Acoustic Glazing White Paper:

An Introduction to Acoustic Glazing

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Introduction

The purpose of this Acoustic Glazing White Paper is to provide an introductory definition of acoustic glazing, methods of measuring transmission loss and to provide general recommended roles and responsibilities for acoustic glazing selection on projects. The paper can be used as an introduction to acoustic glazing and as a general procedural guideline. Still, each project is unique and should be specific to your own project for a successful acoustic glazing selection process.

The acoustic glazing selection can be a complicated and laborious process if the owner is targeting high acoustic performance or is unsure of what their targeted performance should be. However, by educating ourselves about acoustic glazing systems and understanding the capabilities of a system, we can mitigate potential risks and exposures that acoustic glazing can create. Ultimately, if the owner knows the sound loss they intend to achieve, the architect designs accordingly and the builder is educated about these systems, we can manage owner expectations and deliver an end product that achieves the owner's targeted performance.

Locations where acoustic glazing would generally be considered are projects near:

1) Heavy highway traffic
2) Consistent loud music
3) Stadiums, Speedways & Circuits
4) Busy city streets (NYC, London, Las Vegas, etc.)
5) Transportation hubs such as airports, train stations or railroad tracks

This list in not intended to be comprehensive but to provide examples of conditions where acoustic glazing may need to be considered depending on the owner's end use purpose and intended client experience.

The next sections will define acoustic glazing, methods of transmission loss and roles and responsibilities. Following the conclusion, additional resources have been provided for reference such as: A general list of acoustic glazing manufacturers/suppliers, acoustic glazing consultants and acoustic testing laboratories.

Defining Acoustic Glazing

Acoustic glass is constructed from combinations of various glass types along with acoustical window frames that assist in reducing sound transmission (transmission loss) from unwanted noises (1).

It is important to note that in discussions regarding acoustic glazing, there is the composition of the acoustic glass itself and then there the complete acoustic glazing assembly. The acoustic glass (Fig. 1) would consist of glass lite(s), laminate and potentially air space between the lites. The complete acoustic glazing assembly (Fig. 2) consists of the acoustic glass and the frame.

Figure 1 – Acoustic Glass (2)

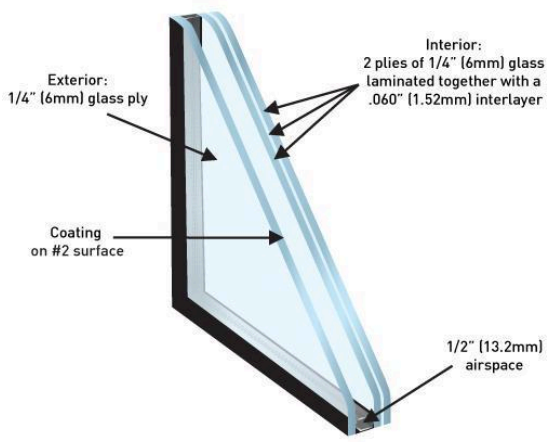
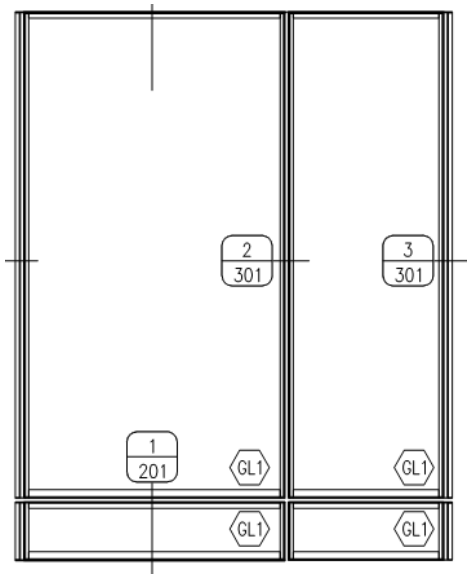


Figure 2 – Acoustic Glass Assembly



The purpose of acoustic glazing is to create a Sound Transmission Loss (STL or TL), which is the reduction of energy as it is transferred through a barrier (interior partition, exterior wall, etc.). The TL is measured by the resulting change in decibels, as measured across a range of frequencies, between the source of the sound and the opposite side of the sound barrier (partition) and is given as a number noted as STC and/or OITC.

STC (Sound Transmission Class) – a number rating representing the sound isolating properties of a building partition over the sound frequency range 125Hz to 4000Hz. This value is used most often for interior partitions.

Although Viracon does not recommend using STC for exterior wall glass selection (1), do not assume STC performance is irrelevant when evaluating exterior glazing performance. It is still used in qualifying exterior wall acoustic performance.

OITC (Outdoor-Indoor Transmission Class) – a number rating representing the sound isolation properties of a building façade element over the sound frequency range of 80Hz to 4000 Hz to account for lower frequency transportation noise.

It should be noted that although overall STC & OITC are the most used method of measurement, the TL at each frequency should also be carefully observed. A project where acoustic glazing is used near a music venue and the desired STC & OITC is met, may still underachieve with transmission loss because lower frequencies (bass) are more noticeable to the human ear. This is why it is important to review TL at each frequency to confirm adequate performance.

