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Night time restrictions at Amsterdam-Schiphol

An international comparison

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Under contract of

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Inhoudsopgave

1 Introduction

Amsterdam-Schiphol (AAS) is one of the four major European airports apart from Frankfurt-Main, London-Heathrow and Paris-Charles de Gaulle, and offers important economic benefits to the Netherlands. At Present about 400.000 aircraft movements are performed on a yearly basis, transporting about 41 million passengers. With increasing traffic volumes in the last decades, environmental consequences emerged due to aircraft noise, resulting in annoyance (e.g. sleep disturbance) of people living in the neighbourhood of the airport. In order to reduce the environmental consequences of the airport activities, restrictions have become in force since several decades. Efforts have especially concentrated on restrictions during the night time period in order to reduce the number of people with sleep disturbance related to aircraft noise.

At Amsterdam-Schiphol, special measures for the night time operations were already being used in 1979. With the introduction of a noise zone in 1996, a set of legal night time restrictions for the period 23:00 – 6:00 hour[1] was implemented. During the night regime period, special landing procedures, take-off routes and runway combinations are in use. The aviation sector voluntarily extended the night regime period till 07:00 hour, until February 2003. In addition, a night time noise exposure zone[2] was in force for the period 23:00 – 6:00 hour.

Since then, the 5th runway has become operational and a new set of night time restrictions was introduced. Legal night time restrictions are still in effect between 23:00 - 6:00 hour, but are no longer voluntarily extended till 07:00 hour by the aviation sector. At present between 6:00 – 07:00 hour, operations are corresponding to the off-peak mode (1 runway for departures and 1 runway for arrivals and no night time restrictions). Night time noise exposure limits at Amsterdam-Schiphol are now based on the period 23:00 – 07:00 hour including the night regime period (23:00 - 6:00 hour) as well as the off-peak mode period (6:00 - 07:00 hour).

The period of the night regime is currently under review. Legal extension of the night regime period till 07:00 hour is being considered in order to reduce the community annoyance (sleep disturbance) due to aircraft noise at night. However, in the opinion of the aviation sector, an extension of the restrictions to the period 6:00 – 07:00 would cause significant economic damage.

Under contract of the Directorate General of Civil Aviation (DGL) of the Ministry of Transport, Public Works and Water Management, To70 Aviation & Environment has made a comparison between the four major European airports (Paris-Charles de Gaulle, London-Heathrow, Frankfurt-Main and Amsterdam-Schiphol) of the night time restrictions for the period 23:00 – 07:00 hour, the impact on community annoyance and the impact on airport operations. The information necessary for this comparison is based on public domain sources as well as questionnaires to airports, airliners and slot coordinators.

[1] all times are local times

[2] in this report also considered as a night time restriction

Chapter 2 of this report contains the research layout dealing with the research questions, approach of the research and the data collection. In chapter 3, the night time restrictions that are in effect at the considered airports are discussed. A comparison of the community annoyance at night between the airports will be presented in chapter 4 followed by the impact of night time restrictions on the airport operations in chapter 5. In chapter 6, the environmental consequences of aircraft operations at each airport are compared with the level of strictness of the night time restrictions. Finally, chapter 7 presents the conclusions of this study.

The authors would hereby like to thank the people of the different airports and airlines who provided us with the information we needed for the successful completion of this study. Appendix D contains a list of persons which were contacted.

2 Research layout

2.1 Introduction

This chapter explains how the research was set up and how the necessary data were obtained for the airports included in the project. The airports of Frankfurt-Main, Paris-Charles de Gaulle, Amsterdam-Schiphol and London-Heathrow were chosen for this project. Amsterdam-Schiphol considers the other airports to be the main competitors. Other airports in the area close to Amsterdam-Schiphol (such as Dusseldorf, Liege, Brussels) were considered by DGL, but because they have a different scale and type of airport business, they were excluded for comparison in this study.

2.2 Research questions

The study is based on the following research questions:

1. What night time restrictions are currently in effect at Amsterdam-Schiphol airport and competing European airports?

2. What is the level of community annoyance caused by night time aircraft operations at Amsterdam-Schiphol airport compared to competing European airports?

3. What is the level of strictness of these night time restrictions compared to competing European airports?

The answers to these questions are used in order to investigate whether the balance between the level of strictness of night time restrictions and community annoyance (sleep disturbance) during night time (23:00-07:00 hour) is different between the four airports.

2.3 Approach

General

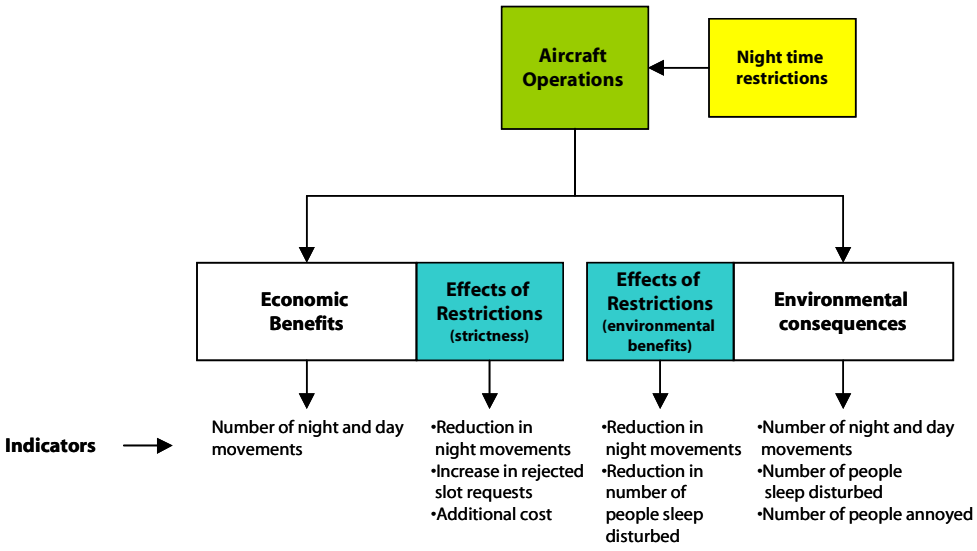
Figure 1 gives a schematic overview of the effect of night time restrictions on the economical benefits and environmental consequences of night time aircraft operations.

The overall goal of night time restrictions is to reduce the community annoyance (sleep disturbance) around the airport due to aircraft noise. Sleep disturbance is the most important contributor to community annoyance during night time. In general, introduction of more night time restrictions will result in a further reduction of community annoyance.

Night time restrictions however will also have an impact on the operation of the airport and consequently on the economical benefits of the airport. In this study, it is investigated whether there is a difference in the balance between the strictness of the night time restrictions and the corresponding community annoyance (sleep disturbance) at the considered airports.

The balance is investigated by considering a number of indicators given in figure 1. In the following paragraphs this will be explained in more detail.

Figure 1: Schematic overview of effect of night time restrictions on economy and environment.



Calculation of sleep disturbance

Different night time restrictions are in effect at the considered airports. The overall goal of these restrictions is the reduction of sleep disturbance. This paragraph discusses the calculation procedure of night time sleep disturbance.

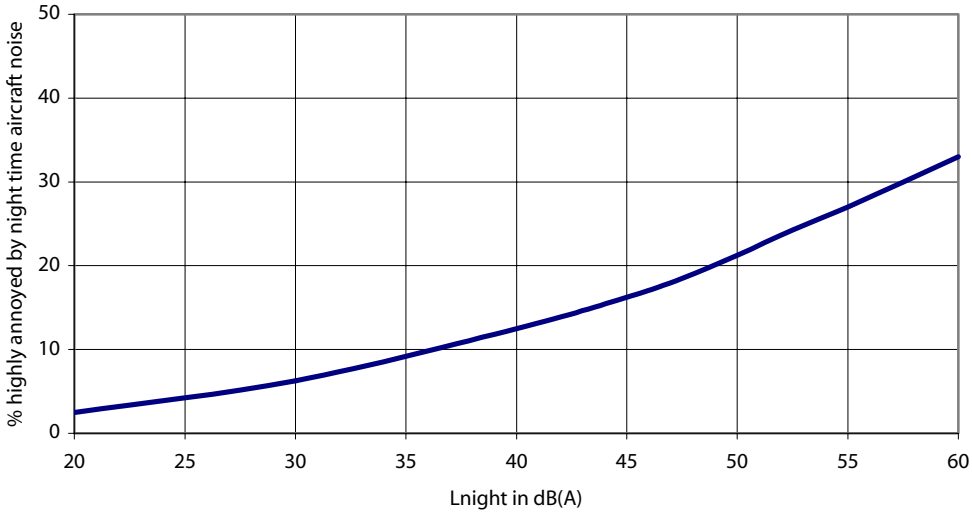
The Dutch Health Council concluded in their report "Public health impact of large airports" from 1999 (Ref. 1) that there is sufficient evidence for a causal relationship between environmental noise exposure and sleep disturbance. The TNO report "Sleep disturbance by aircraft noise" from 2002 (Ref. 2) discusses different relations between aircraft noise at night and sleep disturbance. From this study, the following important conclusion/assumption is used in this investigation:

There is a statistically significant relation between the equivalent noise level inside a bedroom during sleeping hours and the measured motoric disturbance. It is assumed that this motoric disturbance is a good indicator for the sleep disturbance. This then establishes the relation between the equivalent noise level and the level of sleep disturbance. Based on this relation, it is assumed that restrictions which reduce the equivalent noise level during sleeping hours will have a similar effect on the level of sleep disturbance.

