Department for Transport

Addendum to the Updated Appraisal Report

Airport Capacity in the South East

Moving Britain Ahead

June 2018

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1. Introduction

1.1 This is an addendum to the "Updated Appraisal Report" (UAR)[1], which was first published by the Government on 24 October 2017, as part of the suite of documents presented alongside the "Revised draft Airports National Policy Statement: new runway capacity and infrastructure at airports in the South East of England".[2] The UAR is an updated version of the "Further Review and Sensitivities Report" (FRSR),[3] detailing the economic and strategic assessment of each of the three shortlisted schemes for increasing airport capacity in the South East of England.

1.2 Since the UAR was published, we have identified two issues with the analysis. Following scrutiny by the Transport Committee in early 2018, the Department found that in updating its air quality analysis for the purposes of the UAR, there was an unintended omission in monetising some health impacts.[4] Additionally, we have since identified a minor error in the modelling of surface access trips and as a result, the associated monetised carbon emissions.

1.3 This addendum addresses both of these issues, presenting revised estimates of air quality and carbon emissions. While the changes are small in magnitude compared to the overall costs and benefits of the schemes, they do mean that the various summary metrics for each scheme need to be updated as well. These changes do not have a significant impact on the economic case of each scheme, relative to total costs and benefits. Furthermore, the changes do not alter the relative rankings of each scheme under any of the revised summary metrics.

1.4 This addendum should be read in conjunction with the UAR. Chapters 2 to 4 of the addendum refer to the sections of the UAR that have been replaced to address these two issues. These sections contain revised estimates and where helpful to the reader, additional text has been added to understand how the revisions have been made, and what the implications are. Each of these chapters begins with an overview of the issue that has generated the revisions, in *italics*.

[1] https://www.gov.uk/government/publications/airport-expansion-updated-cost-and-benefits-appraisal
[2] https://www.gov.uk/government/publications/revised-draft-airports-national-policy-statement
[3] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/562160/further-review-and-sensitivities-report-airport-capacity-in-the-south-east.pdf
[4] https://www.parliament.uk/documents/commons-committees/transport/Letter-from-Chris-Grayling-MP-to-Committee-Chair-re-Airports-NPS-revised-draft-23-2-2018.pdf

2. Changes to Section 8: Environmental impacts

Carbon

Emissions from surface access, airport operations, and construction

2.1 *To update estimates of CO2 emissions from surface access trips[5] in the UAR, the Department used estimates of passenger trips from the Department's surface access models. After publication, we identified a minor error in the surface access models, which once corrected provides revised estimates of passenger trips (these revisions are shown in Annex A, page 14 of this Addendum). Using these revised passenger trips, we have updated our estimate of CO2 emissions from surface access, shown in Table 2.1 below (which updates Table 8.2 on page 38 of the UAR). The revised trips lead to a relatively small increase in the cost of carbon emissions: London Gatwick (LGW) Second Runway by £4.3m, London Heathrow (LHR) Extended Northern Runway by £19.3m and LHR Northwest Runway by £21.9m. The Appraisal of Sustainability (AoS) also reports CO2 emissions from surface access by scheme. We have therefore updated the relevant tables in the AoS, and those changes are reflected in the updated change log for the AoS.* [6]

Table 2.1 Cumulative carbon impacts by 2084/5 under Airport Commission's (AC) assessment of need, carbon traded forecasts (present value, £m, 2014 prices)

