88 124 55 209 1,017 1,038 12.81 2022 382 144	392 145 87 124 55 207 1,010 1,035 12.72	390 144 86 124 54 207 1,005 1,036 12.60  2024 379 143	387 143 85 124 54 206 1,000 1,035 12.50  2025 374 141	455 151 102 159 57 239 1,163 1,248 12.96	505 156 114 183 59 261 1,278 1,379 12.89	518 177 116 187 60 269 1,327 1,446 12.73	523 192 115 187 60 273 1,351 1,479 12.42 2029 484 171	544 195 122 201 60 283 1,405 1,545 12.55 2030 491 184	544 195 120 201 60 284 1,404 1,552 12.34 2031 490 183	537 200 119 201 60 282 1,399 1,553 12.38  2032 488 185	534 198 118 201 59 281 <b>1,391</b> <b>1,553</b> 12.29 <b>2033</b> 486 184	531 197 117 201 59 281 <b>1,386</b> <b>1,555</b> 12.16	526 196 116 201 58 280 <b>1,378</b> <b>1,551</b> 12.24 <b>2035</b> 483 183	527 196 116 201 58 282 1,379 1,561 12.15	525 195 115 201 58 282 1,376 1,566 12.14 2037 500 183	523 195 115 201 58 283 1,375 1,572 12.11  2038 500 183	524 195 114 201 58 285 1,377 1,583 12.01 2039 497 189	521 194 114 201 58 284 1,371 1,583 12.04 2040 496 188	520 193 113 201 58 285 1,371 1,589 11.98 2041 493 187	519 193 113 201 58 286 1,369 1,596 11.96	517 192 112 201 57 287 1,366 1,601 11.94 2043 489 185	515 192 112 201 57 287 <b>1,363</b> <b>1,606</b> 11.94	516 192 111 201 57 289 <b>1,366</b> <b>1,622</b> 11.87	515 191 111 201 57 290 <b>1,364</b> <b>1,629</b> 11.84 2046 484 184	513 191 110 201 57 290 1,362 1,635 11.82	513 191 110 201 57 292 1,363 1,645 11.74 2048 481	510 190 109 201 57 291 <b>1,358</b> <b>1,646</b> 11.78	511 190 109 201 57 293 <b>1,360</b> <b>1,658</b> 11.68
Staff Routine maintenance Utilities Rent and rates Rail Other Opex Opex (incl. Risk & OB) Opex/pax (£)  Global Fragmentation Carbon Capped Staff Routine maintenance Utilities	17,867 6,552 3,919 6,431 2,136 9,597 46,503 51,596 Total 16,842 6,300 3,838	449 168 94 129 69 228 1,137 1,137 15.68 2014 449 168 94	434 161 94 128 58 222 1,096 1,096 14.84 2015 425 161 94	421 155 93 127 57 220 1,072 14.22 2016 411 155 93	409 151 92 125 57 216 1,049 13.88 2017 398 150 92	403 149 91 124 56 213 1,036 13.48  2018 390 147 91	402 149 90 124 56 212 1,034 1,039 13.24 2019 388 147 90	400 148 89 124 56 211 1,029 1,039 13.08 2020 388 147 89	395 146 88 124 55 209 <b>1,018</b> <b>1,033</b> 13.08 <b>2021</b> 387 146 88	396 146 88 124 55 209 1,017 1,038 12.81  2022 382 144 87	392 145 87 124 55 207 1,010 1,035 12.72 2023 380 144 87	390 144 86 124 54 207 1,005 1,036 12.60  2024 379 143 86	387 143 85 124 54 206 1,000 1,035 12.50  2025 374 141 85	455 151 102 159 57 239 1,163 1,248 12.96 2026 434 147 101	505 156 114 183 59 261 1,278 1,379 12.89 2027 445 151 101	518 177 116 187 60 269 1,327 1,446 12.73 2028 482 170 113	523 192 115 187 60 273 <b>1,351</b> <b>1,479</b> 12.42 <b>2029</b> 484 171 112	544 195 122 201 60 283 1,405 1,545 12.55 2030 491 184 114	544 195 120 201 60 284 1,404 1,552 12.34 2031 490 183 113	537 200 119 201 60 282 1,399 1,553 12.38  2032 488 185 112	534 198 118 201 59 281 <b>1,391</b> <b>1,553</b> 12.29 <b>2033</b> 486 184 111	531 197 117 201 59 281 <b>1,386</b> <b>1,555</b> 12.16 <b>2034</b> 485 184 110	526 196 116 201 58 280 <b>1,378</b> <b>1,551</b> 12.24 <b>2035</b> 483 183 109	527 196 116 201 58 282 1,379 1,561 12.15 2036 482 183 109	525 195 115 201 58 282 1,376 1,566 12.14 2037 500 183 115	523 195 115 201 58 283 1,375 1,572 12.11 2038 500 183 114	524 195 114 201 58 285 1,377 1,583 12.01 2039 497 189 114	521 194 114 201 58 284 1,371 1,583 12.04  2040 496 188 113	520 193 113 201 58 285 1,371 1,589 11.98 2041 493 187 113	519 193 113 201 58 286 1,369 1,596 11.96  2042 491 186 112	517 192 112 201 57 287 <b>1,366</b> <b>1,601</b> 11.94 <b>2043</b> 489 185 112	515 192 112 201 57 287 <b>1,363</b> <b>1,606</b> 11.94 <b>2044</b> 487 185 111	516 192 111 201 57 289 1,366 1,622 11.87 2045 485 184 111	515 191 111 201 57 290 1,364 1,629 11.84 2046 484 184 110	513 191 110 201 57 290 1,362 1,635 11.82 2047 482 183 109	513 191 110 201 57 292 1,363 1,645 11.74 2048 481 182 109	510 190 109 201 57 291 <b>1,358</b> <b>1,646</b> 11.78 <b>2049</b> 478 181 108	511 190 109 201 57 293 <b>1,360</b> <b>1,658</b> 11.68 <b>2050</b> 477 181 108
Staff Routine maintenance Utilities Rent and rates Rail Other Opex Opex (incl. Risk & OB) Opex/pax (£)  Global Fragmentation Carbon Capped Staff Routine maintenance Utilities Rent and rates	17,867 6,552 3,919 6,431 2,136 9,597 46,503 51,596  Total 16,842 6,300 3,838 6,303	449 168 94 129 69 228 1,137 1,137 15.68  2014 449 168 94 129	434 161 94 128 58 222 1,096 1,096 14.84 2015 425 161 94 128	421 155 93 127 57 220 1,072 14.22 2016 411 155 93 127	409 151 92 125 57 216 1,049 13.88 2017 398 150 92 125	403 149 91 124 56 213 1,036 13.48  2018 390 147 91 124	402 149 90 124 56 212 1,034 1,039 13.24 2019 388 147 90 124	400 148 89 124 56 211 1,029 13.08 2020 388 147 89 124	395 146 88 124 55 209 <b>1,018</b> <b>1,033</b> 13.08 <b>2021</b> 387 