U.S. Department
of Transportation
Federal Aviation
Administration

Advisory Circular

Subject: Guidelines for Sound Insulation of Structures Exposed to Aircraft Noise	Date: **Draft**	AC No: 150/5000-9B
	Initiated By: APP-400	Change:

1. Purpose.

This advisory circular (AC) provides guidance on developing and managing sound insulation programs (SIP) that mitigate noise impacts to structures exposed to aircraft noise around airports.

2. Cancellation.

This AC cancels AC 150/5000-9A, *Announcement of Availability--Report No. DOT/FAA/PP/92-5, Guidelines for the Sound Insulation of Residences Exposed to Aircraft Operations,* dated July 2, 1993, and changes the title of the AC to *Guidelines for Sound Insulation of Structures Exposed to Aircraft Noise.*

3. Application.

This AC is intended for sound insulation programs for residences and public buildings (i.e., schools and hospitals) that receive Airport Improvement Program (AIP) grants or Passenger Facility Charge (PFC) funding. Residences and public buildings that are eligible for sound insulation are referred to as structures in this AC. This AC does not constitute a regulation, and is not legally binding in its own right. It will not be relied upon as a separate basis by the FAA for affirmative enforcement action or other administrative penalty. Conformity with this AC is voluntary, and nonconformity will not affect rights and obligations under existing statutes and regulations, except for the projects described in subparagraphs 2 and 3 below:

1. The standards and processes contained in this AC are specifications the FAA considers essential for the fidelity of Residential Sound Insulation Programs.
2. Use of these standards and guidelines is mandatory for projects funded under Federal grant assistance programs, including the Airport Improvement Program (AIP). See Grant Assurance #34.

3. This AC is mandatory, as required by regulation, for projects funded by the Passenger Facility Charge program. See PFC Assurance #9.

Note: This AC provides one, but not the only, acceptable means of meeting the requirements of 14 CFR Part 139, *Certification of Airports*.

4. **Principal Changes.**

The focus of these guidelines has changed from primarily presenting the technical aspects of sound insulation programs (such as sound exposure and insulation metrics, sound insulation methods and plans, and specifications requirements) to also providing guidance on conducting and managing a sound insulation program. These guidelines apply to sound insulation programs for non-residential public buildings as well as residential buildings and incorporate research results from the Transportation Research Board's (TRB) Airport Cooperative Research Program (ACRP) Report 89, *Guidelines for Airport Sound Insulation Programs* and ACRP Report 152, *Evaluating Methods for Determining Interior Noise Levels Used in Airport Sound Insulation Programs*. Both of these provide additional information on the technical aspects of sound insulation program, such as property surveys, development of an acoustical test plan, testing methods, determination of noise level reductions (NLRs), testing, and establishing program boundaries. The revised AC describes:

1. Participants' roles and responsibilities
2. Steps of sound insulation program development and management
3. Considerations for phasing and treatment strategies
4. Community outreach
5. Acoustical engineering principles and testing
6. Project cost development and funding opportunities
7. Best practices for program reporting and closeout

5. **Feedback on this AC.**

If you have suggestions for improving this AC, please use the Advisory Circular Feedback form at the end of this document.

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CHAPTER 1. INTRODUCTION

1.1 Background.

1.1.1 The Aviation Safety and Noise Abatement Act (ASNA) of 1979[1] required the Federal Aviation Administration (FAA) to identify levels of significant impact and designate compatible and non-compatible land uses in areas surrounding airports in the United States. On December 18, 1984, the FAA published 14 Code of Federal Regulations (CFR) Part 150, *Airport Noise Compatibility Planning*, which describes the procedures, standards, and methodology for developing noise exposure maps, noise compatibility programs, and the FAA's process for approving these programs.[2] It also establishes a single system for measuring noise exposure and outlines compatible land uses for varying levels of exposure.

1.1.2 Airports may pursue measures to achieve noise compatibility through a voluntary 14 CFR Part 150 study or as part of a federal action[3] under the National Environmental Policy Act (NEPA). Examples of methods used by airports to improve airport noise compatibility, mitigate noise effects of a proposed action, or pursue noise abatement when conducting a Part 150 or NEPA study include:

- Changes in how aircraft operate to reduce noise in the surrounding area.
- Land use measures such as acquisition of surrounding properties or sound insulation of structures.
- Construction of noise walls.
- Compatibility with local regulations and zoning requirements.

1.1.3 The Part 150 study process provides a structured approach for collaboration between the airport, airlines and other airport users, neighboring communities, and the FAA resulting in the airport's submission of Noise Exposure Maps (NEMs) and a Noise Compatibility Program (NCP) to the FAA. The NCP will describe the proposed methods to achieve noise compatibility, which may include sound insulation measures. The FAA will issue a Record of Approval (ROA) that approves or disapproves of each proposed measure identified in the NCP, and identifies which mitigation measures are eligible for funding consideration under the Airport Improvement Program (AIP).

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[1] Aviation Safety and Noise Abatement Act of 1979, Pub. L. No. 96-193 (Feb. 27, 1979).
[2] 14 CFR Part 150, *Airport Noise Compatibility Planning.*
[3] A federal action may involve federal funding and/or a project subject to federal control and responsibility.

1.1.4 For a NEPA analysis, mitigation for significant noise impacts[4] are documented in a Record of Decision (ROD). A ROD is issued by a lead federal agency (in this case, the FAA) after a NEPA process is completed that involves mitigation for significant impacts. The ROD defines the mitigation commitments.

1.1.5 A Sound Insulation Program (SIP) may be developed as the result of recommendations in either an NCP or a ROD as one of several possible mitigation measures. The SIP provides a consistent process by which an airport operator may identify properties impacted by aircraft noise and implement mitigation measures.

1.2 Purpose of this AC.

1.2.1 This advisory circular (AC) provides guidance on the development and management of SIPs to mitigate aircraft noise impacts around airports. Use of this AC is mandatory for all SIPs supported by AIP grants or Passenger Facility Charge (PFC) revenue and recommended for SIPs supported by airport revenue. This document:

- Establishes uniform procedures for the FAA Office of Airports (ARP) and airport owners and operators to define and implement a SIP for residences or public[5] buildings (structures) determined to be non-compatible with aviation noise.
- Clearly defines the design objective of a SIP so there is a direct relationship between the objective and the treatment options recommended to meet the design objective.
- Provides a consistent, general explanation of SIPs for use in the public outreach process to ensure informed expectations of these programs.
- Includes a standardized noise-testing methodology to determine non-compatible structures within the boundaries of each phase of a SIP considered to be impacted.

1.2.2 This AC is intended for use by FAA staff, airport operators, airport consultants, and contractors to ensure SIPs are designed and implemented in accordance with FAA policies and are accurately described to the public. Other FAA regulations, policies, and guidance remain in effect and are not superseded by this AC.

[4] Significant noise impacts are defined in FAA Order 1050.1, *Environmental Impacts: Policies and Procedures,* and in FAA Order 5050.4, *National Environmental Policy (NEPA) Implementing Instructions for Airport Actions.*
[5] In this AC, public buildings are considered hospitals, places of worship, and public schools.

1.3 Relationship between this AC and Other FAA Guidance and Regulations.

1.3.1 FAA Order 5100.38, *Airport Improvement Program (AIP) Handbook.*

The AIP Handbook provides guidance on eligibility and justification determinations for funding elements of noise abatement and mitigation measures under the AIP. This AC refers to the AIP Handbook for any determinations of AIP funding eligibility. The AIP Handbook is regularly updated in response to changes to AIP-related legislation in the U.S. Code (U.S.C.) Title 49. A noise abatement or mitigation measure is not identified as eligible for funding in the AIP Handbook, the ADO must coordinate with APP-400 and APP-500 to establish an eligibility determination. Defined by the AIP Handbook, eligibility – or qualifications for funding – is determined by modeled noise impact and noise level reduction values determined through testing.

1.3.2 FAA Order 5500.1, *Passenger Facility Charge (PFC).*

The PFC program is authorized by 49 U.S.C. §40117. This statute was implemented by the Aviation Safety and Capacity Expansion Act of 1990 (Pub. L. No. 101-508) and authorizes the Secretary of Transportation to allow an airport operator to impose a fee for each paying passenger of an air carrier enplaned at (departing from) the airport. This revenue finances eligible airport projects at the airport, including sound insulation programs, as defined in the FAA Order 5100.1, *Passenger Facility Charge.* Under 49 U.S.C. § 40117, the airport operator must receive approval from FAA before implementing a PFC program.

1.3.3 14 CFR Part 150, *Airport Noise Compatibility Program*.

A SIP can be defined as a NCP measure in a Part 150 study. Initial SIP boundaries, or program limits, are determined in the Part 150 study, based on the NEMs and areas previously mitigated as a result of RODs. Part 150 NEMs must be current to determine impacted structures. Therefore, a SIP boundary may shift if noise exposure changes, as reflected by updated NEMs.

1.3.4 National Environmental Policy Act of 1969.

NEPA noise mitigation commitments will define the SIP boundary. NEPA noise mitigation commitments, which are based on significant impact criteria and may include residential and/or public building sound insulation measures, are specific to the ROD for a particular airport-related development project. Noise mitigation requirements defined in a ROD will not change unless project modifications after the ROD is issued result in new or alter significant noise exposure impacts. FAA's NEPA guidance is contained in FAA Order 1050.1, *Environmental Impacts: Policies and Procedures*, and FAA Order 5050.4, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*.

1.4 Content of this AC.

This AC is divided into nine chapters:

- **Chapter 1: Introduction** – briefly describes the AC background, goals and objectives, and content.
- **Chapter 2: Roles and Responsibilities** – describes the typical responsibilities of the FAA, airport operator, consultants, and the property owner when developing and implementing a SIP.
- **Chapter 3: Development of a Sound Insulation Program** - outlines the overall steps for developing a SIP, including preparation of the Program Policy and Procedure Manual (PPM).
- **Chapter 4: Defining and Implementing Individual Phase Components** – recommends strategies for phasing the SIP in relation to FAA grants, identification of non-compatible buildings, determination of phase boundaries, and acoustical testing and construction.
- **Chapter 5: Sound Insulation Treatment Strategies** – identifies treatments to consider based on architectural design, interior features, and exterior influences, and it addresses other design and construction considerations.
- **Chapter 6: Community Outreach** – outlines the strategies to follow when conducting community outreach in development of the SIP and PPM as well as when implementing the SIP.
- **Chapter 7: Acoustical Engineering and Testing** – defines the acoustical testing process to measure and calculate interior noise level reductions, the application of modeled results, field measurement adjustment and acoustical retesting.
- **Chapter 8: Project Cost Development and Funding** – describes SIP funding opportunities, cost development, and contracting and procurement.
- **Chapter 9: Reporting and Closeout** – describes the best practices for required reporting and the closeout process.

CHAPTER 2. ROLES AND RESPONSIBILITIES

2.1 Background.

This chapter describes the roles and responsibilities of the various entities within the FAA, airport operators and consultants, and property owners that are involved in SIPs. The Responsibility Matrix in Appendix A presents the roles and responsibilities for each of the groups and their entities described in this section for each of the tasks discussed in this AC in terms of whether each entity is responsible, assists, is consulted, or is informed.

2.2 FAA Staff.

2.2.1 In this AC, Airports District Office (ADO) refers to the FAA Office of Airports staff that works directly with the airport operator. In regional offices with no ADOs, ADO refers to the staff regional office that works directly with the airport operator.

2.2.2 The FAA approves and accepts these documents prior to the airport operator beginning the SIP process:

- NEM – ADO or Regional Division Manager accepts NEMs.
- NCP – Regional office Division Manager provides Record of Approval for NCP.
- Finding of No Significant Impact (FONSI)/Record of Decision (ROD) or ROD – APP-400 approves FONSI/ROD or Environmental Impact Statement (EIS) ROD resulting from NEPA documentation (unless approval authority has been delegated to the region or ADO on a case-by-case basis).

2.2.3 In this AC, current NEMs, NCPs, FONSI/RODs and RODs[6] are the "controlling documents" that define how the SIP is developed and implemented.

2.2.4 FAA ADO Noise Subject Matter Expert (SME).

The FAA ADO Noise SME is the designated noise program specialist in each ADO or region and has the following responsibilities:

- Conduct technical reviews of all aspects of noise programs and noise projects that may be considered under AIP or PFC funding.

[6] If the controlling document for the SIP is a NEPA mitigation commitment, that commitment remains binding until it is completed or until it is no longer warranted (e.g. the project does not move forward into construction/operation).

- Review scopes of work and coordinate comments and changes with the FAA ADO Program Manager and airport operator.
- Perform review of an airport sponsor's SIP Policies and Procedures Manual (PPM), particularly the Acoustical Test Plan (see PPM requirements in Chapter 3 and Acoustical Testing Plan in Chapter 7). Provide comments to the airport operator about any elements of the PPM not in accordance with FAA policy or that would eliminate the program from consideration for FAA funding.

2.2.5 FAA ADO Program Manager.

The FAA ADO Program Manager works directly with the airport operator and fulfills these responsibilities:

- Assist in the development of SIP funding strategies with the airport operator (in consultation with the FAA ADO planner).
- Review and approve the PPM and scope of work for sound insulation projects (in consultation with the FAA ADO Noise SME).
- Make decisions regarding AIP or PFC consideration per the AIP Handbook or PFC Order. For items not specifically addressed or clearly defined in the AIP Handbook, resolve the questionable items in the FAA Region, coordinating as appropriate with APP-400 and APP-500 for a written determination.
- Attend project meetings (including public meeting as appropriate) and lead pre-design discussions.
- Provide feedback throughout the SIP process.
- Coordinate with APP-400/500 to approve additional testing (if necessary).
- Ensure compliance with NEPA and any applicable special purpose laws (particularly Section 106 of the National Historic Preservation Act of 1966 (Pub. L. No. 89-665).
- Receive and review quarterly reports for grants through grant closeout.

2.3 **Airport Operator and Consultant Team.**

2.3.1 In general, the airport operator is responsible for defining the project team composition (comprising airport staff and consultants; see Chapter 3), preparing the PPM, developing a financial plan for implementation, developing the program phasing (see Chapter 4), and implementing the SIP.

2.3.2 Airport operators should consider creating a formal roles and responsibilities matrix that identifies each position title and member role for the SIP team. The Responsibility Matrix in Appendix A can be used as a template to help the airport operator assign the position titles needed and identify the tasks for which each will be responsible.

2.3.3 The roles and responsibilities of professional disciplines and technical experts that will make up the airport operator and consultant team are described further in this section. The composition of the team could be a combination of the airport's in-house staff and consulting support staff, and could include the following positions:

2.3.4 Airport Authority, Board, or Approving Officials.

All SIPs must meet the program requirements for noise level reduction, accuracy of noise contours, reporting, and other factors defined by the 14 CFR Part 150 Record of Approval or mitigation commitments defined in a ROD. The Airport Authority, Board, or approving officials are ultimately responsible for providing milestone documentation, application for funding, quarterly reporting, and closeout information to the FAA.

2.3.5 Airport Operator's Program Manager.

2.3.5.1 The airport operator's Program Manager ensures all project work from the SIP development, implementation, and testing staff is completed in accordance with the AIP Handbook and the PFC Order in a timely manner. The Program Manager is also responsible for the airport operator's quarterly reporting and project closeout (see Chapter 9). The airport operator's Program Manager can be a member of the airport staff or a consultant team.

2.3.5.2 The specific responsibilities of the airport operator's Program Manager include:

- Provide supervision of program development, implementation, and overall program management.
- Ensure efficient and timely completion of the program and provide progress reports to the Airport Authority, Board or approving officials, and FAA.
- Submit monthly status reports, ensure contract compliance, prepare the program budget, and assist in the development of the program schedule and tasks.
- Assist in the identification and prioritization of program participants.
- Manage consultant team and conduct regular team meetings.
- Review public outreach activity plans.
- Conduct and attend public meetings.

- Supervise the development of design documents, which describe construction material options, select display materials, and develop visual presentation of the products and construction process provided to property owners7.
- Manage program website and advertisements.
- Prepare bid packages, oversee bid process, and review legal documents.
- Coordinate and assist in program closeout to the FAA.

2.3.6 Airport Operator's Program Development and Implementation Team.

2.3.6.1 Depending on the size of the program, the development and implementation team could include a variety of staff responsibilities, but it is up to the discretion of the airport operator's Program Manager to determine the most appropriate team composition. The team is responsible for the identification of program objectives, design of the program, construction and testing, and overall implementation of the SIP.

2.3.6.2 The program development and implementation team can be comprised of the team members listed in Table 2-1. Team composition will vary depending on the complexity of the SIP and local issues.

Table 2-1. Airport Operator's SIP Development and Implementation Team Roles and Responsibilities

Position	Responsibility
Property Owner Liaison	• Assist in the coordination of program activities with the team and impacted property owners; notify and communicate with the participants. • Document interactions with property owners. • Attend regular development and implementation team meetings and all public meetings.

[7] In the category of property owner, this AC includes structure owners and other public entities.

Position	Responsibility
	• Assist in property owner orientation session, distribute property owner handbooks, and project documentation. • Provide legal documents to property owners, answer questions and concerns, and coordinate property owner schedules with the program team as needed. • Communicate all pertinent information to construction staff. • Attend the design review meeting and pre-bid open house. • Update, maintain, and document file and database information and assist in invoicing and payments. Assist airport operator's Program Manager in preparing closeout documents for submittal to the FAA.
Legal Consultant	• Prepare all legal documents including title certifications, participation agreements, avigation easements, lender consent documents, etc. • Provide recommendations for changes in legal documents. • Record and document all avigation easements. Review and discuss legal issues as needed with airport operator's Program Manager.
Design Consultants	• Conduct code inspections for pre-existing deficiencies; prepare pre-existing deficiency report for submittal to the airport operator including the legal release and corrections needed in properties with deficiencies. • Coordinate with acoustical engineer. • Conduct a design (property) survey at each impacted property, prepare all designs and design packages, review

Position	Responsibility
	designs with property owners, review all design revisions, and provide solutions to property owners regarding functionality and aesthetics. • Attend pre-design meeting and develop final scope of work that incorporates corrections and changes. • Determine construction cost estimates. • Prepare bid documents (and addenda to bids and specifications), attend the pre-bid, and bid opening meetings. • Review contractors' bids and prepare a recommendation to award documents for the airport operator to submit to the ADO. • Develop and issue notice to proceed and develop and initiate contractor training. • Document with photographs all impacted properties before, during, and after construction. • Review contractor's requests for information, change orders, Buy American waiver requests[8], and submit to the ADO for review and approval. • Attend regular construction meetings and review contractor pay requests. • Develop the construction safety and phasing plan and submit to the ADO at 60 percent completion of the technical construction plans and

[8] Appendix Y of the *AIP Handbook*, FAA Order 5100.38, provides Buy American guidance, including market or product conditions that may exist requiring a waiver request allowable under 49 U.S.C. Section 50101(b).

Position	Responsibility
	specifications. Develop technical construction plans and specifications and submit them to the ADO at 90 percent completion (for each phase of the SIP as the program progresses).
Mechanical or Ventilation Engineer	• Conduct a design (property) survey to determine mechanical and ventilation requirements, inspect properties for deficiencies, and provide recommendations to correct deficiencies to the existing ventilation, insulation, and mechanical designs. • Design necessary heating, cooling, and ductwork, as well as modify ventilation design if the property survey determines it is needed. • Provide schedules, details, and drawings to include in the plans' specifications. • Coordinate with the design consultants throughout the process. Inspect all completed mechanical, ventilation, and insulation work and conduct pre- and post-construction ventilation tests.
Hazardous Materials Consultant	• Create a testing and sampling protocol based on the project scope. • Conduct tests in impacted structures where hazardous materials may be located and record all materials found. • Attend pre-design meetings and additional design meetings if hazardous materials are found in impacted structures. • Provide cost estimate for abatement work, develop abatement specifications and documentation, and provide supervision of abatement work for impacted structures where hazardous materials were found. Provide air quality monitoring, clearance

Position	Responsibility
	testing, and hazardous materials assessment of the project based on the results of the hazardous materials testing of the impacted structures.
Electrical Engineer	• Determine if any electrical deficiencies are present and if an electrical panel upgrade is necessary. • Design electrical wiring and provide schedules, details, drawings for inclusion in the plans and specifications. • Coordinate with the Design Consultants throughout the process. Inspect all completed electrical work post-construction.
Structural Engineer	• The structural engineer responsibilities may be performed by the Design Consultant because it is not always necessary or a requirement to have both an architect and an engineer.[9] When a structural engineer is part of the design and implementation team their responsibilities are to: o Determine housing and other structure types. o Determine the condition of each structure, as well as document construction suspensions. Inspect all deficiency corrections, if

[9] Some states allow engineering firms to do all the work described in this section, however most states will not allow an architectural firm to do engineering work unless there are professional engineers on staff to sign and affix a seal to the design map. The airport operator's program manager should determine the applicable laws in the state that the SIP is being conducted.

Position	Responsibility
	necessary.
Resident Engineer	• The resident engineer is familiar with the design of the project and coordinate closely with the design consultant before and during construction. Specific responsibilities of the resident engineer include: o Conduct daily site visits to all properties under construction. o Review all change orders and pay requests from the contractor (the Design Consultant is responsible for developing and ultimately submitting all change orders and pay requests). o Review compliance documentation prepared by Design Consultant of contractor disadvantaged business enterprise (DBE) requirements. o Perform inspections before final inspection. o Attend regular construction meetings. • Perform final inspection and prepare necessary reporting and closeout paperwork.
Sustainable Design Consultant	• Depending on local building code requirements, an airport operator may use a sustainable design consultant. The sustainable design consultant would preferably be a

Position	Responsibility
	LEED® Accredited Professional (LEED AP)[10] to design and administer certification of any buildings if necessary. A sustainable design consultant could also provide these services: ○ Coordinate with the local utility and government to determine what rebate or incentive programs might be available, as well as ensure the compliance of the SIP with any energy codes and ratings enforced by local, national, or international entities. ○ Conduct energy audits as necessary and create policies and procedures to meet Environmental Protection Agency (EPA) EnergyStar performance criteria. • Identify and determine any other sustainability opportunities throughout the program.[11]
Acoustical Engineer	• Conduct testing of sound levels for a final determination of noise impact. (See Chapter 7 for details on activities). • Assist in preparation of the PPM and participant prioritization (identification of program phases). • Determine design goals in

[10] U.S. Green Building Council (USGBC), Leadership in Environmental and Energy Design (LEED)®, http://www.usgbc.org/leed. (Note this entity is not a part of a federal agency.)
[11] Chapter 3 of the *AIP Handbook*, FAA Order 5100.38, provides guidance on eligibility of sustainability-related costs.

Position	Responsibility
	consultation with the design consultants. • Consult and coordinate with design consultants throughout the design process. • Coordinate with the design consultants to determine the level of pre- and post-testing required. • Conduct acoustical testing and ensure acoustical compliance when conducting all acoustical tests. • Review design documents and prepare recommendations for all requests for property owners. • Assist with inspection of materials, new product review, and review of requests for information and change orders in coordination with the design consultants and the resident engineer. • Coordinate noise monitoring data for the airport based on the needs identified in the SIP. • Prepare final report for acoustical performance to be submitted to the FAA.

2.4 Property (Structure) Owner Responsibilities.

Sound insulation programs are voluntary. Property owners are not required to participate. For property owners who volunteer to participate, interior acoustical testing occurs to determine if their structures are impacted. Owners of impacted structures are responsible for understanding the SIP through coordination with the property owner liaison. Owners must sign an application if interested in the SIP, then sign an agreement for the airport to acknowledge that they understand the program and treatment strategy. Property owners may be required to provide an avigation easement on their property in exchange for sound insulation if required by the airport operator. Owners are also informed that homes currently included the DNL 65 dB or greater contour, may not be considered to be impacted for noise mitigation purposes if contours change with respect to their property in the future due to NEM updates.

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CHAPTER 3. DEVELOPMENT OF A SOUND INSULATION PROGRAM

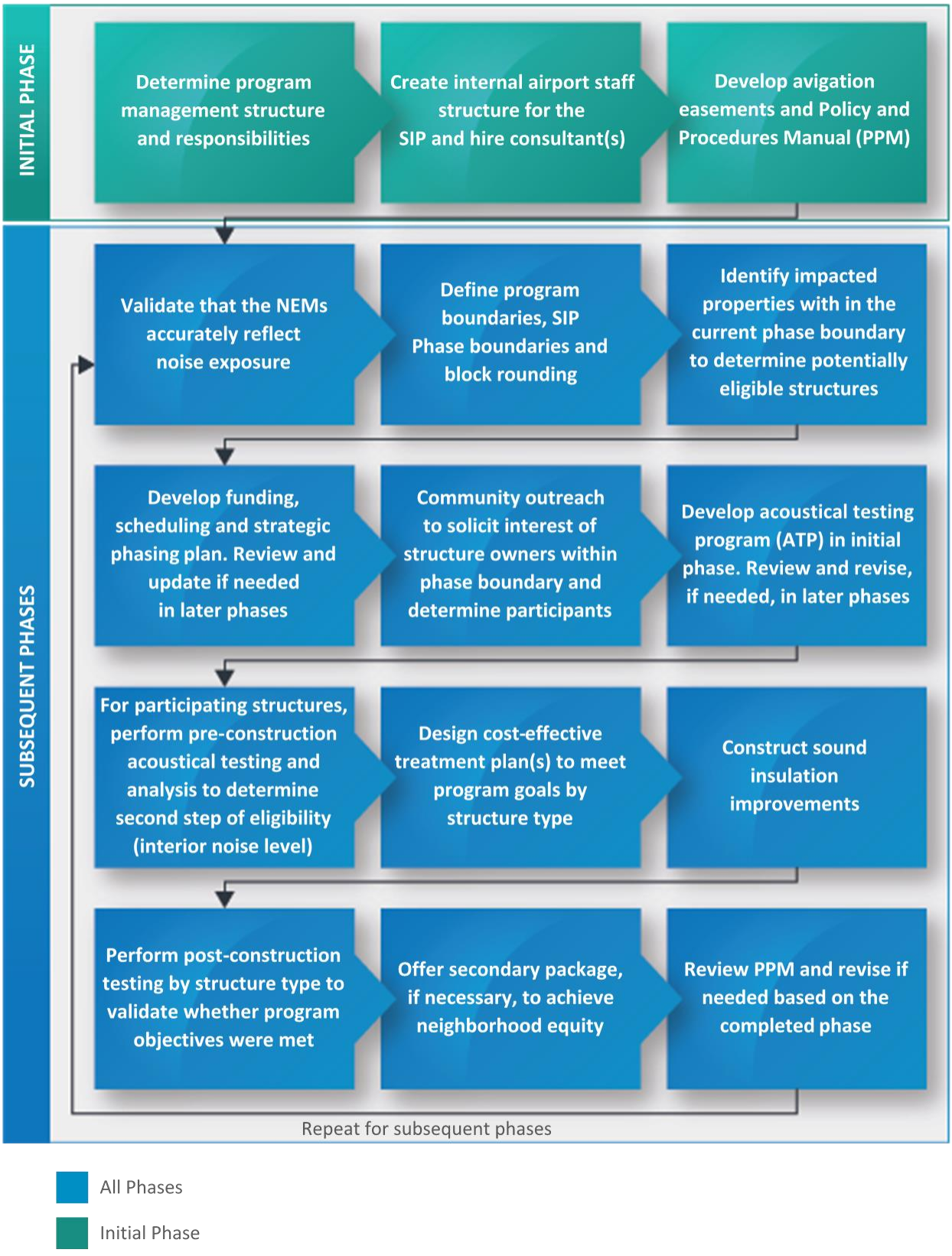
3.1 The SIP Process.

3.1.1 After the FAA has approved mitigation through a voluntary Part 150 ROA or NEPA ROD, in the form of sound insulation, an airport operator follows a series of steps to develop the sound insulation program through implementation and close out. A simplified overview of the process is illustrated in Figure 3-1. FAA review and approval is required at key points. Community outreach and structure owner engagement is also an ongoing part of the process. Implementation – actual design and construction of sound insulation treatments – can be done in multiple phases over many years, depending on the size and complexity of the program, and the airport operator's resources and available funding.

Figure 3-1. Overview of the SIP Process

3.1.2 SIP development includes assembling the airport owner's team (as described in Chapter 2), defining program objectives and priorities, setting program boundaries, and defining priorities that determine phasing and phase boundaries. The PPM is developed to guide the process and can be refined as the program progresses, based on lessons learned and changing priorities. The airport operator defines a funding strategy early in the process. This guides phasing and FAA funding requests, which may also be revised as the program progresses. Figure 3-2 illustrates the steps for SIP development and implementation that are discussed in greater detail throughout this AC.

413 **Figure 3-2. SIP Development and Implementation Steps**



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3.2 **Program Objectives.**

3.2.1 Design Objective of All Sound Insulation Programs.

3.2.1.1 The objective of a sound insulation project or program is to achieve a 5 decibels (dB) reduction in interior noise and reduce the average interior noise levels in impacted residences to a level below 45 dB.

3.2.1.2 The controlling document of the SIP will determine land use compatibility based on the definition outlined in 14 CFR Part 150, Table 1, Land Use Compatibility[12] With Yearly Day-Night Average Sound Levels (DNL). If the airport operator and the government entity with jurisdiction and land use enforcement authority define land use compatibility differently, then its (the governing authority's) definition takes precedent.

3.2.1.3 In 14 CFR Part 150, all land uses are defined to be compatible with noise exposure below DNL 65 dB. Table 1 indicates that some common noncompatible land uses may be made compatible by reducing the level of interior noise to the requisite level through sound insulation programs. Land uses that are not identified in Table 1 require coordination with FAA APP-400 and APP-500 (through the Region) to determine their compatibility by using comparable land use standards.

3.2.1.4 SIPs are designed to reduce interior noise due to aircraft noise associated with the airport[13] in habitable residences, places of worship, or classrooms. The design objectives for SIPs must reduce indoor noise levels by at least 5 dB and bring the average interior noise level below 45 dB (see AIP Handbook, FAA Order 5100.38). If a 5 dB noise reduction is not feasible, the FAA ADO Program Manager must coordinate with APP-400 and APP-500 to determine acceptable levels in the specific case.

