Environmental Research and Consultancy Department

Environmental charging – review of impact of noise and NOx landing charges: update 2017

CAP 1576

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Contents

Summary

This review provides an update to our report *Environmental charging – Review of impact of noise and NOx landing charges* (CAP 1119) published in 2013, to highlight to what extent airports have followed CAP 1119 recommendations and used landing charges to incentivise airlines to use quieter aircraft types to improve their noise performance in order to share the benefit of new aircraft technology with local residents.

This report presents noise and emissions related charges in the intervening period since publication of CAP 1119, from 2014/15 to 2017/18.

Information is presented on how differential environmental charges have been applied at the three airports designated for noise management by the Secretary of State (Gatwick, Heathrow and Stansted) by considering their fleet mix with respect to aircraft noise category.

Recommendations are made regarding:

- Disaggregation of noise charging categories
- Earlier signalling of future charging levels
- Night time charging period
- Separation of noise charges for arrivals and departures
- Night period charging levels

Chapter 1

Introduction

1.1 In 2013, we reviewed noise-related and NOx emissions-related landing charging schemes for airports designated by the Secretary of State, namely Heathrow, Gatwick and Stansted airports as well as three non-designated airports (Manchester, East Midlands and Birmingham airports) for comparison. Our report *Environmental charging – Review of impact of noise and NOx landing charges* (referred henceforth as CAP 1119[1]) was published in October 2013.

1.2 The main finding of CAP 1119 was that differential environmental landing charges were unlikely to be the main financial driver for using quieter and less polluting aircraft although they do offer some incentives to operate quieter aircraft. We suggested that more appropriate charge differentials and earlier introduction of the higher charges for categories of aircraft that exhibit poor noise and NOx performance relative to emerging standards, could reasonably increase the incentive to shift to best-in-class aircraft. As such, we made seven recommendations to airports which we believe may improve the effectiveness of landing charging schemes.

1.3 This review provides an update to CAP 1119, to highlight where and where not airports have followed our recommendations:

a) Noise charging categories should be based on ICAO certification data, namely the margin to Chapter 3, to incentivise best-in-class.

b) Noise charging categories should be of equal width, typically 5 EPNdB, or narrower, to ensure adequate differentiation of noise performance.

[1] Environmental charging – Review of impact of noise and NOx landing charges. CAP 1119.UK Civil Aviation Authority (2013)

c) The noise charging categories used at a given airport should cover the full range of aircraft in operation at the airport. This range should be reviewed periodically and modified as appropriate.

d) Noise charges for operations occurring at night should be greater than those that occur during the day.

e) Where noise-related charge differentials occur depending on the time of day of an operation, the scheduled time of the operation should be used as oppose to the actual time. Penalties may be used to disincentivise operations scheduled to occur on the cusp of the night period that regularly fall into the night period.

f) There should be a clear distinction between noise-related landing charges and any non-noise-related charges, e.g. demand-related charges.

g) Charging schemes should ideally be harmonised across airports within the UK. Aircraft should be treated similarly from one airport to another, even if the charges at each airport are different.

1.4 As a first report on landing charges, CAP 1119 presented an historical background to landing charging, and to noise and emissions related charges in particular, in the context of general airport charges, the impact that it had on both airports and operators, the rationale for the charges and the benefits that were expected from noise and emissions related charges. It presented data from 2001 up to and including 2014, with a particular focus on the latest year (2013/14) and the proposed changes that the main airports were consulting at the time.

1.5 This report will present, in Chapter 2, background information on the main aspects of environmental landing charges that we address in this report, including a description of noise categories, and relevant legislation and guidance documents. In Chapter 3, a landing charges review and an analysis of the fleet by noise category at each designated airport with some derived conclusions is presented, in addition to a brief description on how the non-designated airports have addressed landing charges by

comparison. Chapter 4 addresses emission charges, and Chapter 5 presents a review of the current and proposed charging schemes against the recommendations we made in CAP 1119. Finally, Chapter 6 concludes with a summary of the main issues addressed and a set of final recommendations.

1.6 As an update report to CAP 1119, this revision is pursuant to the same environmental objectives in relation to DfT's Aviation Policy Framework at the designated airports as well as the environmental objectives of CAA's Five Year Strategic Plan[2].

[2] Our CAA Five Year Strategic Plan sets out how we propose to contribute to the development of the UK aviation sector over the five years from 2016–2021, what we want to achieve and how we plan to do it. It is available to view at https://www.caa.co.uk/Our-work/Corporate-reports/Strategic-Plan/Our-five-year-strategic-plan/

Chapter 2

Legislative drivers and guidance documents: update

2.1 CAP 1119 presented the legislative and guidance background relevant to landing charges. In this chapter, only a brief reminder is given, highlighting where changes have occurred in respect to legislative drivers, guidance documents, noise category definitions and NOx standards.

Legislative drivers

2.2 The legislative drivers regulating airport charges are, as stated previously in CAP 1119, as follows:

i. Civil Aviation Act 2006

ii. Airport Charges Directive (2009/12/EC)

iii. Airport Charges Regulations 2011

iv. Balanced Approach Directive (2002/30/EC)

v. UK Aerodrome Regulations

2.3 The only change since the publication of CAP 1119 is that the European Union (EU) Balanced Approach Regulations 2014[3] entered into force on 16 April 2016 repealing the Balanced Approach Directive (2002/30/EC). The Balanced Approach Regulations 2014 aim to facilitate the achievement of specific noise abatement objectives, and to enable the use of operating restrictions to achieve sustainable development of an airport.

[3] Regulation (EU) 598/2014 of the European Parliament and the Council of 16 April 2014 on the establishment of rules and procedures with regards to the introduction of noise-related operating restrictions at Union airports within a Balanced Approach. European Parliament (2014)

Guidance documents

2.4 Guidance on noise-related charges, as presented in CAP 1119, was provided by the International Civil Aviation Organization (ICAO), namely:

i. Policies on charges for airports and air navigation services (ICAO, Doc 9082)

ii. Airports Economic Manual (ICAO, Doc 9562)

iii. Guidance on the Balanced Approach to Aircraft Noise Management (ICAO, Doc 9829)

2.5 No changes occurred since the publication of CAP 1119.

Previous and current sets of noise categories

2.6 Noise standards for aircraft certification are set by ICAO to ensure that the latest technological advances in the mitigation of aviation noise are transposed into the design and manufacturing of new aircraft. The ICAO noise standards are set out in ICAO Annex 16 to the Convention on Civil Aviation, Environmental Protection, Volume 1: Aircraft Noise.

2.7 Noise certification involves the measurement of noise levels during the take-off and landing phases of operation in a specific and controlled manner. Three measurements are taken: flyover and sideline (lateral) during take-off, and approach during landing. For each measurement point, the measured level is then compared with the maximum allowed level (limit) as specified in ICAO Annex 16. The difference between each measurement and the maximum allowed level constitutes the noise margin for a given airframe/engine configuration at the certificated take-off and landing masses[4]. The sum of the noise margin at each of the measurement points is the cumulative margin.

[4] The term mass is used here as the ICAO Annex 16 regulations are related to the aeroplane mass measured in kilograms. Although commonly referred to as the aeroplane weight (including in some airports' Conditions of Use documentation), technically speaking, weight is the force on an object due to gravity.

2.8 The Chapter 2 standard was the first noise standard for subsonic jet aircraft in 1972. The Chapter 3 standard became applicable in 1977 and introduced new noise limits at each of the three measurement points such that the Chapter 3 limit has a cumulative margin of at least 16 dB lower than Chapter 2. The Chapter 4 standard, introduced in 2006, retained the Chapter 3 limits at each measurement point, but requires that a) the limit at any single point is not exceeded, b) the minimum margin at any two points is at least 2 EPNdB, and c) that the cumulative margin is at least 10 EPNdB (effective perceived noise level in decibels) relative to Chapter 3. The latest standard, Chapter 14, agreed in 2013, retains the Chapter 3 limits, but requires at least 1 EPNdB margin at each measurement point and a cumulative margin of at least 17 EPNdB below than the Chapter 3 limit.

2.9 For charging purposes, further subdivisions are made by certain airports based on the ranges of ICAO Annex 16 noise standards to achieve a greater level of refinement in the noise categorisation of aircraft types, such as those set by the Airports Council International (ACI) allocating an Aircraft Noise Rating Index to each aircraft depending on its cumulative margin. For example, the ACI indices are stepped in 5 EPNdB bands. However, rather than use the ACI rating, airports have traditionally assigned each category a name that relates to the cumulative noise margin or to the noise standard to which it is certified[5], i.e. Chapter 3 Base, Chapter 4 High and so on.

2.10 The previous and current sets of noise categories used by airports in the UK are illustrated in Figure 1, where it can be seen that Chapter 3 is subdivided into two subcategories, Chapter 3 High (between 0 and -5 EPNdB cumulative margin relative to Chapter 3 limit) and Chapter 3 Base (between -5 and -10 EPNdB cumulative margin). Currently,

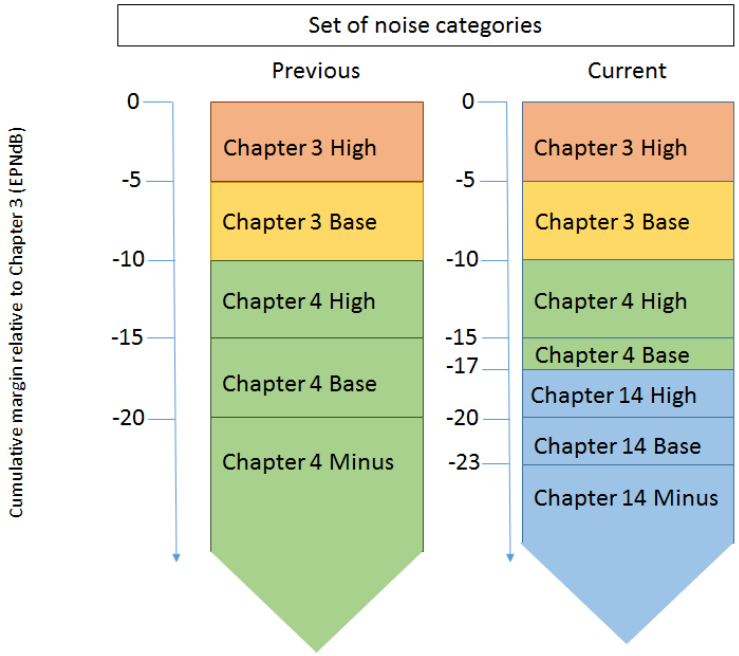
[5] At some airports, aircraft do not need to be officially certified to the relevant ICAO Chapter to be eligible for the corresponding noise charge. Instead airlines at some airports are only required to demonstrate the potential to comply with the noise category claimed. For example, an aircraft certified to the Chapter 4 noise standard that has a cumulative noise margin in excess of 17 EPNdB would qualify for the Chapter 14 noise charge.

Chapter 4 is subdivided into Chapter 4 High (-10 to -15 EPNdB), Chapter 4 Base (-15 to -20 EPNdB) and Chapter 4 Minus (< -20 EPNdB).

2.11 With the introduction of Chapter 14, some airports have proposed revised noise categories, where the previous lowest category (Chapter 4 Minus) is replaced by a suite of Chapter 14 subcategories, namely Chapter 14 High (-17 to -20 EPNdB), Chapter 14 Base (-20 to -23 EPNdB) and Chapter 14 Minus (< -23 EPNdB). The previous range of Chapter 4 Base, between -15 and -20 EPNdB, is narrowed to between -15 and -17 EPNdB in the current set of noise categories. Departing from the allocation of noise categories based on steps of 5 EPNdB, the new subdivisions of the new Chapter 14 standard are differentiated in steps of 3 EPNdB, leaving the Chapter 4 Base category with a width of 2 EPNdB.

2.12 The Chapter 14 standard will come into effect in 2018 (from 31st December 2017 for aircraft with a MTOW of more than 55 tonnes, and 31st December 2020 for aircraft with a MTOW of less than 55 tonnes), and is therefore not applicable at present. However, the current set of noise categories, used by the UK designated airports, is used in this report to illustrate the incentives that are being built into the charging schemes by the airports for airlines to operate quieter fleets.

Figure 1: Previous and current sets of noise categories

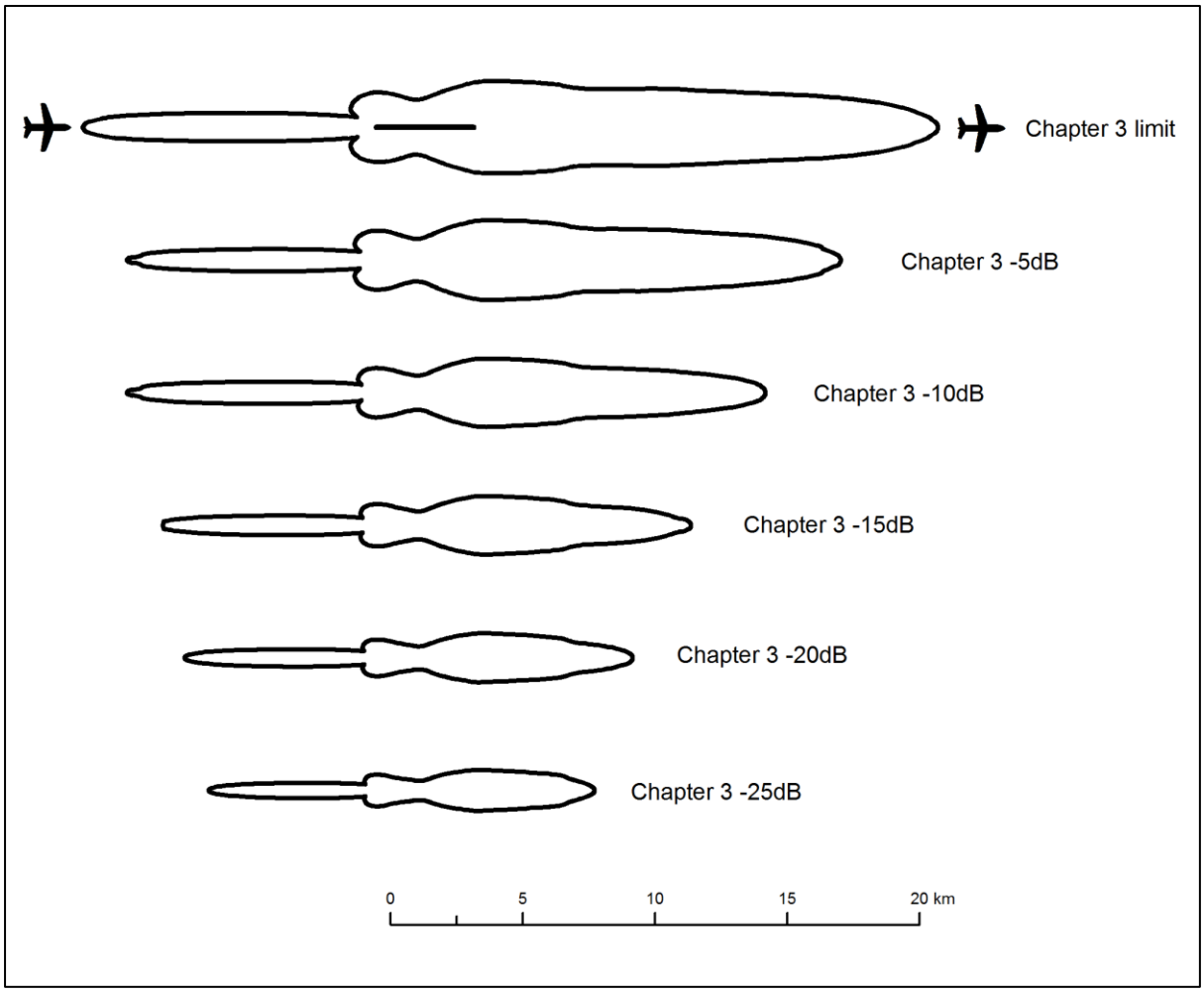


2.13 Aligning the categories with the Chapter 14 limit results in categories that are narrower than 5 EPNdB and no longer of equal width across the range of categories. In responding to local community concern, airports have established noise categories, such that they incentivise the adoption of progressively quieter aircraft. This can be achieved by relating the noise categories to cumulative margin alone. Secondly, having adopted noise categories directly linked to noise performance at certification, progress may be monitored and tracked over time.

Footprints by noise category

2.14 In order to appreciate the noise benefits associated with quieter noise categories, Figure 2 illustrates the differences in combined arrival and departure noise footprint area given by the 80 dB SEL footprint of a 150-179 passenger twin engine aircraft (A320/B737-800 equivalent) with different cumulative margins (given in steps of 5 dB). For illustration purposes, an A320 built in 2000 with CFM56-5B4/2 engines has a cumulative margin of -12.6 dB relative to Chapter 3 limits which put it in the Chapter 4 High category. The footprint of this aircraft would correspond to somewhere between the third and the fourth footprint from the top. In contrast, an A320 built in 2014 with V2527-A5 engines, with cumulative margin of -20.7 dB, is Chapter 14 Base and its footprint is similar to the second footprint from the bottom in Figure 2.

Figure 2: SEL 80 dB arrival and departure footprint by noise margin of a 75 tonne twin engine aircraft



2.15 The footprints of 4-engine aircraft are larger than 2-engine aircraft, due to their poorer climb performance on departure. However, the proportional differences between the footprints of a 4-engine aircraft are equivalent to the proportional difference of the footprints of the 2-engine aircraft.