146 88 124	396 146 88 124 55 209 1,017 1,038 12.81 2022 382 144 87 124	392 145 87 124 55 207 1,010 1,035 12.72 2023 380 144 87 124	390 144 86 124 54 207 1,005 1,036 12.60  2024 379 143 86 124	387 143 85 124 54 206 1,000 1,035 12.50  2025 374 141 85 124	455 151 102 159 57 239 1,163 1,248 12.96 2026 434 147 101 159	505 156 114 183 59 261 1,278 1,379 12.89 2027 445 151 101 159	518 177 116 187 60 269 1,327 1,446 12.73 2028 482 170 113 183	523 192 115 187 60 273 1,351 1,479 12.42 2029 484 171 112 183	544 195 122 201 60 283 1,405 1,545 12.55 2030 491 184 114 187	544 195 120 201 60 284 <b>1,404</b> <b>1,552</b> 12.34 <b>2031</b> 490 183 113 187	537 200 119 201 60 282 1,399 1,553 12.38  2032 488 185 112 187	534 198 118 201 59 281 <b>1,391</b> <b>1,553</b> 12.29 <b>2033</b> 486 184 111 187	531 197 117 201 59 281 <b>1,386</b> <b>1,555</b> 12.16 <b>2034</b> 485 184 110 187	526 196 116 201 58 280 <b>1,378</b> <b>1,551</b> 12.24 <b>2035</b> 483 183 109 187	527 196 116 201 58 282 1,379 1,561 12.15 2036 482 183 109 187	525 195 115 201 58 282 1,376 1,566 12.14 2037 500 183 115 201	523 195 115 201 58 283 1,375 1,572 12.11 2038 500 183 114 201	524 195 114 201 58 285 1,377 1,583 12.01 2039 497 189 114 201	521 194 114 201 58 284 1,371 1,583 12.04 2040 496 188 113 201	520 193 113 201 58 285 1,371 1,589 11.98 2041 493 187 113 201	519 193 113 201 58 286 1,369 1,596 11.96  2042 491 186 112 201	517 192 112 201 57 287 <b>1,366</b> <b>1,601</b> 11.94 <b>2043</b> 489 185 112 201	515 192 112 201 57 287 <b>1,363</b> <b>1,606</b> 11.94 <b>2044</b> 487 185 111 201	516 192 111 201 57 289 1,366 1,622 11.87 2045 485 184 111 201	515 191 111 201 57 290 1,364 1,629 11.84 2046 484 184 110 201	513 191 110 201 57 290 1,362 1,635 11.82  2047 482 183 109 201	513 191 110 201 57 292 1,363 1,645 11.74  2048 481 182 109 201	510 190 109 201 57 291 <b>1,358</b> <b>1,646</b> 11.78 <b>2049</b> 478 181 108 201	511 190 109 201 57 293 <b>1,360</b> <b>1,658</b> 11.68 <b>2050</b> 477 181 108 201
Staff Routine maintenance Utilities Rent and rates Rail Other Opex Opex (incl. Risk & OB) Opex/pax (£)  Global Fragmentation Carbon Capped Staff Routine maintenance Utilities Rent and rates Rail	17,867 6,552 3,919 6,431 2,136 9,597 46,503 51,596  Total 16,842 6,300 3,838 6,303 2,097	449 168 94 129 69 228 1,137 1,137 15.68  2014 449 168 94 129 69	434 161 94 128 58 222 <b>1,096</b> <b>1,096</b> 14.84 <b>2015</b> 425 161 94 128 58	421 155 93 127 57 220 1,072 14.22 2016 411 155 93 127 57	409 151 92 125 57 216 1,049 13.88 2017 398 150 92 125 57	403 149 91 124 56 213 1,036 13.48  2018 390 147 91 124 56	402 149 90 124 56 212 1,034 1,039 13.24 2019 388 147 90 124 56	400 148 89 124 56 211 1,029 13.08 2020 388 147 89 124 56	395 146 88 124 55 209 1,018 1,033 13.08 2021 387 146 88 124 56	396 146 88 124 55 209 1,017 1,038 12.81  2022 382 144 87 124 55	392 145 87 124 55 207 1,010 1,035 12.72 2023 380 144 87 124 55	390 144 86 124 54 207 1,005 1,036 12.60  2024 379 143 86 124 54	387 143 85 124 54 206 1,000 1,035 12.50  2025 374 141 85 124 54	455 151 102 159 57 239 1,163 1,248 12.96 2026 434 147 101 159 56	505 156 114 183 59 261 1,278 1,379 12.89 2027 445 151 101 159 57	518 177 116 187 60 269 1,327 1,446 12.73 2028 482 170 113 183 58	523 192 115 187 60 273 1,351 1,479 12.42 2029 484 171 112 183 58	544 195 122 201 60 283 1,405 1,545 12.55 2030 491 184 114 187 58	544 195 120 201 60 284 <b>1,404</b> <b>1,552</b> 12.34 <b>2031</b> 490 183 113 187 58	537 200 119 201 60 282 1,399 1,553 12.38  2032 488 185 112 187 58	534 198 118 201 59 281 <b>1,391</b> <b>1,553</b> 12.29 <b>2033</b> 486 184 111 187 58	531 197 117 201 59 281 <b>1,386</b> <b>1,555</b> 12.16 <b>2034</b> 485 184 110 187 57	526 196 116 201 58 280 <b>1,378</b> <b>1,551</b> 12.24 <b>2035</b> 483 183 109 187 57	527 196 116 201 58 282 <b>1,379</b> <b>1,561</b> 12.15 <b>2036</b> 482 183 109 187 57	525 195 115 201 58 282 1,376 1,566 12.14 2037 500 183 115 201 57	523 195 115 201 58 283 1,375 1,572 12.11 2038 500 183 114	524 195 114 201 58 285 1,377 1,583 12.01 2039 497 189 114 201 57	521 194 114 201 58 284 <b>1,371</b> <b>1,583</b> 12.04 <b>2040</b> 496 188 113 201 57	520 193 113 201 58 285 1,371 1,589 11.98 2041 493 187 113 201 56	519 193 113 201 58 286 1,369 1,596 11.96  2042 491 186 112 201 56	517 192 112 201 57 287 1,366 1,601 11.94  2043 489 185 112 201 56	515 192 112 201 57 287 <b>1,363</b> <b>1,606</b> 11.94 <b>2044</b> 487 185 111 201 56	516 192 111 201 57 289 1,366 1,622 11.87 2045 485 184 111 201 55	515 191 111 201 57 290 1,364 1,629 11.84 2046 484 110 201 55	513 191 110 201 57 290 1,362 1,635 11.82  2047 482 183 109 201 55	513 191 110 201 57 292 1,363 1,645 11.74  2048 481 182 109 201 55	510 190 109 201 57 291 <b>1,358</b> <b>1,646</b> 11.78 <b>2049</b> 478 181 108 201 55	511 190 109 201 57 293 <b>1,360</b> <b>1,658</b> 11.68 <b>2050</b> 477 181 108 201 55
