AS 2021—2000

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Australian Standard™

Acoustics—Aircraft noise intrusion—Building siting and construction

Standards Australia

This Australian Standard was prepared by Committee EV/11, Aircraft and Helicopter Noise. It was approved on behalf of the Council of Standards Australia on 7 July 2000 and published on 10 August 2000.

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Australasian Faculty of Occupational Medicine

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Australian Air Transport Association

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Australian Standard™

Acoustics—Aircraft noise intrusion—Building siting and construction

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PREFACE

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee EV/11, Aircraft and Helicopter Noise to supersede AS 2021—1994. This Standard is the result of a consensus among representatives on the Joint Committee to produce it as an Australian Standard.

This Standard provides guidance on the siting and construction of buildings in the vicinity of airports to minimize aircraft noise intrusion. The assessment of potential aircraft noise exposure at a given site is based on the Australian Noise Exposure Forecast (ANEF) system (for details of this system refer to Appendix A).

This edition provides expanded aircraft noise tables and incorporates various associated amendments to the text.

The term 'informative' has been used in this Standard to define the application of the appendix to which it applies. An 'informative' appendix is only for information and guidance.

CONTENTS

FOREWORD

Aircraft noise intrusion within a building depends substantially on—

(a) the location, orientation and elevation of the site relative to the aircraft flight paths;

(b) the types and frequency of aircraft operating from the aerodrome;

(c) meteorological conditions;

(d) the types of activity (including sleep) to be, or being, accommodated in the building;

(e) the type of layout, construction and ventilation used; and

(f) the internal acoustic environment.

The data contained in the aircraft Noise Level Tables (Tables 3.4 to 3.24) are based on modelling and actual measurement and are estimates of the noise levels emitted by the aircraft currently operating. These data will be amended as new aircraft are commissioned and as otherwise necessary.

Exposure prediction below 25 ANEF may be significantly inaccurate, and therefore caution should be exercised in the evaluation of locations outside the 25 ANEF contour. In addition, the extent of noise reduction required for a building may depend in part on the amount of noise from sources other than aircraft. Because of these factors and of the special acoustic requirements of certain types of building, it will sometimes be necessary to undertake supplementary noise measurements so that a sufficiently representative prediction of the noise exposure at the site under evaluation can be obtained. This is also true for aerodromes at which a significant number of training circuits occur. Such measurements should be performed only by personnel appropriately qualified in acoustics.

Human reaction to aircraft noise is known to depend not only on the amount of noise, but also on psychosocial factors such as personal sensitivity to noise, fear of aircraft crashing and attitudes towards aviation. Thus some individuals will be seriously disturbed by aircraft noise even when the building is sited and constructed according to this Standard.

Some experience has shown that communities which are newly-exposed to aircraft noise (e.g. as a result of the construction of new runways, or the redesign of flight paths near an airport) tend to be more sensitive to such noise than communities which are accustomed to it. Land use planning must by necessity use a long-term horizon, and the building siting acceptability recommendations in this Standard are based on the reactions of noise-accustomed communities. Regulatory authorities are cautioned that a transient heightened reaction could result from substantial new noise exposure.

STANDARDS AUSTRALIA

Australian Standard

Acoustics—Aircraft noise intrusion—Building siting and construction

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE

This Standard, together with the relevant Australian Noise Exposure Forecast (ANEF) chart or locality map available for the aerodrome under consideration, provides guidelines for determining—

(a) whether the extent of aircraft noise intrusion makes building sites 'acceptable', 'unacceptable' or 'conditionally acceptable' for the types of activity to be, or being, undertaken (Clause 2.3);

(b) for 'conditionally acceptable' sites, the extent of noise reduction required to provide acceptable noise levels indoors for the types of activity to be, or being, undertaken; and

(c) the type of building construction necessary to provide a given noise reduction, provided that external windows and doors are closed (see Note 1).

This Standard deals specifically with noise from take-off, landing and circuit training operations at civil aerodromes or military airfields.

The acceptability of outdoor spaces is not covered by this Standard.

NOTES:

1 The recommendations for building construction are based on the assumption that external windows and doors are shut. If external windows or doors are opened for ventilation or other purposes, the noise attenuation values for various components given in Clause 3.3 will not be achieved. Item (c) above implies that mechanical ventilation will need to be installed when external windows and doors are shut to provide adequate protection against aircraft noise intrusion. Whether or not sufficient ventilation can be achieved by mechanical or other means should be considered before the selection of building components described in Clause 3.3.

2 There may be a significant increase in costs incurred in buildings designed to provide higher than normal noise attenuation for their type.

1.2 OBJECTIVE

This Standard is concerned with land use planning and building treatments in the vicinity of an airport. The objective is to provide guidance to regional and local authorities, organizations, communities and others associated with urban and regional planning and building development on the siting and construction of new buildings against aircraft noise intrusion and on the acoustical adequacy of existing buildings in areas near aerodromes.

This Standard is not intended to be applied for the purposes of assessing the effects of noise from aircraft. However, it should be noted that the effects of noise from aircraft are not confined to areas where the noise exposure exceeds 20 ANEF and may occur at or below 20 ANEF (see Appendix A for a description of the ANEF system).

1.3 APPLICATION

Application of this Standard should be considered when a building site is located within certain distances from an aerodrome as given below. The following distances are approximations and should be used as guidelines only:

(a) Within 15 km of an international airport, major domestic airport, or major military aerodrome.

(b) Within 10 km of a domestic airport with regular scheduled public transport services.

(c) Within 5 km of any other type of aerodrome for which an ANEF chart is available.

Reference to the appropriate ANEF chart will be necessary to determine the applicability of the recommendations of this Standard.

Section 2 of this Standard gives guidelines for determining the acoustical acceptability of a particular site.

Section 3, used in sequence with Section 2, gives guidelines for determining the extent of noise reduction and type(s) of construction required for a particular building.

A high level of skill is required to comply with many of the provisions of this Standard. Unsuccessful designs may be difficult and expensive to remedy. Inferior aircraft noise attenuation performance resulting from unsatisfactory design and construction will detract from the value and usefulness of a building throughout its life. It is expected that the provisions of this Standard will be interpreted by a qualified acoustician experienced in the characteristics of aircraft noise.

NOTES:

1 A flow chart setting out the various steps contained in this Standard is shown in Figure 1.1.

2 A worked example of the application of the Standard is given in Appendix B.

1.4 REFERENCED DOCUMENTS

The following documents are referred to in this Standard:

AS
1170 Minimum design loads on structures (known as the SAA Loading Code)
1170.4 Part 4: Earthquake loads

1259 Acoustics—Sound level meters
1259.1 Part 1: Non-integrating
1259.2 Part 2: Integrating—Averaging

1633 Acoustics—Glossary of terms and related symbols

1668 The use of mechanical ventilation and air-conditioning in buildings
1668.2 Part 2: Mechanical ventilation for acceptable indoor-air quality

2047 Windows in buildings—Selection and installation

2107 Acoustics—Recommended design sound levels and reverberation times for building interiors

2659 Guide to the use of sound measuring equipment
2659.1 Part 1: Portable sound level meters
2659.2 Part 2: Portable equipment for integration of sound signals

3826 Strengthening existing buildings for earthquake

AS/NZS
1276 Acoustics—Rating of sound insulation in buildings and of building elements
1276.1 Part 1: Airborne sound insulation

3000 Electrical installations (known as the Australian/New Zealand Wiring Rules)

Building Code of Australia

1.5 DEFINITIONS

For the purpose of this Standard, the definitions in AS 1633 and those below apply.

1.5.1 Aerodrome

An area of land or water (including any buildings, installations and equipment)—

(a) established as an aerodrome under Air Navigation Regulations; or

(b) the use of which as an aerodrome is authorized under the regulations made under the Civil Aviation Act; and

being such an area intended for use wholly or partly for the arrival, departure or movement of aircraft.

NOTE: The Department of Defence often refers to an aerodrome as an airfield.

1.5.2 Aircraft noise level

The arithmetic average of the maximum sound levels occurring during a series of flyovers by a specific aircraft type and load conditions measured in A-weighted decibels (dB(A)) using the S time-weighting of a sound level meter.

NOTES:

1 Derivation of the aircraft noise levels in Tables 3.4 to 3.24 is covered in Note 2 to Clause 3.1.4.

2 Internationally aircraft noise is measured using slow (S) time-weighting, and the extensive databases and programming algorithms used in determining aircraft noise exposure levels use data based on S time-weighted measurements. Consistent with these practices, aircraft noise measurements and assessments in Australia use S time-weighting and an average of the maximum noise levels.

3 Maximum noise levels will vary from time to time depending on the prevailing meteorological conditions.

1.5.3 Aircraft noise reduction (ANR)

A calculated or measured value. For design purposes, the arithmetic difference between the aircraft noise level at a site and the indoor design level, as described in Clause 3.2.2. For measurement purposes, the difference between the exterior and indoor sound levels as determined in accordance with Appendix C.

1.5.4 Airfield

An area of land or water (including any buildings, installations and equipment) established in accordance with military standards and requirements and intended for use wholly or partly for the arrival, departure or movement of aircraft.

1.5.5 Airport

An aerodrome with significant facilities.

1.5.6 Australian Noise Exposure Forecast (ANEF)

A single number index for predicting the cumulative exposure to aircraft noise in communities near aerodromes during a specified time period (normally one year).

NOTE: The computation of this index includes—

(a) measurements of aircraft noise (expressed in Effective Perceived Noise Decibels, EPNdB), which take account of the spectral, temporal and spatial aspects of the noise;

(b) estimates and generalizations of aircraft type groups and mix, number of operations, runway utilization, flight paths and operational procedures; and

(c) time of day, i.e. whether daytime (0700 hours to 1900 hours) or evening/night-time (1900 hours to 0700 hours).

This single number index is useful for rating the compatibility of various land uses with respect to aircraft noise. For this purpose, equivalent ANEF values at individual positions around an aerodrome are combined on a map to form ANEF contours. (See Appendix A for a description of the ANEF system and the method for its determination.)

1.5.7 Building site

The location of a proposed or existing building not associated with the aerodrome.

1.5.8 Indoor design sound level

The recommended maximum level in dB(A) inside a building from an aircraft flyover.

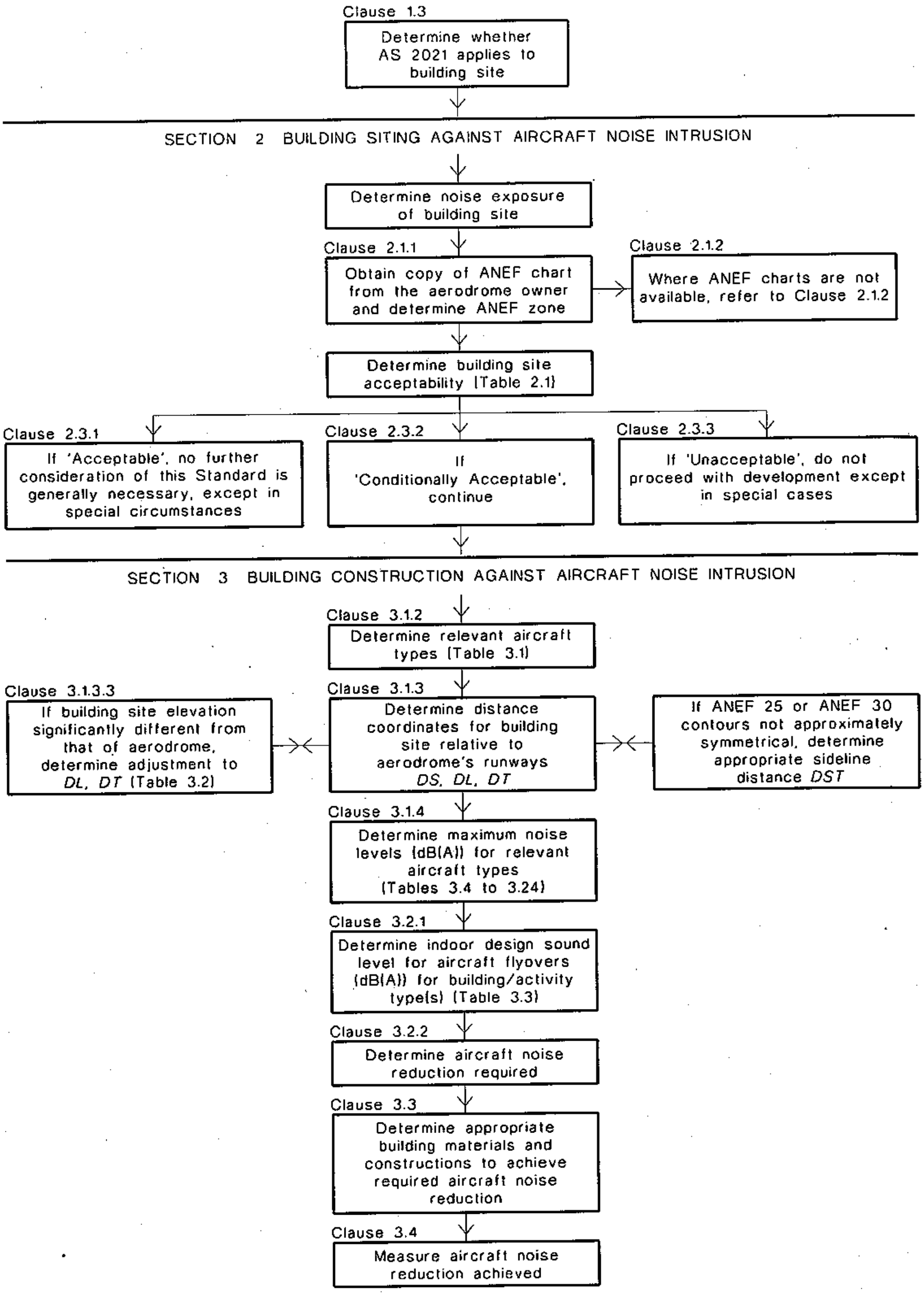


FIGURE 1.1 FLOW CHART

SECTION 2 BUILDING SITING AGAINST AIRCRAFT NOISE INTRUSION

2.1 DETERMINATION OF NOISE EXPOSURE OF BUILDING SITE

2.1.1 Aerodromes with ANEF charts

ANEF charts for the major Australian city airports, military aerodromes and for many of the country aerodromes are available from the appropriate authorities. All or some of the noise exposure contours of 20, 25, 30, 35 and 40 ANEF are shown on these charts.

These contours indicate land areas around aerodromes which are forecast to be exposed to aircraft noise of certain levels as defined in Clause 1.5.6; the higher the ANEF value the greater is the noise exposure.

Locate the position of the building site on the ANEF chart and determine the highest value ANEF contour which crosses the building site.

If the building site is outside the 20 ANEF contour, noise from sources other than aircraft may dominate; therefore, there is usually no need to proceed further in this Standard as the construction of the building need not specifically be designed to provide protection against aircraft noise intrusion. Nevertheless, if it is desired that premises be insulated against aircraft noise, the procedures of this Standard may be followed.

NOTES:

1 The individual aerodrome operators should be approached regarding the availability of ANEF charts.

2 For certain highly specialized building types such as auditoria or recording studios, specialist acoustic advice should always be sought.

2.1.2 Aerodromes without ANEF charts

The ANEF system takes account of noise levels, frequency and time of day of aircraft noise events. Therefore it is always preferable to use an ANEF chart to predict aircraft noise exposure at a site. If one does not exist, the preparation of an ANEF chart for the particular aerodrome should be requested through the aerodrome owner.

Where aerodrome usage is confined to a small number of light general aviation aircraft the production of an ANEF chart may not be justified and is unlikely to occur. In these cases refer to Appendix D.

2.2 DETERMINATION OF BUILDING SITE ACCEPTABILITY

2.2.1 General

The acceptability of the building site is dependent on the type of building proposed and on the ANEF zone in which it is to be located.

2.2.2 Determination of acceptability

For the particular building type under consideration, determine from Table 2.1 the building site acceptability, i.e. acceptable, conditionally acceptable or unacceptable, for the ANEF zone in which it is to be located.

2.3 ACTION RESULTING FROM ACCEPTABILITY DETERMINATION

2.3.1 Acceptable

If from Table 2.1, the building site is classified as 'acceptable', there is usually no need for the building construction to provide protection specifically against aircraft noise. However, it should not be inferred that aircraft noise will be unnoticeable in areas outside the ANEF 20 contour. (See Notes 1, 2 and 3 of Table 2.1.)

2.3.2 Conditionally acceptable

If from Table 2.1, the building site is classified as 'conditionally acceptable', the maximum aircraft noise levels for the relevant aircraft and the required noise reduction should be determined from the procedure of Clauses 3.1 and 3.2, and the aircraft noise attenuation to be expected from the proposed construction should be determined in accordance with Clause 3.3 (see Notes 1 and 3 of Table 2.1).

2.3.3 Unacceptable

If, from Table 2.1 the building site is classified as 'unacceptable', construction of the proposed building should not normally be considered. Where in the community interest redevelopment is to occur in such areas, e.g. a hotel in the immediate vicinity of an aerodrome, refer to the notes to Table 2.1.

TABLE 2.1

BUILDING SITE ACCEPTABILITY BASED ON ANEF ZONES
(To be used in conjunction with Table 3.3)

Building type	ANEF zone of site		
	Acceptable	Conditionally acceptable	Unacceptable
House, home unit, flat, caravan park	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF (Note 1)	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF (Note 1)	20 to 30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

NOTES:

1 The actual location of the 20 ANEF contour is difficult to define accurately, mainly because of variation in aircraft flight paths. Because of this, the procedure of Clause 2.3.2 may be followed for building sites outside but near to the 20 ANEF contour.

2 Within 20 ANEF to 25 ANEF, some people may find that the land is not compatible with residential or educational uses. Land use authorities may consider that the incorporation of noise control features in the construction of residences or schools is appropriate (see also Figure A1 of Appendix A).

3 There will be cases where a building of a particular type will contain spaces used for activities which would generally be found in a different type of building (e.g. an office in an industrial building). In these cases Table 2.1 should be used to determine site acceptability, but internal design noise levels within the specific spaces should be determined by Table 3.3.

4 This Standard does not recommend development in unacceptable areas. However, where the relevant planning authority determines that any development may be necessary within existing built-up areas designated as unacceptable, it is recommended that such development should achieve the required ANR determined according to Clause 3.2. For residences, schools, etc., the effect of aircraft noise on outdoor areas associated with the buildings should be considered.

5 In no case should new development take place in greenfield sites deemed unacceptable because such development may impact airport operations.

SECTION 3 BUILDING CONSTRUCTION AGAINST AIRCRAFT NOISE INTRUSION

3.1 AIRCRAFT NOISE LEVEL

3.1.1 General

The procedure for estimating the aircraft noise level likely to be experienced at the building site involves—

(a) the determination of the aircraft types forecast to be operating at the aerodrome near the building site;

(b) the graphical determination of a set of distance coordinates which describe the position of the building site relative to the aerodrome, and thus are an estimate of the position of the building with respect to that of aircraft during take off, landing and circuit training operations; and

(c) the prediction of the aircraft noise level to which the building site will be exposed.

3.1.2 Determine aircraft types

Refer to Column 1 of Table 3.1. Identify all those aircraft types and operations (take offs, landings and training circuits) forecast in the ANEF to occur on each runway and the times of operation. The aircraft types forecast to operate are given in the aircraft type tabulations included on ANEF charts.

3.1.3 Determine distance coordinates for building site relative to aerodrome runways

3.1.3.1 *Aircraft using straight approach and departure flight paths*

The distance coordinates are determined as follows:

(a) On the appropriate ANEF chart or locality map, extend the centre-line of each runway to a point beyond the building site.

All runways should be taken as relevant and the procedures given carried out to determine the noise levels from aircraft movements on all runways.

(b) As shown in Figure 3.1, draw a line perpendicular to the extended runway centre-line and passing through the building site, known as 'sideline projection'.

(c) Determine for each runway—

(i) *DS*, the distance in metres from the building site to the extended runway centre-line along the line drawn in Item (b);

(ii) *DL*, the distance in metres from the closer end of the runway to the intersection of the extended runway centre-line and the line drawn in Item (b); and

(iii) *DT*, the distance in metres from the further end of the runway to the intersection of the runway centre-line and the line drawn in Item (b).

3.1.3.2 *Aircraft using curved approach and departure tracks*

Where curved flight paths occur, the combined effects of aircraft altitude (as it proceeds along the curved flight path), site elevation, and sideline distance need careful consideration. It is recommended that a series of computations should be performed for a number of positions along the curved segment of the flight path with respect to the building site, and not just for the position closest to the building site.

See Figure 3.2. The distance coordinates are determined as follows:

NOTE: The following procedure should be adopted only if the details used to describe the curved flight paths for the production of the ANEF are known. The individual aerodrome operators should be approached regarding the availability of flight track information.

(a) On the appropriate ANEF chart or locality map, plot the closest relevant curved flight paths for each runway to a point beyond the building site. All runways should be taken as relevant and the procedures given carried out to determine the noise levels from aircraft movements on all runways.

(b) As shown in Figure 3.2, draw a line perpendicular to the flight path or its tangent and passing through the building site, known as 'sideline projection'.

(c) Determine *DST* and *DSL*. *DST* and *DSL* are the parts of the flight path which follow the centre-line from the end of the runway (see Figure 3.2).

(d) Determine *DC*. *DC* is that part of the flight path which is curved (see Figure 3.2). *DC* can be calculated using the following equation:

$$DC = \frac{2\pi RA}{360} \quad \ldots 1$$

where *A*, the angle shown in Figure 3.2 is measured in degrees and *R* (see Figure 3.2) is measured in metres.

(e) Determine for each runway—

(i) *DS*, the distance in metres from the building site to the curved flight path along the line drawn in Step (b);

(ii) *DL*, the distance in metres obtained by adding *DSL* and *DC*; and

(iii) *DT*, the distance in metres obtained by adding *DST* and *DC*.

3.1.3.3 *Land height correction*

If the elevation of the building site differs from that of the aerodrome by ±10 m or more, the distance coordinates *DL* and *DT* must be corrected in accordance with Table 3.2 to take account of this difference.

Site elevations above or below that of the aerodrome are listed in Column 1 of Table 3.2 and the corresponding values to be subtracted from, or added to, *DL* and *DT* are given in the Columns 2 to 5. If the elevation of the aerodrome is greater than that of the site, the values given in Table 3.2 are to be added to *DL* and *DT* and if it is less they are to be subtracted from *DL* and *DT*.

NOTE: ANEF charts may not account for topography; if they do so it will be indicated on the chart. To determine difference of elevation between the aerodrome and building site refer to a survey map of the area.

3.1.4 Determine aircraft noise levels (dB(A))

The aircraft noise levels are determined as follows:

(a) For *each* relevant aircraft type listed in Table 3.1, identify two associated noise level tables in the series Tables 3.4 to 3.24. The set of tables should be listed.

(b) For each noise level table in the set, read off a corresponding noise level for the appropriate centre-line and sideline distance coordinate as follows:

(i) For take off noise level tables, use *DT* and *DS* distance coordinates.

(ii) For landing noise level tables, use *DL* and *DS* distance coordinates.

(c) List the set of noise levels, and from the set select the highest value. This is the aircraft noise level to be used to determine the aircraft noise reduction required (see Clause 3.2.2). The only exception is where there is evidence that the particular aircraft type and movement which produced that noise level do not constitute a typical operation. In this case, select the next highest value from the noise tables.

NOTES:

1 Land-use planning authorities may require testing to establish that particular ANR values have been achieved. In these circumstances, the aircraft noise levels used for the design of the building construction should be taken as the higher of measurements taken at the site by an acoustic specialist and tabulated levels given in this Standard.

2 The noise levels in Tables 3.4 to 3.24 are based on modelling and measurements. The tabulated values are estimates of the aircraft noise levels emitted by typical aircraft operating in Australia. Uncertainties in the data increase as the distances *DT*, *DL*, and *DS* increase.

3 For some building sites, an aircraft noise level table may not include a value for a particular pair of distance coordinates determined in accordance with Clause 3.1.3. If this is the case, it indicates that the take off or landing noise for the aircraft type being considered will not generally be of significance in terms of noise reduction requirements at that site.

3.2 NOISE REDUCTION REQUIREMENTS

3.2.1 Determine indoor design sound level for aircraft flyovers

From Table 3.3, select the indoor design sound level appropriate for the activity or building type under consideration.

3.2.2 Determine aircraft noise reduction (*ANR*) required

Subtract the level obtained in Clause 3.2.1 from the aircraft noise level determined in accordance with Clause 3.1.4. The resulting value is an estimate of the extent of aircraft noise reduction (*ANR*), in dB(A), to be incorporated in the building's envelope.

NOTES:

1 In any one building, several different activity and space types may be accommodated, necessitating the selection of several indoor design sound levels and noise reductions, as appropriate. See also notes to Table 3.3.

2 For building sites that require an *ANR* in excess of 30 it is recommended that for the purpose of noise control the assessment be evaluated in terms of the spectral components of the aircraft noise rather than a dB(A) value, so as to take account of low frequency components of the aircraft overflight that may influence the internal dB(A) level.

3.3 CONSTRUCTION GUIDELINES

Buildings on sites determined to be 'conditionally acceptable' under Clause 2.2 should be designed such that the ANR values determined under Clause 3.2.2 are achieved for all internal spaces. In general, this will require that external windows and doors be kept closed, since if these are opened for ventilation purposes the aircraft noise reduction of the building envelope will be significantly reduced. If it is necessary to close windows and doors to comply with this Standard, building ventilation should be in accordance with the Building Code of Australia on the assumption that windows and doors are not openable. Mechanical ventilation or airconditioning systems complying with AS 1668.2 should be installed.

Various rooms in a building may require different indoor design sound levels and consequently different ANR values (see Clause 3.2). In addition, the areas of external building components may differ between rooms. For this reason, determination of appropriate building components should be performed separately for each room within a building. In some cases, an external perimeter approach to design may be appropriate (see Note 6 to Table 3.3).

NOTE: Appendix E provides guidance on achieving high levels of acoustic insulation against aircraft noise.

If internal doors within a building need to be opened for functional reasons, then noise transmission from other internal spaces should also be taken into account in determining the overall ANR for each room.