Noise quota system

2.16 It is widely acknowledged that noise from night-time aircraft operations can cause a greater adverse effect in humans than noise from daytime operations. As such, some noise charging schemes aim at disincentivising night operations. In addition to noise charging schemes, which can vary between day and night, airports may also apply restrictions on the overall numbers (or types) of movements during the night period. Night flying

restrictions at the designated London airports are set by the Department for Transport, using the Quota Count (QC) system.

2.17 The QC is a numeric classification assigned to a specific aircraft (airframe/engine) configuration, calculated from its ICAO noise certification data. It applies to arrival and departure movements separately i.e. a specific aircraft may have a different Quota Count for take-off and for landing.

2.18 The noise levels in the Quota system are classified into bands of 3 EPNdB corresponding to a doubling of noise energy, i.e. an aircraft classified QC0.25 emits half the noise energy than an aircraft classified QC0.5, and so on. The current noise level classifications and corresponding Quota Counts are presented in Table 1.

Table 1: Quota count classifications

Noise classification (EPNdB)[6]	Quota count
More than 101.9	16
99 – 101.9	8
96 – 98.9	4
93 – 95.9	2
90 – 92.9	1
87 – 89.9	0.5
84 – 86.9	0.25
Less than 84	0 (Exempt)

2.19 The QC system is widely used at airports in the UK for banning, restricting or disincentivising movements of aircraft in certain periods of the day.

2.20 The QC system is of particular importance at the three designated airports during most of the night period. The night period covers from 23.00 to 07.00, while the night quota period covers from 23.30 to 06.00. During the night period QC8 and QC16 aircraft are banned from operating. During the night quota period, QC4 aircraft operations cannot be scheduled.

6 Effective Perceived Noise Decibels, a specialised noise unit used for aircraft noise certification tests. Figures based on average of flyover and sideline for departures, and after 9 EPNdB subtraction from approach value.

2.21 Further limits are placed on the night quota period at the designated airports. Since 1993 the Government has imposed restrictions on the number of movements and the amount of noise energy emitted (expressed as the sum of the quota counts of all aircraft operating during any one season) during the night quota period at Heathrow, Gatwick and Stansted. The limits of movements and quota are placed for summer and winter seasons separately. The restriction applies to whichever criterion is reached first. In other words, the movement limit cannot be surpassed even if the quota has not been exhausted, and vice versa. The movement and quota limits are revised periodically by the Government.

2.22 Airports are also given flexibility to carry-over unused movements or quota from one season to another, or may over-run the movement or quota limit in one season leading to a deduction in the next. Full details of the scheme are set out in a statutory Notice which is published for each summer and winter season in a Supplement to the UK Aeronautical Information Publication (UK AIP)[7].

CAEP NOx standards

2.23 As stated in CAP 1119, ICAO standards exist 'to ensure, in the most part, comprehensive uptake of the new technology by certain dates'. The adoption and entry years as well as the NOx limit of each standard are presented in Table 2.

Table 2: CAEP NOx standards

NOx standard	Adoption year	Entry year	Limit (grNOx/kn)
CAEP/1	1981	1986	100
CAEP/2	1993	2000	80
CAEP/4	1999	2004	67
CAEP/6	2004	2008	59
CAEP/8	2010	2014	50

7 http://www.nats-uk.ead-it.com/

2.24 The limit is given in grams of NOx per kilo Newton[8] of thrust per engine and is based on the NOx emitted during a standardised landing and take-off (LTO) cycle with defined thrust settings and times in mode for landing, taxi-in, taxi-out, take-off and climb respectively.

2.25 Unlike for airport noise charges, airport NOx charges are not directly related to NOx standards, however they are based on the standardised ICAO LTO cycle used to calculate NOx emissions, and are applied proportionately using a charge per kilogramme of NOx emitted during the ICAO LTO cycle. No changes have occurred in relation to NOx standards since the publication of CAP 1119.

[8] A Newton is the force required to accelerate one kilogram of mass at a rate of 1m/s^2. A kilo-Newton (kN) is 1,000 Newtons.

Chapter 3

Noise-related charges

3.1 As mentioned in CAP 1119, environmental charges are unlikely to be the decisive factor upon which airport users (airlines) base their fleet replacement decisions. Under the current charging schemes that we have reviewed, it is difficult to ascertain the true measure of the influence that differential landing charges have in incentivising airlines to shift to quieter aircraft. CAP 1119 exemplified that environmental landing charges make up a small percentage of the total charges met by airlines (typically less than 5%).

3.2 We stated in CAP 1119 that, in order to increase the influence of environmental landing charges in encouraging a shift to quieter aircraft, differentials between noise categories should be increased. However, there is a concern that high environmental landing charges could become an operating restriction if operators are not given enough time to adapt to a new scheme. There are two ways in which an airline can react to a new set of differential charges, namely:

- Purchasing newer and quieter aircraft;
- Bringing quieter aircraft from other routes/airports where noise charges are not so stringent.

3.3 Whilst landing charges are unlikely to trigger the purchase of an aircraft, it is expected that operators will have a fleet renewal strategy. Landing charges are more likely to influence decisions to assign the quietest aircraft of an operator's fleet into the airport with the most stringent noise policy. Because airlines will have different levels of scope to assign quieter aircraft to a given airport, environmental charges may have different impacts on individual airlines – some may be able to offset or absorb higher charges on a noisier aircraft type against those of a quieter one, whereas those operating a single fleet type will clearly have limited scope to adapt their operations.

3.4 With these notions in mind, this chapter presents an overview of noise and emissions landing charges in the intervening period since publication of CAP 1119 for each study airport. The main changes in the structure of charges, if any, and the current relativity of charges are also addressed. In addition, the aircraft fleet at each designated airport has been analysed for each of the noise categories set out in Chapter 2, in order to determine the progress made in incentivising the use of quieter aircraft.

3.5 Heathrow Airport Limited (HAL) and Gatwick Airport Limited (GAL) carried out consultations on their schemes of charges (implemented in 2017), which are also addressed in this report.

3.6 We give recommendations at the end of each airport section (if applicable) where changes are checked in relation to CAP 1119 recommendations. In addition, Chapter 5 presents a review of the previous and current schemes against CAP 1119 recommendations.

Details of charging schemes

3.7 Details of the charging schemes in use at the study airports are presented in this section. In addition, a summary of the main aspects of the charging schemes is given below (Table 3). The changes, relative to the charges given in CAP 1119, are shaded. The charging schemes of the non-designated airports chosen for comparison have not changed significantly, and therefore the main focus has shifted to the designated airports in this update report.

Table 3: Summary of charging systems at the study airports

		Heathrow	Gatwick	Stansted	Manchester	East Midlands	Birmingham
Runway charge	**Type**	Landing	Landing and Departure	Landing	Departure	Departure (landing and departure separately for freight)	Departure (landing and departure separately for freight aircraft >30T))
	Aircraft Weight parameter	MTOW (stepped)	MTOW (stepped)	MTOW (stepped)	'Maximum Take Off Weight Authorised' (semi-continuous, rate changes at 25t and 120t)	MTOW (> 5.8t continuous)	MTOW (continuous for passenger aircraft, semi-continuous for cargo aircraft, rate changes at 30t)
	Noise category parameter(s)	ICAO/ACI noise category	ICAO/ACI noise category	ICAO/ACI noise category & QC	ICAO/ACI noise category & QC	QC	n/a
Relative Charges re. Chapter 3 base	**Ch2**	n/a	n/a	300%	170%	n/a	n/a
	Ch3 high			150%	100%	n/a	n/a
	Ch3 base			100%	100%	n/a	n/a
	Ch3 minus			90%	n/a	n/a	n/a
	Ch4			90%	100%	n/a	n/a
Relative Charges re. Chapter 4 base	**Ch3 & below**	389%	200%	n/a	n/a	n/a	n/a
	Ch4 high	111%	100%				
	Ch4 base	100%					
	Ch14 high	78%	60%				
	Ch14 base	56%	50%				
	Ch14 minus	33%	40%				
Night period (where relevant to landing charges)	**Night period, local time**	01:00-04:30	23:30-05:59 local time (1 Apr to 31 Oct)	n/a	n/a	23:30-06:00	23:30-06:00
	Night surcharge	2.5 times day charge	12.6 times summer day charge*	0%	0%	25% (if ≥QC/4)	0%

		Heathrow	Gatwick	Stansted	Manchester	East Midlands	Birmingham
	Night surcharge, Freight (if different to passenger)	n/a	n/a	n/a	n/a	Shoulder periods (06:00-07:00 & 21:00-23:30): 302% Night period (23:30-06:00): 405-474% depending on QC.	300%
Off-peak	**Off-peak criteria, local time**	n/a	Winter all day, and Summer 19:00-23:00 for Arrivals and 19:00-22:30 for Departures	Winter all day only	Reduced winter rates. Combinations of QC values and time periods from 05:30-23:00	n/a	n/a
	Off-peak reduction	n/a	67% summer, 100% winter	74%	19% (MTOW>25t)	n/a	n/a
	Off-peak reduction, Freight (if different to passenger)	n/a	n/a	n/a	48%	n/a	n/a

* The night charge is the same in winter and summer. However, the summer day charge is referenced here as there is no winter day charge.

Heathrow Airport

Determination of noise category of aircraft

3.8 The methodology used by Heathrow Airport to determine the noise category of an aircraft is based solely on the cumulative margin, relative to Chapter 3 and adhering to the ranges given in Figure 1. The previous scheme of charges included all noise categories available when using a 5 EPNdB category width i.e. two categories within Chapter 3, and three categories in Chapter 4. In the current scheme, the categories are amended to align with the new Chapter 14 standard in the framework of charges. The new category, as shown in Figure 3, is divided into three new subcategories separated in 3 EPNdB steps. This is clear and transparent and broadly in line with CAP 1119 recommendations; however, the categories are narrower than 5 EPNdB and no longer of equal width across the range of categories.

Landing charges overview 2001 to 2018

3.9 This section looks at the past and present framework of landing charges at Heathrow Airport. A summary of the charging system at Heathrow is presented in Table 3.

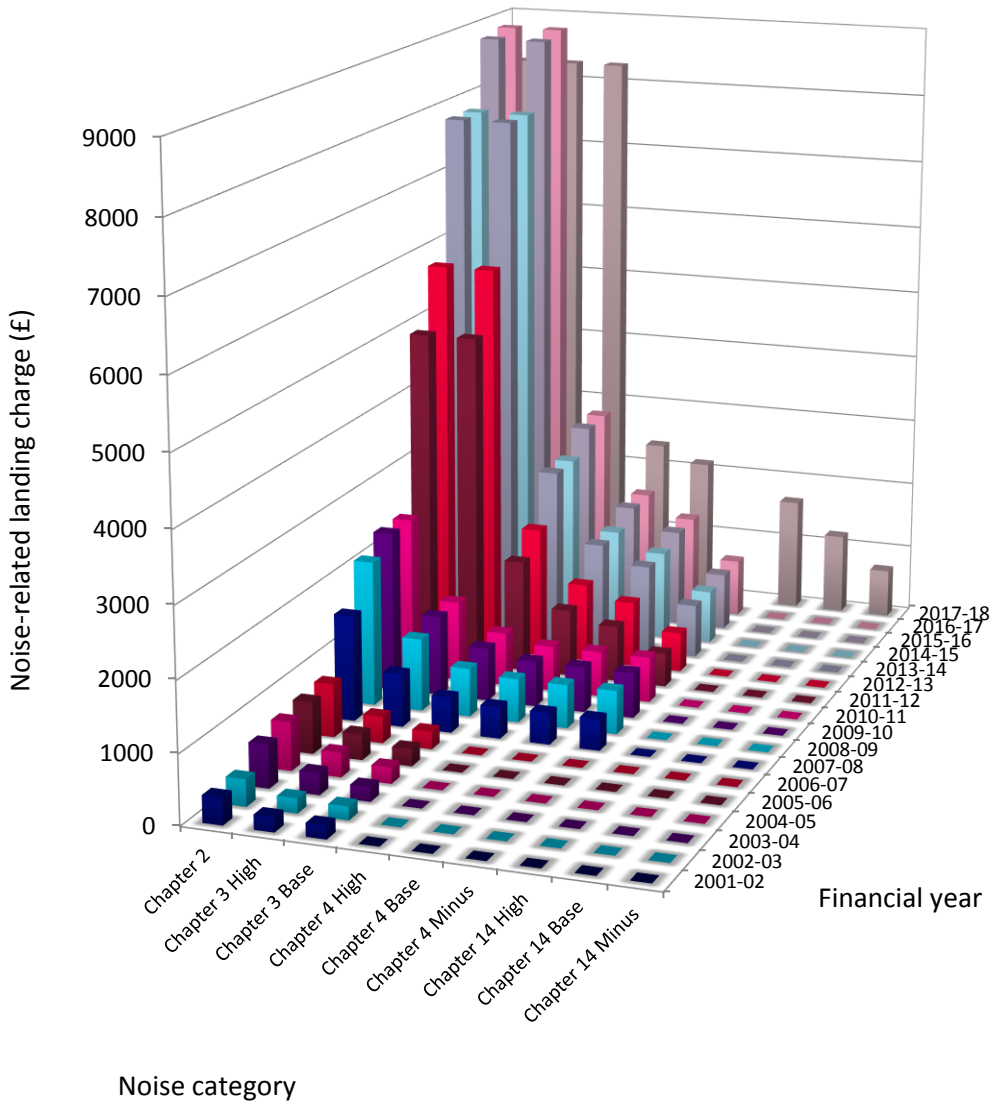
3.10 The most significant change in the framework of landing charges at Heathrow Airport since the publication of CAP 1119, has been the decision by Heathrow Airport to increase, from 2017, the percentage of revenue from environmental charges which currently stands at 21% of total airport charges, to 28% of total airport charges[9]. Due to the capping of airport charges[10] at the designated airports, the increase in environmental charges is offset by a reduction in per-passenger charges, which fall from 75% to 68% of airport charges.

9 Heathrow Airport, Airport Charges Structural Review, Decision document, Aug 2015

10 The CAA has powers under the Civil Aviation Act 2012 for the economic regulation of Gatwick and Heathrow airports.

3.11 CAP 1119 presented an historical overview of noise-related charges applied to Heathrow Airport landing operations starting in the year 2001/02 and ending in 2013/14. Maintaining the historical trend, Figure 3 shows noise related charges from the period 2001-2014 as well as those in the subsequent years up to the present and including changes for the year 2017/18, which includes the new ICAO Chapter 14 standard as the basis for the lowest charge categories.

Figure 3: Noise-related landing charge (£) per noise category



3.12 Following the CAP 1119 review, landing charges for the noisiest categories, Chapter 2 and Chapter 3 High, experienced another steep change in the year 2015/16. Landing charges for Chapter 3 Base aircraft

experienced the biggest increase compared to previous years, from £2,959 in 2016/17 to £8,274 in the year 2017/18, a 180% increase.

3.13 Between 2011 and 2016, the proportional landing charge at Heathrow, relative to Chapter 4 Base has remained approximately the same, as presented in Table 4.

Table 4: Landing charge relative to Chapter 4 Base (from 2011 to 2016)

Noise category	Landing charges relative to Chapter 4 Base
Chapter 3 Base	200%
Chapter 4 High	120%
Chapter 4 Base	100%
Chapter 4 Minus	60%

3.14 The scheme of charges for 2017/18, relative to Chapter 4 Base, is presented in Table 5.

Table 5: Landing charge relative to Chapter 4 Base (2017/18)

Noise category	Landing charges relative to Chapter 4 Base
Chapter 3	389%
Chapter 4 High	111%
Chapter 4 Base	100%
Chapter 14 High	78%
Chapter 14 Base	56%
Chapter 14 Minus	33%

3.15 Table 5 shows the proportionally high charge that is applied to Chapter 3, as well as the discounts related to Chapter 14 subcategories. Comparing Table 4 and Table 5 shows the move towards greater charge differentials.

Movement and QC limits during the night quota period

3.16 The number of movements allowed to operate at Heathrow airport during the night quota period is limited to 5,800; 3,250 in the summer period and 2,550 in the winter period.

3.17 Table 6 and Table 7 present the movement and noise quota limits at Heathrow airport from 2007 to 2016 for summer and 2006/07 to 2016/17 for winter respectively.

3.18 Figure 4 illustrates the values in Tables 6 and 7. In the summer of 2016, the movement usage was at 90.7% and the noise quota usage was at 45.2% (Table 6). Because the movement limit was not reached, HAL was able to carry over movements to the winter period which reflects the 102.4% movement usage in that period (Table 7 and Figure 5). The fact that the winter movements exceed the movement limit by 2.4% does not constitute a breach of the night restrictions, since the London Airport Noise Restrictions Notice permits up to 10% of unused movements from either season to be carried over into the following season (in contrast to Heathrow, Gatwick carries over unused movements from winter to summer).