Staff Routine maintenance Utilities Rent and rates Rail Other Opex Opex (incl. Risk & OB) Opex/pax (£)  Global Fragmentation Carbon Capped Staff Routine maintenance Utilities Rent and rates Rail Other	17,867 6,552 3,919 6,431 2,136 9,597 46,503 51,596  Total 16,842 6,300 3,838 6,303 2,097 9,265	449 168 94 129 69 228 1,137 1,137 15.68  2014 449 168 94 129 69 228	434 161 94 128 58 222 <b>1,096</b> <b>1,096</b> 14.84 <b>2015</b> 425 161 94 128 58 223	421 155 93 127 57 220 1,072 14.22 2016 411 155 93 127 57 219	409 151 92 125 57 216 1,049 13.88 2017 398 150 92 125 57 215	403 149 91 124 56 213 1,036 1,036 13.48  2018 390 147 91 124 56 210	402 149 90 124 56 212 1,034 1,039 13.24 2019 388 147 90 124 56 209	400 148 89 124 56 211 1,029 1,039 13.08 2020 388 147 89 124 56 209	395 146 88 124 55 209 1,018 1,033 13.08 2021 387 146 88 124 56 209	396 146 88 124 55 209 1,017 1,038 12.81 2022 382 144 87 124 55 206	392 145 87 124 55 207 1,010 1,035 12.72 2023 380 144 87 124 55 205	390 144 86 124 54 207 1,005 1,036 12.60  2024 379 143 86 124 54 206	387 143 85 124 54 206 1,000 1,035 12.50  2025 374 141 85 124 54 204	455 151 102 159 57 239 1,163 1,248 12.96 2026 434 147 101 159 56 232	505 156 114 183 59 261 1,278 1,379 12.89 2027 445 151 101 159 57 240	518 177 116 187 60 269 1,327 1,446 12.73 2028 482 170 113 183 58 256	523 192 115 187 60 273 1,351 1,479 12.42 2029 484 171 112 183 58 259	544 195 122 201 60 283 <b>1,405</b> <b>1,545</b> 12.55 <b>2030</b> 491 184 114 187 58 263	544 195 120 201 60 284 <b>1,404</b> <b>1,552</b> 12.34 <b>2031</b> 490 183 113 187 58 264	537 200 119 201 60 282 1,399 1,553 12.38  2032 488 185 112 187 58 264	534 198 118 201 59 281 <b>1,391</b> <b>1,553</b> 12.29 <b>2033</b> 486 184 111 187 58 264	531 197 117 201 59 281 <b>1,386</b> <b>1,555</b> 12.16 <b>2034</b> 485 184 110 187 57 265	526 196 116 201 58 280 <b>1,378</b> <b>1,551</b> 12.24 <b>2035</b> 483 183 109 187 57 265	527 196 116 201 58 282 <b>1,379</b> <b>1,561</b> 12.15 <b>2036</b> 482 183 109 187 57 266	525 195 115 201 58 282 1,376 1,566 12.14 2037 500 183 115 201 57 275	523 195 115 201 58 283 1,375 1,572 12.11 2038 500 183 114 201 57 276	524 195 114 201 58 285 1,377 1,583 12.01 2039 497 189 114 201 57 276	521 194 114 201 58 284 1,371 1,583 12.04 2040 496 188 113 201 57 277	520 193 113 201 58 285 1,371 1,589 11.98 2041 493 187 113 201 56 277	519 193 113 201 58 286 1,369 1,596 11.96  2042 491 186 112 201 56 277	517 192 112 201 57 287 1,366 1,601 11.94 2043 489 185 112 201 56 277	515 192 112 201 57 287 <b>1,363</b> <b>1,606</b> 11.94 <b>2044</b> 487 185 111 201 56 277	516 192 111 201 57 289 1,366 1,622 11.87 2045 485 184 111 201 55 277	515 191 111 201 57 290 1,364 1,629 11.84 2046 484 110 201 55 278	513 191 110 201 57 290 1,362 1,635 11.82  2047 482 183 109 201 55 278	513 191 110 201 57 292 1,363 1,645 11.74  2048 481 182 109 201 55 279	510 190 109 201 57 291 <b>1,358</b> <b>1,646</b> 11.78 <b>2049</b> 478 181 108 201 55 279	511 190 109 201 57 293 <b>1,360</b> <b>1,658</b> 11.68 <b>2050</b> 477 181 108 201 55 280
Staff Routine maintenance Utilities Rent and rates Rail Other Opex Opex (incl. Risk & OB) Opex/pax (£)  Global Fragmentation Carbon Capped Staff Routine maintenance Utilities Rent and rates Rail Other Opex	17,867 6,552 3,919 6,431 2,136 9,597 46,503 51,596  Total 16,842 6,300 3,838 6,303 2,097 9,265 44,646	449 168 94 129 69 228 1,137 1,5.68 2014 449 168 94 129 69 228 1,137	434 161 94 128 222 1,096 1,096 14.84 2015 425 161 94 128 58 223 1,087	421 155 93 127 57 220 1,072 14.22 2016 411 155 93 127 57 219	409 151 92 125 57 216 1,049 13.88 2017 398 150 92 125 57 215 1,037	403 149 91 124 56 213 1,036 13.48  2018 390 147 91 124 56 210 1,018	402 149 90 124 56 212 1,034 1,039 13.24 2019 388 147 90 124 56 209 1,014	400 148 89 124 56 211 1,029 1,039 13.08 2020 388 147 89 124 56 209 1,013	395 146 88 124 55 209 1,018 1,033 13.08 2021 387 146 88 124 56 209 1,011	396 146 88 124 55 209 1,017 1,038 12.81  2022 382 144 87 124 55 206 998	392 145 87 124 55 207 1,010 1,035 12.72 2023 380 144 87 124 55 205 994	390 144 86 124 54 207 1,005 1,036 12.60  2024 379 143 86 124 54 206 992	387 143 85 124 54 206 1,000 1,035 12.50  2025 374 141 85 124 54 204 982	455 151 102 159 57 239 1,163 1,248 12.96 2026 434 147 101 159 56 232 1,129	505 156 114 183 59 261 1,278 1,379 12.89 2027 445 151 101 159 57 240 1,152	518 177 116 187 60 269 1,327 1,446 12.73 2028 482 170 113 183 58 256 1,262	523 192 115 187 60 273 1,351 1,479 12.42 2029 484 171 112 183 58 259 1,267	544 195 122 201 60 283 1,405 1,545 12.55 2030 491 184 114 187 58 263 1,298	544 195 120 201 60 284 <b>1,404</b> <b>1,552</b> 12.34 <b>2031</b> 490 183 113 187 58 264 <b>1,295</b>	537 200 119 201 60 282 1,399 1,553 12.38  2032 488 185 112 187 58 264 1,294	534 198 118 201 59 281 <b>1,391</b> <b>1,553</b> 12.29 <b>2033</b> 486 184 111 