It can be concluded that the results of a noise exposure calculation using equivalent noise levels will give a good indication of the level of sleep disturbance. The TNO report (Ref. 2) discusses different exposure-effect relationships for aircraft noise at night around Amsterdam-Schiphol. Figure 2 gives one of these relationships from this report and shows the percentage

of highly annoyed adults due to night time aircraft noise as a function of the Lnight noise descriptor[3]. This relation should be interpreted as follows: when, for example, a population is exposed to an Lnight level of 45 dB(A), about 16% of a population will be highly annoyed (sleep disturbed).

Figure 2: Exposure-effect relationship for Lnight and % highly annoyed



The total number of people that are sleep disturbed is calculated using the relationship from figure 2 and the number of people enclosed by a specific Lnight contour pairs (for instance enclosed by the 50 and 55 Lnight contour) using the following formula:

$$PSD = \sum_{i=1}^{N} P_i \cdot HA_i \quad (1)$$

Where:

PSD	Number of people sleep disturbed
i	Index over number of contour pairs
N	Number of Lnight contour pairs
P_i	Total number of people enclosed by Lnight contour pair, i
HA_i	Percentage of highly annoyed for the average Lnight contour value of Lnight contour pair, i (from figure 2)

In this investigation, it is assumed that the exposure-effect relationship is airport independent. More specifically, it is assumed that the attenuation of aircraft noise by the façade of dwellings is comparable at all airports.

[3] The European standard for the calculation of the noise load at night between 23.00 and 07:00 hr using equivalent noise levels.

Strictness of night time restrictions

Night time restrictions are subdivided in the following categories:

1. Restrictions with respect to operating quota, such as a maximum number of departures during a certain period
2. Restrictions with respect to the use of the airport, such as the closure of a runway during the night
3. Restrictions with respect to operational procedures, such as special SID's for night time use.

As a consequence of these restrictions:

- the number of night movements and slots may be limited;
- the operational costs of the airport and airliners may increase.

Within the framework of this study it will not be possible to compare the strictness of the night time restrictions quantitatively. Hence in order to judge the strictness of the night time restrictions, a relative score will be set up based on the consequence of each restriction on overall airport capacity (number of movements) during night time[4], in relation to the overall demand for night movements.

The scores will be based on estimates made by experts of airlines, experts of airports and slot coordinators. Where information is lacking, To70 will make a motivated estimate.

The impact of night time restrictions on operational costs was not investigated in this study.

Comparison of airports

The strictness of the night time restrictions in relation to sleep disturbance will be compared for the considered airports. The results of this comparison will show for each airport which balance exists between the strictness of night time restrictions and the number of people sleep disturbed. Based on this it will be made clear whether there is fair competition for night time operations between the four airports.

2.4 Data collection

Information on the following subjects was searched for to be able to answer the research questions for each of the selected airports:

1. Night time restrictions that are in effect.
2. Level of night time community annoyance.
3. Impact of night time restrictions on airport operations.

In order to gather this information, a literature and internet survey (public domain) was carried out to obtain as much as possible of the necessary information. For the remaining part of the

[4] A reduction in aircraft movements during night time may also have consequences for the operations during day time. This effect is not considerd in this investigation.

information (and to check the information found in the public domain), a questionnaire was sent out to:

- the airport (usually the environmental affairs department),
- the slot coordinator of the airport and
- the home carrier.

The questionnaire can be found in Appendix A. The answers in Appendix B. In the following paragraphs, the data collection process is explained for each of the subjects.

Night time restrictions that are in effect

The night time restrictions that are in effect at the four airports were obtained from the Boeing website (Ref. 3) and the Aeronautical Information Publication (AIP) of each airport. The data from these sources were used as a starting point for this study. The different restrictions were brought up to date with the information gathered through the questionnaire.

Although it is not a measure with operational consequences, noise insulation of houses in the area around the airport is often used to reduce sleep disturbance from aircraft noise at night. In order to compare the different noise insulation schemes of the airports, information was gathered of the main features.

Level of community annoyance

The available information about the community annoyance or sleep disturbance caused by aircraft noise at night in the area around different airports is usually not uniform. Differences exist in (among others):

- the noise model;
- the noise metric;
- the noise and performance database;
- the noise contour level enclosing dwellings or people around the airport;
- the exposure-effect relationship between noise metric and annoyance or sleep disturbance.

Therefore the existing information available at the airports is usually not comparable. However, recently the "Study on Current and future aircraft noise exposure at and around Community airports" (Ref. 4) was completed. This study was carried out by ANOTEC consulting and was funded by the European Union (DG-TREN). The study assesses the noise situation at 53 Community airports with more than 50.000 jet movements per year. This includes the four airports in the present study: London-Heathrow, Paris-Charles de Gaulle, Frankfurt-Main and Amsterdam-Schiphol. Each of the airports was analysed in detail with the same noise model, the same noise and performance database and the same noise contours expressed in the European noise metrics Lden and Lnight. Also, the number of people enclosed by contour pairs were determined. The noise contours and consequently the number of people enclosed by these contours include the effects of the night time restrictions in effect at the considered airports in 2002.

In order to investigate the impact of night time restrictions on sleep disturbance, calculation results for the situation without night time restrictions are desired. By comparison of these results with results including night time restrictions, the effect of the restrictions can be isolated. However no comparable information was available for the situation without night time restrictions. Hence, the effect of night time restrictions on sleep disturbance could not be isolated.

The number of people enclosed by contour pairs was used as input for the calculation of the number of people suffering with sleep disturbance based on equation 1.

The number of sleep disturbed people is among others highly dependent on the number of aircraft operations during night time. In order to show the correlation between sleep disturbance and number of aircraft operations, the last quantity was also gathered.

Impact of night time restrictions on airport operations

The information on this subject was gathered with the questionnaire from the airport specialist and slotcoordinator. The home base carriers of the four airports, i.e. KLM, Air France, Lufthansa and British Airways, were also interviewed on this subject since they directly experience the economic effects of the night time restrictions.

A strict package of night time restrictions will have consequences for the number of slots during night time and may lead to a shortage in slots during the night. In order to investigate whether there is relation between strictness and the ratio of actual and desired slots, slot coordinators of all considered airports were requested to supply information on this matter. It will be investigated whether this information supports the conclusions on the strictness of the package of night time restrictions.

The questionnaire which was send to the airports also contained a question on the cumulative costs of noise insulation. However, no specific information was obtained for the night time period. Hence, this report gives no comparison of noise insulation at the considered airports. For an overall comparison (day and night) of noise insulation at the airports, the SEO report "Benchmark Government influence on Aeronautical Charges" (Ref. 5) should be consulted.

3 Night time restrictions

3.1 Overview of operational restrictions

The following table gives an overview of the main night time restrictions at the four airports at the end of 2003. The complete list can be found in appendix C. For each restriction it is indicated whether it is in effect at an airport. In the next paragraph, the restrictions at the four airports are compared to each other in more detail.

Table 1: Overview of night time restrictions at the considered airports in 2003

	Amsterdam	London	Paris	Frankfurt
Restrictions with respect to operating quota				
• Fixed limit of slots or movements		✓	✓	
• Noise load or noise quota limit	✓	✓		
Restrictions with respect to the use of the airport				
• Runways not available	✓			
• Limited use of noisier aircraft	✓	✓	✓	✓
• Engine tests not allowed	✓	✓	✓	
• Limits to APU[5] and GPU[6] use	✓	✓		
• Closure of taxi aprons		✓		
• No exercise flight, training flights, etc.	✓			✓
• Landing only allowed for home base carrier				✓
Restrictions with respect to operational procedures				
• Low noise landing procedures (CDA[7])	✓			
• Limit to deviations from airways[8]	✓		✓	
• Limit on noise level at noise monitoring terminal		✓		
• Special SID's[9] for night time use	✓		✓	
• Closure of arrival route			✓	
• Ban on VFR[10] approaches			✓	
• No reverse thrust	✓	✓		✓

3.2 Comparison of night time restrictions

The night time restrictions at the four airports have been compared using the three different categories of night time restrictions.