Table 6: Movements and noise quota usage in the summer period at Heathrow Airport from 2007 to 2016

	Movements			Noise quota		
	Usage	Limit	% Used	Usage	Limit	% Used
Summer 2007	3,047	3,250	93.8%	5,227.5	5,610	93.2%
Summer 2008	2,922	3,250	89.9%	4,634.0	5,460	84.9%
Summer 2009	2,848	3,250	87.6%	4,429.3	5,460	81.1%
Summer 2010	3,066	3,250	94.3%	4,541.3	5,340	85.0%
Summer 2011	2,958	3,250	91.0%	4,491.0	5,220	86.0%
Summer 2012	2,853	3,250	87.8%	3,946.3	5,100	77.4%
Summer 2013	2,837	3,250	87.3%	3,917.0	5,100	76.8%
Summer 2014	2,714	3,250	83.5%	3,242.5	5,100	63.6%
Summer 2015	2,802	3,250	86.2%	2,847.0	5,100	55.8%
Summer 2016	2,949	3,250	90.7%	2,304.5	5,100	45.2%

Figure 4: Movement and noise quota usage against the limits at Heathrow Airport in the summer night quota period between 2007 and 2016

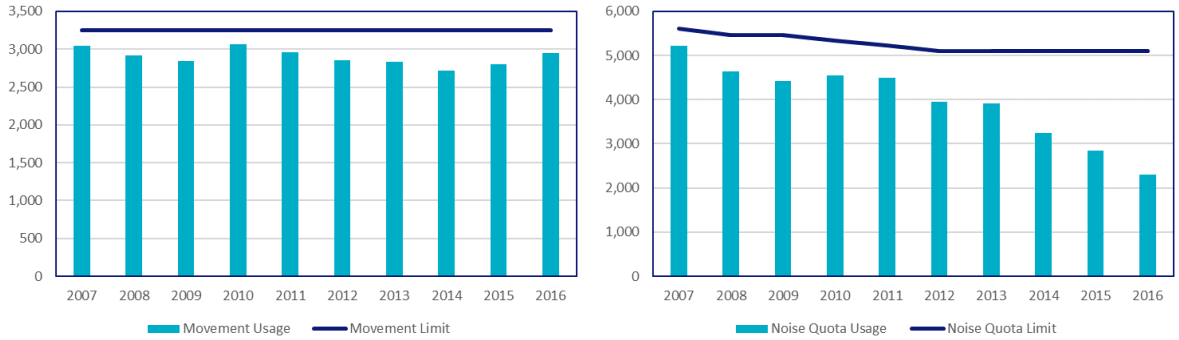
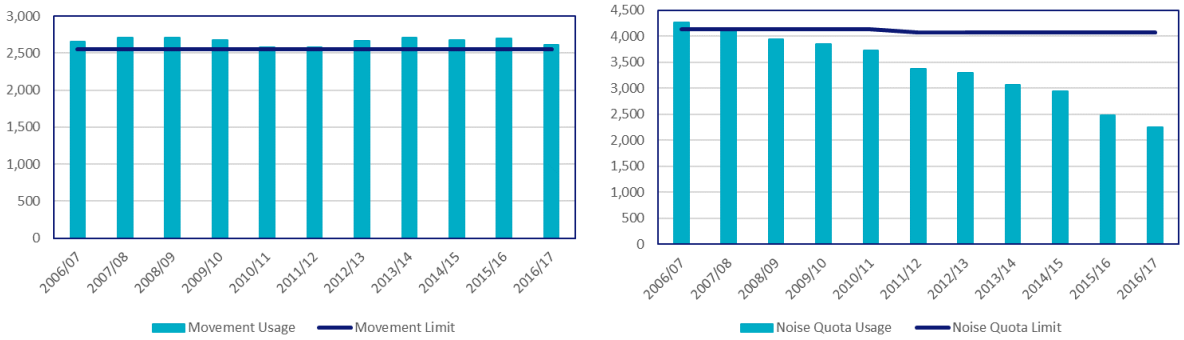


Table 7: Movements and noise quota usage in the winter period at Heathrow Airport from 2006/07 to 2016/17

	Movements			Noise quota		
	Usage	Limit	% Used	Usage	Limit	% Used
Winter 2006/07	2,659	2,550	104.3%	4,266.0	4,140	103.0%
Winter 2007/08	2,710	2,550	106.3%	4,100.3	4,140	99.0%
Winter 2008/09	2,715	2,550	106.5%	3,947.5	4,140	95.4%
Winter 2009/10	2,682	2,550	105.2%	3,856.0	4,140	93.1%
Winter 2010/11	2,577	2,550	101.1%	3,735.3	4,140	90.2%
Winter 2011/12	2,581	2,550	101.2%	3,374.5	4,080	82.7%
Winter 2012/13	2,668	2,550	104.6%	3,304.8	4,080	81.0%
Winter 2013/14	2,715	2,550	106.5%	3,070.5	4,080	75.3%
Winter 2014/15	2,676	2,550	104.9%	2,939.5	4,080	72.0%
Winter 2015/16	2,696	2,550	105.7%	2,475.3	4,080	60.7%
Winter 2016/17	2,612	2,550	102.4%	2,259.3	4,080	55.4%

Figure 5: Movement and noise quota usage against the limits at Heathrow Airport in the winter night quota period between 2006/07 and 2016/17



3.19 Table 3 also shows that HAL's noise charge during the night period increases by 2.5 times the charge outside of the night period. However, HAL define the night period for charging purposes as 0100-0429 (local

time), in contrast to, for example, GAL's night charging period which is aligned with the Night Quota Period, i.e. 2330-0559 (local time). In 2016, there were 31 arrivals during the Heathrow night charging period, compared with 5,502 arrivals during the Night Quota Period.

3.20 HAL's noise charging scheme is currently based on actual arrival time and does not take into account departure time. This leads to a situation where an aircraft may arrive on time, but depart late, potentially into the night period, and face no additional charge. In contrast GAL separate noise charges into arrival and departure elements based on actual arrival and departure time.

Fleet analysis by previous noise category

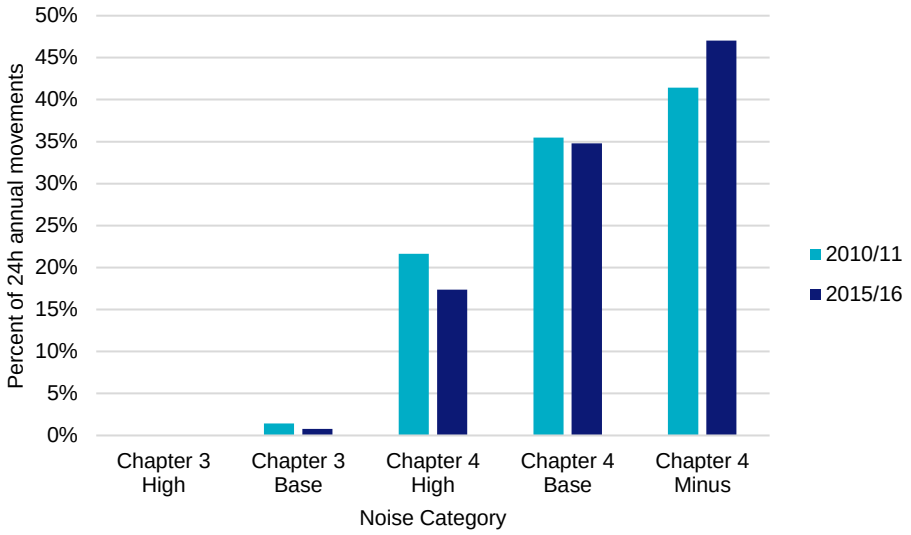
Chapter 2 and Chapter 3 High

3.21 CAP 1119 stated that since the adoption of the Chapter 4 standard in 2006, 5 years elapsed (until year 2011/12) before charges for the noisier Chapter 3 categories showed a steep increase in differential charge compared to Chapter 4 charges.

3.22 When the high charge was introduced in year 2011/12 for Chapter 2 and Chapter 3 High aircraft, there were not significant numbers of movements by aircraft in those noise categories. Figure 6 shows the proportion of 24h annual landing movements in Heathrow for each noise category in 2010/11 and in 2015/16, where it can be seen that in 2010/11[11] there was a negligible number (3 operations) of movements served by Chapter 3 High aircraft at Heathrow airport (observe that the column of Chapter 3 High in Figure 6 is unnoticeable). Therefore, the highest charges are effectively a back stop to disincentivise the use of aircraft that do not meet current standards of noise performance, rather than an incentive to shift to quieter aircraft. Subsequent changes observed in 2012/13, 2013/14 and 2015/16 for Chapter 3 High aircraft function in the same way.

[11] Noise and Track Keeping system data for Heathrow Airport (ANOMS) queried in June 2016.

Figure 6: Heathrow Airport – movements distribution (%) by current noise category



Chapter 3 Base

3.23 Likewise, in regard to the higher charges planned for Chapter 3 Base aircraft for the year 2017/18, as Figure 6 shows, the percentage of movements carried out by Chapter 3 aircraft was less than 1% in 2015. Because the charge for this category increased after the proportion of movements dropped to less than 1%, it is apparent that the charge increase is aimed at preventing the re-introduction of these aircraft into the airport fleet, i.e. a back-stop, rather than a continued incentive to shift to quieter aircraft.

Chapter 4

3.24 The proportion of aircraft in each of the Chapter 4 subcategories, as seen in Figure 6, illustrates the intended progression in shifting to 'best in class' whereby the noisiest aircraft have less proportion of the fleet, increasing gradually for each noise category.

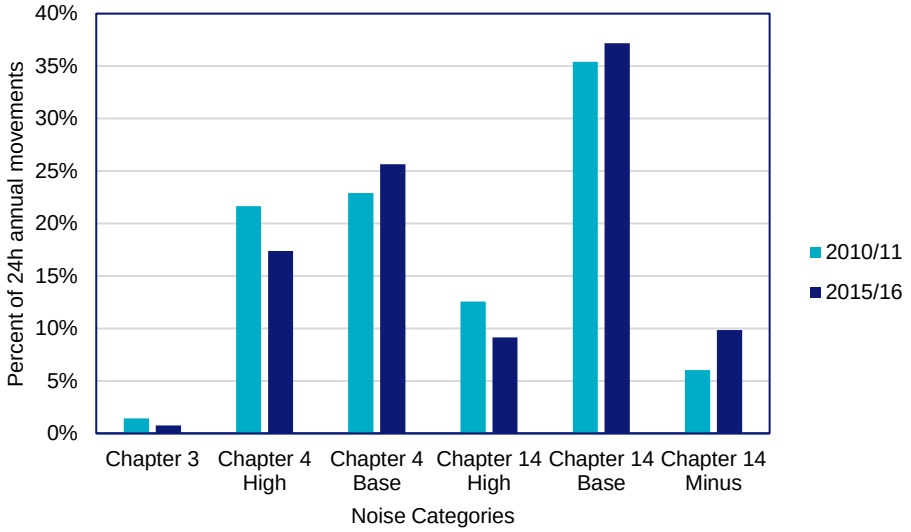
Fleet analysis by current noise category

3.25 In 2017/18 HAL has introduced Chapter 14 noise categories in the scheme of landing charges. Figure 7 shows the 24h annual movement distribution by the newly adopted set of noise categories at Heathrow Airport, including the new Chapter 14 High, Base and Minus noise

categories. It can be seen that, in 2015/16, 56% of operations are carried out by aircraft complying with the new Chapter 14 noise standard (42% of Heathrow Airport fleet), comprising 9% Chapter 14 High, 37% Chapter 14 Base and 10% Chapter 14 Minus aircraft.

The reduction of the Chapter 4 Base width from 5 to 2 EPNdB (from -15 to -20 EPNdB in the previous noise category scheme to -15 to -17 EPNdB in the newly adopted categorisation) has caused the percentage of movements of Chapter 4 Base aircraft to decrease significantly from 35% to 26%, based on 2015/16 and 2010/11 data.

Figure 7: Heathrow Airport – movements distribution (%) by proposed set of noise categories



Discussion

3.26 HAL has applied differential charging across all noise categories. The highest charges correspond to aircraft of noise categories that serve a marginal number of operations. The steepest charges are an effective back stop to re-introduction and the lower charges an incentive to shift to 'best in class' aircraft, which is the intention behind the implementation of differential charging.

3.27 With the adoption of the Chapter 14 standard, and the replacement of most Chapter 3 aircraft, Chapter 4 becomes the next noise charging category to be addressed for phasing out of operations at the airport. The

Chapter 4 High category accounts for 17% of operations at present whereas Chapter 4 Base aircraft serve 26% of operations.

3.28 HAL recently published its Heathrow 2.0 plan for sustainable growth[12]. Although it contains no specific commitment to increase noise landing charges, it signals that HAL will continue to use noise landing charges as an important part of their toolkit in order to meet their targets to reduce the proportion of Chapter 3 and 4 aircraft, and to increase the proportion of Chapter 14 aircraft operating at Heathrow. We welcome the recognition that noise based landing charges can be an effective incentive to enhance noise performance. However, the CAA considers that there is scope to enhance the targets within Heathrow 2.0 to deliver greater noise reduction. For instance, in Heathrow 2.0, the goal for operational aircraft compliance with Chapter 14 is 60% by 2020: in 2015/16, 42% of Heathrow aircraft, operating 56% of movements, were Chapter 14 compliant.

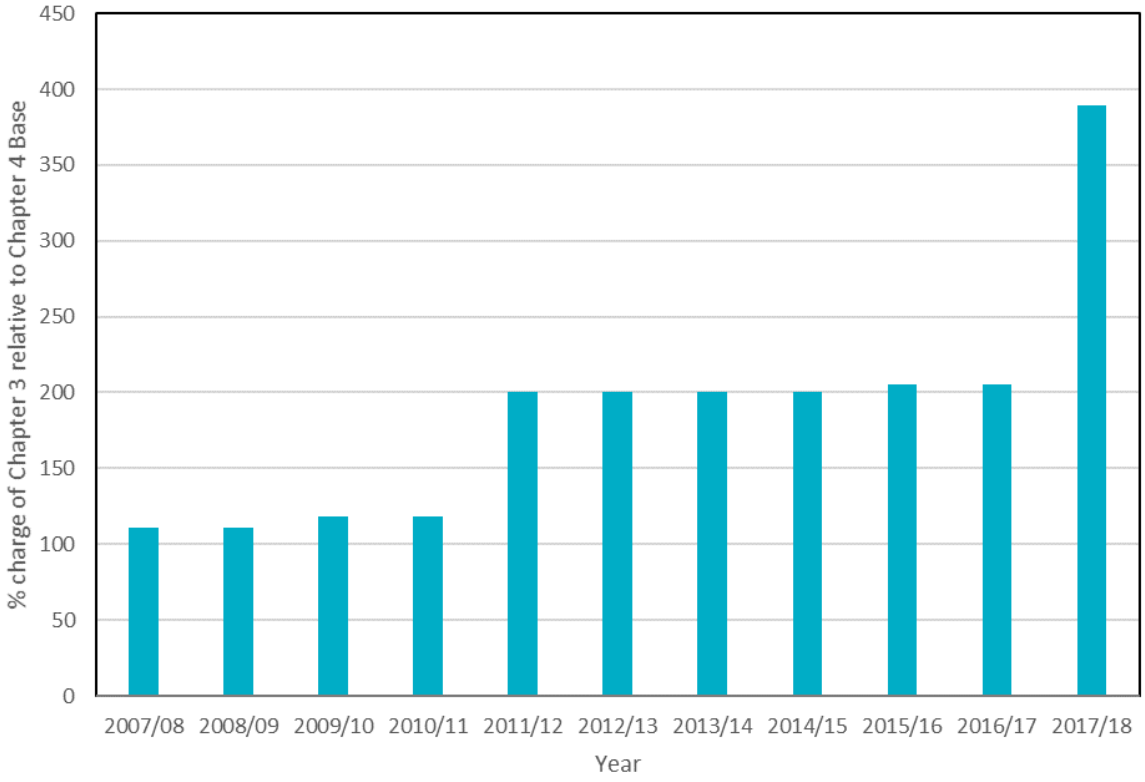
3.29 As mentioned in the introduction to this chapter, airlines can respond in two ways to a new scheme of differential noise charges: purchasing quieter aircraft and/or substitution within their existing fleet elsewhere. In addition, the airport can, at its own discretion, set landing charges in such a manner whereby operators can counterbalance higher charges from their noisier aircraft with those from the quieter aircraft. The latter is the less onerous option but although, on average the fleet at Heathrow Airport has more than 50% of operations served by Chapter 14 aircraft, airlines may not necessarily have enough ‘quieter’ aircraft in their fleet to counterbalance higher charges for the noisier aircraft.

3.30 We consider that earlier signalling of the introduction of higher charges can provide a more effective and efficient outcome giving operators an increased ability to respond as opposed to the current practice that typically gives less than one-year’s notice before charges are introduced.

[12] Heathrow 2.0: Our plan for sustainable growth, Heathrow Airport Limited, accessed 01/06/2017.

3.31 Looking retrospectively at the charges applied to Chapter 3 Base aircraft, over the ten years following the adoption of the Chapter 4 noise standard in 2006, Chapter 3 Base aircraft charges were levied at 110-120% of the Chapter 4 Base tariff for four years, and then six years being levied at 200% of Chapter 4 tariff. For the year 2017/18, the residual Chapter 3 Base aircraft remaining at Heathrow is levied 389% the tariff of Chapter 4 Base aircraft (see Figure 8).

