



AEROSPACE INFORMATION REPORT

AIR6501™

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Method for Modeling Line-of-Sight Blockage of Aircraft Noise

RATIONALE

This Aerospace Information Report (AIR) describes a method to calculate noise level adjustments due to line-of-sight blockage (LOS) of the noise propagation between a source and receiver by terrain for the purposes of aircraft noise prediction modeling.

AIR1845 provides guidance for modeling aircraft noise at airports with flat terrain. In reality, many airports are surrounded by non-level terrain that may result in noise blockage (or shielding) at some nearby receptors. This noise blockage can be accounted for with the line-of-sight blockage calculation, based on the difference in propagation path length between the direct path (straight line between source and receiver, terrain feature absent) and the propagation path over or around the terrain feature.

FOREWORD

SAE International Aircraft Noise Committee (A-21) initiated activity to provide a method to compute attenuation of sound due to line-of-sight blockage or shielding from non-level terrain around airports. This method follows closely the methods used for computing basic (single-edge diffraction) attenuation due to noise barriers adjacent to roadways and other transportation/transit noise sources. This method has been updated for use with aircraft noise sources.

This method will benefit current noise prediction models by introducing the capability of modeling shielding of aircraft noise by terrain, resulting in more accurate calculation of noise exposure around airports.

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TABLE OF CONTENTS

1.	SCOPE.....	3
1.1	Purpose	3
2.	REFERENCES.....	3
2.1	Applicable Documents	3
2.1.1	SAE Publications.....	3
2.1.2	ANSI Accredited Publications	3
2.1.3	FICAN Publications	3
2.1.4	NTIS Publications.....	4
2.2	Related Publications	4
2.2.1	SAE Publications.....	4
2.2.2	Defense Technical Information Center Publications.....	4
2.2.3	ECAC Publications	4
2.2.4	Elsevier Publications	4
2.2.5	FAA Publications	4
2.2.6	ICAO Publications	4
2.2.7	ISO Publications.....	5
2.2.8	NAP Publications	5
2.2.9	NASA Publications	5
2.2.10	VNTSC Publications.....	5
2.2.11	Wiley Online Library Publications	5
2.3	Definitions	5
3.	LINE-OF-SIGHT BLOCKAGE	6
3.1	Line-of-Sight Blockage Adjustment (LOS_{ADJ}).....	6
4.	APPLICATION NOTES	12
5.	NOTES	12
5.1	Revision Indicator.....	12
APPENDIX A	LINE-OF-SIGHT BLOCKAGE EXAMPLE.....	13
Figure 1	Line-of-sight blockage example	7
Figure 2	Line-of-sight blockage concept, where the direct path is blocked by a terrain feature.....	8
Figure 3	Line-of-sight blockage concept, where the direct path is not blocked by a terrain feature	8
Figure 4	Attenuation versus path length difference, positive values of N	10
Figure 5	Attenuation versus path length difference, negative values of N.....	11

1. SCOPE

1.1 Purpose

This document describes methods for calculating the attenuation of sound due to line-of-sight blockage or shielding from non-level terrain. This method applies to sound propagating from an airplane to locations on the ground during ground roll, climbout after liftoff, and landing operations.

AIR1845 and AIR5662 provides guidance for modeling aircraft noise at airports with flat terrain. In reality, many airports are surrounded by non-level terrain that may result in attenuation (or shielding) of sound at some receptors. This noise blockage can be accounted for with the line-of-sight blockage calculation, based on the difference in propagation path length between the direct path and propagation path over the top of terrain feature. The purpose of this aircraft information report is to provide a method that accounts for the attenuation due to line-of-sight blockage of aircraft noise by terrain features.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AIR1845	Procedure for the Calculation of Airplane Noise in the Vicinity of Airports
AIR5662	Method for Predicting Lateral Attenuation of Airplane Noise
ARP866	Standard Values of Atmospheric Absorption as a Function of Temperature and Humidity
ARP5534	Application of Pure-Tone Atmospheric Absorption Losses to One-Third Octave-Band Data

2.1.2 ANSI Accredited Publications

Copies of these documents are available online at <http://webstore.ansi.org/>.

ANSI/S1.6-2016	Preferred Frequencies, Frequency Levels, and Band Numbers for Acoustical Measurements
ANSI/S1.11-2014 Part 1	Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters
ANSI/S1.1-2013	Acoustical Terminology, American National Standard

2.1.3 FICAN Publications

Available from Federal Interagency Committee on Aviation Noise, <http://www.fican.org/>.