		Carbon assessment findings, change in $MtCO_2$* over the appraisal period				Value of monetised carbon impacts (present value, £m, 2014 prices)			
		Surface access	Airport operations	Construction*	**Total**	Surface access	Airport operations	Construction	**Total**
LGW Second Runway	**FRSR (AC Forecasts)**	10.1	1.1	3.9	**15.1**	-650.5	-71.0	-146.6	**-868.1**
	DfT17	9.7	1.2	3.9	**14.9**	-449.1	-67.5	-146.6	**-663.2**
LHR Extended Northern Runway	**FRSR (AC Forecasts)**	6.3	2.1	10.1	**18.5**	-393.8	-125.2	-229.6	**-748.6**
	DfT17	8.1	2.2	10.1	**20.3**	-374.5	-114.7	-229.6	**-718.8**
LHR Northwest Runway	**FRSR (AC Forecasts)**	7.4	2.6	11.3	**21.2**	-467.7	-155.9	-253.0	**-876.7**
	DfT17	9.5	2.7	11.3	**23.6**	-442.2	-144.7	-253.0	**-839.9**

*Construction emissions are calculated as $MtCO_2(e)$

[5] These figures do not take account of potential traffic mitigation measures, or of the requirements in the revised draft National Policy Statement on increasing public transport mode share, or any additional measures that could be taken by a scheme promoter to mitigate surface access impacts.

[6] The tables have also been updated to correct a drafting error where total emissions for Heathrow Extended Runway were misreported.

Air quality

2.2 *To address the air quality monetisation issue, we have set out below an updated version of the "Air quality" section in the UAR. Following scrutiny by the Transport Committee in early 2018, the Department found that in updating its air quality analysis for the publication of the UAR, there was an unintended omission in monetising some health impacts. The approach set out in the UAR assessed the health impacts on populations living within 2km of the expanded airport, but failed to assess impacts on those people living outside of this area. This section therefore addresses this omission and replaces the original "Air quality" section in the UAR (paragraphs 8.25-8.29, pages 39-40 of the UAR).*

2.3 The AC's approach monetised the aggregated effect of nitrogen dioxide and particulate matter emissions. Since the AC's final report, the Department for Environment, Food and Rural Affairs (Defra) has published new guidance allowing the direct effect of exposure to nitrogen dioxide and particulate matter to be quantified and monetised.[7] The guidance sets out an approach of valuing changes in pollutant concentrations directly, as well as updating the estimates of damage costs associated with these pollutants.

2.4 The FRSR provided a sensitivity test of the impact of using the latest guidance on the estimated air quality impacts of each scheme for the high demand scenario only.[8] The air quality valuation for each scheme using this revised approach and the AC's forecasts is reported in Table 2.2 alongside the AC's previous estimates. It should be noted that these figures are not directly comparable as the sensitivity only includes air quality impacts within the 2km radius of the airport for which detailed air quality modelling was undertaken.

Table 2.2 Cumulative monetised air quality impacts by 2084/5 under the AC's forecasts (present value, £bn, 2014 prices)

	FRSR*	FRSR sensitivity+ (based on latest Defra guidance)		
	Total	PM_{10}	NO_2	Total
LGW Second Runway	**-0.2**	-0.03	-0.02	**-0.05**
LHR Extended Northern Runway	**-0.5**	-0.06	-0.02	**-0.08**
LHR Northwest Runway	**-0.8**	-0.07	-0.03	**-0.10**

* estimated for the AC's assessment of need, carbon traded forecasts
\+ estimated for the AC's high demand forecasts

2.5 Even though the figures are not directly comparable, it is noticeable how much lower the monetised impacts under the revised approach are than the AC's original estimates presented in the FRSR, despite the damage costs being higher. This reflects the use of the dispersion modelling (within the 2km zone only) in the revised approach, which better maps the relationship between emissions and concentrations, and so provides an improved approach to identifying impacts on affected populations.

[7] https://www.gov.uk/guidance/air-quality-economic-analysis
[8] https://www.gov.uk/Government/publications/airport-expansion-further-review-and-sensitivities-report p72. The high demand scenario is low-cost is king, carbon traded for the LGW Second Runway scheme and global growth, carbon traded for the Heathrow expansion schemes.