Figure 8: Historical scheme of charges for Chapter 3 Base aircraft at Heathrow Airport



3.32 It is difficult to ascertain to what extent the phasing out of Chapter 3 aircraft is due to the incentive in landing charge differentials or part of the natural cycle of replacing older aircraft with newer models. It is arguable whether the scheme of charges of Chapter 3 base aircraft, as seen in Figure 8, was as effective as it could have been compared to a scenario in which, on year zero (2006/07), the airport, after consultation with stakeholders, signalled a ten-year scheme to remove Chapter 3 Base aircraft with a proposed scheme of differential charges. This sort of initiative would have allowed operators to consider their fleet options well in advance, and, in addition, such a forecast scheme could have provided

a base for stakeholders to discuss its reasonability and its impact. Moreover, it would undoubtedly be beneficial to transparency.

3.33 Therefore, we believe that a forecast, in consultation with stakeholders, setting out the likely rate of increase in charges for Chapter 4 aircraft, assessing the potential ability of operators to reasonably bring 'best in class' from their forecasted fleet, would show the continued efforts that HAL is making to shift Heathrow Airport's fleet to quieter aircraft.

3.34 With regard to night noise charges, as discussed in paragraph 3.19, we recommend that HAL align its night noise charging period with the Night Quota Period, recognising the additional disturbance caused by flights before 0600. In addition we recommend that HAL separate noise charges into arrival and departure elements based on actual arrival and departure time.

Gatwick Airport

Determination of noise category of aircraft

3.35 The methodology followed by Gatwick airport up until 2016/17 to determine the noise category of aircraft was as follows:

- Chapter 2: Aircraft which are either not certificated or fail to meet the noise certification standards of ICAO Annex 16 Chapter 3.
- High: Defined set of aircraft that meet the noise certification standards of ICAO Annex 16 Chapter 3 unless the operator can provide satisfactory noise certification data demonstrating that the aircraft noise performance is at least - 5 EPNdB (cumulative) below the ICAO Annex 16 Chapter 3 certification limits.
- Base: Aircraft which meet the noise certification standards of ICAO Annex 16 Chapter 3 and are not classified as either Chapter 3 High or Chapter 3 Minus.

- Minus: Aircraft which meet the Chapter 3 standard and, on both arrival and departure, have a Quota Count[13] (QC) of 0.25, 0.5 or 1, or are exempt from a QC rating
- Chapter 4: Aircraft which were either put into service on or after 1 January 2006 and meet the noise certification standards of ICAO Annex 16 Chapter 4 or can demonstrate that they meet the noise certification standards of ICAO Annex 16 Chapter 4.

3.36 From the year 2017/18, GAL grouped all Chapter 3 and below aircraft into a single noise charging category (Chapter 3 and Below), with the Chapter 4 category remaining unchanged. The airport also introduced Chapter 14 High, Base and Minus in its framework of charges. These subcategories are each 3 EPNdB wide and based on the cumulative margin to Chapter 3 exceeding -17, -20 and -23 dB respectively.

Landing and take-off charges overview

3.37 This section looks at the past and present framework of landing and take-off charges at Gatwick Airport. In addition, a summary of the charging system at Gatwick Airport is presented in Table 3.

3.38 Gatwick Airport Limited (GAL) levies a runway charge on both arrival and departure operations. Before the current year (2017/18) the runway charge did not discern between demand and environmental allocations. This was highlighted by CAP 1119, stating that the framework of charges at Gatwick airport was more demand based than noise related, as night operations in winter did not incur a landing charge for aircraft in categories Chapter 3 Base or above, and charges in the off-peak summer season (which includes the sensitive night period) offered a 67% discount relative to summer peak time.

3.39 Consequently, in the year 2015/16, GAL changed its charging framework dividing the off-peak summer period into evening (19.00-22.30) and night (22.30-05.00). During the night period, operations were charged at base

[13] The Quota Count is a weighting attributed to the arrival or departure of a specified aircraft type by reference to its certificated noise performance, divided into 3 EPNdB bands.

rates, while evening operations were charged at 36% of the base rate. In addition, operations during the winter-night period were charged the same as summer evening operations (at 36% of base charges). This scheme of charges was maintained in the year 2016/17 in terms of proportion, however the absolute value of charges had increased by 10% from 2014/15 to 2016/17.

3.40 In addition, following a consultation and published decision on airport charges[14,15], GAL decided to divide landing and take-off charges into demand-related charges (82% of revenue from aircraft movement charges) and environment-related charges (18% of revenue from aircraft movement charges, divided equally between noise-related charges and emissions-related charges) in 2017/18. With this scheme, GAL is expected to recover 50% of noise charges from movements in the night period in the year 2017/18, despite the fact that in 2016 night movements accounted for just 5% of total movements. For context, aircraft movement charges make up approximately 27% of core services charges, with 65% raised from passenger charges and the remaining 8% from parking charges.[16]

3.41 Another change in the framework of charges at Gatwick Airport has been the introduction of a financial mechanism for Airbus A320 aircraft that emit a high-pitched tone from the airframe. The tone is generated by the aircraft's Fuel Over Pressure Protection (FOPP) system and is apparent only during approach when engine noise is low and the flaps are retracted and landing gear are not lowered. Airbus has developed a modification to eliminate the tone, which also lowers the noise level during approach, which became standard on all A320 aircraft made after 2014. The modification is also available for retrofit to existing A320 family aircraft. In

14 2017/18 Airport Charges Consultation Aircraft Noise Charges-Phase 2 Consultation. Gatwick Airport Ltd (April 2016).

15 2017/18 Airport Charges Consultation Aircraft Noise Charges-Phase 2 Consultation Decision Advice. Gatwick Airport Ltd (September 2016).

16 2017/18 Airport Charges Consultation. Charges Overview & Consultation Timetable. Gatwick Airport Ltd (September 2016).

order to incentivise the retrofit, from January 2018, unmodified A320 aircraft will be charged the same as Chapter 3 aircraft in the night period.

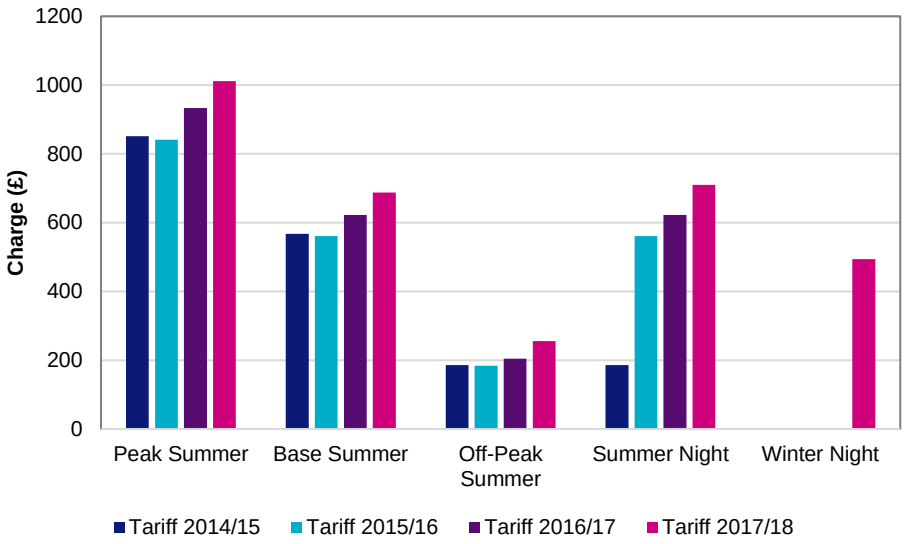
3.42 The current framework of charges (2017/18) recognises the new Chapter 14 noise standard, bringing a charging structure with a single Chapter 4 category and Chapter 14 disaggregated into High, Base and Minus categories according to the proposed categories shown in Figure 1. This reflects the noise performance of the current fleet, and the expectation that some of the largest operators at Gatwick are renewing their fleet, principally with the latest versions of the A320 and B737 aircraft.

3.43 As a result of some of these changes, the charges in some noise sensitive periods of the day have increased significantly since the publication of CAP 1119.

Figure 9 shows a comparison of charges in the period 2014/15-2017/18 for Chapter 4 aircraft (the most common with 82% of the UK-registered fleet, and 88% of total operations at Gatwick in 2015). Among the changes worth noting are:

- There was no charge for Chapter 4 aircraft to land in the winter night period prior to the 2017/18 charging period where a charge has been introduced (note in Figure 9 that there are no columns for the years 2014/15 to 2016/2017 for the winter night period).
- In 2015/16, the summer night period had a 200% increase from the previous year.

Figure 9: Gatwick Airport – evolution of noise and demand related charges per departure movement* for Chapter 4 aircraft at Gatwick

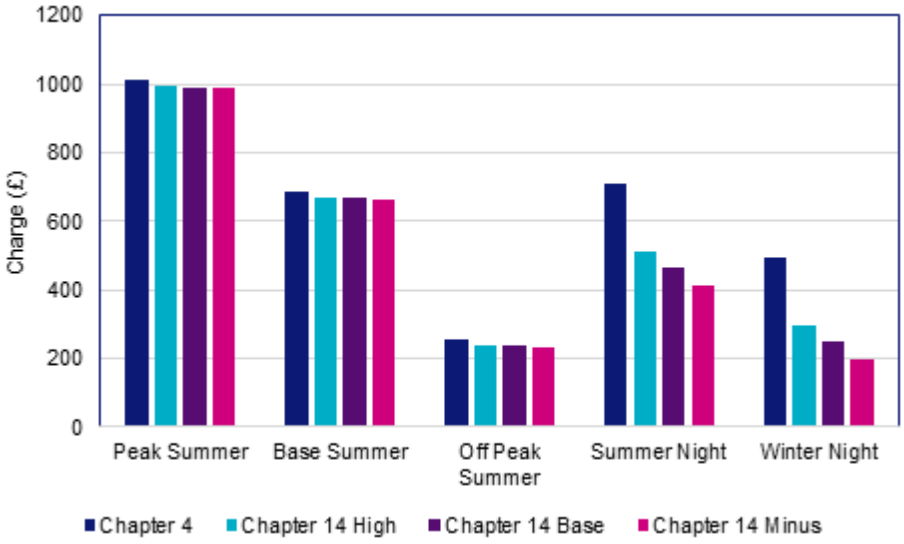


* Charges shown correspond to departures, as peak period charges do not apply to arrivals

3.44 It is also worth noting that with the charging scheme reflecting new categories based on the new Chapter 14 standard, Chapter 4 aircraft movements in 2017 is 33% of that in 2016. 67% of current Chapter 4 aircraft (UK registered) at Gatwick are eligible for Chapter 14 standard charges which is in effect a reduction in the charges relative to the previous year. In addition, the winter day period does not command a noise or demand charge.

3.45 To illustrate this, Figure 10 presents the charges that are applied to Chapter 4 and Chapter 14 aircraft under the scheme of charges for year 2017/18 for the different time periods. For the summer night period, the discounts offered to Chapter 14 aircraft (with charges of £512, £463 and £414 for Chapter 14 High, Chapter 14 Base and Chapter 14 Minus respectively) means that charges for movements in that period are lower than that in the year 2016/17 for the same period, which was £622 for Chapter 4 aircraft.

Figure 10: Comparison between Chapter 4 and Chapter 14 charges for year 2017/18



Differentiation of noise related charges for 2017/18

3.46 In segregating landing and take-off charges into demand and noise related charges, GAL has considered loudness based on cumulative margin as a proxy for the differentiation of noise related charges. Subsequently, noise categories are given a noise ratio (or multiplier) relative to Chapter 14 Minus based on the difference between the cumulative margin of their lower limits.

3.47 The lower limit for each noise category is the lower threshold of their range, i.e. 0 EPNdB for Chapter 3, -10 EPNdB for Chapter 4, -17 EPNdB for Chapter 14 High, - 20 EPNdB for Chapter 14 Base and -23 EPNdB for Chapter 14 Minus (see Figure 1). The resulting charge relativities per noise category and their value can be seen in Table 8 below. GAL initially proposed to levy night noise movements at ten times the day tariff. In doing so, the proportion of noise charges recovered for day movements would have been 53%, and 47% for night movements respectively. After consultation GAL decided to recover 50% of noise charges from the day period and 50% from the night period. Consequently, the charges during the night period were adjusted resulting in them being more than 12 times the day charge.

Table 8: Gatwick Airport noise-only charge relativities for 2017/18, relative to Chapter 4

Noise categories	Day	Night	% of Chapter 4
Chapter 3 and below	£78	£988	200%
Chapter 4	£39	£494	100%
Chapter 14 High	£24	£296	60%
Chapter 14 Base	£20	£247	50%
Chapter 14 Minus	£16	£198	40%

3.48 In order to compare landing and take-off charges at Gatwick Airport between the current segregated framework (demand and noise related) and the previous scheme of charges (which combines noise and demand), Table 9 presents demand charges, and Table 10 shows the charges (demand and noise) applied for different time periods in the new framework of charges for 2017/18.

Table 9: Gatwick Airport demand charges for 2017/18

Period	Demand Charges	Applicability
Peak	£972	July and August between 05:00-09:00 for departures only
Base	£648	1st April to 31st October, between 05:00-19:00, except July and August which is from 09:00-19:00
Off peak	£216	1st April to 31st October, between 19:00-22:30, Winter (24h) and nights (22:30-05:00)

Table 10: Combined demand and noise charges for departure movements resulting from the framework of charges in 2017/18

Noise Category	Peak Summer	Base Summer	Off Peak Summer	Summer Night	Winter Night
Chapter 3	£1,050	£726	£294	£1,204	£988
Chapter 4	£1,011	£687	£255	£710	£494
Chapter 14 High	£995	£671	£239	£512	£296
Chapter 14 Base	£991	£668	£236	£463	£247
Chapter 14 Minus	£988	£664	£232	£414	£198

3.49 Table 11 shows the charges per noise category as a percentage relative to the Chapter 4 charges, illustrating the surcharges and discounts emerging from the new framework of charges. Noise charges for the night period (summer and winter) for the noisiest Chapter 3 aircraft commands a surcharge of 70% in summer and a surcharge of 100% in winter relative to Chapter 4 charge , while the Chapter 14 categories have discounts of

28%, 35% and 42% in the summer night period for Chapter 14 High, Chapter 14 Base and Chapter 14 Minus respectively. The discounts in the winter night period range from 40% for Chapter 14 High and 60% for Chapter 14 Minus. At other periods, presented in the table, the surcharge varies from 4% to 15%, and the discounts vary from 2% to 9%.

Table 11: Differential charging per noise category relative to Chapter 4 (departure movements)

Noise category	Peak Summer	Base Summer	Off-Peak Summer	Summer night	Winter night
Chapter 3	104%	106%	115%	170%	200%
Chapter 4	100%	100%	100%	100%	100%
Chapter 14 High	98%	98%	94%	72%	60%
Chapter 14 Base	98%	97%	92%	65%	50%
Chapter 14 Minus	98%	97%	91%	58%	40%

3.50 According to GAL, in 2020/21, the proportion of movements served by Chapter 14 Minus is forecasted to be 40%, in contrast to the current 3%. This is based on assumptions made on passenger growth (of 2% per annum) outpacing movement growth (1% per annum). Under this scenario, in 2020/21, for Chapter 14 Minus, the day noise charge will increase by 25% and night noise charge will increase by 29%. We welcome these figures as a first step towards airports providing more information on forecast changes to environmental charges.

Determination of noise category of aircraft

3.51 The methodology followed by Gatwick airport up until 2016/17 to determine the noise category of aircraft was as follows:

- Chapter 2: Aircraft which are either not certificated or fail to meet the noise certification standards of ICAO Annex 16 Chapter 3.
- High: Defined set of aircraft that meet the noise certification standards of ICAO Annex 16 Chapter 3 unless the operator can provide satisfactory noise certification data demonstrating that the aircraft noise performance is at least - 5 EPNdB (cumulative) below the ICAO Annex 16 Chapter 3 certification limits.

- Chapter 3 Base: Aircraft which meet the noise certification standards of ICAO Annex 16 Chapter 3 and are not classified as either Chapter 3 High or Chapter 3 Minus.
- Chapter 3 Minus: Aircraft which meet the Chapter 3 standard and, on both arrival and departure, have a Quota Count[17] (QC) of 0.25, 0.5 or 1, or are exempt from a QC rating.
- Chapter 4: Aircraft which were either put into service on or after 1 January 2006 and meet the noise certification standards of ICAO Annex 16 Chapter 4 or can demonstrate that they meet the noise certification standards of ICAO Annex 16 Chapter 4.

3.52 From the year 2017/18, GAL grouped all Chapter 3 and below aircraft into a single noise charging category (Chapter 3 and Below), with the Chapter 4 category remaining unchanged. The airport also introduced Chapter 14 High, Base and Minus in its framework of charges. These subcategories are each 3 EPNdB wide and based on the cumulative margin to Chapter 3 exceeding -17, -20 and -23 dB respectively.

Movement and QC limits during the night quota period

3.53 At Gatwick the number of movements in the night quota period is limited to 11,200 in the summer season and 3,250 in the winter season respectively (total of 14,450 movements). In addition to a limit on night time movements there is also a noise quota limit, limiting the total amount of noise based on a system of noise quota counts assigned to individual aircraft type variants. Table 12 and Table 13 present the movement and noise quota limits at Gatwick airport from 2006/07 to 2016/17, for summer and winter.