In general, specialist acoustic advice will need to be sought to ensure that the sound transmission loss of all individual building components is appropriate to achieve the required ANR values. Possible sound transmission through vents and other openings should also be considered in the design.

Appendix F provides one method for determining appropriate building materials and constructions to achieve a required ANR value. Appendix F is intended to serve as a guide to the types of construction which would be necessary in any instance. Other specific building materials may also be suitable, and alternative building designs which optimize noise attenuation may also be developed to achieve the required performance.

3.4 COMPLIANCE TEST

In situations where measurement of noise attenuation is required following construction, testing by an acoustics specialist following the method described in Appendix C is recommended.

If the measured ANR is equal to or greater than the design ANR determined in accordance with Clause 3.2 the building as constructed complies with this Standard (see Appendix C, Paragraph C4(m)).

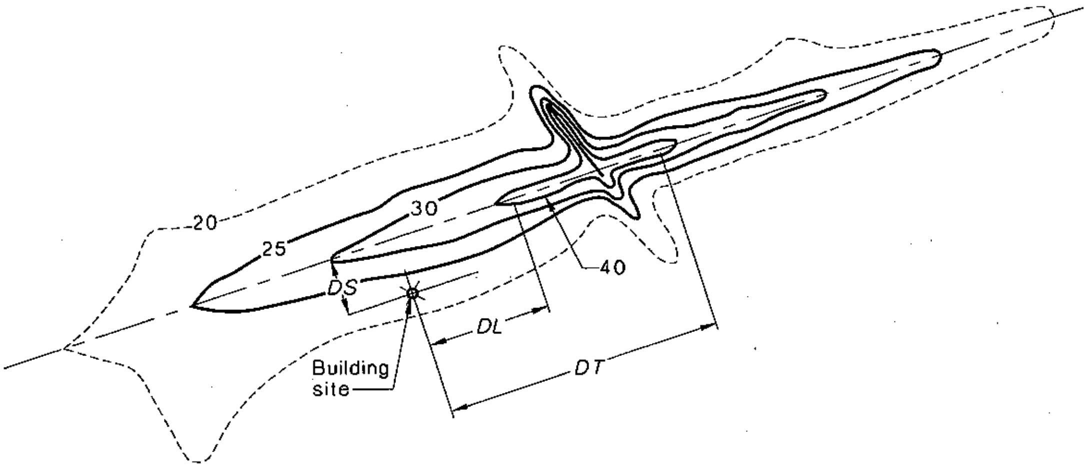


FIGURE 3.1 DETERMINATION OF *DS*, *DL* AND *DT* FOR STRAIGHT FLIGHT PATHS

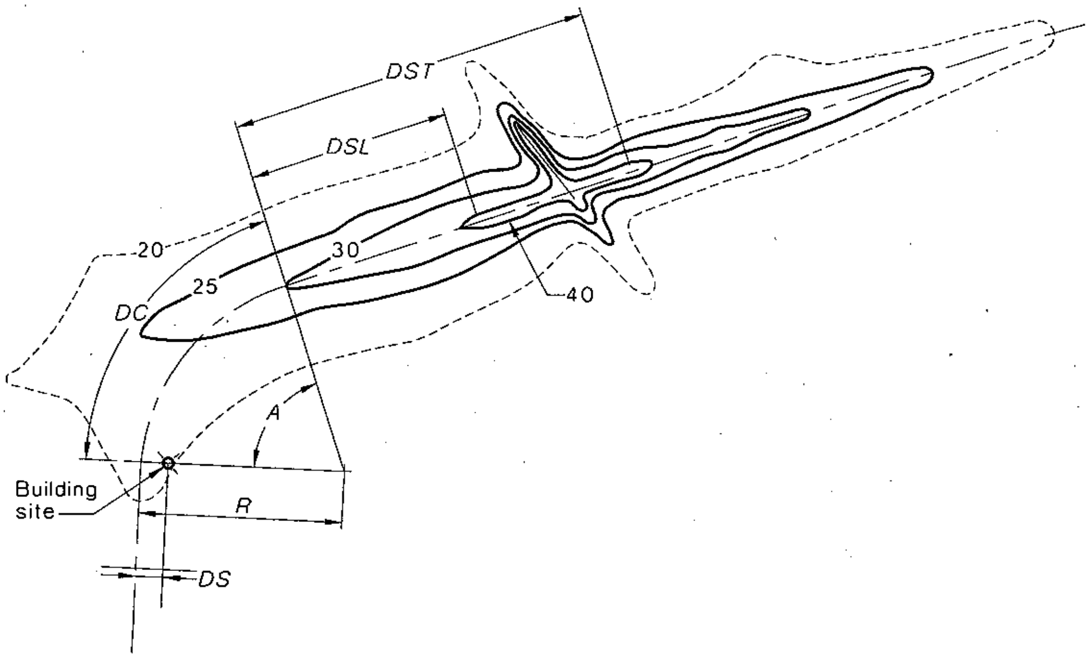


FIGURE 3.2 DETERMINATION OF *DS*, *DL* AND *DT* FOR CURVED FLIGHT PATHS

TABLE 3.1

SELECTION OF AIRCRAFT NOISE LEVEL TABLES

Relevant aircraft type	Operation	Applicable noise level Table
Boeing 727 (hush-kitted)	Take off Landing	Table 3.4 Table 3.5
Boeing 747-200B	Take off - long range (Note 8) Take off - short range (Note 8) Landing	Table 3.6 Table 3.7 Table 3.8
Boeing 747-400	Take off - long range (Note 8) Take off - short range (Note 8) Landing	Table 3.9 Table 3.10 Table 3.11
Boeing 737-300, Boeing 737-400, Airbus A320	Take off Landing	Table 3.12 Table 3.13
Boeing 767	Take off - long range (Note 8) Take off - short range (Note 8) Landing	Table 3.14 Table 3.15 Table 3.16
British Aerospace BAe 146	Take off Landing	Table 3.17 Table 3.18
Saab 340, Boeing Dash 8, Fokker F50	Take off Landing	Table 3.19 Table 3.20
Corporate jet (Note 5)	Take off Landing	Table 3.21 Table 3.22
Typical light general aviation aircraft types (Note 6)	Take off Landing	Table 3.23 Table 3.24

NOTES:

1 The aircraft types given in the above Table have been selected to be representative. For those types not given, an aircraft type of similar size and configuration may be selected.

2 For civil aircraft that are not similar in size and configuration to those listed, the appropriate noise levels may be obtained by contacting AirServices Australia.

3 For military aircraft, the appropriate noise levels should be obtained by contacting the Department of Defence.

4 Where aircraft with similar noise characteristics are grouped together, noise levels shown in the relevant table represent the highest value in each case.

5 The data in the Table is based on a Lear 35 jet.

6 The data in the Table is for twin-engine, propeller-driven aircraft of Maximum Take off Weight up to 5700 kg (data is based on Beech 58 Baron).

7 All data are based on zero wind conditions.

8 As the climb rate, and hence the spread of noise levels, is affected significantly by the aircraft take off weight, data has been included for international aircraft for long (>8000 km) and short (900 to 1800 km) ranges. For any given set of site coordinates, both take off tables should be checked, and the higher of the two noise levels used for design purposes.

9 The noise levels given in Tables 3.4 to 3.24 represent average maximum levels. Therefore there may be individual flights that produce higher or lower levels than those tabulated.

10 The noise levels shown in Tables 3.4 to 3.24 were provided by AirServices Australia, which has advised that—

(a) The levels were calculated using the best available modelling process at the time of preparation of this Standard.

(b) The input data were provided by an external source.

AirServices Australia and Standards Australia are not able to guarantee the correctness of the tabulated noise levels.

TABLE 3.2
LAND HEIGHT CORRECTIONS

metres

Difference in elevation between site and aerodrome	Distance in metres to be added to *DT* and *DL*, if site is below the aerodrome, or subtracted from *DT* and *DL*, if site is above the aerodrome			
	Landing (correction to *DL*)	Take off (correction to *DT*)		
	All aircraft type groups	Domestic jet aircraft types	International aircraft types	Domestic propeller-driven aircraft and light aircraft types
10	190	60	80	110
15	290	90	110	170
20	380	120	150	220
25	480	150	190	280
30	570	180	230	330
35	670	210	260	390
40	760	240	300	450
45	860	270	340	500
50	950	300	380	560
55	1 040	320	410	610
60	1 140	350	450	670
65	1 230	380	500	730
70	1 330	410	530	780
75	1 420	440	570	840
80	1 520	470	600	890
85	1 610	500	640	950
90	1 710	530	680	1 000
95	1 800	560	720	1 060
100	1 900	590	750	1 120

NOTES:

1 This Table is based on a 3° glide slope for landing, and an average climb gradient has been assumed for take off.

2 Interpolation between values is permissible.

TABLE 3.3

INDOOR DESIGN SOUND LEVELS* FOR DETERMINATION OF AIRCRAFT NOISE REDUCTION

Building type and activity	Indoor design sound level*, dB(A)
Houses, home units, flats, caravan parks	
Sleeping areas, dedicated lounges	50
Other habitable spaces	55
Bathrooms, toilets, laundries	60
Hotels, motels, hostels	
Relaxing, sleeping	55
Social activities	70
Service activities	75
Schools, universities	
Libraries, study areas	50
Teaching areas, assembly areas (see Note 5)	55
Workshops, gymnasia	75
Hospitals, nursing homes	
Wards, theatres, treatment and consulting rooms	50
Laboratories	65
Service areas	75
Public buildings	
Churches, religious activities	50
Theatres, cinemas, recording studios (see Note 4)	40
Court houses, libraries, galleries	50
Commercial buildings, offices and shops	
Private offices, conference rooms	55
Drafting, open offices	65
Typing, data processing	70
Shops, supermarkets, showrooms	75
Industrial	
Inspection, analysis, precision work	75
Light machinery, assembly, bench work	80
Heavy machinery, warehouse, maintenance	85

* These indoor design sound levels are not intended to be used for measurement of adequacy of construction. For measurement of the adequacy of construction against aircraft noise intrusion see Appendix C.

NOTES:

1 The indoor design sound levels in Column 2 are hypothesized values based on Australian experience. A design sound level is the maximum level (dB(A)) from an aircraft flyover which, when heard inside a building by the average listener, will be judged as not intrusive or annoying by that listener while carrying out the specified activity. Owing to the variability of subjective responses to aircraft noise, these figures will not provide sufficiently low interior noise levels for occupants who have a particular sensitivity to aircraft noise.

2 Some of these levels, because of the short duration of individual aircraft flyovers, exceed some other criteria published by Standards Australia for indoor background noise levels (see AS 2107).

3 The indoor design sound levels are intended for the sole purpose of designing adequate construction against aircraft noise intrusion and are not intended to be used for assessing the effects of noise. Land use planning authorities may have their own internal noise level requirements which may be used in place of the levels above.

4 For opera and concert halls and theatres, and for recording, broadcast and television studios and similar buildings where noise intrusion is unacceptable, specialist acoustic advice should always be obtained.

5 Certain activities in schools may be considered particularly noise sensitive and 50 dB(A) may be a more desirable indoor sound level to select for any teaching areas used for such activities. However, the effect of other noise sources should be considered.

6 The provisions of this Standard relating to different internal design sound levels for different indoor spaces could result in the use of different construction and materials in contiguous spaces, and require the construction of substantial barriers between habitable spaces, e.g. heavy self-closing internal doors, detracting from the amenity of the building. Therefore consideration should be given to a uniform perimeter insulation approach.

TABLE 3.4

NOISE LEVELS FOR BOEING 727 (HUSH-KITTED)—TAKE OFFS

Centre-line distance (*DT*), m	Noise levels, dB(A)																		
	Sideline distance (*DS*), m																		
	0	100	200	300	400	500	600	700	800	900	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 600
0	**	**	**	**	**	84	81	78	76	74	73	71	69	67	66	64	63	62	61
250	**	**	**	**	**	83	81	78	76	74	73	71	69	67	65	64	63	61	60
500	**	**	**	**	**	83	80	78	76	74	72	70	68	67	65	64	62	61	60
750	**	**	**	**	**	83	80	77	75	73	72	70	68	66	65	63	62	61	60
1 000	**	**	**	**	**	83	80	77	75	73	72	70	68	66	65	63	62	61	60
1 250	**	**	**	**	**	82	79	77	75	73	72	69	67	66	64	63	62	61	60
1 500	**	**	**	**	**	82	79	77	74	73	71	69	67	65	64	63	61	60	59
1 750	**	**	**	**	**	82	79	76	74	72	71	69	67	65	64	62	61	60	59
2 000	**	**	**	**	**	81	78	76	74	72	71	68	66	65	63	62	61	60	59
2 250	**	**	**	**	**	83	80	78	75	73	72	70	67	65	64	63	62	61	60
2 500	116	108	100	95	90	86	83	80	78	76	74	71	69	67	65	64	63	62	61
2 750	111	107	101	95	91	88	84	82	79	77	76	73	70	68	66	65	64	63	62
3 000	108	105	100	96	92	88	86	83	81	79	77	74	71	69	67	66	65	63	62
3 250	106	104	100	96	92	89	86	84	82	80	78	75	72	70	68	67	65	64	63
3 500	104	102	99	95	92	89	87	84	82	80	79	76	73	71	69	68	66	65	64
3 750	102	101	98	95	92	90	87	85	83	81	79	76	74	72	70	68	67	65	64
4 000	100	100	98	95	92	90	87	85	83	81	80	77	75	72	71	69	67	66	64
4 250	99	99	97	94	92	90	87	85	83	82	80	78	75	73	71	69	67	66	65
4 500	98	98	96	94	92	89	87	85	84	82	80	78	75	73	71	69	68	66	65
4 750	98	97	96	94	91	89	87	85	84	82	80	78	75	73	71	69	68	66	65
5 000	97	97	95	93	91	89	87	85	84	82	80	78	75	73	71	70	68	66	65
5 500	96	96	95	93	91	89	87	85	83	82	81	78	76	73	72	70	68	67	65
6 000	95	95	94	92	90	89	87	85	83	82	81	78	76	74	72	70	68	67	65
6 500	94	94	93	92	90	88	87	85	83	82	81	78	76	74	72	70	68	67	66
7 000	92	92	91	90	89	87	86	84	83	81	80	78	76	74	72	70	68	67	66
7 500	90	90	89	88	87	85	84	82	81	79	78	76	74	72	71	69	68	66	65
8 000	89	89	88	88	86	85	83	82	80	79	78	76	74	72	70	68	66	65	64
8 500	88	88	87	87	86	84	83	82	80	79	78	76	74	72	70	68	67	65	64
9 000	87	87	86	86	85	84	82	81	80	79	78	76	74	72	70	69	67	66	64
9 500	86	86	85	85	84	83	82	81	80	79	78	76	74	72	70	69	67	66	65
10 000	85	85	84	84	83	83	82	81	80	79	77	76	74	72	70	69	67	66	65
10 500	84	84	84	83	83	82	81	80	79	78	77	75	74	72	70	69	68	66	65
11 000	83	83	83	83	82	82	81	80	79	78	77	75	74	72	70	69	68	66	65
11 500	83	83	83	82	82	81	81	80	79	78	77	75	73	72	70	69	68	66	65
12 000	82	82	82	82	81	81	80	79	79	78	77	75	73	72	70	69	67	66	65
12 500	82	82	82	82	81	81	80	79	78	77	77	75	73	72	70	69	67	66	65
13 000	82	82	82	81	81	80	80	79	78	77	76	75	73	72	70	69	67	66	65
13 500	81	81	81	81	81	80	80	79	78	77	76	75	73	71	70	69	67	66	65
14 000	81	81	81	81	80	80	79	79	78	77	76	74	73	71	70	68	67	66	65
14 500	80	80	80	80	80	79	79	78	77	77	76	74	73	71	70	68	67	66	65
15 000	80	80	80	80	79	79	78	78	77	76	75	74	72	71	70	68	67	66	65
15 500	79	79	79	79	79	78	78	77	77	76	75	74	72	71	70	68	67	66	65
16 000	79	79	79	78	78	78	77	77	76	76	75	74	72	71	69	68	67	66	65
16 500	78	78	78	78	78	77	77	77	76	75	75	73	72	71	69	68	67	66	65
17 000	78	78	78	77	77	77	77	76	76	75	74	73	72	70	69	68	67	66	65
17 500	77	77	77	77	77	76	76	76	75	75	74	73	72	70	69	68	67	66	65
18 000	77	77	77	76	76	76	76	75	75	74	74	73	71	70	69	68	67	66	65
18 500	76	76	76	76	76	76	75	75	75	74	74	72	71	70	69	68	67	66	64
19 000	76	76	76	76	75	75	75	75	74	74	73	72	71	70	69	68	66	65	64
19 500	75	75	75	75	75	75	74	74	74	74	73	72	71	70	68	67	66	65	64
20 000	75	75	75	75	75	74	74	74	74	73	73	72	71	69	68	67	66	65	64

TABLE 3.5

NOISE LEVELS FOR BOEING 727 (HUSH-KITTED)—ARRIVALS

Centre-line distance (*DL*), m	Noise levels, dB(A)																				
	Sideline distance (*DS*), m																				
	0	50	100	150	200	250	300	350	400	450	500	550	600	700	800	900	1 000	1 100	1 200	1 300	1 400
0	**	**	**	**	**	**	**	**	**	**	70	69	68	66	64	63	62	61	60	59	58
250	**	**	**	**	**	**	**	**	**	**	68	66	65	63	62	61	61	60	59	58	57
500	101	97	91	87	83	80	77	75	72	70	69	67	65	63	60	60	59	58	57	56	56
750	99	96	91	87	84	81	78	75	73	71	69	68	66	63	61	59	57	56	56	55	54
1 000	97	95	91	87	84	81	78	76	74	72	70	68	67	64	62	60	58	56	55	54	53
1 250	95	94	90	87	84	81	79	76	74	72	71	69	68	65	62	60	58	57	56	54	53
1 500	94	92	90	87	84	81	79	77	75	73	71	70	68	65	63	61	59	57	56	55	53
1 750	92	91	89	86	84	81	79	77	75	73	71	70	69	66	63	61	59	58	57	55	54
2 000	91	91	88	86	83	81	79	77	75	73	72	70	69	66	64	62	60	58	57	56	54
2 250	90	90	88	86	83	81	79	77	75	74	72	71	69	67	64	62	60	59	57	56	55
2 500	89	89	87	85	83	81	79	77	75	74	72	71	69	67	65	62	61	59	58	56	55
2 750	88	88	87	85	83	81	79	77	75	74	72	71	70	67	65	63	61	59	58	57	55
3 000	88	87	86	84	83	81	79	77	76	74	73	71	70	67	65	63	61	60	58	57	56
3 250	87	87	86	84	82	81	79	77	76	74	73	71	70	68	65	63	62	60	59	57	56
3 500	86	86	85	84	82	80	79	77	76	74	73	71	70	68	66	64	62	60	59	58	56
3 750	86	85	84	83	82	80	79	77	75	74	73	71	70	68	66	64	62	61	59	58	57
4 000	85	85	84	83	81	80	78	77	75	74	73	72	70	68	66	64	62	61	59	58	57
4 500	84	84	83	82	81	79	78	77	75	74	73	72	70	68	66	64	63	61	60	58	57
5 000	83	83	82	81	80	79	78	76	75	74	73	72	70	68	66	65	63	62	60	59	58
5 500	82	82	81	81	80	79	77	76	75	74	73	72	70	68	67	65	63	62	60	59	58
6 000	81	80	80	79	79	78	77	75	74	73	72	71	70	68	66	65	63	62	60	59	58
6 500	79	79	79	78	78	77	76	75	74	73	72	71	70	68	66	64	63	61	60	59	58
7 000	78	78	78	77	77	76	75	74	73	72	71	70	69	67	66	64	62	61	60	59	57
7 500	77	77	77	76	76	75	74	73	72	71	70	70	69	67	65	64	62	61	60	58	57
8 000	76	76	76	75	75	74	73	73	72	71	70	69	68	66	65	63	62	60	59	58	57
8 500	75	75	75	74	74	73	73	72	71	70	69	68	68	66	64	63	61	60	59	58	57
9 000	74	74	74	74	73	73	72	71	71	70	69	68	67	66	64	63	61	60	59	58	57
9 500	74	73	73	73	73	72	72	71	70	69	69	68	67	66	64	63	61	60	59	58	57
10 000	73	73	73	72	72	72	71	71	70	69	68	68	67	65	64	63	61	60	59	58	57
10 500	72	72	72	72	72	71	71	70	70	69	68	67	67	65	64	62	61	60	59	58	57
11 000	72	72	72	71	71	71	70	70	69	68	68	67	66	65	64	62	61	60	59	58	57
11 500	71	71	71	71	71	70	70	69	69	68	67	67	66	65	63	62	61	60	59	58	57
12 000	71	71	70	70	70	70	69	69	68	68	67	67	66	65	63	62	61	60	59	57	56
12 500	70	70	70	70	69	69	69	68	68	67	67	66	66	64	63	62	61	60	58	57	56
13 000	69	69	69	69	69	69	68	68	68	67	67	66	65	64	63	62	61	59	58	57	56
13 500	69	69	69	69	68	68	68	68	67	67	66	66	65	64	63	62	60	59	58	57	56
14 000	68	68	68	68	68	68	68	67	67	66	66	65	65	64	63	61	60	59	58	57	56
14 500	68	68	68	68	68	67	67	67	66	66	66	65	65	63	62	61	60	59	58	57	56
15 000	68	67	67	67	67	67	67	66	66	66	65	65	64	63	62	61	60	59	58	57	56
15 500	67	67	67	67	67	67	66	66	66	65	65	65	64	63	62	61	60	59	58	57	56
16 000	67	67	67	66	66	66	66	66	65	65	65	64	64	63	62	61	60	59	58	57	56
16 500	66	66	66	66	66	66	65	65	65	65	64	64	63	63	62	61	60	59	58	57	56
17 000	66	66	66	66	65	65	65	65	65	64	64	64	63	62	61	60	59	58	57	56	56
17 500	65	65	65	65	65	65	65	64	64	64	64	63	63	62	61	60	59	58	57	56	55
18 000	65	65	65	65	65	65	64	64	64	64	63	63	63	62	61	60	59	58	57	56	55
18 500	65	64	64	64	64	64	64	64	64	63	63	63	62	62	61	60	59	58	57	56	55
19 000	64	64	64	64	64	64	64	63	63	63	63	62	62	61	60	59	59	58	57	56	55
19 500	64	64	64	64	63	63	63	63	63	63	62	62	62	61	60	59	58	57	57	56	55
20 000	63	63	63	63	63	63	63	63	62	62	62	62	62	61	60	59	58	57	56	56	55

TABLE 3.6
NOISE LEVELS FOR BOEING 747-200B—LONG RANGE TAKE OFFS

Centre-line distance (*DT*), m	Noise levels, dB(A)																		
	Sideline distance (*DS*), m																		
	0	100	200	300	400	500	600	700	800	900	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 600
0	**	**	**	**	**	85	83	80	78	76	75	73	70	69	67	66	64	63	62
250	**	**	**	**	**	85	82	80	78	76	74	72	70	68	67	65	64	63	61
500	**	**	**	**	**	85	82	79	77	75	74	72	70	68	66	65	63	62	61
750	**	**	**	**	**	84	81	79	77	75	74	72	69	68	66	65	63	62	61
1 000	**	**	**	**	**	84	81	79	76	75	73	71	69	67	66	64	63	62	61
1 250	**	**	**	**	**	84	81	78	76	74	73	71	69	67	65	64	63	62	60
1 500	**	**	**	**	**	83	80	78	76	74	72	70	68	67	65	64	62	61	60
1 750	**	**	**	**	**	83	80	77	75	73	72	70	68	66	65	63	62	61	60
2 000	**	**	**	**	**	82	80	77	75	73	72	70	68	66	64	63	62	60	59
2 250	**	**	**	**	**	82	79	77	74	73	71	69	67	65	64	63	61	60	59
2 500	**	**	**	**	**	82	79	76	74	72	71	69	67	65	64	62	61	60	59
2 750	**	**	**	**	**	81	78	76	74	72	71	68	66	65	63	62	60	59	58
3 000	**	**	**	**	**	83	80	77	75	73	71	69	67	65	63	62	60	59	58
3 250	**	**	**	**	**	85	82	79	77	75	73	70	68	66	64	63	61	60	59
3 500	112	106	100	95	90	87	84	81	78	76	75	72	69	67	65	64	62	61	60
3 750	109	105	100	95	91	88	85	82	80	78	76	73	70	68	66	65	63	61	60
4 000	106	104	99	95	92	88	86	83	81	79	77	74	71	69	67	65	64	62	61
4 250	104	103	99	95	92	89	86	84	81	79	78	75	72	70	68	66	64	63	62
4 500	103	102	98	95	92	89	87	84	82	80	78	75	73	71	69	67	65	64	63
4 750	102	101	98	95	92	89	87	85	83	81	79	76	73	71	69	67	66	64	63
5 000	100	99	97	95	92	89	87	85	83	81	79	77	74	72	70	68	66	65	64
5 500	98	98	96	94	92	89	87	85	83	82	80	77	75	73	71	69	67	65	64
6 000	97	96	95	93	91	89	87	85	83	82	80	78	75	73	71	69	67	66	64
6 500	96	95	94	93	91	89	87	85	83	82	80	78	75	73	71	69	68	66	65
7 000	95	94	94	92	90	89	87	85	83	82	81	78	76	73	72	70	68	67	65
7 500	94	94	93	92	90	88	87	85	83	82	81	78	76	74	72	70	68	67	65
8 000	93	93	92	91	90	88	86	85	83	82	81	78	76	74	72	70	69	67	66
8 500	92	92	91	91	89	88	86	85	83	82	80	78	76	74	72	70	69	67	66
9 000	91	91	91	90	89	87	86	84	83	82	80	78	76	74	72	71	69	67	66
9 500	91	90	90	89	88	87	85	84	83	82	80	78	76	74	72	71	69	68	66
10 000	90	90	89	89	88	86	85	84	83	81	80	78	76	74	72	71	69	68	66
10 500	89	89	89	88	87	86	85	84	82	81	80	78	76	74	73	71	69	68	66
11 000	88	87	87	87	86	85	84	83	82	81	80	78	76	74	72	71	69	68	66
11 500	84	84	84	83	83	82	80	79	78	78	77	75	74	72	71	70	68	67	66
12 000	84	84	84	83	82	81	80	79	78	77	76	74	72	70	69	68	67	66	64
12 500	84	84	83	83	82	81	80	79	78	77	76	74	72	70	68	67	65	64	63
13 000	83	83	83	83	82	81	80	79	78	77	76	74	72	70	68	67	65	64	63
13 500	83	83	83	82	82	81	80	79	78	77	76	74	72	70	68	67	65	64	63
14 000	83	83	83	82	82	81	80	79	78	76	75	73	72	70	68	67	65	64	63
14 500	83	83	82	82	81	81	80	78	77	76	75	73	72	70	68	67	65	64	63
15 000	82	82	82	82	81	80	79	78	77	76	75	73	72	70	68	67	65	64	63
15 500	82	82	82	81	81	80	79	78	77	76	75	73	71	70	68	67	65	64	63
16 000	82	82	82	81	81	80	79	78	77	76	75	73	71	70	68	67	65	64	63
16 500	82	82	81	81	80	80	79	78	77	76	75	73	71	70	68	67	65	64	63
17 000	81	81	81	81	80	80	79	78	77	76	75	73	71	70	68	67	65	64	63
17 500	81	81	81	80	80	79	79	78	77	76	75	73	71	70	68	67	65	64	63
18 000	81	81	81	80	80	79	78	78	77	76	75	73	71	70	68	67	65	64	63
18 500	81	81	80	80	80	79	78	77	76	75	75	73	71	70	68	66	65	64	62
19 000	80	80	80	80	79	79	78	77	76	75	74	73	71	69	68	66	65	64	62
19 500	80	80	80	80	79	79	78	77	76	75	74	73	71	69	68	66	65	64	62
20 000	80	80	80	79	79	79	78	77	76	75	74	73	71	69	68	66	65	64	62