Methods of Measuring Sound Transmission Loss

As mentioned in the section above, achieving the desired level of Sound Transmission Loss (STL or simply TL) through glass wall systems is the purpose of acoustic glazing . It is important to know and understand TL and that there are at least four different TL measurement methods: Predictive, Historical Data, Acoustic Mockup and a Final In-Place Test. They are listed below in the order of least to most accurate.

Predictive

This method attempts to "predict" the glass and or glass assembly performance based on a combination of real data and assumed data. Predictive methods include techniques such as surface area predictions or utilize transmission loss prediction software (auralizations). These methods typically utilize the real product information (i.e. metal type and thickness, glass type and composition, etc.) and plug them into mathematical formulas or software programs to produce an assumed TL. However, the TL results produced from the predictive method are theoretical and should not be used to guarantee performance.

Historical Data

This method can be used in two ways. Previously recorded system performance test data can be used to "mix and match" with other proposed assemblies and can then be extrapolated to "predict" the glass and/or glass assembly performance. However, this is only slightly better than the predictive method mentioned above.

The other application of Historical Data is to reference the performance of a previous assembly that was tested. The more similar the designs are to the assembly that was tested, the more accurate the TL results would be. As dissimilarities increase between the systems, the reliability

of the previous historical data decreases. This method should not be used to guarantee performance unless it is identical to a previous system that was tested, and all other factors are the same.

Facility Tests

Performing an acoustical laboratory test, per ASTM E90, using the complete glazing assembly is the next best option. This test uses the exact materials and construction of the acoustic glazing assembly and places the system between two sound chambers. One chamber produces sound from speakers (music, pink noise, etc.) and the other chamber measures and records the sound allowed to pass through the system. These results are likely to be close to the performance of the final installed system but cannot be expected to match final in place performance. The facility test will not account for the dampening/intensifying of the sound due to window treatments, flooring, ceiling and wall finishes and the effects of running ceiling or exhaust fans, TV, etc. Most of these factors have a minor impact to TL by themselves but when considered as a whole, anticipated performance may be altered. This method could be used to reasonably infer the anticipated performance of an acoustic glazing system.

Final In-Place Testing

This method should be considered the only method that is guaranteed to provide accurate results. There are several variables mentioned in Facility Tests above that cannot be captured when tested outside of the final installation. It is recommended that Final In-Place acoustic test results should be maintained to keep as a reference for future acoustic glazing reports. This method is the only 100% accurate method to guarantee the transmission loss results.

Recommended Roles & Responsibilities

The process for acoustic glazing selection begins with the owner who should identify acoustic targets that are desired. The architect should integrate sound considerations into the design and provide specifications that are representative of the owner's acoustic target. Finally, the builder and subcontractor will be responsible for meeting the architectural design and sound requirements given by the architect. These roles are expanded below:

Owner/Developer – Identify Targeted TL

When it is determined that a project is near excessive volumes that are unfavorable to the end user experience, the owner should seek out an acoustic consultant. The owner acoustic consultant should create an acoustic report that will assist in understanding the measured volume of the nearby disturbances and guide the owner toward determining a satisfactory

TL. The acoustic report should quantify and summarize the surrounding sound disruptions, reference industry standards for building types, codes, etc. and provide a recommendation to the owner.

The owner will ultimately decide what the targeted TL will be. Because the level of acoustic performance is directly correlated with cost, the owner sound consultant should assist in guiding the owner toward a range of targeted TL performance criteria that would be acoustically and fiscally acceptable to the owner.

Architect - Design & Specifications Conducive to Owner Targeted TL

Cognizant aesthetic design is critical to designing for acoustic glazing that is conducive to the targeted TL. Thickness of the exterior wall, mullion layout, balcony doors and operable windows will all impact the performance of the acoustic glazing and must be carefully considered in respect to the targeted TL. The architect will be required to work closely with the owner and owner sound consultant to generally understand the necessary design criteria to meet the targeted TL. The architect must provide specifications for the acoustic glazing system identifying:

1) Glass Design
2) Thermal Movements
3) General System Requirements
4) Acoustical Performance Criteria
5) Thermal & Optical Performance Properties

*Note - See example Specifications 08 81 00 in Resources Section

In addition to the specifications listed above, the architect should also specify a full-size acoustic mockup per ASTM E90. The architect should actively manage owner expectations that these

are targeted specifications and that performance cannot be guaranteed until it is tested in place as the final assembly.

Builder - Verify Design and Select Glazing System

Hire a sound consultant that represents you as the builder. An acoustic glazing consultant responsibility is not to hold or direct the acoustic glazing scope of work, but rather to assist in interpreting the owner's sound report and reviewing the architect design & specifications. Utilize the builder sound consultant to participate in all acoustic glazing meetings and to provide comments and guidance regarding proposed acoustic glazing systems and associated submittals.