[5] Auxiliary Power Unit

[6] Ground Power Unit

[7] Continuous Descent Procedure

[8] For London Heathrow, this limit is set by maximum allowable noise levels that are measured at Noise Monitoring Terminals

[9] Standard Instrument Departure

[10] Visual Flight Rules

Restrictions with respect to operating quota

Frankfurt-Main is the only airport that does not have restrictions with respect to operating quota. At Amsterdam-Schiphol the noise limits have been established for the entire night time period (23:00 – 07:00), while the noise limits and/or movements limits at Heathrow and Charles de Gaulle are only in effect for a part of this period.

Restrictions with respect to the use of the airport

Amsterdam-Schiphol is the only airport where certain runways are closed during the night time period. Frankfurt-Main is closed for landing during certain hours (the night regime period is two hours shorter for home base carriers). All four airports, use aircraft noise certification limits as quantity for judgement of the noisiness of aircraft. Aircraft with noise certification levels exceeding specific levels are prohibited during night time. Most of the other restrictions in this category are related to land side activities such as engine tests.

Restrictions with respect to operating procedures

Frankfurt-Main has only one restriction with respect to operating procedures. The other airports all have a restriction related to deviations from airways. Both Amsterdam-Schiphol and Charles de Gaulle use special SID's during the night time period. Amsterdam-Schiphol is the only airport using special low noise landing procedures at night.

3.3 Future developments

The restrictions discussed in this chapter are based on the available information at the beginning of 2004. For the airports in this study, information is available about the future developments with respect to the night time operations. Also, the European Union has plans to implement rules or regulations for (night time) aircraft operations. In this paragraph, these developments are discussed for each airport.

Amsterdam-Schiphol

It has already been mentioned that an extension of the night time restrictions for the period 06:00 – 07:00 is being considered. The discussion about this extension was one of the reasons for this study. This discussion has been going on for a number of years and it is therefore unsure if and when this extension will be implemented.

London Heathrow

For London-Heathrow, the night time restrictions are set for a period of 5 years. This period ends on 31 October 2004. However, it is planned to continue this night restrictions regime for another year. During this year, consultation will take place on the night time restrictions, which will be in effect from October 2005. An extension of the night quota period (at present 23.30-06:00) to include 06:00-07:00 and the possibility of removing the limit on the number of movements to encourage the use of quieter aircraft, will be the points for discussion.

Paris – Charles de Gaulle

In November 2003, a new set of night time restrictions was implemented at Charles de Gaulle. This includes a limit on the number of slots for the period 0:00 – 5:30. This limit will be adjusted downwards each year with the number of unused or abandoned slots. No changes in the night restrictions regime are planned for the near future.

Frankfurt-Main

The airport of Frankfurt-Main is planning an expansion with a fourth runway. When this runway becomes operational (current planning is 2006) a general ban on night time operations between 23:00 and 5:00 will become effective. Together with this ban, there are also plans to limit the number of movements during the periods 22:00 - 23:00 and 5:00 - 06:00.

European developments

In March 2002, a directive of the European Parliament was published with regard to the introduction of noise related operating restrictions at Community airports. It is commonly referred to as the EU "Noise Management Directive"(Ref. 6). Although the directive does not specifically target night time operating restrictions, it provides a set of rules to facilitate the introduction of operating restrictions at airport level to reduce the number people affected by noise. The main points of the directive are:

- It allows the gradual withdrawal over a period of 5 years of so called marginally compliant aircraft (aircraft not meeting the ICAO chapter 3 standard with a cumulative margin of at least 5 EPNdB).
- It requires the EU member states to adopt a balanced approach to noise management. This balanced approach consists of the following four elements:
    - Reduction of noise at the source (the chapter 4 standard).
    - Land use planning and management around airports;
    - Operating procedures
    - Operating restrictions
- It requires the EU member states to undertake an assessment, including a cost benefit analysis of the various measures available, when taking a decision on operating restrictions.

The directive should have been transferred into national law on 28 September 2003 at the latest. It therefore already applies to the airports in this study. This means that new operating restrictions for the night at airports can now only be introduced after careful consideration of the benefits of the various other measures that are available.

The contents of the EU-directive was also discussed during the ICAO[11] CAEP[12]-6 meeting which was held in February 2004. Among others guidance was recommended on the implementation of a 'balanced approach' to noise management. CAEP proposed guidance document for

[11] International Civil Aviation Organization

[12] Committee on Aviation Environmental Protection

implementing the so-called balanced approach to controlling aviation noise focuses on each of the plan's four elements: reduction of noise at the source; land use planning and management; noise abatement operational procedures; and operating restrictions on aircraft. It covers actions that member states can take in each of the four areas, plus trade-offs to consider, economic factors, and cost-benefit analysis. The Council of ICAO will review the recommendations before submitting its report to the 35th Session of the Assembly of the Organization, convened for 28 September to 8 October 2004.

3.4 Conclusions

In general, the four airports use a lot of similar restrictions to limit the community annoyance at night. An important difference is the length of the period in which an restriction is in effect. Some of the restrictions are rather airport specific since they are aimed at, for example, avoiding a certain village when departing at night.

Future developments with respect to night time restrictions are ongoing on a national (individual airports), European and international (ICAO) scale. Changes in the night time restrictions at individual airports are under discussion at all considered airports except Paris-Charles de Gaulle.

4 Community annoyance at night

4.1 Number of movements

The first indication of the level of community annoyance is given by the number of movements during night time. The table below shows the number of movements for each of the airports for both the night time (23:00 – 07:00) and the 24-hour period. The ratio night/day movements is also shown to be able to compare the relative number of movements at night.

Table 2: Number of aircraft movements (year 2002)

Airport	Movements night time	Movements 24-hour period	Ratio night/day movements (%)
Amsterdam-Schiphol	23.462	406.273	5,8
Frankfurt-Main	46.662	461.792	10,1
London-Heathrow	26.465	462.791	5,7
Paris-Charles de Gaulle	51.683	501.547	10,3

The figures show that at Amsterdam-Schiphol and London-Heathrow, the number of movements at night is the lowest. The ratio of night over day movements shows nearly a factor of two between London-Heathrow and Amsterdam-Schiphol on the one hand and Frankfurt-Main and Paris-Charles de Gaulle on the other hand. This might be the consequence of a strict night time regime but might also be due to differences in contribution to specific market segments (scheduled, unscheduled, freight etc.) at the considered airports. Full freighter flights are for instance not linked to a special period of the day while intercontinental flights arrive by preference in the early morning. Charter flights preferably depart in the early morning. In this study no further investigation was done on airport specific market segments at the different airports.

4.2 Sleep disturbance

To determine the number of people that are sleep disturbed, the number of people enclosed by Lnight contours is used as a starting point. The table below shows the number of people, living in the area around the airport, enclosed by specific Lnight contours for the four airports in 2002. These data were taken from the EU-study "Current and future noise exposure at Community airports" (Ref. 4).

Table 3: Number of people enclosed by Lnight contours (Ref. 4)[13] and number of people sleep disturbed enclosed by 45 dB(A) Lnight contour (year 2002). The last column gives the percentage of sleep disturbed people with respect to the total number of people enclosed by the 45 dB(A) Lnight contour.

Airport	45-50 dB(A)	50-55 dB(A)	55-60 dB(A)	>60 dB(A)	Total	Number of sleep disturbed	Percentage of sleep disturbed
Amsterdam-Schiphol	47.465	13.660	2.939	1.027	65.091	13314	20.5%
Frankfurt-Main	91.578	55.685	9.162	0	156.425	33194	21.2%
London-Heathrow	274.829	152.967	53.572	28.715	510.083	113485	22.2%
Paris-Charles de Gaulle	175.234	43.842	5.482	484	225.042	44854	19.9%

The number people that are sleep disturbed have been calculated using the method described in paragraph 2.3.2. The average Lnight value for each column in table 3 has been used, except for the ">60 dB(A)"column. In this case, 60 dB(A) has been used since the exposure-effect relationship is defined for a maximum noise load of 60 dB(A).

Figure 2 shows that sleep disturbance occurs down to Lnight levels of 20 dB(A). Hence, the numbers given in table 3 are no absolute indication of the total number of sleep disturbed people. The numbers are only used to indicate the relative effect between the four airports.