TABLE 3.7

NOISE LEVELS FOR BOEING 747-200B—SHORT RANGE TAKE OFFS

Centre-line distance (*DT*), m	Noise levels, dB(A)																		
	Sideline distance (*DS*), m																		
	0	100	200	300	400	500	600	700	800	900	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 600
0	**	**	**	**	**	85	83	80	78	76	75	73	70	69	67	66	64	63	62
250	**	**	**	**	**	85	82	79	77	75	74	72	70	68	66	65	64	62	61
500	**	**	**	**	**	84	81	79	77	75	74	71	69	67	66	64	63	62	61
750	**	**	**	**	**	84	81	78	76	74	73	71	69	67	66	64	63	62	61
1 000	**	**	**	**	**	83	80	78	75	74	72	70	68	67	65	64	63	62	61
1 250	**	**	**	**	**	82	79	77	75	73	72	70	68	67	66	65	64	63	62
1 500	**	**	**	**	**	84	81	78	76	74	73	71	70	69	67	66	65	64	63
1 750	**	**	**	**	**	87	84	82	79	77	75	73	72	70	69	67	66	64	63
2 000	**	**	**	**	**	89	86	84	81	79	77	75	73	71	70	68	66	65	64
2 250	**	**	**	**	**	90	87	85	83	81	79	76	74	72	70	69	67	66	64
2 500	**	**	**	**	**	90	88	85	83	81	80	78	75	73	71	69	68	66	65
2 750	**	**	**	**	**	90	88	86	84	82	81	78	76	73	71	69	68	66	65
3 000	98	98	96	94	92	90	88	86	84	82	81	78	76	74	72	70	68	66	65
3 250	97	97	96	94	92	90	88	86	84	83	81	78	76	74	72	70	68	67	65
3 500	96	96	95	93	91	90	88	86	84	83	81	79	76	74	72	70	69	67	66
3 750	95	95	94	93	91	89	87	86	84	83	81	79	76	74	72	71	69	67	66
4 000	94	94	93	92	91	89	87	86	84	83	81	79	76	74	72	71	69	67	66
4 250	94	93	93	92	90	89	87	85	84	82	81	79	77	75	73	71	69	68	66
4 500	93	93	92	91	90	88	87	85	84	82	81	79	77	75	73	71	69	68	66
4 750	92	92	91	91	89	88	86	85	84	82	81	79	77	75	73	71	70	68	67
5 000	91	91	91	90	89	88	86	85	83	82	81	79	77	75	73	71	70	68	67
5 500	88	88	87	87	86	85	84	83	82	81	80	78	76	74	72	71	69	68	66
6 000	86	86	85	85	84	83	81	80	79	78	77	75	74	72	71	69	68	67	66
6 500	85	85	85	84	83	82	81	80	79	77	76	74	72	70	69	68	66	65	64
7 000	85	85	84	84	83	82	81	79	78	77	76	74	72	70	69	67	65	64	63
7 500	84	84	84	83	83	82	80	79	78	77	76	74	72	70	68	67	65	64	62
8 000	84	84	83	83	82	81	80	79	78	77	76	74	72	70	68	67	65	64	62
8 500	83	83	83	82	82	81	80	79	78	76	75	73	72	70	68	67	65	64	62
9 000	82	82	82	82	81	80	79	78	77	76	75	73	71	70	68	67	65	64	62
9 500	82	81	81	81	80	80	79	78	77	76	75	73	71	70	68	67	65	64	63
10 000	81	81	81	80	80	79	78	78	77	76	75	73	71	70	68	67	65	64	63
10 500	80	80	80	80	79	79	78	77	76	76	75	73	71	70	68	67	65	64	63
11 000	80	80	80	80	79	79	78	77	76	75	74	73	71	70	68	67	65	64	63
11 500	79	79	79	79	79	78	78	77	76	75	74	73	71	69	68	66	65	64	63
12 000	79	79	79	78	78	78	77	76	76	75	74	72	71	69	68	67	65	64	63
12 500	78	78	78	78	77	77	77	76	75	74	74	72	71	69	68	66	65	64	63
13 000	77	77	77	77	77	76	76	76	75	74	73	72	71	69	68	66	65	64	63
13 500	77	77	77	76	76	76	76	75	74	74	73	72	70	69	68	66	65	64	63
14 000	76	76	76	76	76	75	75	75	74	73	73	72	70	69	68	66	65	64	63
14 500	76	76	76	75	75	75	75	74	74	73	73	71	70	69	67	66	65	64	63
15 000	75	75	75	75	75	74	74	74	73	73	72	71	70	69	67	66	65	64	63
15 500	75	75	74	74	74	74	74	73	73	73	72	71	70	68	67	66	65	64	63
16 000	74	74	74	74	74	73	73	73	73	72	72	71	69	68	67	66	65	64	63
16 500	74	74	74	73	73	73	73	73	72	72	71	70	69	68	67	66	65	64	63
17 000	73	73	73	73	73	73	72	72	72	72	71	70	69	68	67	66	65	64	63
17 500	73	73	73	73	72	72	72	72	72	71	71	70	69	68	67	66	65	64	63
18 000	72	72	72	72	72	72	72	71	71	71	71	70	69	68	67	66	65	64	63
18 500	72	72	72	72	72	72	71	71	71	71	70	69	68	67	66	65	65	64	63
19 000	72	72	72	71	71	71	71	71	70	70	70	69	68	67	66	65	64	64	63
19 500	71	71	71	71	71	71	71	70	70	70	70	69	68	67	66	65	64	63	63
20 000	71	71	71	71	71	70	70	70	70	70	69	69	68	67	66	65	64	63	62

TABLE 3.8

NOISE LEVELS FOR BOEING 747-200B—ARRIVALS

Centre-line distance (*DL*), m	Noise levels, dB(A)																				
	Sideline distance (*DS*), m																				
	0	50	100	150	200	250	300	350	400	450	500	550	600	700	800	900	1 000	1 100	1 200	1 300	1 400
0	**	**	**	**	**	**	**	**	**	**	72	71	71	69	67	66	65	64	63	62	61
250	**	**	**	**	**	**	**	**	**	**	73	72	70	67	65	65	64	63	62	61	60
500	107	103	97	93	89	86	83	80	78	76	74	72	71	68	66	64	62	61	61	60	59
750	104	101	97	93	89	86	84	81	79	77	75	73	72	69	66	64	63	61	60	59	58
1 000	102	100	96	93	90	87	84	82	79	77	76	74	72	70	67	65	63	62	60	59	58
1 250	101	99	96	93	90	87	84	82	80	78	76	75	73	70	68	66	64	62	61	60	58
1 500	99	98	95	92	89	87	84	82	80	78	77	75	74	71	68	66	64	63	62	60	59
1 750	98	97	95	92	89	87	85	82	81	79	77	75	74	71	69	67	65	63	62	61	59
2 000	97	96	94	92	89	87	85	83	81	79	77	76	74	72	69	67	65	64	62	61	60
2 250	96	95	94	91	89	87	85	83	81	79	78	76	75	72	70	68	66	64	63	61	60
2 500	95	94	93	91	89	87	85	83	81	79	78	76	75	72	70	68	66	65	63	62	60
2 750	94	94	92	90	88	86	85	83	81	79	78	77	75	73	70	68	66	65	63	62	61
3 000	93	93	92	90	88	86	84	83	81	79	78	77	75	73	71	69	67	65	64	62	61
3 250	93	92	91	90	88	86	84	83	81	80	78	77	75	73	71	69	67	65	64	63	61
3 500	92	92	91	89	88	86	84	83	81	80	78	77	76	73	71	69	67	66	64	63	62
3 750	91	91	90	89	87	86	84	82	81	80	78	77	76	73	71	69	68	66	65	63	62
4 000	91	90	90	88	87	85	84	82	81	80	78	77	76	73	71	69	68	66	65	63	62
4 500	89	89	89	88	86	85	84	82	81	79	78	77	76	74	72	70	68	67	65	64	63
5 000	88	88	88	87	86	84	83	82	81	79	78	77	76	74	72	70	68	67	66	64	63
5 500	87	87	87	86	85	84	83	82	80	79	78	77	76	74	72	70	69	67	66	64	63
6 000	86	86	86	85	84	83	82	81	80	79	78	77	76	74	72	70	69	67	66	65	63
6 500	85	85	85	84	84	83	82	81	80	79	78	77	76	74	72	70	69	67	66	65	64
7 000	84	84	84	84	83	82	81	80	79	78	77	76	75	74	72	70	69	67	66	65	64
7 500	84	84	83	83	82	82	81	80	79	78	77	76	75	73	72	70	69	67	66	65	64
8 000	83	83	83	82	82	81	80	80	79	78	77	76	75	73	72	70	69	67	66	65	64
8 500	82	82	82	82	81	81	80	79	78	77	77	76	75	73	72	70	69	67	66	65	64
9 000	81	81	81	81	81	80	80	79	78	77	76	75	75	73	71	70	69	67	66	65	64
9 500	81	81	81	80	80	80	79	78	78	77	76	75	74	73	71	70	69	67	66	65	64
10 000	80	80	80	80	79	79	79	78	77	77	76	75	74	73	71	70	69	67	66	65	64
10 500	80	80	79	79	79	79	78	78	77	76	75	75	74	73	71	70	69	67	66	65	64
11 000	79	79	79	79	78	78	78	77	77	76	75	74	74	72	71	70	69	67	66	65	64
11 500	79	79	78	78	78	78	77	77	76	76	75	74	74	72	71	70	68	67	66	65	64
12 000	78	78	78	78	77	77	77	76	76	75	75	74	73	72	71	70	68	67	66	65	64
12 500	78	77	77	77	77	77	76	76	76	75	74	74	73	72	71	69	68	67	66	65	64
13 000	77	77	77	77	77	76	76	76	75	75	74	73	73	72	70	69	68	67	66	65	64
13 500	77	76	76	76	76	76	76	75	75	74	74	73	73	71	70	69	68	67	66	65	64
14 000	76	76	76	76	76	75	75	75	74	74	74	73	72	71	70	69	68	67	66	65	64
14 500	76	76	75	75	75	75	75	74	74	74	73	73	72	71	70	69	68	67	66	65	64
15 000	75	75	75	75	75	75	74	74	74	73	73	72	72	71	70	69	68	67	66	65	64
15 500	75	75	75	75	74	74	74	74	73	73	73	72	72	71	70	69	68	67	66	65	64
16 000	74	74	74	74	74	74	74	73	73	73	72	72	71	70	69	68	67	66	65	65	64
16 500	74	74	74	74	74	73	73	73	73	72	72	72	71	70	69	68	67	66	65	64	64
17 000	73	73	73	73	73	73	73	73	72	72	72	71	71	70	69	68	67	66	65	64	64
17 500	73	73	73	73	73	73	72	72	72	72	72	71	71	70	69	68	67	66	65	64	63
18 000	73	73	73	73	72	72	72	72	72	71	71	71	71	70	69	68	67	66	65	64	63
18 500	72	72	72	72	72	72	72	72	71	71	71	71	70	69	69	68	67	66	65	64	63
19 000	72	72	72	72	72	72	72	71	71	71	71	70	70	69	68	67	67	66	65	64	63
19 500	72	72	72	72	71	71	71	71	71	71	70	70	70	69	68	67	66	66	65	64	63
20 000	71	71	71	71	71	71	71	71	71	70	70	70	70	69	68	67	66	65	65	64	63

TABLE 3.9

NOISE LEVELS FOR BOEING 747-400—LONG RANGE TAKE OFFS

Centre-line distance (*DT*), m	Noise levels, dB(A)																		
	Sideline distance (*DS*), m																		
	0	100	200	300	400	500	600	700	800	900	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 600
0	**	**	**	**	**	81	78	76	74	72	71	69	67	66	65	63	62	61	60
250	**	**	**	**	**	81	78	76	74	72	71	69	67	66	64	63	62	61	59
500	**	**	**	**	**	81	78	75	73	72	70	68	67	65	64	62	61	60	59
750	**	**	**	**	**	80	77	75	73	71	70	68	66	65	64	62	61	60	59
1 000	**	**	**	**	**	80	77	75	73	71	70	68	66	65	63	62	61	60	59
1 250	**	**	**	**	**	79	77	74	72	70	69	67	65	64	63	62	61	59	59
1 500	**	**	**	**	**	79	76	74	72	70	69	67	65	64	62	61	60	59	58
1 750	**	**	**	**	**	79	76	73	71	70	68	66	65	63	62	61	60	59	58
2 000	**	**	**	**	**	78	76	73	71	69	68	66	64	63	61	60	59	58	57
2 250	**	**	**	**	**	78	75	73	71	69	68	66	64	63	61	60	59	58	57
2 500	**	**	**	**	**	78	75	72	70	69	67	65	63	62	61	60	58	57	56
2 750	**	**	**	**	**	77	74	72	70	68	67	65	63	62	60	59	58	57	56
3 000	**	**	**	**	**	77	74	72	70	68	67	64	63	61	60	59	58	56	56
3 250	**	**	**	**	**	79	76	73	71	69	68	66	63	62	60	59	58	56	56
3 500	110	102	95	90	85	81	78	75	73	71	70	67	65	63	61	60	58	57	57
3 750	106	102	95	91	86	83	80	77	75	73	71	68	66	64	62	61	59	58	57
4 000	104	100	95	91	87	84	81	78	76	74	72	69	67	65	63	62	60	59	58
4 250	101	99	95	91	87	84	82	79	77	75	73	70	68	66	64	62	61	60	59
4 500	100	98	94	91	88	85	82	80	77	76	74	71	69	67	65	63	62	61	59
4 750	98	97	94	91	88	85	82	80	78	76	75	72	69	67	65	64	62	61	60
5 000	97	96	93	90	88	85	83	80	78	77	75	72	70	68	66	65	63	62	61
5 500	94	94	92	90	87	85	83	81	79	77	76	73	71	69	67	65	64	62	61
6 000	93	92	91	89	87	85	83	81	79	78	76	74	71	69	67	66	64	63	61
6 500	92	91	90	88	87	85	83	81	79	78	76	74	72	70	68	66	64	63	62
7 000	91	90	89	88	86	84	83	81	79	78	76	74	72	70	68	66	65	63	62
7 500	90	89	89	87	86	84	82	81	79	78	77	74	72	70	68	67	65	64	62
8 000	89	88	88	87	85	84	82	81	79	78	77	74	72	70	68	67	65	64	63
8 500	88	88	87	86	85	83	82	80	79	78	76	74	72	70	69	67	66	64	63
9 000	87	87	86	86	84	83	82	80	79	78	76	74	72	70	69	67	66	64	63
9 500	86	86	86	85	84	83	81	80	79	77	76	74	72	71	69	67	66	64	63
10 000	86	85	85	84	83	82	81	80	79	77	76	74	72	71	69	67	66	65	63
10 500	85	85	84	84	83	82	81	80	78	77	76	74	72	71	69	67	66	65	63
11 000	84	84	84	83	83	82	80	79	78	77	76	74	72	71	69	68	66	65	64
11 500	83	83	83	83	82	81	80	79	78	77	76	74	72	71	69	67	66	65	64
12 000	81	80	80	80	79	78	77	76	75	75	74	72	71	70	68	67	65	64	63
12 500	80	80	80	79	79	78	77	76	75	74	73	71	69	68	67	65	64	63	62
13 000	80	80	80	79	79	78	77	76	75	74	73	71	69	67	66	64	63	62	61
13 500	80	80	79	79	78	78	77	76	74	73	72	71	69	67	66	64	63	62	60
14 000	80	79	79	79	78	77	76	75	74	73	72	71	69	67	66	64	63	62	60
14 500	79	79	79	78	78	77	76	75	74	73	72	70	69	67	66	64	63	61	60
15 000	79	79	79	78	78	77	76	75	74	73	72	70	69	67	66	64	63	61	60
15 500	79	79	78	78	78	77	76	75	74	73	72	70	69	67	65	64	63	61	60
16 000	79	78	78	78	77	77	76	75	74	73	72	70	68	67	65	64	63	61	60
16 500	78	78	78	78	77	77	76	75	74	73	72	70	68	67	65	64	63	61	60
17 000	78	78	78	77	77	76	76	75	74	73	72	70	68	67	65	64	63	61	60
17 500	78	78	78	77	77	76	75	74	74	73	72	70	68	67	65	64	63	61	60
18 000	78	77	77	77	77	76	75	74	73	72	72	70	68	67	65	64	63	61	60
18 500	77	77	77	77	76	76	75	74	73	72	71	70	68	67	65	64	62	61	60
19 000	77	77	77	77	76	76	75	74	73	72	71	70	68	67	65	64	62	61	60
19 500	77	77	77	76	76	75	75	74	73	72	71	70	68	67	65	64	62	61	60
20 000	77	77	76	76	76	75	75	74	73	72	71	69	68	66	65	64	62	61	60

TABLE 3.10

NOISE LEVELS FOR BOEING 747-400—SHORT RANGE TAKE OFFS

Centre-line distance (*DT*), m	Noise levels, dB(A) — Sideline distance (*DS*), m																		
	0	100	200	300	400	500	600	700	800	900	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 600
0	**	**	**	**	**	81	78	76	74	72	71	69	67	66	65	63	62	61	60
250	**	**	**	**	**	81	78	75	73	72	71	69	67	65	64	63	61	60	59
500	**	**	**	**	**	80	77	75	73	71	70	68	66	65	63	62	61	60	58
750	**	**	**	**	**	79	77	74	72	71	70	68	66	64	63	62	61	59	58
1 000	**	**	**	**	**	79	76	74	72	70	69	67	65	64	63	61	60	59	58
1 250	**	**	**	**	**	78	75	73	71	69	68	66	65	64	63	62	61	60	59
1 500	**	**	**	**	**	78	75	72	70	69	69	68	66	65	64	63	62	61	60
1 750	**	**	**	**	**	82	79	77	74	72	71	69	68	67	65	64	63	62	60
2 000	**	**	**	**	**	84	81	79	77	75	73	71	69	68	66	65	63	62	61
2 250	**	**	**	**	**	85	83	80	78	76	75	72	70	69	67	65	64	63	61
2 500	**	**	**	**	**	86	83	81	79	77	76	73	71	69	68	66	64	63	62
2 750	**	**	**	**	**	86	84	81	80	78	77	74	72	70	68	66	65	63	62
3 000	94	94	92	90	88	86	84	82	80	78	77	74	72	70	68	66	65	63	62
3 250	93	93	91	89	87	85	84	82	80	78	77	75	72	70	68	67	65	64	62
3 500	92	92	91	89	87	85	83	82	80	79	77	75	73	71	69	67	65	64	63
3 750	91	91	90	88	87	85	83	82	80	79	77	75	73	71	69	67	66	64	63
4 000	90	90	89	88	86	85	83	81	80	79	77	75	73	71	69	68	66	65	63
4 250	89	89	88	87	86	84	83	81	80	78	77	75	73	71	69	68	66	65	63
4 500	89	88	88	87	86	84	83	81	80	78	77	75	73	71	69	68	66	65	64
4 750	88	88	87	86	85	84	82	81	80	78	77	75	73	71	70	68	66	65	64
5 000	87	87	87	86	85	83	82	81	79	78	77	75	73	71	70	68	67	65	64
5 500	86	86	85	85	84	82	81	80	79	78	77	75	73	71	70	68	67	65	64
6 000	82	82	82	81	80	79	78	77	76	76	75	73	72	70	69	67	66	65	63
6 500	82	82	81	81	80	79	78	77	75	74	73	71	69	68	67	66	65	64	63
7 000	81	81	81	80	80	79	77	76	75	74	73	71	69	67	66	64	63	62	61
7 500	81	81	80	80	79	78	77	76	75	74	73	71	69	67	66	64	63	61	60
8 000	80	80	80	80	79	78	77	76	75	74	73	71	69	67	66	64	63	61	60
8 500	80	80	80	79	79	78	77	76	74	73	72	70	69	67	65	64	63	61	60
9 000	79	79	79	78	78	77	76	75	74	73	72	70	69	67	65	64	63	61	60
9 500	78	78	78	78	77	77	76	75	74	73	72	70	69	67	66	64	63	62	60
10 000	78	78	77	77	77	76	75	74	74	73	72	70	68	67	66	64	63	62	60
10 500	77	77	77	77	76	76	75	74	73	72	72	70	68	67	65	64	63	61	60
11 000	77	77	77	76	76	75	75	74	73	72	71	70	68	67	65	64	63	61	60
11 500	76	76	76	76	75	75	74	74	73	72	71	70	68	67	65	64	63	62	60
12 000	75	75	75	75	75	74	74	73	72	72	71	69	68	67	65	64	63	62	61
12 500	75	75	75	74	74	74	73	73	72	71	71	69	68	67	65	64	63	62	61
13 000	74	74	74	74	74	73	73	72	72	71	70	69	68	66	65	64	63	62	61
13 500	74	73	73	73	73	73	72	72	71	71	70	69	68	66	65	64	63	62	61
14 000	73	73	73	73	72	72	72	72	71	70	70	69	67	66	65	64	63	62	61
14 500	72	72	72	72	72	72	71	71	71	70	70	68	67	66	65	64	63	62	61
15 000	72	72	72	72	71	71	71	71	70	70	69	68	67	66	65	64	63	62	61
15 500	71	71	71	71	71	71	71	70	70	70	69	68	67	66	65	64	63	62	61
16 000	71	71	71	71	71	70	70	70	70	69	69	68	67	66	65	64	63	62	61
16 500	70	70	70	70	70	70	70	70	69	69	69	68	67	66	65	64	63	62	61
17 000	70	70	70	70	70	70	69	69	69	69	68	67	66	65	65	64	63	62	61
17 500	70	70	70	70	69	69	69	69	69	68	68	67	66	65	64	64	63	62	61
18 000	69	69	69	69	69	69	69	69	68	68	68	67	66	65	64	63	63	62	61
18 500	69	69	69	69	69	69	68	68	68	68	67	67	66	65	64	63	63	62	61
19 000	69	69	69	68	68	68	68	68	68	67	67	67	66	65	64	63	62	62	61
19 500	68	68	68	68	68	68	68	68	67	67	67	66	66	65	64	63	62	62	61
20 000	68	68	68	68	68	68	67	67	67	67	67	66	65	65	64	63	62	62	61