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[12] The designations contained in 14 CFR Part 150 Table 1 do not constitute a Federal determination that any use of land covered by the program is acceptable or unacceptable under Federal, State, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities.

[13] FAA Order 5100.38, *Airport Improvement Program (AIP) Handbook*.

3.2.2 Relationship of Acoustic Modifications to Design Objectives of All Sound Insulation Programs.[14]

Acoustic modifications as defined in the AIP Handbook, FAA Order 5100.38 (for doors, windows, etc.), are used to achieve the design objectives of a SIP. Other measures not defined in the handbook are not allowed unless the ADO, in coordination with APP-400 and APP-500 (through the Region), approves them in advance. In this case, the ADO must keep a copy of the airport operator's request to use other measures and another of FAA's approval of the request in the project files.

3.2.3 Financial Feasibility.

When AIP or PFC funds will be used to accomplish noise mitigation, the design must not exceed the required noise level reduction requirements as outlined in the SIP. When there are no AIP or PFC funds involved in accomplishing noise mitigation, this requirement does not apply. Phasing of the SIP can assist in dividing the program into feasible portions (see Chapter 4).

3.2.4 ROD-related SIP Boundaries Will Not Change.

A SIP that is a commitment outlined in a ROD will be completed as stipulated unless project modifications made after the ROD results in a NEPA re-evaluation affecting a significant change in noise exposure or the project evaluated in the NEPA document is not constructed. Otherwise, the program boundary associated with ROD mitigation commitments will not change.

3.2.5 Part 150-related SIP Boundaries Must be Re-evaluated for NEM Change.

A SIP developed for a Part 150 study considers potential changes in noise contours surrounding an airport. If contours along noise-sensitive land uses change by 1.5 dB or greater (increase or decrease), the airport updates the NEM. Typical aspects that may change noise exposure include aircraft operation frequency, a reapportionment between day/night flight schedules, and changes in fleet mix. Before developing a formal NEM Update, the airport operator may conduct an analysis without public involvement to validate the current NEM or determine if the formal update process is needed. Therefore, only the initial phases of a Part 150-related SIP should be defined to account for potential changes in noise relative to construction timeframes (see Chapter 4 for phasing of the SIP) to effectively manage the property owners' expectations.

[14] This assumes that AIP or PFC funds are to be used. Other measures may be used if only local funds are used.

3.2.6 Application of Block Rounding and Neighborhood Equity.

Block Round and Neighborhood Equity are not the same thing. The program boundaries may be adjusted to account for block rounding and neighborhood equity in residential areas. Block rounding expands the SIP boundaries to include parcels that are contiguous to the contour area to prevent the boundary from intercepting and splitting a block. Neighborhood equity allows an airport operator to provide a separate treatment package for a certain percentage of residences that do not meet the interior noise level requirements but are scattered among residences that do meet the criteria. The AIP Handbook, FAA Order 5100.38, describes options for block rounding or neighborhood equity in program boundaries. Before additional structures or areas outside the boundary can be offered sound insulation, the ADO reviews and agrees with the identified extended boundaries.

3.3 Determining Impacted Structures for Sound Insulation Program Consideration.

3.3.1 There are generally two common methods by which SIPs may be considered impacted and eligible for FAA funding: FAA-approved 14 CFR Part 150 Program or a Record of Decision (ROD) associated with a National Environmental Policy Act of 1969 (NEPA) evaluation. In addition, a facility used primarily for medical or educational purposes (typically, hospitals and schools) may be considered for FAA funding if it is adversely impacted per 49 U.S.C. §47504(c)(2)(D), regardless if the airport has a 14 CFR Part 150 program. These three methods of determining structures for program consideration are described further in this section.[15]

3.3.2 Impact Requirements under the Voluntary 14 CFR Part 150 Process.

Several impact requirements must be met before land uses identified as "normally noncompatible" can be tested to determine if they are actually noncompatible:

- An airport operator must have completed a NCP in accordance with the requirements of the statute.
- The airport operator must have recommended a sound insulation program as an NCP measure to reduce noncompatible land uses around the airport.

[15] The *AIP Handbook,* FAA Order 5100.38, Table R-1, also notes that noise mitigation that is included in a land use compatibility plan prepared by a local jurisdiction surrounding a medium or large hub airport that either has not prepared a 14 CFR Part 150 program or has not updated a 14 CFR Part 150 program in the preceding 10 years may not be eligible for FAA grant funding. Per 49 USC §47141(f), grants for projects approved under an FAA-accepted compatible land use plan are *only allowable until September 30, 2023*. After this date, the ADO must check the current legislation to see if the sunset date was extended.

- The FAA must have approved the SIP as an NCP measure in its ROA for the subject NCP.
- With each SIP phase grant application (see Chapter 4), the airport operator must submit a supporting NEM, representing the noise exposure at the time of application that has been reviewed and accepted by the FAA.

3.3.3 Building Construction Date Requirement per the SIP.

A building's construction date is important in determining the mitigation considerations for the structure. The structure must have been built prior to October 1, 1998[16] unless the airport operator has demonstrated to the FAA that no published noise contours existed at that time. Structures are not eligible to participate in a SIP if they were permitted or constructed after NEMs (14 CFR Part 150) or noise contours (for NEPA studies) that have been made available to the public indicate that the underlying property is normally noncompatible for the type of structure. New noncompatible land uses created by subsequent airport expansion or development may also be considered to be impacted.

3.3.4 If the project meets all the above criteria, the following, more detailed impact criteria must then be met:

- All structures proposed for consideration of the program are located within the boundaries of a noncompatible land-use contour.
- In accordance with the AIP Handbook, the airport operator submits a proposal to apply block rounding to a phase boundary, applicable only to residential structures, for FAA approval consideration.[17]
- The airport operator must reach out to all the owners of structures located within the program boundary to identify those wishing to have their structure tested to determine if their structure is impacted. Pre-construction acoustical testing to determine which structures are impacted and can participate in the SIP is arranged according to public outreach protocols defined by the airport operator and

[16] October 1, 1998, is the date included in the publication of the FAA Final Policy on Part 150 Approval of Noise Mitigation Measures: Effect on the Use of Federal Grants for Noise Mitigation Projects, Federal Register: April 3, 1998 (Volume 63, Number 64), Rules and Regulations, Page 16409-16414 "As of October 1, 1998, the FAA will approve under 14 CFR Part 150 (Part 150) only remedial noise mitigation measures for existing noncompatible development and only preventative noise mitigation in areas of new non-compatible development." Remedial measures include sound insulation, whereas preventive measures include zoning and other land use regulations.

[17] An airport operator can propose to expand the noise mitigation boundary just beyond the DNL 65 dB contour to include parcels contiguous to the contour area. Conditions for FAA acceptance are included in the *AIP Handbook*, FAA Order 5100.38.

completed to determine potential impacts in accordance with Chapter 7 and the AIP Handbook. Structures are considered to be impacted if the test results for the structure's interior finds the interior noise level is at or above 45 dB.

- If there are a relatively small number of residential structures within the defined study area (up to 10% of, but no more than 20 residences within a neighborhood as defined by the AIP Handbook) that do not meet the interior noise level requirements dispersed among residences that do, an airport operator, may submit a neighborhood equity proposal to the FAA per the requirements outlined in the AIP Handbook. If approved, the extent of improvements offered under neighborhood equity proposal is very limited (such as caulking and weather stripping) compared to the full SIP phase improvements.

3.3.5 Noise Impact Requirements for AIP or PFC Eligibility under the National Environmental Policy Act (NEPA).

If the controlling document for the SIP is a FONSI/ROD or ROD under NEPA, the project-related mitigation commitments remain until the commitment is completed or it is no longer warranted (i.e., the project does not move forward into construction). However, interior testing is still required for individual structures to be designated as impacted. The airport operator must complete interior testing for the structure(s) in accordance with the testing protocol (see Chapter 7) and the AIP Handbook for final consideration for a sound insulation project. Structures are considered impacted and candidates for sound insulation if the interior test results for the structure indicate a noise level at or above 45 dB as stipulated in the AIP Handbook, FAA Order 5100.38.

3.3.6 Impact Requirements for Facilities Used Primarily for Medical or Educational Purposes.

Under the authority of 49 U.S.C. § 47504(c)(2)(D), a facility used primarily for medical or educational purposes that is impacted by noise can be considered for sound insulation, even if it has not been evaluated under 14 CFR Part 150 or NEPA. For the structure to be considered,

- The airport operator prepares and submit to the FAA:
  - A noise exposure map using the current version of the FAA's accepted noise modeling software that demonstrates that the structure is located within a noise exposure contour that is normally noncompatible for such land use.
  - The corresponding aircraft operational and fleet assumptions used to develop the submitted noise exposure map.
- The FAA reviews and determines that the submitted noise exposure map meets the acceptability criteria that would apply had it been submitted under 14 CFR Part 150.
- The FAA reviews and validates that the structure is located within a noise exposure contour that is normally noncompatible for such land use.
- The applicant completes interior testing of the structure(s) in accordance with the testing protocol (see Chapter 7) and the AIP Handbook *(see Appendix R)*.

Structures are considered for sound insulation if the test results indicate an interior noise level at or above 45 dB.

- Interior testing for schools will consider the following parameters:
  - The noise level is represented effectively by the Sound Equivalent Level (Leq) for the hours of school operation (typically daytime) rather than the 24-hour period measured by DNL. Leq quantifies noise that varies over a continuous period of time – in this case over the school day – into a single value in decibels.
  - The single-event Sound Exposure Level (SEL) can be used with Leq long-term averaging as a more practical measure of determining existing and improved interior noise level reductions. SEL measures discrete, short-duration transient noise instances such as an aircraft flyover. Single loud events can be disruptive to teaching and learning, so are important to consider for schools.

3.4 **Program Implementation Steps.**

3.4.1 SIP implementation can be divided into five general steps, which are described further in this section:

- Property Owner Outreach
- Pre-Construction Acoustical Testing
- Treatment Plan Design (includes developing technical plans and specifications)
- Construction
- Post-Construction Acoustical Testing

3.4.2 Property Owner Outreach.

The outreach process starts after the program boundary is defined and policies and protocols are reviewed and approved by FAA) to engage property owners identified within the program boundary. The potentially impacted property owners should be contacted, provided a description of the SIP, and required to sign participation agreement if the property owner volunteers to be included in the program. The airport operator should express to structure owners that noise contours and impact determinations for sound insulation treatment can change before the treatments are installed. The FAA recommends that airport sponsors require property owners to sign

an avigation easement agreement[18]. Examples of these documents are provided in Appendix B of ACRP Report 89, Guidelines for Airport Sound Insulation Programs[19]. More detail on community outreach is discussed in Chapter 6 of this AC.

3.4.3 Pre-Construction Acoustical Testing.

Airport operators must conduct pre-construction acoustical testing to determine impacts and assist in the finalization of product and treatment recommendations. The pre-construction testing establishes a baseline for the structures within the phase boundary and provides each structure with accurate treatment suggestions to decrease interior noise levels. Not all structures may be tested depending on the type of structures in the phase boundary. If structures are similar in construction type, then operators may choose to conduct pre-construction sampling, testing a smaller number of structures in the phase boundary. The SIP testing plan and analysis are discussed in detail in Chapter 7.

3.4.4 Treatment Plan Design.

After the airport operator has identified, and the FAA has confirmed potentially impacted structures for sound insulation, the design process begins and comprises these main steps:

- Evaluation and documentation of the existing conditions of each residence through assessment surveys and indoor air quality and hazardous materials testing.
- Development of a detailed Scope of Work by the airport operator to comply with design policies, approved products, and recommended treatments.
- After the Scope of Work is established and approved by the airport operator, the team can begin the work, after proper procurement is followed (in accordance with the AIP Handbook, FAA Order 5100.38 or PFC Order, FAA Order 5500.1). The actual design of the project should be completed prior to bidding the work to a contractor. Otherwise, the grant could remain open for an excessive amount of time, which is inconsistent with the AIP Handbook. The basis for selecting a design consultant or architectural firm/ team should follow the procurement requirements in the AIP Handbook or PFC Order.

[18] An avigation easement is an easement or right of overflight in the airspace above or near a particular property. It also includes the right to create such noise or other effects as may result from the lawful operation of aircraft in such airspace and the right to remove any obstructions to such overflight.

[19] ACRP Report 89, *Guidelines for Airport Sound Insulation Programs* (2013): http://nap.edu/22519

- After the project is designed, it should be released for bidding, and the project should be awarded to the lowest qualified bidder following the 2 CFR Part 200 rules of procurement and the AIP Handbook, FAA Order 5100.38.

3.4.5 Post-Construction Acoustical Testing.

Airport operators must conduct post-construction acoustical testing to ensure that goals of the insulation program have been met. Not all structures must be tested depending on the type of structures in the program boundary. If structures are similar in construction type, then operators may choose to conduct post-construction sampling, testing a smaller number of structures in the phase boundary. Details on the SIP testing plan are described in Chapter 4.

3.5 Development of Policy and Procedure Manual.

3.5.1 Purpose of the Policy and Procedures Manual (PPM).

Before starting design and implementation, the airport operator must define how reasonably foreseeable programmatic issues would be addressed in a consistent manner throughout the SIP. The PPM defines why the program is being undertaken and how it will be implemented. In general, developing and following a PPM is important to ensure consistent operational guidance, compliance with FAA standards and local codes, and efficient and impartial implementation of the SIP. Specifically, a PPM is useful for the following reasons:

1. The PPM explains the nature of the SIP that is being undertaken (i.e., what type of controlling document is driving the insulation program) so the process is as transparent as possible and the community's expectations are managed appropriately. For example, if it is a SIP implemented because of a Part 150 study, the PPM needs to explain that the initial program boundary defined by the Part 150 Noise Exposure Map is not static and could shift given operational changes at the airport. For this reason, the PPM for SIPs under Part 150 are limited to describing the method for prioritizing structures and policies for how the program will be implemented.
2. The PPM provides common template documents, such as structure owner communications, program applications, testing and inspection forms, as necessary to ensure all activities are performed consistently and communicated properly. Chapter 9 describes several sample documents, examples of which are included in Appendix C.
3. The PPM identifies best management practices for implementing the program, and should be revised as needed to incorporate lessons learned after implementation of various phases.
4. The PPM is reviewed and approved by the FAA ADO Program Manager, with assistance from the FAA Noise SME (see Section 3.4.4).

3.5.2 PPM Content.

The PPM should include the following contents:

1. Overview of the SIP process
2. Administration
   a. Roles and responsibilities of the SIP team
   b. Coordination and communication protocols within the airport operator's staff, between the SIP team and airport operator, and with FAA
3. Public Outreach
   a. Coordination and communication protocols with the public
   b. Criteria for prioritizing participation
   c. Consideration of residences other than single-family permanent structures[20] and other special situations associated with public buildings (criteria and approval responsibility)
   d. New owner participation in program in cases where the previous owner opted out
   e. Block rounding and neighborhood equity applicability (see Section 4.2)
   f. Handling of complaints regarding design or construction
   g. Templates for all standard documents and forms that will be used throughout the program, examples include:
      i. Letters to residents describing the program phase soliciting interest in being tested to determine impact.
      ii. Disclosure of property owner's responsibilities and limitations of the program.
      iii. Easement language if the airport operator wishes to require it as a condition of participation.
4. Contractor Outreach
   a. Prime contractor prequalification policy
   b. Review process for prime contractor statements of qualification
   c. Contractor training and certification procedures

[20] Modular structures (permanent structures on a foundation) can be considered for sound insulation but require a detailed assessment by acoustical engineers and must be approved by the FAA. Manufactured structures (mobile/nonpermanent) are not practical for sound insulation treatments.

5. Design Policy, Process and Procedures

a. Acoustical testing protocol to determine program participation (see Chapter 7)

b. Addressing nonconforming building codes and pre-existing deficiencies (See AIP Handbook)

c. Consideration of mixed-use residential properties (most sensitive land use according to 14 CFR Part 150)

d. Handling of requests for exceptions (requires early coordination with ADO to determine eligibility of exceptions)

6. Construction

a. Pre-construction submittals, materials procurement and meetings

b. Construction administration and inspection process

3.5.3 FAA Review of the PPM.

3.5.3.1 If the SIP is being implemented with AIP or PFC funding, the PPM must be reviewed and approved by the FAA before finalization and public release. As detailed in Chapter 2, the FAA Noise SME will perform the review of the PPM, in close consultation with the FAA ADO Program Manager. The SME will provide comments to the airport operator regarding elements of the manual that are not in accordance with FAA policy or would not be considered for FAA funding. If the FAA Program Manager finds that the PPM is not acceptable, the ADO should notify the Region, which should notify APP-400 and APP-500.

3.5.3.2 If the airport operator does not make the required revisions, the FAA notifies the airport operator that the particular element of the program will not be considered for federal participation and will be limited only to local

CHAPTER 4. DEFINING AND IMPLEMENTING INDIVIDUAL PHASE COMPONENTS

4.1 Background.

4.1.1 This chapter describes recommended strategic phasing of the SIP in relation to FAA grants, identification of noncompatible structures, determination of phase boundaries, acoustical testing, and construction. Appendix C provides a Program Activities Checklist for use by airport operators or consultants during the SIP phase process.

4.1.2 Airport operations are dynamic. As an airport's operations change, the NEM contours, which are the basis of the overall SIP boundaries, shift in response to those changes. For this reason, SIP boundaries cannot be concretely defined for Part 150 programs at their onset. Changes that have the potential to shift the NEM contours include sizeable changes in aircraft types utilizing the airport, aircraft operations schedule and runway utilization, and new runway construction.

4.1.3 Unless the airport operator has a very small overall SIP, the airport operator's funding limits often dictate that their programs be implemented over time in multiple phases, during which the NEM contours can and often do shift. The PPM should define a phasing plan within the overall program boundary that allows practical and financially realistic implementation of the SIP and identifies the process and timing for reevaluating phase and program boundaries.

4.2 Funding, Scheduling, and Strategic Phasing of Sound Insulation Program and Grants.

4.2.1 Funding Plan.

The airport operator should couple a financial or funding plan with a constructability overview to determine reasonable phasing criteria and define it in the PPM. The boundaries for each SIP phase are constrained by their fund-matching capability. More details on funding are described in Chapter 8 of this AC.

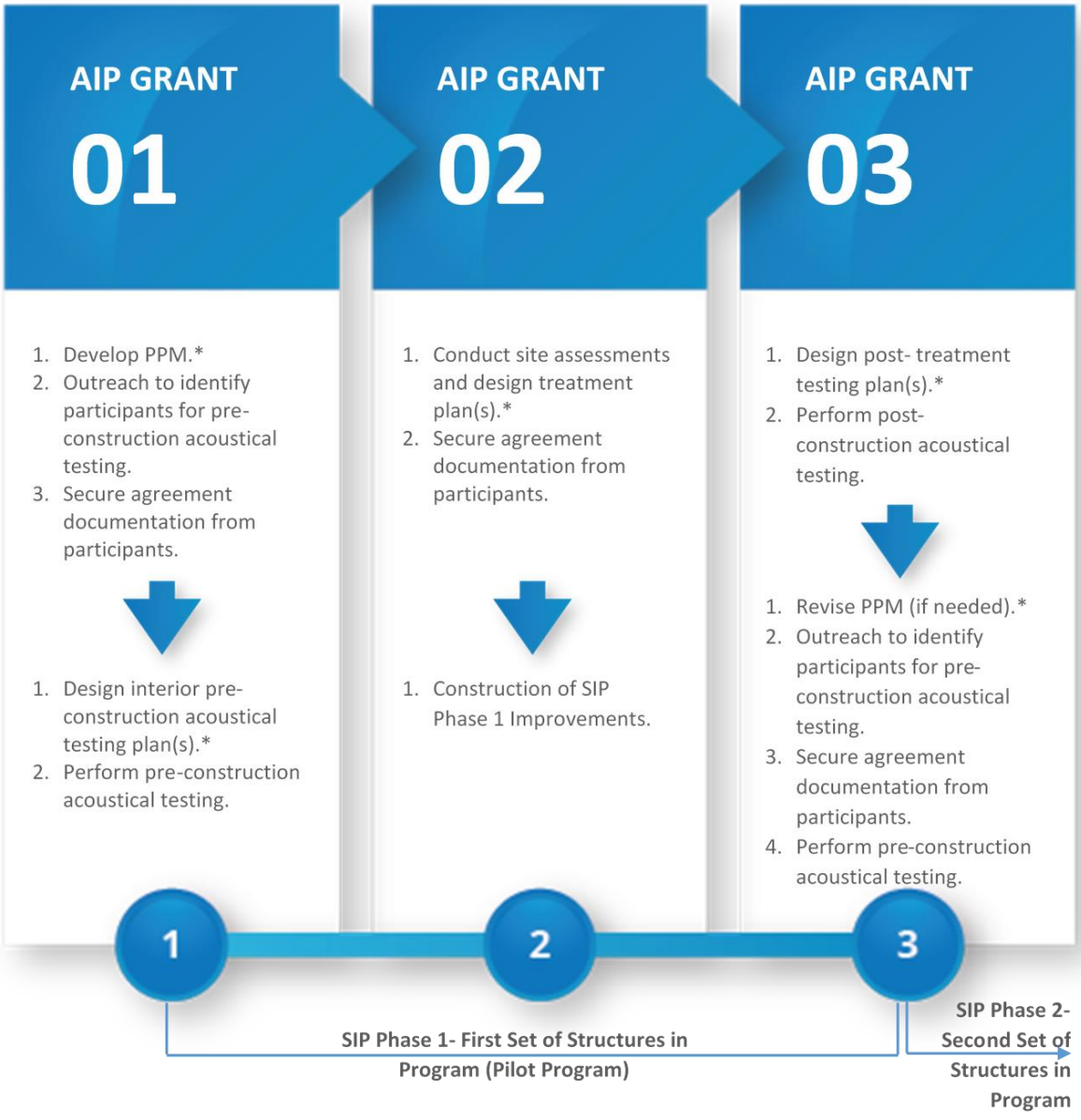
4.2.2 Project Timelines.

4.2.2.1 To develop a successful timeline, airport operators should consider the entities that will review various steps in the program, community outreach efforts, and any deadlines imposed by FAA grants. For example, FAA review and approvals, property owner coordination, and local building department permit review and approval should be considered in all schedules.

4.2.2.2 Each SIP phase is planned for completion within five years from the date the FAA validates the supporting NEMs (in the case of a Part 150 program as the controlling document). Doing so ensures that the structures being treated are still considered impacted when the actual SIP improvements are made. It also ensures that the airport operator's closeout

documentation can be completed in compliance with FAA grant obligations. Figure 4-1 shows how initial portions a SIP can be structured under AIP grants.

Figure 4-1. Sample SIP Phasing Under AIP Grants



4.2.3 Strategic Phasing of Sound Insulation Program under AIP Grants.

4.2.3.1 Unless it is a small program that can be completed in five years or less, phasing of the program would likely be need to be considered by an airport operator. Phasing allows for adequate program funding (both

locally and federally) and allows for adapting to potentially changing noise exposure conditions (relative to a SIP defined by a Part 150 study). Prioritizing treatment is an important determination of the phasing process and should be done in a fair manner. Prioritization and setting phase boundaries are discussed further in Sections 3.2.4, 3.2.5, 3.2.6, and 4.3, respectively.

4.2.3.2 The first phase of the SIP is often a pilot program. This allows airport operators to develop the procedures, policies, treatments, estimate costs, etc. and test them on a small but representative set of structures to ensure the program is appropriate for the rest of the impacted structures and additional phases.

4.3 Determination of Phase Boundaries.

4.3.1 When developing a phasing plan, airports should consider identifying the number and type of structures that can reasonably be completed within a five-year period from a funding and constructability standpoint. To determine each phase, prioritization can be determined by many different factors (i.e., geographic location, funding level, treatment type, number of potentially impacted buildings, number of property owners that will accept the program, time for testing each area within the phase, airport construction, and the level of noise exposure at the present and over the next five years). The FAA recommends airports prioritize based on the highest level of noise exposure.

4.3.2 Where numerous properties are within the same exposure levels, the airport operator will need to set additional priorities. These need to be set in consultation with the FAA Program Manager, and can include criteria such as prioritizing:

- Schools before homes
- Homes before religious facilities
- Single family homes before multi-family homes

4.3.3 Grouping structures together geographically and with similar modification requirements increases efficiency and helps airports justify the phasing method to the community. If there are multiple types of structures under the same noise exposure level, an airport will need to decide which type of structure (single-family structures, multifamily structures, schools, etc.) will be provided mitigation first.

4.3.4 Use of Block Rounding.

Block rounding can also be considered when identifying the phase boundaries, and it consists of incorporating a neighborhood block to prevent a phase boundary from intercepting or splitting the block beyond the DNL 65 dB contour. Per FAA policy, an airport operator can propose to expand the noise mitigation boundary just beyond the DNL 65 dB contour to include parcels contiguous to the contour area. Conditions for

FAA acceptance of the proposal are contained in the AIP Handbook, FAA Order 5100.38.

4.3.5 Use of Neighborhood Equity.

4.3.5.1 If there are a relatively small number of residential structures within the defined study area (up to 10% within a neighborhood as defined by the AIP Handbook, FAA Order 5100.38) that do not meet the interior noise level requirements dispersed among residences that do, an airport operator may submit a neighborhood equity proposal to the FAA, per the requirements outlined in the AIP Handbook.

4.3.5.2 Neighborhood equity proposals typically cover secondary treatments, including improvements such as caulking and weather stripping (when windows and doors are not being replaced), and installation of storm doors or ventilation packages.

4.4 Identification of Noncompatible (Impacted) Structures.

As discussed in Chapter 3, the airport operator needs to understand the impact requirements for all buildings depending on structure type. Potentially impacted buildings should be identified and construction data gathered. Single and multi-family residential buildings, public buildings, and historic structures should be identified and proper measures created to mitigate potential adverse impacts. Sound insulation goals remain the same for each type of structure and building: average interior noise level of less than 45 dB and at least 5 dB noise level reduction (NLR).

4.4.1 Windshield Survey.

4.4.1.1 A windshield survey, or drive-by survey that gathers whatever preliminary information can be seen from the street, should be conducted to identify potentially compatible and non-compatible buildings. The survey can begin, however, with GIS data collected to identify information about potentially impacted structures. The GIS data should be consistent with the study preceding the SIP (either Part 150 or NEPA study).

4.4.1.2 The windshield survey, further described in the AIP Handbook, FAA Order 5100.38, should result in collecting the following information:

- Identification and confirmation of the residential and nonresidential buildings within the program boundary.
- Photographs of each building structure.
- Catalog of building type, style, construction type, and general condition (as visible from the exterior), and “year built.”
- Identification of potential historic and unique structures.

4.4.1.3 The information collected from the windshield survey will also help to identify the types of structures within the program boundary and to begin determining the potential acoustical treatment protocols and neighborhood treatment standards.

4.4.2 Determining Interior Noise Level.

4.4.2.1 A noise-impacted structure must have interior noise levels that are 45 dB or greater[21] with the windows closed to be considered noncompatible. For schools, the 45 dB measurement is based on the length of the school day using Leq (number of hours).

4.4.2.2 Habitable areas for residences include areas for of living, sleeping, eating, or cooking. Schools are limited to classrooms, libraries, fixed-seat auditoriums, and educators' offices. Areas of a structure that do not meet building code requirements are not considered habitable.

4.4.2.3 Detailed descriptions of proper testing to determine interior noise levels are provided in Chapter 7.

4.5 Treatment Options and Procurement.

4.5.1 Treatment Goals and Feasibility.

4.5.1.1 Given the primary goals of the SIP and treatment measures are attaining an average interior noise level below 45 dB and a NLR of at least 5 dB, the first step in determining the interior noise level reduction is to determine the existing exterior and interior noise levels. Engineers can then understand the required treatment for those structures. This information can be obtained by testing all structures[22] in the pilot program or by completing an analysis to determine the noise level based on the structure type (this option may be selected for a neighborhood setting where all structures have the same structure type). Some structures may

[21] The 45 dB standard has been adopted by the FAA for interior noise based on 46 Federal Register 8316 (January 26, 1981). It was further clarified in 1992 by the Federal Interagency Committee on Noise (FICON) findings of 45 dB to be the interior noise level that will accommodate indoor conversations or sleep.

[22] APP-400 approval is required for testing more than 30% of residences of particular type, per the *AIP Handbook*, FAA Order 5100.38.

require more than a 5 dB decrease in NLR to attain the less than 45 dB for the average interior noise level.

4.5.1.2 Engineers must also consider the local building codes in the area where the sound insulation work is being performed. It is advisable to contact the local building officials to discuss the SIP and its objectives. If multiple municipalities are involved in the program, it is suggested to choose the strictest code/rules for building codes to follow throughout the SIP process for consistency in the program. Engineers should also consult with other federal, state, or local departments that may have restrictions on the type of material used for certain aspects of the project.

4.5.1.3 In addition to measurable goals for reducing the interior noise levels, airport operators should set a goal to be active and engaging with the community utilizing the program. For example, the airport operator can ensure the quality of materials, maintain aesthetics for the structures and community, and be available to the community for questions and concerns.

4.5.2 Treatment Options for Different Types of Structures.

4.5.2.1 Determining how noise enters a structure is essential to developing a proper treatment method. Walls/roof, windows/doors, and gaps/cracks are the major sources of noise paths into structures.

4.5.2.2 A region's climate should also be considered. Solar heat may determine the type of material to be used on the structures, especially for window treatments to be sure the windows are properly insulated.

4.5.2.3 **Residential Structures.**

4.5.2.3.1 Local and state building codes should be considered when determining appropriate residential structure treatments. A code analysis should be provided at the beginning of the design process linked to a description of the program's scope of work. Also, some residential neighborhood groups may want to review the products and materials used for insulation of the structures prior to installation. For example, residential treatments that are externally visible, such as doors, must be assessed to determine the types of doors appropriate for the neighborhood.