3.54 Figure 11 and Figure 12 illustrate the values in the tables. In the 2015 and 2016 summer seasons, the movement usage was 99.5% and 100.9% respectively (Table 12). During that period the noise quota used was 76.9% in the summer of 2015 and 79.2% in the summer of 2016. During the winter period the lower demand is reflected in a lower movement and

[17] The Quota Count is a weighting attributed to the arrival or departure of a specified aircraft type by reference to its certificated noise performance, divided into 3 EPNdB bands.

noise quota usage; in the 2016/17 winter, the movement usage was 62.2% of the limit while 59.9% of the noise quota limit was used (Table 13).

Table 12: Movements and noise quota usage in the summer period at Gatwick Airport from 2007 to 2016

	Movements			Noise quota		
	Usage	Limit	% Used	Usage	Limit	% Used
Summer 2007	10,173	11,200	90.8%	5,328.50	6,700	79.5%
Summer 2008	10,618	11,200	94.8%	5,660.00	6,600	85.8%
Summer 2009	9,099	11,200	81.2%	4,786.50	6,500	73.6%
Summer 2010	9,875	11,200	88.2%	4,824.00	6,400	75.4%
Summer 2011	9,859	11,200	88.0%	4,998.50	6,300	79.3%
Summer 2012	9,837	11,200	87.8%	4,993.50	6,200	80.5%
Summer 2013	9,998	11,200	89.3%	4,818.00	6,200	77.7%
Summer 2014	11,147	11,200	99.5%	4,943.75	6,200	79.7%
Summer 2015	11,149	11,200	99.5%	4,765.50	6,200	76.9%
Summer 2016	11,303	11,200	100.9%	4,912.75	6,200	79.2%

Figure 11: Movement and noise quota usage against the limits at Gatwick Airport in the summer night quota period between 2007 and 2016

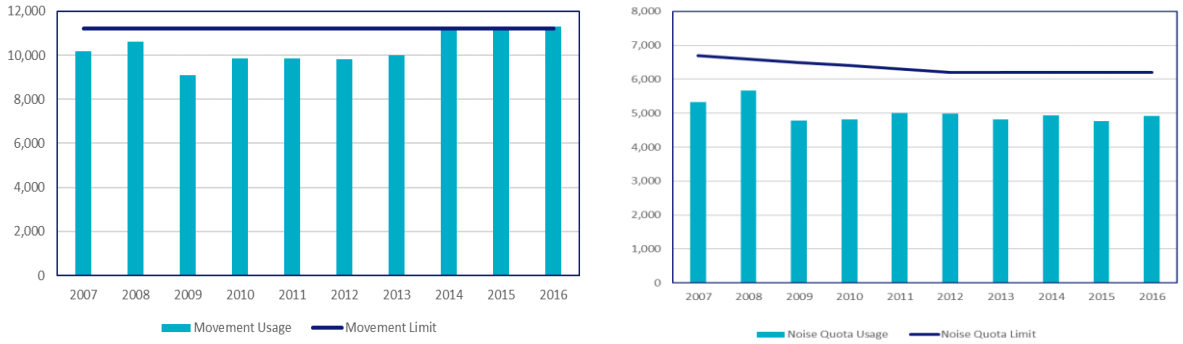
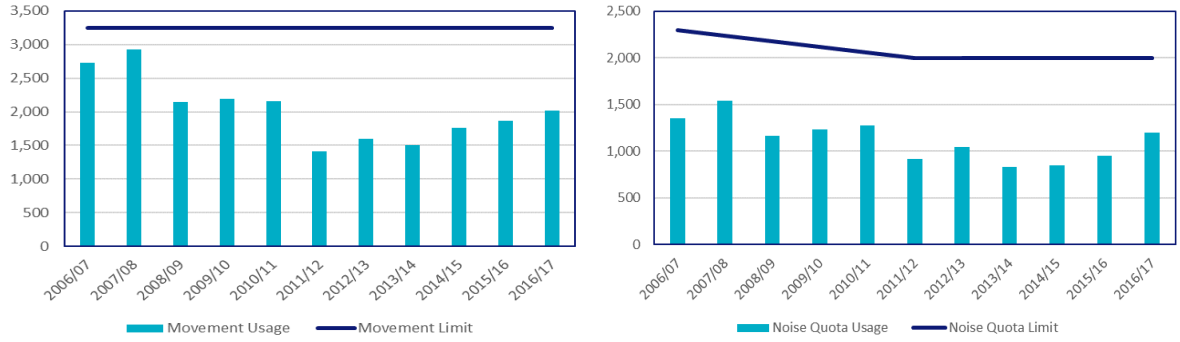


Table 13: Movements and noise quota usage in the winter period at Gatwick Airport from 2006/07 to 2016/17

	Movements			Noise quota		
	Usage	Limit	% Used	Usage	Limit	% Used
Winter 2006/07	2,734	3,250	84.1%	1,355.3	2,300	58.9%
Winter 2007/08	2,929	3,250	90.1%	1,542.3	2,240	68.9%
Winter 2008/09	2,145	3,250	66.0%	1,169.0	2,180	53.6%
Winter 2009/10	2,199	3,250	67.7%	1,236.8	2,120	58.3%
Winter 2010/11	2,160	3,250	66.5%	1,280.8	2,060	62.2%
Winter 2011/12	1,411	3,250	43.4%	920.3	2,000	46.0%
Winter 2012/13	1,603	3,250	49.3%	1,044.0	2,000	52.2%
Winter 2013/14	1,510	3,250	46.5%	828.5	2,000	41.4%
Winter 2014/15	1,756	3,250	54.0%	852.8	2,000	42.6%
Winter 2015/16	1,872	3,250	57.6%	953.0	2,000	47.7%
Winter 2016/17	2,022	3,250	62.2%	1,198.3	2,000	59.9%

Figure 12: Movement and noise quota usage against the limits at Gatwick Airport in the winter night quota period between 2006/07 and 2016/17

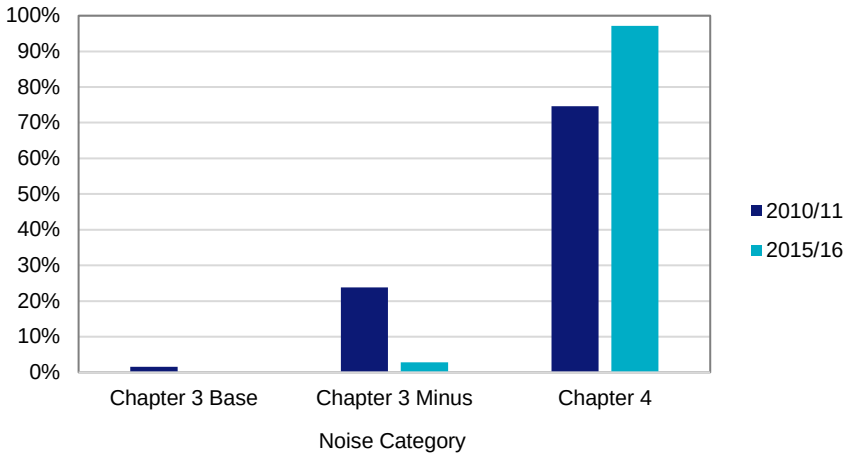


Fleet analysis by noise category

3.55 Based on information provided by Gatwick airport, the aircraft mix by noise category for 2010/11 and 2015/16[18] can be seen in Figure 13, which shows that 97% of operations were served by Chapter 4 aircraft and 3% by Chapter 3 Minus aircraft in 2015/16. The number of Chapter 3 aircraft operating has decreased by 22% in 2015/16 relative to 2010/11.

[18] Source: Gatwick Airport Finance Department. July 2016.

Figure 13: Gatwick aircraft mix, % operations by noise category



Source: Gatwick Airport Limited

3.56 Under the current or previous noise categorisation, it is not possible to verify levels of Chapter 4 High and Chapter 4 Base operations as GAL has not sub-divided the Chapter 4 standard into separate noise categories. It has not been possible, with the information available on Gatwick's fleet, to determine the aircraft mix by noise category. In the absence of a global database, noise certification levels for aircraft operating at Gatwick airport have only been available to us for aircraft registered in the UK (UK registered). Information given below in regard to aircraft movements per noise category has been obtained from the Gatwick operational database (Casper)[19] for arrival operations during the financial year (1st April to 31st March).

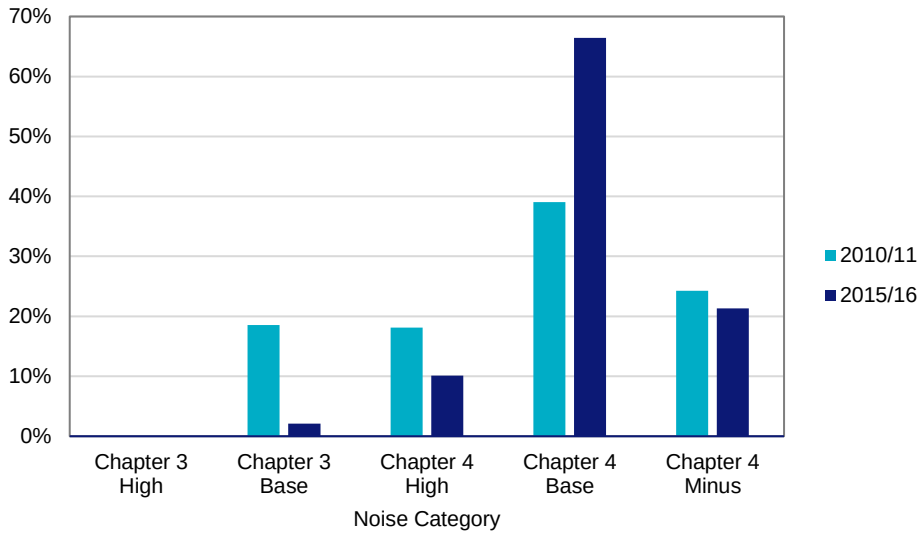
3.57 In 2010/11, 26% of the aircraft fleet at Gatwick were UK registered (642 aircraft) accounting for 77% of total movements, while in 2015/16, 24% were UK registered (576 aircraft) accounting for 72% of total operations. This sample is assumed to be representative of the overall fleet at Gatwick airport for the purpose of this report.

3.58 Table 8 showed the charge for Chapter 3 aircraft is double the charge for Chapter 4 aircraft. However, according to operational data from Gatwick airport only 3% of operations are Chapter 3 or below, as shown in

[19] The Gatwick Noise and Track Keeping (NTK) system

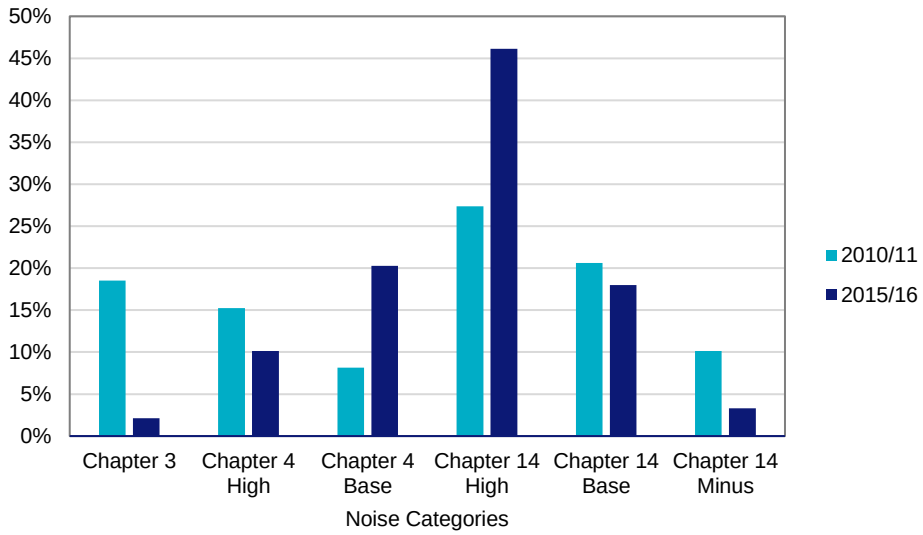
Figure 13. Considering only UK registered aircraft, Figure 14 shows that 98% of aircraft movements were Chapter 4 or above in 2015, in contrast to 81% in 2010, even though the fleet was made up of 95% and 97% Chapter 4 aircraft or above in 2010/11 and 2015/16 respectively. In light of the small percentage of operations affected, the higher charge on Chapter 3 aircraft still present in Gatwick's framework of charges acts as an effective back stop.

Figure 14: Gatwick Airport – movements distribution by previous noise category for UK registered aircraft



3.59 The operations that occurred at Gatwick Airport in both 2010/11 and 2015/16, with the current noise categorisation, are illustrated in Figure 15. The current set of noise categories subdivide Chapter 4 into Chapter 4 High and Chapter 4 Base with 10% and 20% share of operations respectively. Sixty-seven percent (67%) of movements at Gatwick meet the new Chapter 14 standard with 46% falling in the Chapter 14 High category, 18% in the Chapter 14 Base category and 3% in the Chapter 14 Minus category (for UK registered aircraft).

Figure 15: Gatwick Airport – movements distribution (%) by current noise category for UK registered aircraft



Discussion

3.60 There have been significant changes in the framework of charges at Gatwick airport since the publication of CAP 1119.

3.61 As recommended in CAP 1119, demand charges have been separated from environmental charges. GAL also introduced new noise charging bands for quieter aircraft that have lower costs for the best performing aircraft and higher costs for poorer performing ones. We welcome these changes to the framework of charges.

3.62 We further welcome that GAL has separated noise landing charges for landing and take-off and that these are based on the actual time of operation.

3.63 In regard to categorisation of aircraft, the division of noise categories for charging purposes does not reflect the present mix of aircraft at Gatwick. Most operations are served by Chapter 4 aircraft. Just 2% of operations are attributed to Chapter 3 Minus aircraft (the quietest aircraft that meets the ICAO Chapter 3 Base standard).

3.64 GAL accepts that 'the structure of aircraft noise charges has remained unchanged for a number of years and no longer reflects the most recent

developments in airframe and engine technology'[15]. Indeed, it seems disproportionate to divide Chapter 3 into two subcategories when no operations were served by Chapter 3 Base aircraft in 2015/16, and residual operations were attributed to Chapter 3 Base in 2010/11 (Figure 13). On the other hand, the Chapter 4 category is not subdivided despite accounting for 75% and 97% of operations in 2010/11 and 2015/16 respectively. This appears inconsistent.

3.65 CAP 1119 observed that there was insufficient differentiation between the aircraft with higher cumulative margins that make up the vast majority of operations. The current fleet has 10% of operations served by Chapter 4 High, and 20% served by Chapter 4 Base. The previous categorisation chosen by Gatwick with a single Chapter 4 category may have been unhelpful, as it masks the next noise category to be targeted, the Chapter 4 High.

3.66 By not subdividing its Chapter 4 charging band, Gatwick's charging system has a 7dB wide band (from -10dB to -17dB relative to the Chapter 3 limits). Whilst this may encourage operators, where they can, to select aircraft with margins in excess of -17dB, it does nothing to incentive operators to use quieter aircraft within the Chapter 4 charging band.

3.67 CAP 1119 recommended that for consistency and purposes of harmonising airport charges schemes, Chapter 4 High and Chapter 4 Base should be disaggregated noise categories so Chapter 4 High can be targeted with landing charges aligned with its own noise ratio.

3.68 As mentioned in paragraph 3.44, GAL has introduced a financial mechanism to Airbus A320 aircraft which have not carried out the FOPP modification by levying such aircraft with the highest charge in the framework of noise charges, namely Chapter 3 in the night period. This charge will be applied from the start of 2018, which has given airlines over a year to plan and modify their A320 aircraft in order avoid the charge. We welcome such initiatives by airports to address noise issues, and note that there is already evidence that the levy is encouraging adoption of the FOPP modification, reducing approach noise.

3.69 As with Heathrow airport, we believe that a forecast setting out the likely rate of increase in charges would show the continued efforts invested in moving Gatwick airport's fleet to quieter aircraft. It would need to be developed in consultation with airport users, assessing their potential ability to reasonably introduce 'best in class' aircraft from their forecast fleet.

3.70 The numbers of night movements in the Night Quota Period are set by government. Although Gatwick exceeded the summer season movement limit by 1% in Summer 2016, it offset this against unused movement quota in the winter period under the Night Quota System rules permitting it to trade up to 10% of movements from one season to another.

3.71 A noise charge has been introduced for night flights in winter, where there was previously no charge. GAL has decided also to recover 50% of noise charges from the day period and 50% from the night period, despite the latter accounting for only 5% of total flights. Consequently, the noise charges during the night period are adjusted accordingly, resulting in them being more than 12 times the day charge. We welcome these changes.

3.72 However, because the demand charges are much lower in the night period, some aircraft incur a lower overall (noise + demand) charge at night than during the day, despite the night noise charge being 12 times the day noise charge. This leads to a situation where an aircraft may be charged less to operate at night, than during the daytime which seems counterintuitive and risks incentivising airlines to operate night movements. We would like to see GAL plan to set night charges in subsequent years which disincentivise night operations, and to set these out in the forecast recommended in paragraph 3.69.

3.73 In addition, relative to the previous year, charges during the summer night period for 2017/18 are lower for the aircraft which are reallocated from the Chapter 4 category to the recently introduced Chapter 14 categories. Those that remain in Chapter 4 incur a higher charge than the previous year and thus the revised charging scheme now incentivises a shift from Chapter 4 to Chapter 14 during both day and night. As 67% of the fleet at

Gatwick already meet the Chapter 14 standard, they benefit from this change by incurring lower noise charges without changing noise exposure.