2.6 We have updated the assessment and economic valuation of air quality impacts using DfT17 forecasts for both aviation passenger and surface access demand (these values are the same for both carbon traded and carbon capped scenarios). We have revised our approach to ensure it captures health impacts from worse air quality not just around the airport, but also around the wider study area where additional passenger road trips have been identified.

2.7 The updated monetisation relies on revised estimates of the impact of expansion on air quality to take account of the latest demand forecasts. Further detail on the methodology employed to do this and the revised changes in air quality impacts can be found in the update to air quality re-analysis report, published alongside this report. These impacts are further set out in the AoS.[9]

2.8 This update applies both an impact pathway and damage cost approach. The impact pathway approach values changes in concentrations directly, consistent with Defra's latest guidance, making use of the dispersion modelling undertaken for the AC. This corresponds to emissions occurring within a 2km radius of the expanded airport. These results are set out in Table 2.3 below. They are estimated by applying the scaling factors developed for the air quality reanalysis to adjust the values presented as the sensitivity analysis in Table 2.2.

Table 2.3 Cumulative monetised air quality impacts inside the 2km study area by 2084/5, DfT17 high demand forecasts (present value, £bn, 2014 prices)

	Total
LGW Second Runway	-0.05
LHR Extended Northern Runway	-0.11
LHR Northwest Runway	-0.15

2.9 We then apply a damage cost approach to monetise the air quality impacts from additional passenger trips, which captures emissions outside of the 2km study area (but also will include emissions from passenger trips inside this area, so there is some double-counting of these impacts). This is reasonable because we are monetising roadside emissions for which specific damage cost values have been derived by applying an impact pathway approach to the same roadside locations. For example, Defra publish damage cost values for transport emissions in Outer London which have been estimated by modelling how a change in emissions in Outer London would change local air concentrations, and estimating the health impacts of this change in concentrations by taking account of local populations. Applying the appropriate damage cost value should therefore provide a very good approximation of the actual value of additional emissions occurring on these Outer London roads.

2.10 We apply the scaling factors developed for the air quality re-analysis to the estimates of emissions from passenger trips developed for the AC. These

[9] Appraisal of Sustainability: Draft Airports National Policy Statement. Appendix A-8: Air Quality. Available from: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/659921/aos-revised-draft-airports-nps-appendix-a01-to-a12-topic-based-schemes-assessment-and-change-logs.zip

emissions are then monetised using Defra's updated low, central and high damage costs[10] respectively, to demonstrate the full range of air quality costs. These are shown in Table 2.4.

Table 2.4 Cumulative monetised air quality impacts outside the principal study area by 2084/5, DfT17 high demand forecasts (present value, £bn, 2014 prices)

	Low damage cost	Central damage cost	High damage cost
LGW Second Runway	-0.02	-0.03	-0.04
LHR Extended Northern Runway	-0.24	-0.37	-0.48
LHR Northwest Runway	-0.20	-0.32	-0.44

2.11 Table 2.5 shows the total air quality costs, including all emissions both inside and outside the 2km principal study area. It uses the central damage cost estimates for the air quality impacts from outside the principal study area. The results, despite using higher estimates for the cost of poor air quality, are still lower than the AC's estimates. This is largely due to applying the impact pathway approach in the 2km principal study area which provides a much better estimate of how emissions transfer into changes in air quality concentrations, which in turn affect people's health. Applying the impact pathway approach reduces the overestimation which occurs when applying a damage cost approach to airside emissions. This occurs because the damage cost values are based on the assumption that these emissions occur close to where people live, which while appropriate for roadside emissions, is not appropriate for airside emissions.

2.12 The two Heathrow schemes have significantly larger impacts than the LGW Second Runway scheme, but for all three schemes these costs are very small in comparison with the benefits, and other impacts considered in the economic appraisal. Subsequent to the AC's analysis, the promoter of the LHR Extended Northern Runway scheme put forward alternative improved surface access plans. Whilst these have not been considered in the analysis, it is expected that these updated plans would lead to a reduction in the air quality impacts outlined in this assessment.