4.5.2.3.2 Treatments and methods should consider different housing types. **Error! Reference source not found.** Table 4-1 lists examples of common types of structures and their typical sound insulation treatments. The AIP Handbook, FAA Order 5100.38, discusses justification and funding eligibility of sound insulation treatments for residential buildings.

Table 4-1. Examples of Common Types of Residential Structures and Typical Treatments

Structure Type	Characteristics and Insulation Treatments
Cape	Low roofs and may not have an attic. Treatments include increased ceiling insulation, window improvements, and storm door additions.
Ranch	Small-pitched roofs and attic space. Typically built on concrete foundations; noise exposure from underneath the structure is less common. Replacing (or caulking) windows and doors, and sealing attic openings may be needed.
Raised or Split Ranch	These structures contain two stories with different framings on each floor. Treatments typically focused on wall insulation.
A-Frame Contemporary	These structures have a large pitched roof typically with large windows. Treatments typically needed in the roof, windows, walls, and ventilation system.
Row Houses Structures	These typically have multiple single-family structures within a row of buildings. Treatments typically focused on attic insulation, with opportunities for improvements in exterior wall insulation only.
Structure Additions	Due to the variations in types of additions and the original structure type, a detailed assessment is required to determine the appropriate sound insulation treatments.
Mobile or Manufactured	Manufactured structures (mobile/nonpermanent) are not practical for sound insulation treatments because treatments are not designed for the type of construction.

4.5.2.4 **Public Buildings.**

4.5.2.4.1 Sound insulation treatments for public buildings are like those of residential buildings and similarly have local building codes that need to be acknowledged. Treatment requirements for public buildings are often unique to the design and construction of the structures, therefore the AIP Handbook notes the flexibility of sound insulation treatment methods for public buildings.

4.5.2.4.2 Some public buildings may have specific regulations and requirements, which must be considered. For example, because noise can affect students' ability to learn, schools may have different local regulations to address, noise level reduction requirements, and FAA review times for recommended design measures.

4.5.2.4.3 Schedules and timelines should be created to allow the appropriate amount of time for each step of the process to be completed, including review by the public building owner. Airport operators and the project team should also work closely with the local government and owners of the buildings to ensure all regulations, requirements, and concerns are addressed.

4.5.2.5 **Historic Structures and the Section 106 Process.**

4.5.2.5.1 Use of federal funds requires that airports consider the historic nature of structures when determining impact and treatment for sound insulation. The National Register Bulletin defines historic structures as "properties which include districts, sites, structures and objects that are significant to American history, architecture, archeology, engineering and culture.' Section 106 of the National Historic Preservation Act (Pub. L. No. 89-665) identifies the potential for an adverse effect when "an undertaking would alter (directly or indirectly) the characteristics of a historic property that qualify it for inclusion on the National Register of Historic Properties." These characteristics include the property's location, design, setting, materials, workmanship, feel, or association. It can be a challenge for airports to provide sound insulation on these historic structures because of the material or architectural style; however, it is necessary to avoid adverse impacts to the community's historic properties.

4.5.2.5.2 If the airport is receiving AIP funding, the grant assurance requires that the airport consider if any of the impacted structures are historic. The Secretary of Interior determines if a historic structure is eligible to be listed in the National Register if the structure meets specific criteria.[23] **Error! Reference source not found.** Table 4-2 lists the criteria for eligibility and exceptions for buildings not typically eligible for listing.

[23] National Federal Register Program Regulations, Title 36, chapter 1, Part 60, Section 60.4, Criteria for evaluation.

Table 4-2. National Register Eligibility Criteria for a Historic Structure

A historic structure is eligible to be listed in the National Register if the structure meets one or more of the following criteria:	Buildings that are not typically eligible for the National Register include the following:
• Structures associated with events that have made a significant contribution to the broad patterns of our history. • Structures associated with the lives of persons significant in our past. • Structures that embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction. • Structures that have yielded, or may be likely to yield, information important in prehistory or history.	• Buildings used or owned by religious institutions. • Buildings that have been moved from their original location. • Reconstructed historic buildings. • The birthplace or cemetery of a historic figure or person of primary significance. • Commemorative buildings. • Buildings less than 50 years old.

4.5.2.5.3 The Section 106 Process.

1. The Section 106 process is part of the National Historic Preservation Act of 1966 (Pub. L. No. 89-665) and compliance with Section 106 is required for airports to receive AIP grant funding. The process identifies historic properties that could potentially be affected during federally funded projects. Adverse effects to structures, described by 36 CFR § 800.5(a)(2)(ii), include restorations, rehabilitations, repairs, maintenance, stabilization, hazardous materials remediation, and provision of handicapped access. During this process (typically projects initiation in the initial phases), stakeholders and other parties are able to review the project with respect to historic structures.

2. In considering mitigation efforts for the historic structures in their local community, airports can use the Section 106 process to determine if any of the identified impacted structures are historic, if sound insulation treatments are appropriate, and if the treatments are considered adverse. Depending on the geographic location of some structures, many different types of doors, windows, walls, and roofs are characteristics of a specific region. Providing the appropriate products and treatments to these particular sites can be challenging,

but is necessary to preserve these historic buildings and mitigate any potential adverse impacts.

4.5.2.5.4 Programmatic Agreement.

1. In order to receive federal funding for sound insulating historic buildings on or eligible for the National Register of Historic Properties, the airports treatment guidelines must include a Programmatic Agreement that complies with the Secretary of the Interior's Standards for Treatment of Historic Properties and is coordinated with APP-400.
2. For selecting a treatment, appropriate identification of the building's needs is the first step, which considers the character-defining features that the sound-insulation treatments must preserve, including the windows, doors, roofs, walls, and other physical features.

4.5.3 Site Assessment (Structure Inventory Assessment (Structure Inventory)).

The design team is responsible for conducting a site assessment of the impacted structures. Also known as a structure inventory, site assessments are conducted to determine the current condition of the structure receiving treatment. Pre-construction acoustical testing, discussed in Chapter 7, can be included in the site assessments. During the site assessment, a design team member provides the property owner with a list of treatment options/packages. The design team member discusses each treatment option in detail so the property owner can identify a selected treatment package. Once the treatment options are selected, a member of the design team discusses the next steps, proposed treatment/modifications, and scheduling of the construction process with the property owner. At the end of the site assessment, the design team should provide written documentation of the work that will be completed and indicate the option the property owner selected.

4.5.4 Procurement.

4.5.4.1 Before purchasing any materials or products for sound insulating structures, the design team must complete all assessments, measurements, and pre-construction testing. This allows the contractor to develop a plan and prepare a list of the materials that will be needed. The design team may need to coordinate with the community or property owner associations. After all assessments, measurements, testing, and aesthetics have been considered and determined, the contractor is able to purchase the materials. The design team should identify long-lasting, durable products for the improvements. Identifying high-quality, cost-effective products is important for community satisfaction, and should be accounted for in the cost development process (see Chapter 8).

4.5.4.2 The AIP Handbook, FAA Order 5100.38, discusses the procurement requirements for the airport operator. Airport operators should also contact

the local ADO if there are questions about the procurement requirements. The FAA also provides a document for airport operators to use when developing contracts. It assists with applicability and identifies other useful information necessary during the procurement process.[24] Airport operators may also use 2 CFR Part 200,[25] for additional procurement information. The regulations specify and discuss the following procurement methods:

- Micro-purchase - a purchase of supplies or services using simplified acquisition procedures to expedite purchases of relatively inexpensive items and minimize the associated administrative burden and cost.
- Small Purchase - relatively simple and informal procurement methods for securing services, supplies, or other property that do not cost more than the Simplified Acquisition Threshold. Price or rate quotations must be obtained from an adequate number of qualified sources.
- Competitive Sealed Bids - publicly solicited and a firm fixed price contract is awarded to the responsible bidder whose bid, conforming to all the material terms and conditions of the invitation for bids, is the lowest in price.
- Competitive Proposal - normally conducted with more than one source submitting an offer, and either a fixed price or cost-reimbursement type contract is awarded. It is generally used when conditions are not appropriate for the use of sealed bids.
- Procurement by Noncompetitive Proposals - solicitation of a proposal from only one source, typically used when there is only one provider of the service or product, or there is an emergency scenario where time is of the essence.

4.5.4.3 According to 2 CFR Part 200, airport operators must provide open competition for all procurement transactions, as well as provide equal opportunity for minority and women's business enterprises throughout the bid process. These items are also discussed in of the AIP Handbook, FAA Order 5100.38.

[24] The most recent copy of the *Required Contract Provisions for AIP and Obligated Airport Operators is* at: http://www.faa.gov/airports/aip/procurement/federal_contract_provisions/

[25] Title 2 CFR Part 200, *Uniform Administrative Requirements, cost Principles, and Audit Requirements*, Subpart D, § 200.317 - 200.326, http://www.ecfr.gov/cgi-bin/text-idx?tpl=/ecfrbrowse/Title02/2cfr200_main_02.tpl

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CHAPTER 5. SOUND INSULATION TREATMENT STRATEGIES

5.1 Background.

5.1.1 Noise can enter a structure through multiple points such as windows, doors, cracks, walls, roofs, ventilators, and chimneys. Airport operators should work closely with the design consultants to determine the best method of insulation for the structures based on the points at which the largest amount of noise enters the structure. Most SIPs include either a retrofit or a replacement in most areas where noise is entering a structure. The design consultant should determine the best method during the site assessment and field measurements of the structure.

5.1.2 As discussed in Chapter 4, design consultants need to consider building codes as well as the habitable space within the structure to determine the locations to install the sound insulation. This will help determine retrofitting or replacement needs to reduce outside noise from entering a structure.

5.1.3 A rating system known as the sound transmission class (STC) is used to determine the reduction of noise within a structure. STC ratings indicate how well a building partition attenuates, or decreases, airborne sound. It is widely used to rate interior partitions, ceilings/floors, doors, windows and exterior wall configurations.

5.2 Windows and Doors.

5.2.1 Design consultants should consider fenestration[26] when evaluating structures during the site assessment and when determining the treatments for each structure. Design consultants should ensure the quality of the product, aesthetics of the structure, maintenance of the window or door product, installation effort, and reduction of noise. These noise-reduction considerations include the type of materials used to reduce sound from entering the structure, proper caulking and sealant, and the thickness of the wall. To ensure proper installation, design consultants should provide flashing[27] details within the construction documents provided to the airport operator. This is an important step to ensure proper fenestration installations. Significant weather characteristics within the region of the airport helps determine the type of materials and products in installation.

[26] Fenestration is the arrangement of windows and doors on a building.
[27] Flashing is the use of waterproof materials to redirect or stop water flow.

5.2.2 The fenestration process includes two types of installation methods: retrofit or unit installation. Retrofitting is simply installing a different material within the existing frame or wall. Retrofit installations decrease time spent working on the structure, which in turn causes less disruption to property owners, but can only be used if the material will easily fit into the existing structure. Once the retrofit is complete, proper sealants will need to be used in the frame. Unit installations (replacements) are used where retrofits cannot be used. This could be due to existing framing size or wall depth, deterioration of the opening or lack of square openings to accommodate new windows and doors. In most cases, replacements are preferred and recommended for door insulations.

5.2.3 Windows.

5.2.3.1 If windows are to be replaced or upgraded, design consultants will review multiple considerations. Design consultants will need to consider items such as the U-value[28] associated with the type of glass installed in the window frame. The type of glass in the window can determine the following three items:

- Amount of heat entering the room
- Amount of condensation build-up on the glass
- The level of noise reduction

5.2.3.2 Some windows can have a glaze finish to reduce noise within a structure.

5.2.3.3 The window types determine costs, for example, whether they are sliding, projecting, fixed, double hung, or other more unique windows. More unique windows can increase the cost if the product required for installation is not readily available. It is not recommended to increase or decrease the size of the window, unless required to meet safety codes. Window cost considerations should be determined during cost development (see Chapter 8). Design consultants should assess the construction around the windows to determine the level of effort and type of replacement if necessary.

5.2.3.4 If a structure has windows with metal security bars on the exterior of the window, the design consultants will need to consider the appropriate approach to removing and reinstalling them—whether reinstalling the bars

[28] The U-value is the level of thermal heat that enters the structure.

after window installation or leaving this work for the property owner. The design team and/or contractors in coordination can make decisions with the resident engineer based on local safety-codes. The PPM should include specifics on procedures and policies for handling unique residential windows.

5.2.4 Doors.

5.2.4.1 Exterior door treatment types depend on the general climate of the area. Three of the most common types of exterior doors are wood panel, flush wood, and metal/steel. Other doors may not provide the necessary sound insulation.

5.2.4.2 The primary method used to reduce noise within a structure is increasing the mass of the door. If increasing the mass or thickness of the door is not feasible, a secondary (storm) door may be added to the outside of the door. Certain types of doors will typically include the use of a secondary door to add the extra level of sound insulation. For example, wood doors are typically combined with a secondary door.

5.2.4.3 A secondary door can be of a different material, but will still add the additional layer of protection from external noise. However, both the primary and secondary doors must include a mechanical seal (gasket) to fill the open space between the floor and the door. While typically created by different manufacturers, a combination of the two doors should provide the insulation necessary for the structure.

5.2.4.4 Sound insulated patio doors are common and can be provided to property owners as a treatment option. Typical patio doors include sliding and swinging doors made from wood or aluminum. Aluminum patio doors may not meet the STC requirements and may need a secondary door to accomplish the necessary NLR and STC ratings.

5.3 **Ventilation.**

5.3.1 The primary source of outside air entering a structure should be through the ventilation system rather than through walls, windows, doors, etc. Design consultants should be cautious of the placement of the intake for the ventilation system - locating them where minimal dust, dirt, and other impurities will enter the structure.

5.3.2 As mentioned throughout this chapter, design consultants should evaluate building codes for ventilation systems. Building codes will set the standard on which to base the type of ventilation system. In addition to building codes, consultants must also follow appropriate energy codes, which may also determine the type of ventilation system used. The International Residential Code® (IRC) is used as the minimum standard for ventilation systems in structures.[29] Other standards for ventilation systems include American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards. ASHRAE standards focus on indoor air quality for residential buildings.[30]

5.3.3 These standards and codes serve as the minimum requirements. If local codes and standards are in place, consultants should follow the most stringent standards and codes when installing ventilation systems. The AIP Handbook, FAA Order 5100.38, Appendix R, discusses requirements for noise mitigation and the use of ventilation in residential buildings.[31]

5.3.4 Design consultants should coordinate with the local municipal officials for clarification on building codes and be familiar with the codes and standards applicable to the program. Airport operators should also consult with the FAA ADO for clarification on building codes.

5.4 Indoor Air Quality.

Indoor air quality must be considered in SIPs when developing treatment strategies. Indoor pollutants can be physical, chemical, or biological, and can include contaminants such as mold/allergens, radon, carbon monoxide (CO), carbon dioxide (CO2), and volatile organic compounds (VOCs). These items, although not specific to SIPs, are issues that should be considered for structures with a tight exterior envelope (little or no exterior ventilation). ASHRAE standards are also used to ensure proper indoor air quality.[32]

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[29] To find the most recent version of the IRC, visit: http://www.iccsafe.org/codes-tech-support/codes/2015-i-codes/irc/

[30] To find the most recent versions of ASHRAE standards, visit: https://www.ashrae.org/standards-research--technology/standards--guidelines/other-ashrae-standards-referenced-in-code

[31] *AIP Handbook*, FAA 5100.38D, Appendix R.

[32] ASHRAE 62.1 & 62.2-2013, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings, https://www.ashrae.org/resources--publications/bookstore/standards-62-1--62-2

5.5 Insulating Public Buildings.

Public buildings are typically built much differently than residential structures. They have thicker walls, thinner ceilings, and larger spaces. Roof composition, openings, ceiling construction have been typical target areas to address entry of noise. Effective noise mitigation measures in these areas also includes replacement of windows and doors.

5.6 Hazardous Materials.

5.6.1 For construction purposes, testing for hazardous materials should be included in the design of the SIP. Testing of all structures may be required if hazardous materials are present in a sample. If hazardous materials are present, the structures' consideration for the SIP can be affected.

5.6.2 Federal, state, and local requirements provide regulations on the removal of hazardous materials. Each state and municipality may have its own abatement policies and procedures; therefore, airports should consult with the state and local governments to ensure proper removal and abatement procedures are met.

5.6.3 Table 5-1 describes the three primary hazardous materials typically found during structure inspections and its typical disposition. Airports may consider working with a hazardous materials consultant to assist in the regulatory issues and in removing the hazardous materials encountered.

Table 5-1. Hazardous Materials Typically Found During Structure Inspections

Hazardous Material	Typical Location and Disposition
Asbestos	Typically found in older residential structures, mostly in the ventilation systems or in siding materials (mobile-asbestos). Asbestos may be removed, altered, or disposed of if stated in the construction contract. Federal, state, and local regulations must be followed.

Hazardous Material	Typical Location and Disposition
Lead	Lead is typically found in paint in older residential structures. Property owners may be required to remove the lead from the area to be sound insulated, which may delay the insulation process until the activity is complete and approved. The EPA provides guidance on the appropriate handling of lead paint.[33]
Mold and Radon	Although not defined as a hazardous material, mold and radon can cause environmental health problems. SIPs should develop policies and procedures on how to properly handle the presence of mold and radon.

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[33] Renovation, Repair, and Painting Program – Related Information, United States Environmental Protection Agency, accessed January 2016, http://www.epa.gov/lead/pubs/rrp.htm.

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CHAPTER 6. COMMUNITY OUTREACH

6.1 Community Involvement.

6.1.1 The FAA's community involvement policy establishes the agency's commitment to the community's interests. The goals of the FAA's community involvement policy are to:

- Provide active, early, and continuous public involvement.
- Provide reasonable public access to information.
- Provide the public an opportunity to comment prior to key decisions.
- Solicit and consider public input on plans, proposals, alternatives, impacts, mitigation, and final decisions.

6.1.2 The intent of these goals is to improve the effectiveness of the FAA's public involvement activities, ensure well-informed decisions, and encourage innovative methods for involving the public. The FAA extends this policy to all planning and studies receiving federal funding or which require FAA approvals for implementation, including SIPs. Community outreach within a SIP needs to be a continuation of public involvement efforts conducted during the preceding Part 150 or NEPA studies. Within the SIP process, community outreach begins before the design process and continues through the end of the construction phase.

6.1.3 The main steps that should be taken as part of the community outreach efforts are summarized here and shown in Figure 6-1.

6.1.4 Plan.

6.1.4.1 Successful community outreach should be planned early enough so all parties can obtain the necessary resources and data to interact effectively. In particular, defining the goals and objectives of the community outreach efforts will guide the entire process by determining who will be engaged, the level of participation, and the types of public involvement tools and techniques to be used. As noted earlier, planning for community outreach in the SIP should consider closely following the public involvement process used in the preceding Part 150 or NEPA studies.

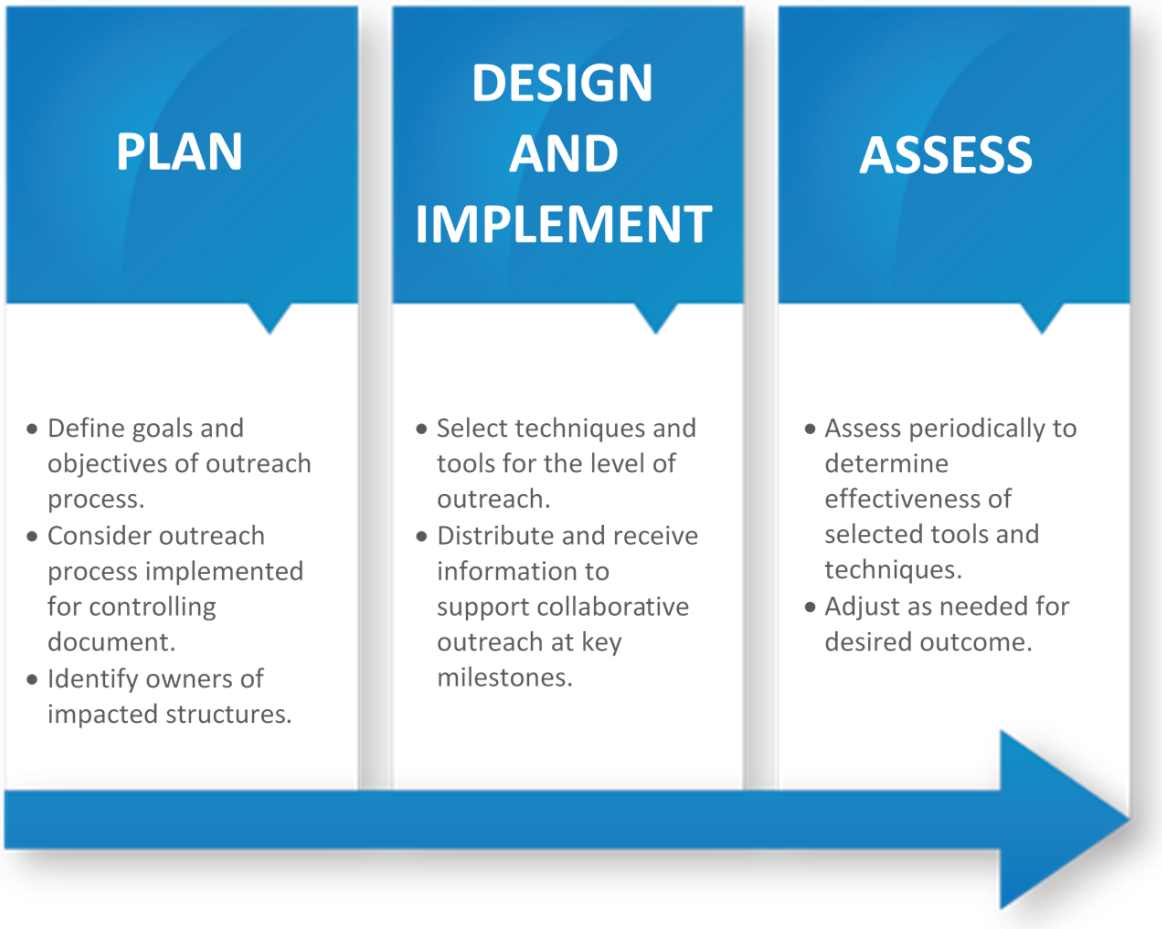
6.1.4.2 The airport operator should submit the proposed outreach plan and materials to the FAA ADO Program Manager for review and comment. Receiving FAA input will ensure that public information corresponds to the general scale of the SIP.

6.1.5 Design and implement.

One of the most important steps is to select the most effective communication techniques and tools. Tools include public meetings, the formation of special committees, data collection techniques, and the use of Internet and mobile technologies

(personal cell phones, tablets, instant voting technology, etc.). The communication strategy needs to remain flexible and open to new ideas because these tools are constantly evolving with the advent of new technology and media platforms.

Figure 6-1. Community Outreach Process



6.1.6 Assess, Reevaluate, and Update as Necessary.

6.1.6.1 Assessing community outreach efforts periodically can help the airport operator (and the FAA) determine if the selected tools are effective and whether resources have been effectively and efficiently allocated. When effectiveness is evaluated throughout the process, airport operators can make adjustments to the outreach program so that it achieves the desired outcome.

6.1.6.2 The program and implementation team must ensure the following information is addressed, understood by the airport, and expressed to the community during the outreach process:

1. An explanation of the study and how the sound insulation mitigation project came about either through a Part 150 or NEPA Study.

2. The Part 150 NEM contours reflect current conditions at the airport. This is especially true if airport operations have changed or five or more years have passed since the FAA accepted the NEMs.
3. An explanation of the two requirements for determining impact.
4. The residence is located in a DNL 65 dB or greater noise contour.
5. The average interior noise levels are 45 dB or greater for habitable rooms.
6. An explanation of the identified impact area's demographics.
7. Provide collateral materials discussing the program and the method of communication to potentially impacted participants.
8. The airport operator's commitment to property owner satisfaction.

6.2 **Milestones.**

6.2.1 Within the SIP, important milestones need to be communicated and coordinated with the community:

1. Identify potentially impacted structures within the program area.
2. Create phasing plan based on funding availability and project size.
3. Send program information and offer letter to residents for pre-construction testing to determine if structure is impacted; include required forms and documentation.
4. If participation agreement and application is confirmed, conduct pre-construction testing and site assessment on structures identified within the potentially impacted program area.
5. If structure meets the testing criteria, the structure is then considered impacted and included in the SIP.
6. Conduct and complete construction of sound insulation based on phasing plan.
7. Conduct post-construction testing to verify the required noise level reduction or interior noise level has been accomplished.

6.2.2 The following sections of this chapter describe outreach efforts that should be conducted throughout the SIP process.

6.3 **Coordination.**

6.3.1 Demographic Analysis.

Before contacting potentially impacted residents, airport operators should complete an analysis of the program area, including demographics and economic factors. Understanding the individuals living in the program area helps establish appropriate goals and plans that will better serve and satisfy the community. Demographics include

age, race, gender, income, marital status, primary language, and ethnicity. When determining the demographics of the area, airport operators should consider the use or function of the facilities (schools, hospitals, or places of worship), along with its geographic location, and the number and demographics of those that might work at, reside, or use the services of the facility, such as staff, students, patients, or members of a congregation. Airport operators can identify the area's demographics by conducting door-to-door questionnaires, distributing surveys (online or mailings), reviewing census reports, and any additional methods available.

6.3.2 Cultural, Language, and Socioeconomic Considerations.

6.3.2.1 Depending on the demographic findings, the airport operator may need to be sensitive to accommodate the culture and language of the surrounding area, for example, by providing translations of all documents as well as interpreters at local meetings or individual site assessments.

6.3.2.2 Socioeconomic considerations are also important to consider within the program area. This may determine the method in which documentation and how collateral materials are developed and delivered to accommodate for the residents' education level, occupation, and income. For instance, are email and social media the best communication tools or direct mailings and announcements in community newsletters? Regardless of the demographics, Airport operators should ensure that all materials are created to be easily understood. Airport operators may also consider hiring a local representative to help in the outreach efforts. This may add an additional level of trust or comfort for the community when learning about the program.

6.4 **Communication.**

Communicating with the public is important for gaining support and trust from the community. To be successful, an airport operator should understand its target audience, and create a consistent and concise message.

6.4.1 Notification Methods.

6.4.1.1 The first step in the communication process is to understand your target audience. Depending on the target audience, various notification methods can be considered. The notification methods also depend on the program size, airport size, funding, demographics, and other relative factors. Consistent, frequent, two-way communication with the community is important to avoid misinformation or misinterpretation of the program goals and requirements.

6.4.1.2 The most common notification methods include:

- Written correspondence

- Airport website
- Personal visits to structures
- Newspaper advertisements or other publication methods
- Videos
- Public service announcements
- Public or community meetings, open houses, workshops

6.4.1.3 Airport sponsors should ensure consistent, frequent, individualized communication with all property owners who may potentially be impacted.

6.4.1.4 Holding a property owner's orientation can be an effective way to inform property owners of the study requirements, impact requirements program boundaries, and the steps that will be taken if the individual's property is considered for sound insulation.

6.4.2 Messaging.

6.4.2.1 **Airport Leadership.**

Customer satisfaction depends on the airport operator's community involvement. Throughout the program, the airport leadership should be identifiable and active in the SIP process. A community's attitude toward the program will be based on the leadership's involvement and attitude toward the program. Communities will gain trust with positive, actively engaged leadership.

6.4.2.2 **Communication to Non-Qualified Residences.**

It may be appropriate for airport operators to create and develop a policy for those who do not qualify for sound insulation to ensure a consistent message is provided throughout the program. A written letter with a description of why the resident is not impacted by airport noise may be provided to gain the understanding of those who do not meet the requirements.

6.4.2.3 **Individual Communication.**

Individual communication to each resident can increase trust and provide a better basis for receiving feedback on the program. It also allows the airport operator to understand the type of communication method that suits those individuals. Airport operators should provide contact information for the one person assigned to represent a specific area of the project. The designated representative should be available to listen to the community's comments and concerns and address questions on the program clearly and consistently.

6.4.2.4 **Transparency.**

The airport operator should ensure the SIP process is transparent by remaining truthful and open about the process and program to build a greater sense of trust with the community. To succeed, a service-oriented staff should be part of the outreach efforts. Whether the staff is hired for the program or they are current employees, all personnel that may receive questions about the program should be provided the information for answering comments and concerns from the public. Staff must have a positive, helpful attitude when answering the public's questions. Negative perceptions of the SIP can result from a lack of transparency and lead to public opposition to this and future airport development projects.

6.4.2.5 **News Media.**

Airport operators may consider using the traditional news media as a way to get information to the public. Many airport operators use local events to advertise their programs as well as to encourage the media to attend and report on the SIP. News articles and press releases can also reach a large population.

6.4.2.6 **Internet and Social Media.**

6.4.2.6.1 Airport operators who develop a website for their program should ensure that all information is updated frequently and has the current status of the program. The internet can be an important source for the community to learn more about the program and find contact information for communicating their concerns and asking questions. Using the same branding, tone, and message on a project website as other materials is essential to establishing credibility.

6.4.2.6.2 Social media sites are a common form of distributing information. Airport operators should know the types of social media tools used primarily in the local community and determine which type of media/technology is best for the project. Staff should be hired or identified to create and update information website or social media sites.

6.4.2.7 **Program Offices.**

6.4.2.7.1 Depending upon the size of the program, it may be reasonable for airport operators to consider using a program office for the SIP. A program office provides a community with a single location to contact SIP staff as well as a consolidated work area for the program staff. If a program office is used, leasing or renting space and the provision of office equipment should be considered during SIP cost development (Chapter 8).

6.4.2.7.2 It may also be reasonable for airport operators to consider including a product showroom for the stakeholders in the community to understand and display the types of equipment, materials, and products that will be

used in the SIP process. It is the airport operator's responsibility to organize and determine the location of the product showroom to accommodate the contractor's materials/equipment. Airport operators may also consider providing a sample structure so property and property owners can see a completed insulated structure. Purchasing a residence to serve as a product showroom, however, is not allowable for AIP funding. The cost of completing the demonstration structure with treatments must be coordinated with the FAA. This expense should be considered when developing a program.