The figures in table 3 should be considered as a relative indication of the number of sleep disturbed since the actual sleep disturbance depends on many different factors. The results show that at Amsterdam-Schiphol, the number of people that are sleep disturbed is the lowest, followed by Frankfurt-Main and Paris-Charles de Gaulle. The number of sleep disturbed people is the highest at London-Heathrow.

[13] The ANOTEC noise calculations are based on an Eurocontrol database containing the actual flights in 2002 at the four airports. A check of the number of movements used by ANOTEC with the number of movements supplied by the individual airports showed large discrepancies (ANOTEC numbers are a factor 2 to 3 higher) for the airports of Amsterdam-Schiphol, London Heathrow and Frankfurt-Main. Consultation with ANOTEC made clear that night movements were based on UTC times instead of local times. The consequence is that the number of aircraft movements used in the Lnight calculations were too high resulting in an overestimation of the Lnight values.
It is expected that ANOTEC will recalculate the Lnight results. If the corrected results become available on short term, this report will be updated. Finally, it is expected that the update of the ANOTEC results will not lead to different conclusions than given in this report.

The last column of the table shows the percentage of sleep disturbed people enclosed by the 45 dB(A) Lnight contour, with respect to the total number of people in the contour. On average, a percentage of 20% is obtained at all considered airports.

The results for Amsterdam-Schiphol are based on the 4-runway system. Since February 2003, the 5th runway has become operational. With this runway, the number of movements can grow within more stringent environmental protection conditions like a reduced number of annoyed and sleep disturbed people. Hence, a similar calculation with the new runway lay-out will probably result in lower figures for Amsterdam-Schiphol.

5 Impact of night time restrictions on airport operations

5.1 Impact on airport capacity

Using expert judgement and the information from the airports and airlines, the relative consequence of each restriction on total airport capacity has been scored in relation to the overall demand for night movements in 2002 for the period 23:00-07:00 hr.

In the table below, the consequence of each restriction during night time is indicated with the following symbols:

- "++" means a very high impact
- "+" means a high impact
- "o" means a moderate impact.
- "-" means a low or no impact.

For the overall ranking, the frequency was counted for each symbol. The highest score of each airport was leading for the overall ranking. In case the frequency of the highest score was equal for two airports, the frequency of the next highest score was compared, ranking the two relatively, and so on. Finally, a relative ranking resulted which is given in the last row of table 4. A ranking of 1 denotes a high strictness level, a ranking of 4, a relatively low level.

Table 4: Level of impact of night time restrictions on overall airport capacity in the period 23:00 07:00 hr.

	Amsterdam	London	Paris	Frankfurt
Restrictions with respect to operating quota				
• Fixed limit of slots or movements		++	o	
• Noise load or noise quota limit	+	++		
Restrictions with respect to the use of the airport				
• Runways not available	o			
• Limited use of noisier aircraft	o	o	-	-
• Engine tests not allowed	-	-	-	
• Limits to APU and GPU use	-	-		
• Closure of taxi aprons		-		
• No exercise flight, training flights, etc.	-			-
• Landing only allowed for home base carrier				o
Restrictions with respect to operational procedures				
• Low noise landing procedures (CDA)	o			
• Limit to deviations from airways[14]	o	o	o	
• Limit on noise level at noise monitoring terminal		o		
• Special SID's for night time use	o		o	
• Closure of arrival route			-	

[14] For London Heathrow, this limit is set by maximum allowable noise levels that are measure at Noise Monitoring Terminals

	Amsterdam	London	Paris	Frankfurt
• Ban of VFR approaches			-	
• No reverse thrust	-	-		-
Overall ranking (strictness)	**2**	**1**	**3**	**4**

The score given in table 4 is motivated below for each of the categories.

Restrictions with respect to operating quota

According to the answers on the questionnaire, operation quota restrictions are in general felt as the most limited restriction at the airports.

Since 1999 London-Heathrow has a movement limit as well as a noise limit which was sufficient to accommodate existing traffic but has no scope for growth in night movements. Also in the period 06:00-07:00 which is outside the night quota period (23:30-06:00), no spare slots are available due to the limited runway capacity. For the period 23:00-23:30, no slots are allocated in order to prevent that delayed air traffic will run in to the night quota period. On the other hand, the demand for slots in the period 23:00-23:30 hr is low. The total number of movements in the period 23:00-07:00 hr, in 2002, amounted 26.465 which is nearly half the number at Paris-Charles de Gaulle and slightly more than Amsterdam-Schiphol.

The new noise quota which became operational at Amsterdam Schiphol in February 2003, make a growth possible from 23.500 in 2002 till about 34.500 aircraft movements in the future[15] for the night time period 23:00-07:00 hr. The night regime period (23:00-06:00 hr) differs from the period with noise load limits (23:00-07:00). During the night regime period, runway use, take-off routes, landing procedures, runway combinations and others, differ from the period 06:00-07:00 hr. Because the noise load limits in control points are set for the complete period, it is hardly possible to shift traffic from the night regime period to the period of 06:00-07:00 and vice versa.

At Paris- Charles de Gaulle the number of slots are set to a maximum in a limited period during night time compared to London-Heathrow and Amsterdam-Schiphol. According to Air France, it was possible to avoid major drawbacks after the introduction of this restriction. Traffic that could not be accommodated in the period between 00:00 and 05:30 hr[16] (due to the restrictions), could be moved to other night time hours. However, Air France stated that serious problems in building an efficient flight program would occur if other airports adopt the same restrictions as Paris-Charles de Gaulle. For this reason, Air France doesn't agree to spread these restrictions and set them as a common rule everywhere. The total number of movements in 2002, in the period 23:00-07:00 hr, amounted 51.683 which is more than two times the number (23.462) at Amsterdam-Schiphol.[17]

[15] Future scenario for year 2005 from which the noise load limits are set in control points.

[16] 00:00-5:00 for departures and 00:30-05:30 for arrivals

[17] The ratio night over day movements is 1,8 times the ratio at Amsterdam-Airport.

According to Frankfurt-Main, all schedules which were requested for in the period 23:00-07:00 hr, could be accommodated. The total number of flights coordinated between 23:00 and 07:00 hr is even higher than the number of requested schedules for this time period due to transfer of rejected day-time slot requests to the night time period.

Resuming, London-Heathrow is considered to be the airport with the most severe measures related to *operating quota*.

Restrictions with respect to the use of the airport

According to the answers on the questionnaire and expert judgement, the restrictions with respect to the *use of the airport* are felt less restrictive than the operation noise quota restrictions.

At London Heathrow and Amsterdam-Schiphol, the restrictions on usage of noisier aircraft are similar to those at Frankfurt and Paris. However, the effective night period is longer and therefore these airports are more strict in this respect. Amsterdam-Schiphol is the only airport where runways are closed during the night regime period. On the other hand, it is the only airport with 5 runways and the smallest number of night time flights which makes it easier to close one or more runways at night. The noise load limits make it impossible to use more than two runways on a regularly basis in the period 06:00-07:00 hr.

Restrictions with respect to operational procedures

According to the answers on the questionnaire and expert judgement, the restrictions with respect to the *operational procedures* are also felt less restrictive than the operation noise quota restrictions.

The restrictions with respect to the *operational procedures* are considered the most strict at Amsterdam-Schiphol mainly because of the strict limit to deviations from the airways combined with the special night time SID's. For Paris, there is an obligation to follow the prescribed airways but there is no defined limit for the number or percentage of deviations.

The table shows that the night time restrictions are the most stringent at London-Heathrow in comparison the airports of Amsterdam, Paris and Frankfurt.

5.2 Impact on rejected slot requests

Another indicator for the strictness of the night time restrictions might be given by the number of rejected slot requests for the night time period. This information might be inaccurate, since:

- many airlines usually ask for more slots than they need;
- airlines will not request additional slots for a certain period when they know that maximum number of slots have already been reached for that period.

None of the airports have indicated that there is a lack of demand for slots in general. London Heathrow, for example, has indicated that the limited availability of slots during the day would encourage operations at night if there were no night time restrictions in effect. At Frankfurt-Main, this is exactly what happens. Airlines that request slots for the day, are appointed a slot between 23:00 – 7:00 when no day time slots are available. The number of flights at night is therefore higher than the number of requested slots for the night time.
Table 5 shows the percentage of rejected slot requests during night time with respect to the total number of actual night slots in relation to the strictness of the night time restrictions.