2.13 These values are likely to be an overestimate, because the analysis uses the high passenger demand scenario (the more likely, central scenario would produce lower impacts), and the analysis does not account for any additional mitigation measures to reduce additional traffic. The damage cost estimates value passenger trips within and outside the 2km area, so double count the impact of those emissions within the 2km area which are captured in the impact pathway approach. Moreover, when both NOx and PM10 are valued separately the resulting costs will overestimate the

[10] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/460398/air-quality-econanalysis-damagecost.pdf

true amount because it is not possible to accurately disentangle the health impacts of each pollutant. Latest Defra guidance is that estimates of NOx should be reduced by a factor of between 0.25 and 0.55 to adjust for this risk of double-counting. In the Department's updated IPA, a smaller factor of 0.16 was applied. This is very conservative and leads to higher estimates than Defra's latest guidance.

Table 2.5 Cumulative monetised air quality impacts by 2084/5, DfT17 high demand forecasts (present value, £bn, 2014 prices)

	Total (using central cost estimates)
LGW Second Runway	-0.08
LHR Extended Northern Runway	-0.48
LHR Northwest Runway	-0.47

3. Changes to Section 9: Combined impact of costs and benefits

Updating metrics with the latest forecasts

3.1 *As a result of the changes to the carbon and air quality impacts, the summary metrics also need to be updated. The metrics affected are total environmental disbenefits, the net public value, the net social benefit and the net present value of each scheme. We have updated all the tables and charts where these metrics are presented. This includes Table 9.2, on page 44 of the UAR, replaced by Table 3.1 below.*

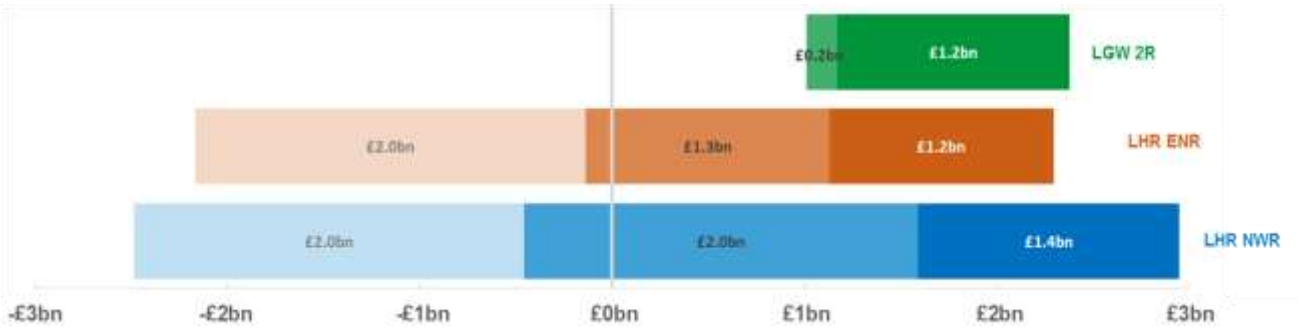
Table 3.1 Monetised impacts under the DfT17 central, carbon traded forecasts and revised methodologies (present value, £bn, 2014 prices)

	LGW Second Runway	LHR Extended Northern Runway	LHR Northwest Runway
Passenger benefits	69.4	57.2	67.6
Government revenue	4.6	2.9	3.5
Wider economic impacts	0.1 to 1.3	1.6 to 2.7	1.8 to 3.1
Total benefits to passengers and the wider economy	**74.1 to 75.3**	**61.7 to 62.8**	**72.8 to 74.2**
Environmental disbenefits*	-0.9	-1.5	-1.9
Net public value ^	**72.5 to 74.3**	**56.2 to 61.3**	**67.4 to 72.2**
Airline profit loss	-65.1	-46.4	-55.0
Net social benefit	**8.0 to 9.2**	**13.7 to 14.9**	**15.8 to 17.2**
Scheme cost (AC forecasts)	-6.4 to -6.3	-12.0 to -10.7	-14.9 to -12.9
Surface access cost (AC forecasts)	-0.6	-3.9 to -1.9	-3.4 to -1.4
Net Present Value ^	**1.0 to 2.4**	**-2.2 to 2.3**	**-2.5 to 2.9**

* All impacts other than air quality are modelled for the central demand scenario. Air quality is monetised using the high demand scenario. These impacts are relatively very small, so do not impact on the summary metrics.
^ Scheme and surface access costs are based on AC forecasts.