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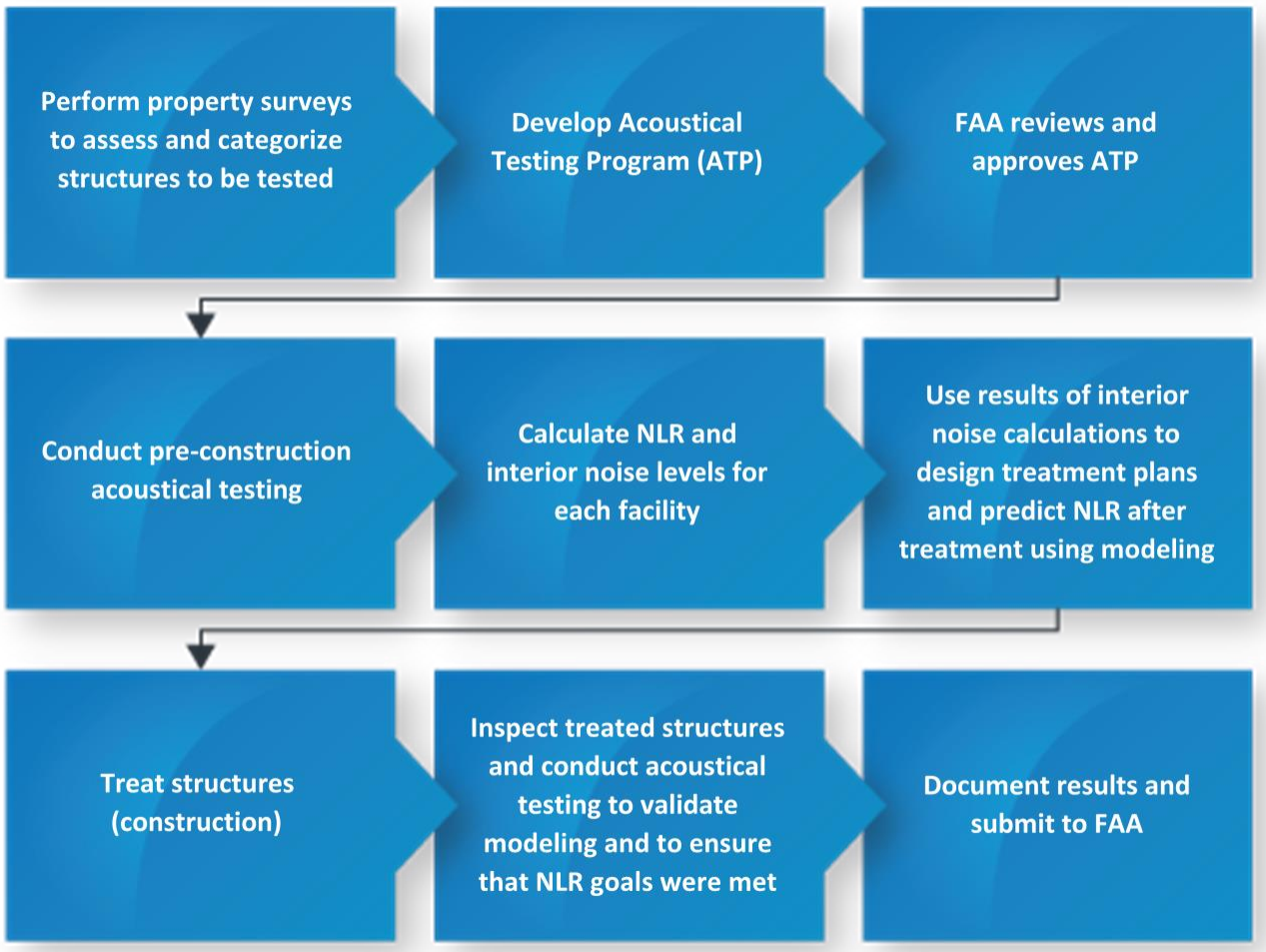
CHAPTER 7. ACOUSTICAL ENGINEERING AND TESTING

7.1 Background.

This chapter outlines the acoustical testing process to determine interior noise levels and noise level reduction. This chapter also addresses the application of modeled results (results obtained by FAA's AEDT), field measurement adjustment, and acoustical retesting. Figure 7-1 illustrates the process for acoustical testing.

Figure 7-1. Acoustical Testing Process



7.2 Program Overview.

This section describes how a property's habitable spaces are analyzed to determine its average interior noise exposure.

7.2.1 Habitable Rooms.

7.2.1.1 **Single- and Multi-Family Residences.**

7.2.1.1.1 The definitions of habitable and non-habitable rooms in single-family and multi-family residences are the same. The Appendix on Noise Compatibility Planning/Projects of the AIP Handbook, FAA Order 5100.38, defines habitable rooms for residences as living, sleeping, eating, or cooking areas. This would include living rooms, family rooms, dining rooms, bedrooms, kitchens, and offices. In limited cases, a sunroom that meets the latest edition of the International Residential Building Code (IRBC) definition of a Category V sunroom, and also adopted by a variety of state building codes, may be considered habitable.

7.2.1.1.2 Bathrooms, closets, halls, vestibules, foyers, stairways, unfinished basements, storage and utility spaces are not considered to be habitable space. In addition, spaces not allowed under local building codes are not considered habitable—for example, a garage converted to a bedroom or a basement converted to a bedroom.

7.2.1.1.3 In some cases, elements such as windows of non-habitable space might be entry points that contribute to unacceptable noise levels in adjacent habitable rooms. For example, a stairway window next to an open bedroom or an open closet with a window next to a bedroom may need to be considered for mitigation if it is considered and entry point to a habitable room, and should be determined when inspecting the structure.

7.2.1.2 **Educational Facilities.**

For educational facilities, habitable space is defined as limited to classrooms, libraries, fixed seat auditoriums, and educator offices. Non-habitable space in educational facilities is generally defined as areas such as gymnasiums, cafeterias, and hallways, even if these areas are used for incidental instruction. Educational facilities that are located in leased storefront property are not considered education facilities. The Part 150 Noise Compatibility Program (NCP) for the airport will describe the structures to be included in the mitigation plan.

7.2.1.3 **Other Facilities.**

Other facilities considered as habitable generally include places of worship, medical facilities, day care centers, or other facilities where habitation or teaching occurs. Facilities located in leased storefront property are not included. The Part 150 NCP and FAA Record of Approval (ROA) for the airport will describe the structures to be included for evaluation in the mitigation plan.

7.2.2 Property Survey.

7.2.2.1 **Single-Family Residences.**

A preliminary survey of single-family residences, or a windshield survey, must assess and categorize the structure to the extent possible, and is described further in Section 4.4.1. The inspection of property interiors is not required for this survey.

7.2.2.2 **Multi-Family Residences.**

7.2.2.2.1 For multi-family residences, a preliminary property survey must determine the use of the building areas, type and numbers of the building layouts and floor plans, and type and materials of construction. The survey is undertaken with on-site property managers, and the information will be used to select buildings, floor plans, and rooms that would be acoustically tested. It is also important to determine if the multi-family property is rental apartments (with one owner for the building) or condominiums (with individual ownership of each unit).

7.2.2.2.2 Photographs and notes are taken of all buildings.

7.2.2.2.3 The information to be collected during the property survey is listed in Table 7-1.

Table 7-1. Property Survey Data Collection for Multi-Family Residences

Data Element	Information to Collect
Assessment of property	• Number of buildings on the property • Number of units • Number and types of various floor plans • Variations to any of the floor plans • Number and type of floor plans by building
Exterior construction styles	• Number of levels, facade type, and roof style

Data Element	Information to Collect
Inspection of typical housing units	• Number and dimensions of habitable rooms • Type, size, and condition of windows in habitable rooms • Type, number, and condition of exterior doors/sliders in habitable rooms • Type of interior ceilings • Presence of unusual openings such as pet doors, mail slots, and fireplaces • Assessment of ventilation systems and fresh air ventilation components • Other factors that could impact the acoustical test results

1454

1455 7.2.2.3 **Educational Facilities.**

1456 7.2.2.3.1 Preliminary property surveys of educational facilities determine building
1457 layouts, use of the building areas, use of the rooms, and type and materials
1458 of construction. Identifying the use of the building areas is important
1459 because the main purpose of this survey is to determine what rooms are
1460 used for educational purposes and considered for mitigation.

1461 7.2.2.3.2 This on-site property survey is undertaken with on-site facility managers,
1462 and the information will be used to select buildings, floor plans, and rooms
1463 to be acoustically tested.

1464 7.2.2.3.3 The information to be collected during the property survey of educational
1465 facilities is listed in Table 7-2.

1466 **Table 7-2. Property Survey Data Collection for Educational and Other Facilities**

Data Element	Information to Collect
Assessment of property	• Number of buildings on the property • Number and type of rooms in each building • Use of the rooms in each building

Data Element	Information to Collect
Exterior construction styles	• Number of levels • Window type • Facade type • Roof style • Interior ceilings • Assessment of ventilation systems and fresh air ventilation components • Other factors that could impact acoustical test results

7.2.2.4 **Other Facilities.**

7.2.2.4.1 Preliminary property surveys of other facilities such as places of worship, medical facilities, and day care centers are needed to determine what areas are considered habitable. A review of the approved Part 150 NCP may be required to determine if a particular property type is in the mitigation program for consideration. A survey delineates the building layouts, use of the building areas, use of the rooms, and type and materials of construction. It is undertaken with on-site facility managers, and the information will be used to select buildings, floor plans, and rooms that would be acoustically tested.

7.2.2.4.2 The information to be collected during the property survey of other facilities is listed in Table 7-3.

7.2.3 Development of an Acoustical Test Plan.

7.2.3.1 **Purpose of an ATP.**

An Acoustical Test Plan (ATP) is developed to provide clear and consistent guidance for the airport and their consultants to begin implementation of a mitigation program. The ATP is also the official consultation plan with the FAA. The ATP has three major goals:

- Outline the compliance with FAA policy
- Establish a framework for determining property testing
- Receive FAA approval for the testing program

7.2.3.2 **Components of an ATP.**

The ATP must include these major sections:

- Introduction and Purpose

- Summary of Property Assessment and Surveys
- Description of Applicable Acoustical Criteria
- Summary of the Testing Plan
- Discussion of Acoustical Measurement Method
- Determination of the Exterior DNL/CNEL (or other noise metric)
- Determination of the Interior DNL/CNEL (or other noise metric)
- Description of Post-Construction Acoustical Testing

7.2.3.3 **Consultation with FAA.**

The draft ATP is developed with input from the airport operator. Following approval by the airport operator, the draft ATP is submitted to the FAA Regional Office or the local ADO for approval. Following FAA approval, all comments and changes are addressed in the final ATP. The final ATP becomes the overall work plan for all properties under consideration in the mitigation program.

7.3 Acoustical Testing.

The two most common measurement methods of determining noise level reduction (NLR) are the flyover measurement method and the loudspeaker measurement method.

7.3.1 Flyover Measurement Method.

7.3.1.1 **Background.**

7.3.1.1.1 To determine reliable estimates of NLR using the flyover measurement method, it is necessary to simultaneously measure both the exterior and interior noise exposure from an aircraft flyover. The flyover measurement method uses samples of actual aircraft flyovers as the noise source to determine the NLR. Because the exposure differs for each aircraft, statistical analysis has been used to establish an acceptable sample size to achieve 90 percent *confidence interval* of less than 2 dB. The confidence interval, or margin of error, conveys how precise the measurement is.

7.3.1.1.2 The following subsections discuss the measurement equipment required, the equipment setup and acquisition procedures, and the calculation procedures for the flyover measurement method.

7.3.1.2 **Equipment.**

Equipment typically used to take flyover measurements is listed in Table 7-3.

Table 7-3. Equipment Used to Perform Flyover Measurements

Equipment	Use and Purpose
Integrating Sound Level Meter	An integrating sound level meter (SLM) with spectral analysis is required to measures spectral Leqs (unweighted). SLMs must comply with the American National Standards Institute (ANSI) for Type 1 precision measurements or the equivalent international standard. At least one (1) SLM must be provided for each habitable room being measured, along with one (1) SLM for the exterior measurements. SLMs that have triggering capability can automate much of the data acquisition.
Tripods	Microphones in all interior rooms and outside must be mounted on a tripod capable of reaching at least 1.5 meters (≈5 feet) above ground level. No special tripods are required as they are only meant to hold the SLM microphone and pre-amplifier.
Microphone Extension Cable	Measuring multiple rooms usually requires having all SLMs operated from one central location such as the living room. Microphone extension cables are required to connect the exterior microphone and the interior microphones with the SLMs to the central location. Microphone cables of at least 50-feet are recommended.
Camera	Room conditions for absorption must be noted through photographs, as well as the condition of the elements (windows, walls, exterior doors, roofs/ceilings, in-wall air conditioning units) in the rooms being tested that could affect the acoustics.
Laptop/Tablet Computer or Other Data Management Methods	A laptop or tablet computer can be used to log the aircraft Sound Exposure Level (SEL) noise events after each aircraft flyover. The exterior and interior SEL must be logged in each room. Spreadsheet calculations can determine when an acceptable statistical sample size has been measured.

7.3.1.3 **Measurements.**

Determination of NLR for the flyover measurement method requires the simultaneous measurement of both the exterior and interior noise exposure. Obtaining accurate NLR measurements requires consistency, which necessitates a precise setup and data acquisition methodology.

7.3.1.3.1 Setup.

1. ***Each SLM*** must be calibrated each day before the start of measurements. The SLMs must be connected to an external power source or have adequate battery power so measurements are not interrupted. The clocks on all SLMs must be synchronized daily with no more than a two-second difference.

2. ***The exterior microphone*** must be positioned so it is exposed to the entire aircraft flyover with no obstructions to interfere with the measurements or noise sources to contaminate them. The microphone must be positioned away from the structure and other structures as well as away from reflections from large objects or buildings to achieve as much as possible a free-field measurement. If possible, do not place a microphone close to a busy roadway.

3. ***The interior microphones*** must be positioned to measure the average sound pressure in the room and should be at least 3.3 feet (1m) from the most sound transmitting element[34] in the room in the facade (wall) facing the aircraft flight path and from any hard reflective surface such as a wall. All household noise sources must be switched off to the extent possible. This includes televisions, stereos, radios, ceiling fans, ventilation systems, and older refrigerators that may make noise. For the measurements, the windows and doors must be closed and latched.

4. ***The setup of all microphones/tripods*** must be documented with photos of all the microphone locations, and a simple sketch of the microphone locations. Photos of all rooms where a microphone has been placed must document the room conditions for absorption and the condition of the elements in the rooms (windows, walls, exterior doors, roof/ceiling, or in-wall air conditioning unit).

7.3.1.3.2 Data Acquisition.

Once the noise measurements of the aircraft flyovers begin, clean data (little to no background noise other than the aircraft) must be collected from each flyover. If event triggering (collection of sound data in a SLM when a certain sound level is reached) is used, triggers must be set in each SLM. The use of a level trigger and options for storing events may automate much of the process in the field.

1. ***If the SLMs do not have event triggering*** capability, the user may need to measure or record a one-second A-weighted time history and post-process the data manually to determine the SELs of the clean sample (no other background noise) of aircraft flyover measurements.

2. ***If event triggering is used*** in the SLM, the trigger may be set to about 10 dB above the average ambient levels. Interior triggering must have

[34] The most sound transmitting element can be considered the "weakest link" in the building envelope relative to sound transmission, or the element (typically a window) that lets in the most noise.

event durations which match the exterior event durations. The time period for the event is determined from the time period starting and ending 10 dB to 15 dB below the maximum A-weighted noise level (Lmax). Notes must be taken to identify when other noise may have contaminated the measurements. If a loud noise event contaminates the exterior measurement, such as a truck passing or dog barking, the whole set of exterior and interior noise measurements must be eliminated. Indoors, the ambient levels must be below 40 dB for pre-test measurement and 35 dB for post-test measurements.

3. One of two methods can be used to collect the necessary data—collecting a minimum sample size or calculating a 90 percent confidence interval of 2 dB.

   a. **Minimum sample size**. In almost all situations, a minimum sample size of at least 10 overflights will result in 90 percent confidence interval being less than 2 dB. From the sample data, the NLR of the sample of "*x"* number of overflights is calculated in accordance to the formula

$$NLR_{x\ samples}\ 10\log\left(\sum_{i=1}^{x}\frac{10^{exterior\ SEL_i}}{x}\right)-\ 10\log\left(\sum_{i=1}^{x}\frac{10^{interior\ SEL_i}}{x}\right)$$

      i. Where "x" = 10 if a minimum sample size of 10 aircraft are measured.

      ii. In this formula the louder events weigh more than the quieter events. This is consistent in the way that the exterior DNL or CNEL is determined.

   b. **The 90 percent confidence interval.** The 90 percent confidence interval can also be computed after each flyover using a spreadsheet as the aircraft noise is measured and events are created on the SLMs. The data from the SELs are entered into the spreadsheet after each flyover, until the 90 percent confidence interval reaches 2 dB or lower. The spreadsheets that calculate the NLR must be saved and included as part of the documentation for each property.

7.3.1.3.3 Documentation.

As mentioned throughout this process, photographs and other records are needed to document the acoustical testing set-up and on-site conditions. Table 7-4 provides a checklist of photographic and other requirements. The data to be recorded for each property and each measured aircraft noise event are shown in Table 7-5.

Table 7-4. Documentation Checklist Onsite Setup and Conditions

Required Documentation	Use and Purpose
Photographs of the exterior	Aids in identifying the property
Exterior and interior microphone locations	Useful if post-construction measurements are taken and the same setup needs to be recreated.
Photographs of the room interiors	Documents absorption conditions in case additional (secondary) noise testing is later required. Useful if post-construction measurements are taken and the interior conditions (furniture) are documented.
Photographs and notes on the exterior elements in poor condition or exterior elements that have been replaced with modern products	Helps to explain measurement results if needed.
A sketch of the floorplan that identifies the windows, doors, sliding door, pull through air-conditioners marked as well as microphone positions.	Describes setting in plain view to correlated with photographs

Table 7-5. Data to be Recorded during Field Testing for the Flyover Measurement Method

Record for Each Property	Record for Each Measured Noise Event (Aircraft Flyover)
• Property address • DNL contour zone • Date and time of measurements • Description of rooms tested • Photo documentation for microphone setups, room conditions, and element conditions • Simple sketch of room layout and microphone placement	• Date and time of the noise event; • Type of aircraft • Type of aircraft operations (takeoff or landing) • Measured SEL for each event for each room and for each microphone (interior and exterior)

7.3.1.4 **Optional Flyover Measurement Approach.**

7.3.1.4.1 An optional approach may be used to conduct the flyover measurements. SLMs are placed in each of the habitable rooms and on the exterior of the

structure to collect data on aircraft events. All setups are the same as described previously in Section 7.3. The main difference is that no one stays in the house during the noise measurements. The consultant and the structure owner must leave the property for a predetermined amount of time. The consultants return to collect the SLMs and download the data. The data analysis can be completed offsite.

7.3.1.4.2 In this approach, the SLMs are usually time-synchronized to the local airports noise monitoring system to ensure that events recorded on the SLM are actual aircraft noise events. The consultant must monitor the site from outside to ensure contamination of the measured data does not occur if non-aircraft events occur at the same time as an aircraft event resulting in invalid data for that event. Both outdoor and indoor measurement data are evaluated to ensure that only clean measurement data is recorded.

7.3.2 Loudspeaker Measurement Method.

7.3.2.1 **Background.**

7.3.2.1.1 Another measurement method uses a loudspeaker as the noise source to determine the NLR. However, FAA research has shown that "The median NLR of actual aircraft measurement [of this] method is 2.4 dB higher than using an artificial noise source." In other words, the loudspeaker test method consistently underestimates the NLR.

7.3.2.1.2 The following sections provide the procedures for the loudspeaker measurement. This method is designed to maximize consistency in performing the measurements, and follows the most current version of the ASTM E966-10 standard and findings from recent research sponsored by the FAA and Airport Cooperate Research Program (ACRP) including these other sources:

- "Study of Noise Level Reduction (NLR) Variation" April 2013. https://www.faa.gov/about/office_org/headquarters_offices/apl/research/science_integrated_modeling/media/BTV_NLR_report.pdf
- "Review and Evaluation of Aircraft Noise Spectra used to Estimate Noise Level Reduction for Airport Sound Insulation Programs based on the Loudspeaker Test Method", March 2016.
- "Evaluating Methods for Determining Interior Noise Levels Used in Airport Sound Insulation Programs", ACRP 02-51. http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3697

7.3.2.2 **Equipment.**

Table 7-6 lists the equipment required to perform loudspeaker measurements.

1654 **Table 7-6. Equipment Used for Loudspeaker Measurements**

Equipment	Use and Purpose
Integrating Sound Level Meter (SLM)	An integrating sound level meter (SLM) with spectral analysis is required to measure spectral Leqs (unweighted). SLMs must comply with the American National Standards Institute (ANSI) for Type 1 precision measurements or the equivalent international standard.
Loudspeaker (active or passive)	The loudspeaker can be an active speaker with a built-in amplifier or passive loudspeaker with a separate amplifier. Both loudspeaker types must have a minimum of 500 watts of power output. Use of a loudspeaker in heavy rain conditions is not recommended.
Power Amplifier	If a passive loudspeaker is used with a separate amplifier, a minimum 300 watts per channel amplifier must be used in bridge-mono mode, which doubles the available voltage (combines two amp channels into one mono, much more powerful amp channel).
Graphic Equalizer	If a passive loudspeaker is used with a separate amplifier, an equalizer is recommended to adjust the system output and ensure a reasonably flat response.
Signal Generator (pink noise)	A signal generator is required for producing pink noise (a signal or process with a frequency spectrum such that the power spectral density is inversely proportional to the frequency of the signal).
Tripod	The loudspeaker must be mounted on a tripod capable of handling the weight of the loudspeaker at the height required.
Monopod	A microphone boom pole (monopod) extendable to 10 feet is required for external measurements on 2nd story facades (walls) or other hard to reach areas.

Equipment	Use and Purpose
Speaker Extension Cables	If a passive loudspeaker is used which requires a separate amplifier, a minimum of two 100-foot speaker extension cables are required. No speaker cables are required if using an active loudspeaker system.
Power Extension Cables	Testers should maintain at least two 100-foot power extension cables to power the loudspeaker system. Optionally, a low-noise power generator may be used with a shorter power cable.
Camera	A digital camera must be used to photo document each location of the speaker and tripod setup in the exterior. In addition, room conditions for absorption conditions, must be noted, as well as the condition of the elements in the rooms being tested.

7.3.2.3 **Measurements.**

Determination of NLR with the loudspeaker measurement method requires measuring both the exterior and interior noise exposure. The NLR needs to be measured consistently, which necessitates a precise setup and data acquisition methodology.

7.3.2.3.1 Loudspeaker Setup.

1. The loudspeaker must be positioned so the sound field at the facade of the room being measured is as uniform as possible at a 45-degree angle of incidence. A larger facade, or wall, requires a greater distance from the facade to the speaker. Corner rooms with two facades must have both facades exposed simultaneously. If only one facade is tested, it must be the one with least performing facade in terms of potential to reduce noise. From the center of the facade, the perpendicular and the parallel distance to the speaker must be roughly equal. To conduct efficient testing, place the loudspeaker to be able to test multiple rooms at one time.
2. The loudspeaker must be setup on the tripod and directed towards the middle of the facade. The 45-degree angle of incidence is usually achieved in the horizontal plane. However, the 45-degree angle of incidence can also be achieved in the vertical plane by setting the speaker on the ground and tilting it up. This is useful when measuring second story facades.

3. Flat or vaulted roof structures must be tested using an elevated loudspeaker, raising it by using a vertical lift, crane or bucket truck, unless there is clear evidence that such structures already have sufficient insulation capabilities. The loudspeaker must be positioned so all exposed surfaces have an angle of incidence as close to 45-degrees as possible.

4. If external amplifiers or active loudspeakers have to be powered from an indoor power outlet, the cable must not create an opening (sound leak) through a door or a window that is exposed to the external sound source.

7.3.2.3.2 Exterior Data Acquisition.

1. **General requirements.**

   a. The amplifier-loudspeaker system must be capable of producing an A-weighted level at the facade that is at least 80 dB and at least five dB louder than the Lmax of the ambient levels. Typical A-weighted exterior levels at the facades must range from 80 to 95 dB. Data acquisition must be paused during aircraft overflights or when a truck passes by to minimize contamination of the measurement. Clean data must be collected during the measurements.

   b. The SLM must be set to measure the unweighted Leq of full or one-third octave bands at least from 100 Hertz (Hz) to 5,000 Hz (one-third octave bands) or 125 Hz to 4,000 Hz (full octave bands).

2. **Measurement sequence**.

   a. First, the SLM measures exterior background noise. This is a Leq measurement of 30 seconds without the loudspeaker system on. It documents the exterior background conditions and accounts for any contamination of the measurement.

   b. Next, exterior measurements are taken with the loudspeaker system turned on. The SLM is either used to measure at various spot positions over the entire exposed facade of the room or is swept over the facade for 30 seconds or longer as needed.

3. **Choice of methods.**

   a. Three types of exterior measurement methods may be used, depending upon local conditions—Flush Method, Nearby Method, or Calibrated Source Method. Each of these methods accounts for the reflected sound off the facade differently. The reflected energy is subtracted from the measured exterior levels, using guidelines outlined in ASTM E966-*10 Standard Guide for Field Measurements of Airborne Sound Attenuation of Building Facades and Facade Elements.*

b. The three measurement methods are explained in more detail here and in order of preference.

i. *Calibrated Source Method* – for this method loudspeaker output is calibrated in a free-field environment[35] at the same distance that the loudspeaker is from the exterior facade. In the room to be tested, the distance from the facade to the loudspeaker is measured, and noted, and an exterior measurement is undertaken at 0.5 meters (or 1.6 feet) from the loudspeaker ($L_{Ext,Close}$). After measuring at a structure(s), select a free-field environment to perform a calibration measurement ($L_{Ext,Cal}$) at 0.5 meters (or 1.6 feet) from the loudspeaker, and undertake a series of free-field measurements at the respective distances that were measured at all the rooms of the properties prior to the free-field measurements. The exterior measurements can be performed for all rooms at one time or for each room at a time if a sufficient free-field environment exists outside of each room by rotating the speaker, and using the following steps: First, the calibration measurement is subtracted from the 0.5 meter (or 1.6 feet) measurement taken in the rooms of the structure. Second, the free-field measurement at the corresponding distance of each room is tested, and the difference is added to each measurement to obtain the exterior noise levels. This method works if the environment near the facade is similar to that at the average facade distance for the free-field measurement. Due to differences between the environment near the facade being tested and that of the free-field location, this may not be the best method to use in some cases.

ii. *"Flush Method"* – for this method, the microphone must measure 10 to 15 spot locations on the exterior facade and they must be no further than 17 millimeters, or 0.7 inches, from the facade to determine an average exterior Leq.

iii. *"Nearby Method"* – for this method, the microphone must measure 10 to 15 spot locations on the exterior facade at distances varying from 1.2 to 2.4 meters, 4 to 8 feet, from the facade. Alternately, the microphone can be swept over

[35] A free-field environment has no reflective surfaces (like wall of building) nearby.

the facade at these distances for 30 seconds or longer to determine an average exterior Leq.

7.3.2.3.3 Local conditions may not always allow the preferred method to be used. For example, in areas where residences are tightly spaced distance thresholds may limit the choice of methods. If practical issues such as available space limit the use of a method, use the next preferable method, and document why the method was selected.

7.3.2.3.4 Interior Data Acquisition.

1. **General requirements.** The amplifier-loudspeaker system must be capable of producing an A-weighted level in the interior of at least 50 dB, and at least 10 dB higher than the indoor ambient noise level. The interior measurements are performed similarly to the exterior measurements in that the SLM must be set to measure the unweighted Leqs of full or ⅓ octave bands at least from 100 Hz to 5,000 Hz (⅓ octave bands) or 125 Hz to 4,000 Hz (full octave bands).

2. **Measurement sequence**.

   a. First, measure the interior background Leq for 30 seconds without the loudspeaker system on. This is done to document the interior background conditions, ensure that the interior background levels are less than 40 dB, and potentially account for any contamination of the measurement. To the extent possible, all household noise sources must be eliminated to not contaminate the measurements. This typically includes televisions, stereos, radios, ceiling fans, ventilation systems and older, louder refrigerators.

   b. Measure next the interior Leq with the loudspeaker system turned on. The microphone is swept to measure the average sound pressure of the room and should be at least 3.3 feet (1m) from the most sound transmitting element in the room (usually this is a window in the outside wall facing the aircraft flight path) and from any hard reflective surface such as an interior wall in the room. The Leq measurements must be conducted for 30 seconds or longer.

7.3.2.3.5 Documentation.

Table 7-7 lists the photographic and site specific documentation that must be completed during field testing under the Loudspeaker Measurement Method. Digital format is recommended for data sheets and photographs.

7.3.2.4 **Data Analysis.**

To calculate the measured NLR in a room, three sources of noise measurement data are required, including exterior levels, interior levels, and exterior noise source spectrum. The following sections discuss measuring these sources for determining the NLR.

Table 7-7. Data to be Recorded during Field Testing for the Loudspeaker Measurement Method

Photographs	Data Sheet Contents
• Exterior of the structure to aid in identifying the property. • Loudspeaker setup locations. • Exterior elements that are in poor condition or that have been replaced with modern products. • Room interiors to document absorption conditions in case noise modeling is undertaken or if retesting is required to document changes in the interior conditions. The date and time on all SLMs must be synchronized with the camera time and date.	• Resident name • Property address • Date and time of measurements • Description of rooms tested • Site number • Initials of person conducting the testing • Airport code • Log whether tripod or elevated speaker used • Room being tested • A-weighted dB level tagged to SLM file number for interior/exterior and background/facade measurement • Simple sketch of room layout, loudspeaker and microphone placement noting all exterior elements

7.3.2.4.1 Outdoor/Indoor Noise Reduction (OINR) Calculation.

To determine the OINR in each 1/3 or full octave band, the calculation will depend on the exterior measurement method in accordance with ASTM E966-10. The following equations are applied in accordance to the corresponding measurement method.