187 58 264 <b>1,290</b>	531 197 117 201 59 281 <b>1,386</b> <b>1,555</b> 12.16 <b>2034</b> 485 184 110 187 57 265 <b>1,288</b>	526 196 116 201 58 280 <b>1,378</b> <b>1,551</b> 12.24 <b>2035</b> 483 183 109 187 57 265 <b>1,285</b>	527 196 116 201 58 282 1,379 1,561 12.15 2036 482 183 109 187 57 266 1,284	525 195 115 201 58 282 1,376 1,566 12.14 2037 500 183 115 201 57 275 1,331	523 195 115 201 58 283 1,375 1,572 12.11 2038 500 183 114 201 57 276 1,332	524 195 114 201 58 285 1,377 1,583 12.01 2039 497 189 114 201 57 276 1,333	521 194 114 201 58 284 1,371 1,583 12.04 2040 496 188 113 201 57 277 1,332	520 193 113 201 58 285 1,371 1,589 11.98 2041 493 187 113 201 56 277 1,327	519 193 113 201 58 286 1,369 1,596 11.96  2042 491 186 112 201 56 277 1,323	517 192 112 201 57 287 1,366 1,601 11.94  2043 489 185 112 201 56 277 1,320	515 192 112 201 57 287 <b>1,363</b> <b>1,606</b> 11.94 <b>2044</b> 487 185 111 201 56 277 <b>1,317</b>	516 192 111 201 57 289 1,366 1,622 11.87 2045 485 184 111 201 55 277 1,313	515 191 111 201 57 290 1,364 1,629 11.84 2046 484 110 201 55 278 1,312	513 191 110 201 57 290 1,362 1,635 11.82  2047 482 183 109 201 55 278 1,308	513 191 110 201 57 292 1,363 1,645 11.74  2048 481 182 109 201 55 279 1,307	510 190 109 201 57 291 <b>1,358</b> <b>1,646</b> 11.78 <b>2049</b> 478 181 108 201 55 279 <b>1,303</b>	511 190 109 201 57 293 <b>1,360</b> <b>1,658</b> 11.68 <b>2050</b> 477 181 108 201 55 280 <b>1,300</b>
Staff Routine maintenance Utilities Rent and rates Rail Other Opex Opex (incl. Risk & OB) Opex/pax (£)  Global Fragmentation Carbon Capped Staff Routine maintenance Utilities Rent and rates Rail Other	17,867 6,552 3,919 6,431 2,136 9,597 46,503 51,596  Total 16,842 6,300 3,838 6,303 2,097 9,265	449 168 94 129 69 228 1,137 1,137 15.68  2014 449 168 94 129 69 228 1,137 1,137	434 161 94 128 222 1,096 1,096 14.84 2015 425 161 94 128 58 223 1,087	421 155 93 127 57 220 1,072 14.22 2016 411 155 93 127 57 219 1,062 1,062	409 151 92 125 57 216 1,049 13.88 2017 398 150 92 125 57 215 1,037 1,037	403 149 91 124 56 213 1,036 13.48  2018 390 147 91 124 56 210 1,018 1,018	402 149 90 124 56 212 1,034 1,039 13.24 2019 388 147 90 124 56 209 1,014	400 148 89 124 56 211 1,029 1,039 13.08 2020 388 147 89 124 56 209 1,013 1,023	395 146 88 124 55 209 1,018 1,033 13.08 2021 387 146 88 124 56 209 1,011 1,026	396 146 88 124 55 209 1,017 1,038 12.81  2022 382 144 87 124 55 206 998 1,018	392 145 87 124 55 207 1,010 1,035 12.72 2023 380 144 87 124 55 205 994 1,019	390 144 86 124 54 207 1,005 1,036 12.60  2024 379 143 86 124 54 206 992 1,022	387 143 85 124 54 206 1,000 1,035 12.50  2025 374 141 85 124 54 204 982 1,017	455 151 102 159 57 239 1,163 1,248 12.96 2026 434 147 101 159 56 232 1,129 1,211	505 156 114 183 59 261 1,278 1,379 12.89 2027 445 151 101 159 57 240 1,152 1,246	518 177 116 187 60 269 1,327 1,446 12.73 2028 482 170 113 183 58 256 1,262 1,372	523 192 115 187 60 273 1,351 1,479 12.42 2029 484 171 112 183 58 259 1,267 1,386	544 195 122 201 60 283 1,405 1,545 12.55 2030 491 184 114 187 58 263 1,298 1,427	544 195 120 201 60 284 1,404 1,552 12.34 2031 490 183 113 187 58 264 1,295 1,431	537 200 119 201 60 282 1,399 1,553 12.38  2032 488 185 112 187 58 264 1,294 1,438	534 198 118 201 59 281 <b>1,391</b> <b>1,553</b> 12.29 <b>2033</b> 486 184 111 187 58 264 <b>1,290</b> <b>1,441</b>	531 197 117 201 59 281 <b>1,386</b> <b>1,555</b> 12.16 <b>2034</b> 485 184 110 187 57 265 <b>1,288</b> <b>1,447</b>	526 196 116 201 58 280 <b>1,378</b> <b>1,551</b> 12.24 <b>2035</b> 483 183 109 187 57 265 <b>1,285</b> <b>1,450</b>	527 196 116 201 58 282 1,379 1,561 12.15 2036 482 183 109 187 57 266 1,284 1,457	525 195 115 201 58 282 1,376 1,566 12.14 2037 500 183 115 201 57 275 1,331 1,516	523 195 115 201 58 283 1,375 1,572 12.11 2038 500 183 114 201 57 276 1,332 1,525	524 195 114 201 58 285 1,377 1,583 12.01 2039 497 189 114 201 57 276 1,333 1,533	521 194 114 201 58 284 1,371 1,583 12.04 2040 496 188 113 201 57 277 1,332 1,540	520 193 113 201 58 285 1,371 1,589 11.98 2041 493 187 113 201 56 277 1,327 1,541	519 193 113 201 58 286 1,369 1,596 11.96  2042 491 186 112 201 56 277 1,323 1,545	517 192 112 201 57 287 1,366 1,601 11.94  2043 489 185 112 201 56 277 1,320 1,547	515 192 112 201 57 287 <b>1,363</b> <b>1,606</b> 11.94 <b>2044</b> 487 185 111 201 56 277 <b>1,317</b> <b>1,553</b>	516 192 111 201 57 289 1,366 1,622 11.87 2045 485 184 111 201 55 277 1,313 1,555	515 191 111 201 57 290 1,364 1,629 11.84 2046 484 110 201 55 278 1,312 1,562	513 191 110 201 57 290 1,362 1,635 11.82  2047 482 183 109 201 55 278 1,308 1,564	513 191 110 201 57 292 1,363 1,645 11.74  2048 481 182 109 201 55 279 1,307 1,572	510 190 109 201 57 291 1,358 1,646 11.78 2049 478 181 108 201 55 279 1,303 1,574	511 190 109 201 57 293 1,360 1,658 11.68 2050 477 181 108 201 55 280 1,300 1,577