3.2 *As a result of the summary metrics changing, we have also revised Figure 9.2, on page 45 of the UAR, which has been replaced by Figure 3.1 below.*

Figure 3.1 Scheme Net Present Value under the DfT17 central, carbon traded forecasts, with key areas of uncertainty (£bn, 2014 prices)



KEY: M4 uncertainty (Heathrow schemes only) | Scheme cost uncertainty | **Wider economic uncertainty**

Carbon capped metrics

3.3 *As a result of the summary metrics changing, we have also revised Table 9.3, on page 46 of the UAR, and replaced it with Table 3.2 below. The only metrics to have been revised in this change are the net social benefit, the net present value and the net public value of each scheme.*

Table 3.2 Appraisal metrics under the DfT17 central, carbon capped forecasts and revised methodologies (present value, £bn, 2014 prices)

	LGW Second Runway	LHR Extended Northern Runway	LHR Northwest Runway
Carbon abatement costs	-0.6	-0.6	-1.0
Total benefits to passengers and the wider economy *	**74.1 to 75.3**	**61.7 to 62.8**	**72.8 to 74.2**
Net social benefit	**7.5 to 8.7**	**13.2 to 14.3**	**14.9 to 16.2**
Net Present Value ^	**0.5 to 1.8**	**-2.7 to 1.7**	**-3.5 to 1.9**
Net public value ^ *	**72.5 to 74.3**	**56.2 to 61.3**	**67.4 to 72.2**

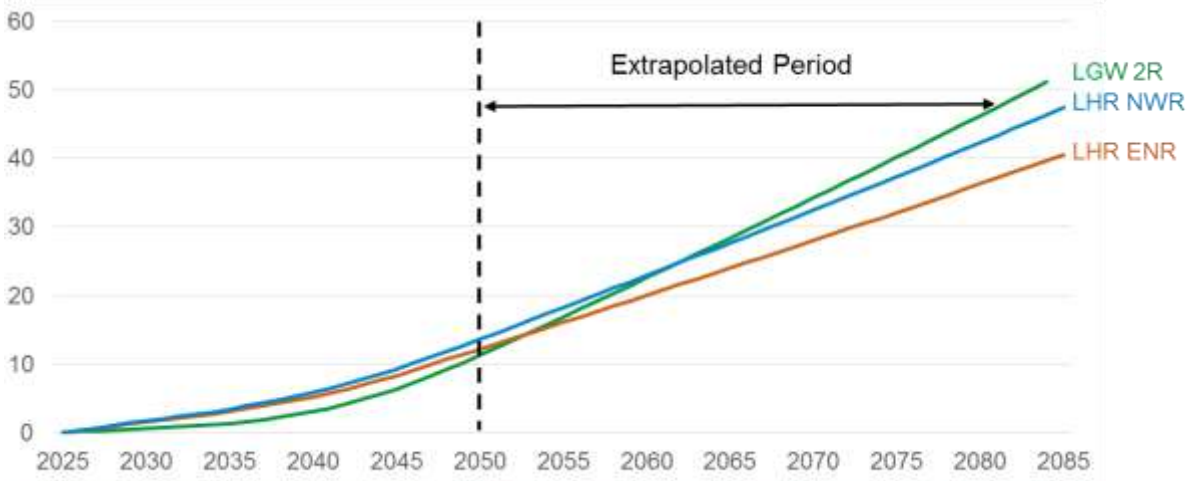
* As abatement costs aren't incorporated into the total benefits and net public value metrics, the estimates remain the same as under the carbon traded assumption.