- Flush Method: $OINR = L_{Flush} - L_{Int} - 5$ dB
- Nearby Method: $OINR = L_{Near} - L_{Int} - 2$ dB
- Calibrated Source Method: $OINR = L_{Free} - L_{Int}$ (If $L_{Ext,Close}$ is within one dB from $L_{Ext,Cal}$ then the free test site meets the free field requirement).

7.3.2.4.2 Source Spectrum.

1. The exterior noise spectrum is determined to calculate the NLR. The NLR is subtracted from the exterior noise level to determine the interior noise exposure.
2. Exterior noise spectrum can be calculated by using one of two methods: a worst-case aircraft type (noisiest aircraft type) or an

average measured aircraft spectrum. The methods are described in Table 7-8.

3. These methods are supported and recommended by research conducted for the FAA. In particular, more detail can be found in *Review and Evaluation of Aircraft Noise Spectra used to Estimate Noise Level Reduction for Airport Sound Insulation Programs based on the Loudspeaker Test Method*, available on the FAA website.

Table 7-8. Source Spectrum Methods

Method	Description
Most Frequently Operating Aircraft	The aircraft that dominates (used most frequently) at an airport by runway end must be used as the *aircraft noise spectrum*. For example, the program at Los Angeles International (LAX) uses the noise spectrum of the Boeing B737-800, since that is the most common aircraft in use at LAX. Alternative versions of this method use an *approach spectrum* since that best represents the dominant noise communities receive from arrivals or use a *departure spectrum* since they receive almost exclusively departure noise.
Average Aircraft Noise Spectrum	The source spectrum must estimate an average aircraft noise spectrum for aircraft using the airport. This requires field measurements to collect samples of the noise from aircraft departures and arrivals and then weighting them to account for the annual average runway use.

7.3.2.4.3 Calculation of NLR.

1. Once the exterior spectrum is determined, the interior spectrum can be determined by subtracting the OINR from the exterior one-third or full octave band exterior noise spectrum. If the measured outdoor or indoor levels with the loudspeaker turned on are less than 10 dB louder than their respective outdoor or indoor background levels, then either the power to the loudspeaker needs to be increased or measures need to be taken to reduce background noise. The simple steps for calculating the NLR are:

   a. Determine the sums of all exterior and interior A-weighted levels.

   b. Subtract the total A-weighted interior level from the A-weighted exterior level.

2. This is shown in the following equations.

   The exterior A-weighted total level is:

$$L_{Ext\,Total} = 10log \sum_{i=1}^{k} 10^{\frac{L_{Ext\ Noise\ Source\ Spectrum,i}}{10}}$$

The interior A-weighted total level is:

$$L_{Int\,Total} = 10log\sum_{i=1}^{k} 10^{\frac{L_{Ext\,Noise\,Source\,Spectrum,i} - OINR_i}{10}}$$

Where "*k"* is the total number of full octave or ⅓ octave bands used.

The NLR is then determined by:

$$NLR = L_{Ext\,Total} - L_{Int\,Total}$$

3. Table 7-9 presents an example of a full octave band calculation measurement. The following parameters are provided under "Unweighted Measured Data":
   - *Interior Background* - the measured interior background octave band levels and the A-weighted total;
   - *Interior Measurement* - the measured interior octave band levels and the A-weighted total;
   - *Exterior Background* - the measured exterior background octave band levels and the A-weighted total;
   - *Exterior Measurement* - the measured exterior facade octave band levels and the A-weighted total.
4. In this example, the A-weighted totals show the measurements with the loudspeaker turned on to be more than 10 dB louder than the background levels. The *OINR* is developed by subtracting the *Interior Measurement* from the *Exterior Measurement.*
5. Under "A-Weighted Aircraft Noise Source Spectrum," the *OINR* is subtracted from the *Exterior Spectrum* to obtain the *Interior Spectrum*. The A-weighted acoustical energy totals of the *Exterior Spectrum* and the *Interior Spectrum* are subtracted to obtain the *Noise Level Reduction* on the last line.

1863 **Table 7-9. Example of a Full Octave Band Calculation Measurement**

	Octave Band Center Frequeny								A-Weighted Total
	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz	
Unweighted Measured Data									
Int. Background	45.6	40.2	36.2	27.7	30.1	28.0	22.6	18.9	35.2 dBA
Int. Measurement	56.3	52.7	48.3	40.8	46.6	43.5	43.3	36.4	51.0 dBA
Ext. Background	63.1	58.8	55.6	41.3	43.7	43.5	41.0	24.7	51.7 dBA
Ext. Measurement	78.1	77.0	74.0	70.8	75.9	75.8	74.8	74.6	82.0 dBA
OINR	21.8	24.3	25.7	30.0	29.3	32.3	31.5	38.2	
A-Weighted Aircraft Noise Source Spectrum									
Ext. Spectrum	63.2	74.1	80.4	84.1	84.0	82.4	75.0	58.2	89.3 dBA
Int. Spectrum	41.5	49.8	54.7	54.1	54.7	50.1	43.5	20.0	60.4 dBA
								Noise Level Reduction:	**28.9 dB**

1864

1865 7.4 **Determination of NLR and Interior Noise Levels.**

1866 7.4.1 Several types of noise metrics can be used to define interior noise levels, as shown in
1867 Table 7-10. The following sections discuss the process of determining the various
1868 property types using the measured NLR.

1869 7.4.2 The Day-Night Average Noise Level (DNL), which includes a nighttime penalty
1870 component (an additional 10 dB between10:00 p.m. to 7:00 a.m.), is a typical noise
1871 metric to define goals for residential structures (single- and multi-family residences). In
1872 California, the Community Noise Equivalent Level (CNEL) is used which includes an
1873 evening and a nighttime penalty. Under CNEL, a 5 dB penalty is added between 7:00
1874 p.m. and 10:00 p.m. and a 10-dB penalty is added between 10:00 p.m. and 7:00 a.m.
1875 These penalties are added to account for human sensitivity to nighttime noise. The FAA
1876 recognizes CNEL as an alternative noise metric for use in California, and therefore will
1877 accept either DNL or CNEL metric for projects in California.

1878 7.4.3 For educational facilities, the Equivalent Sound Level (Leq) is a typical noise metric for
1879 defining program goals. Leq quantifies noise that varies over a continuous period of
1880 time into a single value in decibels. The single value contains the same acoustic energy
1881 as the varying sound level contains during that time period. For educational facilities,
1882 the Leq is generally based on the number of hours of a typical school day (i.e., Leq^{8}
1883 represents the single noise level equivalent to noise over the 8 hours of a school day).

1884 7.4.4 For other facilities, the noise metric must be based on the type of use and must be
1885 reviewed with the local FAA Regional Office or ADO before proceeding. For example,
1886 habitable portions of places of worship may dictate the use of DNL, which has a
1887 nighttime component. Daycare centers may be more suited for the use of Leq since
1888 instruction usually takes place during the day.

Table 7-10. Appropriate Interior Noise Level Metrics by Structure Type

Structure Type	Appropriate Interior Noise Level Metric
Residential	Day-Night Average Noise Level (DNL) and, in California, Community Noise Equivalent Level (CNEL)
Educational	Continuous Sound Level (Leq)
Other	DNL (and CNEL in California) or Leq, based on type of use, and approved by FAA Regional Office or ADO

7.4.5 The determination of potential interior noise levels and NLR begins with the development of exterior DNL noise contours. These are based on the most recent set of FAA-accepted Noise Exposure Maps (NEMs) from an airport's Part 150 Study. The AIP Handbook, FAA Order 5100.38, states that noise compatibility projects must not use noise exposure maps that are more than five years old.

7.4.6 Single-Family Residences.

Figure 7-2 illustrates how testing protocol for single-family residences, which fall into one of two types, either categorized or uncategorized.

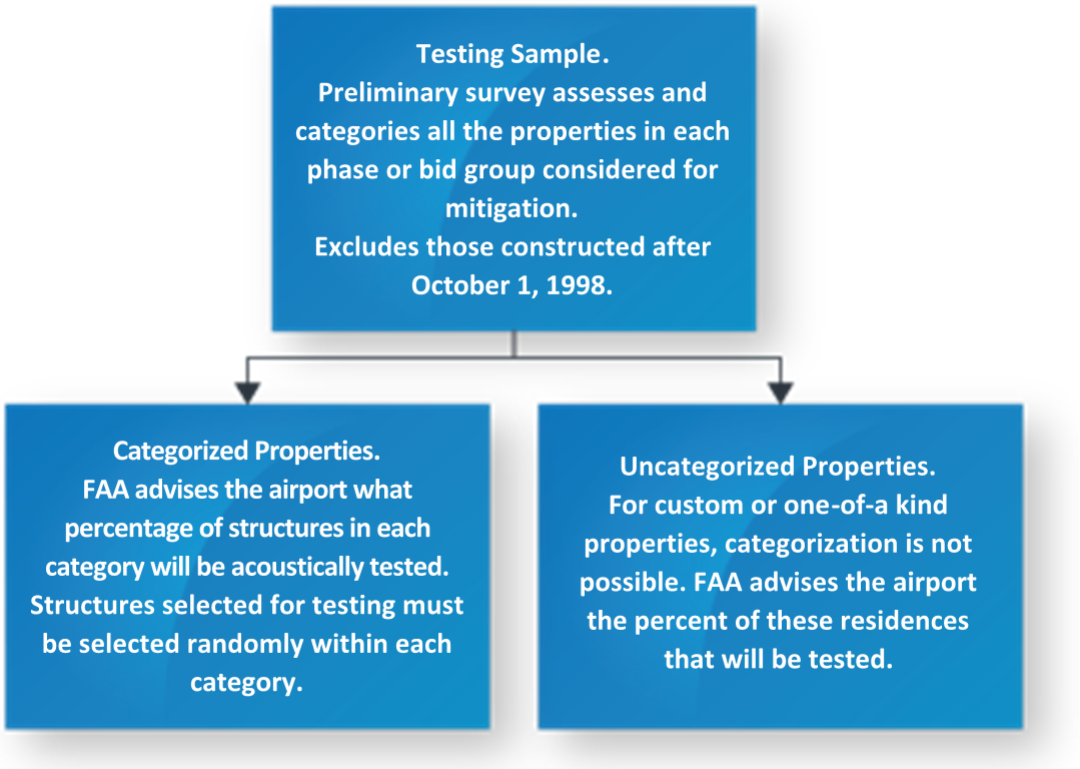
7.4.6.1 **Categorized Properties.**

For each phase or bid group, if the preliminary survey reveals that structures can be categorized and organized into groups of structures, the FAA will advise the airport what percentage of structures in each category will be acoustically tested. Structures included in the testing must be selected randomly within each category.

7.4.6.2 **Uncategorized Properties.**

For each phase or bid group, when the preliminary survey identifies custom or one-of-a- kind properties, categorization is not possible. In these cases, the FAA will advise the airport the percent of the residences that will be tested.

Figure 7-2. Single-Family Residences: Testing Protocol



7.4.6.3 **Exterior DNL.**

7.4.6.3.1 Exterior noise levels for single-family residences must be based on the FAA-accepted noise contours in the NEMs from the airport's Part 150 Study. The exterior DNL noise levels must be based on a specific grid point analysis using the Aviation Environmental Design Tool (AEDT) model. To the extent possible, the grid-point analysis must use a location of the actual structure. If this is not available, the grid-point analysis can use a location on the residential property, although discretion must be used so a grid-point on a large property is not placed far enough away from the structure to change the modeled DNL level. Specific noise levels for each property must be set as shown in Table 7-11.

Table 7-11. Specific Noise Level Assumptions for Single Family Residences

Exterior DNL	For Properties Located . . .	Assumption
75 dB	within the 70 to 75 dB noise contours	≥70 & ≤75 is assumed to be 75 dB
70 dB	within the 65 to 70 dB noise contours	≥65 & <70 is assumed to be 70 dB
Actual dB Grid Point Level	outside the 65 dB noise contours (usually block rounding properties)	<65 use actual grid point level

7.4.6.3.2 The FAA does not normally approve sound insulation for areas above 70 DNL. At noise levels above 70 DNL it becomes difficult to sound insulate and acquisition should have been considered. Consult with the local FAA Regional Office or ADO.

7.4.6.4 **Measured NLR.**

The airport operator or their consultant will acoustically test all habitable rooms within a specific single-family residence. Measurements will be taken both outside and inside of the habitable rooms as outlined in Section 7.3. This measured NLR is used to judge sound insulation programs.

7.4.6.5 **Interior DNL.**

The interior DNL noise level is calculated by subtracting the measured NLR for a room, from the exterior DNL that is taken from an airport's FAA-accepted NEM. This equation is expressed below, as:

$$Exterior\ DNL - NLR_{Room} = Interior\ DNL_{Room}$$

7.4.6.6 **Determination of Average Interior DNL.**

7.4.6.6.1 An average interior DNL must be developed for each property. The average must be a logarithmic (energy) average of the interior DNL noise levels of all habitable rooms within the property tested.

7.4.6.6.2 An arithmetic average must not be used to average noise levels expressed as decibels. Properties tested in each category that has interior DNL noise levels equal to or greater than 45 dB are considered noise impacted. Results for properties less than 45 dB will not be considered noise impacted.

Note: If 50 percent or more of the properties tested in each category have an average interior DNL noise level equal to or greater than 45 dB, the FAA may determine that the entire category (100%) will be equal to or greater than 45 dB. the FAA may also determine that acoustical testing

will be performed on 100% of the structures in the category. In any calculation using interior DNL, the interior DNL value must not be rounded up. For example, an interior DNL of 44.7 must not be rounded to 45.

7.4.7 Multi-Family Residences.

7.4.7.1 **Testing Sample.**

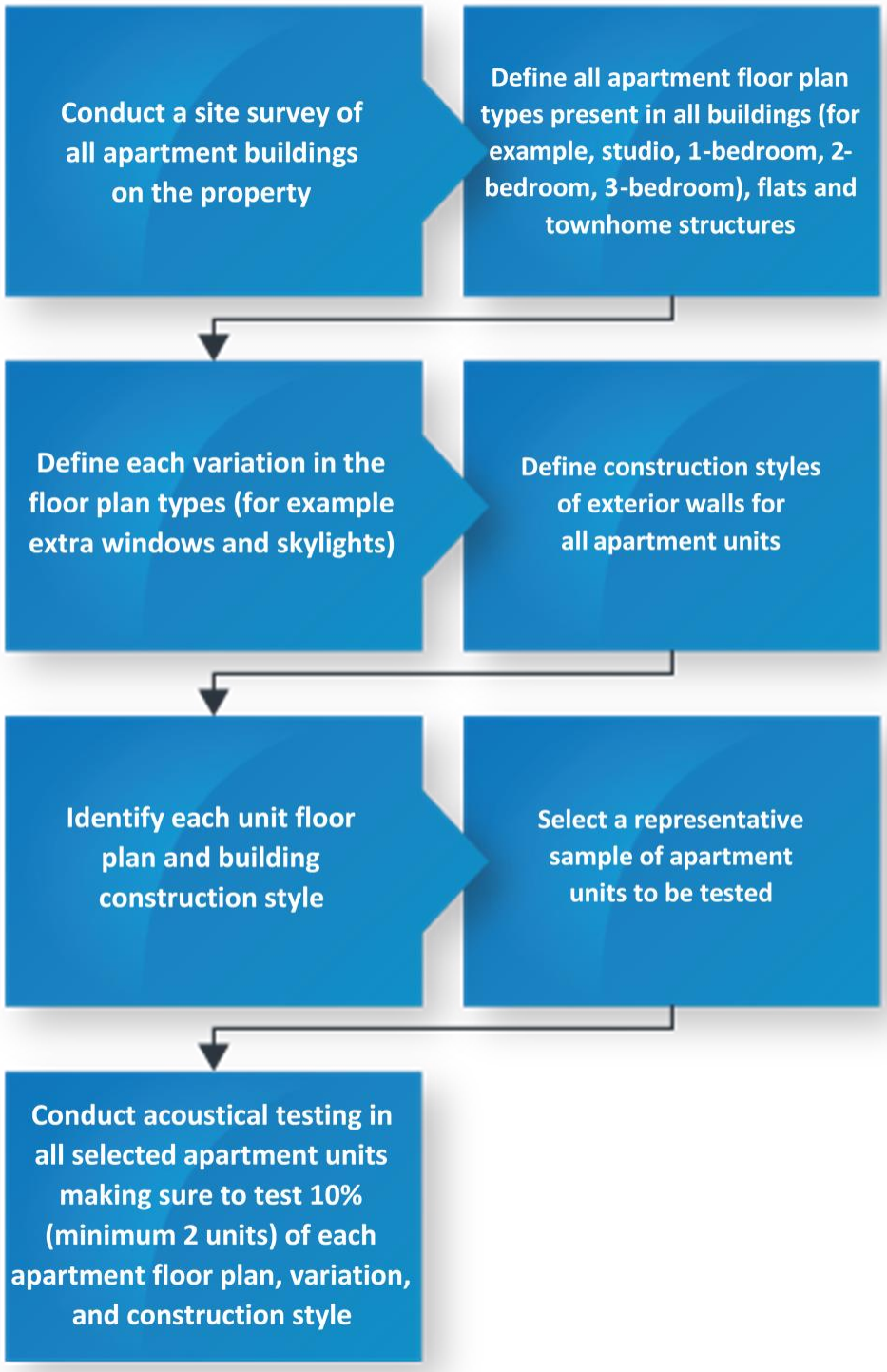
7.4.7.1.1 As outlined in Section 7.2.2.3, preliminary property surveys are required for all the properties in each phase or bid group considered for mitigation. The survey assess and categorizes properties to the extent possible. Based on the FAA Final Policy on Part 150 *Approval of Noise Mitigation Measures Effect on the Use of Federal Grants for Noise Mitigation Projects* (63 Federal Register 16409, April 3, 1998), residential property constructed after October 1, 1998, is not approved for remedial noise mitigation. This also applies to partial renovations and additions, which must be justified to the FAA and will be evaluated on a case-by-case basis.

7.4.7.1.2 The test method varies slightly for multi-family properties, apartments and condominiums. The difference in the testing plans is described in more detail in the following sections.

7.4.7.1.3 Apartment Buildings (Rental Property).

1. Testing for apartments is based on the “Individual Building” acoustical testing plan and generally have one owner with multiple tenants. Unlike condominiums, apartments are more likely to have consistent exterior elements since any changes would be undertaken as part of each building and the whole complex. The property survey will identify all floor plan types and variation in all buildings on the property.
2. Floor plan types are usually studios, 1-bedroom, 2-bedroom, 3-bedroom plans, and can be further categorized as flats or townhouses. Variations on the floor plans may include units that have extra windows or different exterior construction. Once all floor plan types have been identified, acoustical testing is conducted on at least 10 percent of each floor plan type/variation with a minimum of two units per floor plan type.
3. For small multi-family apartment buildings (6 units or less) testing on 100 percent of all units is recommended. Consultation with the local FAA Regional Office or ADO is required to confirm when 100 percent testing is required.
4. The selection of the testing sample for apartment buildings is presented in Figure 7-3**.**

1992 **Figure 7-3. Process for Selecting the Testing Sample for Apartment Buildings**



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7.4.7.1.4 Condominium Buildings (Owner-Occupied Property).

1. Condominiums are also based on the "Individual Building" acoustical testing plan and are individually owned similar to single-family structures. Unlike apartments, condominiums are more likely to have had exterior changes such as newer windows and doors. The property survey must identify all floor plan types and variations in all buildings on the property. Floor plan types are usually studios, 1-bedrooms, 2-bedrooms, 3-bedrooms and can be further categorized as flats or townhouses.
2. Variations on the floor plans may include units that have extra windows or different exterior construction. Variations also include replaced exterior windows and doors that could result in interior noise levels different from comparable units. Once all floor plan types have been identified, acoustical testing must be conducted on at least 10 percent of each floor plan type/variation with a minimum of two units per floor plan type.
3. The selection of the testing sample for condominium buildings is presented in Figure 7-4.

7.4.7.2 **Exterior DNL.**

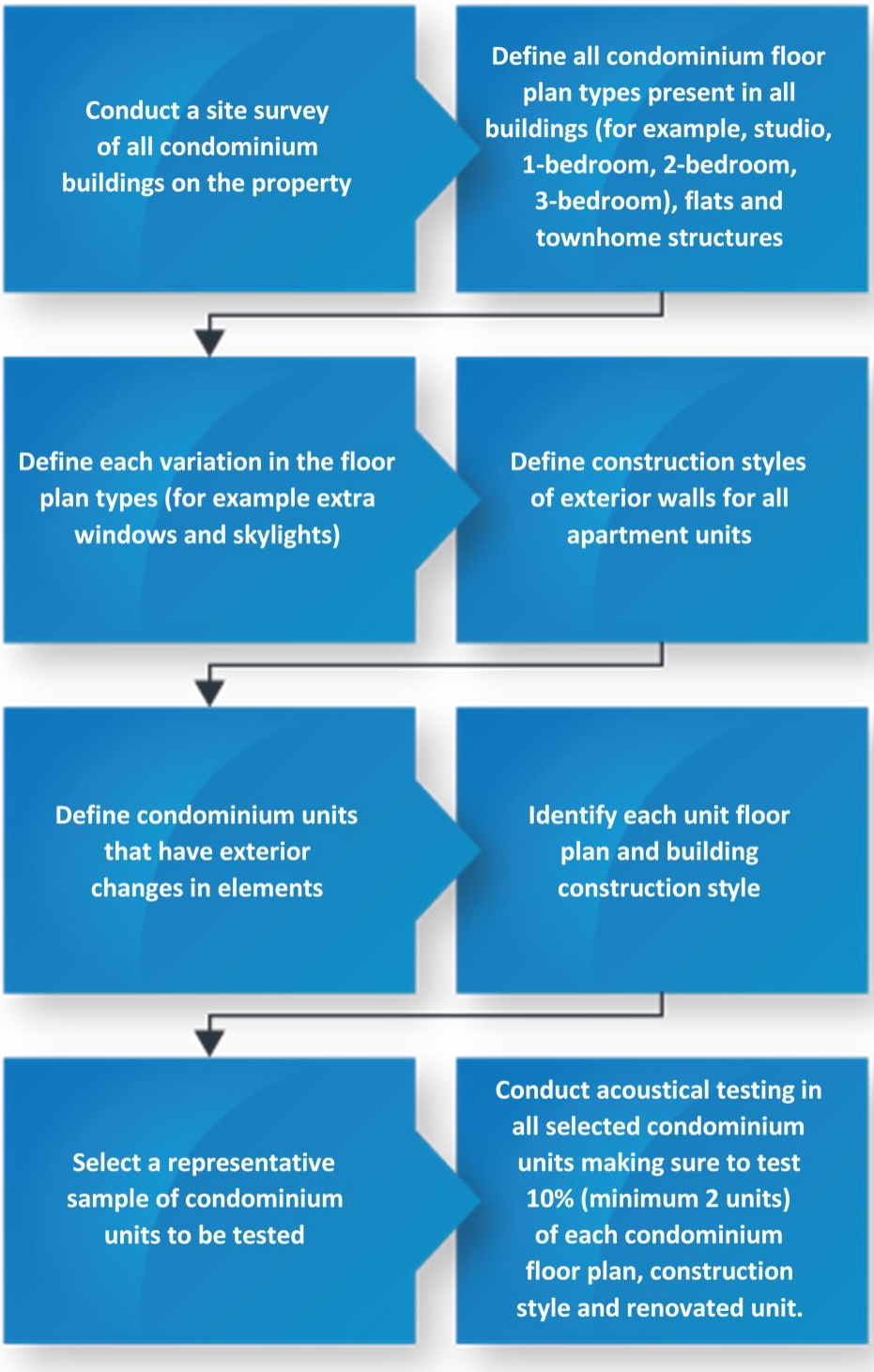
7.4.7.2.1 Exterior noise levels for multi-family residences must be based on the FAA-accepted noise contours in the NEMs. The exterior DNL noise levels must be based on a specific grid point analysis using the Aviation Environmental Design Tool (AEDT) model, or the most recent model update approved by the FAA Office of Environment and Energy.

7.4.7.2.2 For apartment or condominium complexes with multiple buildings, the exterior noise levels must be based on a grid-point analysis at the location of the apartment or condominium building that is located in the highest noise contour area of the complex. Specific noise levels for each property must be set as shown in Table 7-12.

Table 7-12. Specific Noise Level Assumptions for Multi-Family Residences

Exterior DNL	For Properties Located . . .	Assumption
75 dB	within the 70 to 75 dB noise contours	≥70 or ≤75 is assumed to be 75 dB
70 dB	within the 65 to 70 dB noise contours	≥65 or <70 is assumed to be 70 dB
Actual dB Grid Point Level	outside the 65 dB noise contours (approved for block rounding)	<65 use actual grid point level

Figure 7-4. Process for Selecting the Testing Sample for Condominium Buildings



7.4.7.2.3 The FAA does not normally approve sound insulation for areas above 70 DNL (sound insulation is often not successful with noise at this level and

the property should be acquired), or below 65 DNL. Consultation with the local FAA Regional Office or ADO is advised.

7.4.7.3 **Measured NLR.**

Since NLR is typically used to judge the overall effectiveness of sound insulation programs, airport operators or their consultants will conduct acoustical testing for all habitable rooms specified in the ATP to determine the NLR for the multi-family apartment or condominium property. Testing may done on a minimum of 30 percent of all floor plan types, construction styles, and variations. Measurements will be conducted both outside and inside of the habitable rooms following the procedures outlined in Section 7.3 and the standards in the most current version of the ASTM E966-10.

7.4.7.4 **Outdoor-Indoor Level Reduction Calculation**

Once the measurements have been completed, the Outdoor-Indoor Level Reduction (OILR) of rooms is calculated from the measured exterior and interior sound levels in each octave band, as outlined in ASTM E966-10. The OILR values are then used to compute the NLR of aircraft noise as measured in A-weighted (dBAs).

7.4.7.5 **Interior DNL**

The interior DNL noise level is calculated by subtracting the measured NLR for a room from the exterior DNL from an airport's FAA-accepted NEM. This equation is expressed below, as:

$$\text{Exterior DNL} - \text{NLR}_{\text{Room}} = \text{Interior DNL}_{\text{Room}}$$

7.4.7.6 **Determination of Average Interior DNL.**

An average interior DNL must be developed for each property. The average must be a logarithmic average of the interior DNL noise levels of all habitable rooms within the property tested. An arithmetic average must not be used to average noise levels expressed as decibels. In any calculation using interior DNL, the interior DNL value must not be rounded up. For example, an interior DNL of 44.7 must not be rounded to 45.

7.4.7.7 **Apartment Buildings (Rental Property).**

7.4.7.7.1 As mentioned in Section 7.3.2, apartments have one owner and multiple tenants and so the structures are more likely to have consistent exterior elements. Any changes would be usually made to the whole complex. In these cases, calculations may be based on the "Individual Building" plan.

7.4.7.7.2 Once the acoustical testing has been completed, the steps listed in Table 7-13 must be taken to develop an average interior DNL for each of the buildings within the entire apartment complex.

7.4.7.7.3 Apartment complexes that have average interior DNL noise levels equal to or greater than 45 dB may be considered to be noise impacted. Those properties less than 45 dB are not considered noise impacted. However, the mitigation treatment plan will be based on actual units impacted.

7.4.7.7.4 In any calculation that uses interior noise level, the interior noise level value must not be rounded up. An interior noise level of 44.7 dB must not be rounded up to 45 dB.

Table 7-13. Process for Determining Average Interior DNL for Apartment and Condominium Buildings

Step	Apartment and Condominium Building Process
Determine average interior DNL for each unit tested	This is based on testing a minimum 10% of each floor plan type or construction style. Here's an example for a complex of 30 one-bedroom units and 15 two-bedrooms units: 10% of 30 one-bedroom units = 3 must be tested 10% of 2 one-bedroom units = 1.5, so 2 must be tested
Determine average interior DNL for each floor plan type and construction type	Average all interior noise levels together for all similar floor plans/construction styles. Using the same example above for 1- and 2-bedroom units— 1. Average the three interior DNLs for all 1-bedroom units tested. 2. Average the two interior DNLs for all 2-bedroom units tested.
Determine average interior DNL for each building	Multiply the average interior DNL for each floor plan type/construction style by the number of units in each apartment building in the complex. For an apartment building has eight units— Four are one-bedroom units with an average XX DNL Four are two-bedroom units with an average xx DNL. The average interior DNL for the building must be the average of the 1-bedroom DNL times four, and the 2-bedroom DNL times four.

7.4.7.8 **Condominium Buildings (Owner-Occupied Property).**

7.4.7.8.1 As stated in Section 7.4.7, condominiums are individually owned, similar to single-family structures, and so they are more likely to have had exterior changes in the elements (windows and doors) that changed the floor plan type. In these instances, the floor plans may be categorized. As a result, acoustical testing must also be based on the "Individual Building" testing plan and the final determination of interior noise levels presented in the ATP.

7.4.7.8.2 Once the acoustical testing has been completed, the steps listed in Table 7-13 must be taken to develop an average interior DNL for all the buildings in the complex.

7.4.7.8.3 Condominium complexes that have average interior DNL noise levels equal to or greater than 45 dB may be considered to be noise impacted.

Note: Properties that have average interior DNL noise levels less than 45 dB would not be considered noise impacted. However, the mitigation treatment plan will be based on actual units impacted. As in all the calculations using interior noise level, the interior noise level values must not be rounded up. An interior noise level of 44.7 dB must not be rounded to 45 dB.

7.4.8 Educational Facilities.

7.4.8.1 **Testing Sample.**

7.4.8.1.1 Educational facilities are generally one-of-a-kind structures that may have expanded with multiple additions over decades as the building use changed.

7.4.8.1.2 Multiple additions over time result in changes in construction materials and techniques. Roof construction changes, window-glazing changes, ventilation systems may be different, as may room sizes and finishes. Therefore, it is important to do acoustical testing in all variations of rooms. Rooms such as libraries, fixed-seat auditoriums, and educator offices must each be tested separately.