Stansted Airport

Determination of noise category of aircraft

3.74 The CAA understands that noise environmental charges at Stansted are set based on the cumulative margin to the Chapter 3 limits, rather than the ICAO noise Chapter to which the aircraft is certified. It also includes a subcategory called Chapter 3 Minus which is based on QC values (QC/1 or quieter on both arrival and departure), and a Chapter 4 category for aircraft that meet the noise certification standards of ICAO Annex 16 Chaper 4. However, it is unclear from the description given in the "Conditions of Use 2017/18" whether Chapter 3 and Chapter 4 aircraft with the same cumulative margin would be levied the same noise charge.

Landing charges overview

3.75 This section looks at the current status of landing charges at Stansted Airport. In addition, a summary of the charging system at Stansted is presented in Table 3.

3.76 There has been a 3% increase in landing charges at Stansted Airport between 2014/15 and 2016/17 across noise categories and Maximum Total Weights[20]; and a 2% increase in 2017/18 compared to 2016/17

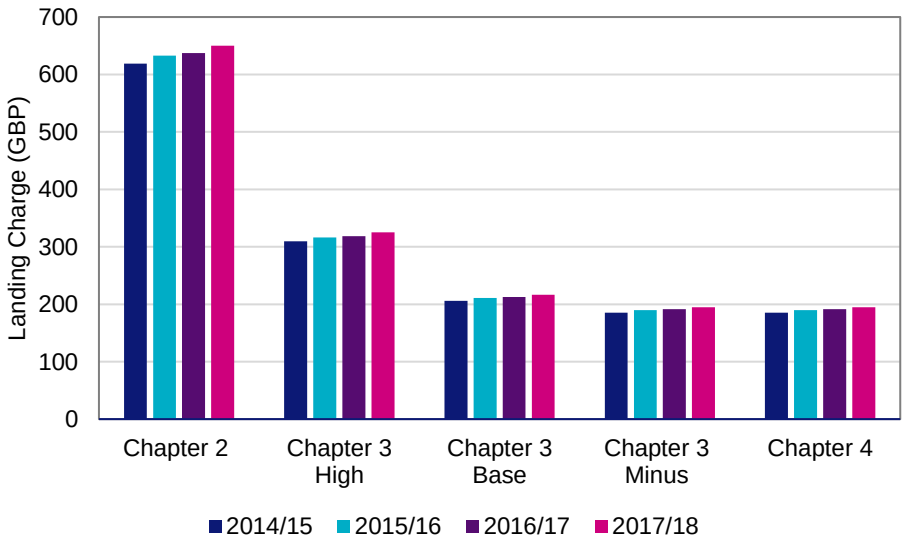
3.77 The noise categories that command the lowest charge (Chapter 3 Minus and Chapter 4) apply to aircraft with QC values (in both arrivals and departures) of 0.25, 0.5, 1 or that are exempt or entered into service from 2006. At peak times (1st April to 31st October), for aircraft of more than 55 tonnes, the charge is 164% of that applying to aircraft of more than 16

[20] According to Stansted Airport's Conditions of Use for 2017/18, Maximum Total Weight refers to ''Maximum Total Weight Authorised', which means the maximum total weight of the aircraft and its contents at which the aircraft may take-off anywhere in the world in the most favourable circumstances in accordance with the Certificate of Airworthiness in force in respect of the aircraft.'

tonnes and less than 55 tonnes. For aircraft heavier than 250 tonnes, the charge is 282% of that for aircraft of more than 16 tonnes and less than 55 tonnes, across all noise categories. In Off-Peak times (1st November to 31st March), landing charges are 26% lower than the Peak counterpart. It is worth noting that the framework of charges at Stansted airport does not discern between day and night periods.

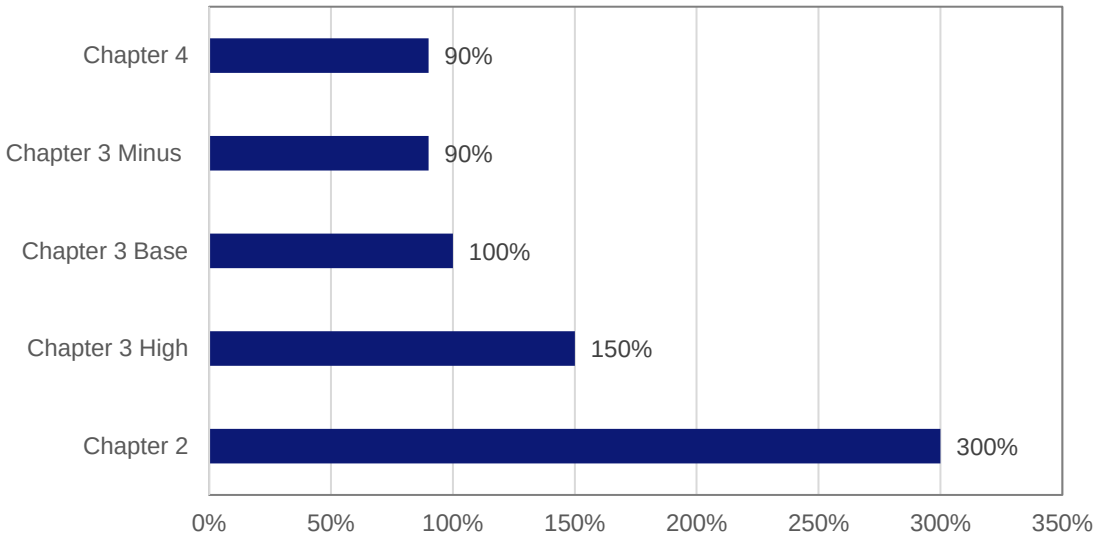
3.78 Figure 16 shows the evolution of charges from 2014/15 to 2017/18 for an aircraft with Maximum Total Weight between 16 tonnes and 55 tonnes by noise category. Although absolute values have increased slightly (see Figure 16), the relationship between charges of different categories, total weight or time of day have remained the same over the period.

Figure 16: Stansted Airport landing charges, peak time for aircraft between 16-55 tonnes, 2014-2018



3.79 Noise categories Chapter 3 Minus and Chapter 4 are grouped together and therefore levy the same tariff, which is 10% lower than that for Chapter 3 Base aircraft. Chapter 3 High aircraft are levied 50% more than Chapter 3 Base (see Figure 17).

Figure 17: Stansted Airport landing charge per noise category relative to Chapter 3 base



Movement and QC limits during the night quota period

3.80 At Stansted the movement limit stands at 7,000 in the summer and 5,000 in the winter night quota period (total of 12,000 movements). Table 14 and Table 15 illustrate movements and quota used over time. In the summer of 2016, the movement usage was at 105.3% and the noise quota usage was at 99.6% (Table 14). During the winter period of 2016/17 the lower demand is reflected by a lower movement and noise quota usage of 65.8% and 70.9% respectively (Table 15).

Table 14: Movements and noise quota usage in the summer period at Stansted Airport from 2007 to 2016

	Movements			Noise quota		
	Usage	**Limit**	**% Used**	**Usage**	**Limit**	**% Used**
Summer 2007	7,307	7,000	104.4%	4,399.5	4,900	89.8%
Summer 2008	6,498	7,000	92.8%	3,931.0	4,850	81.1%
Summer 2009	5,979	7,000	85.4%	3,538.3	4,800	73.7%
Summer 2010	6,081	7,000	86.9%	3,453.8	4,750	72.7%
Summer 2011	6,004	7,000	85.8%	3,552.0	4,700	75.6%
Summer 2012	5,837	7,000	83.4%	3,603.5	4,650	77.5%
Summer 2013	5,614	7,000	80.2%	3,513.3	4,650	75.6%
Summer 2014	6,747	7,000	96.4%	4,261.3	4,650	91.6%
Summer 2015	6,347	7,000	90.7%	4,085.5	4,650	87.9%
Summer 2016	7,370	7,000	105.3%	4,630.5	4,650	99.6%

Figure 18: Movement and noise quota usage against the limits at Stansted Airport in the summer night quota period between 2007 and 2016

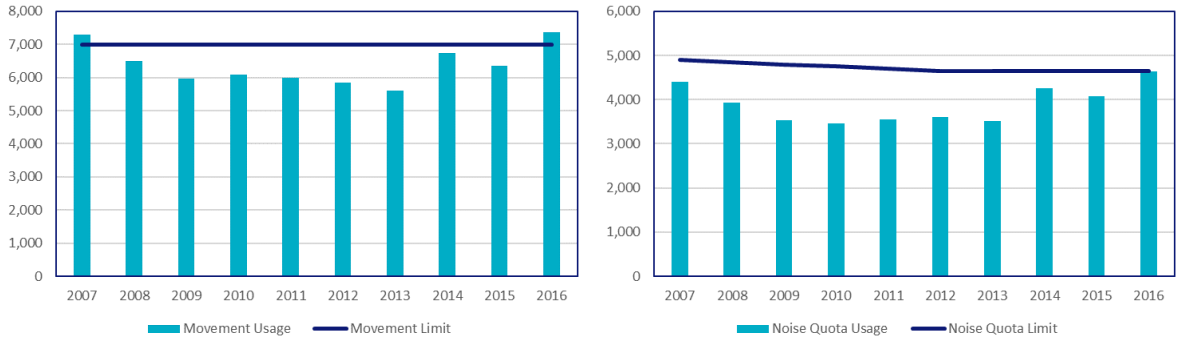
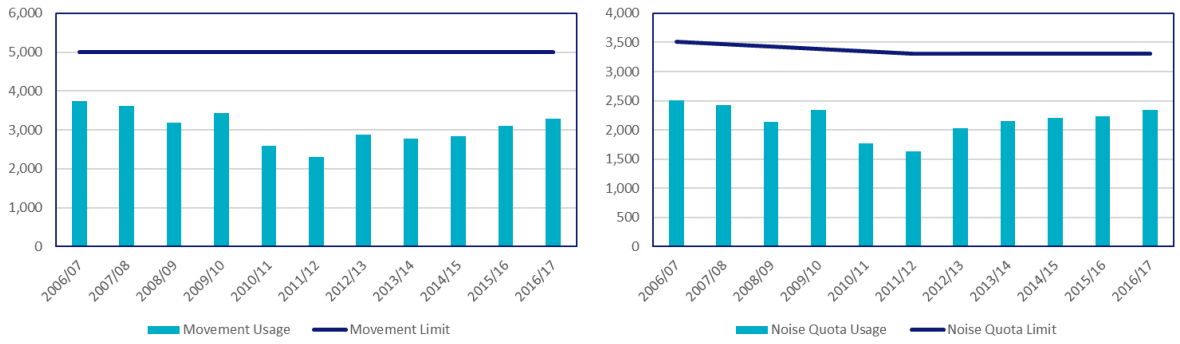


Table 15: Movements and noise quota usage in the winter period at Stansted Airport from 2006/07 to 2016/17

	Movements			Noise quota		
	Usage	Limit	% Used	Usage	Limit	% Used
Winter 2006/07	3,751	5,000	75.0%	2,513.8	3,510	71.6%
Winter 2007/08	3,612	5,000	72.2%	2,428.3	3,470	70.0%
Winter 2008/09	3,196	5,000	63.9%	2,136.5	3,430	62.3%
Winter 2009/10	3,426	5,000	68.5%	2,342.8	3,390	69.1%
Winter 2010/11	2,595	5,000	51.9%	1,766.3	3,350	52.7%
Winter 2011/12	2,298	5,000	46.0%	1,632.0	3,310	49.3%
Winter 2012/13	2,876	5,000	57.5%	2,023.5	3,310	61.1%
Winter 2013/14	2,778	5,000	55.6%	2,158.5	3,310	65.2%
Winter 2014/15	2,840	5,000	56.8%	2,205.5	3,310	66.6%
Winter 2015/16	3,105	5,000	62.1%	2,234.8	3,310	67.5%
Winter 2016/17	3,289	5,000	65.8%	2,348.3	3,310	70.9%

Figure 19: Movement and noise quota usage against the limits at Stansted Airport in the winter night quota period between 2006/07 and 2016/17



Fleet by noise category: analysis

3.81 In 2015/16, there were 269 airlines operating at Stansted of which 17 accounted for 94% of operations. The main operators at Stansted are Ryanair (with 68% of total operations) and easyJet (with 11% of total operations).

3.82 Ryanair used a fleet of 354 aircraft, and all but nine were Boeing 737-800, the majority of them are Chapter 4 High. In September 2014, Ryanair placed an order to purchase 200 Boeing 737 MAX 200 aircraft, with first deliveries due in 2019.[21] These aircraft will meet the new Chapter 14 standard.

3.83 easyJet, likewise, is expecting delivery of 100 A320neo aircraft (meeting Chapter 14 Minus criteria) between 2017 and 2022[22], having replaced part of its fleet already with current generation A320s which already meet the Chapter 14 standard (over 33% of current generation A320 aircraft meet Chapter 14 standard).

3.84 The CAA only holds noise certification data for UK registered aircraft. Ryanair's fleet are not UK registered but the noise category of the majority of its Boeing 737-800 aircraft are Chapter 4 High. Ryanair's fleet and the UK registered aircraft operating at Stansted accounted for 88% of operations in 2015 and 82% in 2010. The percentage of operations per noise category for both the previous and current categories are presented in Figure 20 and Figure 21, respectively. This shows that operations at Stansted Airport have been mostly served by Chapter 4 High aircraft in both 2010 and 2015. The fleet mix at Stansted airport in 2015 compared to 2010 shows an increase of movements served by higher noise categories (i.e. noisier aircraft) and a decrease of movements served by lower noise categories (quieter aircraft). This is unsurprising, since the proportion of total movements by the Boeing 737-800 have increased at Stansted over the same period.

[21] Ryanair website http://corporate.ryanair.com/. Accessed July 2017

[22] easyJet website: http://corporate.easyjet.com/. Accessed July 2017

3.85 Chapter 4 Base in the previous noise category system represents aircraft with a cumulative margin relative to ICAO Chapter 3 of between -15 and -20 EPNdB. In the current noise category classification, Chapter 4 Base represents aircraft with a cumulative margin between -15 and -17 EPNdB. The narrowing of the range of Chapter 4 Base explains the reduction of the Chapter 4 Base percentage contribution as presented with the newly adopted noise categorisation (Figure 21) relative to the previous noise categorisation (Figure 20).

Figure 20: Stansted Airport – percentage of operations by previous set of noise categories for the years 2010/11 and 2015/16

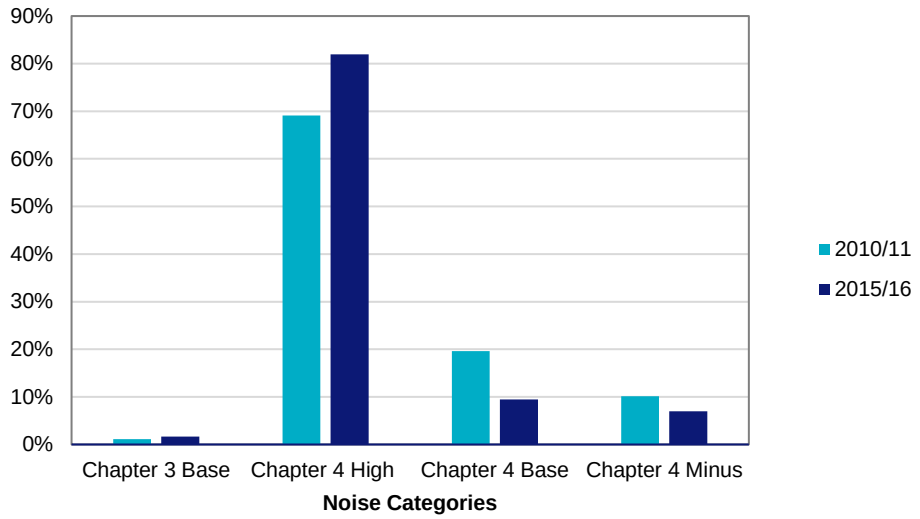
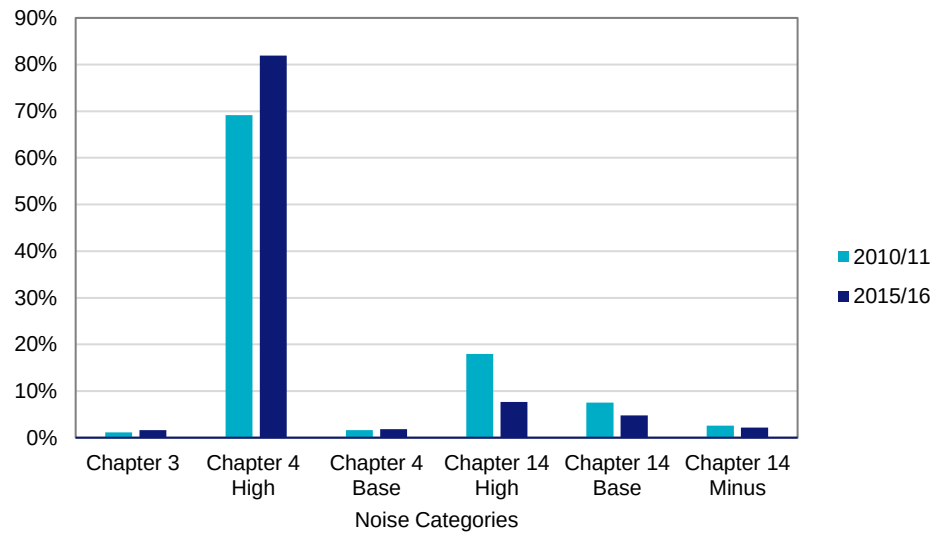


Figure 21: Stansted Airport – percentage of operations by current noise categories for the years 2010/11 and 2015/16



Discussion

3.86 There have not been significant changes in the framework of charges at Stansted airport since publication of CAP 1119. Of the three designated airports, Stansted has shown the lowest uptake of the recommendations laid out in CAP 1119.