TABLE 3.11
NOISE LEVELS FOR BOEING 747-400—ARRIVALS

Centre-line distance (*DL*), m	Noise levels, dB(A)																				
	Sideline distance (*DS*), m																				
	0	50	100	150	200	250	300	350	400	450	500	550	600	700	800	900	1 000	1 100	1 200	1 300	1 400
0	**	**	**	**	**	**	**	**	**	**	70	69	67	65	64	62	61	60	60	59	58
250	**	**	**	**	**	**	**	**	**	**	72	70	68	65	63	61	60	59	59	58	57
500	107	102	97	92	88	85	82	79	77	75	73	71	69	66	64	62	60	59	57	57	56
750	104	101	96	92	88	85	82	80	77	75	73	72	70	67	65	63	61	59	58	57	56
1 000	102	100	96	92	88	85	83	80	78	76	74	72	71	68	65	63	62	60	59	57	56
1 250	100	99	95	92	88	86	83	81	78	76	75	73	71	69	66	64	62	61	59	58	57
1 500	99	98	95	91	88	86	83	81	79	77	75	73	72	69	67	64	63	61	60	58	57
1 750	98	97	94	91	88	86	83	81	79	77	75	74	72	70	67	65	63	62	60	59	57
2 000	96	95	93	91	88	86	83	81	79	77	76	74	73	70	68	65	64	62	61	59	58
2 250	95	94	93	90	88	85	83	81	79	78	76	74	73	70	68	66	64	62	61	60	58
2 500	94	94	92	90	88	85	83	81	79	78	76	75	73	71	68	66	64	63	61	60	59
2 750	93	93	91	89	87	85	83	81	80	78	76	75	73	71	69	66	65	63	62	60	59
3 000	92	92	91	89	87	85	83	81	80	78	76	75	74	71	69	67	65	63	62	61	59
3 250	92	91	90	88	87	85	83	81	80	78	77	75	74	71	69	67	65	64	62	61	60
3 500	91	90	90	88	86	85	83	81	80	78	77	75	74	71	69	67	65	64	62	61	60
3 750	90	90	89	88	86	84	83	81	79	78	77	75	74	72	69	67	66	64	63	61	60
4 000	89	89	88	87	86	84	82	81	79	78	77	75	74	72	70	68	66	64	63	62	60
4 500	88	88	87	86	85	84	82	81	79	78	77	75	74	72	70	68	66	65	63	62	61
5 000	87	87	86	86	84	83	82	80	79	78	77	75	74	72	70	68	67	65	64	62	61
5 500	86	86	85	85	84	83	81	80	79	78	76	75	74	72	70	68	67	65	64	63	61
6 000	85	85	84	84	83	82	81	80	79	77	76	75	74	72	70	68	67	65	64	63	62
6 500	84	84	84	83	82	81	80	79	78	77	76	75	74	72	70	68	67	66	64	63	62
7 000	83	83	83	82	82	81	80	79	78	77	76	75	74	72	70	69	67	66	64	63	62
7 500	82	82	82	81	81	80	79	78	78	77	76	75	74	72	70	69	67	66	64	63	62
8 000	81	81	81	81	80	80	79	78	77	76	75	74	73	72	70	68	67	66	65	63	62
8 500	81	81	80	80	80	79	78	78	77	76	75	74	73	72	70	68	67	66	65	63	62
9 000	80	80	80	79	79	79	78	77	76	76	75	74	73	71	70	68	67	66	65	63	62
9 500	79	79	79	79	79	78	78	77	76	75	74	74	73	71	70	68	67	66	65	63	62
10 000	79	79	79	78	78	78	77	77	76	75	74	73	73	71	70	68	67	66	65	63	62
10 500	78	78	78	78	77	77	77	76	75	75	74	73	72	71	70	68	67	66	65	63	62
11 000	78	78	77	77	77	77	76	76	75	74	74	73	72	71	69	68	67	66	65	63	62
11 500	77	77	77	77	76	76	76	75	75	74	73	73	72	71	69	68	67	66	65	63	62
12 000	77	77	76	76	76	76	75	75	74	74	73	72	72	70	69	68	67	66	65	63	62
12 500	76	76	76	76	75	75	75	74	74	73	73	72	72	70	69	68	67	66	64	63	62
13 000	76	75	75	75	75	75	74	74	74	73	73	72	71	70	69	68	67	65	64	63	62
13 500	75	75	75	75	75	74	74	74	73	73	72	72	71	70	69	68	66	65	64	63	62
14 000	75	75	74	74	74	74	74	73	73	73	72	71	71	70	69	67	66	65	64	63	62
14 500	74	74	74	74	74	73	73	73	73	72	72	71	71	70	68	67	66	65	64	63	62
15 000	74	74	74	73	73	73	73	73	72	72	71	71	70	69	68	67	66	65	64	63	62
15 500	73	73	73	73	73	73	72	72	72	72	71	71	70	69	68	67	66	65	64	63	62
16 000	73	73	73	73	72	72	72	72	72	71	71	70	70	69	68	67	66	65	64	63	62
16 500	72	72	72	72	72	72	72	71	71	71	71	70	70	69	68	67	66	65	64	63	62
17 000	72	72	72	72	72	72	71	71	71	71	70	70	69	69	68	67	66	65	64	63	62
17 500	72	72	72	71	71	71	71	71	71	70	70	70	69	68	67	66	65	64	64	63	62
18 000	71	71	71	71	71	71	71	70	70	70	70	69	69	68	67	66	65	64	63	63	62
18 500	71	71	71	71	71	71	70	70	70	70	69	69	69	68	67	66	65	64	63	63	62
19 000	71	71	71	70	70	70	70	70	70	69	69	69	69	68	67	66	65	64	63	62	62
19 500	70	70	70	70	70	70	70	70	69	69	69	69	68	68	67	66	65	64	63	62	62
20 000	70	70	70	70	70	70	69	69	69	69	69	68	68	67	67	66	65	64	63	62	61

TABLE 3.12

NOISE LEVELS FOR BOEING 737-300, -400, AND AIRBUS A320—TAKE OFFS

Centre-line distance (*DT*), m	Noise levels, dB(A)																		
	Sideline distance (*DS*), m																		
	0	100	200	300	400	500	600	700	800	900	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 600
0	**	**	**	**	**	75	73	70	68	67	65	63	61	60	58	57	55	54	53
250	**	**	**	**	**	75	72	70	68	66	65	63	61	59	57	56	54	53	52
500	**	**	**	**	**	74	71	69	67	65	64	62	60	58	57	55	54	53	51
750	**	**	**	**	**	74	71	68	66	65	64	62	60	58	56	55	54	52	51
1 000	**	**	**	**	**	73	70	68	66	64	63	61	59	58	56	55	53	52	51
1 250	**	**	**	**	**	72	70	67	65	64	62	60	58	57	56	54	53	52	51
1 500	**	**	**	**	**	72	69	67	64	63	62	60	59	58	57	55	54	53	52
1 750	**	**	**	**	**	75	72	69	67	65	63	62	61	59	58	57	55	54	53
2 000	**	**	**	**	**	78	75	72	70	68	66	64	62	61	59	58	56	55	54
2 250	**	**	**	**	**	79	76	74	72	70	68	65	64	62	60	58	57	55	54
2 500	92	91	88	85	82	80	77	75	73	71	69	67	65	63	61	59	57	56	55
2 750	90	89	87	85	82	80	78	75	73	72	70	68	65	63	61	60	58	56	55
3 000	88	88	86	84	82	80	78	76	74	72	71	68	66	64	62	60	58	56	55
3 250	87	87	86	84	82	80	78	76	74	72	71	68	66	64	62	60	58	57	55
3 500	86	86	85	83	81	79	77	76	74	72	71	68	66	64	62	60	58	57	55
3 750	85	85	84	83	81	79	77	75	74	72	71	69	66	64	62	60	58	57	55
4 000	85	84	84	82	81	79	77	75	74	72	71	69	66	64	62	60	59	57	56
4 250	84	84	83	82	80	78	77	75	74	72	71	68	66	64	62	60	59	57	56
4 500	82	82	81	80	79	77	75	74	72	71	70	68	66	64	62	60	58	57	55
4 750	82	82	81	80	78	77	75	73	72	71	69	67	65	63	61	59	58	56	55
5 000	82	81	81	80	78	77	75	73	72	70	69	67	64	62	61	59	57	56	55
5 500	81	80	80	79	78	76	74	73	72	70	69	67	64	62	61	59	57	55	54
6 000	79	79	78	78	77	75	74	73	71	70	69	67	65	63	61	59	58	56	55
6 500	78	78	77	77	76	75	73	72	71	70	69	67	65	63	61	60	58	56	55
7 000	76	76	76	75	75	74	73	72	71	70	69	67	65	63	61	60	58	57	55
7 500	75	75	75	74	74	73	72	71	70	69	68	67	65	63	61	60	58	57	56
8 000	74	74	74	73	73	73	72	71	70	69	68	66	65	63	62	60	59	57	56
8 500	74	74	73	73	73	72	72	71	70	69	68	66	64	63	61	60	58	57	56
9 000	73	73	73	73	72	72	71	70	70	69	68	66	64	63	61	60	58	57	56
9 500	73	73	73	72	72	72	71	70	69	68	67	66	64	63	61	59	58	57	56
10 000	72	72	72	72	71	71	70	70	69	68	67	65	64	62	61	59	58	57	56
10 500	71	71	71	71	71	70	70	69	68	68	67	65	64	62	61	59	58	57	56
11 000	71	71	71	70	70	70	69	69	68	67	66	65	64	62	61	59	58	57	56
11 500	70	70	70	70	69	69	69	68	68	67	66	65	63	62	61	59	58	57	56
12 000	69	69	69	69	69	68	68	68	67	66	66	64	63	62	61	59	58	57	56
12 500	69	69	68	68	68	68	67	67	67	66	65	64	63	62	60	59	58	57	56
13 000	68	68	68	68	67	67	67	67	66	66	65	64	63	61	60	59	58	57	56
13 500	67	67	67	67	67	67	66	66	66	65	65	64	62	61	60	59	58	57	56
14 000	67	67	67	67	66	66	66	66	65	65	64	63	62	61	60	59	58	57	56
14 500	66	66	66	66	66	66	65	65	65	65	64	63	62	61	60	59	58	57	56
15 000	66	66	66	66	65	65	65	65	64	64	64	63	62	61	60	59	58	57	56
15 500	65	65	65	65	65	65	65	64	64	64	63	62	61	60	59	58	57	57	55
16 000	65	65	65	65	64	64	64	64	64	63	63	62	61	60	59	58	57	56	55
16 500	64	64	64	64	64	64	64	63	63	63	63	62	61	60	59	58	57	56	55
17 000	64	64	64	64	64	63	63	63	63	63	62	62	61	60	59	58	57	56	55
17 500	63	63	63	63	63	63	63	63	62	62	62	61	61	60	59	58	57	56	55
18 000	63	63	63	63	63	63	62	62	62	62	62	61	60	59	59	58	57	56	55
18 500	63	63	63	62	62	62	62	62	62	62	61	61	60	59	58	58	57	56	55
19 000	62	62	62	62	62	62	62	62	61	61	61	60	60	59	58	57	57	56	55
19 500	62	62	62	62	62	62	61	61	61	61	61	60	60	59	58	57	56	56	55
20 000	62	61	61	61	61	61	61	61	61	61	60	60	59	59	58	57	56	55	55

TABLE 3.13

NOISE LEVELS FOR BOEING 737-300, -400, AND AIRBUS A320—ARRIVALS

Centre-line distance (*DL*), m	Noise levels, dB(A)																				
	Sideline distance (*DS*), m																				
	0	50	100	150	200	250	300	350	400	450	500	550	600	700	800	900	1 000	1 100	1 200	1 300	1 400
0	**	**	**	**	**	**	**	**	**	**	64	63	62	60	59	57	56	55	54	53	52
250	**	**	**	**	**	**	**	**	**	**	65	63	62	59	57	56	55	54	53	52	52
500	98	94	89	84	80	77	74	72	70	68	66	64	63	60	57	55	54	53	52	51	51
750	96	93	88	84	81	78	75	72	70	68	66	65	63	60	58	56	54	53	51	50	50
1 000	94	92	88	84	81	78	75	73	71	69	67	66	64	61	59	57	55	53	52	51	49
1 250	92	91	87	84	81	78	76	73	71	69	68	66	65	62	59	57	55	54	52	51	50
1 500	91	90	87	84	81	78	76	74	72	70	68	67	65	62	60	58	56	54	53	52	50
1 750	90	89	86	83	81	78	76	74	72	70	69	67	66	63	60	58	56	55	53	52	51
2 000	88	88	86	83	80	78	76	74	72	70	69	67	66	63	61	59	57	55	54	52	51
2 250	87	87	85	83	80	78	76	74	72	71	69	68	66	64	61	59	57	56	54	53	51
2 500	86	86	84	82	80	78	76	74	72	71	69	68	67	64	62	59	58	56	55	53	52
2 750	86	85	84	82	80	78	76	74	72	71	69	68	67	64	62	60	58	56	55	54	52
3 000	85	84	83	81	80	78	76	74	73	71	70	68	67	64	62	60	58	57	55	54	52
3 250	84	84	83	81	79	77	76	74	73	71	70	68	67	65	62	60	59	57	56	54	53
3 500	83	83	82	81	79	77	76	74	73	71	70	68	67	65	63	61	59	57	56	54	53
3 750	83	82	81	80	79	77	75	74	72	71	70	69	67	65	63	61	59	58	56	55	53
4 000	82	82	81	80	78	77	75	74	72	71	70	69	67	65	63	61	59	58	56	55	54
4 500	81	81	80	79	78	76	75	74	72	71	70	69	67	65	63	61	60	58	57	55	54
5 000	80	80	79	78	77	76	75	73	72	71	70	69	68	65	63	62	60	58	57	56	54
5 500	79	79	78	78	77	75	74	73	72	71	70	69	68	65	63	62	60	59	57	56	55
6 000	78	78	77	77	76	75	74	73	72	71	69	68	67	65	63	62	60	59	57	56	55
6 500	77	77	76	76	75	74	73	72	71	70	69	68	67	65	63	62	60	59	57	56	55
7 000	76	76	75	75	74	74	73	72	71	70	69	68	67	65	63	62	60	59	57	56	55
7 500	75	75	74	74	74	73	72	71	70	69	68	67	67	65	63	61	60	59	57	56	55
8 000	74	74	74	73	73	72	72	71	70	69	68	67	66	64	63	61	60	59	57	56	55
8 500	73	73	73	73	72	72	71	70	69	69	68	67	66	64	63	61	60	58	57	56	55
9 000	72	72	72	72	72	71	71	70	69	68	67	66	66	64	62	61	60	58	57	56	55
9 500	72	72	72	71	71	71	70	69	69	68	67	66	65	64	62	61	59	58	57	56	55
10 000	71	71	71	71	70	70	70	69	68	67	67	66	65	64	62	61	59	58	57	56	55
10 500	71	71	70	70	70	70	69	68	68	67	66	66	65	63	62	60	59	58	57	56	54
11 000	70	70	70	70	69	69	69	68	67	67	66	65	64	63	62	60	59	58	57	56	54
11 500	69	69	69	69	69	68	68	68	67	66	66	65	64	63	61	60	59	58	57	55	54
12 000	69	69	69	68	68	68	67	67	67	66	65	65	64	63	61	60	59	58	56	55	54
12 500	68	68	68	68	68	67	67	67	66	65	65	64	64	62	61	60	59	57	56	55	54
13 000	68	68	67	67	67	67	66	66	66	65	65	64	63	62	61	60	58	57	56	55	54
13 500	67	67	67	67	66	66	66	66	65	65	64	64	63	62	61	59	58	57	56	55	54
14 000	66	66	66	66	66	66	65	65	65	64	64	63	63	61	60	59	58	57	56	55	54
14 500	66	66	66	66	65	65	65	65	64	64	63	63	62	61	60	59	58	57	56	55	54
15 000	65	65	65	65	65	65	64	64	64	64	63	63	62	61	60	59	58	57	55	54	53
15 500	65	65	65	65	64	64	64	64	63	63	63	62	62	61	60	59	57	56	55	54	53
16 000	64	64	64	64	64	64	64	63	63	63	62	62	61	60	59	58	57	56	55	54	53
16 500	64	64	64	64	64	63	63	63	63	62	62	62	61	60	59	58	57	56	55	54	53
17 000	63	63	63	63	63	63	63	62	62	62	62	61	61	60	59	58	57	56	55	54	53
17 500	63	63	63	63	63	62	62	62	62	62	61	61	60	60	59	58	57	56	55	54	53
18 000	63	63	62	62	62	62	62	62	61	61	61	61	60	59	58	57	56	55	54	54	53
18 500	62	62	62	62	62	62	62	61	61	61	61	60	60	59	58	57	56	55	54	53	53
19 000	62	62	62	62	62	61	61	61	61	61	60	60	60	59	58	57	56	55	54	53	52
19 500	61	61	61	61	61	61	61	61	60	60	60	60	59	59	58	57	56	55	54	53	52
20 000	61	61	61	61	61	61	61	60	60	60	60	59	59	58	57	57	56	55	54	53	52

TABLE 3.14
NOISE LEVELS FOR BOEING 767—LONG RANGE TAKE OFFS

Centre-line distance (*DT*), m	Noise levels, dB(A) Sideline distance (*DS*), m																		
	0	100	200	300	400	500	600	700	800	900	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 600
0	**	**	**	**	**	82	79	77	75	73	72	69	67	66	64	62	61	60	59
250	**	**	**	**	**	81	79	76	74	72	71	69	67	65	63	62	61	59	58
500	**	**	**	**	**	81	78	76	74	72	71	68	66	65	63	61	60	59	58
750	**	**	**	**	**	80	78	75	73	71	70	68	66	64	63	61	60	59	58
1 000	**	**	**	**	**	80	77	75	73	71	70	67	65	64	62	61	60	58	57
1 250	**	**	**	**	**	79	76	74	72	70	69	67	65	63	62	60	59	58	57
1 500	**	**	**	**	**	79	76	73	71	70	68	66	64	63	61	60	59	58	57
1 750	**	**	**	**	**	78	75	73	71	69	68	66	64	62	61	60	59	58	57
2 000	**	**	**	**	**	81	78	75	73	71	69	67	65	63	62	61	60	59	58
2 250	**	**	**	**	**	83	80	78	75	73	72	69	66	64	63	62	61	60	59
2 500	102	100	95	92	88	85	82	79	77	75	73	70	68	66	64	63	62	60	59
2 750	100	98	95	92	88	86	83	80	78	76	75	72	69	67	65	64	62	61	60
3 000	98	97	94	91	88	86	84	81	79	77	75	73	70	68	66	65	63	62	60
3 250	96	96	94	91	88	86	84	82	80	78	76	73	71	69	67	65	64	62	61
3 500	95	94	93	91	88	86	84	82	80	78	77	74	72	69	67	66	64	62	61
3 750	94	93	92	90	88	86	84	82	80	78	77	74	72	70	68	66	64	62	61
4 000	93	93	92	90	88	86	84	82	80	79	77	74	72	70	68	66	64	63	61
4 250	92	92	91	89	88	86	84	82	80	78	77	74	72	70	68	66	64	63	61
4 500	92	92	91	89	87	85	84	82	80	78	77	75	72	70	68	66	64	63	61
4 750	91	91	90	89	87	85	83	82	80	78	77	75	72	70	68	66	64	63	61
5 000	91	90	90	88	87	85	83	81	80	78	77	74	72	70	68	66	65	63	62
5 500	88	88	87	86	85	83	82	80	79	78	76	74	72	70	68	66	64	63	62
6 000	85	85	84	83	82	80	79	77	75	75	74	72	70	68	67	65	64	62	61
6 500	85	85	84	83	82	80	78	77	75	74	73	70	68	66	65	63	62	61	60
7 000	84	84	83	83	81	80	78	77	75	74	73	70	68	66	64	62	61	59	58
7 500	84	83	83	82	81	79	78	76	75	74	72	70	68	66	64	62	61	59	58
8 000	83	83	82	82	80	79	78	76	75	73	72	70	68	66	64	62	61	59	58
8 500	83	82	82	81	80	79	77	76	75	73	72	70	68	66	64	62	61	59	58
9 000	82	82	82	81	80	78	77	76	74	73	72	70	68	66	64	62	61	59	58
9 500	82	81	81	80	79	78	77	75	74	73	72	70	68	66	64	62	61	59	58
10 000	81	81	81	80	79	78	77	75	74	73	72	69	67	66	64	62	61	59	58
10 500	80	80	80	79	78	77	76	75	74	73	72	69	67	66	64	62	61	59	58
11 000	79	79	79	78	78	77	76	75	74	72	71	69	68	66	64	63	61	60	58
11 500	78	78	78	78	77	76	75	74	73	72	71	69	68	66	64	63	61	60	59
12 000	78	78	77	77	77	76	75	74	73	72	71	69	67	66	64	63	61	60	59
12 500	77	77	77	76	76	75	75	74	73	72	71	69	67	66	64	63	62	60	59
13 000	76	76	76	76	75	75	74	73	72	72	71	69	67	66	64	63	62	60	59
13 500	76	76	75	75	75	74	74	73	72	71	70	69	67	66	64	63	62	60	59
14 000	75	75	75	75	74	74	73	73	72	71	70	69	67	66	64	63	62	60	59
14 500	75	75	74	74	74	73	73	72	72	71	70	69	67	66	64	63	62	61	59
15 000	74	74	74	74	73	73	73	72	71	71	70	68	67	66	64	63	62	61	59
15 500	74	73	73	73	73	73	72	72	71	70	70	68	67	66	64	63	62	61	59
16 000	73	73	73	73	72	72	72	71	71	70	69	68	67	65	64	63	62	61	60
16 500	73	72	72	72	72	72	71	71	70	70	69	68	67	65	64	63	62	61	60
17 000	72	72	72	72	72	71	71	71	70	70	69	68	66	65	64	63	62	61	60
17 500	72	72	71	71	71	71	71	70	70	69	69	68	66	65	64	63	62	61	60
18 000	71	71	71	71	71	70	70	70	70	69	69	67	66	65	64	63	62	61	60
18 500	71	71	71	71	70	70	70	70	69	69	68	67	66	65	64	63	62	61	60
19 000	70	70	70	70	70	70	70	69	69	69	68	67	66	65	64	63	62	61	60
19 500	70	70	70	70	70	69	69	69	69	68	68	67	66	65	64	62	61	61	60
20 000	70	70	70	69	69	69	69	69	68	68	68	67	66	64	63	62	61	60	60

TABLE 3.15

NOISE LEVELS FOR BOEING 767—SHORT RANGE TAKE OFFS

Centre-line distance (*DT*), m	Noise levels, dB(A) — Sideline distance (*DS*), m																		
	0	100	200	300	400	500	600	700	800	900	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 600
0	**	**	**	**	**	82	79	77	75	73	72	69	67	66	64	62	61	60	59
250	**	**	**	**	**	81	78	76	74	72	71	69	66	65	63	62	60	59	58
500	**	**	**	**	**	80	77	75	73	71	70	68	66	64	63	62	61	60	59
750	**	**	**	**	**	79	77	74	72	70	70	69	67	66	64	63	62	61	60
1 000	**	**	**	**	**	80	77	75	74	73	72	70	69	67	66	64	63	61	60
1 250	**	**	**	**	**	85	82	79	77	75	74	72	70	68	67	65	63	62	61
1 500	**	**	**	**	**	86	84	81	79	77	76	73	71	69	67	66	64	63	61
1 750	**	**	**	**	**	87	84	82	80	78	77	75	72	70	68	66	64	63	61
2 000	**	**	**	**	**	87	85	83	81	79	78	75	72	70	68	66	65	63	62
2 250	**	**	**	**	**	87	84	83	81	79	78	75	73	70	68	66	65	63	62
2 500	93	92	91	90	88	86	84	82	81	79	78	75	73	70	68	67	65	63	62
2 750	92	91	91	89	88	86	84	82	81	79	78	75	73	71	69	67	65	64	62
3 000	91	90	90	89	87	85	84	82	80	79	78	75	73	71	69	67	65	64	62
3 250	88	88	87	86	85	83	82	81	79	78	77	74	72	70	68	67	65	63	62
3 500	86	86	85	84	83	81	79	78	77	76	75	73	71	69	68	66	64	63	62
3 750	86	85	85	84	82	81	79	77	76	74	74	72	70	68	67	65	64	62	61
4 000	85	85	84	83	82	80	79	77	76	74	73	70	69	67	66	64	63	62	61
4 250	85	85	84	83	82	80	78	77	75	74	73	70	68	66	65	63	62	61	60
4 500	84	84	84	83	81	80	78	77	75	74	73	70	68	66	64	62	61	60	59
4 750	84	84	83	83	81	80	78	76	75	74	72	70	68	66	64	62	61	59	58
5 000	84	84	83	82	81	79	78	76	75	74	72	70	68	66	64	62	61	59	58
5 500	83	82	82	81	80	79	77	76	75	73	72	70	68	66	64	62	61	59	58
6 000	81	81	80	80	79	78	77	75	74	73	72	70	68	66	64	63	61	60	59
6 500	79	79	79	79	78	77	76	75	74	73	72	70	68	66	65	63	62	60	59
7 000	78	78	78	77	77	76	75	74	73	73	72	70	68	66	65	63	62	61	59
7 500	77	77	77	77	76	76	75	74	73	72	71	70	68	66	65	63	62	61	59
8 000	77	77	77	76	76	75	75	74	73	72	71	69	68	66	65	63	62	60	59
8 500	76	76	76	75	75	75	74	73	72	71	71	69	67	66	65	63	62	61	59
9 000	75	75	75	74	74	74	73	73	72	71	70	69	67	66	64	63	62	61	60
9 500	74	74	74	74	73	73	73	72	71	71	70	69	67	66	64	63	62	61	60
10 000	73	73	73	73	73	72	72	72	71	70	70	68	67	66	64	63	62	61	60
10 500	72	72	72	72	72	72	71	71	70	70	69	68	67	65	64	63	62	61	60
11 000	72	72	72	71	71	71	71	70	70	69	69	68	66	65	64	63	62	61	60
11 500	71	71	71	71	71	70	70	70	70	69	69	67	66	65	64	63	62	61	60
12 000	70	70	70	70	70	70	70	69	69	69	68	67	66	65	64	63	62	61	60
12 500	70	70	70	70	70	69	69	69	69	68	68	67	66	65	64	63	62	61	60
13 000	69	69	69	69	69	69	69	68	68	68	67	66	65	64	63	62	62	61	60
13 500	69	69	69	69	69	68	68	68	68	67	67	66	65	64	63	62	61	61	60
14 000	68	68	68	68	68	68	68	67	67	67	67	66	65	64	63	62	61	60	60
14 500	68	68	68	68	68	67	67	67	67	67	66	66	65	64	63	62	61	60	59
15 000	67	67	67	67	67	67	67	67	66	66	66	65	65	64	63	62	61	60	59
15 500	67	67	67	67	67	67	66	66	66	66	66	65	64	63	63	62	61	60	59
16 000	66	66	66	66	66	66	66	66	66	65	65	65	64	63	62	62	61	60	59
16 500	66	66	66	66	66	66	66	65	65	65	65	64	64	63	62	62	61	60	59
17 000	66	66	66	66	65	65	65	65	65	65	65	64	64	63	62	61	61	60	59
17 500	65	65	65	65	65	65	65	65	65	64	64	64	63	63	62	61	60	60	59
18 000	65	65	65	65	65	65	65	64	64	64	64	64	63	63	62	61	60	60	59
18 500	65	65	65	65	64	64	64	64	64	64	64	63	63	62	62	61	60	59	59
19 000	64	64	64	64	64	64	64	64	64	64	63	63	63	62	61	61	60	59	59
19 500	64	64	64	64	64	64	64	64	63	63	63	63	62	62	61	61	60	59	58
20 000	64	64	64	64	64	63	63	63	63	63	63	63	62	62	61	60	60	59	58