Table 5: Percentage of rejected slot requests as function of strictness of night time restrictions

Airport	**Rejected slot requests (%)**	**Strictness of night time restrictions**
Amsterdam-Schiphol	20 %	+
Frankfurt-Main	0 %	-
London-Heathrow	N/A	++
Paris-Charles de Gaulle	<10 %[18]	o

For London Heathrow, a quantitative indication was not available since the quota for the night time period (23:30-06:00 hr) have been in effect for quite some time. Airlines do not request slots since they know these are not available. However, since there are no slots available for the period 06:00–07:00, any available slots before 06:00 would definitely be used for long-haul arrivals if the night quota were lifted. At the other airports, this "saturation" effect is not yet reached.

This indicator can also be compared with the strictness of the night time restrictions and although the indicator might be inaccurate, there seems to be a correlation between the percentage of rejected slots and the strictness of the night time restrictions.

This paragraph shows that clear differences exist between the strictness of the night time restrictions of the considered airports. It seems that the strictness of the night time restrictions has consequences for the number of rejected slots for night time operations.

[18] Figure based on the average number of movements before the limit was introduced

6 Comparison of strictness of night time restrictions with community annoyance

In this chapter, the results of previous chapters are compared to determine whether the balance between community annoyance and the strictness of the night time restrictions differs between the four airports. The table below summarizes the results for each of the airports.

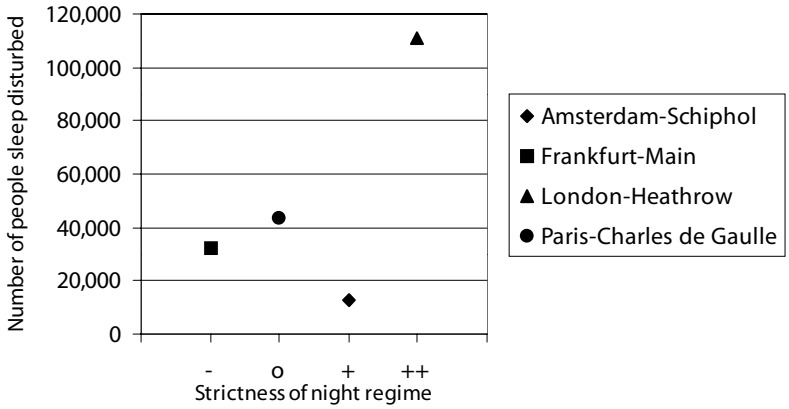
Table 6: Summary of results

Airport	Movements night time	Ratio night/day movements (%)	Number of sleep disturbed	Strictness of night time restrictions	Rejected slot requests (%)
Amsterdam-Schiphol	23.462	5,8	13,043	+	20 %
Frankfurt-Main	46.662	10,1	32,597	-	0 %
London-Heathrow	26.465	5,7	110,867	++	N/A
Paris-Charles de Gaulle	51.683	10,3	43,869	o	<10 %

Table 6 shows that relatively low ratios of night over day movements are reported at Amsterdam-Schiphol and London-Heathrow while the strictness of the night time restrictions is relatively high at these airports. Although the ratio of night/day movements might also be dependent on other factors (e.g. type of market segments), the correlation is striking.

The strictness of the night time restrictions is also presented versus the number of sleep disturbed people in the following figure.

Figure 3: Number of sleep disturbed people versus the strictness of the night time restrictions



Amsterdam-Schiphol

At Amsterdam-Schiphol, the level of sleep disturbance is relatively low compared to the other airports. One of the reasons is the relatively low number of movements at night. Another important aspect is the runway lay-out and route structure of the airport. Amsterdam-Schiphol

is the only airport of the four considered airports that does not only have a parallel runway system. This gives the airport more possibilities in using runways and departure and arrival routes that avoid urban areas. The 5th runway that became operational in February 2003 was specifically designed to reduce the community annoyance around the airport. Hence, it is expected that the number of people sleep disturbed corresponding to the 5-runway system is lower than the numbers reported.
Amsterdam-Schiphol has the second strictest night time regime of the four airports. The ratio night/day movements is relatively low and according to the statement of the airport, the current night time regime causes a 20% reduction in the number of movements at night, based on the demand for slots at night and the actual number of slots handed out.

According to figure 3, the number of sleep disturbed people versus the strictness of the night time restrictions appear to be out of line in comparison with the other considered airports.

London-Heathrow
London-Heathrow has the highest level of community annoyance of the four airports. Since the number of movements at night is the lowest after Amsterdam-Schiphol, this is probably caused by the high population density around the airport and the parallel runway system which does not give many possibilities for avoiding urban areas.
The night time restrictions at London Heathrow are the strictest of the four airports. It also has a low ratio of night/day movements.

Paris-Charles de Gaulle
The level of community annoyance is the second highest of the four airports. The number of movements at night is the highest of the four airports and about 2 times higher than the numbers at Amsterdam-Schiphol and London-Heathrow. The level of strictness of the night time regime is relatively low compared to Amsterdam-Schiphol and London Heathrow. Also, the ratio day/night movements is high. According to the airport, the restriction on the number of movements which was recently introduced will result in a reduction of about 10 % of the number of movements between 0:00 and 5:00 hr. However, it is expected that this reduction can be compensated in the other hours of the night.

Frankfurt-Main
Frankfurt-Main has the second lowest level of community annoyance of the four airports, but it is still more than two times higher as Amsterdam-Schiphol. The number of movements at night at Frankfurt-Main is almost 2 times higher than the numbers at Amsterdam-Schiphol and London Heathrow.
The night time restrictions has the lowest level of strictness at Frankfurt-Main. According to the slotcoordinator, all slots requested for the night time period could be allocated. The night time period was even used to accommodate slots for which no space was available during day time.

7 Conclusions

This report gives a comparison of sleep disturbance and the strictness of night restrictions between the airports Amsterdam-Schiphol, Frankfurt-Main, London-Heathrow and Paris-Charles de Gaulle. Information on these subjects was gathered in the public domain and by sending a questionnaire to specialists of airports, airliners and slot coordination. It was not possible to obtain quantitative information in all cases. Especially for the ranking of airports with respect to the strictness of the night time restrictions, a qualitative judgement was necessary based on the information obtained from the questionnaire and expert judgement.

The conclusions of this report are corresponding to the situation in 2002/2003.

The study leads to the following conclusions:

- When comparing Amsterdam-Schiphol with London-Heathrow, Paris-Charles de Gaulle and Frankfurt-Main, it can be concluded that the balance between the level of community annoyance and the strictness of the night time restrictions at Amsterdam-Schiphol differs from the other three airports. The night time restrictions at Amsterdam-Schiphol are relatively strict while the number of sleep disturbed people is relatively low in comparison with the considered airports.

- The ranking of airports with respect to the strictness of the night time restrictions seems to be supported with the number of rejected slot requests and the ratio of night over day movements.

- In general, the four airports use a lot of similar restrictions to limit the community annoyance at night. An important difference is the length of the period in which an restriction is in effect. Some of the restrictions are rather airport specific since they are aimed at, for example, avoiding a certain village when departing at night.

- Future developments with respect to night time restrictions are ongoing on a national (individual airports), European and international (ICAO) scale. Changes in the night time restrictions at individual airports are under discussion at all considered airports except Paris-Charles de Gaulle.

- The questionnaire provided little information on the effects of restrictions on the environment and the airport economy. Obviously, the effects of the present night time restrictions are in general introduced without quantitative study preceding the introduction. Also, it seems that no dedicated evaluation is made concerning the effectivity of specific night time restrictions after the introduction.

8 References

1. *Public health impact of large airports*, Gezondheidsraad, Den Haag, 1999.

2. *Slaapverstoring door vliegtuiggeluid*, Passchier-Vermeer, W. et al., TNO-INRO report 2002.027/2002.028, Delft, 2002..

3. *Airport Noise Regulation information*, http://www.boeing.com/commercial/noise/flash.html

4. *Study on current and future aircraft noise exposure at and around Community airports,* ANOTEC Consulting, S.L., Madrid, 2004.

5. *Benchmark Government influence on aeronautical charges*, SEO report nr. 712, ISBN 90-6733-248-8, November 2003

6. The establishment of rules and procedures with regard to the introduction of noise-related operating restrictions at Community airports, EU-Directive 2002/30/CE, 1 April 2002

Appendix A

Questionnaire

"Benchmark level playing field night restrictions"

Attached to this questionnaire you will find an overview of the night restrictions at the Airports of Frankfurt, London, Amsterdam and Paris (FLAP). The information in this overview has been gathered from the Boeing website and the Aeronautical Information Publication (AIP).