3.87 Stansted airport is the only designated airport that still has not set a night period in its charging framework. The Aviation Policy Framework,[23] which sets out Government objectives and policy in regard to aviation, recognises that 'the impact and costs on local communities are higher from aircraft noise at night' than it is during the day, but also that 'it is neither reasonable nor realistic for such actions to impose unlimited costs on industry. Instead, measures to address noise impacts should be proportionate to the extent of the noise problem and numbers of people affected'.

3.88 In line with Government objectives, CAP 1119 recommended that 'Noise charges for operations occurring at night should be greater than those that occur during the day'. Since the publication of CAP 1119 there have not been changes at Stansted airport aimed at addressing a differentiation of charges between day and night periods. As a result, the current structure of charges at Stansted airport does not discern between day and night operations, a differentiation that we believe it is necessary in order to a) be able to target night noise at Stansted, b) show harmonisation with practices at other airports, and c) account for the higher impact that night noise has in relation to day noise.

3.89 In regard to landing charges per noise category, Chapter 2 and Chapter 3 High noise categories have relatively high landing charges (Figure 16) although no movements were attributed to either noise category in 2015 (based on analysis of movements by UK registered aircraft and those operated by Ryanair). As with Heathrow and Gatwick airports, the higher

[23] Aviation Policy Framework, Department for Transport, March 2013

charges for these noise categories are effectively a back stop rather than encouraging a shift to ‘best in class’.

3.90 As a consequence, a significant majority of Stansted operations fall in two noise charging categories. Differential charging is intended to encourage operators to bring ‘best in class’ aircraft by levying above a standard rate for noisier aircraft and below a standard rate for quieter aircraft. However, the noise categories in Stansted’s framework of charges appear to be too broad for that purpose. CAP 1119, recommendation b) states that “Noise charging categories should be of equal width, typically 5 EPNdB, or narrower, to ensure adequate differentiation of noise performance” (see Table 17).

3.91 Under the present regime, the Chapter 4 category is not disaggregated into its subcategories, Chapter 4 High and Chapter 4 Base. In fact, it is grouped, for billing purposes, with Chapter 3 Minus. We recommend Stansted Airport disaggregates Chapter 4 aircraft into subcategories, namely Chapter 4 High, Chapter 4 Base and the Chapter 14 standard subcategories in line with CAP 1119 recommendations a) to c) (Table 17). This follows our recommendation in regard to harmonisation in charges schemes at UK airports as stated in CAP 1119 recommendation g).

3.92 As illustrated in Figure 20 and Figure 21, the next noise category to be incentivised for phasing out is the Chapter 4 High category. However, it is not seen as a straight forward action, since the main operator uses a single Chapter 4 High type of aircraft, which in the event of increasing landing fees differentials may result in an unreasonable operational restriction given the difficulty the operator would have in responding to it.

3.93 On the other hand, the new Boeing 737 MAX 200 aircraft orders that Ryanair has placed, with deliveries starting in 2019, in combination with easyJet’s forthcoming A320neos, are arguably expected to increase significantly the proportion of quieter aircraft operations at Stansted. Despite this positive outlook, it is uncertain how significant the changes in the fleet mix will be.

3.94 In summary, we believe that a forecast setting out the likely rate of increase in charges for Chapter 4 aircraft would help to drive further improvements in environmental impacts at Stansted. It would need to be developed in consultation with airport users, assessing the potential ability of operators to reasonably bring 'best in class' aircraft from their forecasted fleet.

Current framework of noise-related charges at non-designated airports

3.95 This section gives details of the current framework of noise related charges at the three non-designated study airports. In addition, a summary of charging systems at the study airports is presented in Table 3.

Manchester Airport

3.96 Manchester Airport levies runway charges on departures, based on Maximum Take-Off Weight (MTOW) authorised, QC category and time of day and year.

3.97 The runway charges levied to passenger aircraft are shown in Table 16. Cargo aircraft are levied £6.62 per tonne in standard period and £3.43 per tonne in off-peak period (-48%). The Off-peak period for cargo operations is from 05.30-06.30, 10.00-16.00 and 20.00-23.00, which is a different period from that applied to passenger aircraft.

Table 16: Manchester airport departure runway charges for passenger aircraft in 2017/18

		Summer Standard	Summer Off-Peak	Winter Standard	Winter Off-Peak
	Applicable time of day	**07.00-13.00 16.00-19.00 23.00-05.30**	**05.30-07.00 13.00-16.00 23.00-05.30**	**Same as Summer Standard**	**Same as Summer Off-Peak**
MTOW Authorised	**<25 tonnes**	£6.67/tonne	£6.67/tonne	£6.14/tonne	£6.14/tonne
	25-120 tonnes	£8.20/tonne	£6.67/tonne	£7.56/tonne	£6.14/tonne
	>120 tonnes	£8.20/tonne (120T) + £4.45/tonne (thereafter)	£6.67/tonne	£7.65/tonne (120T) + £4.11/tonne (thereafter)	£6.14/tonne

3.98 The framework of charges at Manchester Airport does not differentiate by noise category. The only charges relating to noise are:

- Only Chapter 3, Chapter 4 or Chapter 14 aircraft are allowed to be scheduled to land or take off in the period from 23.30-05.59. Noisier aircraft that are permitted to land or take off will incur a 70% surcharge.

East Midlands Airport

Passenger aircraft

3.99 East Midlands Airport levies a runway charge of £10.41/tonne on departures for all passenger aircraft. A surcharge of 25% is applicable in the night period between 23.30-06.00, for aircraft that are rated QC4 or above.

3.100 Between 23.00-07.00, QC8 and QC16 aircraft are only allowed to operate in exceptional circumstances (such as delays for technical reasons). When permitted, operations will incur a penalty of £5,000 for QC8 aircraft and £10,000 for QC16 aircraft.

Cargo aircraft

3.101 Charges for cargo aircraft are levied at £0.94 per tonne (base charge) for both arrivals and departures. In the shoulder periods (between 06.00-07.00 and 21.00-23.30), there is an additional charge of £1.90 per tonne on arrivals and departures (200% surcharge relative to base charge).

3.102 In the night quota period, 23.30-6.00, and in addition to the runway charge, cargo aircraft is charged depending on their QC category: £2.86 per tonne for QC<1, £3.18 for QC1, £3.32 for QC2 and £3.50 for QC4. Relative to the base charge, the night surcharges range from 305% for aircraft rated at QC<1 to 374% for QC4 aircraft. Between 23.00-07.00, QC8 and QC16 aircraft are only allowed to operate in exceptional circumstances; when permitted, these operations will incur a penalty of £5,000 for QC8 aircraft and £10,000 for QC16 aircraft.

Birmingham Airport

Passenger aircraft

3.103 Charges on passenger aircraft are levied based on authorised MTOW at £11.22 per tonne on departure. There is no noise element to this charge.

Cargo aircraft

3.104 For cargo operations of aircraft below 30 tonnes, departures are charged at the same rate as passenger aircraft. For heavier aircraft the charges apply to both arrivals and departures, and depend on the time of day. Between 07.00-21.00 (day period) a charge of £1.69 per tonne is levied; in the shoulder period (between 06.00-07.00 and 21.00-23.00) the charge is £3.37 per tonne (100% surcharge relative to day period rate); and for the night period, 23.00-06.00, the charge is £5.05 per tonne (200% surcharge relative to the day period rate).

Non-designated airports: summary

3.105 The three non-designated airports do apply some differentiation of charges depending on the noisiness of the aircraft, whether it is applied according to QC categories as it is in Birmingham and East Midlands, or

according to QC categories and ICAO noise standards as is the case for Manchester Airport. However, some airports, as Manchester airport in this report, charge more for passenger aircraft than cargo aircraft, irrespective of the noise certification levels of the aircraft. This may reflect airport business decisions, however, our recommendation in CAP 1119 was, and continues to be, that noise and business related charges (e.g. demand or operation type) should be separated and that noise charges should be linked to certificated noise performance.

3.106 The only noise-related charge differential applied at Manchester Airport is the surcharge of 70% applied during the night period to aircraft that fail to meet the Chapter 3 standard (Chapter 2 aircraft with an MTOW greater than 34 tonnes have been banned from the EU since 2002, and only under specific circumstances are operations are granted. However those below 34 tonnes may continue to operate).

3.107 At Birmingham Airport, there is no differentiation of charges by noise category, but, in regard to night noise, cargo operations of aircraft of more than 30 tonnes command a 200% surcharge during the night period relative to the day charge.

3.108 At East Midlands Airport, passenger aircraft are levied a 25% surcharge during the night for the noisiest aircraft, rated QC4 and above. Cargo operations during the shoulder period command a 200% surcharge (relative to daytime). During the night, a differential charge is applied in addition to standard runway charges depending on the QC rating of the aircraft (from £2.86 per tonne for QC<1 to £3.50 per tonne for QC4, applying equally to arrivals as well as departures).

3.109 Overall, the charging schemes at the three non-designated airports are quite different to each other and to those at the designated airports. The non-designated airports have not yet made changes to their charging schemes following the recommendations made in CAP 1119.

Chapter 4

Emissions-related charges

4.1 The EU, through The Air Quality Framework Directive on Ambient Air Quality, has placed a requirement on Member States to achieve prescribed health based air quality limits which are legally binding and to be met by the UK government. In regard to NOx emissions the EU/UK annual average limit value is 40µg/m^3 and 200 µg/m^3 is the peak limit (measured as a 1 hour mean which is not to be exceeded more than 18 times in a calendar year).

4.2 In addition, under the Environment Act 1995, local authorities have a statutory duty to assess air quality in their area. Concern or likelihood of breaches of limits in a particular locality may lead the local authority to declare an Air Quality Management Area (AQMA).

4.3 Consequently, local air quality is part of the agenda for the sustainable development of airport activities as action must be taken where necessary to avoid breaching the limits. The three designated airports produce annual updates to their air quality strategy objectives.

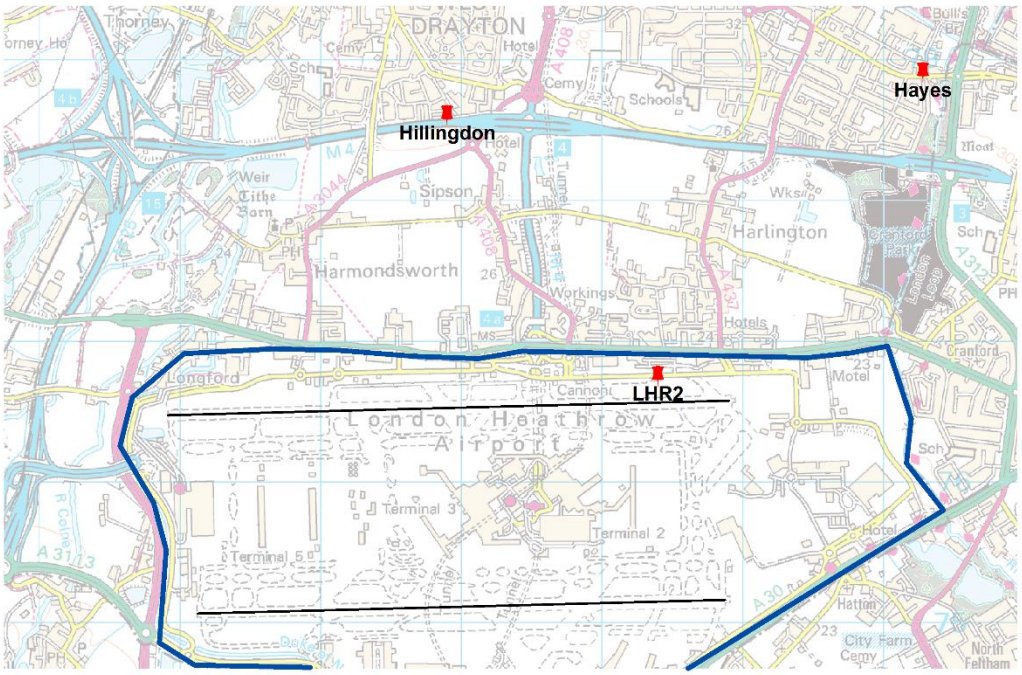
4.4 Heathrow and Gatwick airports levy emission charges as they are experiencing, or are likely to experience, a local air quality problem. Such concerns are not present at the other study airports, and consequently they do not levy an emissions charge.

Heathrow Airport

4.5 Heathrow Airport is surrounded by main roads as well as an industrial estate that contributes significantly to local air quality pollutant emissions. Consequently, the allocation of emissions to their sources is not straightforward, however Heathrow Airport has reported that the contribution of the airport to NOx pollutant levels is 30% at the boundary of airport and decreasing fast beyond the boundaries. Three air quality

monitoring sites have consistently recorded breaches of the annual average limit.[24] One of the sites is within the airport boundary and not accessible to the public (LHR2), another is at a junction of the M4 motorway (Hillingdon at 2.0 km from closest runway point), and the third is in Hayes (at around 2.6 km from closest runway point) see Figure 22. Aircraft activity has a limited effect at the latter two monitoring sites, as non-aviation stationary sources and road traffic are the main contributors to pollutant levels at these locations. Pollutant levels in residential areas close to the boundaries of the airport have not breached EU/UK limits. Nonetheless, the four local authorities surrounding Heathrow have all declared AQMAs for NO_2 (NO_2 and NO are nitrogen oxides which, together, are generally referred to as NOx when relating to air pollution). Heathrow Airport is working with these local authorities to monitor and improve air quality.

Figure 22: Map of Heathrow Airport and surroundings



[24] Q4 2015 briefing and end of year summary. Air Quality at Heathrow Airport. http://www.heathrowairwatch.org.uk/documents/AQ_briefing_2015_Q4.pdf (accessed July 2017)

4.6 HAL's strategy in regard to emissions is to quantify, reduce and demonstrate best practice.[25] HAL carries out continuous air quality measurements at fixed locations as well as modelling to estimate air quality levels.

4.7 The main sources of NOx emissions as a result of direct airport activities are aircraft (landing, taxiing, take-off, engine testing), boilers (power and heating), airside vehicles and APUs (Auxiliary Power Units).

4.8 Airlines operating at Heathrow have adopted the Sustainable Aviation Departures Code of Practice which provides advice on:

- the use of Fixed Electrical Ground Power and Preconditioned Air rather than using APUs;
- taxi with less than all engines operating; and
- Continuous Climb Operations.

4.9 Despite the increase in the number of operations, NOx emissions have been reducing. Between 2008/9 and 2012/13 ground based NOx emissions (aircraft, airside and landside) were reduced by 16%. HAL considers that changes in Heathrow's fleet, the opening of Terminal 5 allowing more efficient ground operations, limits in the use of APUs, the landing charges and reduced engine taxiing (taxiing produces 40% of ground based aircraft emissions) are the main reasons attributed for that reduction. According to Heathrow Airport's website, 55% of aircraft met the CAEP6 standard (Table 2) in 2014 in contrast to 46% in 2013.

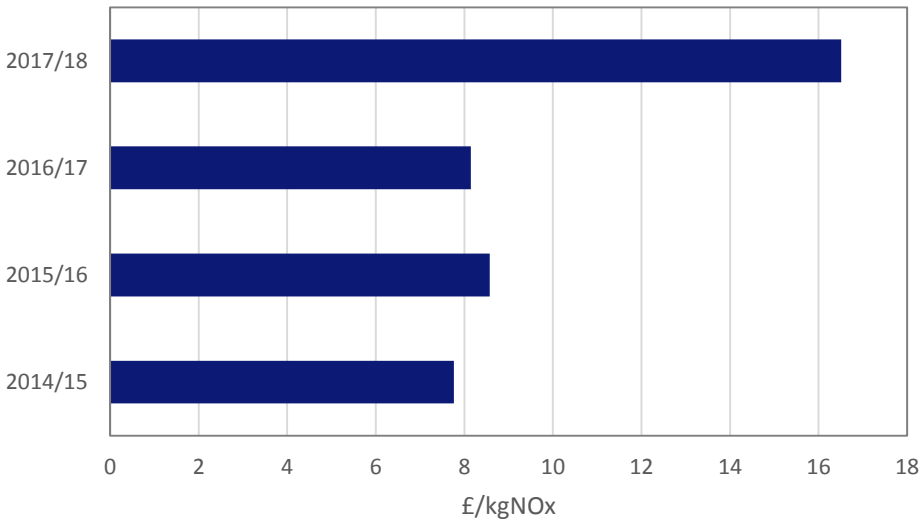
4.10 To further incentivise NOx emissions reductions, HAL operates a NOx charging scheme based on a cost per kilogram of NOx emitted per landing and take-off cycle.