TABLE 3.16

NOISE LEVELS FOR BOEING 767—ARRIVALS

Centre-line distance (*DL*), m	Noise levels, dB(A)																				
	Sideline distance (*DS*), m																				
	0	50	100	150	200	250	300	350	400	450	500	550	600	700	800	900	1 000	1 100	1 200	1 300	1 400
0	**	**	**	**	**	**	**	**	**	**	69	68	67	65	63	62	61	60	59	58	57
250	**	**	**	**	**	**	**	**	**	**	67	65	64	63	62	61	60	59	58	57	56
500	101	97	91	87	83	80	77	75	72	70	68	66	65	62	60	59	58	58	57	56	55
750	99	96	91	87	84	81	78	75	73	71	69	67	66	63	60	58	57	56	55	55	54
1 000	97	95	91	87	84	81	78	76	74	72	70	68	66	64	61	59	57	56	54	54	53
1 250	95	93	90	87	84	81	79	76	74	72	70	69	67	64	62	60	58	56	55	54	53
1 500	94	92	90	87	84	81	79	76	74	72	71	69	68	65	62	60	58	57	56	54	53
1 750	92	91	89	86	84	81	79	77	75	73	71	69	68	65	63	61	59	57	56	55	53
2 000	91	90	88	86	83	81	79	77	75	73	71	70	68	66	63	61	59	58	56	55	54
2 250	90	90	88	86	83	81	79	77	75	73	72	70	69	66	64	62	60	58	57	55	54
2 500	89	89	87	85	83	81	79	77	75	73	72	70	69	66	64	62	60	59	57	56	55
2 750	88	88	87	85	83	81	79	77	75	73	72	70	69	67	64	62	61	59	58	56	55
3 000	88	87	86	84	82	81	79	77	75	74	72	71	69	67	65	63	61	59	58	56	55
3 250	87	86	85	84	82	80	79	77	75	74	72	71	69	67	65	63	61	60	58	57	56
3 500	86	86	85	84	82	80	78	77	75	74	72	71	70	67	65	63	61	60	58	57	56
3 750	85	85	84	83	82	80	78	77	75	74	72	71	70	67	65	63	62	60	59	57	56
4 000	85	85	84	83	81	80	78	77	75	74	72	71	70	67	65	63	62	60	59	58	56
4 500	84	83	83	82	81	79	78	76	75	74	72	71	70	68	66	64	62	61	59	58	57
5 000	83	82	82	81	80	79	77	76	75	73	72	71	70	68	66	64	62	61	60	58	57
5 500	82	81	81	80	79	78	77	76	74	73	72	71	70	68	66	64	63	61	60	59	57
6 000	81	80	80	79	79	78	76	75	74	73	72	71	70	68	66	64	63	61	60	59	58
6 500	80	80	79	79	78	77	76	75	74	73	72	71	70	68	66	64	63	61	60	59	58
7 000	79	79	78	78	77	76	75	74	73	72	71	70	69	68	66	64	63	62	60	59	58
7 500	78	78	78	77	77	76	75	74	73	72	71	70	69	67	66	64	63	62	60	59	58
8 000	77	77	77	76	76	75	75	74	73	72	71	70	69	67	66	64	63	62	60	59	58
8 500	76	76	76	76	75	75	74	73	72	71	71	70	69	67	66	64	63	62	60	59	58
9 000	76	75	75	75	75	74	74	73	72	71	70	69	69	67	65	64	63	62	60	59	58
9 500	75	75	75	74	74	74	73	72	72	71	70	69	68	67	65	64	63	61	60	59	58
10 000	74	74	74	74	73	73	73	72	71	70	70	69	68	67	65	64	63	61	60	59	58
10 500	73	73	73	73	73	72	72	71	71	70	69	69	68	66	65	64	62	61	60	59	58
11 000	73	73	73	72	72	72	71	71	70	70	69	68	68	66	65	63	62	61	60	59	58
11 500	72	72	72	72	72	71	71	70	70	69	69	68	67	66	65	63	62	61	60	59	58
12 000	72	72	71	71	71	71	70	70	69	69	68	68	67	66	64	63	62	61	60	59	58
12 500	71	71	71	71	71	70	70	70	69	68	68	67	67	65	64	63	62	61	60	59	58
13 000	70	70	70	70	70	70	69	69	69	68	68	67	66	65	64	63	62	61	59	58	57
13 500	70	70	70	70	69	69	69	69	68	68	67	67	66	65	64	63	61	60	59	58	57
14 000	69	69	69	69	69	69	68	68	68	67	67	66	66	65	63	62	61	60	59	58	57
14 500	69	69	69	69	68	68	68	68	67	67	67	66	65	64	63	62	61	60	59	58	57
15 000	68	68	68	68	68	68	68	67	67	67	66	66	65	64	63	62	61	60	59	58	57
15 500	68	68	68	68	68	67	67	67	67	66	66	65	65	64	63	62	61	60	59	58	57
16 000	67	67	67	67	67	67	67	66	66	66	65	65	65	64	63	61	60	59	59	58	57
16 500	67	67	67	67	67	66	66	66	66	65	65	65	64	63	62	61	60	59	58	57	57
17 000	66	66	66	66	66	66	66	66	65	65	65	64	64	63	62	61	60	59	58	57	56
17 500	66	66	66	66	66	66	65	65	65	65	64	64	64	63	62	61	60	59	58	57	56
18 000	66	66	66	66	65	65	65	65	65	64	64	64	63	63	62	61	60	59	58	57	56
18 500	65	65	65	65	65	65	65	65	64	64	64	64	63	62	61	60	60	59	58	57	56
19 000	65	65	65	65	65	65	64	64	64	64	64	63	63	62	61	60	59	59	58	57	56
19 500	65	65	65	64	64	64	64	64	64	63	63	63	63	62	61	60	59	58	58	57	56
20 000	64	64	64	64	64	64	64	64	63	63	63	63	62	62	61	60	59	58	57	57	56

TABLE 3.17

NOISE LEVELS FOR BRITISH AEROSPACE BAe146—TAKE OFFS

Centre-line distance (*DT*), m	Noise levels dB(A) — Sideline distance (*DS*), m																		
	0	100	200	300	400	500	600	700	800	900	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 600
0	**	**	**	**	**	71	68	65	63	61	60	57	55	54	52	51	49	48	47
250	**	**	**	**	**	70	67	64	62	60	59	57	54	53	51	50	48	47	46
500	**	**	**	**	**	69	66	64	61	60	58	56	54	52	51	49	48	47	45
750	**	**	**	**	**	68	65	63	60	59	57	55	54	52	50	49	48	46	45
1 000	**	**	**	**	**	67	64	62	59	58	57	55	53	51	50	48	47	46	45
1 250	**	**	**	**	**	70	67	64	62	60	58	55	53	51	49	48	47	46	45
1 500	**	**	**	**	**	72	69	66	64	62	60	57	54	52	50	49	47	46	44
1 750	**	**	**	**	**	74	70	68	65	63	61	58	56	53	51	50	48	46	45
2 000	**	**	**	**	**	74	71	69	66	64	62	59	57	54	52	50	49	47	46
2 250	**	**	**	**	**	75	72	69	67	65	63	60	57	55	53	51	49	48	47
2 500	91	89	85	82	78	75	72	70	68	66	64	61	58	56	54	52	50	49	48
2 750	89	88	85	81	78	75	73	70	68	66	64	61	59	56	54	53	51	50	48
3 000	87	87	84	81	78	75	73	71	68	67	65	62	59	57	55	53	52	50	49
3 250	86	85	83	81	78	75	73	71	69	67	65	62	60	58	56	54	52	50	49
3 500	85	84	83	80	78	75	73	71	69	67	66	63	60	58	56	54	52	50	49
3 750	84	84	82	80	77	75	73	71	69	67	66	63	60	58	56	54	52	51	49
4 000	84	83	82	79	77	75	73	71	69	67	66	63	60	58	56	54	52	51	49
4 250	83	83	81	79	77	75	73	71	69	67	66	63	60	58	56	54	52	51	49
4 500	82	82	81	79	77	75	72	71	69	67	66	63	60	58	56	54	52	51	49
4 750	82	81	80	79	76	74	72	70	69	67	66	63	60	58	56	54	52	51	49
5 000	81	81	80	78	76	74	72	70	69	67	66	63	60	58	56	54	52	51	49
5 500	80	80	79	78	76	74	72	70	68	67	65	63	60	58	56	54	53	51	49
6 000	79	79	78	77	75	73	72	70	68	67	65	63	60	58	56	54	53	51	49
6 500	79	78	78	76	75	73	71	70	68	67	65	63	60	58	56	54	53	51	49
7 000	77	77	76	75	74	72	70	69	67	66	64	62	60	58	56	54	52	51	49
7 500	77	76	76	75	73	72	70	68	67	66	64	62	59	57	55	54	52	50	49
8 000	76	76	75	74	73	71	70	68	67	65	64	62	59	57	55	53	52	50	49
8 500	75	75	74	73	72	71	69	68	66	65	64	61	59	57	55	53	52	50	48
9 000	74	74	73	73	71	70	69	67	66	65	64	61	59	57	55	53	52	50	49
9 500	73	73	72	72	71	70	68	67	66	65	63	61	59	57	55	54	52	50	49
10 000	72	72	71	71	70	69	68	67	66	64	63	61	59	57	55	54	52	51	49
10 500	71	71	71	70	69	69	67	66	65	64	63	61	59	57	55	54	52	51	49
11 000	70	70	70	69	69	68	67	66	65	64	63	61	59	57	55	54	52	51	49
11 500	69	69	69	69	68	67	67	66	65	64	63	61	59	57	55	54	52	51	50
12 000	69	69	68	68	68	67	66	65	64	63	62	60	59	57	55	54	52	51	50
12 500	68	68	68	68	67	67	66	65	64	63	62	60	58	57	55	54	52	51	49
13 000	68	68	68	67	67	66	66	65	64	63	62	60	58	57	55	53	52	51	49
13 500	67	67	67	67	66	66	65	64	64	63	62	60	58	56	55	53	52	50	49
14 000	67	67	67	67	66	66	65	64	63	62	61	60	58	56	55	53	52	50	49
14 500	67	67	66	66	66	65	65	64	63	62	61	59	58	56	55	53	52	50	49
15 000	66	66	66	66	65	65	64	64	63	62	61	59	58	56	54	53	51	50	49
15 500	66	66	66	65	65	65	64	63	62	62	61	59	57	56	54	53	51	50	49
16 000	66	66	65	65	65	64	64	63	62	61	60	59	57	56	54	52	51	50	48
16 500	65	65	65	65	64	64	64	63	62	61	60	59	57	55	54	52	51	50	48
17 000	65	65	65	64	64	64	63	62	62	61	60	58	57	55	54	52	51	50	48
17 500	64	64	64	64	64	63	63	62	61	61	60	58	57	55	54	52	51	50	48
18 000	64	64	64	64	63	63	62	62	61	60	60	58	56	55	53	52	51	49	48
18 500	64	63	63	63	63	62	62	62	61	60	59	58	56	55	53	52	51	49	48
19 000	63	63	63	63	62	62	62	61	61	60	59	58	56	55	53	52	51	49	48
19 500	63	63	62	62	62	62	61	61	60	60	59	57	56	55	53	52	51	49	48
20 000	62	62	62	62	62	61	61	61	60	59	59	57	56	54	53	52	50	49	48

TABLE 3.18
NOISE LEVELS FOR BRITISH AEROSPACE BAe146—ARRIVALS

Centre-line distance (*DL*), m	Noise levels, dB(A) — Sideline distance (*DS*), m																				
	0	50	100	150	200	250	300	350	400	450	500	550	600	700	800	900	1 000	1 100	1 200	1 300	1 400
0	**	**	**	**	**	**	**	**	**	**	61	60	59	57	55	54	53	51	50	49	48
250	**	**	**	**	**	**	**	**	**	**	61	60	58	55	53	52	51	50	49	48	48
500	96	92	86	81	78	74	71	69	66	64	62	61	59	56	54	51	50	49	48	47	46
750	93	90	86	82	78	75	72	69	67	65	63	61	60	57	54	52	50	49	47	46	45
1 000	91	89	85	81	78	75	72	70	68	66	64	62	61	58	55	53	51	49	48	47	45
1 250	90	88	85	81	78	75	73	70	68	66	64	63	61	58	56	53	52	50	49	47	46
1 500	88	87	84	81	78	75	73	71	69	67	65	63	62	59	56	54	52	51	49	48	46
1 750	87	86	83	81	78	75	73	71	69	67	65	64	62	59	57	55	53	51	50	48	47
2 000	86	85	83	80	78	75	73	71	69	67	66	64	63	60	57	55	53	52	50	49	47
2 250	85	84	82	80	77	75	73	71	69	67	66	64	63	60	58	55	54	52	50	49	48
2 500	84	83	82	79	77	75	73	71	69	68	66	65	63	60	58	56	54	52	51	49	48
2 750	83	82	81	79	77	75	73	71	69	68	66	65	63	61	58	56	54	53	51	50	48
3 000	82	82	80	79	77	75	73	71	69	68	66	65	64	61	58	56	55	53	51	50	49
3 250	81	81	80	78	76	75	73	71	69	68	66	65	64	61	59	57	55	53	52	50	49
3 500	81	80	79	78	76	74	73	71	69	68	66	65	64	61	59	57	55	53	52	50	49
3 750	80	80	79	77	76	74	72	71	69	68	66	65	64	61	59	57	55	54	52	51	49
4 000	79	79	78	77	75	74	72	71	69	68	66	65	64	61	59	57	56	54	52	51	50
4 500	78	78	77	76	75	73	72	70	69	68	66	65	64	62	60	58	56	54	53	51	50
5 000	77	77	76	75	74	73	72	70	69	68	66	65	64	62	60	58	56	55	53	52	50
5 500	76	76	75	75	74	72	71	70	69	68	66	65	64	62	60	58	56	55	53	52	51
6 000	75	75	74	74	73	72	71	69	68	67	66	65	64	62	60	58	56	55	54	52	51
6 500	74	74	73	73	72	71	70	69	68	67	66	65	64	62	60	58	56	55	54	52	51
7 000	73	73	72	72	71	70	70	69	68	67	65	64	63	61	60	58	56	55	54	52	51
7 500	72	72	71	71	71	70	69	68	67	66	65	64	63	61	59	58	56	55	54	52	51
8 000	71	71	71	70	70	69	68	68	67	66	65	64	63	61	59	58	56	55	54	52	51
8 500	70	70	70	70	69	69	68	67	66	65	64	63	63	61	59	58	56	55	54	52	51
9 000	69	69	69	69	69	68	67	67	66	65	64	63	62	61	59	58	56	55	54	52	51
9 500	69	69	69	68	68	68	67	66	66	65	64	63	62	61	59	57	56	55	54	52	51
10 000	68	68	68	68	67	67	67	66	65	64	64	63	62	60	59	57	56	55	54	52	51
10 500	68	68	67	67	67	67	66	66	65	64	63	63	62	60	59	57	56	55	54	52	51
11 000	67	67	67	67	66	66	66	65	64	64	63	62	62	60	59	57	56	55	54	52	51
11 500	67	67	66	66	66	66	65	65	64	63	63	62	61	60	58	57	56	55	53	52	51
12 000	66	66	66	66	65	65	65	64	64	63	62	62	61	60	58	57	56	55	53	52	51
12 500	65	65	65	65	65	65	64	64	63	63	62	61	61	60	58	57	56	55	53	52	51
13 000	65	65	65	65	64	64	64	63	63	62	62	61	61	59	58	57	56	54	53	52	51
13 500	64	64	64	64	64	64	63	63	63	62	62	61	60	59	58	57	56	54	53	52	51
14 000	64	64	64	64	64	63	63	63	62	62	61	61	60	59	58	57	55	54	53	52	51
14 500	64	63	63	63	63	63	63	62	62	62	61	60	60	59	58	56	55	54	53	52	51
15 000	63	63	63	63	63	62	62	62	62	61	61	60	60	59	57	56	55	54	53	52	51
15 500	63	63	63	62	62	62	62	62	61	61	60	60	59	58	57	56	55	54	53	52	51
16 000	62	62	62	62	62	62	61	61	61	61	60	60	59	58	57	56	55	54	53	52	51
16 500	62	62	62	62	61	61	61	61	61	60	60	59	59	58	57	56	55	54	53	52	51
17 000	61	61	61	61	61	61	61	60	60	60	60	59	59	58	57	56	55	54	53	52	51
17 500	61	61	61	61	61	60	60	60	60	60	59	59	58	57	57	55	54	53	52	52	51
18 000	60	60	60	60	60	60	60	60	59	59	59	59	58	57	56	55	54	53	52	51	50
18 500	60	60	60	60	60	60	59	59	59	59	59	58	58	57	56	55	54	53	52	51	50
19 000	60	60	60	59	59	59	59	59	59	58	58	58	58	57	56	55	54	53	52	51	50
19 500	59	59	59	59	59	59	59	58	58	58	58	58	57	56	55	54	54	53	52	51	50
20 000	59	59	59	59	59	58	58	58	58	58	57	57	57	56	55	54	53	52	52	51	50

TABLE 3.19

NOISE LEVELS FOR SAAB 340, BOEING DASH 8, FOKKER F50—TAKE OFFS

Centre-line distance (*DT*), m	Noise levels, dB(A)																		
	Sideline distance (*DS*), m																		
	0	100	200	300	400	500	600	700	800	900	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 600
0	**	**	**	**	**	65	62	60	58	57	55	54	52	50	49	47	46	45	44
250	**	**	**	**	**	65	63	60	58	57	56	54	52	50	49	48	47	46	45
500	**	**	**	**	**	65	62	60	58	57	55	54	52	50	49	49	48	47	46
750	**	**	**	**	**	65	62	60	58	57	55	54	52	51	50	50	49	48	47
1 000	**	**	**	**	**	68	65	63	61	59	58	55	54	53	52	51	50	49	48
1 250	**	**	**	**	**	71	68	65	63	61	60	57	55	54	53	52	51	50	49
1 500	91	88	83	79	75	72	70	67	65	63	61	59	57	55	54	53	51	50	49
1 750	88	87	83	79	76	73	71	68	66	64	63	60	58	56	55	54	52	51	50
2 000	86	85	82	79	76	73	71	69	67	65	64	61	59	57	56	54	53	51	50
2 250	85	84	81	79	76	74	72	70	68	66	65	62	60	58	57	55	53	52	51
2 500	83	83	81	78	76	74	72	70	68	67	65	63	61	59	57	55	54	52	51
2 750	82	81	80	78	76	74	72	70	68	67	66	63	61	59	57	55	54	52	51
3 000	80	80	79	77	75	73	71	69	68	66	65	63	60	59	57	55	54	52	51
3 250	79	79	78	76	74	72	71	69	67	66	65	62	60	58	56	55	53	52	50
3 500	78	77	77	75	73	72	70	68	67	65	64	62	60	58	56	54	53	51	50
3 750	76	76	75	74	72	71	69	68	66	65	64	61	59	57	56	54	52	51	50
4 000	73	73	72	71	70	68	67	66	65	64	63	61	59	57	55	54	52	51	49
4 250	72	72	71	70	69	67	65	64	63	62	61	60	58	56	55	53	52	50	49
4 500	71	71	70	69	68	66	65	63	62	61	60	58	57	55	54	52	51	50	49
4 750	70	70	69	68	67	65	64	63	61	60	59	57	55	54	53	52	50	49	48
5 000	69	69	68	68	66	65	63	62	60	59	58	56	54	53	52	51	49	48	47
5 500	68	68	67	66	65	64	63	61	60	59	58	56	54	52	51	49	48	47	46
6 000	67	67	66	66	65	64	62	61	60	59	58	56	54	52	51	49	48	47	45
6 500	66	66	65	65	64	63	62	61	60	59	58	56	54	53	51	50	48	47	46
7 000	65	65	65	64	64	63	62	61	60	59	58	56	54	53	51	50	49	47	46
7 500	64	64	64	63	63	62	61	61	60	59	58	56	54	53	52	50	49	48	47
8 000	63	63	63	63	62	62	61	60	59	59	58	56	55	53	52	50	49	48	47
8 500	63	63	62	62	62	61	61	60	59	58	58	56	55	53	52	51	49	48	47
9 000	62	62	62	62	61	61	60	60	59	58	57	56	55	53	52	51	49	48	47
9 500	62	62	61	61	61	61	60	59	59	58	57	56	55	53	52	51	50	48	47
10 000	61	61	61	61	60	60	60	59	59	58	57	56	55	53	52	51	50	49	48
10 500	61	61	60	60	60	60	59	59	58	58	57	56	54	53	52	51	50	49	48
11 000	60	60	60	60	60	59	59	59	58	58	57	56	54	53	52	51	50	49	48
11 500	60	60	60	59	59	59	59	58	58	57	57	56	54	53	52	51	50	49	48
12 000	59	59	59	59	59	59	58	58	58	57	57	55	54	53	52	51	50	49	48
12 500	59	59	59	59	58	58	58	58	57	57	56	55	54	53	52	51	50	49	48
13 000	59	58	58	58	58	58	58	57	57	57	56	55	54	53	52	51	50	49	48
13 500	58	58	58	58	58	58	57	57	57	57	56	55	54	53	52	51	50	49	48
14 000	58	58	58	58	57	57	57	57	57	56	56	55	54	53	52	51	50	49	48
14 500	58	57	57	57	57	57	57	57	56	56	56	55	54	53	52	51	50	49	48
15 000	57	57	57	57	57	57	57	56	56	56	56	55	54	53	52	51	50	49	48
15 500	57	57	57	57	57	57	56	56	56	56	55	55	54	53	52	51	50	49	48
16 000	57	57	57	57	56	56	56	56	56	55	55	54	54	53	52	51	50	49	48
16 500	56	56	56	56	56	56	56	56	55	55	55	54	53	53	52	51	50	49	48
17 000	56	56	56	56	56	56	56	55	55	55	55	54	53	53	52	51	50	49	48
17 500	56	56	56	56	56	56	55	55	55	55	55	54	53	52	52	51	50	49	48
18 000	56	56	56	56	55	55	55	55	55	55	54	54	53	52	52	51	50	49	48
18 500	55	55	55	55	55	55	55	55	55	54	54	54	53	52	52	51	50	49	48
19 000	55	55	55	55	55	55	55	55	54	54	54	54	53	52	52	51	50	49	48
19 500	55	55	55	55	55	55	55	54	54	54	54	54	53	52	51	51	50	49	48
20 000	55	55	55	55	55	55	54	54	54	54	54	53	53	52	51	51	50	49	48

TABLE 3.20

NOISE LEVELS FOR SAAB 340, BOEING DASH 8, FOKKER F50—ARRIVALS

Centre-line distance (*DL*), m	Noise levels, dB(A)																				
	Sideline distance (*DS*), m																				
	0	50	100	150	200	250	300	350	400	450	500	550	600	700	800	900	1 000	1 100	1 200	1 300	1 400
0	**	**	**	**	**	**	**	**	**	**	57	56	54	52	50	48	47	45	44	43	42
250	**	**	**	**	**	**	**	**	**	**	58	57	55	53	51	49	47	46	45	44	43
500	90	86	81	77	73	70	67	65	63	61	59	58	56	54	51	50	48	47	46	45	44
750	88	85	81	77	73	71	68	66	64	62	60	59	57	55	52	50	49	48	46	45	44
1 000	86	84	80	77	74	71	69	66	64	62	61	59	58	55	53	51	50	48	47	46	45
1 250	84	83	80	77	74	71	69	67	65	63	61	60	58	56	54	52	50	49	48	46	45
1 500	83	82	79	76	74	71	69	67	65	63	62	60	59	56	54	52	51	49	48	47	46
1 750	82	81	79	76	74	71	69	67	65	64	62	61	59	57	55	53	51	50	49	47	46
2 000	81	80	78	76	73	71	69	67	66	64	62	61	60	57	55	53	52	50	49	48	47
2 250	80	79	77	75	73	71	69	67	66	64	63	61	60	58	55	54	52	51	49	48	47
2 500	79	78	77	75	73	71	69	67	66	64	63	62	60	58	56	54	52	51	50	48	47
2 750	78	78	76	75	73	71	69	67	66	64	63	62	61	58	56	54	53	51	50	49	48
3 000	77	77	76	74	73	71	69	67	66	65	63	62	61	58	56	55	53	52	50	49	48
3 250	77	76	75	74	72	71	69	67	66	65	63	62	61	59	57	55	53	52	51	49	48
3 500	76	76	75	74	72	70	69	67	66	65	63	62	61	59	57	55	54	52	51	50	48
3 750	75	75	74	73	72	70	69	67	66	65	63	62	61	59	57	55	54	52	51	50	49
4 000	75	74	74	73	71	70	69	67	66	65	63	62	61	59	57	55	54	53	51	50	49
4 500	74	73	73	72	71	70	68	67	66	65	63	62	61	59	57	56	54	53	52	51	49
5 000	73	73	72	71	70	69	68	67	66	65	63	62	61	59	58	56	55	53	52	51	50
5 500	72	72	71	71	70	69	68	67	65	64	63	62	61	60	58	56	55	54	52	51	50
6 000	71	71	70	70	69	68	67	66	65	64	63	62	61	60	58	56	55	54	53	51	50
6 500	70	70	70	69	69	68	67	66	65	64	63	62	61	59	58	56	55	54	53	52	50
7 000	69	69	69	69	68	67	66	66	65	64	63	62	61	59	58	56	55	54	53	52	51
7 500	69	68	68	68	67	67	66	65	64	63	63	62	61	59	58	56	55	54	53	52	51
8 000	68	68	68	67	67	66	66	65	64	63	62	62	61	59	58	56	55	54	53	52	51
8 500	67	67	67	67	66	66	65	64	64	63	62	61	61	59	58	56	55	54	53	52	51
9 000	67	67	66	66	66	65	65	64	63	63	62	61	60	59	58	56	55	54	53	52	51
9 500	66	66	66	66	65	65	65	64	63	62	62	61	60	59	58	56	55	54	53	52	51
10 000	66	66	65	65	65	65	64	64	63	62	62	61	60	59	58	56	55	54	53	52	51
10 500	65	65	65	65	64	64	64	63	63	62	61	61	60	59	57	56	55	54	53	52	51
11 000	65	65	64	64	64	64	63	63	62	62	61	60	60	59	57	56	55	54	53	52	51
11 500	64	64	64	64	64	63	63	63	62	62	61	60	60	58	57	56	55	54	53	52	51
12 000	64	64	64	63	63	63	63	62	62	61	61	60	60	58	57	56	55	54	53	52	51
12 500	63	63	63	63	63	63	62	62	62	61	60	60	59	58	57	56	55	54	53	52	51
13 000	63	63	63	63	62	62	62	62	61	61	60	60	59	58	57	56	55	54	53	52	51
13 500	62	62	62	62	62	62	62	61	61	61	60	60	59	58	57	56	55	54	53	52	51
14 000	62	62	62	62	62	61	61	61	61	60	60	59	59	58	57	56	55	54	53	52	51
14 500	62	62	62	61	61	61	61	61	60	60	60	59	59	58	57	56	55	54	53	52	51
15 000	61	61	61	61	61	61	61	60	60	60	59	59	58	58	57	56	55	54	53	52	51
15 500	61	61	61	61	61	60	60	60	60	60	59	59	58	57	56	56	55	54	53	52	51
16 000	61	61	61	60	60	60	60	60	60	59	59	59	58	57	56	55	55	54	53	52	51
16 500	60	60	60	60	60	60	60	60	59	59	59	58	58	57	56	55	54	54	53	52	51
17 000	60	60	60	60	60	60	59	59	59	59	59	58	58	57	56	55	54	53	53	52	51
17 500	60	60	60	60	59	59	59	59	59	59	58	58	58	57	56	55	54	53	53	52	51
18 000	59	59	59	59	59	59	59	59	58	58	58	58	57	57	56	55	54	53	52	52	51
18 500	59	59	59	59	59	59	59	58	58	58	58	58	57	56	56	55	54	53	52	52	51
19 000	59	59	59	59	59	58	58	58	58	58	58	57	57	56	56	55	54	53	52	52	51
19 500	58	58	58	58	58	58	58	58	58	58	57	57	57	56	55	55	54	53	52	52	51
20 000	58	58	58	58	58	58	58	58	57	57	57	57	57	56	55	54	54	53	52	51	51