We kindly request you to answer the questions given below. In case you don't know the answer please ask your colleague or provide us with a different source where the requested information could be obtained. If you have any questions do not hesitate to contact us at:

e-mail: frenk.wubben@to70.nl or jurgen.busink@to70.nl
telephone: 0521-520077 or 070-3922322
fax: 0521-520203 or 070-3658867

Questions

1) Please check if the overview of night time restrictions is correct for your airport. If not, which restrictions are missing or are no longer active?
2) How many aircraft operations are presently conducted at your airport on a yearly basis during the night periods 23:00-06:00 and 06:00-07:00 hr local time?
3) Is there a limit to the number of aircraft operations in the night period (23:00-07:00 hr) due to night restrictions?
4) What were the changes in the traffic distribution (aircraft types, number of flights, type of airlines, etc.) after the night time restrictions were introduced?
5) Please estimate the number of operations "lost" (as a result of the restrictions) during night time (23:00-07:00 hr) expressed in percentage of the number of yearly night flights during this period.
6) Please rank the top 5 of economically most stringent night time restrictions at your airport.
7) Do you have any additional information regarding the strictness of the night restrictions (such as complaints of airlines)?
8) How is the annoyance of people around the airport at night registered or measured? (for example, number of complaints, number of sleep disturbed, number of people within noise contours, etc.)
9) How many people around your airport are sleep disturbed or annoyed by aircraft noise at night?
10) How many houses around the airport are noise insulated in order to reduce the effects of sleep disturbance? What are the cumulative cost of this insulation?

11) What is the effectivity of the different night restrictions? (e.g. reduction of complaints, smaller noise contours, etc.)
12) Please estimate the reduction in people sleep disturbed due to introduction of the night restrictions expressed in percentage of the total number of people sleep disturbed.
13) Do you have any other information to illustrate the effectivity of the night restrictions?
14) Are changes to be expected in the near future concerning night restrictions at your airport? If yes, please motivate these changes.

We thank you very much for taking the time to answer these questions. After finishing of the project we will send you a final copy of the report.

Appendix B

Answers for Amsterdam-Schiphol (includes answers from the airport, slot coordinator and KLM)

1) Please check if the overview of night time restrictions is correct for your airport. If not, which restrictions are missing or are no longer active?
Some restrictions were added or corrected, these are included in Appendix C

2) How many aircraft operations are presently conducted at your airport on a yearly basis during the night periods 23:00-06:00 and 06:00-07:00 hr local time?

2002
23:00 - 06:00 LT: 9419 ARR + 3333 DEP
06:00 - 07:00 LT: 8113 ARR + 2597 DEP

2003
23:00 - 06:00 LT: 10932 ARR + 3369 DEP
06:00 - 07:00 LT: 6152 ARR + 3029 DEP

3) Is there a limit to the number of aircraft operations in the night period (23:00-07:00 hr) due to night restrictions?
There is no fixed limit , but because of the Lnight limit in noise control points, there is an indirect limit to the number of operations. This limit is determined each year through the capacity declaration.

4) What were the changes in the traffic distribution (aircraft types, number of flights, type of airlines, etc.) after the night time restrictions were introduced?
   - *Limited hourly capacity 06:006:00-07:00 hrs for arriving intercontinental flights was met by a more even spread of these arrivals over the period 05.30-07:00 hrs.*
   - *Limited hourly capacity 06:006:00-07:00 hrs for departing European flights (e.g. charters) was met by a more even spread of these departures to the period before 06:006:00 hrs.*
   - *Limited hourly capacity 07:00-07.20 hrs was met by planning arrivals and departures after 07.20, where slots were still available.*
   - *Limited noise capacity in period 23:00-06:00 hrs was met by annual development of an "Operational Plan" to fit planned traffic within the noise limits and resulted in (uneconomic) rescheduling of flights in the night and early morning, in particular for KLM.*
   - *The introduction of a "Noise monitoring committee" of "sector". It results in required schedule adjustments by the home carriers, mostly during peak summer season.*
   - *Freeze of the hourly capacity in the early morning (06:00-07.20 hrs) in the years 1999-2003 at approximately "night regime" level. It resulted in rescheduling of flights to a later moment.*
   - *Competitor hub-operations do not have such restrictions, whereby some flights were forced to be scheduled "behind competitor flights", resulting in lower yields.*

- *The airport is restricted for take-off between 23:00-06:00 for chapter III "high" aircraft (aircraft equipped with engines with a bypass ratio of more than 3 and a cumulative noise level that is within the 5 EPNdB margin of chapter III aircraft). In particular full freighter flights were rescheduled.*

5) Please estimate the number of operations "lost" (as a result of the restrictions) during night time (23:00-07:00 hr) expressed in percentage of the number of yearly night flights during this period.

Period 23:00 – 6:00:
Winter 2001/2002: demand 4800; slots, slots allocated 3500. Difference: 27 %
Summer 2002: demand 10253 slots, slots allocated 8405. Difference: 18 %
Period 23:00 – 7:00:
There are a total of 32.200 slots available on an annual basis at Amsterdam Airport Schiphol. Based on our experience with waiting lists and withdrawn requests from multiple airlines for this period we estimate that over 6.500 slots are to be considered "lost". This would be 20% of total traffic. This figure does not take into account the fact that Amsterdam Airport Schiphol could actively promote any surplus of night slots within the airline community resulting in an even further utilisation of night slots.

Other qualitative information: FEDEX had plans to start operating out of Schiphol. These plans were cancelled due to the limited number of slots available at night

6) Please rank the top 5 of economically most stringent night time restrictions at your airport.
1. *Lnight noise limit /Noise volume night limit*
2. *Limited availability of runways*
3. *Limited capacity due to operational procedures (special SID's, CDA)*
4. *Restriction of Chapter 3 "high" aircraft*

7) Do you have any additional information regarding the strictness of the night restrictions (such as complaints of airlines)?
Carriers have several complaints for Amsterdam Airport Schiphol regarding night time restrictions. Here are some examples of the questions and complaints we receive most of all:
- *There are not enough slots available to operate a decent commercial schedule out of AMS.*
- *Why do we circle in a holding stack above downtown Amsterdam at night?*
- *Why are the restrictions laid down for AMS the most complicated in the world?*
- *Is the use of a reduced flap approach to improve noise not in conflict with safety?*
- *Why are some carriers protecting their night slots just to keep newcomers out?*
- *The night time restrictions are always confused with restrictions for noisy aircraft*
- *Foreign carriers not familiar with AMS generally assume we are completely closed at night*

8) How is the annoyance of people around the airport at night registered or measured? (for example, number of complaints, number of sleep disturbed, number of people within noise contours, etc.)
No answer.

9) How many people around your airport are sleep disturbed or annoyed by aircraft noise at night?
No answer.

10) How many houses around the airport are noise insulated in order to reduce the effects of sleep disturbance? What are the cumulative cost of this insulation?
Noise insulation around Schiphol is required for approx. 10.000 houses. At the end of 2003 almost 5600 houses were actually insulated. The whole insulation project is costed at 520 mln euro.

11) What is the effectivity of the different night restrictions? (e.g. reduction of complaints, smaller noise contours, etc.)
No answer.

12) Please estimate the reduction in people sleep disturbed due to introduction of the night restrictions expressed in percentage of the total number of people sleep disturbed.
No answer.

13) Do you have any other information to illustrate the effectivity of the night restrictions?
No answer.

14) Are changes to be expected in the near future concerning night restrictions at your airport? If yes, please motivate these changes.
No answer.

Answers for Paris-Charles de Gaulle (includes answers from the airport, slot coordinator and Air France)

1) Please check if the overview of night time restrictions is correct for your airport. If not, which restrictions are missing or are no longer active?
Latest restrictions were sent and these are included in Appendix C.

2) How many aircraft operations are presently conducted at your airport on a yearly basis during the night periods 23:00-06:00 and 06:00-07:00 hr local time?

To answer the question, I am considering a yearly number of slots based on summer season 2003 and Winter 2003/2004 :

	S03 + W03		
	Departure	*Arrival*	*TOTAL*
23h00-06h00	*29 989*	*26 573*	*56 562*
06h00-07h00	*14 274*	*15 735*	*30 009*

Figures available on calendar years:

	2001			*2002*		
	Departure	*Arrival*	*TOTAL*	*Departure*	*Arrival*	*TOTAL*
23h00-06h00	*18383*	*19359*	*37 742*	*18551*	*18834*	*37 385*
06h00-07h00	*4733*	*10010*	*14 743*	*4455*	*9843*	*14 298*
07h00-23h00	*234353*	*228278*	*462 631*	*227657*	*222207*	*449 864*
total	*257 469*	*257 647*	*515 116*	*250 663*	*250 884*	*501 547*

	2003		
	Departure	*Arrival*	*TOTAL*
23h00-06h00	*17787*	*18663*	*36 450*
06h00-07h00	*4238*	*10120*	*14 358*
07h00-23h00	*230754*	*224072*	*454 826*
total	*252 779*	*252 855*	*505 634*

3) Is there a limit to the number of aircraft operations in the night period (23:00-07:00 hr) due to night restrictions?