Table F-3 Operational Expenditure Forecasts

F-4 ENR Cost and Revenue Identification Update - Final.docx



## 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 Extended Northern 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 decreases in non-aeronautical revenue in 2027, 2029, and 2032-2034 under the Global Fragmentation Carbon Capped demand scenario; and
- 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 (Figures G-1 and G-2) and summary tables (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

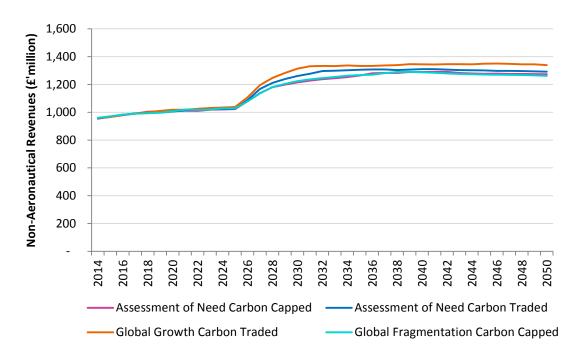


Figure G-1 Heathrow Airport Northern Runway Extension Scheme Forecast Non-Aeronautical Revenue (Risk Adjusted and Optimism Bias)



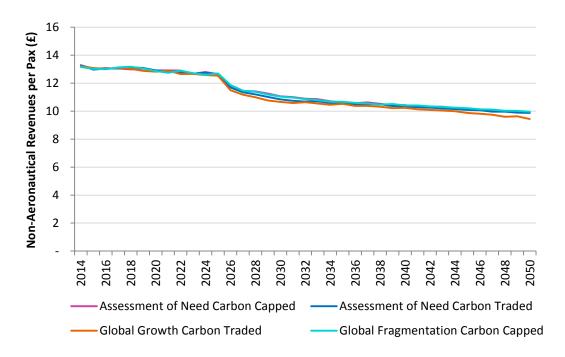


Figure G-2 Heathrow Airport Northern Runway Extension Scheme Forecast Non-Aeronautical Revenue per Passenger (Risk Adjusted and Optimism Bias)

Table G-1, on the following page, sets out the independent forecasts for each demand scenario.