TABLE 3.21

NOISE LEVELS FOR CORPORATE JET—TAKE OFFS

Centre-line distance (*DT*), m	Noise levels, dB(A)																		
	Sideline distance (*DS*), m																		
	0	100	200	300	400	500	600	700	800	900	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 600
0	**	**	**	**	**	77	74	71	68	66	65	62	59	57	55	53	51	50	48
250	**	**	**	**	**	76	73	70	67	65	64	61	58	56	54	52	50	49	47
500	**	**	**	**	**	75	72	69	66	64	63	60	58	55	53	51	50	48	46
750	**	**	**	**	**	74	70	68	65	63	62	60	57	55	53	51	49	48	46
1 000	**	**	**	**	**	74	71	68	65	64	62	60	57	55	53	51	49	47	46
1 250	**	**	**	**	**	76	73	70	68	65	64	61	58	55	53	51	49	48	46
1 500	**	**	**	**	**	78	74	71	68	66	64	61	58	56	53	51	50	48	46
1 750	**	**	**	**	**	79	76	73	70	68	66	63	60	57	55	53	51	49	47
2 000	**	**	**	**	**	80	77	74	72	69	67	64	61	58	56	54	52	50	48
2 250	**	**	**	**	**	80	78	75	72	70	68	65	62	59	57	55	53	51	49
2 500	93	92	90	86	83	80	78	75	73	71	69	66	63	60	58	55	53	52	50
2 750	91	90	88	86	83	80	78	75	73	71	70	66	63	61	58	56	54	52	51
3 000	89	89	87	85	82	80	78	75	73	72	70	67	64	61	59	57	55	53	51
3 250	88	87	86	84	82	80	77	75	73	72	70	67	64	62	59	57	55	54	52
3 500	86	86	85	83	81	79	77	75	73	72	70	67	65	62	60	58	56	54	52
3 750	85	85	84	82	81	79	77	75	73	72	70	67	65	62	60	58	56	54	52
4 000	84	84	83	82	80	78	77	75	73	71	70	67	65	62	60	58	56	54	52
4 250	83	83	82	81	80	78	76	74	73	71	70	67	64	62	60	58	56	54	52
4 500	83	82	82	81	79	78	76	74	73	71	70	67	64	62	60	58	56	54	52
4 750	82	82	81	80	79	77	76	74	72	71	69	67	64	62	60	58	56	54	52
5 000	81	81	80	79	78	76	75	73	72	70	69	67	64	62	60	58	56	54	52
5 500	77	77	77	76	75	74	72	71	70	68	67	65	62	60	58	56	55	53	51
6 000	76	76	75	75	74	73	72	70	69	68	67	64	62	60	58	56	55	53	51
6 500	74	74	74	73	73	72	71	70	69	68	66	64	62	60	58	56	55	53	52
7 000	73	73	73	72	72	71	70	69	68	67	66	64	62	60	58	56	55	53	52
7 500	72	72	72	71	71	70	70	69	68	67	66	64	62	60	58	56	55	53	52
8 000	71	71	71	71	70	70	69	68	67	66	65	63	61	60	58	56	55	53	52
8 500	71	71	71	70	70	69	69	68	67	66	65	63	61	59	58	56	54	53	51
9 000	70	70	70	70	69	69	68	67	66	65	64	63	61	59	57	56	54	53	51
9 500	70	69	69	69	69	68	68	67	66	65	64	62	61	59	57	56	54	53	51
10 000	69	69	69	68	68	68	67	66	66	65	64	62	60	59	57	55	54	53	51
10 500	68	68	68	68	68	67	67	66	65	64	63	62	60	58	57	55	54	52	51
11 000	68	68	68	67	67	67	66	65	65	64	63	61	60	58	57	55	54	52	51
11 500	67	67	67	67	66	66	66	65	64	63	63	61	60	58	56	55	53	52	51
12 000	67	67	66	66	66	65	65	65	64	63	62	61	59	58	56	55	53	52	51
12 500	66	66	66	66	65	65	65	64	63	63	62	60	59	57	56	54	53	52	51
13 000	65	65	65	65	65	64	64	64	63	62	62	60	59	57	56	54	53	52	50
13 500	65	65	65	64	64	64	63	63	63	62	61	60	58	57	56	54	53	52	50
14 000	64	64	64	64	64	63	63	63	62	62	61	60	58	57	55	54	53	51	50
14 500	64	63	63	63	63	63	62	62	62	61	61	59	58	56	55	54	53	51	50
15 000	63	63	63	63	62	62	62	62	61	61	60	59	58	56	55	54	52	51	50
15 500	62	62	62	62	62	62	61	61	61	60	60	59	57	56	55	54	52	51	50
16 000	62	62	62	62	61	61	61	61	60	60	59	58	57	56	55	53	52	51	50
16 500	61	61	61	61	61	61	61	60	60	60	59	58	57	56	54	53	52	51	50
17 000	61	61	61	61	61	60	60	60	59	59	59	58	57	55	54	53	52	51	50
17 500	60	60	60	60	60	60	60	59	59	59	58	57	56	55	54	53	52	51	50
18 000	60	60	60	60	60	59	59	59	59	58	58	57	56	55	54	53	52	51	49
18 500	60	59	59	59	59	59	59	59	58	58	58	57	56	55	54	53	52	50	49
19 000	59	59	59	59	59	59	58	58	58	58	57	56	55	54	53	52	51	50	49
19 500	59	59	59	58	58	58	58	58	57	57	57	56	55	54	53	52	51	50	49
20 000	58	58	58	58	58	58	58	57	57	57	57	56	55	54	53	52	51	50	49

TABLE 3.22

NOISE LEVELS FOR CORPORATE JET—ARRIVALS

Centre-line distance (*DL*), m	Noise levels, dB(A)																				
	Sideline distance (*DS*), m																				
	0	50	100	150	200	250	300	350	400	450	500	550	600	700	800	900	1 000	1 100	1 200	1 300	1 400
0	**	**	**	**	**	**	**	**	**	**	64	62	61	59	57	56	54	53	52	51	50
250	**	**	**	**	**	**	**	**	**	**	59	59	58	56	55	54	53	52	51	50	49
500	92	88	82	77	73	70	67	64	62	60	58	56	55	54	53	52	51	51	50	49	48
750	89	86	82	77	74	70	67	65	62	60	58	57	55	52	51	50	49	49	48	47	47
1 000	87	85	81	77	74	71	68	65	63	61	59	57	56	53	50	48	48	47	46	46	45
1 250	86	84	80	77	74	71	68	66	63	61	60	58	56	54	51	49	47	46	45	44	44
1 500	84	83	80	77	74	71	68	66	64	62	60	58	57	54	52	49	48	46	45	43	42
1 750	83	82	79	76	73	71	68	66	64	62	60	59	57	55	52	50	48	47	45	44	43
2 000	82	81	79	76	73	71	68	66	64	62	61	59	58	55	53	50	49	47	46	44	43
2 250	81	80	78	75	73	71	68	66	64	63	61	59	58	55	53	51	49	47	46	45	43
2 500	80	79	77	75	73	70	68	66	65	63	61	60	58	56	53	51	49	48	46	45	44
2 750	79	78	77	75	72	70	68	66	65	63	61	60	59	56	54	52	50	48	47	45	44
3 000	78	77	76	74	72	70	68	66	65	63	61	60	59	56	54	52	50	48	47	46	44
3 250	77	77	75	74	72	70	68	66	65	63	62	60	59	56	54	52	50	49	47	46	45
3 500	76	76	75	73	72	70	68	66	65	63	62	60	59	57	54	52	51	49	48	46	45
3 750	75	75	74	73	71	70	68	66	65	63	62	60	59	57	55	53	51	49	48	46	45
4 000	75	74	74	72	71	69	68	66	65	63	62	60	59	57	55	53	51	50	48	47	45
4 500	73	73	73	72	70	69	67	66	64	63	62	60	59	57	55	53	51	50	49	47	46
5 000	72	72	72	71	70	68	67	66	64	63	62	60	59	57	55	53	52	50	49	47	46
5 500	71	71	71	70	69	68	66	65	64	63	62	60	59	57	55	54	52	51	49	48	47
6 000	70	70	69	69	68	67	66	65	63	62	61	60	59	57	55	53	52	50	49	48	47
6 500	69	69	68	68	67	66	65	64	63	62	61	60	59	57	55	53	52	50	49	48	47
7 000	68	68	67	67	66	65	64	63	62	61	60	59	58	56	55	53	52	50	49	48	47
7 500	67	67	66	66	65	65	64	63	62	61	60	59	58	56	54	53	51	50	49	48	46
8 000	66	66	65	65	64	64	63	62	61	60	59	58	57	56	54	53	51	50	49	47	46
8 500	65	65	64	64	64	63	62	61	61	60	59	58	57	55	54	52	51	50	48	47	46
9 000	64	64	64	63	63	62	62	61	60	59	58	58	57	55	54	52	51	50	48	47	46
9 500	63	63	63	62	62	62	61	60	60	59	58	57	56	55	53	52	51	49	48	47	46
10 000	62	62	62	62	61	61	61	60	59	58	58	57	56	55	53	52	50	49	48	47	46
10 500	61	61	61	61	61	60	60	59	59	58	57	56	56	54	53	51	50	49	48	47	46
11 000	61	61	61	60	60	60	59	59	58	57	57	56	55	54	53	51	50	49	48	47	46
11 500	60	60	60	60	59	59	59	58	58	57	56	56	55	54	52	51	50	49	48	47	46
12 000	59	59	59	59	59	58	58	58	57	57	56	55	55	53	52	51	50	49	47	46	45
12 500	59	59	58	58	58	58	57	57	57	56	55	55	54	53	52	51	49	48	47	46	45
13 000	58	58	58	58	57	57	57	57	56	56	55	54	54	53	51	50	49	48	47	46	45
13 500	57	57	57	57	57	57	56	56	56	55	55	54	53	52	51	50	49	48	47	46	45
14 000	57	57	57	56	56	56	56	55	55	55	54	54	53	52	51	50	49	48	47	46	45
14 500	56	56	56	56	56	55	55	55	55	54	54	53	53	52	50	49	48	47	46	45	45
15 000	55	55	55	55	55	55	55	54	54	54	53	53	52	51	50	49	48	47	46	45	44
15 500	55	55	55	55	55	54	54	54	54	53	53	52	52	51	50	49	48	47	46	45	44
16 000	54	54	54	54	54	54	54	53	53	53	52	52	52	51	50	49	48	47	46	45	44
16 500	54	54	54	54	53	53	53	53	53	52	52	52	51	50	49	48	47	46	45	45	44
17 000	53	53	53	53	53	53	53	52	52	52	52	51	51	50	49	48	47	46	45	44	44
17 500	53	53	53	53	53	52	52	52	52	52	51	51	50	50	49	48	47	46	45	44	43
18 000	52	52	52	52	52	52	52	52	51	51	51	51	50	49	48	48	47	46	45	44	43
18 500	52	52	52	52	52	52	52	51	51	51	51	50	50	49	48	47	46	46	45	44	43
19 000	52	52	52	52	51	51	51	51	51	51	50	50	50	49	48	47	46	45	45	44	43
19 500	51	51	51	51	51	51	51	51	50	50	50	50	50	49	48	47	46	45	45	44	43
20 000	51	51	51	51	51	51	50	50	50	50	50	49	49	48	48	47	46	45	44	44	43

TABLE 3.23

NOISE LEVELS FOR LIGHT GENERAL AVIATION AIRCRAFT—TAKE OFFS

Centre-line distance (*DT*), m	Noise levels, dB(A) — Sideline distance (*DS*), m																		
	0	100	200	300	400	500	600	700	800	900	1 000	1 200	1 400	1 600	1 800	2 000	2 200	2 400	2 600
0	**	**	**	**	**	69	66	64	62	60	59	57	55	53	52	51	49	48	47
250	**	**	**	**	**	69	66	64	62	60	59	57	55	53	52	51	49	48	47
500	**	**	**	**	**	69	66	63	62	60	59	57	55	53	52	51	49	48	47
750	**	**	**	**	**	69	67	64	62	60	59	57	55	53	52	51	49	48	47
1 000	**	**	**	**	**	70	67	65	63	61	59	57	55	53	52	50	49	48	47
1 250	**	**	**	**	**	70	67	65	63	61	59	57	55	53	51	50	49	48	47
1 500	92	88	83	78	75	71	69	66	64	62	60	58	55	53	52	51	50	49	48
1 750	89	87	82	79	75	72	70	67	65	63	62	59	57	54	53	52	51	49	48
2 000	87	85	82	79	75	73	70	68	66	64	63	60	57	55	54	53	51	50	49
2 250	85	84	81	78	76	73	71	69	67	65	63	61	58	56	55	53	52	51	49
2 500	84	83	81	78	75	73	71	69	67	65	64	61	59	57	56	54	52	51	50
2 750	82	82	80	78	75	73	71	69	67	66	64	62	60	58	56	54	53	51	50
3 000	81	81	79	77	75	73	71	69	68	66	65	62	60	58	56	54	53	51	50
3 250	80	80	79	77	75	73	71	69	67	66	65	62	60	58	56	54	53	51	50
3 500	79	79	78	76	74	72	70	69	67	66	64	62	60	58	56	54	53	51	50
3 750	78	78	77	75	74	72	70	68	67	65	64	62	59	57	56	54	52	51	50
4 000	77	77	76	75	73	71	69	68	66	65	64	61	59	57	55	54	52	51	49
4 250	76	76	75	74	72	71	69	67	66	65	63	61	59	57	55	53	52	50	49
4 500	74	73	73	72	70	69	68	66	65	64	63	60	58	57	55	53	52	50	49
4 750	73	73	72	71	70	68	66	65	63	62	61	60	58	56	54	53	51	50	49
5 000	73	72	72	71	69	68	66	65	63	62	61	59	57	55	54	52	51	50	48
5 500	72	72	71	70	69	68	66	65	63	62	61	59	57	55	53	52	50	49	48
6 000	71	71	71	70	69	67	66	65	63	62	61	59	57	55	54	52	51	49	48
6 500	71	70	70	69	68	67	66	65	63	62	61	59	57	55	54	52	51	49	48
7 000	70	70	69	69	68	67	66	64	63	62	61	59	57	56	54	52	51	50	48
7 500	69	69	69	68	68	67	65	64	63	62	61	59	57	56	54	53	51	50	49
8 000	69	69	68	68	67	66	65	64	63	62	61	59	57	56	54	53	51	50	49
8 500	68	68	68	67	67	66	65	64	63	62	61	59	57	56	54	53	51	50	49
9 000	68	68	67	67	66	66	65	64	63	62	61	59	57	56	54	53	52	50	49
9 500	67	67	67	67	66	65	65	64	63	62	61	59	57	56	54	53	52	50	49
10 000	67	67	67	66	66	65	64	63	63	62	61	59	57	56	54	53	52	51	49
10 500	66	66	66	66	65	65	64	63	62	62	61	59	57	56	55	53	52	51	50
11 000	66	66	66	65	65	65	64	63	62	61	61	59	57	56	55	53	52	51	50
11 500	66	66	65	65	65	64	64	63	62	61	60	59	57	56	55	53	52	51	50
12 000	65	65	65	65	64	64	64	63	62	61	60	59	57	56	55	53	52	51	50
12 500	65	65	65	64	64	64	63	63	62	61	60	59	57	56	55	53	52	51	50
13 000	65	65	64	64	64	64	63	62	62	61	60	59	57	56	55	53	52	51	50
13 500	64	64	64	64	64	63	63	62	62	61	60	59	57	56	55	53	52	51	50
14 000	64	64	64	64	63	63	63	62	61	61	60	59	57	56	55	53	52	51	50
14 500	64	64	64	63	63	63	62	62	61	61	60	58	57	56	55	53	52	51	50
15 000	63	63	63	63	63	62	62	62	61	60	60	58	57	56	55	53	52	51	50
15 500	63	63	63	63	63	62	62	61	61	60	60	58	57	56	55	53	52	51	50
16 000	63	63	63	62	62	62	62	61	61	60	59	58	57	56	55	53	52	51	50
16 500	63	62	62	62	62	62	61	61	61	60	59	58	57	56	55	53	52	51	50
17 000	62	62	62	62	62	61	61	61	60	60	59	58	57	56	55	53	52	51	50
17 500	62	62	62	62	61	61	61	61	60	60	59	58	57	56	54	53	52	51	50
18 000	62	62	62	61	61	61	61	60	60	60	59	58	57	56	54	53	52	51	50
18 500	61	61	61	61	61	61	61	60	60	59	59	58	57	56	54	53	52	51	50
19 000	61	61	61	61	61	61	60	60	60	59	59	58	57	55	54	53	52	51	50
19 500	61	61	61	61	61	60	60	60	60	59	59	58	56	55	54	53	52	51	50
20 000	61	61	61	60	60	60	60	60	59	59	59	57	56	55	54	53	52	51	51

TABLE 3.24

NOISE LEVELS FOR LIGHT GENERAL AVIATION AIRCRAFT—ARRIVALS

Centre-line distance (*DL*), m	Noise levels, dB(A) Sideline distance (*DS*), m																				
	0	50	100	150	200	250	300	350	400	450	500	550	600	700	800	900	1 000	1 100	1 200	1 300	1 400
0	**	**	**	**	**	**	**	**	**	**	56	54	53	50	48	47	45	44	43	42	41
250	**	**	**	**	**	**	**	**	**	**	57	55	54	52	49	48	46	45	44	43	42
500	88	84	79	75	71	69	66	64	62	60	58	56	55	53	50	48	47	46	45	44	43
750	86	83	79	75	72	69	67	64	62	61	59	57	56	53	51	49	48	46	45	44	43
1 000	84	82	78	75	72	69	67	65	63	61	60	58	57	54	52	50	48	47	46	45	44
1 250	83	81	78	75	72	70	67	65	63	62	60	59	57	55	52	51	49	48	46	45	44
1 500	81	80	77	75	72	70	68	66	64	62	61	59	58	55	53	51	50	48	47	46	45
1 750	80	79	77	74	72	70	68	66	64	62	61	60	58	56	54	52	50	49	47	46	45
2 000	79	78	76	74	72	70	68	66	64	63	61	60	59	56	54	52	51	49	48	47	46
2 250	78	77	76	74	72	70	68	66	64	63	62	60	59	57	54	53	51	50	48	47	46
2 500	77	77	75	73	71	70	68	66	65	63	62	60	59	57	55	53	51	50	49	47	46
2 750	76	76	75	73	71	70	68	66	65	63	62	61	59	57	55	53	52	50	49	48	47
3 000	76	75	74	73	71	69	68	66	65	63	62	61	60	57	55	54	52	51	49	48	47
3 250	75	75	74	72	71	69	68	66	65	63	62	61	60	58	56	54	52	51	50	48	47
3 500	74	74	73	72	71	69	68	66	65	63	62	61	60	58	56	54	53	51	50	49	47
3 750	74	74	73	72	70	69	67	66	65	63	62	61	60	58	56	54	53	51	50	49	48
4 000	73	73	72	71	70	69	67	66	65	64	62	61	60	58	56	54	53	52	50	49	48
4 500	72	72	72	71	70	68	67	66	65	63	62	61	60	58	56	55	53	52	51	50	48
5 000	71	71	71	70	69	68	67	66	65	63	62	61	60	58	57	55	54	52	51	50	49
5 500	70	70	70	69	69	68	67	65	64	63	62	61	60	59	57	55	54	53	51	50	49
6 000	70	69	69	69	68	67	66	65	64	63	62	61	60	59	57	55	54	53	52	50	49
6 500	69	69	68	68	67	67	66	65	64	63	62	61	60	58	57	55	54	53	52	51	49
7 000	68	68	68	67	67	66	65	64	63	63	62	61	60	58	57	55	54	53	52	51	50
7 500	67	67	67	67	66	66	65	64	63	62	61	61	60	58	57	55	54	53	52	51	50
8 000	66	66	66	66	66	65	64	64	63	62	61	60	60	58	57	55	54	53	52	51	50
8 500	66	66	66	65	65	65	64	63	62	62	61	60	59	58	56	55	54	53	52	51	50
9 000	65	65	65	65	64	64	64	63	62	61	61	60	59	58	56	55	54	53	52	51	50
9 500	65	65	64	64	64	64	63	63	62	61	60	60	59	58	56	55	54	53	52	51	50
10 000	64	64	64	64	64	63	63	62	62	61	60	60	59	58	56	55	54	53	52	51	50
10 500	64	64	64	63	63	63	62	62	61	61	60	59	59	57	56	55	54	53	52	51	50
11 000	63	63	63	63	63	62	62	62	61	60	60	59	59	57	56	55	54	53	52	51	50
11 500	63	63	63	62	62	62	62	61	61	60	60	59	58	57	56	55	54	53	52	51	50
12 000	62	62	62	62	62	62	61	61	60	60	59	59	58	57	56	55	54	53	52	51	50
12 500	62	62	62	62	61	61	61	61	60	60	59	59	58	57	56	55	54	53	52	51	50
13 000	61	61	61	61	61	61	60	60	60	59	59	58	58	57	56	55	54	53	52	51	50
13 500	61	61	61	61	61	60	60	60	60	59	59	58	58	57	56	55	54	53	52	51	50
14 000	61	61	60	60	60	60	60	60	59	59	58	58	57	56	55	54	53	53	52	51	50
14 500	60	60	60	60	60	60	59	59	59	59	58	58	57	56	55	54	53	52	52	51	50
15 000	60	60	60	60	59	59	59	59	59	58	58	57	57	56	55	54	53	52	51	51	50
15 500	59	59	59	59	59	59	59	59	58	58	58	57	57	56	55	54	53	52	51	51	50
16 000	59	59	59	59	59	59	58	58	58	58	57	57	57	56	55	54	53	52	51	50	50
16 500	59	59	59	59	58	58	58	58	58	57	57	57	56	56	55	54	53	52	51	50	50
17 000	58	58	58	58	58	58	58	58	57	57	57	57	56	55	55	54	53	52	51	50	50
17 500	58	58	58	58	58	58	58	57	57	57	57	56	56	55	54	54	53	52	51	50	50
18 000	58	58	58	58	58	57	57	57	57	57	56	56	56	55	54	53	53	52	51	50	49
18 500	57	57	57	57	57	57	57	57	57	56	56	56	56	55	54	53	52	52	51	50	49
19 000	57	57	57	57	57	57	57	57	56	56	56	56	56	55	54	53	52	52	51	50	49
19 500	57	57	57	57	57	57	56	56	56	56	56	56	55	55	54	53	52	51	51	50	49
20 000	57	57	57	57	56	56	56	56	56	56	56	55	55	54	54	53	52	51	51	50	49

APPENDIX A

AUSTRALIAN NOISE EXPOSURE FORECAST SYSTEM

(Informative)

A1 GENERAL

The aircraft Noise Exposure Forecast (NEF) technique was first developed in the United States of America in the late 1960s. It was subsequently redefined in Australia in 1982.

The NEF system is a scientifically based computational procedure for determining aircraft noise exposure levels around aerodromes. It can be used for assessing average community response to aircraft noise and for land-use planning around aerodromes. In the Australian NEF system, noise exposure levels are calculated in Australian Noise Exposure Forecast (ANEF) units, which take into account the following features of aircraft noise:

(a) The intensity, duration, tonal content and spectrum of audible frequencies of the noise of aircraft take offs, approaches to landing, and reverse thrust after landing (for practical reasons, noise generated on the aerodrome from aircraft taxiing and engine running during ground maintenance is not included).

(b) The forecast frequency of aircraft types and movements on the various flight paths, including flight paths used for circuit training.

(c) The average daily distribution of aircraft arrivals and departures in both daytime and night-time (daytime defined as 0700 hours to 1900 hours, and night-time defined as 1900 hours to 0700 hours).

ANEF charts are provided for most aerodromes throughout Australia. The charts are simply plans of the aerodrome and the surrounding localities on which noise exposure contours of 20, 25, 30, 35 and 40 ANEF units have been drawn. These contours indicate land areas around an aerodrome which are exposed to aircraft noise of certain levels as defined by Clause 1.5.6; the higher the ANEF value the greater the noise exposure.