7.4.8.1.3 For rooms that are similar, such as classrooms, a minimum of 10 percent must be tested, with a minimum sample of two rooms, as long as the room sizes are identical and the year of construction does not differ. For example, if a facility has 10 classrooms of identical size in a building built in 1967 and four new classrooms of identical size added in 1982, then a minimum of two classrooms must be tested in the 1967 building and two must be tested in the 1982 building.

7.4.8.1.4 The selection of the testing sample for educational facilities can be summarized in two guidelines or directives:

- Perform acoustical testing in each room that is unique, i.e., libraries, fixed-seat auditoriums, and educator offices.
- Perform acoustical testing in a minimum of 10 percent of classrooms of similar size and construction style and a minimum sample of two classrooms.

7.4.8.2 **Exterior Leq.**

7.4.8.2.1 Exterior noise levels for educational facilities must also be based on the FAA-accepted noise contours in the NEMs. However, for educational facilities, the Leq noise metric is used to represent the average noise level during the hours of the normal school day. The exterior Leq noise levels must be based on a specific grid point analysis using the Aviation Environmental Design Tool (AEDT) model.

7.4.8.2.2 Since the exterior Leq is based on the average noise during normal school hours, the normal school hours for that facility needs to be determined. In addition to day classes, schools of higher (post-secondary) education often have classes in the late afternoon and early evening. Normal hours for primary, middle, and secondary are usually daytime, and they may have after school programs and evening events.

7.4.8.2.3 The first step in the assessment of educational facilities is to discuss with school officials what are the normal class hours and types of activities occurring outside of the normal classroom hours. Once the time period is known, the period of the Leq can be determined.

7.4.8.2.4 Several options to determine the appropriate Leq noise level include:

- Facility has normal classroom hours, plus after school and evening activities – Use the Leq(day) or the 15-hour Leq noise metric from AEDT. The Leq(day) represents the Leq from 7:00 a.m. to 10:00 p.m. and is easily extracted from the AEDT modeled results.
- Facility has normal classroom hours – Obtain hourly operations data and run hourly Leq in AEDT for school hour period for average day or annual average day.

7.4.8.2.5 The determination of the appropriate Leq for educational facilities must be discussed in the ATP and approved by the local FAA Regional Office or ADO.

7.4.8.2.6 For educational facilities with multiple or very large buildings, the exterior noise levels must be based on a grid-point analysis at the location of the building(s) located in the highest noise contour area of the complex. Specific noise levels for educational facilities are listed in Table 7-14.

Table 7-14. Specific Noise Level Assumptions for Educational Facilities

Exterior DNL	For Properties Located . . .	Assumption
75 dB	within the 70 to 75 dB noise contours	≥70 dB or ≤75 is rounded to 75 dB
70 dB	within the 65 to 70 dB noise contours	≥65 dB or <70 dB is rounded to 70 dB
Actual dB Grid Point Level	outside the 65 dB noise contours	all Leqs of <65 use actual rounded grid point level

7.4.8.2.7 The FAA does not normally approve sound insulation for areas above 70 DNL (sound insulation is often not successful with noise at this level and the property should be acquired), or outside of 65 DNL. Consultation with the local FAA Regional Office or ADO is advised.

7.4.8.3 **Measured NLR.**

Airport operators or their consultants will conduct acoustical testing for all habitable rooms specified in the ATP for the educational property. As a consistent metric used throughout the sound insulation programs, the NLR is typically used to judge their overall effectiveness. Testing may be done on a minimum of 10 percent of all rooms that are similar such as classrooms, and on 100 percent of the rooms considered one-of-a-kind such as libraries. Measurements will be conducted both outside and inside of the habitable rooms as outlined in Section 7.3.

7.4.8.4 **Interior Leq.**

The interior Leq noise level is calculated by subtracting the overall or broadband measured Noise Level Reduction (NLR) for a room from the exterior Leq from an airport's FAA-accepted NEM. This equation is expressed as

$$\text{Exterior Leq} - \text{NLR}_{\text{Room}} = \text{Interior Leq}_{\text{Room}}$$

7.4.8.5 **Determination of Average Interior Leq.**

7.4.8.5.1 An average interior Leq must be developed for each building. The average must be a logarithmic average of the interior Leq noise levels of all habitable rooms within the property tested.

Note: An arithmetic average must not be used to average noise levels expressed as dBs.

7.4.8.5.2 Buildings that have average interior Leq noise levels equal to or greater than 45 dB would be considered noise impacted. Properties that average less than 45 dB would not.

Note: In any calculation using interior Leq, the interior Leq value must not be rounded up. An interior Leq of 44.7 must not be rounded up to 45.

7.4.9 Other Facilities.

Other facilities are structures such as places of worship and may include other one-of-a-kind structures such as medical facilities, day care centers, or other structures where habitation or teaching may occur.

7.4.9.1 **Testing Sample.**

7.4.9.1.1 Construction materials and techniques will vary widely. Roof construction, window glazing, air ventilation systems, room sizes and finishes will be different. Therefore, for these one-off structures it is likely that no two rooms are exactly the same and the airport must do the acoustical testing in all variations of rooms. If identical rooms are present in these structures, then a minimum of two rooms must be tested. For large rooms within these structures, such as the nave or sanctuary in a place of worship or a large hall with fixed seating, the minimum is two tests at two different locations within the room. Exterior DNL/Leq/Lmax.

7.4.9.1.2 Exterior noise levels for other facilities must also be based on the FAA-accepted noise contours in the NEMs. However, the proper noise metric depends on the use of the facility. For example, residential portions of places of worship or fire stations may dictate the use of DNL, which factors in the more sensitive nighttime component. Day care centers that offer instruction and educational activities may be more suited for the use of Leq. The proper noise metric to use for other facilities must be discussed in the ATP and reviewed with the local FAA Regional Office or ADO.

7.4.9.2 **Measured NLR.**

7.4.9.2.1 Airport operators or their consultants will conduct acoustical testing for all habitable rooms specified in the ATP classified as *other property*. As for other SIP testing NLR will be used to judge the overall effectiveness of sound insulation.

7.4.9.2.2 It is reasonable to expect that 100 percent of the rooms will need to be tested since they are likely to be individual, one-of-a-kind rooms. Measurements will be conducted both outside and inside of the habitable rooms as outlined in Section 7.3 and according to the standard procedures and industry-accepted guidelines outlined in ASTM E966-10.

7.4.9.2.3 Once the measurements have been completed, the Outdoor-Indoor Level Reduction (OILR) of rooms is calculated from the measured exterior and interior sound levels in each octave band, as outlined in ASTM E966-10. The OILR values are then used to compute the NLR of aircraft noise as measured in A-weighted dBAs). Interior DNL/Leq/Lmax.

7.4.9.2.4 The interior DNL/Leq/Lmax noise level is calculated by subtracting the overall measured NLR for a room from the exterior DNL/Leq/Lmax from an airport's FAA-accepted NEM. This equation is expressed below, as:

Exterior DNL/Leq/Lmax – NLR = Interior DNL/Leq/Lmax

7.4.9.3 **Determination of Average DNL/Leq/Lmax.**

7.4.9.3.1 As stated in the AIP Handbook, FAA Order 5100.38, an average interior DNL/Leq/Lmax must be developed for each property. The average must be a logarithmic average of the interior DNL/Leq/Lmax noise levels of all habitable room within the property.

Note: An arithmetic average must not be used to average noise levels expressed as dBs.

7.4.9.3.2 Properties that have average interior DNL/Leq noise levels equal to or greater than 45 dB/dBA would be considered noise impacted. Properties with noise levels less than 45 dB would not. Properties using Lmax noise levels, however, may use different criteria level other than 45 dB.

Note: In any calculation using interior noise level, the interior noise level value must not be rounded up. An interior noise level of 44.7 dB must not be rounded up to 45 dB.

7.5 Application of Modeled Results.

This section discusses how modeling results can be used to aid in the design process and determine interior noise levels for certain conditions.

7.5.1 Background.

7.5.1.1 The NLR is typically determined through measurements, but it may also be calculated through acoustical modeling.

7.5.1.2 The FAA has not approved a standard approach or model for NLR modeling, leaving these decisions to the individual acoustical professional. As a result, differences in the NLR calculations may occur depending on the individual. Therefore, developing a consistent approach to determine the NLR by acoustical modeling is important. The following section outlines a consistent approach.

7.5.2 Basics of NLR Modeling.

7.5.2.1 To model NLR, consultants use proprietary room models or the commercially available Insulation Buildings Against Noise from Aircraft model (IBANA) developed by the acoustics laboratory of the Institute for Research in Construction at the National Research Council of Canada. These noise models are based on a diffuse octave band or one-third octave band sound field calculation of noise reduction (NR), calculated as

$$NR = TL_{comp} - 10\log(S/A)$$

Where:

"TL_{comp}" is the composite Transmission Loss of all exposed surface,

"S" is the size of the sound transmitting partition, and

"A" is the total room absorption.

7.5.2.2 Calculations must be based on TL values of 45 degrees angle of incidence. Laboratory measurements are based on random angle of incidence. All exposed facades and roof structure must be included when determining the NLR. The NLR using calculated NR values is computed in the same manner as for measured OINR values.

7.5.2.3 The basic data inputs that the noise models require are defined in the following sections.

7.5.2.4 **Exterior Noise Source.**

The spectrum of the exterior noise source is required as an input to the model and may be obtained in a variety of ways:

1. Determining a predominant aircraft type, operations type, and noise spectra.
2. Measuring a representative sample of aircraft types at the airport and determining the average noise spectra.
3. Evaluating the annual average fleet mix at the airport and determining the average aircraft noise spectra.

7.5.2.5 **Transmission Loss Data.**

TL data for all exposed transmitting surfaces (elements) including doors, windows, walls, roof structures are required and may be obtained in a variety of ways:

1. Using the database of TL data for elements included in IBANA.
2. Using the INSUL model to determine TL data for elements.
3. Using field measurements of elements to determine TL data.

4. Using other published sources of data to determine TL data for elements.

7.5.2.6 **Dimensional Data.**

The room and element size, type, and condition must be documented:

1. Room type and dimensions
2. Window and door type, style and dimensions
3. Roof style and dimensions
4. Ceiling style
5. Exterior wall style and dimensions and number of exposed walls
6. Interior wall style
7. Floor style
8. Number and size of interior openings to adjacent spaces
9. Number and style of interior furnishings

7.5.2.7 **Interior Room Acoustics.**

The amount of absorption in the room must be accurately determined in several ways:

1. Using the standard inputs in the NLR models.
2. Estimating total absorption using laboratory data in conjunction with dimensional data.
3. Undertaking reverberation measurements in each room to determine reverberation time.

7.5.3 Modeling for Design Purposes.

7.5.3.1 As part of the design process for sound insulation programs, consultants may determine or predict how using (or replacing) different insulation projects affect an NLR modeling their acoustical properties. The modeling is usually validated by measured data.

7.5.3.2 To project changes in an NLR, the consultant will typically model the existing room conditions, validate the modeled results with measured data, and then change the room conditions by entering data measured for new acoustical products such as windows or doors. The new windows and doors will result in the decibel change as modeled.

7.5.3.3 Differences in assumptions and approaches may still lead to differences in the calculated NLR. However, if the modeling used with actual, verified measurements, the results can be validated and aid in the development of design recommendations.

7.5.4 Modeling for Determination of Interior Noise Levels.

7.5.4.1 The objective of modeling for design studies performed to project changes in the NLR can be achieved because the results can be validated with measurements. However, modeling for interior noise levels requires the determination of an NLR in absolute terms. That is, without the ability to validate the modeling process through measurements or on-site inspection, the uncertainty of the NLR is significantly increased due to unknown factors that may influence the results.

7.5.4.2 For example, the condition of interior furnishings and of the critical elements may affect the NLR significantly. Without an on-site inspection, the seals around critical elements (to determine TL) and the influence of the interior furnishings (which determine absorption) are unknown which increases the uncertainty. Without an on-site inspection, there is greater likelihood that modeled NLR result will not be consistent with measured results reached by the methods discussed in these guidelines.

7.5.4.3 *As a result, modeling NLR without an on-site inspection to determine interior noise levels is not recommended. An on-site inspection may allow for a better determination of room absorption and the leakage of critical elements.*

7.5.4.4 When on-site inspection are possible, the preparation of modeling rooms comprises measuring the dimensions of the rooms and elements, categorizing the conditions of critical elements, and as an option, measuring reverberation times. With this on-site information available and an industry wide consistent modeling process, modeling may present a consistent method for determining interior noise levels.

7.5.4.5 This consistent method has an advantage in analyzing roof exposure when a roof's structure may be of greater importance, such as analyzing flat or vaulted roofs. In instances where measurements of rooms with flat or vaulted roof structures cannot be performed due to access limitations, modeling along with an on-site visit may be preferred. If the modeling is supported with measurements and inspections, the results can be validated and used to account for noise penetration through flat or vaulted roof structures.

7.5.4.6 The goal of modeling for interior noise levels so an NLR can be expressed in absolute terms is not yet achieved. Research, however, continues into the uncertainties and consistency of modeling for determining interior noise levels.

7.6 Acoustical Retesting.

This section discusses the process of retesting structures to determine interior noise levels.

7.6.1 Background.

The process for retesting is the same as that for initial testing. Acoustical testing measures the NLR of all the habitable rooms. The NLRs of the rooms are subtracted from the exterior DNLs, as determined by the existing FAA- accepted NEMs, to arrive at the interior DNL in each of the rooms. The acoustical energy average of the interior noise levels results in a single average interior noise level for that property. The results are determined from the measurement of the NLR in each of the rooms.

7.6.2 Conditions for Retesting.

7.6.2.1 During the initial testing, certain conditions may have existed in which acoustical testing was not ideal. In certain situations, it would be advantageous to the property owner to have the structure retested when the average interior DNL may have been lower than the actual conditions warrant. These conditions include the following situations:

- No previous access to a locked habitable room prevented its testing.
- Local conditions, for example lack of overflights if using the overflight method of testing, may not have allowed testing of certain rooms during the initial test period.
- Exterior of the most sound-transmitting element in a room may have been blocked.
- Access to the interior of the most-sound transmitting element in a room may have been blocked.
- Hurricane shutters may be blocking the windows.
- Vehicles, such as motor homes or boats, may be blocking the element.
- The structure has an exceptional amount of material in the interior (furniture, window drapes, heavy carpeting).

7.6.2.2 Under these and similar conditions, retesting could result in different findings and a property could be determined as noise impacted.

7.6.3 Provisions for Retesting.

7.6.3.1 With the determination of noise impact based on interior DNL levels being at, or greater, than 45 dB, a slight change in the noise level measurements and calculation can make a difference between a property being noise impacted or not. Therefore, the FAA will accept the results from retesting based on the conditions mentioned in Section 7.6.2. If the result of the retesting indicates that a property now has interior DNL levels

at, or greater than 45 dB, then the property may be considered to be noise impacted.

7.6.3.2 The local FAA Regional Office or ADO approves or disapproves a request for acoustical retesting.

7.7 Recommendations for Retesting.

To maintain as much consistency as possible during the retesting, it is important to recreate the original testing conditions and set up to the extent possible. To do this, consider taking these measures:

- Use the same acoustical consultant (if possible) to maintain a consistent measurement method.
- Place the loudspeaker is in the same location, verified by using documentation collected during the initial tests.
- Ensure the measurement techniques of the engineers conducting the tests are similar or at least based on a standard measurement method.
- Measure exterior and interior ambient levels to ensure that ambient levels do not impact the results.
- Use the same sound meters that were used previously and that they are calibrated daily so the margin of error due to the instruments is minimal;
- Conduct the exterior noise measurements in the same location (flush, near-field, or free-field).
- Measure the interior noise in the same location (opposite the major sound-transmitting element in the room, or opposite the exterior facade).
- Ensure that the interior conditions are similar using documentation collected during the initial tests. Internal room acoustics such as the type of flooring, presence of drapes, large soft furnishings can affect the measurements. Before and after photographs are required to for documentation.

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CHAPTER 8. PROJECT COST DEVELOPMENT AND FUNDING

8.1 Funding.

8.1.1 Airports have multiple funding source options for SIPs, particularly these three main sources:

1. AIP grants, criteria for which are described in the AIP Handbook, FAA Order 5100.38.
2. Passenger Facility Charge,' as described in the PFC Order, FAA Order 5500.1
3. Revenue collected from an airports disposal of noise land, that is, land that has been purchased by an airport operator with AIP funds for noise mitigation.

8.1.2 Determination of project funding should be conducted during the administration phase of the program.

8.1.3 After an airport accepts AIP funding, it is obligated to meet specific FAA grant assurances. Grant assurances include an obligation for the sponsor to maintain and operate the airport in a safe and efficient manner throughout the useful life of the facilities developed under the project, but not to exceed 20 years. There are two types of assurances which may be relevant to developing SIPs: Airport sponsor Assurances and Noise Compatibility Assurances for Non-Airport Sponsors. The current versions of these grant assurances are on the FAA website.[36]

8.1.4 The FAA does not reimburse the airport for the full cost of the project. Reimbursement can vary depending on the project size and type of airport (primary versus nonprimary). The AIP Handbook, FAA Order 5100.38, discusses additional reimbursement for pre- and post-construction testing as well as for procurement processes.

8.2 Cost Development.

8.2.1 Airport operators should work closely with all departments and consultants involved in the SIP to determine cost estimates for each of its activities. Airport operators may also consider hiring a professional to assist in the cost development. It may also be helpful to compare previous SIP costs. If a Part 150 study was previously conducted, costs could have been evaluated within the study; however, not all Part 150 studies determine cost development for SIPs.

[36] http://www.faa.gov/airports/aip/grant_assurances.

8.2.2 Prioritization of the stages of the program are imperative to understand the allocation of funding to each area. Airport operators should create a list of all items and potential issues within the program, then prioritize the list based on importance and necessary costs. The list can then be provided to stakeholders for review and comments. Prioritization may be needed throughout multiple phases or areas of the program. Airport operators can create multiple lists for each area and the related stakeholders.

8.2.3 To maximize the use of available funding sources, airport operators should establish goals and priorities to ensure timely implementation. Establishing goals and priorities for cost development early can allow for costs to be better evaluated and tracked throughout the SIP process. Issues can be more easily resolved with early clarification on program costs.

8.2.4 Multiple areas of a SIP should be included in determining the cost of the program. Table 8-1 describes examples of areas to consider:

Table 8-1. Program Elements to Consider in Determining Program Cost

Program Element	Consideration
Administration	Administration duties can be assigned to internal staff or to external staff hired by the airport operator. This can be an important factor in the cost of administration. Evaluation should be completed to determine the need for an internal Administrator rather than hiring an external one. The airport operator will have the initial and overall task of administrating the program; however, other areas of leadership and responsibility can be delegated as needed. Airport operators should establish policies for the program to ensure consistency given possible changes in management or consultants during the program process.
Public Relations (Community Outreach)	Airport operators should consider all areas of public relations as it relates to the program. This includes advertisements, collaterals, meetings, and other areas of public relations. Start-up and continuing costs should be evaluated.

Program Element	Consideration
Facilities	Separate from the existing facilities used by each department, contractor, or consultant, this consideration includes additional facilities used during the program—meeting/workshop rooms, store rooms, show rooms, demonstration structures, and more.
Fees	Fees associated with the program are primarily fees for professional workers. Fees can vary based on project size and available funding, but generally include all contractors associated with the project. Construction fees may be more stringent than others due to constant collaboration with the contractor. AC 150/5100-14, *Architectural, Engineering, and Planning Consultant Services for Airport Grant Projects*, describes these fees in detail.
Testing and Construction	Airport operators should consider pre-construction testing and post-construction testing for all structures. Pre-construction testing may include more structures or buildings because it is a required step in determining impact. Construction fees are the largest in regard to the cost of the program. It is the largest phase in the program and requires the most detail and of the lengthiest effort.

8.2.5 Construction costs can be estimated by multiple methods. Benchmarking, unit pricing, pilot programs, and contractor estimates are common methods. Pilot programs offer a unique and more precise approach. Implementing a pilot program can allow for changes in treatment methods as well as policies and procedures that effect cost estimates before implementing the full-scale program.

8.2.6 After components have been prioritized, airport operators should create a budget for each program area. This helps the airport operator to meets all goals without exceeding budgets and the allocated funding. In addition to managing costs, the airport operator should be aware of items throughout the program that can vary in cost. For example, contractor employee wages, testing requirements that may increase over time, deficiencies in structures or buildings, and environmental issues. Treatments offered to

the community may also affect the cost of the program. Treatment options can be different depending on the SIP and the location of the structures.

8.2.7 Lastly, airport operators should consider the type, brand, and quality of the materials and products that will be purchased for the program. These purchases can vary in price. The type of product or material can also vary depending on the type of structure or its geographic location. Evaluations should be conducted with the contractor to discuss the proper products and materials that are best for the SIP.

8.3 Contracting and Procurement.

8.3.1 Selection guidance for architectural and engineering consultants is provided in FAA AC 150/5100-14, *Architectural, Engineering, and Planning Consultant Services for Airport Grant Projects.* Under this guidance, airports select consultants based on qualifications and the negotiation of a reasonable price. Airports using AIP funding shall ensure the SIP complies with its guidance. Airports not using AIP funding ensure the SIP complies with all local and state requirements, starting with the team selection.

8.3.2 Since projects are considered to be multi-year projects, outreach to construction contractors will be ongoing throughout the project. The process begins during the outreach to property owners, but before the design and construction phase. This process is necessary to identify qualified contractors for the bidding and for performing the project. The primary goal is to have a large selection of qualified bidders. Training should be provided to all selected contractors to describe all SIP processes and procedures.

8.3.3 Before contracting to use AIP grants, an independent cost estimate of the selected contractor’s fees is required. Usually the design consultant does the independent cost estimate for the construction contracts.

CHAPTER 9. REPORTING AND CLOSEOUT

9.1 Background.

9.1.1 Project reporting needs to be part of the program set-up and practiced continuously throughout the SIP. Continuous reporting allows for accurate records when closing out the project, responding to intra-agency information requests, or auditing is required. Airport operators should consult with the local ADO early in the SIP process if they have any questions concerning reporting and closeout requirements.

9.1.2 The AIP Handbook, FAA Order 5100.38, and in 49 CFR § 18.40, *Monitoring and Reporting Program Performance*[37] provide reporting and closeout guidelines and procedures.

9.2 Quarterly and Annual Reporting.

9.2.1 The AIP Handbook, FAA Order 5100.38, discusses Quarterly Performance Reporting. Quarterly Performance Reports are required for federal grant projects. Construction projects, like those included in a SIP, follow all requirements listed in the AIP Handbook, such as these submissions:

- Submission of appropriate forms (FAA Form 5370-1, Construction Progress and Inspection Report).
- Submission each fiscal quarter until the project is complete.
- Submission of additional forms if there is a major project change or schedule change per ADO or Headquarters requirements.

9.2.2 Monitoring and reporting guidelines are also provided in 49 CFR § 18.40. These guidelines require the airport operators, as grant recipients, to be responsible for all day-to-day-operations while complying with federal regulations and requirements. It also requires a quarterly performance report, due at the end of each fiscal quarter. The report will typically require a range of information:

- Proposed objectives vs. actual accomplishments throughout the period (includes all schedules).
    - Acoustical testing results

[37] 49 CFR § 18.40, *Monitoring and Reporting Program Performance*, https://www.govinfo.gov/app/details/CFR-2011-title49-vol1/CFR-2011-title49-vol1-sec18-40.

- Pre and post construction
- Outreach activities
- Design status
- Construction (sound insulation) progress, including addresses and mapping of structures tested, including those impacted and not impacted based on testing.

- Explanations for not meeting deadlines or proposed objectives.
- Impacts to any other phases of the SIP.
- Explanation of additional funding needs or additional costs.

9.2.3 The AIP Handbook, FAA Order 5100.38, discusses Annual Reporting of Annual Residential Population Benefits. This discusses the requirements of the ADO to report annually the number of residents and students that benefit from noise compatibility projects.

9.2.4 Reporting Documentation Organization.

9.2.4.1 It is recommended that airport operators include, within the project scope of work, a document that outlines reporting timelines and other commitments to the FAA, and lists the required reporting documents and formats for reporting and closeout.

9.2.4.2 Flow and Gantt charts can assist in organizing the project reporting process. The development of a step-by-step process can strengthen the relationship between the airport and the community by allowing the community to understand how progress in the program will be tracked and reported.

9.2.4.3 In addition to charts, a reporting and closeout schedule should be developed. Airport operators should work closely with the local ADO to determine the timeline requirements as well as address and anticipate important issues. As mentioned previously, 49 CFR § 18.40 requires airport operators to submit quarterly performance reports within a 30-day time period after the end of the reporting period.

9.2.4.4 The reporting and closeout process can produce a large number of documents; therefore, airport operators may consider using a computer tracking system. Program tracking systems are discussed in more detail in Section 9.4. Airport operators may also create a simple spreadsheet/database to track progress of the SIP and would include the following fields/data items:

1. Property address and identification, with the location noted on Noise Exposure Map.
2. Property Owner (dates) – if owners decide not to participate in the program, then additional information is not needed after this entry.

3. Initial owner outreach.
    a. Property owner orientation
    b. Entry authorization received
4. Predesign Activities (dates)
    a. Property inspection survey
    b. Acoustical test results (pre- and post-construction)
    c. Environmental tests
    d. Property inspection report
    e. Preliminary acoustic design report
    f. Preliminary environmental test reports
    g. Draft scope of work
    h. Design budget
    i. Design schedule
    j. Task order prepared
    k. Task order submittal
5. Design Activities (dates)
    a. Design surveys
    b. Schematic Design
    c. Design Development
    d. Construction Documents (drawings and specifications)
6. Avigation Easement Process
7. Certification of compliance with all required federal contract provisions, including Buy American.
8. Issues.
    a. Note.
    b. Actions required

9.3 **Closeout Reporting.**

9.3.1 The FAA's goal is to close out active grants typically within three years from acceptance or as quickly as possible. The regular and continuous reporting recommended throughout the SIP therefore should result in an efficient closeout reporting process.

9.3.2 Airport operators should submit closeout documents within 90 days of completing post-construction testing or construction, whichever is later. Any delays—or potential

delays—that may result in missing the target closeout date should be communicated to and discussed with the ADO.

9.3.3 When an Airport operator has multiple AIP grants within an SIP, closeout documents should be submitted to the ADO within 90 days of completing all the work that was included in the scope of work for that particular grant. For example, a sponsor may have a grant for conducting a Part 150 study; a subsequent grant for developing the SIP PPM, surveys and Testing Plan; a third one for acoustical testing, hazardous materials testing and design; then a fourth for construction of the first SIP phase. For each of these grants, the sponsor should submit closeout documents as soon as the work within that grant is completed (within 90 days of completion).

9.3.4 Project Work Completion: Final Documents.

9.3.4.1 The essential closeout documentation may vary depending on the project type and size; however, the closeout process will typically address the areas listed below. Areas may be omitted if they do not apply to the project. Airport operators should consult with the ADO to determine closeout items to be submitted.

1. As-built plans. Plans demonstrating the treatments (retrofit or unit installations) installed in each structure or public building.
2. Updated property map. The airport's land use plan may need to be updated to demonstrate the SIP accomplishments.
3. A list of structures sound insulated during the period, including start and completion construction dates.
    a. Address.
    b. Year structure constructed.
    c. Location noted on NEM.
4. A list of structures not participating or found not to be impacted by airport noise.
    a. Address.
    b. Reason for non-participation.
5. Certification of compliance with all required federal contract provisions, including Buy American.
6. Final construction project closeout report**.** Must be submitted by the airport operator with an accurate record of the project. The length and format may vary based on the project size and type. Airport operators should consult with the ADO to determine the necessary items to be included in this final report. Typically, unless otherwise specified, the report will include the following sections. (See Appendix B of ACRP

Report 89, Guidelines for Airport Sound Insulation Programs for sample Project Closeout Report):

a. Project Summary – summarizing the location of the airport, grant agreement date, and amount of grant amendments; narrative of the work accomplished; summary of key milestones; acoustical engineer's report; and contract time (includes explanations for weather delays and liquidated damages).

b. Executive Summary – summary of compliance with federal assurances; program budget (with explanation of expenses); historic properties (discussing Section 106 actions); land use compatibility; labor and Buy American provisions; administrative, engineering, construction costs; and force account (the construction work requested, completed, and paid for outside of the main contract).

c. Project Cost Summary – List with descriptions of all project costs.

d. Partial Payment History Summary – Explanation and proof of all payments for grant reimbursement.

e. Change Order Summary – Included in the financial summary, it accounts for any changes to the budget affected by consultant contract amendments. Also includes construction change orders.

f. Final Inspection and Punch List Item Clearance – Includes punch list items, inspections, and reports from pre- and post-inspections.

g. Project Review Comments and Certification Summary – Completed in checklist format.

h. Disadvantaged Business Enterprise (DBE) Program Participation Summary – Typically the Equal Employment Opportunity office will fill in the DBE use forms; however, the airport operator may need to provide background and basic information.

i. Final Payment Recommendation and Project Amendment Requirement – Includes any excess payments and fiscal adjustments.

7. Administrative Requirements. Includes final outlay report, summary of DBE use, property accountability, and submittal of federal assurances.

8. Financial Requirements. Includes final project cost summary, block grants, excess payments, and fiscal adjustments.

9.3.4.2 The final report form is required by 49 CFR § 18.41 and must be signed by the airport operator or grant administrator.

9.4 Links to tools, forms, and templates.

This section provides descriptions of the tools, forms, and templates that can be utilized by airports, consultants, and contractors during the SIP process. Examples of some of these forms and templates are in Appendix B of ACRP Report 89, Guidelines for Airport Sound Insulation Programs and Appendix C.

9.4.1 Tools.

9.4.1.1 When considering a program-tracking system to assist in organizing the extensive SIP files and documents, Case Management Systems and Document Management Systems are common program-tracking systems used during the SIP process. Sufficient training should be provided to the individuals using the tracking system to ensure efficiency and accuracy. The systems can perform tasks such as:

1. Track program costs
2. Track eligible FAA reimbursable expenses
3. Identify impacted and non-impacted parcels
4. Identify all participating and non-participating property owners
5. Perform as a web-based tool
6. Include program database
7. Provide parcel mapping
8. Archive all program files in a searchable format
9. Track users and user rights
10. Host all program communications in a secure environment.[38]

9.4.1.2 Airport operators should not rely on the tax assessor information from the Part 150 study. The tax assessor information may not include the appropriate amount of information needed for the SIP. Airport operators should consider conducting a land use survey, which can be managed through Case Management Systems.