2014 real prices in £'million  Assessment of Need Carbon Capped	Total	2014	2015	2016	2017	2018	2019	2020	2021	2022	2022	2024	2025	2026	2027	2028	2020	2020	2021	2022	2022	2024	2025	2026	2027	2020	2020	2040	2041	2042	2042	2044	2045	2046	2047	2048	2040	20
•	3,569	65	66	68	70			74		77	70	80	82	87		99		102	104	105	106	107	108		110					112			112					
Car parking Total retail	21,520	404	400	417	423	72	73 435	438	76	444	450	455	458	486	95 530	559	101 578	102	608	620	629	639	652	110 665	672	110 676	111	111 690	112	500	112 696	111	600	112 703	706	113 709	113 712	71
Duty and tax-free	7,695	129	131	135	137	141	143	144	146	147	150	152	456 154	166	184	197		212	219	224		233	239	245	248	250	255	25 <i>7</i>	258	260	259	260	261	262	264	265	266	26
Other retail	11,701	236	238	242	244		250	251		254	256	152	260	272	202	306	205	213	329		228	233	348	245	357		364	366	258	200	368		261	371		265 374	200 376	37
Food and beverage	2,125	40	238	41	244	248	42	251	253	254 43	250	258	200	40	292	56	315	322	329 61	334	338	343 64	348	354	357	359	304	300	307	309	308	369	370	3/1	373	3/4	376 70	37 7
•			40		42	42		43	43		44	44	44	48	33		38	116		116	03	0.	116	117	117	117	08	08	117	117	08	09	09	117	117	117	, 0	
Property rental	4,240	108	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	11
Rail	7,536	124	126	130	134	138	140	143	145	147	152	153	157	172	18/	194	199	204	209	214	217	222	227	232	234	237	242	245	249	252	253	256	258	263	265	269	272	27
Other revenue	9,884	253	253	253	253	253	253	253	253	252	252	252	252	264	264	272	272	272	274	274	274	273	273	277	277	277	277	277	276	276	276	276	275	275	275	275	275	27
Non-aero	46,750	955	966	979	990	1,005	•	1,019	,	1,031	•	•	•	•	•	•	,	•	•	1,328	•	•	•	•	•	1,417	1,433	•	1,448	1,455	•	•	1,462	1,471	•	•	1,489	,
Non-aero (incl. Risk & OB)	43,253	955	966	979	990	1,005	•	1,009	,-	•	•	•	•	1,079	•				1,228				1,264	•	•	1,282	•	•	1,290	•	•	•	•	•	1,276	•	1,275	,
Non-aero/pax (£)		13.28	13.04	13.08	13.05	12.98	13.04	12.91	12.91	12.91	12.67	12.80	12.64	11.84	11.45	11.42	11.25	11.06	11.01	10.89	10.86	10.71	10.62	10.57	10.62	10.52	10.43	10.44	10.32	10.31	10.32	10.22	10.20	10.09	10.11	9.99	9.99	9.9
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	205
Carparking	3,661	65	66	68	70	71	72	74	76	78	80	81	82	88	98	103	106	108	110	112	112	113	113	113	113	113	113	114	114	114	114	114	115	115	115	115	115	11
Total retail	21,998	404	411	420	424	427	430	435	443	449	455	457	459	491	543	579	603	624	641	655	663	670	678	684	689	691	697	704	708	709	711	713	716	717	721	724	726	72
Duty and tax-free	7,898	129	132	136	138	140	141	143	147	149	152	153	154	167	190	205	216	225	232	239	243	246	250	253	255	257	260	263	264	265	266	267	268	268	270	272	272	27
Other retail	11,919	236	239	243	245	246	247	250	253	256	258	260	261	274	298	315	326	335	343	350	353	356	360	363	365	366	369	372	374	374	375	376	377	378	380	381	382	38
Food and beverage	2,180	40	41	41	42	42	42	42	43	44	44	44	44	49	55	59	61	63	65	66	67	67	68	68	68	68	69	70	70	70	70	70	71	71	71	71	72	7
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	11
Rail	7,734	124	127	131	134	136	138	142	146	150	153	155	157	175	193	203	210	216	222	228	230	234	236	239	242	243	247	251	254	257	259	262	266	268	272	275	278	28
Other revenue	9,921	253	253	253	253	253	253	253	253	252	252	252	252	264	273	273	274	274	274	278	278	278	278	278	277	277	277	277	277	276	276	276	276	276	275	275	275	27
Non-aero	47,561	955	969	983	992	998	1,003	1,015	1,029	1,040		1,056			1.222	1,274		1.339						1.432					1,470	1.474	1.478	1,483	1.489	1,493			1,512	
Non-aero (incl. Risk & OB)	43,993	955	969	983	992	998	998	1.005	,	1,020	•					1,212										1,303		1,311	•	•	•	1,302	•				1,295	,
Non-aero/pax (£)	•		12.97			13.14	13.09	,	, -	,	•	•	,	,	,	11.20	,	•	•	•	•	•	•	•	•	•	,	•	•	,	•	,	•	,	9.96	9.97	9.89	9.8
Global Growth Carbon Traded	Total															2028																						
Carparking	3,805	66	66	68	70	71	73	76	77	79	81	82	84	91	101	108	112	115	117	117	117	117	117	116	117	117	118	118	119	119	120	120	121	122	123	123	124	12
Total retail	22,673	405	410	418	424	429	437	444	446	452	458	463	468	503	560	601	631	655	673	680	684	693	696	701	709	715	725	729	731	736	740	743	749	753	754	752	757	75
Duty and tax-free	8,189	129	132	135	138	140	144	147	148	150	154	156	158	172	197	214	227	238	246	250	252	256	258	260	264	267	271	273	274	277	278	279	282	284	285	284	286	28
Other retail	12,223	236	238	242	244	247	250	254	255	257	260	262	264	280	306	325	339	350	358	362	363	367	369	371	374	377	381	383	384	387	388	390	392	394	394	393	395	39
Food and beverage	2,260	40	40	41	41	42	43	43	43	44	45	45	45	51	57	61	64	67	69	69	69	70	70	70	71	71	72	72	73	73	74	74	75	75	75	75	75	7.
Property rental	4,250	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	117	11
Rail	8,051	125	126	131	133	137	142	145	147	152	154	158	161	181	201	212	222	229	235	237	239	243	243	246	250	253	258	260	264	268	272	275	281	286	290	295	298	30
Other revenue	9,944	253	253	253	253	253	253	253	253	253	252	252	252	264	273	275	275	279	279	279	279	278	278	278	278	278	278	277	277	277	277	276	276	276	276	276	276	27
Non-aero	48,722	958	966	981	990	1,001	1,016	1,029	1,033	1,046	1,057	1,066	1,075	1,153	1,250	1,312	1,356	1,395	1,421	1,430	1,436	1,449	1,451	1,459	1,471	1,480	1,496	1,502	1,508	1,518	1,525	1,532	1,544	1,554	1,559	1,563	1,571	1,57
Non-aero (incl. Risk & OB)	45,043	958	966	981	990	1,001	1,011	1,019	1,018	1,025	1,031	1,034	1,038	1,107	1,195	1,248	1,283	1,313	1,331	1,334	1,332	1,337	1,333	1,333	1,337	1,339	1,346	1,345	1,344	1,346	1,346	1,345	1,349	1,350	1,348	1,345	1,345	1,33
Non-aero/pax (£)		13.21	13.08	13.01	13.09	13.03	12.88	12.82	12.89	12.65	12.67	12.58	12.54	11.50	11.18	10.99	10.77	10.67	10.58	10.63	10.54	10.45	10.52	10.38	10.37	10.32	10.22	10.23	10.13	10.09	10.04	10.00	9.87	9.81	9.75	9.60	9.63	9.4
	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	205
Global Fragmentation Carbon Capped				68	69	70		74		78	79	81	83	87	95	99	102	103	105	106	107	108	109		110			111									112	