In the areas outside 20 ANEF, noise from sources other than aircraft tends to predominate over aircraft noise. Within the area from 20 ANEF to 25 ANEF, aircraft noise exposure starts to emerge as an environmental problem, while above 25 ANEF the noise exposure becomes progressively more severe.

The land-use compatibility recommendations made in this Standard relate to the above ANEF contours.

In 1979, the then Department of Transport together with the Department of Defence jointly sponsored the National Acoustic Laboratories (NAL) of the Department of Health in undertaking a major socio-acoustic investigation to assess the impact of aircraft noise on residential communities in Australia. In the social survey, personal interviews were conducted with 3575 residents around the major airports in Sydney, Adelaide, Perth and Melbourne, and the RAAF Base Richmond, N.S.W. From the responses to the questionnaire, subjective reaction to aircraft noise was measured in terms of general reaction (GR), a composite of a number of ratings of dissatisfaction, annoyance and fear, as well as reports of activity disturbance and complaint disposition. A high score of GR was used to define whether or not respondents were 'seriously affected' by aircraft noise. Noise measurements were made at several sites around each airport either by tape-recording fly overs or by the unmanned logging of noise levels over periods of two weeks. The noise exposure at each of the dwellings in the social survey was estimated in terms of 20 different noise indices.

Analysis by NAL showed that 'equal-energy' indices such as NEF were more highly correlated with community reaction than other types of index, including 'peak-level' indices. However, it was found that the standard weighting given to night flights was too high, and that there should be a weighting applied to flights during evening hours. Attitudes towards the aviation industry, personal sensitivity to noise, and fear of aircraft crashing were found to be important in modifying the extent to which a person will be affected by a given amount of aircraft noise. Demographic variables such as age, sex, occupation and education were found to be of generally minor importance in explaining subjective reaction.

The report of NAL's extensive and definitive study was published in 1982*. As a result of NAL's findings, the Department of Aviation decided to revise its existing American-based NEF system to reflect the specific Australian findings. The system was renamed the ANEF system. The following changes were included in the new system:

(a) The 'night-time' period was changed from between 2200 hours and 0700 hours to between 1900 hours and 0700 hours. The weighting of noise in the 'night' hours was lowered from 12 dB to 6 dB.

(b) The 20 ANEF contour was included on all ANEF charts.

(c) Tabulations of aircraft movements and runway usages were included on ANEF charts.

The findings of the NAL survey also provided information on the percentage of residents living around established aerodromes who are either moderately or seriously affected by aircraft noise. Such information, which is called a dose/response relationship, provides the basic information necessary for formulating appropriate recommendations on compatible land use around Australian aerodromes.

Prior to 1982, Australian land use recommendations were essentially similar to the criteria used in the U.S. NEF system. However, with the availability of an Australian dose/response function derived from the NAL social survey, the U.S. criteria were revised to take into account the general reaction of Australian communities to aircraft noise.

In essence, this revision was limited to a firmer definition of the criterion for residential land-use compatibility. In the NEF system as originally adopted in Australia, the U.S. criterion of 30 NEF was adhered to, but, in accordance with a recommendation of the House of Representatives Select Committee on Aircraft Noise made in 1970, cautious restraint was urged to be applied by land-zoning authorities when applying the system to Australian conditions. Where possible, the 25 NEF contour was used rather than the 30 NEF as a conservative safeguard until the system was validated in Australia.

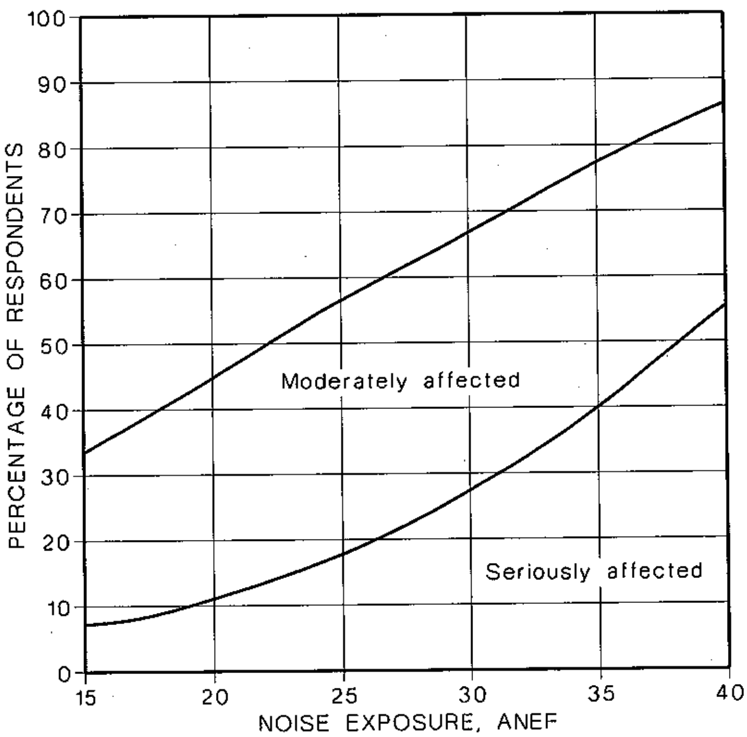
The NAL Report provided substantial evidence to support the use of 25 ANEF as the appropriate criterion for residential land usage. The 25 ANEF as a residential land usage criterion was recommended in 1985 by the House of Representatives Select Committee on Aircraft Noise, and subsequently adopted as policy by the Commonwealth Government. The only qualification which arises from the findings of the NAL Report is that some people will find that the noise exposure at 25 ANEF is still unacceptable (refer to Figure A1 for the percentage of people affected in the 20 ANEF to 25 ANEF zone). Accordingly, the issuing authorities enter the 20 ANEF contour on all ANEF charts. It is to be stressed, however, that the actual location of the 20 ANEF contour is difficult to define accurately, because of variations in aircraft flight paths, pilot operating techniques, and the effect of meteorological conditions on noise propagation. For that reason, the 20 ANEF contour is shown as a broken line on ANEF charts.

* HEDE, A.J. and BULLEN, R.B. *Aircraft Noise in Australia: A Survey of Community Reaction*, National Acoustic Laboratories Report No. 88. Australian Government Publishing Service, Canberra, February 1982.

Land-use planning is a function carried out by State or local government authorities in all but the Commonwealth Territories. It is realized that many unrelated, non-aviation factors have to be taken into account and could influence decisions taken in specific land-use considerations. The land-use recommendations in Table 2.1 are most readily applicable to new development on undeveloped land around aerodromes. In those areas around some of the major Australian airports where established residential development has existed for some considerable time, it is generally not feasible to apply appropriate land-use criteria unless the opportunity for rezoning of individual properties arises.

Figure A1 shows the dose/response relationship between aircraft noise and community reaction derived from the NAL Report. This figure indicates that significant community reaction may occur for exposures below 20 ANEF. Experience has shown that newly exposed communities may exhibit a higher reaction than that suggested by the curves in Figure A1. ANEF values average noise exposure over a year and do not take account of variations in noise exposure patterns to which the community reacts on an hourly, daily, weekly or seasonal basis. To address this issue, other parameters such as maximum noise levels and frequency of noise events may be included in noise assessment of airports to supplement ANEF levels.

The land-use recommendations in the ANEF system are given in Table 2.1. Paragraph A2 is a technical description of the ANEF formulation. Paragraph A3 describes the different types of aircraft noise contour charts prepared using the ANEF system.



NOTE: This graph was derived from the National Acoustic Laboratories Report No. 88.

FIGURE A1 RELATIONSHIP BETWEEN NOISE EXPOSURE FORECAST LEVEL AND COMMUNITY REACTION IN RESIDENTIAL AREAS

A2 THE ANEF FORMULA

A2.1 General

The ANEF system is based on survey evidence of the reaction of Australian communities to aircraft noise. The ANEF unit incorporates, in a single equation, the noise levels produced by the various aircraft operating at an airport, plus a logarithmic function of the daily average number of aircraft noise events, with a weighting included if they occur during the evening or night-time hours when the sensitivity of people to noise is increased. The forecast frequency of aircraft movements on various flight paths (either take off, landing or touch-and-goes), and the proportion of aircraft movements by day and by night, provides the input to determine this aircraft number weighting factor.

The basis for combining aircraft noise levels with a logarithmic function of frequency of occurrences is called the principle of energy equivalence. Briefly, this principle holds that people respond to a number of noise events in the same way as they react to their loudness, and therefore the number of noise events should also be expressed in logarithmic form. This implies that a loud noise perceived only a few times per day produces similar subjective response to a moderate noise perceived many times. Most social surveys, including the Australian survey by the National Acoustic Laboratories, have confirmed that 'equal energy' units of aircraft noise exposure are better correlated with community reaction than are other units known as peak-level indices which have also been postulated for aircraft noise exposure measurement.

The ANEF combines the above two factors of aircraft noise (i.e. noise level and frequency of operations) by a mathematical formula. Noise of evening/night operations (defined as 1900 hours to 0700 hours in the ANEF system) of aircraft is weighted to account for the increased sensitivity of communities to noise during periods of relaxation or sleep. The actual aircraft noise level measurement used in the ANEF formulation is the complex Effective Perceived Noise Level (EPNdB) which takes into account annoying aspects in both the temporal and frequency domains. (The EPNdB unit is also used for the international noise certification of new aircraft). Its calculation is complex but its principles are fairly basic.

The three basic physical properties of noise are measured: level, frequency distribution and time variation. Specifically, the instantaneous sound pressure level in each of 24 one-third octave bands of the noise is gathered for each one-half second increment of time during the aircraft fly over. The following are then computed:

(a) The instantaneous one-third octave levels are converted to perceived noise level by reference to a subjective annoyance table (NOY table).

(b) A tone correction factor is calculated to account for spectral irregularities.

(c) A duration correction factor is calculated.

(d) The EPNdB is the algebraic addition of the maximum perceived noise level of the overflight plus the tone and duration corrections.

A2.2 Formula derivation

Noise levels of most civil transport aircraft, military aircraft and a representative sampling of light aircraft now operating in Australia, are known with a reasonable degree of accuracy. Aircraft manufacturers in the USA and Europe provide accurate noise definitions of their products. Additionally, aircraft noise data have been collected over the years from airport noise-monitoring systems at major airports, and from measurements of light and military aircraft noise.

The noise information, together with aircraft performance information giving the aircraft's height, speed and engine power level at the various stages of its take off or arrival flight path, are incorporated into the aircraft noise modelling computer software.

If the flight path of an aircraft is known, the typical noise level at any point along and to the side of the flight path can be calculated. If the aircraft flies that operation on the same flight path N_d times in daytime hours and N_n times in evening/night-time hours, the partial ANEF value due to that aircraft type on that particular flight path can be calculated from the following equation:

$$ANEF_{ij} = EPNdB_{ij} + 10 \log_{10} (N_d + 4 N_n) - 88 \quad \ldots A1$$

where

$ANEF_{ij}$ = noise exposure due to aircraft type i on flight path j

$EPNdB_{ij}$ = noise level of aircraft type i on flight path j

N_d, N_n = number of flights during the day and night respectively, of aircraft type i on flight path j, and

The figure '88' is an arbitrary constant chosen so that ANEF numbers typically lie in a range where they are not likely to be confused with other noise ratings.

It can be seen from Equation A1 that if there were only one aircraft flight, in daytime hours only, then the partial ANEF value would be directly proportional to the noise level of the aircraft. Also, it can be seen that the ANEF increases as the logarithm of the number of operations increases. The total ANEF at any point on the ground around an aerodrome is composed of all individual noise exposures (summed logarithmically) produced by each aircraft type operating on each flight path over the period of one day as follows:

$$ANEF = 10 \log_{10} \sum_{i=1}^{i=I} \sum_{j=1}^{j=J} \text{antilog}_{10} \left(\frac{ANEF_{ij}}{10} \right) \quad \ldots A2$$

where

I = total number of aircraft types

J = total number of flight tracks

$ANEF$ = noise exposure forecast.

In line with many other acoustic descriptors, the ANEF value is a logarithmic value.

A2.3 Traffic forecasts and flight path allocation

The ANEF method is sensitive to the forecast of air traffic movements and to the allocation of such air traffic to the flight paths on which departing and arriving aircraft are routed. Every attempt is made to ensure that the traffic forecast and flight paths are as accurate as possible. However, at major airports particularly, accurate definition of flight paths to the extent of the 20 ANEF contour is difficult to achieve. For that reason, the confidence in the location of the 20 ANEF will be less than for the 25, 30, 35 and 40 ANEF contours.

The ANEF computation is based on forecasts of air traffic movements on an average day. Allocations of the forecast movements to runways and flight path are on an average basis and take into account the existing and forecast air traffic control procedures at the airport which nominate preferred runways and preferred flight paths for noise abatement purposes (as described in AirServices Australia Aeronautical Information Publications). Aircraft movements are categorized by—

(a) night or day;

(b) type of aircraft;

(c) take off, landing or touch-and-go;

(d) range;

(e) runway used;

(f) flight path; and

(g) if applicable, circuits.

A2.4 Military aircraft operations

In preparing ANEFs for Defence airfields, it is necessary to include an assessment of the projected aircraft operations. This projection includes planned and forecast operations and incorporates allowances for possible future military aircraft activities in order to maintain the operational requirements of the airfields. All allowances are based on policies which address both the capability of the airfield to sustain such activities and the future strategic requirements of the airfield relating to its role in the defence of Australia.

In many cases the military flying activities conducted at Defence airfields may be limited to weekdays. Consequently, a daily movement average based on 365 days of activity per year, as assessed for civil aerodromes, may not be appropriate when producing the ANEF for military airfields and joint Defence/civil airports. When military flying activities at an airfield are expected to occur for less than 365 days per year, average daily movement numbers for military aircraft may be assessed on the basis of average aircraft movements during operating days only. In the case of increased activity during exercise periods, the estimated movements may be averaged on the number of days planned for the exercises and included as an average aircraft movement in the ANEF.

Factors influencing the forecast aircraft operations may change during the term of the ANEF in response to the ongoing review of Australia's defence requirements.

A3 TYPES OF AIRCRAFT NOISE CONTOUR CHARTS

There are three different types of aircraft noise contour charts produced using the ANEF system. All three types of chart are prepared using the same computational procedures. The differences arise from the types of data which have been input to produce the following charts:

(a) ANEF—Australian Noise Exposure Forecast

This is a contour map showing the forecast of noise exposure levels that will exist in a future year. It may be for a particular year, generally about 10 years from the date of issue, or in the case of some of the busier civil airports, it may represent the airport operating at 'ultimate capacity'. It is based on a firm forecast of aircraft movement numbers and operating times, aircraft types, destinations, flight paths and a given use of runways at the aerodrome.

The ANEF chart is the only one of the three types of chart which is intended to have status in land-use planning decisions. It will have been subjected to review by relevant authorities before release, and the chart will display the official endorsement of AirServices Australia or the Department of Defence. Only one ANEF chart for a given aerodrome can be current at any one time. A more recently endorsed chart supersedes an earlier chart.

(b) ANEI—Australian Noise Exposure Index

This is a contour map based on historical data from a previous year, where exact numbers and types of aircraft which used the aerodrome are known. It shows the average daily aircraft noise exposure around the aerodrome for that year.

ANEI charts are used principally as benchmarks or indicators of change of aircraft noise exposure.

(c) ANEC—Australian Noise Exposure Concept

This is a noise contour map which may be produced during consideration of options for aerodrome development. It is based on a hypothetical set of conditions of runways, aircraft types and so on, and there may be several ANEC charts prepared for the same future year. It may be a supposition for a long way into the future, and may never occur.

Because it has a hypothetical basis and may not have been subject to review by relevant authorities, an ANEC chart is not intended for use for land-use planning purposes.

APPENDIX B

EXAMPLE OF APPLICATION OF THIS STANDARD

(Informative)

A single-storey house is to be built on a site which is approximately 10 km from a major international airport. Reference to the Standard confirms the likelihood of a problem from aircraft noise. As the site is within 15 km of the airport, the procedure described in the Standard is applied.

Clause No.

1.3 An ANEF chart applying to the airport is obtained from the airport owner for examination.

2.1 The site is located on the map between the 20 ANEF and 25 ANEF contours. Reference to Table 2.1 shows that this location is only 'conditionally acceptable', requiring further implementation of the provisions of the Standard. The almost certain need to have closed windows and alternative ventilation in exposed rooms is recognized and accepted.

3.1.2 All the aircraft types listed in Table 3.1 operate from the airport frequently throughout both day and night except for the hours when a curfew is in effect. It is necessary, therefore, to refer to all the Tables from 3.4 to 3.24 to determine the aircraft noise level which will be experienced at the site.

3.1.3 The coordinates of the site, which is 15 m above the airport with respect to the relevant runway, are as follows:

$DT = 8600$ m

$DL = 6000$ m

$DS = 100$ m

The corrections to be subtracted from *DT* because of site elevation are (from Table 3.2) 90 m, 110 m and 170 m. Hence *DT* becomes 8510 m, 8490 m, and 8430 m, according to the aircraft type to which it is to be applied. *DL* becomes 5710 m when corrected. *DS* remains 100 m.

3.1.4 The aircraft noise level at the site is determined by entering the corrected coordinates in Tables 3.4 through 3.24 (*DT* for take offs and *DL* for landings). The aircraft noise level is found to be 92 dB(A) for a 747-200B (long range) aircraft taking off.

3.2.1 The most critical indoor design level for the proposed house is 50 dB(A) (from Table 3.3) for habitable spaces. A bedroom on a corner is considered as a specific example of a space to be insulated.

3.2.2 The aircraft noise reduction (*ANR*) is 92 − 50 = 42 dB(A).

3.3 Use the procedure in Appendix F or another suitable method to determine the type of building construction which may be appropriate.

F1.2 Noise will enter the room through the ceiling, the external walls, and the windows. The bedroom is assumed to have two external walls with a window in each. The components of concern are the roof/ceiling, the walls, and the windows. In this example it is assumed that the floor is not elevated and not exposed to aircraft noise.

F2.2 For the room under consideration, $N = 3$.

F2.3 The ceiling height is 2.75 m.

F2.4 The dimensions of the bedroom, the ratio of the areas of the components to the floor area are as follows:

Component	Dimension, m	Area, m^2	Ratio S_c/S_f
Ceiling (and floor)	4 × 3.5	14	1.0
Windows	2 × 1.5 (each of 2)	6.0	0.43
External walls	(4 + 3.5) × 2.75 − 6	14.6	1.05

F2.5 The reverberation time (T) is taken to be 0.5 s.

F2.6 For the purpose of preliminary assessment, assume a value of 6 dB can be taken for K_c, for all components.

F2.7 The aircraft noise attenuation required of each component is determined from the equation:

$$ANA_c = ANR + 10\log_{10}[(S_c/S_f) \times (3/h) \times 8TN] - K_c$$

The values for the roof/ceiling, external walls, and windows are as follows:

ANA_c roof/ceiling $= 42 + 10\log_{10}(1 \times 1.09 \times 8 \times 0.5 \times 3) - 6$

$= 47$ dB(A)

ANA_c external walls $= 42 + 10\log_{10}(1.05 \times 1.09 \times 8 \times 0.5 \times 3) - 6$

$= 47$ dB(A)

ANA_c windows $= 42 + 10\log_{10}(0.43 \times 1.09 \times 8 \times 0.5 \times 3) - 6$

$= 43$ dB(A)

3.4 If required, following construction use the method described in Appendix C to measure the aircraft noise reduction achieved.

APPENDIX C

METHOD FOR MEASURING AIRCRAFT NOISE REDUCTION (*ANR*)

(Informative)

C1 SCOPE

This Appendix provides the recommended method for determining the measured aircraft noise reduction (*ANR*) obtained for a completed building space. The method requires the simultaneous measurement of the maximum exterior and indoor sound levels during flyovers by the relevant aircraft under the relevant operating condition(s) as determined in Clause 3.1.4.

NOTES:

1 The noise levels in Tables 3.4 to 3.24 are based on modelling and measurements (see Note 2 to Clause 3.1.4). The exterior flyover noise levels measured according to this Appendix may differ from those determined according to Clause 3.1.4 because the values given in the tables are long-term average maximum values and it is not possible to confirm long-term maximum aircraft noise levels by a few short-term measurements taken on a particular day.

2 It is recommended that a minimum of five relevant aircraft overflights, and where practical ten overflights, be used for the determination of the ANR.

C2 INSTRUMENTATION

C2.1 General

The instrumentation required comprises one or more of the following:

(a) Type 1 sound level meters as specified in AS 1259.1.

(b) Integrating-averaging sound level meters as specified in AS 1259.2.

(c) Statistical analysers and data loggers with equivalent performance, in respect of frequency-weighting, time-weighting, statistical accuracy and tolerances, to Items (a) and (b).

(d) Storage devices, including but not limited to level recorders, magnetic tape recorders and digital event recorders, complying with the relevant requirements of AS 1259.1 and AS 1259.2.

Where any storage device, e.g. a magnetic tape recorder or digital event recorder, is used, take into account its effects on the accuracy of measurements.

NOTES:

1 Special care should be taken to ensure that the dynamic range of the instruments is large enough for the applications, and that the inherent electrical noise and overload capacity of these instruments are suitable.

2 The accuracy of the measurement will depend on the temporal characteristics of the sound being measured and the type of instrumentation being used. Care should be taken to achieve the required accuracy in any given circumstances.

C2.2 Calibration

The complete measuring system, including portable reference sound sources, should be calibrated over its full frequency and dynamic range by a certified calibration laboratory at intervals not exceeding 2 years (see AS 2659.1 and AS 2659.2).

C2.3 Field checks

Check the performance of the instrumentation periodically when in field use and immediately before and after measurements are made. For extended measurement periods, perform the checks immediately before and after each measurement sequence. Use a pistonphone, portable reference sound source or other portable checking device appropriate to the sound level meter or other instrumentation to perform the checks. Except where the calibration signal cannot be excluded from the data, do not switch the instrument off between checks. In all cases, the operating instructions for the instrument should be followed carefully. If the instrumentation system registers a discrepancy equal to or greater than 1 dB between consecutive checks, any measurements in the interval between the two checks are considered invalid.

C3 MEASUREMENTS

C3.1 General

It is important that pertinent details of the measurement instruments, measurement procedure, and conditions prevailing during the measurements, are carefully recorded and kept for reference purposes. Reference to the relevant Standards should also be given.

NOTE: In some circumstances, an 'A' frequency-weighting is inadequate for filtering out high level infrasound, which occurs near some industrial locations and some forms of transport, as well as near buildings owing to wind turbulence. This may cause overload, and, if not detected, the resulting distortion produced at higher frequencies may be inaccurately attributed to audible sound.

C3.2 Measurement positions

C3.2.1 *Outdoor measurements*

Locate the external microphone either at a height of 1.2 ±0.05 m above the ground surface or at the level of the centre of the window for habitable rooms, with the microphone orientated to be at grazing incidence to the passage of the aircraft overflight. Do not locate the microphone any closer than 3.5 m from any reflecting surface other than the ground. Where possible, position the microphone to have an unobstructed view of the aircraft during the subject test overflight. Where this condition cannot be satisfied or requires the external microphone to be located at a significant distance from the building or room in question, use appropriate corrections to estimate the external noise level immediately outside the room in the absence of obstructions or reflecting surfaces. Describe the basis and extent of such corrections in the report.

C3.2.2 *Indoor measurements*

Perform measurements inside buildings at those locations at which the noise is of interest. It is recommended that measurements be made in the most exposed room for each category of internal space relevant to the building type. For larger, multiple-occupancy buildings, more than one occupancy may need to be tested. The preferred measurement positions are at least 1 m from the walls or other major reflecting surfaces, 1.2 m to 1.5 m above the floor, and about 1.5 m from windows.

NOTES:

1 Where measurements are made inside buildings, the importance of certain transmission paths, e.g. transmission through open or closed doors and windows, should be considered.

2 The presence of furnishings or other reflective surfaces, which may result in shielding or scattering of the noise, should also be considered.

3 Attention is drawn to the possibility of instrument overload due to strong low frequency components (see AS 2659.1).

4 Where any mechanical ventilation system serving the indoor space emits sound within 10 dB(A) of the indoor design level determined in accordance with Table 3.3, the system should be turned off while the measurements are being made.

5 The space in which indoor measurements are made should be furnished normally for its use; if the space is unfurnished the indoor design sound levels will be higher and corrections should be made and reported.

C3.2.3 *Determination of aircraft noise reduction (ANR)*

Measure the maximum sound pressure level simultaneously outside ($L_{A\ out}$) and inside ($L_{A\ in}$) the relevant space during each relevant aircraft flyover using 'A' frequency-weighting and 'S' time-weighting. The arithmetic difference between $L_{A\ out}$ and $L_{A\ in}$ is the aircraft noise reduction for that flyover (ANR_n).

$$L_{A\ out} - L_{A\ in} = ANR_n \qquad \ldots C1$$

The arithmetic average of all ANR_n determined for that space is the ANR achieved.

NOTE: If the ANR achieved is more than 5 dB(A) below the design ANR, the envelope building components should be carefully examined to determine if they have been constructed strictly in accordance with the specifications.

C4 REPORTING OF RESULTS

Include the following items in the test report, where applicable:

(a) Location sketch showing measurement position(s) and relationship to aircraft overflights.

(b) A statement as to the location and height of microphones.

(c) For the indoor measurements, the microphone location and conditions of windows and doors (open or closed) and condition of the room (furnished or unfurnished).

(d) For the indoor measurements, the ambient background level prior to and after measurements, in addition to any extraneous noises that may have interfered with the indoor measurements. The condition of mechanical ventilation (on or off) should be recorded.

(e) For the outdoor measurements, the ambient level prior to and after measurements, and any extraneous noise that may have interfered with the measurement program.

(f) The weather conditions at the time(s) of the measurements including air temperature, relative humidity, barometric pressure and wind speed and direction, relative to the site.

(g) The airport terminal information service data, weather and operational procedures at the time(s) of the measurement(s) (if available).

(h) The times of day when measurements were made.

(i) The aircraft traffic flow, composition of aircraft types, and aircraft operations used for measurements.

(j) The instrumentation used, the date of its most recent calibration, and the type of performance checking procedures used.

(k) The external noise level used for design purposes, the internal noise level goals and the design ANR.