Once the contract documents are verified to be sufficient, pricing should consist of detailed qualifications that clearly describe the system being provided, the system's targeted TL and how the TL information is being quantified (auralization, published data, previously tested system, etc.)

Provide all owner/builder sound consultant information to bidders prior to proposing an acoustic glazing system. The builder sound consultant and bidder(s) should review the bid documents to provide a properly qualified bid for an acoustic glazing system that meets the owner targeted TL.

The builder should verify if the proposed systems have been used previously and if an acoustic test was taken in place. If so, the report from the test should be submitted to the owner, architect and owner sound consultant for their review and to serve as a qualification for the system proposed. Clearly identify the system's performance and its deviations of the

specifications along with any other relevant information. Above all else, it should be stated that the acoustic performance (STC, OITC & Frequencies) of this system is anticipated, but not guaranteed,

As the builder, seek to partner with a subcontractor who has experience with acoustic glazing. ALWAYS manage owner expectations and reinforce that these are targeted specifications and that performance cannot be guaranteed unless it is tested in place in its final assembly.

The subcontractor will be responsible for partnering with an experienced acoustic glazing manufacturer/supplier who is familiar with the acoustic glazing process and must actively participate in selecting a glazing system that meets the targeted project acoustic requirements.

Upon submitting an acoustic glazing system and the associated cost, the subcontractor must provide explicit clarifications and limitations for the glass assembly that has been priced.

At a minimum, the qualifications of a bid should include:

1) Components of the glazing assembly
    1. Glass lite thickness
    2. Laminate thickness
    3. Number lites
    4. Air Space
2) Location(s) of acoustic glazing
3) Type of metal framing

4) Framing thickness
5) Maximum size glazing that can be supported by the system
6) Anticipated acoustic performance of the system.

*Note - It should also be clarified that certain codes and curtain wall features require a different type of glass, even inside of acoustic areas. These areas will have a different acoustic performance than areas with unrestricted acoustic glazing.

Conclusion

As acoustic glazing becomes more popular, it will become more important to be knowledgeable about this product. By defining acoustic glazing, learning how to measure transmission loss and understanding general roles and responsibilities you can avoid exposing yourself to unnecessary financial risks and schedule delays that can result from a disorganized acoustic glazing selection process. Most importantly, remember to manage owner expectations and to provide clear qualifications that create a clear understanding of the acoustic glazing system that is to be provided.

Resources:

Acoustic Glass Providers/Manufacturers

There is a large list of glass providers/manufacturers nationwide. Not all of them produce acoustic glazing and some of the providers who do provide acoustic glazing procure the glass from another manufacturer and then apply their own proprietary acoustic product and glaze it
all into their own system (i.e. Oldcastle Building Envelope procures Viracon glass and then applies their own product). Be aware of the process, who your manufacturer is and fully understand the tested acoustic performance of your glazing assembly.

List of 2019 Top Glass Fabricators by Glass Magazine:
https://glassmagazine.com/article/commercial/2019-top-glass-fabricators-list-1918952

Available Published Acoustic Data

Acoustic data can be difficult to obtain. Some manufacturers have data and others do not. Some of them may use the data from another website or only provide STC or OITC. For example, of the first 5 Companies from the Top Glass Fabricators by Glass Magazine, (3) of the companies do not have data on their website, (1) shows only STC & OITC and only one (Viracon) has a comprehensive list of their acoustic glazing products and their acoustic properties.

*Note It is important to notice that the Viracon data is based on a specific size of glass (3'x7'). Performance of glass will vary depending on its size. Additionally, it should not be assumed that Viracon's results are applicable to all other manufacturer acoustic products. If you are not using Viracon, I recommend using the Viracon acoustic data as a reference, but it should not be used to guarantee results.

Viracon Acoustic Performance Data
http://www.viracon.com/pdf/ViraconAcousticPerfDataTables.pdf

Sound Consultants:
ARUP
Contact Local Office
https://www.arup.com/contact

JE Acoustics
Chad Himmel
4407 Medical Pkwy
Austin, Texas 78756
(512) 371-0800
http://www.jeacoustics.com/
himmel@jeacoustics.com

Navcon Engineering Network*
Hans Forschner
701 West Las Palmas Dr.
Fullerton, CA 92835
(714) 441-3488
www.navcon.com
forschner@navcon.com

*Note – This company also has a Transmission Loss Prediction Software (Auralization) available for demo or purchase, INSUL by Navcon

Test Facilities:
Intertek PSI
Todd Kister
130 Derry Court
York, PA 17406
(717) 764-7700
Todd.Kister@Intertek.com
www.intertek.com

Riverbank Acoustical Laboratories
1512 S Batavia Avenue
Geneva, IL 60134
(630) 232-0104
Eric Wolfram
ewolfram@alionscience.com
Riverbank.alionscience.com

Additional Accredited Facilities can be found at:
http://www.stewartacousticalconsultants.com/linkstestlabs.html

References:

1) Acoustic Data. (n.d.). Retrieved from http://viracon.com/acoustic.
2) InsulatingLaminated. (n.d.). Retrieved from https://www.viracon.com/page/insulating-laminated.