Assessment of Tools for Modeling Aircraft Noise in the National Parks

2.1.4 NTIS Publications

Available from National Technical Information Service, 5301 Shawnee Road, Alexandria, VA 22312, Tel: 1-888-584-8332 or 703-605-6050, www.ntis.gov.

FHWA-RD-77-108 FHWA Highway Traffic Noise Prediction Model (NTIS number 198118)

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

AIR1751 Prediction Method for Lateral Attenuation of Airplane Noise During Takeoff and Landing

2.2.2 Defense Technical Information Center Publications

Available from the Defense Technical Information Center, Fort Belvoir, Virginia 22060, USA; telephone +1 800 225 3842, <https://discover.dtic.mil/>.

AFRL-HE-WP-TR-2002-0132 NMAP 7.0 User's Manual

2.2.3 ECAC Publications

Available from the European Civil Aviation Conference website at <https://www.ecac-ceac.org/>.

ECAC Doc 29 Standard Method of Computing Noise Contours Around Civil Airports

2.2.4 Elsevier Publications

Available from the Elsevier Internet website at <http://www.sciencedirect.com/>.

Kurze, U.J. and Anderson, G.S., "Sound Attenuation by Barriers," Applied Acoustics, Vol 4, p. 35-53, 1971.

Maekawa, Z., "Noise Reduction by Screens," Applied Acoustics, Vol 1, p. 157-173, 1968.

2.2.5 FAA Publications

Available from Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC 20591, Tel: 866-835-5322, www.faa.gov.

FAA-AEE-07-04 Integrated Noise Model (INM) Version 7.0 User's Guide

2.2.6 ICAO Publications

Available from International Civil Aviation Organization, 999 University Street, Montreal, Quebec H3C 5H7, Canada, Tel: +1 514-954-8219, <http://www.icao.int/>.

ICAO 9911 Recommended Method for Computing Noise Contours around Airports

ICAO 7488/3 Manual of the ICAO Standard Atmosphere

2.2.7 ISO Publications

Copies of these documents are available online at <http://webstore.ansi.org/>.

9613-2:1996 Acoustics - Attenuation of Sound During Propagation Outdoors - Part 2: General Method of Calculation

2.2.8 NAP Publications

Available from the National Academies Press at <http://www.nap.edu/>.

ACRP Synthesis 9 Effects of Aircraft Noise: Research Update on Selected Topics

2.2.9 NASA Publications

NASA Technical Services, NASA STI Program STI Support Services, Mail Stop 148, NASA Langley Research Center, Hampton, VA 23681-2199, 757-864-9658, Fax: 757-864-6500, <http://ntrs.nasa.gov/>.

Contractor Report No. 3406 Handbook of Aircraft Noise Metrics

2.2.10 VNTSC Publications

Available from John A. Volpe National Transportation Systems Center, 55 Broadway, Cambridge, MA 02142, Tel: 617-494-2000.

5DTS-34-FA065-LR1 Spectral Classes for FAA's Integrated Noise Model

DOT-VNTSC-FAA-17-16 Aviation Environmental Design Tool (AEDT) Technical Manual Version 2d

DOT-VNTSC-FHWA-98-2 FHWA Traffic Noise Model (FHWA TNM) Technical Manual

2.2.11 Wiley Online Library Publications

Available from the Wiley Online Library at <http://onlinelibrary.wiley.com/>.

Sutherland, L.C. and Daigle, G.A., "Atmospheric Sound Propagation," Encyclopedia of Acoustics, Vol. 1, p. 341-365, 2007.

2.3 Definitions

2.3.1 BASELINE NOISE DATA

Commonly referred to as noise-power-distance (NPD) data. A set of noise levels expressed as a function of engine power, usually the corrected net thrust per engine, and distance. Baseline noise data account for sound propagation over distance, taking into account the spreading of sound and atmospheric absorption through a standard atmosphere, as described in AIR1845. Each set of data typically represent a specific aircraft (airframe and engine) and a range of engine power settings that represent typical aircraft operating conditions (approach, departure, and level flight).

2.3.2 FLIGHT PATH

A directed straight line in three-dimensional space including the aircraft speed, the corrected net thrust per engine at the beginning point of the line, and change in speed and thrust along the line to the end point. A set of flight path segments describes the geometrical and physical parameters used to model the movement of an aircraft in three-dimensional space. Each flight path point contains: (1) the geographical location (x- and y-value) relative to the origin of the airport, (2) the aircraft altitude above field elevation, (3) the aircraft speed relative to the ground (true airspeed without wind), (4) the corrected net thrust per engine or equivalent parameter used to access the baseline noise data, (5) duration (seconds) of the flight path segment following the point, and (6) aircraft bank angle for the flight path segment following the point (if applicable).