9.4.2 Forms.

FAA Form 5370-1, Construction Progress and Inspection Form[39,40] is used for AIP-funded projects to report progress on construction activities. The airport operator

[38] Modified from ACRP Report 89, *Guidelines for Sound Insulation Programs*.

maintains these forms and submit them to the appropriate FAA Region or ADO. The form is not required, but the FAA may request it. Airport operators may use other forms with the same information.

9.4.3 Sample Documents.

Samples of the documents described in Table 9-1 are included in Appendix B of ACRP Report 89, *Guidelines for Airport Sound Insulation Programs.*

Table 9-1. Examples of Types of SIP Documents

Document Type	Use and Content
Structure owner Introductory Letter	• Sent to the structure owners that are within the DNL 65 dB contour (Part 150) or significantly noise impacted area (Record of Decision) to introduce the SIP and request information. • Describes the program to the residents and briefly describes the SIP process. • May request that the structure owners complete an owner interest sheet and property survey.
Structure owner Interest Sheet	• Sent to structure owners with the introductory letter to determine interest in being considered for the SIP. • Does not ensure that the structure owners will test into the program, but determines how many structures will need to undergo pre-construction acoustical testing.

[39] See FAA AC 150/5370-12, *Quality Management for Federally Funded Airport Construction Projects.*
[40] The form can downloaded from http://www.faa.gov/airports/resources/forms/

Document Type	Use and Content
Structure owner Property Survey	• Sent to structure owners with the introductory letter. • Includes questions regarding the existing conditions of the structure and if modifications have been completed in the past. • Provides the project team with an initial understanding of the structure and its occupants.
Structure owner Property Survey Report	• Compilation of the results of the structure owner property surveys and preliminary property surveys that the Airport Owner conducts. • Describes the overall project and program, the types of buildings, layout of each building, number of habitable rooms, images of each habitable room, and describes any previous modifications to the structure/building.
Participation Application	• Sent to all structure owners that completed the Structure owner Interest Form and Structure owner Property Survey. • Requires the participant to provide brief information regarding their structure and number of residing occupants. • Differs from the Structure owner Property Survey in that the property survey is a detailed questionnaire about the specifics of the structure, whereas the participation application form provides owner information, contact information, brief property information, and a release of building records. • All information from the application should be kept confidential throughout the program. The application is considered an agreement to move forward with the testing portion of the SIP and requires the owner’s signature on the participation application and avigation easements (if necessary).

Document Type	Use and Content
Impact Testing	• Includes the ATP and the Final Impact Determination. • The ATP provides information and describes the overall methodology of the impact testing, a summary of the property survey report, and the criteria for structures to be considered for participation in the SIP. • Plans are described for each type of structure within the program boundary. The final section of the ATP should describe the final impact determination.
Structure owner Participation Agreement	• Describes the terms and conditions of the SIP, defines terms, estimates hours of work during the construction period, and provides additional legal requirements. • Required as documentation of all property owner work/participation agreements. • Property owners should be notified of the noise program, fill out initial program application, sign a participation agreement (if private property owner), and participate in pre- and post-questionnaires. • Avigation easements can be included; however, the FAA does not require them.
Structure owner Orientation Letter	• Sent to participants whose structures were found to be impacted and included in the SIP and who have signed the participation agreement. • Provides information regarding the time and location of orientation meetings, which should be mandatory for impacted participants. • Should provide the appropriate SIP contact information to residents in case of questions or concerns.

Document Type	Use and Content
Pre-existing Deficiency Structure Inspection Report	• Used to determine if any structural issues currently exist in the structure. • Prepared by the Airport Owner's project team. • Should provide enough detail so the structure owner and project team understand the existing deficiencies that existed prior to construction. • Structure owners must review the report and sign a pre-existing deficiency release.
Pre-existing Deficiency Release	• Provided to structure owners for signature to confirm their agreement with the finding in the Pre-existing Deficiency Structure Inspection Reports. Once the structure owner formally agrees, the SIP process may continue.

Document Type	Use and Content
Design Waivers	• May be required depending on the geographic location of the program. A moisture waiver may be required and a wood door waiver should be required to provide the project team the appropriate liability. • Moisture waivers may be required for structures that are located in areas of high humidity in which moisture can accumulate inside the structure. The waiver requires the structure owner to acknowledge that the construction for the project may have a negative effect on pre-existing moisture problems by increasing indoor air humidity. The structure owner agrees to assume responsibility of all the pre-existing moisture issues identified on the moisture waiver. • A wood door waiver is required if wood doors are to be installed on the structure. It explains the manufacturer's warranty and potential complications that may occur due to seasonal or environmental changes. The waiver states that the structure owner understands the potential impacts of the installation of a wood door. It ensures the consultant is not liable for any complications after installation due to potential effects listed in the waiver.

Document Type	Use and Content
Program Bid Documents	The bid process for general contractors for the construction portion of the SIP should include, at a minimum, these documents: bid advertisement, pre-bid meeting; instruction to bidders; general contractor statement of qualifications; bid form; and contractor award recommendations and award of contract. • The Airport operator should post the bid advertisement – typically at least 30 days before a pre-bid meeting. The Airport operators should submit evidence of the bid advertisement to the ADO (either at the time of advertising or in the AIP grant application). • The pre-bid meeting is provided for all interested general contractors. The agenda for the meeting should provide a project overview, special conditions, bidding requirements, project requirements, and other legal information. During the pre-bid meeting, potential bidders should be provided with instructions on the bidding process for the project. • General contractors then submit bid packages before the bid opening. The bid package should comply with requirements of the AIP Handbook, and generally provide qualifications of the contractor team and costs of labor and materials with an authorized signature from the contractor and a notary signature. The Contractor Award Recommendations letter is developed by the design consultant and airport operator to announce the winner of the general contractor bid process. It should provide the name of the general contracting company and describe how the company was chosen as the bid winner, along with a signature from the consultant team, airport operator, or both. This letter should be sent to the ADO for review and approval or acceptance.

Document Type	Use and Content
Avigation Easement (and mortgage subordination form)	The FAA under AIP grants does not require avigation easements. Although not required, it is encouraged to receive easements from property owners if sound insulation is provided. • Easements provide documentation that the property is compatible under the NCP. Airports should consult with their legal counsel to determine the language to be included in an avigation easement. • A mortgage subordination form may be required to be signed by the resident's mortgage company. It provides the airport and project team permission to move forward with the avigation easement. A mortgage subordination fact sheet with additional information may be provided with the form. The final documentation avigation easement is signed by the airport operator, structure owner, and any additional individuals that the airport or team find pertinent (city or county officials).
Weekly Progress Report	The airport or the FAA can require weekly Progress Reports. The project team should submit reports. It should briefly describe the work completed with the current period, pertinent observations, and anticipated work for the upcoming period.
Final Project Closeout Report	The Project Closeout Report must be submitted to the FAA at the end of the SIP (after all phases have been completed). The report should describe the program, the process, what was completed, cost summary, and recommendations.
Final Completion Documentation	The contractor, program manager/construction manager, and airport operator should sign a Certificate of Final Completion. It should be submitted to the FAA along with the closeout report. This can be submitted to the FAA, as each phase is complete and at the end of the entire SIP.

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APPENDIX A. ROLES AND RESPONSIBILITIES MATRIX

Project Task	FAA ADO Project Manager	Airport Operator	Airport Operators Program Manager	Property Owner Liaison	Legal Consultant	Design Consultant	Mechanical or Ventilation Engineer	Hazardous Materials Consultant	Electrical Engineer	Structural Engineer	Acoustical Engineer	Resident Engineer	Contractor	Property (Structure) Owner
Select project team & administer contracts	I	R												
Communicate with Airport Operator	I		R	I	I	I	I	I	I	I	I	I	I	I
Identify and prioritize program participants	C	R	A	I										
Notify and maintain contact with eligible participants	I	C	A	R										
Maintain parcel file & database information			A	R	A	C								
Prepare legal documents and conduct title search		C	I	A	R									
Handle all correspondence and questions from Property Owners		I	C	R	A	A								
Conduct pre-existing deficiency and hazardous materials inspection at each eligible property			C	A		R	A	A	A	A				
Prepare pre-existing report & legal release		I	I	A	C	R	C		C	C				
Prepare hazardous materials assessment report			I	A		C	R							
Record Avigation Easement			I	A	R									I
Conduct pre-construction and post-construction acoustical testing			I	A		C					R			
Conduct pre-construction and post-construction ventilation testing			I	A		C	R							
Conduct design survey to observe and define pre-existing ventilation characteristics			I	A		C	R							
Determine the replacement and/or addition of mechanical equipment			I			C	R							
Determine electrical panel upgrade and design wiring for mechanical equipment installation			I			C	A		R					
Determine the extent of a structural condition			I			C				R				
Prepare ventilation, insulation and mechanical design recommendations			I			C	R							
Develop abatement specifications and documents detailing abatement procedures and requirements			I			C	A	R						
Conduct new product review			I			A					R			
Conduct design review with property owner			I	A		R								C
Select window and door colors and styles for individual homes			I	A		C								
Prepare final plans and specifications			I			R	A	A	A	A	A			

Project Task	FAA ADO Project Manager	Airport Operator	Airport Operators Program Manager	Property Owner Liaison	Legal Consultant	Design Consultant	Mechanical or Ventilation Engineer	Hazardous Materials Consultant	Electrical Engineer	Structural Engineer	Acoustical Engineer	Resident Engineer	Contractor	Property (Structure) Owner
Prepare bid documents	C	I	R	A	A	A	A	A	A	A	A			
A Review bids and prepare award recommendation	C	I	A			R						A		
Award and execute construction contract	C	R	A		A							I		
Perform specified modifications and install specified products per plans and specifications		I	I									C	R	I
Perform air quality monitoring during the abatement process			I	A		C		R						
Ensure Contractor DBE and payroll compliance			I		C	A						R	I	
Perform daily site visits in each property under construction			I	A		C						R		I
Photograph documentation of each home prior to and during construction			A									R		
Review contract RFIs and requests for change orders			I	I		C	C	C	C	C	C	R	C	I
Perform punch list walk-thru inspection for quality and completion of work			I	I		C						R	I	I
Correct punch list items and warranty issues			I	I		C						C	R	I
Review & approve General Contractor pay requests		I	C			A						R	C	
Perform final inspection		I	A			A						R	C	I
Provide warranty package to property owner			I	R								C	A	I
Assist with preparation of grant close-out report for FAA	I	C	R									A		

APPENDIX B.
LIST OF DEFINITIONS USED IN THIS ADVISORY CIRCULAR

B.1 Definitions

This appendix contains the definitions of terms and acronyms used within this advisory circular (AC) it also contains certain terms that are used in related ACs and Orders, and are included for convenient reference. U.S. Codes of Federal Regulations (CFR), ACs, and other publications are available on www.faa.gov.

Statues/Regulations	Term	Definition
2 CFR Part 200		Uniform Administrative Requirements, cost Principles, and Audit Requirements, Subpart D.
14 Code of Federal Regulations (CFR) Part 150		"Airport Noise Compatibility Planning," which describes the procedures, standards, and methodology for developing noise exposure maps, noise compatibility programs, and the FAA's process for approving these programs. It also establishes a single system for measuring noise exposure and outlines compatible land uses for varying levels of exposure.
14 CFR Part 150 Record of Approval		Record of approvals listed which include approval actions that the airport recommends be taken by the FAA and indicate only that the actions would, if implemented, be consistent with the purposes of 14 CFR Part 150. The approvals do not constitute decisions to implement the proposed actions or a commitment by the FAA to provide federal financial assistance for these actions.
49 USC § 47504		Noise Compatibility Programs.
	Acoustical Engineering	Branch of engineering dealing with sound, vibration, design, analysis and control of sound. It is the application of acoustics in technology.
	Acoustical Test Plan	A document detailing the testing scope, testing activities, testing objectives target market, test environment, data requirements, safety considerations, and installation of the test article.

Statues/Regulations	Term	Definition
	ADO Noise Subject Matter Expert.	Local Airport District Office Subject Matter Expert (SME) is the designated noise program specialist in each Region or ADO whose responsibilities include: **a.** Conduct technical reviews of all aspects of noise programs and noise projects that may be considered under the Airport Improvement Program (AIP) or for Passenger Facility Charge (PFC) funding. **b.** Review Scopes of Work and coordinate comments and changes with the ADO Program Manager and airport operator. **c.** Review the SIP Policies and Procedures Manual (PPM), in particular the Acoustical Test Plan, providing comments to the airport operator on any elements of the manual that are not in accordance with FAA policy and that would result in certain elements of the program not being considered for FAA funding.
	AIP Handbook	Airport Improvement Program Handbook (FAA Order 5100.38) provides guidance and sets forth policy and procedures used in the administration of the Airport Improvement Program.
	Airport	Per 49 USC § 47102(2), an airport is an area of land or water used or intended to be used for aircraft landing and taking off.
	Airport Authority	An independent entity charged with the operation and oversight of an airport or group of airports. A group of airport commissioners, who are appointed to lead the authority by a government official, often governs these authorities. When the authority of an entity encompasses more than just the airports in an area, harbor and rail facilities for example, the entity may be referred to as a port authority.

Statues/Regulations	Term	Definition
	Airport Operator	The administrator and manager of an airport that regularly serves scheduled passengers of a certificate holder (air carrier).
	Airport Property Map	An airport property map is a drawing depicting the airport property boundary, land or property interests (including method of acquisition and type of interest), and future proposed land acquisition. The Airport Property Map is required as part of the Airport Layout Plan drawing set if any of the airport land was acquired with federal funds or through an FAA administered land transfer program. An airport property map is not a substitute for a property inventory map, unless it is prepared in accordance with the requirements in the current version of Advisory Circular 150/5100-17, *Land Acquisition and Relocation Assistance for Airport Improvement Program Assisted Projects.*
FAA Order 5190.6 (Airport Compliance Manual)	Airport Revenue	FAA Order 5190.6 (*Airport Compliance Manual*) defines airport revenue as "paid to or due to the airport sponsor for use of airport property by the aeronautical and nonaeronautical users of the airport. It also includes revenue from the sale of airport property and resources and revenue from state and local taxes on aviation fuel."
49 USC § 47102(26)	Airport Sponsor	An airport sponsor is defined in 49 USC § 47102(26) as: **a.** A public agency that submits to the Secretary under this subchapter an application for financial assistance; and **b.** A *private owner of a public-use airport* that submits to the Secretary under this subchapter an application for financial assistance for the airport. The airport sponsor is considered to the "airport operator" for the purposes of this advisory circular.

Statues/Regulations	Term	Definition
	Allocation	An allocation is the FAA notification to the sponsor of the intent to obligate funds (by issuing a grant). It does not involve a transfer of funds. It is an internal administrative re-delegation of the authority to incur obligations and make expenditures.
49 USC § 47110	Allowable Cost	The cost of an item or activity that can be funded with AIP per 49 USC § 47110.
	Amendments	A formal change to the terms or scope of a grant agreement.
49 USC § 50101	"Buy American" Waiver Request	A waiver of 49 USC § 50101 preferences submitted as a request to the FAA ADO before an airport operator proceeds with a change order that involves using less than 100% United States steel or manufactured goods. An airport operator may have to obtain prior approval from the FAA ADO for contract changes if under the Buy American Review.
	Applicant	Person or entity that makes a formal application.
	Approving Official	An agency official with approval authority for government actions or documents.
	Avigation Easement	An avigation easement is an easement or right of overflight in the airspace above or near a property. It also includes the right to create such noise or other effects as may result from the lawful operation of aircraft in such airspace and the right to remove any obstructions to such overflight.
	A-Weighted Sound Level	A quantity, in decibels, read from a standard sound level meter with A-weighting circuitry. The A-weighting scale discriminates against the lower frequencies below 1000 hertz according to a relationship approximating the auditory sensitivity of the human ear. The A-weighted sound level is approximately related to the relative "noisiness" or "annoyance" of many common sounds.

Statues/Regulations	Term	Definition
	Block Rounding	Expanding the SIP boundary to incorporate a neighborhood block and prevent the boundary from intercepting or splitting the block. In accordance with FAA policy, an airport operator can propose to expand the noise mitigation boundary just beyond the DNL 65 contour to include parcels contiguous to the contour area. Conditions for FAA approval of Block Rounding proposals are contained in the AIP Handbook.
	Board	A committee of persons organized under authority of law to exercise certain authorities, have oversight or control of certain matters, or discharge certain functions of a magisterial, representative, or fiduciary character. Typically related to an Airport Authority or governing board.
14 CFR § 150.7	Compatible Land Use	Per 14 CFR § 150.7, the use of land that normally compatible with the outdoor noise environment (or an adequately attenuated noise level reduction for any indoor activities involved) at the location because the yearly day-night average sound level is at or below that identified for that or similar use under appendix A (Table 1) of 14 CFR Part 150.
	Consultant	Individual or entity specialist that gives advice, information or analyses to businesses, government, and other organizations.
	Design Consultant	Professional with expertise and necessary licenses to prepare all design packages for implementation of SIP, as well as construction cost estimates, bid documents and construction plans.
	Easement	An interest in land owned by another person, consisting in the right to use or control the land, or an area above or below it, for a specific limited purpose. (Also, see “Avigation Easement”).

Statues/Regulations	Term	Definition
	Educational Facilities	A facility used primarily for instruction and learning. For educational facilities, habitable space is defined as limited to classrooms, libraries, fixed seat auditoriums, and educator offices. Non-habitable space in educational facilities is generally defined as areas such as gymnasiums, cafeterias, and hallways even if these areas are used for incidental instruction. Facilities that are in leased storefront property are not considered education facilities.
	Electrical Engineer	Licensed professional responsible for designing electrical wiring and electrical panel upgrade, if necessary, during the SIP design process.
FAA Order 5100.38	Eligibility	Defined by FAA Order 5100.38, AIP Handbook, eligibility is determined by modeled noise impact and noise level reduction values determined through testing, and refers to qualification for funding under the AIP Handbook.
	Equivalent Sound Level (Leq)	Also referred to as Equivalent Continuous Sound Level, a sound metric that quantifies the noise environment, or total noise energy, into a single sound level value over a period of time. Leq is a logarithmic value and is expressed in decibels (dB).
	Flush Method	A method where the microphone must measure at 10 to 15 spot locations on the exterior facade and measurements must be undertaken no further than 17 millimeters, or 0.7 inches, from the facade to determine an average exterior Leq.
	Free-field	A sound field region with no adjacent reflecting surfaces, whereby bounding surfaces on behavior of a field are negligible. In practice, a free-field can be said to exist if the direct sound is 6 dB or preferably 10 dB greater than the reverberant or reflected sound.

Statues/Regulations	Term	Definition
	Grant Assurances	The obligations airport operators, planning agencies, or other organizations undertake when they accept funds from FAA-administered airport financial assistance programs. These obligations require the recipients to maintain and operate their facilities safely and efficiently and in accordance with specified conditions. The assurances appear either in the application for federal assistance and become part of the final grant offer or in restrictive covenants to property deeds. The duration of these obligations depends on the type of recipient, the useful life of the facility being developed, and other conditions stipulated in the assurances.
	Hazardous Material	Material that contains properties that make it dangerous or capable of having a harmful effect on human health or the environment.
	Hazardous Material Consultant	Licensed professional responsible for conducting tests in impacted structures where hazardous materials may be located and supervising abatement work for impacted structures where hazardous materials were found.

Statues/Regulations	Term	Definition
49 USC § 47102	Hub Airport	49 USC § 47102 defines hub airports as commercial service airports meeting the following criteria. **a.** *Large hub* airports enplane at least 1% of the national annual passenger boardings per 49 USC § 47102(11). **b.** *Medium hub* airports enplane at least 0.25% but less than 1% of the national annual passenger boardings per 49 USC § 47102(13). **c.** *Small hub* airports enplane at least 0.05% but less than 0.25% of the national annual passenger boardings per 49 USC § 47102(25). **d.** *Non hub* airports enplane less than 0.05% of the national annual passenger boardings per 49 USC § 47102(14).
	Home	A residence or place where one lives permanently.
	Homeowner	A person or entity that owns a residence.
	Impacted Property Owner	Owner of a property with a structure that is impacted by noise from airport operations, as determined from a Part 150 Noise Exposure Map or National Environmental Policy Act of 1969 (NEPA) study.
	Legal Consultant	Professional responsible for preparing all legal documents associated with the SIP, including title certifications, participation agreements, avigation easements, and lender consent documents.
	Mechanical/Ventilation Engineer	Licensed professional responsible for designing necessary heating, cooling, ductwork and ventilation systems during the SIP design process and conducting pre- and post-construction ventilation tests.

Statues/Regulations	Term	Definition
	Modification to Standards	Any FAA approved change to FAA standards (other than dimensional standards for runway safety areas) applicable to an airport design, construction, or equipment procurement project.
	Multi-Family Residences	Residential structures with multiple units.
	National Register Bulletin	Technical information on the National Register of Historic Places that provides guidance on evaluating, documenting, and listing different types of historic places.
	Nearby Method	In acoustical testing, for this method the microphone must be measured at 10 to 15 spot locations on the exterior facade at distances varying from 1.2 to 2.4 meters, four (4) to eight (8) feet, from the facade. Alternately, the microphone can be swept over the facade at these distances for 30 seconds or longer to determine an average exterior Leq.
	Near-field	That part of a sound field, usually within about two wavelengths of a noise source, where there is no simple relationship between sound level and distance, where the sound pressure does not obey the inverse square law and the particle velocity is not in phase with the sound pressure.
	Neighborhood Equity	Case in which an airport operator offers "secondary treatment" improvements to a few residences within the eligible noise contour threshold that do not meet the interior noise level requirements and are scattered among residences that are impacted (meet the interior noise level criteria). Secondary treatments are minimal improvements such as caulking and weather stripping. If the airport operator proposes to use neighborhood equity provisions, the FAA ADO has the option to approve this request if the requirements for Neighborhood Equity in the AIP Handbook, FAA Order 5100.38, are met.

Statues/Regulations	Term	Definition
14 CFR § 150.7	Noncompatible Land Use	Per 14 CFR § 150.7, the use of land that is not compatible with the outdoor noise environment (or an adequately attenuated noise level reduction for any indoor activities involved) at the location because the yearly day-night average sound level is at or below that identified for that or similar use under Appendix A (Table 1) of 14 CFR Part 150.
49 USC § 40117 Section 3 of 14 CFR Part 241	Passenger Facility Charge	A charge approved by the FAA that is imposed by a public agency on eligible revenue passengers enplaned at a commercial service airport it controls. Public agencies may use PFC revenue to finance FAA-approved projects that meet the requirements of 49 USC § 40117. Note that *revenue passenger* is further defined in Section 3 of 14 CFR 241, *Uniform System of Accounts and Reports of Large Certificated Air Carriers.*
	Post-Construction Acoustical Testing	Acoustical testing conducted after construction as part of the SIP implementation process to determine if the goals of the program were met.
	Pre-Construction Acoustical Testing	Acoustical testing conducted prior to construction, as part of the SIP implementation process to determine if a structure is impacted.
	Programmatic Agreement	A document that spells out the terms of a formal, legally binding agreement between FAA and other state and/or federal agencies. A Programmatic Agreement establishes a process for consultation, review, and compliance with one or more federal laws, most often with those federal laws concerning historic preservation.

Statues/Regulations	Term	Definition
	Program Manager	In a sound insulation program, both the airport operator and the FAA have program managers. **a.** The Airport Operator's Program Manager is a staff member or consultant responsible for providing overall supervision of program development, implementation, and program management. **b.** The FAA ADO Program Manager works directly with the Airport Operator to plan and implement the SIP, with assistance from the FAA Noise Subject Matter Expert.
	Project Testing Protocol	A formal document prepared by the airport operator or its consultants and approved by FAA that outlines requirements, activities, resources and the process to be used for acoustical testing of potentially impacted structures within a SIP boundary.
	Property	Land containing a structure(s) belonging to an individual or entity.
	Property Owner	The individual or entity that owns land with a structure(s) on it.
	Property Owner Liaison	Responsible for interacting with the property owners during the SIP process.
	Secondary Treatment	Refers to improvements such as caulking and weather stripping that are used as part of "Neighborhood Equity".
	Single-Family Residences	A structure with one habitable unit. The AIP Handbook defines habitable rooms for residences as living, sleeping, eating or cooking areas, which includes living rooms, family rooms, dining rooms, bedrooms, kitchens, and offices.
	SIP Boundary	Geographical limits of the program based on a Part 150 Noise Exposure Map or mitigation area defined in a NEPA Record of Decision.

Statues/Regulations	Term	Definition
	SIP Phase	A SIP boundary broken into parts that are feasible based on financial considerations and constructability. The first SIP phase may be considered a pilot program.
	SIP Phase Boundary	Geographical limits of a SIP phase.
	Structure	A building that may be eligible for sound insulation.
	Sustainable Design Consultant	Design consultant with specialization in designing the built environment based on sustainable principles such as those developed by the U.S. Green Building Council, which may be required by some local building codes.
	Windshield Survey	An assessment of potentially impacted structures conducted by traveling around the community to making observations externally about structure design and condition.

B.2 List of Acronyms

Acronym	Expanded Terminology
AC	Advisory Circular
ACRP	Airport Cooperative Research Program
ADO	Airports District Office
AIP	Airport Improvement Program
APP-400	Office of Airport Planning & Programming, Planning and Environmental
APP-500	Office of Airport Planning & Programming, Airports Financial Assistance
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers standards
ASNA	Aviation Safety and Noise Abatement Act of 1979
ATP	Acoustical Test Plan
CIP	Capital Improvement Program
CFR	Code of Federal Regulations
CMS	Case Management Systems

Acronym	Expanded Terminology
CNEL	Community Noise Equivalent Level
CO	Carbon Monoxide
CO_2	Carbon Dioxide
CSPP	Construction Safety and Phasing Plan
dB	Decibel, scientific unit of sound
dBA	Time-average, A-weighted sound level in decibels
DBE	Disadvantaged Business Enterprise
DNL	Yearly Day-Night Average Sound Levels
DMS	Document Management Systems
EPA	U.S. Environmental Protection Agency
FAA	Federal Aviation Administration
FONSI	Finding of No Significant Impact
FONSI-ROD	Finding of No Significant Impact-Record of Decision
GIS	Geographic Information System
HVAC	Heating, Ventilation and Air Conditioning
LEED AP	U.S. Green Building Council (USGBC), Leadership in Environmental and Energy Design (LEED)®
Leq	Sound Equivalent Level
$L_{Ext,Close}$	Loudspeaker
$L_{Ext,Cal}$	Calibration Measurement
L_{max}	A-weighted noise level
NCP	Noise Compatibility Program
NEM	Noise Exposure Map
NEPA	National Environmental Policy Act of 1969
NLR	Noise Level Reduction
OINR	Outdoor/Indoor Noise Reduction
PFC	Passenger Facility Charge
POC	Point of Contact
PPM	Program Policy Procedure

Acronym	Expanded Terminology
RFI	Request for Information
ROA	Record of Approval
ROD	Record of Decision
SEL	Sound Exposure Level
SIP	Sound Insulation Program
SLM	Sound Level Meters
SME	Subject Matter Expert
STA	State Transportation Agency
STC	Sound Transmission Class
TRB	Transportation Research Board
VOC	Volatile Organic Compounds

APPENDIX C. SAMPLE CHECKLISTS

C.1 Program Activities Checklist.

- ☐ Initial planning
  - Identify possible funding sources
  - Estimate total number of eligible homes
  - Validate NEMs (confirm accuracy)
- ☐ Pre-application to FAA
- ☐ Apply to FAA for project approval and funding
- ☐ Determine staffing approach (airport sponsor staff or consultant services)
- ☐ Issue RFP for consultant services
- ☐ Hire (or acquire) office staff and consultant(s)
- ☐ Set up project office
- ☐ Advertise program to the public
  - Hold public meetings
  - Contact media for newspaper and television coverage
- ☐ Conduct housing survey
- ☐ Determine SIP Phase 1 boundary
- ☐ Solicit participants (homeowners/property owners) within the Phase 1 boundary
- ☐ Review applicants for dwelling insulation to identify residents that opt to have their home tested
- ☐ Select dwellings and alternates, and prioritize
- ☐ Conduct site assessments to see if acceptable for implementation within Phase 1 boundary
- ☐ Secure agreement documentation from participants that elect to participate in the pre-construction acoustical testing
- ☐ Perform pre-construction acoustical testing
- ☐ Determine sound insulation improvements required for each house, while conducting structural field measurements
- ☐ Prepare treatment plans and specifications for each house
- ☐ Prepare work requirements and material definitions for procurement
- ☐ Develop overall project schedule
- ☐ Prepare bid package
- ☐ Submit bid package to local building department for review and approval
- ☐ Advertise for construction bids
- ☐ Pre-bid briefings and site visits
- ☐ Review bids and select construction contractor(s)
- ☐ Give project construction seminar to selected contractor
- ☐ Place order for specialized materials, if necessary
- ☐ Inspect delivered materials before installation
- ☐ Construction of SIP phase improvements
- ☐ Inspect work during construction
- ☐ Post-construction final inspection
- ☐ Post-construction acoustical testing
- ☐ Post-construction homeowner opinion survey
- ☐ Assess program/phase
- ☐ Plan for continuing program/phases, if appropriate

C.2 Selection of Consultants.