(l) The measurement results showing external noise levels ($L_{A\ out}$), internal noise levels ($L_{A\ in}$) and ANR_n for individual aircraft overflights, and the ANR achieved.

(m) A statement as to compliance with the aircraft noise reduction (ANR) requirements of this Standard certifying that the building as constructed complies with the Standard. (See Clause 3.4.)

APPENDIX D

METHOD FOR DETERMINING BUILDING SITE ACCEPTABILITY FOR LIGHT GENERAL AVIATION AERODROMES WITHOUT ANEF CHARTS

(Before proceeding refer to Clause 2.1.2)

(Informative)

D1 GENERAL

The acceptability of a building site for a particular building type depends on both the maximum aircraft noise level (see Section 3) and the average number of flights per day over the site.

D2 PROCEDURE

Determine from Clause 3.1 the aircraft noise levels to which the building site will be exposed. Compare the aircraft noise levels with the levels shown in Table D1 for the particular building type under consideration, and for the appropriate number of aircraft operations over the site.

TABLE D1

BUILDING SITE ACCEPTABILITY BASED ON AIRCRAFT NOISE LEVELS

Building site	Aircraft noise level expected at building site, dB(A)					
	20 or less flights per day			Greater than 20 flights per day		
	Acceptable	Conditionally acceptable	Unacceptable	Acceptable	Conditionally acceptable	Unacceptable
House, home unit, flat, caravan park	<80	80 to 90	>90	<75	75 to 85	>85
Hotel, motel, hostel	<85	85 to 95	>95	<80	80 to 90	>90
School, university	<80	80 to 90	>90	<75	75 to 85	>85
Hospital, nursing homes	<80	80 to 90	>90	<75	75 to 85	>85
Public building	<85	85 to 95	>95	<80	80 to 90	>90
Commercial building	<90	90 to 100	>100	<80	80 to 90	>90
Light industrial	<95	95 to 105	>105	<90	90 to 100	>100
Heavy industrial	No limit	No limit	No limit	No limit	No limit	No limit

NOTE: The forecast daily average number of aircraft flights affecting the site should be obtained from the aerodrome owner. However, each night-time flight between 1900 hours and 0700 hours is to count as four operations.

D3 ACTION RESULTING FROM ACCEPTABILITY DETERMINATION

D3.1 Acceptable

If from Table D1 the building site is classified as 'acceptable', there is usually no need for the building construction to provide protection specifically against aircraft noise.

D3.2 Conditionally acceptable

If from Table D1 the building site is classified as 'conditionally acceptable', the required noise reduction should be determined in accordance with Clause 3.2, and the aircraft noise attenuation to be expected from the proposed construction should be determined in accordance with Clause 3.3.

D3.3 Unacceptable

If, from Table D1 the building site is classified as 'unacceptable', construction of the proposed building should not normally be considered (see Notes 4 and 5 to Table 2.1).

APPENDIX E

INSULATION AGAINST AIRCRAFT NOISE—DESIGN AND CONSTRUCTION CONSIDERATIONS

(Informative)

E1 GENERAL

This Appendix provides guidance on acoustic design for insulation against aircraft noise. It is based on experience gained to date in the Sydney Aircraft Noise Insulation Project for both new construction and retrofit installations.

The information presented is not intended to be exhaustive, but rather to alert designers to a number of factors that need to be taken into account in developing effective and practical designs. In particular, designers need to recognize—

(a) the nature and limitations of much of the available sound transmission data on building components; and

(b) the need to reconcile potentially competing requirements for acoustic performance, function, safety, amenity, and aesthetics.

Because of the noise levels involved and the nature of the noise spectrum, the design should be undertaken by an acoustical specialist with appropriate experience.

E2 SOUND TRANSMISSION DATA

E2.1 General

The most up-to-date information should be obtained on the noise insulation properties and weighted sound reduction index (R_w) of building components, and ongoing development of building components related to the level of attenuation achievable should be taken into account.

NOTE: For the majority of components, the value for weighted sound reduction index, R_w, is similar to the value for sound transmission class STC (see AS/NZS 1276.1).

In Australia, there are generally no universal systems to accredit the acoustic performance of products or components in field situations. In selecting components for acoustic insulation, designers usually have to rely on limited published information, particularly for absorption coefficients and R_w values. In many instances, such data are only available from manufacturers' trade literature; the original test results are not available to the designer. Designers should proceed with caution and should be aware of a number of potential difficulties as discussed below.

E2.2 Laboratory versus in situ performance

The data available to designers are usually based on laboratory measurements determined under idealized conditions. Thus they represent values which are unlikely to be attained in other circumstances. The reported R_w values are unlikely to be achieved in buildings because of imperfections in the detailing of the construction and in the actual construction, or because of the nature of the spaces. Therefore care in both design and construction is particularly important for those parts of the building on which reliance is to be placed to lessen the intrusion of noise. The extent of the degradation of R_w values will be variable. Of vital significance in this regard is the observation that the higher the R_w value potentially achievable by a sound barrier, the more significant is its degradation by quite minor imperfections.

E2.3 Importance of low frequencies

Jet aircraft noise in proximity to an airport tends to be dominated by low frequency components. As a result, R_w ratings alone are not a reliable guide to the attenuation properties of building components. It is possible for components with lesser R_w values to perform better at the critical low frequencies than components with higher R_w values. The full spectrum information for the building component should be consulted where an ANR in excess of 30 is required.

E2.4 Interpretation of test reports

Manufacturers often present their products for testing in a range of configurations such that reported test results do not represent the building component as it is subsequently manufactured and installed. This further complicates the assessment of a different in situ performance compared with one based on information derived from laboratory measurements (see Paragraph E2.2). Purchasers and those preparing specifications should endeavour to determine the precise conditions of test of the component whenever possible.

E2.5 Repeatability and reproducibility of test data

Different products are tested in different laboratories, each with its own characteristics such as size and shape of receiving and transmitting rooms. There is limited published data in Australia to assess the repeatability of test results for the R_w values of different types of materials, such as glass, the R_w values of windows, the absorption coefficients of insulating material, and the R_w values of materials in combination, such as plaster-clad stud walls. For example, some data suggest that the R_w value for the same window measured in more than one laboratory can vary by 3 dB.

E2.6 Confidence of test data

Designers need to be aware that in many instances the reported acoustic performance of a component is based on only one laboratory test report.

E3 DESIGN AND CONSTRUCTION CONSIDERATIONS

E3.1 General

In high noise areas, and in residences and smaller commercial and public buildings, the treatments to achieve the target ANR need to be considered in conjunction with requirements for function, amenity, safety and aesthetics. Examples encountered during retrofit installations include—

(a) excessive intrusion of secondary windows, or their opening sashes, into the functional space;

(b) failure of the associated hardware (window rollers, door locks, hinges and keepers) under the unusually heavy glazing loads;

(c) injury to users opening and closing heavy sashes;

(d) creation of trip hazards in doorways;

(e) injury to children as a result of the momentum of heavy doors;

(f) incompatibility of modern materials with period decor and finish;

(g) need to preserve heritage features of a building;

(h) personal intercommunication and the relationship of spaces;

(i) location, installation and maintenance of mechanical ventilation;

(j) seismic and structural integrity of building; and

(k) fire hazards due to electrical cabling becoming embedded in insulation material, or where insulation prevents the dissipation of heat from electrical appliances and fittings, especially down-lights.

E3.2 Planning

For new construction, greater efficiency and effectiveness are achieved by considering acoustic factors from the earliest planning stages. Decisions should be made early in the planning process regarding the acoustic perimeter, the type of mechanical ventilation and any zones for its operation and control, wall and roof systems best suited to the level of noise exposure, and aesthetically and functionally suitable window types and proportions. Careful attention to modular dimensions permits the use of available insulating materials—such as batts, boards, and membranes—with minimum additional expense. Judicious location of attached garages and roofed outdoor spaces can reduce the level of noise penetrating perimeter walls.

Insulation of an existing construction can be more costly than that of a new construction because of—

(a) the difficulty of gaining access to the areas requiring treatment;

(b) the need to fit components to non-modular spaces, resulting in wastage of material and additional effort in installation; and

(c) less flexibility in the choice of components because of the need to match existing features.

The functional requirements set out in Paragraph E3.1 should be considered during planning.

E3.3 Choice of elements

E3.3.1 *Roofs*

Pitched roofs with a voluminous ceiling space reduce noise more effectively than roofs with a ceiling which follows the form of the external sheeting. Larger roof voids can also accommodate ventilation equipment and ducts, and facilitate their subsequent maintenance. Over larger spans they can also be more readily strengthened to carry the extra weight of insulation and plant.

E3.3.2 *Fibrous insulation*

Fibrous insulation should exhibit the following properties:

(a) Long term stability such that the properties will not change over time. The insulation should not settle under its own weight, blow away, or be otherwise displaced.

(b) Adequate acoustic performance, which may depend on factors such as thickness, mass per unit volume, fibre diameter, and fibre disposition.

(c) Fire retardance.

(d) Insect and vermin resistance.

(e) Non-toxicity.

(f) Non-corrosiveness.

E3.3.3 *Flexible acoustic membranes*

Flexible acoustic membranes are an effective alternative to rigid board insulation, especially for retrofit application. They should exhibit the following properties:

(a) Long term stability, especially when subjected to high roof-space temperatures.

(b) Adequate acoustic performance, which may depend on the relative rigidity of the membrane, mass per unit area, thickness and porosity.

(c) Fire retardance.

(d) Insect and rodent resistance.

(e) Non-toxicity.

NOTE: The combustion products of flexible acoustic membranes should also be non-toxic.

E3.3.4 *Windows*

It is possible to purchase from a large range of laboratory tested acoustic windows for different applications (secondary only, new primary and secondary, new stand-alone) in different styles (sliding, double hung, awning, casement) and different materials (aluminium, wood, UPVC). The availability of product of proven quality should be established before design commences.

In choosing and installing windows, the primary functions of a window to exclude the weather and admit light should not be overlooked. Stand-alone windows, or any secondary windows installed externally, should be constructed to the requirements of AS 2047. Flashings should be properly detailed, water drains should be maintained, and original window sight lines should not be impeded. Windows should also conform to any local planning requirements. For example, new stand-alone windows are not permitted in some designated heritage precincts.

E3.3.5 *Doors*

Doors are an important visual element of a building. The character of an existing building can often be retained by carefully strengthening an existing door with panels of acoustic membrane and fixing laminated glass behind existing glazing.

E3.3.6 *Ventilation*

An acoustically insulated building must be kept virtually air tight to exclude external noise. Therefore mechanical ventilation or airconditioning is needed to provide fresh air and to control odours. Requirements for acceptable indoor-air quality are given in AS 1668.2. Recommended design sound levels for different areas of occupancy in buildings are given in AS 2107.

NOTES:

1 The requirements of AS 1668 should be viewed as applying also to Class 1 buildings as defined by the Building Code of Australia.

2 In domestic situations, the minimum requirements set out in AS 1668 are not always adequate to remove kitchen cooking odours or to control damp in older residences.

Rising damp can cause severe fungal growth when an insulated house is left closed for a prolonged period. A time-clock controlled ventilation cycle of one hour per 24 hours has been found to provide adequate prevention in Sydney.

Special attention should be given to the detailing of ducts in any uninsulated ceiling space to prevent external noise penetrating the occupied spaces by way of the air ducts.

The acoustic design should take account of any additional noise from the ventilation system in the treated space. Because an insulated house has an unnaturally low ambient internal noise level during quiet periods, some occupants can be unusually sensitive to mechanical plant or diffuser noise.

E3.4 Construction

The roof spaces of existing buildings usually contain dust (sometimes of the order of hundreds of kilograms per house) with a high concentration of lead. This dust should be removed and handled in accordance with legislative provisions (e.g. OH&S and environmental legislation) before insulation work commences.

Installation and modification of electrical wiring should be performed in accordance with AS/NZS 3000. If wiring has to be covered by insulation, the circuits should be rated and protected as required by AS/NZS 3000. Down-lights in contact with insulation have been the source of ignition. The minimum requirements to be followed where down-lights are pre-existing or have been installed after provision of acoustic insulation are set out in AS/NZS 3000. Failure to address these issues satisfactorily can result in life-threatening situations. In addition, the impact of existing noise insulation components needs to be considered carefully when electrical retrofits are undertaken. Adequate physical separation of heat generating appliances and insulating materials needs to be provided, together with provision for adequate heat dissipation. Excessive heat buildup can initiate fires in the surrounding insulation, in the building structure, or in the appliance itself. Details to prevent these problems might breach the designed acoustic barrier, reducing its effectiveness. Such practical considerations dictate against the use of recessed down-lights where ceilings are close to the profile of the roof.

Where foil-faced acoustic membranes are used, the installation of residual current or earth leakage circuit breakers to all circuits should be considered to protect installers and maintenance workers from inadvertent short circuits to the foil.

Roof structures should be designed or strengthened for the additional insulation and plant loads. For all buildings other than residences of straightforward configuration, the effect of the additional insulation mass upon the stability of the building under earthquake loads should be considered in accordance with AS 1170.4 and AS 3826.

The weight of acoustic windows is much greater than that of other windows. Window fixings should be designed to resist wind and self-weight loads. As a collapsing window is potentially life threatening, positive mechanical fixings should be used and reliance should not be placed on glues. In retrofit situations, strengthening of existing wall frames and window sub-frames is sometimes necessary.

Care should be taken that insulation loads are not transferred to ceiling linings with inadequate load-carrying capacity. Steel straps, mesh, or slats can be installed to support flexible acoustic membranes; in cases of light ceiling construction, fibrous insulation can also require independent support. When installing fibrous insulation to external walls, care should be taken to avoid creating bridges that allow the transfer of water from the outer cladding to the insulation and inner lining.

APPENDIX F

SELECTION OF BUILDING COMPONENTS FOR REDUCTION OF AIRCRAFT NOISE

(Informative)

F1 GENERAL

F1.1 Selection of components

This Appendix presents a method for selecting building components, based on their sound reduction index (R) or weighted sound reduction index (R_w) values, in order to achieve a specified aircraft noise reduction (*ANR*) value.

NOTE: An explanation of the relationship between weighted sound reduction index, R_w, and sound transmission class, *STC*, is provided in AS/NZS 1276.1.

This Appendix describes a method for the selection of building components and the types of construction which may be necessary to achieve particular ANR values. However, for the detailed design of buildings to meet ANR requirements as specified in this Standard, specialist acoustic advice should generally be sought.

NOTE: As high levels of aircraft noise tend to be dominated by low frequency components, R_w ratings alone are not a reliable guide as to the attenuation properties of building components. The full spectrum information of the building component should be used where an *ANR* in excess of 30 is required.

F1.2 Number of components

It is assumed that noise from aircraft will, usually, enter a room through only the following components:

(a) Ceiling, if no other rooms are between a ceiling and the building roof.

(b) External wall.

(c) Window.

(d) External door.

To achieve the desired noise reduction for a room, it is necessary to select an adequate construction for each of the components present.

NOTES:

1 The procedure outlined in Paragraph F2 results in equal quantities of noise energy entering through each component present.

2 If more than one type of construction is used for any of the components in Items (a) to (d) above, each type should be treated as an individual component.

3 If floors are elevated so that they are exposed in a way similar to the other components, they should be included and their construction selected in accordance with Paragraph F2 (see Note to Paragraph F2.6.2(c)(iii)).

F1.3 Aircraft noise attenuation by building components

For the purpose of this Appendix, a characteristic of a building component called the aircraft noise attenuation (ANA_c) is defined as the reduction in aircraft noise level, in dB(A), between the level outside and the level inside a room that—

(a) contains an equivalent absorption area numerically the same as the area of that component in the envelope of the room; and

(b) is elsewhere bounded by components assumed to transmit zero aircraft noise.

NOTE: The numerical value of the aircraft noise attenuation of a component depends on both the spectral composition of the aircraft noise and the sound transmission loss of the component. If both these factors are known, the value of ANA_c can be calculated in accordance with Appendix G.

F2 DETERMINE ANA_c REQUIRED OF EACH COMPONENT

F2.1 General

This Paragraph enables the determination of the ANA_c value required for each component of the room's envelope subject to the conditions that—

(a) the desired aircraft noise reduction, in dB(A), for the room will be achieved; and

(b) there will be an equal quantity of noise energy transmitted through each component (see Note 1 to Paragraph F1.2).

F2.2 Determine number of components (N)

By reference to Paragraph F1.2, determine the number of components (N) present in the external envelope of the room or the space. N will usually equal 1, 2, 3, or 4; it will equal more if Note 2 or Note 3 to Paragraph F1.2 applies.

F2.3 Determine the ceiling height (h)

Determine the ceiling height (h) of the room in metres.

NOTE: In many instances h will be between 2.6 m and 3.3 m, for which 3 m is a sufficiently accurate approximation.

F2.4 Determine the area ratio (S_c/S_f) for each component

For each component present and for the floor of the room, estimate the surface area to within an accuracy of ±10%. Then determine the ratio of each component's surface area (S_c) to that of the floor of the room (S_f), i.e. the area ratio will be S_c/S_f.

NOTE: The ceiling, if a component, will frequently have an area ratio of 1.

F2.5 Estimate the reverberation time (T) of the room, in seconds

For normally furnished and occupied living rooms and bedrooms, T will be approximately 0.5 s. Sparsely furnished and occupied rooms such as bathrooms, kitchens and corridors, may have a T as long as 1 s.

NOTE: If a room is to be protected against intruding noise such as that from aircraft, it is usually not desirable for it to have a reverberation time as long as 1 s. Sound-absorbent materials, such as carpets, drapes, soft furnishings or ceiling tiles, should be introduced to make the environment, when normally occupied, more like that of a typical living room. Exceptions to this may be buildings such as large auditoria and churches, in which longer reverberation times, e.g. 2 s, may be required. In these cases, the value of T is usually known accurately or is predictable as a function of frequency, e.g. the value of T may be taken at 500 Hz or as the average from 100 Hz to 5000 Hz and this value should be used in the application of Paragraph F2.5.

F2.6 Determine the orientation effect (K_c) for each component

F2.6.1 *General*

The orientation effect, K_c, of a building component represents the attenuation of aircraft noise reaching the component due to its orientation with respect to the aircraft. In general, this parameter varies from 0 dB for components directly facing the aircraft to approximately 8 dB for components which are well shielded.

As a first approximation, it may be acceptable to set this parameter to 6 dB for all components. Alternatively, the guidelines below may be used.

F2.6.2 *More accurate determination of K_c*

Approximate allowances for K_c, in decibels, for the level of exposure of building components by sound waves from an aircraft at point of closest passing, may be made by the following procedure:

(a) Estimate the height H of the aircraft above the building in metres, at the point of closest passing, using the appropriate equation as follows:

$$H_L = 0.052DL + 16 - E \text{ (if landing is involved)} \quad \ldots \text{F1}$$

or

$$H_T = 0.11DT - 160 - E \text{ (if taking off is involved)} \quad \ldots \text{F2}$$

where

H_L = height of aircraft landing, in metres

H_T = height of aircraft taking off, in metres

DL = Distance coordinate for building site relative to runway (as specified in Clause 3.1.3) uncorrected for site elevation, in metres

DT = distance coordinate for building site relative to runway (as specified in Clause 3.1.3) uncorrected for site elevation, in metres

E = excess height by which the elevation of the building site exceeds that of the airport, in metres

(b) For each wall of the building, determine on the ground plane the orientation angle θ between the normal (perpendicular) to the wall, and the line to the building from the point beneath that of the closest aircraft passing. Values of θ between ±90°, i.e. corresponding to walls whose outside surface would be directly irradiated by the aircraft at that point, should be estimated to within ±5°. If θ is between 90° and 175° in magnitude, merely note the fact; if θ is between 175° and 180° in magnitude, note whether the wall is facing a parallel one on a nearby building.

(c) The following approximate procedures for estimating orientation effects, K_c, in decibels take into account the angle of sound incidence on directly irradiated surfaces (at closest passing), diffraction around building edges onto surface not directly irradiated, and reflections off the ground and nearby buildings.

In the following equations for K, for aircraft landings let H be H_L; while for aircraft take offs, let H be H_T.

(i) *Roofs*

In the case where a single (skillion) roof plane has been arranged to slope down directly away from the closest passing point with a slope, in degrees, exceeding (arctan $(H/DS) - 10$), the following value of K may be adopted: $K_{RS} = 8$ dB.

For all other roof configurations (flat, hip, gable butterfly, sawtooth, and so on), it is recommended that they be treated as simple horizontal planes, for which the orientation effect can be calculated as—

$$K_{RH} = 10 \log_{10} [1 + (DS/H)^2]^{½} \quad \ldots \text{F3}$$

up to a maximum value $K_{RH} = 8$ dB

(ii) *Walls, windows, doors*

Where the value of θ is between ±90°, let

$$K_w = 10\log_{10}\left(\frac{[1+(DS/H)^2]^{½}}{(DS/H)\cos\theta}\right) \quad \ldots \text{F4}$$

up to a maximum value $K_w = 8$ dB.

Where θ is outside the range ±90°, let K_w = 8 dB, except where θ is within 5° of ±180° and a parallel wall of a similar or larger building is 6 to 12 m away, in which case let K_w = 3 dB.

(iii) *Floors, elevated or suspended*

The following two well-defined examples represent two rather extreme cases. In both equations, the value of K_w pertaining to the wall of the building having the least magnitude of angle θ is recommended.

(A) *Very exposed floor* elevation above ground of 2 m or more; site level; subfloor space completely open all around. In this case use the following equation:

$$K_{FE} = K_{RH} + K_w \quad \text{. . . F5}$$

up to a maximum value K_{FE} = 8 dB

(B) *Well-shielded floor* elevation above ground 1 m or less; site level; subfloor space walled in completely except for the minimum open venting required by regulations. In this case use the following equation:

$$K_{FS} = (K_w + 5) \quad \text{. . . F6}$$

NOTE: Other practical suspended floor designs will tend to result in orientation effects intermediate between those shown in Items (A) and (B). Since the two estimates K_{FE} and K_{FS} do not differ by more than 5 dB, a subjective interpolation between these two values would be appropriate for a construction which appears to offer an intermediate degree of shielding.

F2.7 Determine the aircraft noise attenuation required of each component

Determine the aircraft noise attenuation required of each component to achieve the specified aircraft noise reduction, using the following equation:

$$ANA_c = ANR + 10 \log_{10} [(S_c/S_f) \times (3/h) \times 8TN] - K_c \quad \text{. . . F7}$$

where

ANA_c = the aircraft noise attenuation required of the component, in dB(A)

ANR = required aircraft noise reduction, in dB(A)

S_c/S_f = area ratio of the component

h = ceiling height of room, in metres

T = reverberation time of room, in seconds

N = number of components

K_c = orientation effect for the component, in decibels

F3 SELECT MATERIALS AND CONSTRUCTIONS HAVING THE ANA_c REQUIRED

F3.1 Determination of ANA_c

The ANA_c value of a particular building material or construction may be determined from the sound reduction index *(R)* values of that material or construction over a range of frequencies, together with spectral data for the aircraft noise event under consideration. A method for performing this calculation is set out in Appendix G.

NOTES:

1 If either the relevant sound reduction index data or aircraft noise spectral data are unavailable, an approximation to the ANA_c value for the building component may be derived from the weighted sound reduction index (R_w) or weighted apparent sound reduction index (R'_w) of the material or construction (see AS/NZS 1276.1). These values are generally quoted

in reports of sound reduction index tests, and in information supplied by manufacturers. If these data are used, the ANA_c value for the component may be approximated as—

$$ANA_c \approx R_w - 5 \text{ or } R'_w - 5 \qquad \ldots F8$$

2 The average spectral allowance of 5 dB adopted here applies to many aircraft types and movements and is based on—

(a) measurements of their respective maximum noise spectra at points near major airports; and

(b) computations of how these spectra would interact with the sound reduction index versus frequency characteristics of a large number of building components (see Appendix G).

3 Design procedures involving the optimization of costs and building performance, for which aircraft noise reduction may be one factor, are beyond the scope of this Standard. For example, the final selection of components may be made after consideration of the relative merits of various area ratios for the components, or departures from the principle of equal acoustic energy transmission per component.

F3.2 Limitations of procedure

Most components identified as probably suitable by the procedure given in Paragraph F3.1 will actually provide ANA_c values within ±3 dB(A) of the value desired, provided builders' or sub-contractors' methods and procedures are appropriately specified and supervised; errors of 5 dB(A) may be expected if these precautions are not taken into account. For buildings where errors of this magnitude can be tolerated, the selection of components may be made from those identified as providing ANA_c values equal to or greater than the values determined in Paragraph F2.

More accurate ANA_c values than those derived from R_w or R'_w values may be computed directly from sound transmission losses by the method given in Appendix G. This procedure should be adopted when greater confidence in the ANA_c values is required.

APPENDIX G

DIRECT COMPUTATION OF ANA_c

(Informative)

Where spectral data for the relevant aircraft noise and for the sound reduction index value for the component under consideration are both available, ANA_c may be predicted from the following equation:

$$ANA_c = 10\log_{10}\sum_{f_{min.}}^{f_{max.}} \text{antilog}_{10}\frac{L_f + C_f}{10} - 10\log_{10}\sum_{f_{min.}}^{f_{max.}} \text{antilog}_{10}\frac{L_f + C_f - R_f}{10} \qquad \ldots \text{G1}$$

where

ANA_c = aircraft noise attenuation that the component (c) of the particular form of construction under consideration will provide against noise having that spectrum, in dB(A)

L_f = relative spectral level for the noise concerned, in the one-third octave band centred on frequency f

C_f = value of the A-weighting function at the frequency f, as given in AS 1259.1, in decibels

R_f = value of the sound reduction index in the one-third octave band centred on frequency f, in decibels

f = the set of standard one-third octave band centre frequencies ranging from $f_{min.}$ to $f_{max.}$ corresponding to the range available in the published weighted sound reduction index data for component (c).

NOTE: It is desirable to use the range 100 Hz to 5000 Hz inclusive, but overseas data often limit the range to either 100 Hz to 3150 Hz or 125 Hz to 4000 Hz. Analogous computation in 1/1 octave bands would be adequate, but the sound reduction index data would be required in that form.

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