^ Scheme and surface access costs are based on AC forecasts.

UK-only metrics

3.4 *As a result of the summary metrics changing, we have also revised Figure 9.4, on page 48 of the UAR, and replaced it with Figure 3.2 below. The only metric to have been revised in this change is the UK-only net public value. There have been no changes to the UK-only cumulative benefits to passengers and the wider economy, for any of the three schemes.*

Figure 3.2 UK-only cumulative benefits to passengers and the wider economy by forecast year, and UK-only net public value by 2084/5 (present value, £bn, 2014 prices) [11]



		Cumulative benefits to passengers and the wider economy				Net public value
		2030	2040	2050	2084/5	2084/5
LGW Second Runway	FRSR (AC Forecasts)	0.6	3.5	10.2	37.8 to 39.1	35.7 to 37.6
	DfT17	0.6	3.1	11.3	50.0 to 51.2	48.4 to 50.2
LHR Extended Northern Runway	FRSR (AC Forecasts)	1.3	5.8	11.7	32.4 to 34.0	25.8 to 31.2
	DfT17	1.6	5.3	12.2	39.4 to 40.6	34.0 to 39.0
LHR Northwest Runway	FRSR (AC Forecasts)	1.3	6.4	13.2	38.1 to 39.9	32.6 to 37.9
	DfT17	1.7	5.9	13.6	46.1 to 47.4	40.7 to 45.5

[11] For illustrative purposes, the chart in Figure 9.4 shows total benefits to passengers and the wider economy using the upper end of the wider economic impact range. The full range for 2084/5 is shown in the table.

4. Changes to Annex A: Economic appraisal, data and methodology updates

Non-flight carbon emissions

Surface Access

4.1 *Correcting the modelling error of passenger trips which are used in the assessment of the carbon surface access figures, we have revised tables A.1 to A.4 inclusive, on page 66 of the UAR, and replaced them with tables A.1 to A.4 below. The surface access modelling has been used solely to assess the carbon impacts of expansion, and has not been used to assess the impact of the schemes on the transport network. The figures do not take account of potential traffic mitigation measures, or of the requirements in the revised draft National Policy Statement on increasing public transport mode share, or any additional measures that could be taken by a scheme promoter to mitigate surface access impacts.*

Table A.1 Annual highway vehicle trips (car and taxi) by passengers and employees at Gatwick, DfT17 central forecasts (millions)

	Highway vehicle trips (millions)				
	2025	2026	2030	2040	2050
No Expansion	24.1	24.0	23.8	24.8	24.6
LGW Second Runway	25.1	26.3	29.5	36.1	45.3

Table A.2 Annual highway vehicle trips (car and taxi) by passengers and employees at Heathrow, DfT17 central forecasts (millions)

	Highway vehicle trips (millions)			
	2026	2030	2040	2050
No Expansion	61.0	63.2	67.2	71.4
LHR Extended Northern Runway	72.8	81.1	85.2	90.2
LHR Northwest Runway	72.8	83.8	87.9	93.9

Table A.3 Annual public transport trips by passengers and employees at Gatwick, DfT17 central forecasts (millions)

	Public transport trips (millions)				
	2025	2026	2030	2040	2050
No Expansion	23.5	23.4	23.7	26.7	28.5
LGW Second Runway	24.4	25.8	29.6	38.9	52.7

Table A.4 Annual public transport trips by passengers and employees at Heathrow, DfT17 central forecasts (millions)

	Public transport trips (millions)			
	2026	2030	2040	2050
No Expansion	38.1	40.1	44.7	48.7
LHR Extended Northern Runway	46.5	52.6	58.0	63.0
LHR Northwest Runway	46.5	54.5	60.0	65.8