FAA Form 5100-134 can be downloaded from the FAA website:
https://www.faa.gov/forms/

U.S. Department of Transportation
Federal Aviation Administration

OMB CONTROL NUMBER: 2120-0569
EXPIRATION DATE: 8/31/2019

Selection of Consultants
Airport Improvement Program Sponsor Certification

Sponsor:

Airport:

Project Number:

Description of Work:

Application
49 USC § 47105(d) authorizes the Secretary to require certification from the sponsor that it will comply with the statutory and administrative requirements in carrying out a project under the Airport Improvement Program (AIP). General requirements for selection of consultant services within federal grant programs are described in 2 CFR §§ 200.317-200.326. Sponsors may use other qualifications-based procedures provided they are equivalent to standards of Title 40 chapter 11 and FAA Advisory Circular 150/5100-14, Architectural, Engineering, and Planning Consultant Services for Airport Grant Projects.

Certification Statements
Except for certification statements below marked as not applicable (N/A), this list includes major requirements of the construction project. Selecting "Yes" represents sponsor acknowledgement and confirmation of the certification statement. The term "will" means Sponsor action taken at appropriate time based on the certification statement focus area, but no later than the end of the project period of performance. This list is not comprehensive and does not relieve the sponsor from fully complying with all applicable statutory and administrative standards. The source of the requirement is referenced within parenthesis.

1. Sponsor acknowledges their responsibility for the settlement of all contractual and administrative issues arising out of their procurement actions (2 CFR § 200.318(k)).
   ☐ Yes ☐ No ☐ N/A
2. Sponsor procurement actions ensure or will ensure full and open competition that does not unduly limit competition (2 CFR § 200.319).
   ☐ Yes ☐ No ☐ N/A
3. Sponsor has excluded or will exclude any entity that develops or drafts specifications, requirements, or statements of work associated with the development of a request-for-qualifications (RFQ) from competing for the advertised services (2 CFR § 200.319).
   ☐ Yes ☐ No ☐ N/A

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4. The advertisement describes or will describe specific project statements-of-work that provide clear detail of required services without unduly restricting competition (2 CFR § 200.319).

☐ Yes ☐ No ☐ N/A

5. Sponsor has publicized or will publicize a RFQ that:

   a. Solicits an adequate number of qualified sources (2 CFR § 200.320(d)); and

   b. Identifies all evaluation criteria and relative importance (2 CFR § 200.320(d)).

☐ Yes ☐ No ☐ N/A

6. Sponsor has based or will base selection on qualifications, experience, and disadvantaged business enterprise participation with price not being a selection factor (2 CFR § 200.320(d)).

☐ Yes ☐ No ☐ N/A

7. Sponsor has verified or will verify that agreements exceeding $25,000 are not awarded to individuals or firms suspended, debarred or otherwise excluded from participating in federally assisted projects (2 CFR §180.300).

☐ Yes ☐ No ☐ N/A

8. A/E services covering multiple projects: Sponsor has agreed to or will agree to:

   a. Refrain from initiating work covered by this procurement beyond five years from the date of selection (AC 150/5100-14); and

   b. Retain the right to conduct new procurement actions for projects identified or not identified in the RFQ (AC 150/5100-14).

☐ Yes ☐ No ☐ N/A

9. Sponsor has negotiated or will negotiate a fair and reasonable fee with the firm they select as most qualified for the services identified in the RFQ (2 CFR § 200.323).

☐ Yes ☐ No ☐ N/A

10. The Sponsor's contract identifies or will identify costs associated with ineligible work separately from costs associated with eligible work (2 CFR § 200.302).

☐ Yes ☐ No ☐ N/A

11. Sponsor has prepared or will prepare a record of negotiations detailing the history of the procurement action, rationale for contract type and basis for contract fees (2 CFR §200.318(i)).

☐ Yes ☐ No ☐ N/A

12. Sponsor has incorporated or will incorporate mandatory contact provisions in the consultant contract for AIP-assisted work (49 U.S.C. Chapter 471 and 2 CFR part 200 Appendix II)

☐ Yes ☐ No ☐ N/A

13. For contracts that apply a time-and-material payment provision (also known as hourly rates, specific rates of compensation, and labor rates), the Sponsor has established or will establish:
    a. Justification that there is no other suitable contract method for the services (2 CFR §200.318(j));
    b. A ceiling price that the consultant exceeds at their risk (2 CFR §200.318(j)); and
    c. A high degree of oversight that assures consultant is performing work in an efficient manner with effective cost controls in place 2 CFR §200.318(j)).

    ☐ Yes ☐ No ☐ N/A

14. Sponsor is not using or will not use the prohibited cost-plus-percentage-of-cost (CPPC) contract method. (2 CFR § 200.323(d)).

    ☐ Yes ☐ No ☐ N/A

Attach documentation clarifying any above item marked with "no" response.

Sponsor's Certification

I certify, for the project identified herein, responses to the forgoing items are accurate as marked and additional documentation for any item marked "no" is correct and complete.

I declare under penalty of perjury that the foregoing is true and correct. I understand that knowingly and willfully providing false information to the federal government is a violation of 18 USC § 1001 (False Statements) and could subject me to fines, imprisonment, or both.

Executed on this day of , .

Name of Sponsor:

Name of Sponsor's Authorized Official:

Title of Sponsor's Authorized Official:

Signature of Sponsor's Authorized Official: _____

I declare under penalty of perjury that the foregoing is true and correct. I understand that knowingly and willfully providing false information to the federal government is a violation of 18 USC § 1001 (False Statements) and could subject me to fines, imprisonment, or both.

C.3 Construction Project Final Acceptance.

FAA Form 5100-129 can be downloaded from the FAA website:
https://www.faa.gov/forms/

U.S. Department of Transportation
Federal Aviation Administration

OMB CONTROL NUMBER: 2120-0569
EXPIRATION DATE: 8/31/2019

Construction Project Final Acceptance
Airport Improvement Program Sponsor Certification

Sponsor:

Airport:

Project Number:

Description of Work:

Application
49 USC § 47105(d), authorizes the Secretary to require me certification from the sponsor that it will comply with the statutory and administrative requirements in carrying out a project under the Airport Improvement Program. General standards for final acceptance and close out of federally funded construction projects are in 2 CFR § 200.343 – Closeout and supplemented by FAA Order 5100.38. The sponsor must determine that project costs are accurate and proper in accordance with specific requirements of the grant agreement and contract documents.

Certification Statements
Except for certification statements below marked not applicable (N/A), this list includes major requirements of the construction project. Selecting "Yes" represents sponsor acknowledgment and confirmation of the certification statement. The term "will" means Sponsor action taken at appropriate time based on the certification statement focus area, but no later than the end of the project period of performance. This list is not comprehensive and does not relieve the sponsor from fully complying with all applicable statutory and administrative standards. The source of the requirement is referenced within parenthesis.

1. The personnel engaged in project administration, engineering supervision, project inspection, and acceptance testing were or will be determined to be qualified and competent to perform the work (Grant Assurance).
   ☐ Yes ☐ No ☐ N/A
2. Construction records, including daily logs, were or will be kept by the resident engineer/construction inspector that fully document contractor's performance in complying with:
   a. Technical standards (Advisory Circular (AC) 150/5370-12);
   b. Contract requirements (2 CFR part 200 and FAA Order 5100.38); and
   c. Construction safety and phasing plan measures (AC 150/5370-2).
   ☐ Yes ☐ No ☐ N/A
3. All acceptance tests specified in the project specifications were or will be performed and documented. (AC 150/5370-12).
   ☐ Yes ☐ No ☐ N/A

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4. Sponsor has taken or will take appropriate corrective action for any test result outside of allowable tolerances (AC 150/5370-12).

   ☐ Yes ☐ No ☐ N/A

5. Pay reduction factors required by the specifications were applied or will be applied in computing final payments with a summary made available to the FAA (AC 150/5370-10).

   ☐ Yes ☐ No ☐ N/A

6. Sponsor has notified, or will promptly notify the Federal Aviation Administration (FAA) of the following occurrences:

   a. Violations of any federal requirements set forth or included by reference in the contract documents (2 CFR part 200);

   b. Disputes or complaints concerning federal labor standards (29 CFR part 5); and

   c. Violations of or complaints addressing conformance with Equal Employment Opportunity or Disadvantaged Business Enterprise requirements (41 CFR Chapter 60 and 49 CFR part 26).

   ☐ Yes ☐ No ☐ N/A

7. Weekly payroll records and statements of compliance were or will be submitted by the prime contractor and reviewed by the sponsor for conformance with federal labor and civil rights requirements as required by FAA and U.S. Department of Labor (29 CFR Part 5).

   ☐ Yes ☐ No ☐ N/A

8. Payments to the contractor were or will be made in conformance with federal requirements and contract provisions using sponsor internal controls that include:

   a. Retaining source documentation of payments and verifying contractor billing statements against actual performance (2 CFR § 200.302 and FAA Order 5100.38);

   b. Prompt payment of subcontractors for satisfactory performance of work (49 CFR § 26.29);

   c. Release of applicable retainage upon satisfactory performance of work (49 CFR § 26.29); and

   d. Verification that payments to DBEs represent work the DBE performed by carrying out a commercially useful function (49 CFR §26.55).

   ☐ Yes ☐ No ☐ N/A

9. A final project inspection was or will be conducted with representatives of the sponsor and the contractor present that ensure:

   a. Physical completion of project work in conformance with approved plans and specifications (Order 5100.38);

   b. Necessary actions to correct punch list items identified during final inspection are complete (Order 5100.38); and

   c. Preparation of a record of final inspection and distribution to parties to the contract (Order 5100.38);

   ☐ Yes ☐ No ☐ N/A

10. The project was or will be accomplished without material deviations, changes, or modifications from approved plans and specifications, except as approved by the FAA (Order 5100.38).

    ☐ Yes ☐ No ☐ N/A

11. The construction of all buildings have complied or will comply with the seismic construction requirements of 49 CFR § 41.120.

    ☐ Yes ☐ No ☐ N/A

12. For development projects, sponsor has taken or will take the following close-out actions:

    a. Submit to the FAA a final test and quality assurance report summarizing acceptance test results, as applicable (Grant Condition);

    b. Complete all environmental requirements as established within the project environmental determination (Oder 5100.38); and

    c. Prepare and retain as-built plans (Order 5100.38).

    ☐ Yes ☐ No ☐ N/A

13. Sponsor has revised or will revise their airport layout plan (ALP) that reflects improvements made and has submitted or will submit an updated ALP to the FAA no later than 90 days from the period of performance end date. (49 USC § 47107 and Order 5100.38).

    ☐ Yes ☐ No ☐ N/A

Attach documentation clarifying any above item marked with "No" response.

Sponsor's Certification

I certify, for the project identified herein, responses to the forgoing items are accurate as marked and additional documentation for any item marked "no" is correct and complete.

Executed on this day of , .

Name of Sponsor:

Name of Sponsor's Authorized Official:

Title of Sponsor's Authorized Official:

Signature of Sponsor's Authorized Official: _____

I declare under penalty of perjury that the foregoing is true and correct. I understand that knowingly and willfully providing false information to the federal government is a violation of 18 USC § 1001 (False Statements) and could subject me to fines, imprisonment, or both.

C.4 Project Plans and Specifications.

FAA Form 5100-132 can be downloaded from the FAA website:
https://www.faa.gov/forms/

U.S. Department of Transportation
Federal Aviation Administration

OMB CONTROL NUMBER: 2120-0569
EXPIRATION DATE: 8/31/2019

Project Plans and Specifications
Airport Improvement Program Sponsor Certification

Sponsor:

Airport:

Project Number:

Description of Work:

Application
49 USC § 47105(d) authorizes the Secretary to require certification from the sponsor that it will comply with the statutory and administrative requirements in carrying out a project under the Airport Improvement Program (AIP). Labor and civil rights standards applicable to AIP are established by the Department of Labor (www.dol.gov/). AIP Grant Assurance C.1—General Federal Requirements identifies applicable federal laws, regulations, executive orders, policies, guidelines and requirements for assistance under AIP. A list of current advisory circulars with specific standards for procurement, design or construction of airports, and installation of equipment and facilities is referenced in standard airport sponsor Grant Assurance 34 contained in the grant agreement.

Certification Statements
Except for certification statements below marked as not applicable (N/A), this list includes major requirements of the construction project. Selecting "Yes" represents sponsor acknowledgement and confirmation of the certification statement. The term "will" means Sponsor action taken at appropriate time based on the certification statement focus area, but no later than the end of the project period of performance. This list is not comprehensive and does not relieve the sponsor from fully complying with all applicable statutory and administrative standards. The source of the requirement is referenced within parenthesis.

1. The plans and specifications were or will be prepared in accordance with applicable federal standards and requirements, so that no deviation or modification to standards set forth in the advisory circulars, or FAA-accepted state standard, is necessary other than those explicitly approved by the Federal Aviation Administration (FAA) (14 USC § 47105).

   ☐ Yes ☐ No ☐ N/A

2. Specifications incorporate or will incorporate a clear and accurate description of the technical requirement for the material or product that does not contain limiting or proprietary features that unduly restrict competition (2 CFR §200.319).

   ☐ Yes ☐ No ☐ N/A

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3. The development that is included or will be included in the plans is depicted on the current airport layout plan as approved by the FAA (14 USC § 47107).

   ☐ Yes ☐ No ☐ N/A

4. Development and features that are ineligible or unallowable for AIP funding have been or will be omitted from the plans and specifications (FAA Order 5100.38, par. 3-43).

   ☐ Yes ☐ No ☐ N/A

5. The specification does not use or will not use "brand name" or equal to convey requirements unless sponsor requests and receives approval from the FAA to use brand name (FAA Order 5100.38, Table U-5).

   ☐ Yes ☐ No ☐ N/A

6. The specification does not impose or will not impose geographical preference in their procurement requirements (2 CFR §200.319(b) and FAA Order 5100.38, Table U-5).

   ☐ Yes ☐ No ☐ N/A

7. The use of prequalified lists of individuals, firms or products include or will include sufficient qualified sources that ensure open and free competition and that does not preclude potential entities from qualifying during the solicitation period (2 CFR §319(d)).

   ☐ Yes ☐ No ☐ N/A

8. Solicitations with bid alternates include or will include explicit information that establish a basis for award of contract that is free of arbitrary decisions by the sponsor (2 CFR § 200.319(a)(7)).

   ☐ Yes ☐ No ☐ N/A

9. Concurrence was or will be obtained from the FAA if Sponsor incorporates a value engineering clause into the contract (FAA Order 5100.38, par. 3-57).

   ☐ Yes ☐ No ☐ N/A

10. The plans and specifications incorporate or will incorporate applicable requirements and recommendations set forth in the federally approved environmental finding (49 USC §47106(c)).

    ☐ Yes ☐ No ☐ N/A

11. The design of all buildings comply or will comply with the seismic design requirements of 49 CFR § 41.120. (FAA Order 5100.38d, par. 3-92)

    ☐ Yes ☐ No ☐ N/A

12. The project specification include or will include process control and acceptance tests required for the project by as per the applicable standard:

    a. Construction and installation as contained in Advisory Circular (AC) 150/5370-10.

       ☐ Yes ☐ No ☐ N/A

b. Snow Removal Equipment as contained in AC 150/5220-20.

☐ Yes ☐ No ☐ N/A

c. Aircraft Rescue and Fire Fighting (ARFF) vehicles as contained in AC 150/5220-10.

☐ Yes ☐ No ☐ N/A

13. For construction activities within or near aircraft operational areas(AOA):

a. The Sponsor has or will prepare a construction safety and phasing plan (CSPP) conforming to Advisory Circular 150/5370-2.

b. Compliance with CSPP safety provisions has been or will be incorporated into the plans and specifications as a contractor requirement.

c. Sponsor will not initiate work until receiving FAA's concurrence with the CSPP (FAA Order 5100.38, Par. 5-29).

☐ Yes ☐ No ☐ N/A

14. The project was or will be physically completed without federal participation in costs due to errors and omissions in the plans and specifications that were foreseeable at the time of project design (49 USC §47110(b)(1) and FAA Order 5100.38d, par. 3-100).

☐ Yes ☐ No ☐ N/A

Attach documentation clarifying any above item marked with "No" response.

Sponsor's Certification

I certify, for the project identified herein, responses to the forgoing items are accurate as marked and additional documentation for any item marked "no" is correct and complete.

Executed on this day of , .

Name of Sponsor:

Name of Sponsor's Authorized Official:

Title of Sponsor's Authorized Official:

Signature of Sponsor's Authorized Official: _____

I declare under penalty of perjury that the foregoing is true and correct. I understand that knowingly and willfully providing false information to the federal government is a violation of 18 USC § 1001 (False Statements) and could subject me to fines, imprisonment, or both.

C.5 Equipment Construction Contracts.

FAA Form 5100-131 can be downloaded from the FAA website:
https://www.faa.gov/forms/

U.S. Department of Transportation
Federal Aviation Administration

OMB CONTROL NUMBER: 2120-0569
EXPIRATION DATE: 8/31/2019

Equipment and Construction Contracts
Airport Improvement Sponsor Certification

Sponsor:

Airport:

Project Number:

Description of Work:

Application
49 USC § 47105(d) authorizes the Secretary to require certification from the sponsor that it will comply with the statutory and administrative requirements in carrying out a project under the Airport Improvement Program (AIP). General procurement standards for equipment and construction contracts within Federal grant programs are described in 2 CFR §§ 200.317-200.326. Labor and Civil Rights Standards applicable to the AIP are established by the Department of Labor (www.dol.gov) AIP Grant Assurance C.1—General Federal Requirements identifies all applicable Federal Laws, regulations, executive orders, policies, guidelines and requirements for assistance under the AIP. Sponsors may use state and local procedures provided the procurement conforms to these federal standards.

This certification applies to all equipment and construction projects. Equipment projects may or may not employ laborers and mechanics that qualify the project as a "covered contract" under requirements established by the Department of Labor requirements. Sponsor shall provide appropriate responses to the certification statements that reflect the character of the project regardless of whether the contract is for a construction project or an equipment project.

Certification Statements
Except for certification statements below marked as not applicable (N/A), this list includes major requirements of the construction project. Selecting "Yes" represents sponsor acknowledgement and confirmation of the certification statement. The term "will" means Sponsor action taken at appropriate time based on the certification statement focus area, but no later than the end of the project period of performance. This list is not comprehensive and does not relieve the sponsor from fully complying with all applicable statutory and administrative standards. The source of the requirement is referenced within parenthesis.

1. A written code or standard of conduct is or will be in effect prior to commencement of the project that governs the performance of the sponsor's officers, employees, or agents in soliciting, awarding and administering procurement contracts (2 CFR § 200.318).

   ☐ Yes ☐ No ☐ N/A

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2. For all contracts, qualified and competent personnel are or will be engaged to perform contract administration, engineering supervision, construction inspection, and testing (Grant Assurance C.17).

   ☐ Yes ☐ No ☐ N/A

3. Sponsors that are required to have a Disadvantage Business Enterprise (DBE) program on file with the FAA have included or will include clauses required by Title VI of the Civil Rights Act and 49 CFR Part 26 for Disadvantaged Business Enterprises in all contracts and subcontracts.

   ☐ Yes ☐ No ☐ N/A

4. Sponsors required to have a DBE program on file with the FAA have implemented or will implement monitoring and enforcement measures that:

   a. Ensure work committed to Disadvantaged Business Enterprises at contract award is actually performed by the named DBEs (49 CFR § 26.37(b));

   b. Include written certification that the sponsor has reviewed contract records and has monitored work sites for performance by DBE firms (49 CFR § 26.37(b)); and

   c. Provides for a running tally of payments made to DBE firms and a means for comparing actual attainments (i.e. payments) to original commitments (49 CFR § 26.37(c)).

   ☐ Yes ☐ No ☐ N/A

5. Sponsor procurement actions using the competitive sealed bid method (2 CFR § 200.320(c)). was or will be:

   a. Publicly advertised, allowing a sufficient response time to solicit an adequate number of interested contractors or vendors;

   b. Prepared to include a complete, adequate and realistic specification that defines the items or services in sufficient detail to allow prospective bidders to respond;

   c. Publicly opened at a time and place prescribed in the invitation for bids; and

   d. Prepared in a manner that result in a firm fixed price contract award to the lowest responsive and responsible bidder.

   ☐ Yes ☐ No ☐ N/A

6. For projects the Sponsor proposes to use the competitive proposal procurement method (2 CFR § 200.320(d)), Sponsor has requested or will request FAA approval prior to proceeding with a competitive proposal procurement by submitting to the FAA the following:

   a. Written justification that supports use of competitive proposal method in lieu of the preferred sealed bid procurement method;

   b. Plan for publicizing and soliciting an adequate number of qualified sources; and

   c. Listing of evaluation factors along with relative importance of the factors.

   ☐ Yes ☐ No ☐ N/A

7. For construction and equipment installation projects, the bid solicitation includes or will include the current federal wage rate schedule(s) for the appropriate type of work classifications (2 CFR Part 200, Appendix II).

   ☐ Yes ☐ No ☐ N/A

8. Concurrence was or will be obtained from the Federal Aviation Administration (FAA) prior to contract award under any of the following circumstances (Order 5100.38D):
    a. Only one qualified person/firm submits a responsive bid;
    b. Award is to be made to other than the lowest responsible bidder; and
    c. Life cycle costing is a factor in selecting the lowest responsive bidder.

    ☐ Yes ☐ No ☐ N/A

9. All construction and equipment installation contracts contain or will contain provisions for:
    a. Access to Records (§ 200.336)
    b. Buy American Preferences (Title 49 U.S.C. § 50101)
    c. Civil Rights - General Provisions and Title VI Assurances(41 CFR part 60)
    d. Federal Fair Labor Standards (29 U.S.C. § 201, et seq)
    e. Occupational Safety and Health Act requirements (20 CFR part 1920)
    f. Seismic Safety – building construction (49 CFR part 41)
    g. State Energy Conservation Requirements - as applicable(2 CFR part 200, Appendix II)
    h. U.S. Trade Restriction (49 CFR part 30)
    i. Veterans Preference (49 USC § 47112(c))

    ☐ Yes ☐ No ☐ N/A

10. All construction and equipment installation contracts exceeding $2,000 contain or will contain the provisions established by:
    a. Davis-Bacon and Related Acts (29 CFR part 5)
    b. Copeland “Anti-Kickback” Act (29 CFR parts 3 and 5)

    ☐ Yes ☐ No ☐ N/A

11. All construction and equipment installation contracts exceeding $3,000 contain or will contain a contract provision that discourages distracted driving (E.O. 13513).

    ☐ Yes ☐ No ☐ N/A

12. All contracts exceeding $10,000 contain or will contain the following provisions as applicable:
    a. Construction and equipment installation projects - Applicable clauses from 41 CFR Part 60 for compliance with Executive Orders 11246 and 11375 on Equal Employment Opportunity;
    b. Construction and equipment installation - Contract Clause prohibiting segregated facilities in accordance with 41 CFR part 60-1.8;
    c. Requirement to maximize use of products containing recovered materials in accordance with 2 CFR § 200.322 and 40 CFR part 247; and
    d. Provisions that address termination for cause and termination for convenience (2 CFR Part 200, Appendix II).

    ☐ Yes ☐ No ☐ N/A

13. All contracts and subcontracts exceeding $25,000: Measures are in place or will be in place (e.g. checking the System for Award Management) that ensure contracts and subcontracts are not awarded to individuals or firms suspended, debarred, or excluded from participating in federally assisted projects (2 CFR parts 180 and 1200).

    ☐ Yes ☐ No ☐ N/A

14. Contracts exceeding the simplified acquisition threshold (currently $150,000) include or will include provisions, as applicable, that address the following:

    a. Construction and equipment installation contracts - a bid guarantee of 5%, a performance bond of 100%, and a payment bond of 100% (2 CFR § 200.325);

    b. Construction and equipment installation contracts - requirements of the Contract Work Hours and Safety Standards Act (40 USC 3701-3708, Sections 103 and 107);

    c. Restrictions on Lobbying and Influencing (2 CFR part 200, Appendix II);

    d. Conditions specifying administrative, contractual and legal remedies for instances where contractor of vendor violate or breach the terms and conditions of the contract (2 CFR §200, Appendix II); and

    e. All Contracts - Applicable standards and requirements issued under Section 306 of the Clean Air Act (42 USC 7401-7671q), Section 508 of the Clean Water Act (33 USC 1251-1387, and Executive Order 11738.

    ☐ Yes ☐ No ☐ N/A

Attach documentation clarifying any above item marked with "No" response.

Sponsor's Certification

I certify, for the project identified herein, responses to the forgoing items are accurate as marked and additional documentation for any item marked "no" is correct and complete.

Executed on this day of , .

Name of Sponsor:

Name of Sponsor's Authorized Official:

Title of Sponsor's Authorized Official:

Signature of Sponsor's Authorized Official: _____

I declare under penalty of perjury that the foregoing is true and correct. I understand that knowingly and willfully providing false information to the federal government is a violation of 18 USC § 1001 (False Statements) and could subject me to fines, imprisonment, or both.

C.6 Real Property Acquisition.

FAA Form 5100-133 can be downloaded from the FAA website:
https://www.faa.gov/forms/

U.S. Department of Transportation
Federal Aviation Administration

OMB CONTROL NUMBER: 2120-0569
EXPIRATION DATE: 8/31/2019

Real Property Acquisition
Airport Improvement Program Sponsor Certification

Sponsor:

Airport:

Project Number:

Description of Work:

Application
49 USC § 47105(d) authorizes the Secretary to require certification from the sponsor that it will comply with the statutory and administrative requirements in carrying out a project under the Airport Improvement Program (AIP). General requirements on real property acquisition and relocation assistance are in 49 CFR Part 24. The AIP project grant agreement contains specific requirements and assurances on the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Uniform Act), as amended.

Certification Statements
Except for certification statements below marked not applicable (N/A), this list includes major requirements of the real property acquisition project. Selecting "Yes" represents sponsor acknowledgement and confirmation of the certification statement. The term "will" means Sponsor action taken at appropriate time based on the certification statement focus area, but no later than the end of the project period of performance. This list is not comprehensive and does not relieve the sponsor from fully complying with all applicable statutory and administrative standards.

1. The sponsor's attorney or other official has or will have good and sufficient title as well as title evidence on property in the project.
   ☐ Yes ☐ No ☐ N/A
2. If defects and/or encumbrances exist in the title that adversely impact the sponsor's intended use of property in the project, they have been or will be extinguished, modified, or subordinated.
   ☐ Yes ☐ No ☐ N/A
3. If property for airport development is or will be leased, the following conditions have been met:
   a. The term is for 20 years or the useful life of the project;
   b. The lessor is a public agency; and
   c. The lease contains no provisions that prevent full compliance with the grant agreement.
   ☐ Yes ☐ No ☐ N/A

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4. Property in the project is or will be in conformance with the current Exhibit A property map, which is based on deeds, title opinions, land surveys, the approved airport layout plan, and project documentation.

   ☐ Yes ☐ No ☐ N/A

5. For any acquisition of property interest in noise sensitive approach zones and related areas, property interest was or will be obtained to ensure land is used for purposes compatible with noise levels associated with operation of the airport.

   ☐ Yes ☐ No ☐ N/A

6. For any acquisition of property interest in runway protection zones and areas related to 14 CFR 77 surfaces or to clear other airport surfaces, property interest was or will be obtained for the following:

   a. The right of flight;

   b. The right of ingress and egress to remove obstructions; and

   c. The right to restrict the establishment of future obstructions.

   ☐ Yes ☐ No ☐ N/A

7. Appraisals prepared by qualified real estate appraisers hired by the sponsor include or will include the following:

   a. Valuation data to estimate the current market value for the property interest acquired on each parcel; and

   b. Verification that an opportunity has been provided to the property owner or representative to accompany appraisers during inspections.

   ☐ Yes ☐ No ☐ N/A

8. Each appraisal has been or will be reviewed by a qualified review appraiser to recommend an amount for the offer of just compensation, and the written appraisals as well as review appraisal are available to Federal Aviation Administration (FAA) for review.

   ☐ Yes ☐ No ☐ N/A

9. A written offer to acquire each parcel was or will be presented to the property owner for not less than the approved amount of just compensation.

   ☐ Yes ☐ No ☐ N/A

10. Effort was or will be made to acquire each property through the following negotiation procedures:

    a. No coercive action to induce agreement; and

    b. Supporting documents for settlements included in the project files.

    ☐ Yes ☐ No ☐ N/A

11. If a negotiated settlement is not reached, the following procedures were or will be used:
    a. Condemnation initiated and a court deposit not less than the just compensation made prior to possession of the property; and
    b. Supporting documents for awards included in the project files.

    ☐ Yes ☐ No ☐ N/A

12. If displacement of persons, businesses, farm operations, or non-profit organizations is involved, a relocation assistance program was or will be established, with displaced parties receiving general information on the program in writing, including relocation eligibility, and a 90-day notice to vacate.

    ☐ Yes ☐ No ☐ N/A

13. Relocation assistance services, comparable replacement housing, and payment of necessary relocation expenses were or will be provided within a reasonable time period for each displaced occupant in accordance with the Uniform Act.

    ☐ Yes ☐ No ☐ N/A

Attach documentation clarifying any above item marked with "No" response.

Sponsor's Certification

I certify, for the project identified herein, responses to the forgoing items are accurate as marked and additional documentation for any item marked "no" is correct and complete.

Executed on this day of , .

Name of Sponsor:

Name of Sponsor's Authorized Official:

Title of Sponsor's Authorized Official:

Signature of Sponsor's Designated Official Representative: _____

I declare under penalty of perjury that the foregoing is true and correct. I understand that knowingly and willfully providing false information to the federal government is a violation of 18 USC § 1001 (False Statements) and could subject me to fines, imprisonment, or both.

Advisory Circular Feedback

If you find an error in this AC, have recommendations for improving it, or have suggestions for new items/subjects to be added, you may let us know by emailing content on this form to the attention of the Manager of the Airport Planning and Environmental Division (APP-400) via the APP-400 webpage.

Subject: AC 150/5000-9B Date: _____

Please check all appropriate line items:

☐ An error (procedural or typographical) has been noted in paragraph _____ on page _____.

☐ Recommend paragraph _____ on page _____ be changed as follows:

_____
_____
_____

☐ In a future change to this AC, please cover the following subject:
(Briefly describe what you want added.)

_____
_____
_____

☐ Other comments:

_____
_____
_____

☐ I would like to discuss the above. Please contact me at (phone number, email address).

_____
_____
_____

Submitted by: _____ Date: _____