From winter season 2003 and the summer season 2004, the yearly number of flights conducted will have to correspond to a maximum of 22 500 slots between :

- *0 h 00 and 4 h 59 for departure slots ;*
- *0 h 30 and 5 h 29 for arrival slots*

4) What were the changes in the traffic distribution (aircraft types, number of flights, type of airlines, etc.) after the night time restrictions were introduced?

At present, we don't have yet accurate information on this matter. The major changes registered is an increase of flights scheduled outside the night restrictions periods (0H00 and 5H00).

5) Please estimate the number of operations "lost" (as a result of the restrictions) during night time (23:00-07:00 hr) expressed in percentage of the number of yearly night flights during this period.

Data should be compared on the night time period between 0h00 and h59 for departure slots and between 0h30 and 5 29 for arrival slots due to the limitation of 22 500 slots from 2003. Here is the evolution from 1999 of number of flights for night periods :

	22h00-6h00	*00h00-0500*
1999	*33 896*	*23 295*
2000	*41 814*	*26 192*
2001	*38 963*	*25 294*
2003		*22 500*

6) Please rank the top 5 of economically most stringent night time restrictions at your airport.

No answer.

7) Do you have any additional information regarding the strictness of the night restrictions (such as complaints of airlines)?

- *The main airlines operating night flights have been part of the reflection to edit the new night restrictions laws (Air France, Europe Airpost, FedEx). For this reason, Air France has no objection against the night restriction mentioned under question 3.*
- *But, if other airports could adopt the same restrictions, it could be very difficult, and some time impossible, to build an efficient flight program including all our (Air France) present destinations. We could undoubtedly be obliged to reduce our operation's plan and to close some overhead lines. For this reason, Air France doesn't agree to spread these restrictions and to set them as a common rule everywhere.*
- *As an economic matter, Air France notes that night restrictions, even set only at CDG, result to get an unbalanced state between the local airport ground facilities and the traffic. This is due to the obligation to increase the facilities in order to be able to perform an identical traffic in less time. Also, this has a negative environmental importance.*

8) How is the annoyance of people around the airport at night registered or measured? (for example, number of complaints, number of sleep disturbed, number of people within noise contours, etc.)

- *A 1985 law has initiated the Plan d'Exposition au Bruit (Noise Exposure Plan) with object is to delimit area exposed to air traffic noise (4 areas defined according to the level of nuisance engendered by aircrafts noise).*
- *Since 1999, The ACNUSA (Autorité de Contrôle des Nuisances Sonores Aéroportuaires) is in charge of transparency of information on noise disturbance originated by air transport and is competent in matters of applicable prescriptions to the noise measuring stations (11 stations around CDG + 3 stations dedicated to motors tests). The ACNUSA is also empowered to impose administrative fines to airlines in case of non respect of night restrictions.*
- *The complaints of people within noise contours are also registered (I could not get the figures at present)*

9) How many people around your airport are sleep disturbed or annoyed by aircraft noise at night?

In 2002, the ACNUSA has ordered a study quantifying the population flied over by aircrafts. There's no distinction made for day or night flights.

	East configuration :		*West configuration :*	
	Arrivals	*Departure*	*Arrivals*	*Departure*
0 to 1 000 meters	*438 000*	*3 900*	*28 900*	*49 500*
0 to 2 000 meters	*1 256 700*	*33 500*	*88 400*	*278 500*
0 to 3 000 meters	*1 513 500*	*193 200*	*216 00*	*1 410 800*

Otherwise, we don't have accurate measures to specifically determine the number of people disturbed or annoyed by aircraft noise for night flights. I think a study have been recently demanded on this matter.

10) How many houses around the airport are noise insulated in order to reduce the effects of sleep disturbance? What are the cumulative cost of this insulation?
In France, insulation is managed by the ADEME (Agence de l'Environnement et de la Maîtrise de l'Energie). Since 1995, the ADEME has financed the insulation of 8 483 houses, representing 26% of the total number of houses in the frame of the current "Plan de Gêne Sonore" (Area of noise disturbance).
For 2001 and 2002 :

	Number of houses insulated	*Financial Aid*
2001	*627*	*7,48 M euros*
2002	*1 030*	*11,50 M euros*

11) What is the effectivity of the different night restrictions? (e.g. reduction of complaints, smaller noise contours, etc.)
The effectivity of the different night restrictions has not been measured yet as they will be put in force, for the latest, next year.

12) Please estimate the reduction in people sleep disturbed due to introduction of the night restrictions expressed in percentage of the total number of people sleep disturbed.
Figures not available

13) Do you have any other information to illustrate the effectivity of the night restrictions?
No answer.

14) Are changes to be expected in the near future concerning night restrictions at your airport? If yes, please motivate these changes.
No changes are scheduled in the near future as new laws have recently been implemented.

Answers for London-Heathrow (includes answers from the airport, slot coordinator and BA)

1) Please check if the overview of night time restrictions is correct for your airport. If not, which restrictions are incorrect, missing or are no longer active?
It appears to be correct.

2) How many aircraft operations are presently conducted at your airport on a yearly basis during the night periods 23:00-06:00 and 06:00-07:00 hr local time?

Figures for 2002:
23:30 – 6:00: 3370 departures
6042 arrivals

6:00 – 7:00: *3564 departures*
13489 arrivals

3) Is there a limit to the number of aircraft operations during the period 23:00-07:00 hr due to night time restrictions?
The Night Quota Period is 2330-0600 local time. Current limits are:
Summer: *3250 movements / 5610 QC points*
Winter: *2550 movements / 4140 QC points*

4) What were the changes in the traffic distribution (aircraft types, number of flights, type of airlines, etc.) after the night time restrictions were introduced?
The restrictions at Heathrow have been in place in broadly their current form for a number of years, so it is difficult to quantify this. In general, the night quota was sufficient to accommodate existing traffic, but has acted to cap it.

The combination of a movements and QC points limit means that there is no scope for growth in night movements and airlines are prevented from changing aircraft to a noisier type, e.g., from a B777 to B744.

5) Please estimate the number of operations "lost" (as a result of the restrictions) during night time (23:00-07:00 hr) expressed in percentage of the number of yearly night flights during this period.
This is not possible with any accuracy. As airlines know that night quota is not available, they generally do not request new night flights. This does not indicate a lack of demand if there were no restrictions, particularly as the lack of slot availability during the day would encourage operations at night if no environmental limits existed.

6) Please rank the top 5 of economically most stringent night time restrictions at your airport.
Clearly the most limiting factor is the night quota limits capping the number of movements and noise points.

7) Do you have any additional information regarding the strictness of the night restrictions (such as complaints of airlines)?
No complaints. The limits are set by the government every 5 years after extensive consultation.

8) How is the annoyance of people around the airport at night registered or measured? (for example, number of complaints, number of sleep disturbed, number of people within noise contours, etc.)
No answer.

9) How many people around your airport are sleep disturbed or annoyed by aircraft noise at night?
No answer.

10) How many houses around the airport are noise insulated in order to reduce the effects of sleep disturbance? What are the cumulative cost of this insulation?
Noise Insulation Scheme -This scheme began in 1996 and is designed to protect homes in areas exposed to the highest level of noise disturbance. All 8,500 homes eligible for noise insulation under the scheme have now been invited to take part of which 4,300 took advantage of the scheme. Following careful consideration of a number of options for the noise insulation scheme, in January 2003 it was decided to re-offer the scheme to those properties where previously none of the options available were taken up. There are approximately 4,200 homes eligible for the re-offer. The scheme has also been extended to include primary schools within the scheme's boundary. This includes 10 schools. Those eligible to apply for the Noise Insulation scheme can select free secondary glazing, a 50 per cent contribution towards standard or high specification replacement windows, or a combinations of these. Free ventilation and loft insulation is also offered as part of the scheme. Around £12 million has been spent on the scheme since it began.

11) What is the effectivity of the different night restrictions? (e.g. reduction of complaints, smaller noise contours, etc.)
No answer.

12) Please estimate the reduction in people sleep disturbed due to introduction of the night restrictions expressed in percentage of the total number of people sleep disturbed.
No answer.

13) Do you have any other information to illustrate the effectivity of the night restrictions?
No answer.

