

Technical Considerations in Selecting Acoustical Products for Airport Sound Insulation Programs

Presented by

Roger Odegard
Manager, Arlington Operations
Wyle Laboratories, Inc.
Arlington, Virginia
www.wyleacoustics.com

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Synopsis

The goal of any airport sound insulation program that has been undertaken in the U.S. is to provide a package of construction modifications that meets the project's goals for reducing sound levels within the home (or school, church, hospital, and other noise-sensitive buildings). This presentation will review a number of technical considerations that have proven to be useful in specifying and selecting specialty acoustical products for a number of sound insulation programs around the nation.

Sound Insulation Programs

Under the Federal Aviation Regulation 14 CFR Part 150 program, billions of Federal dollars have been spent to acquire land and sound insulate buildings inside the 65 dB DNL contours at participating airports. The ultimate goal is to reduce the number of people living within the 65 dB DNL contours or to provide acoustical modifications (i.e., sound insulation treatments), which results in structures that have interior noise levels that are compatible with the exterior aircraft noise environment. Most programs around the nation, particularly those that use Federal funding, require a signed aviation easement from the property owner in exchange for the sound insulation upgrades.

Although there is some variation from program to program, the range of acoustical modifications includes:

- Replacement doors
- Replacement windows
- Wall and ceiling modifications
- Attic and wall insulation
- Vent baffles
- Sealing building penetrations such as the removal of through-wall A/C and heating units
- Installation of A/C systems

The goal is to provide an acoustical package that meets FAA's criteria for reducing sound levels within the home (or school, church, or noise-sensitive building). FAA's established criteria include reducing the interior noise environment to a DNL of 45 dB, while also providing at least a 5-dB noise level reduction (NLR) improvement in the acoustical performance of the structure.

The technical requirements, along with certain architectural, contractual, program, and warranty requirements for replacement door and window products, in particular, present unique challenges for airports and sound insulation consultants alike.

Products Used in Sound Insulation Programs

The design and use of the various door and window products that are used in sound insulation programs varies for different climates and regions of the country. Most airports and consultants alike are aware of the public relations value in providing residents with a replacement product that is both aesthetically pleasing and is of the type they are used to seeing in their neighborhood. For instance, the vinyl composite prime/storm window product has most often been used on the east coast and the colder mid-western climates, while west coast programs have tended to use the vinyl dual-prime window products.

The various types of window products that are generally available include:

- Prime Windows
- Storm Windows
- Composite Prime/Storm Products
- Dual prime (four-sash) Products

The various types of door products include:

- Prime Doors
- Storm Doors
- Sliding Glass Prime Doors
- Sliding Glass Storm Doors
- French Doors

Why Use Specialty Acoustical Products?

Quite often, particularly at the outset of a sound insulation program, airport sponsors and FAA personnel, in their zeal to understand the sound insulation product market and keep control over their budgets, simply ask – why use the “costly” specialty products when off-the-shelf replacement products are available for a lower cost at the local home improvement center? This seems like a fair enough question. Let's attempt to answer the question by providing a comparison of residential “off-the-shelf” products and specialty acoustical products.

Residential Products

The greatest problematic issue that dominates, particularly with regard to windows, is the off-the-shelf products have limited standard sizes – in fact, custom sizing for windows often carry premium pricing. In addition, some manufacturers (because they are not geared toward producing large orders of custom-sized units) may have long lead times on custom sizes and large orders.

Another significant issue facing airports and consultants when considering the use of off-the-shelf products is the fact that third-party test data is limited and often not available – what is available is often completed “in-house” on an informal basis and not at an independent testing laboratory. This results in less technical objectivity when comparing various product lines and manufacturers. This can result in a lack of quality and cost-control for the airport sponsor since there is no objective comparison of the various products.

Finally, these products have a limited history in sound insulation programs. The lack of familiarity with the products can lead to inadequate warranties, unpredictable delivery schedules, unacceptable installation methods necessary for sound insulation purposes, and possibly major changes to the product over the course of an entire program.

Specialty Acoustical Products

Perhaps the biggest benefit to the use of this product type, in contrast to the off-the-shelf replacement windows, is the fact that the units are custom-sized to fit a wall opening. Since the manufacturers of these products are used to large-scale custom-sized production runs, production and lead times are well controlled and can be counted on to meet construction schedules.

Unlike the typical replacement product manufacturer, the specialty products manufacturers understand that a thorough review and acceptance of an extensive set of third-party test data is part of the product approval process.

This generally results in good quality control as the sound insulation consultant/airport team understands the products and the expected performance when installed.