4.11 Since publication of CAP 1119 HAL has increased the NOx charge in 2017/18 to £16.51/kgNOx, double that of the year 2016/17, see Figure 23. This has resulted in a percentage increase in environmental charges from 21% to 28% of airport charges as well as an increase of emission charges

[25] Heathrow Air Quality Strategy 2011-2020. Heathrow Airport Limited. 2010

within the environmental charges from 15% to 20%. This increase in environmental charges is offset by per-passenger charges, which reduces from 75% of airport charges to 68%, acting as a balancing factor for Heathrow Airport to recover the regulated price cap.

Figure 23: Heathrow Airport: emissions charges (£/kgNOx)



Gatwick Airport

4.12 NOx concentrations around Gatwick Airport have never breached EU limits.[26] There is a system of monitoring stations which Gatwick airport together with Horley and Crawley local authorities (neighbouring towns to Gatwick airport) operate.

4.13 Crawley, to the south of the airport did carry out a detailed assessment but, in light of the results, did not declare an AQMA. However, Reigate and Banstead Borough Council did declare an AQMA to the north of the airport perimeter. The closest residential area to the airport lies to the south of the AQMA.

4.14 There are fewer sources of pollution around Gatwick than around Heathrow, which is reflected in the overall levels of NOx emissions.

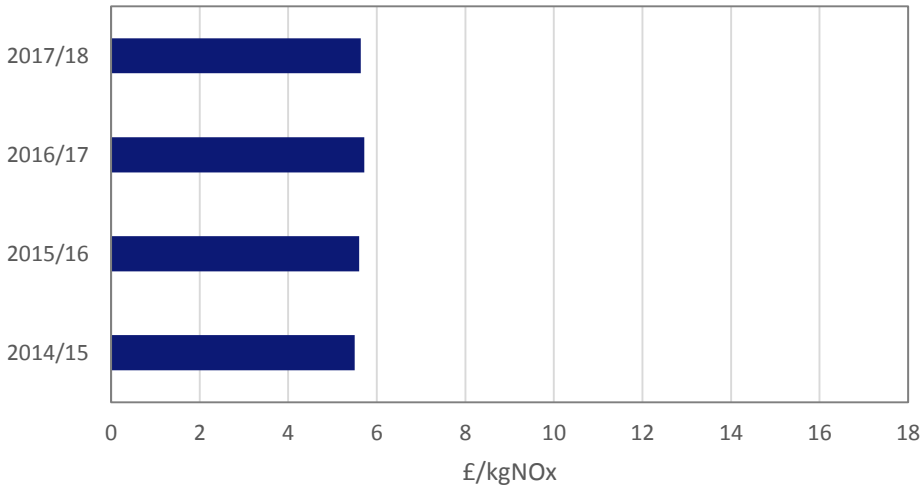
[26] A second runway for Gatwick (Appendix A9 Air Quality). Figure 2, page 12, 2014

Consequently, there is a bigger proportion of airport related activities contributing to emissions (58% in 2010)[26] at Gatwick compared to Heathrow airport (30% at the boundary of airport).

4.15 To further incentivise NOx emissions reductions, GAL operates a NOx charging scheme based on a cost per kilogram of NOx emitted per landing and take-off cycle.

4.16 The emission charges (£/kgNOx per LTO cycle) at Gatwick Airport since the publication of CAP 1119 are shown in Figure 24. They have increased from £5.50 per LTO cycle in 2014/15 to £5.64 per LTO cycle in 2017/18 (2.5% increase). Figure 24 conserves the same scale as the corresponding figure for Heathrow airport (Figure 23) to facilitate comparison.

Figure 24: Gatwick Airport: emissions charges (£/kgNOx)



Stansted Airport

4.17 The number of aircraft movements at Stansted are less than those at Gatwick and Heathrow airports, consequently the emissions of pollutants due to aircraft activity are lower. In addition, Stansted Airport is sited in a rural environment with a much lower population density and a smaller nearby industrial estate than at Heathrow or Gatwick.

4.18 All these factors contribute to the fact that EU NOx limits have never been breached in the vicinity of Stansted Airport. Nevertheless, Stansted produces an annual Air Quality report providing details for air quality monitoring to assess compliance and investigate changes. The latest update on air quality monitoring[27] shows that one monitor exceeded the peak concentration limit 6 times (the limit is breached when the prescribed exceedance happens at least 18 times in a calendar year) but it was attributed to a non-aviation source (generator). Consequently, Stansted airport does not levy a NOx charge on aircraft operations.

[27] Air quality monitoring at Stansted airport 2015, Ricardo Energy and Environment.2016

Chapter 5

Review of previous and current schemes against CAP 1119 recommendations

5.1 This section reviews the level of adherence of the study airports current charging schemes to the recommendations laid out in CAP 1119. This information is presented in Table 17.

Table 17: Check-list CAP 1119 recommendations

CAP 1119 Recommendations	Heathrow	Gatwick	Stansted	Manchester	East Midlands	Birmingham
a) Noise charging categories should be based on ICAO certification data, namely the margin to Chapter 3, to incentivise best-in-class.	Yes	Yes	Yes	Categories are not based on cumulative margin	Categories are not based on cumulative margin	Categories are not based on cumulative margin
b) Noise charging categories should be of equal width, typically 5 EPNdB, or narrower, to ensure adequate differentiation of noise performance.	Noise categories are no greater than 5 EPNdB, but not of equal width	Noise categories are not of equal width and one has a width greater than 5 EPNdB	Currently no subdivision of Chapter 4, nor adoption of Chapter 14 standard	No Charging categories not based on cumulative margin	No Charging categories not based on cumulative margin	No Charging categories not based on cumulative margin
c) The noise charging categories used at a given airport should cover the full range of aircraft in operation at the airport. This range should be reviewed periodically and modified as appropriate.	Yes	Yes	Yes	Yes	Yes	Yes
d) Noise charges for operations occurring at night should be greater than those that occur during the day.	Yes 2.5x that of the day charge	Yes 12.6x that of the summer day charge	No Night period is not differentiated from day period	No	Yes 25% surcharge for passenger operations at night. Surcharge for cargo depends on QC value.	Yes 200% surcharge for cargo operations during the night period; nothing for passenger
e) Where noise-related charge differentials occur depending on the time of day of an operation, the scheduled time of the operation should be used as oppose to the actual time. Penalties may be used to dis-incentivise operations scheduled to occur on the cusp of the night period that regularly fall into the night period.	Actual time	Actual time	Not applicable	Not applicable	Actual time	Actual time

CAP 1119 Recommendations	Heathrow	Gatwick	Stansted	Manchester	East Midlands	Birmingham
f) There should be a clear distinction between noise-related landing charges and any non-noise-related charges, e.g. demand-related charges.	Yes	Yes	No	No	No	No
g) Charging schemes should ideally be harmonised across airports within the UK. Aircraft should be treated similarly from one airport to another, even if the charges at each airport are different.	No	No	No	No	No	No

Chapter 6

Discussions and recommendations

Noise

6.1 CAP 1119, published in 2013, reviewed the environmental landing charges levied at six UK airports: Birmingham, East Midlands, Gatwick, Heathrow, Manchester and Stansted.

6.2 This report presents a summary of the main changes that have occured to the charging schemes at these airports since the publication of CAP 1119 in the context of the recommendations given previously. In the first instance, we look at the way the airports have addressed the noise categorisation of their fleets and its adequacy; secondly, the current mix of the fleet per noise category and progress in shifting to 'best in class' is reviewed; thirdly, we look into how airports have addressed night noise, and; finally, we consider the changes by HAL and GAL, for 2017/18, to their noise-related charging schemes (the other airports have not changed their charging schemes since CAP 1119 was published).

Division of noise categories

6.3 One of the main changes in the division of noise categories is the incorporation of the Chapter 14 noise category in the framework of charges of Heathrow and Gatwick airports for 2017/18. At these airports, the Chapter 14 noise category is fully disaggregated into three subcategories (High, Base and Minus) and replaces the previous Chapter 4 Minus category and partially the Chapter 4 Base category.

6.4 At Heathrow and Gatwick airports (from 2017/18), noise certification levels (cumulative margin relative to Chapter 3) are used to determine which noise category an aircraft should be allocated to, whereas at Stansted the ICAO noise certification Chapter and QC values are used.

6.5 Stansted Airport has continued to adopt a broad grouping of noise categories for charging purposes that does not reflect the current fleet nor provide adequate differentiation in noise performance. Stansted Airport has disaggregated the range of cumulative margin between -5 dB and -10 dB relative to the Chapter 3 limit into Chapter 3 Base and Chapter 3 Minus even though the number of operations served by Chapter 3 aircraft is minimal both in 2010 and 2015. On the other hand, it has not disaggregated the Chapter 4 noise category which accounts for 98% of operations.

6.6 For the purposes of comparability with other airports and providing appropriate incentives for airlines to use 'best in class' aircraft, we continue to recommend that airports should disaggregate their ICAO noise categories fully into all subcategories available using cumulative margin for category allocation, consistent with ICAO guidance and with the recommendations given in CAP 1119. Noise categories should be no greater than 5 EPNdB wide, and should be of equal width. Further sub-categorisation is not discouraged as long as the criteria for differentiation follow ICAO guidance in that it is based on noise certification data, i.e. cumulative margin.

Influence of noise-related landing charges in shifting to 'best in class'

6.7 A fleet analysis, per noise category, of the three designated London airports has been carried out looking at the proportion of operations served by each noise category in order to assess any correlation between differential landing charges and shifts towards a quieter fleet. The allocation of aircraft to a specific noise category in this report has been done considering only the cumulative margin of the noise certification levels of the aircraft relative to Chapter 3 and not the noise standard to which the aircraft was certificated.

6.8 Considering the previous charging schemes, it is difficult to ascertain the true measure of the influence that differential landing charges has had in persuading airlines to shift to quieter aircraft. HAL and GAL have

disaggregated ICAO noise Chapters fully into a number of categories and subcategories, applying different charges to each of them. In contrast, Stansted Airport appears to have an under-divided set of noise categories without much differentiation in charging.

6.9 Despite the different approach in disaggregating noise categories, the numbers of Chapter 3 aircraft in operation at the three designated airports have reduced to below residual levels. Operations at the three designated airports are overwhelmingly served by Chapter 4 or better aircraft (99% at Heathrow airport and 98% at Gatwick and Stansted airports based on CAA analysis).

6.10 The proportion of Chapter 4 High aircraft movements at Stansted is 82%, in contrast to 17% and 10% at Heathrow and Gatwick respectively. The replacement of Chapter 4 High aircraft at Stansted is a complex matter, relative to Heathrow and Gatwick airports, as most of these operations are served by a single operator which uses a single type of aircraft.

6.11 The proportions of operations served by Chapter 14 aircraft may indicate the level of readiness of an airport to encourage the phasing out of Chapter 4 aircraft and replace them with Chapter 14 aircraft. At Heathrow and Gatwick, the proportions of Chapter 14 aircraft are 56% (all fleet) and 67% (UK registered) respectively. In contrast, 43% of the Stansted fleet (our sample is UK registered aircraft and Ryanair fleet) are Chapter 14 aircraft.

6.12 We consider that earlier signalling of the introduction of structured higher charges could help airlines to plan to respond to future changes in landing charges and offer clearer incentives which may result in achieving quieter fleets in less time. To that end, we recommend airports publish, in consultation with airport stakeholders, a forecast report which would include a strategy and timeline of likely changes to the charging regime with the aim of incentivising the phase out of the next noisiest category, Chapter 4 High (or Chapter 4, if applicable). This sort of initiative would allow operators to consider their fleet options well in advance, and in addition, would provide a base for wider stakeholder groups to discuss its

rationale, stringency or its likely impact. Moreover, it would undoubtedly be beneficial to transparency.

Night noise

6.13 At Heathrow Airport, landing charges during the night period have commanded a surcharge of 150% of the landing charge during the day period since 2007. However, as mentioned in paragraph 3.19, HAL define the night period as 0100-0429 (local time), where there is currently a voluntary ban on operations. This definition does not recognise the additional disturbance caused by late departures or arrivals before 0600. With regard to night noise charges, as discussed in paragraph 3.34, we recommend that HAL align its night noise charging period with the Night Quota Period, recognising the additional disturbance caused by flights between 2330 and 0600. Secondly, HAL's noise charging scheme is currently based on actual arrival time and does not take into account departure time. This leads to a situation where an aircraft may arrive on time, but depart late, potentially into the night period, and face no additional charge. We recommend that HAL separate its noise charge into arrival and departure elements based on actual time.

6.14 CAP 1119 reported that the framework of charges at Gatwick airport were more demand based than noise related. Since the publication of CAP 1119, there have been significant changes to the framework of charges, the most recent of which were introduced in April 2017. As recommended in CAP 1119, demand charges have been separated from environmental charges. GAL also introduced new noise charging bands for quieter aircraft that have lower costs for the best performing aircraft and higher costs for poorer performing ones. We welcome these changes to the framework of charges.

6.15 Furthermore, in GAL's framework of charges for 2017/18, a winter night period charge has been introduced, where there was previously no charge. We welcome this change. However, the increase in summer night noise charge is offset by a much lower night demand charges. This leads to a situation where an aircraft may be charged less to operate at night

than during the daytime which seems counterintuitive and risks incentivising airlines to operate night movements. We would like to see GAL plan to set overall night charges to be higher than overall day charges that aim to disincentivise night operations, and we believe that a forecast setting out the likely rate of increase in charges would show the continued efforts invested in moving Gatwick Airport's fleet to quieter aircraft.

6.16 The current structure of charges at Stansted Airport does not discern between day and night operations. CAP 1119 recommended that 'noise charges for operations occurring at night should be greater than those that occur during the day', a differentiation that is necessary in order to a) be able to target night noise at Stansted, b) show harmonisation with practices on other designated airports, and c) account for the higher impact that night noise has in relation to day noise.

6.17 Furthermore, of the airports studied, those with a night period defined in their scheme of charges (Heathrow, Gatwick, East Midlands and Birmingham) do consider actual time of operation rather than scheduled time of operation for billing purposes contrary to CAP 1119 (recommendation "*e"* in Table 17. Recommendation e) stated that 'where noise-related charge differentials occur depending on the time of day of an operation, the scheduled time of the operation should be used as oppose to the actual time. Penalties could be used to dis-incentivise operations scheduled to occur on the cusp of the night period that regularly fall into the night period').

Changes introduced in 2017/18

6.18 HAL and GAL conducted consultations on airport charges which have been implemented in 2017/18. For 2017/18, both airports have incorporated the new ICAO Chapter 14 standard into their charging schemes, which is disaggregated into subcategories called Chapter 14 High, Chapter 14 Base and Chapter 14 Minus.

6.19 For 2017/18, Heathrow Airport has increased environmental charges from 21% to 28% of airport charges, and within environmental charges, 80% is allocated to noise charges and 20% to emissions charges, as opposed to the previous ratio of 85% for noise charges and 15% for emission charges. This increase is offset by the per passenger charge which is decreased from 75% to 68% of airport charges, so the regulated cap on airport charges is not exceeded.

6.20 For 2017/18, Gatwick Airport has divided the landing and take-off charges into demand-related and noise-related charges, as advised in CAP 1119. Demand charges contribute to 82% of the revenue from runway charges, noise-related charges contribute to 9% and emissions (NOx) charges contribute the remaining 9%. Within the segregated scheme of charges (demand and noise separately), noise-related charges during the night period are levied at more than 12 times the tariff of the day period.

6.21 Also for 2017/18, landing and take-off charges at Gatwick Airport in the winter night period are aligned with those in the summer night period, an increase on the previous base summer tariff.

6.22 GAL has also notified that, from 2018, unmodified A320 aircraft (FOPP issue) will incur a noise charge equivalent to Chapter 3 in the night period, giving airlines over a year to modify aircraft in order to avoid the charge[15]. We welcome initiatives by airports to remedy particular noise issues such as the FOPP modification, provided that such measures are appropriately applied. The decision by GAL to make a charge to A320 aircraft without FOPP modification sends a clear message which is hoped will increase the rate at which aircraft are modified.

Emissions

6.23 The emissions charge at Heathrow is increased by 100% from 2017. Under the previous charging scheme, environmental charges made up 21% of airport charges, and 85% of these environmental charges at Heathrow were levied as part of the noise charges, and the remaining

15% as part of the emissions charges. In 2017/18, environmental charges makes up 28% of airport charges, an increase of 7%, and 20% of the environmental revenue comes from emissions charges.

6.24 Two monitoring points near Heathrow Airport have exceeded average UK/EU limits on NOx[28]. However, the direct contribution of aircraft activity to the levels of NOx has been found to be relatively low compared to other sources at these two locations. Nonetheless, Heathrow Airport is actively engaged with the four local authorities surrounding the airport (all of which have declared an Air Quality Management Area for NO_2) in the continuous monitoring and observation of changes, as well as pursuing initiatives to improve air quality.

6.25 Likewise, Gatwick is engaged with local authorities to monitor areas of concern in regard to NOx emissions. The area surrounding Gatwick has never breached UK/EU NOx limits, but there is an Air Quality Management Area to the north of the airport.

6.26 Stansted does not levy an emissions charge but does monitor continuously and investigates any changes of peak or average NOx concentration.

6.27 The three designated airports have adequate monitoring systems through which data is collected and analysed. Annual reports are produced by the three airports reporting on any changes.

[28] Heathrow Air Quality Strategy 2011-2020. Heathrow Airport Limited. 2010