14) Are changes to be expected in the near future concerning night restrictions at your airport? If yes, please motivate these changes
The government will consult on the next 5 year regime in 2004. We do not know the content of this consultation or its proposals, but the government has indicated that it will consult on the possibility of extending the night quota period to include 0600-0700 local time and about the possibility of removing the limit on the number of movements and have only limits on the number of noise points (to encourage use of quieter aircraft). The current regime is due to remain until Oct 2005.

Answers for Frankfurt-Main (includes answers from the airport, slot coordinator and Lufthansa)

1) Please check if the overview of night time restrictions is correct for your airport. If not, which restrictions are missing or are no longer active?
Restrictions were checked with AIP and were correct

2) How many aircraft operations are presently conducted at your airport on a yearly basis during the night periods 23:00-06:00 and 06:00-07:00 hr local time?
46662 slots were allocated between 23:00 and 7:00

3) Is there a limit to the number of aircraft operations in the night period (23:00-07:00 hr) due to night restrictions?
No

4) What were the changes in the traffic distribution (aircraft types, number of flights, type of airlines, etc.) after the night time restrictions were introduced?
No answer.

5) Please estimate the number of operations "lost" (as a result of the restrictions) during night time (23:00-07:00 hr) expressed in percentage of the number of yearly night flights during this period.
Please note that we have been able to accommodate almost all schedules during the night times which were requested for this time period. Also, the total number of flights coordinated between 23:00 and 07:00 is higher than the number of requested schedules since some of those flights were requested for slots outside this time range, for which, however, nothing but a time between 23:00 and 07:00 was available.

6) Please rank the top 5 of economically most stringent night time restrictions at your airport.
No answer.

7) Do you have any additional information regarding the strictness of the night restrictions (such as complaints of airlines)?
No answer.

8) How is the annoyance of people around the airport at night registered or measured? (for example, number of complaints, number of sleep disturbed, number of people within noise contours, etc.)
No answer.

9) How many people around your airport are sleep disturbed or annoyed by aircraft noise at night?
No answer.

10) How many houses around the airport are noise insulated in order to reduce the effects of sleep disturbance? What are the cumulative cost of this insulation?
No answer.

11) What is the effectivity of the different night restrictions? (e.g. reduction of complaints, smaller noise contours, etc.)

No answer.

12) Please estimate the reduction in people sleep disturbed due to introduction of the night restrictions expressed in percentage of the total number of people sleep disturbed.
No answer.

13) Do you have any other information to illustrate the effectivity of the night restrictions?
No answer.

14) Are changes to be expected in the near future concerning night restrictions at your airport? If yes, please motivate these changes.
No answer.

Appendix C: Overview of night time restrictions

Night restrictions at Amsterdam Airport Schiphol

Restrictions with respect to operating quota

- A limited number of slots is available during the night period. Airlines are not allowed to operate between 2300-0700 without a slot applicable to this period.
- Noise quota are defined to limit:
- The L_{den} and L_{night} noise load in control points;
- The TVG_{den} and TVG_{night} total volume of noise load.

Restrictions with respect to the use of the airport

- With respect to daytime, the following runways are not available between 2300-0600:
  - For departures: runways 36C, 09/27, 04/22, 18L/36R
  - For arrivals: runways 18C, 09/27, 24, 04/22, 18L/36R
- Limited use of airport for chapter 3 aircraft for which the margin between the sum of the certification noise levels and the chapter 3 noise limits is less than 5 EPNdB:
  - For aircraft equipped with engines with a bypass-ratio <= 3, take-off and landing is not allowed between 1800-0800;
  - For aircraft equipped with engines with a bypass-ratio > 3: it is not allowed to plan take-off between 2300-0600.
- No use of APU for power supply in case alternative power source is available.
- Limited runways usage (1+1) between 06:00-7:00 (related to Lnight noise control points)

Restrictions with respect to operational procedures

- For runways 06 and 18R RNAV low noise landing procedures for jet aircraft will be used between 2300-0600 (Continuous Descent Approach, ground track above the North Sea)
- For departures: jet aircraft shall remain within the airways, with respect to the time-period and runway. After leaving the TMA, aircraft shall remain on or above flight level 60. Between 2300-0600 the following maximum percentage of deviations during the year are allowed:
  - Horizontal up to flight level 90: 0.05%
  - Vertical between CTR-TMA : 0.05%
    from TMA: 10.00%
- For approaches: jet aircraft shall remain within the airways, with respect to the time-period and runway. The minimal flight level from the TMA boundary up to the final approach is 3000 ft between 2300-0600. Between 2300-0600 the following maximum percentage of deviations during the year are allowed:
  - Horizontal 0.05%
  - Vertical up to TMA-boundary: 0.05%
    from TMA to final approach: 0.05%
- Training and test flights within the Schiphol zone shall not be performed from Monday up to Friday between 2200-0700 and on Saturday and Sunday.
- Engine test running is restricted between 0100-0700.

- After landing, reverse thrust above idle shall not be used from 2300-0700 on all runways.
- Special SID's are effective for all jet aircraft between 2300-0600.

Night restrictions at London Heathrow

Restrictions with respect to operating quota

- An overall maximum number of occasions on which aircraft take-off or land is specified between 2330-0600 throughout the specified period (winter or summer season).
- A maximum sum of quota counts (depending on the noise classification of the aircraft) is specified for operations of aircraft between 2330-0600 throughout the specified period (winter or summer season).

Restrictions with respect to the use of the airport

- Aircraft with a quota count of 8 or 16 (noise classification ≥ 99 EPNdB) may not be scheduled to take-off or land between 2300-0700. However, these aircraft may take-off or land in the period 2300-2329 in circumstances like delays. Unscheduled arrivals may also be permitted between 2300-2329 and 0601-0700.
- Engine runs between 2300-0700 require permission, while all high power runs between 2300-0700 must take place in a ground run pen.
- The maximum total ground running exposure time between 2300-0700 must not exceed 150 minutes; the maximum amount of ground running at high power between 2300-0700 must not exceed a rolling 30 day average of 20 minutes.
- GPU's used between 2330-0600 must meet the IATA noise criteria set for mobile ground service equipment.
- Between 2300-0700 no aircraft is permitted to taxi to or from stands on the "V" and "S" aprons
- APU's must not be used on stand in the Cargo Area between 2330-0600.

Restrictions with respect to operational procedures

- Aircraft, other than Concorde, shall be operated in such a way that it will not cause more than 89 dB(A) L_{max} between 2300-0700 and not more than 87 dB(A) between 2330-0600 at any noise monitoring terminal at any of the sites relating to London Heathrow.
- Commanders of aircraft are requested to avoid the use of reverse thrust after landing between 2330 and 0600.

Night restrictions at Paris Charles de Gaulle

Restrictions with respect to operating quota

- Maximum of 22.500 slots granted between 0:00 and 4:59 for departure slots and between 0:30 and 5:29 for arrival slots. Unused or abandoned slots will be retired from this figure in the following years.
- Carriers are not allowed to take off between 0:00 and 4:59 without a slot applicable to this period.

Restrictions with respect to the use of the airport

- Take-off not allowed between 0:00 and 4:59 for aircraft with a certified departure noise level > 99 EPNdB.
- Landing not allowed between 0:30 and 5:29 for aircraft with a certified arrival noise level > 104.5 EPNdB.
- Engine tests not allowed between 22:00 and 6:00.
- Westbound takeoffs in line with the runway can only be made by chapter 3 aircraft and these aircraft must maintain a minimum climb gradient of 6.5%.

Restrictions with respect to operational procedures

- Between 23:15 and 6:00, the crew of aircraft in noisier categories must indicate this at the first contact with ATC.
- Obligation of aircraft in noisier categories , when departing towards the west, to use the "8Y" procedure "plaine de France".
- Obligation of aircrew to follow with the highest attention the initial departure and arrival procedure.
- Ban of VFR approaches night and day.
- Obligation for propeller driven aircraft to follow the jet aircraft departure procedures at night.
- One arrival procedure (OMAKO-MOSUD) is prohibited between 22:20-07:00.

Night restrictions at Frankfurt Main

Restrictions with respect to operating quota

None

Restrictions with respect to the use of the airport

- Limited use of airport for chapter 3 aircraft.
- Operations are not permitted between 22:00-06:00, unless they have been coordinated at least 1 day in advance.
- Exercise flights, check flights and training flights are not permitted between 23:00-06:00.
- Landings are not permitted between 24:00-05:00 (excluded aircraft of operators which have their main base and maintenance facilities located at Frankfurt for operations between 24:00-01:00 and 04:00-05:00).

Restrictions with respect to operational procedures

- After landing, reverse thrust above idle shall not be used between 22:00-06:00.

Appendix D: Contact persons

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