Finally, many of these products are tried-and-true and have a 20-plus year track history in sound insulation programs across the nation. A side benefit to this is that the airport staff and consultants are used to the products and have a good handle on the costs, allowing accurate cost estimates, bid reviews, and control of program budgets.

Window Product Approval Process

Many of the nation’s on-going sound insulation programs have found that the product approval process and technical specifications should adhere to the following testing requirements:

- ANSI/AAMA 101 Performance Class and Grade
- Laboratory Sound Transmission Loss testing per ASTM E 90-99
- Laboratory Water Penetration testing per ASTM E 331-86
- Laboratory Air Infiltration testing per ASTM E 283-91
- Condensation Resistance Factor (CRF) testing per AAMA 1503.1
- Overall heat Transfer Coefficient (U Value) testing per AAMA 1503.1
- Structural Performance testing per ASTM E 330-90
- Thermal Cycling testing per AAMA Thermal Cycling Test Procedure

The entire consultant team and airport staff should also conduct a thorough review of a product sample. Pay close attention to the product’s aesthetics, operation, and overall usability before making a final decision – be sure the people who will be using the product will be satisfied.

It is extremely helpful to require a thorough review of the shop drawings that show the standard installation details for the product. In some cases, these details need to be adjusted to

improve the acoustical performance or to meet the requirements of the local building code.

Some additional items to consider when evaluating window product include:

- What is the required force to move or remove a window sash?
- Can the window tilt-in for cleaning or does the window sash need to be removed?
- What are the available colors and styles?
- What are the maximum and minimum heights, widths, and united inches?
- Are there additional options available such as muntins, tinting, frosting, and security screens?

Door Product Approval Process

As with the window approval process, many of the nation's on-going sound insulation programs have found that the door approval process and technical specification should adhere to the following testing requirements:

- Laboratory Sound Transmission Loss testing per ASTM E 90-99 (all door types)
- Laboratory Water Penetration testing per ASTM E 331-86 (sliding glass prime and storm doors)
- Laboratory Air Infiltration testing per ASTM E 283-91 (sliding glass prime and storm doors)

As with the window review process, require shop drawings showing standard installation details and allow both the architect and acoustical consultant to review and require a product sample in order to review the entire door assembly.

Some suggested items to consider when evaluating door products include:

- Will the sill height meet the ADA requirements?
- What is the required force to open and close both hinged and sliding doors?
- What are the available colors and styles?
- Does the manufacturer have a moisture penetration control plan for wood doors?

Quality Control throughout a Sound Insulation Program

Many of the nation's sound insulation programs and consultants, including Wyle Laboratories, have discovered several methods of controlling the quality of the products that are installed in a program.

Perhaps the single-most important requirement is third-party laboratory and field testing of the products. Laboratory testing, preferably by a lab certified under the National Voluntary Laboratory Accreditation Program (NVLAP), should be completed on all product types within a manufacturer's line prior to full approval. The Wyle staff consultants have also found the requirement for third-party laboratory testing on representative products delivered to the job site very helpful in ensuring the delivered products meets the same performance requirements of the sample product that was originally tested for approval into the program. Another quality-control recommendation is to require third-party field testing on a representative sample of products that have been installed – this ensures that the installation and the product meet the specified requirements.

Acoustical measurements that are performed by the program's acoustical consultant to document the noise level reduction (NLR) improvement also aid as a quality-control measure. In this case, the acoustical performance of the entire modification package is evaluated, not only the doors and windows.

Additional Considerations

There are several additional considerations that are important in evaluating products for approval in sound insulation programs.

The ability of the manufacturers to meet their agreed-upon product lead-times is a very important issue. Although most contracts include clauses for liquidated damages due to delays, the reality is that product is still late and

ensuring good public-relations becomes very difficult for both the airport and consultants.

Production capacity, particularly the ability to meet the delivery schedules on time over long periods, is critical to a program's success. This is particularly important for large sound insulation programs such as Chicago, Los Angeles, Minneapolis-St. Paul, Boston, and Seattle.

The manufacturer's financial stability is also important. Consider the long-term outlook – the manufacturer will need to support this product for up to ten years under warranty.

An additional consideration is the manufacturer's experience on other sound insulation programs. Common sense would dictate that good performance on other programs is a good sign that they will continue to provide a good product.

A final consideration is quality control. Consider whether the manufacturer takes the time to work with the general contractor and ensure he understands the installation requirements for proper quality control in the field. The manufacturer should allow the consultant team an opportunity to visit their facility to better understand the factory quality control system.