Global Fragmentation Carbon Capped Car parking	3,569	66	67								451	459	462	486	529	560	581	600	614	625	635	647	655	661	670	681	687	689	690	690	691	693	695	698	700	703	706	70
Car parking	3,569		07		424	425	429	437	446	449				400	323	107	207	215	221	226	231	236	240	243	247	252	255	256	257	257			259	260	261	263	264	26
Car parking Total retail	3,569 21,516	406	413	420	424 138	425 138	429 140	437	446 148	449 150		151	156	165	121			213	221	220	231	230	240			232	233	230	237							203	204	
Car parking Total retail Duty and tax-free	3,569 21,516 7,693	406 130	413 133	420 136	138	425 138	140	144	446 148	150	151	154	156 262	165 272	184 292	197 306		225	221	226	2/11	216	350		257	261	261	365	366	257	257 366	258 367		360		277	272	27
Car parking Total retail Duty and tax-free Other retail	3,569 21,516 7,693 11,699	406 130 237	413	420 136 243	138 245	425 138 245	140 247	144 250	446 148 255	150 256	151 257	154 260	262	272	292	306	316	325 60	331 62	336	341	346	350 65	353	357	361 67	364	365	366	366	366	258 367	368	369	370	372		37.
Car parking Total retail Duty and tax-free Other retail Food and beverage	3,569 21,516 7,693 11,699 2,124	406 130 237 40	413 133 239 41	420 136 243 41	138 245 41	245 41	140 247 42	144 250 43	255 44	150 256 44	151 257 44	260 45	262 45	272 48	292 53	306 56	316 58	60	62	63	341 64	65	65	66	66	67	68	68	68	366 68	366 68	367 68	368 68	369 69	370 69	69	69	7
Car parking Total retail Duty and tax-free Other retail Food and beverage Property rental	3,569 21,516 7,693 11,699 2,124 4,240	406 130 237 40 108	413 133 239 41 111	420 136 243 41 111	138 245 41 111	245 41 111	140 247 42 111	144 250 43 111	255 44 111	150 256 44 111	151 257 44 111	260 45 111	262 45 111	272 48 114	292 53 114	306 56 116	316 58 116	<i>60</i> 116	<i>62</i> 116	<i>63</i> 116	341 64 116	<i>65</i> 116	<i>65</i> 116	66 116	<i>66</i> 117	<i>67</i> 117	68 117	<i>68</i> 117	68 117	366 68 117	366 68 117	367 68 117	368 68 117	369 69 117	370 69 117	<i>69</i> 117	<i>69</i> 117	<i>7</i> 11
Car parking Total retail  Duty and tax-free  Other retail  Food and beverage Property rental	3,569 21,516 7,693 11,699 2,124 4,240 7,532	406 130 237 40 108 126	413 133 239 41 111 127	420 136 243 41 111 131	138 245 41 111 133	<ul><li>245</li><li>41</li><li>111</li><li>135</li></ul>	140 247 42 111 138	144 250 43 111 143	255 44 111 148	150 256 44 111 149	151 257 44 111 152	260 45 111 156	262 45 111 158	272 48 114 172	292 53 114 187	306 56 116 195	316 58 116 201	60 116 206	62 116 211	63 116 216	220	65 116 225	65 116 227	66 116 230	66 117 235	67 117 240	68 117 242	68 117 244	68 117 246	366 68 117 249	366 68 117 251	367 68 117 254	368 68 117 257	369 69 117 260	370 69 117 263	69 117 266	69 117 269	7 11 27
Car parking Total retail  Duty and tax-free  Other retail  Food and beverage Property rental Rail Other revenue	3,569 21,516 7,693 11,699 2,124 4,240 7,532 9,882	406 130 237 40 108 126 253	413 133 239 41 111	420 136 243 41 111 131 253	138 245 41 111 133 253	245 41 111 135 253	140 247 42 111 138 253	144 250 43 111 143 253	255 44 111 148 253	150 256 44 111 149 252	151 257 44 111 152 252	260 45 111 156 252	262 45 111 158 252	272 48 114 172 264	292 53 114 187 264	306 56 116 195 272	316 58 116 201 272	60 116 206 274	62 116 211 274	63 116 216 274	220 274	65 116 225 274	65 116 227 273	66 116 230 273	66 117 235 277	67 117 240 277	68 117 242 277	68 117 244 277	68 117 246 276	366 68 117 249 276	366 68 117 251 276	367 68 117 254 276	368 68 117 257 275	369 69 117 260 275	370 69 117 263 275	69 117 266 275	69 117 269 275	7 11 27 27
Car parking Total retail  Duty and tax-free  Other retail  Food and beverage Property rental Rail Other revenue Non-aero	3,569 21,516 7,693 11,699 2,124 4,240 7,532 9,882 46,738	406 130 237 40 108 126 253 <b>960</b>	413 133 239 41 111 127 253 <b>971</b>	420 136 243 41 111 131 253 984	138 245 41 111 133 253 990	245 41 111 135 253 <b>993</b>	140 247 42 111 138 253 1,002	144 250 43 111 143 253 1,018	255 44 111 148 253 1,035	150 256 44 111 149 252 1,039	151 257 44 111 152 252 1,045	260 45 111 156 252 1,059	262 45 111 158 252 <b>1,065</b>	272 48 114 172 264 <b>1,122</b>	292 53 114 187 264 <b>1,188</b>	306 56 116 195 272 1,242	316 58 116 201 272 1,273	60 116 206 274 <b>1,300</b>	62 116 211 274 1,319	63 116 216 274 1,337	220 274 <b>1,352</b>	65 116 225 274 <b>1,369</b>	65 116 227 273 <b>1,381</b>	66 116 230 273 1,390	66 117 235 277 <b>1,409</b>	67 117 240 277 <b>1,426</b>	68 117 242 277 <b>1,434</b>	68 117 244 277 <b>1,438</b>	68 117 246 276 <b>1,441</b>	366 68 117 249 276 <b>1,443</b>	366 68 117 251 276 <b>1,446</b>	367 68 117 254 276 <b>1,451</b>	368 68 117 257 275 <b>1,455</b>	369 69 117 260 275 1,461	370 69 117 263 275 <b>1,467</b>	69 117 266 275 <b>1,473</b>	69 117 269 275 <b>1,478</b>	7 11 27 27 <b>1,48</b>
Car parking Total retail  Duty and tax-free  Other retail  Food and beverage Property rental  Rail Other revenue	3,569 21,516 7,693 11,699 2,124 4,240 7,532 9,882	406 130 237 40 108 126 253	413 133 239 41 111 127	420 136 243 41 111 131 253	138 245 41 111 133 253	245 41 111 135 253	140 247 42 111 138 253 1,002	144 250 43 111 143 253 1,018	255 44 111 148 253 1,035	150 256 44 111 149 252 1,039	151 257 44 111 152 252 1,045	260 45 111 156 252 1,059	262 45 111 158 252 <b>1,065</b>	272 48 114 172 264 <b>1,122</b>	292 53 114 187 264 <b>1,188</b>	306 56 116 195 272	316 58 116 201 272 1,273	60 116 206 274 <b>1,300</b>	62 116 211 274 1,319	63 116 216 274 1,337	220 274 <b>1,352</b>	65 116 225 274 <b>1,369</b>	65 116 227 273 <b>1,381</b>	66 116 230 273 1,390	66 117 235 277 <b>1,409</b>	67 117 240 277 <b>1,426</b>	68 117 242 277 <b>1,434</b>	68 117 244 277 <b>1,438</b>	68 117 246 276 <b>1,441</b>	366 68 117 249 276 <b>1,443</b>	366 68 117 251 276 <b>1,446</b>	367 68 117 254 276 <b>1,451</b>	368 68 117 257 275 <b>1,455</b>	369 69 117 260 275 1,461	370 69 117 263 275 <b>1,467</b>	69 117 266 275 <b>1,473</b>	69 117 269 275 <b>1,478</b>	7 11 27 27 <b>1,48</b>

Table G-1 Non-Aeronautical Revenue Forecasts

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# 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 Extended Northern Runway scheme following consultation.

#### 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.



Heathrow Hub																																							
Highway/Local Road/Rail	Route	Length (		Estimated (				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	20
				m) (£'million)			(£'million)																																
lighway	M4 J3 to J4	3.8	5	50.0 1	90.0 -	83.6	273.6	-	-	-	-	63.3	63.3	63.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Highway	M4 Airport Spur	2.8	9	50.0 1	40.0 -	61.6	201.6	-	-	-	=.	70.0	70.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Highway	M4 J2 to J3	17.6	5	50.0 8	80.0 -	387.2	1,267.2	-	-	-	=	293.3	293.3	293.3	=	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	=	-	-
Highway	M4 J4 and J4B	4.7	5	50.0 2:	35.0 -	103.4	338.4	-	-	-	-	-	117.5	117.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Highway	M4	-	15	50.0 1	50.0 -	66.0	216.0	-	-	-	-	-	75.0	75.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Highway	M4	-	4	40.0	40.0 -	17.6	57.6	-	-	-	-	-	20.0	20.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Highway	M4	-	4	40.0	40.0 -	17.6	57.6	-	-	-	-	-	20.0	20.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Highway	M25	4.0	15	50.0 6	- 0.00	264.0	864.0	-	-	-	200.0	200.0	200.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Local Road	Tunnel from A4 to T5	2.1	2	20.0	42.0 -	18.5	60.5	-	-	-	-	21.0	21.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Local Road	Western Tunnel	3.0	2	20.0	- 0.00	26.4	86.4	-	-	-	-	30.0	30.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Local Road	Airport Way/Southern Perimeter Road Interchange	1.0	3	35.0	35.0 -	15.4	50.4	-	-	17.5	17.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Local Road	Southern Road Tunnel/Southern Perimeter Road Interchange	1.0	2	20.0	20.0 -	8.8	28.8	-	-	10.0	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Local Road	M25 J13 (A13) D2	3.9	2	25.0	97.5 -	42.9	140.4	-	-	-	-	48.8	48.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Local Road	M25 J13 (A13)	-	3	35.0	35.0 -	15.4	50.4	-	-	-	-	17.5	17.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Local Road	A4 Access	2.7	1	15.0	40.5 -	17.8	58.3	-	-	-	-	20.3	20.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rail	SRA to Staines	-	48	87.5 4	87.5 -	321.8	809.3	-	-	-	162.5	162.5	162.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total		-		- 3,0	92.5 -	1,468.0	4,560.5	-	-	39.6	597.4	1,370.2	1,705.0	848.4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Highway Maintenance	Source: Highways Agency website inflated from 2011/12	32.9		0.0	1.5 -	-	-																																
Local Road Maintenance	Source: Highways Agency website inflated from 2011/12	13.7		0.1	0.8 -	-	-																																
Total Road Maintenance /year	r	=		-	2.3 -	1.0	3.3	-	-	-	-	0.16	0.16	1.56	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.28	3.7
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	13.7		0.0	0.4 -	-	-																																
Total Road Opex /year		-		-	1.9 -	0.8	2.72	-	-	-	-	0.09	0.09	1.03	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.72	2.
Rail Maintenance /year	Source: LeighFisher analysis	-	1	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.
Rail Opex /year	Source: LeighFisher analysis	_	19	9.80 1	9.80 -	8.12	27.92			_			-	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.92	27.

Table H-1 Summary Costs

Heathrow Hub	Total 2014-50	) 2	014 2015	2016 20	017 201	8 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	Total
Roads																																						
Capex	2,605.0	•	- <b>"</b> -	'. <b>'</b> .	· *-	· ·	· -	27.5	227.5	764.2	996.7	589.2	- "	- "	- "	- "			- "	- "	- "	- "	- "	- "	- "	- "	-	-	-	-	-	-	-	-	-	-	-	2,605
Asset Replacement Cape	58.3				-	-	-	-	-	0.1	0.1	1.1	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3	58
Opex	48.1				-	-	-	-	-	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	48
Rail																																						
Capex	487.5				-	-	-	-	162.5	162.5	162.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	488
Asset Replacement Cape	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	46
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	515
Risk on Capex	-				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	=	-	-	-	-	-	-	=
Optimism Bias on Capex	1,523.6				-	-	-	12.1	207.4	443.5	545.8	260.9	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	2.2	1,524
Risk on Opex	-				-	-	-	-	-	=.	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	=
Optimism Bias on Opex	232.2				-	-	-	-	-	0.0	0.0	8.4	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	232
Total Capex (inc. Risk & C	B) 4,720.0				-	-	-	39.6	597.4	1,370.3	1,705.1	852.9	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	6.2	4,720
Total Opex (inc. Risk & O	3) 795.2				-	-	-	-	-	0.1	0.1	29.0	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	795

Table H-2 Summary Outputs

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