

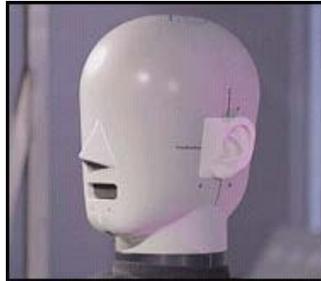


Acoustic and Insulation Product Testing Laboratories

Owens Corning Acoustics Research Center

Testing, Analysis, and Consulting Services

Services
Programs



Equipment &
Facilities

Vehicle
Industry

Appliance/HVAC
Industry

Materials
Industry

Professional
Quality

Contact Info

Owens Corning
Solution Briefs

Overview

The **Owens Corning Acoustics Research Center (OCARC)** is located at the internationally recognized Science and Technology Center in Granville, Ohio. From its founding in the 1930's, Owens Corning has been a leader in research and development in the field of acoustics. Data on acoustical properties developed in our laboratory is found in almost every acoustic reference or text.

Owens Corning has expanded on this core competency to provide a wide range of engineering services and consulting solutions to clients in the automotive, heavy vehicle, appliance, building, and HVAC industries.

With a proven track record, the Owens Corning Acoustics Laboratory has established itself as a leader in providing these three fundamental services:

- (1) [Engineering and Consulting Services](#) – Owens Corning offers consulting, problem solving, and product solutions for noise reductions and improved product sound quality.
- (2) [Benchmarking and Acoustic Performance Target Setting](#) - Owens Corning also specializes in developing product specific acoustical performance specifications or ratings and can implement innovative methods using specialized equipment to benchmark products against these specifications.
- (3) [Standard Noise and Vibration Testing](#) - At the core of the Owens Corning expertise is a long history of excellence and service conducting standardized noise and vibration testing such as sound power, sound transmission loss, and sound absorption to ISO and ASTM specifications.



In addition to these fundamental services, Owens Corning has also listened to the product manufacturers in various industries and developed several special services programs targeted to meet the specific needs our clients. These service programs allow us to become a strategic team member with our clients in areas like:

- (4) [Engineering for Product Innovation](#) – Working as a partner, Owens Corning assists clients in to developing and taking to market special products or components designed to improve noise and vibration performance.
- (5) [Acoustical Performance Marketing](#) – Owens Corning applies engineering principals and advanced technology in areas like *Sound Quality*, *Acoustical Nearfield Holography*, and *CAE modeling* to help clients communicate product differentiation in the area of noise and vibration.
- (6) [Rapid Response Services](#) - The *Rapid Response Services* were developed to meet our customer's needs in critical situations when data or solutions are needed in a minimum amount of time. Owens Corning offers the highest project priority, extended working hours, and industry networking to be able to deliver high quality results within the time window that is often needed in today's market. This time and materials based program is designed to minimize lead-time in initiating a project and in preparing detailed proposals. This is yet another example of the Owens Corning commitment to customer satisfaction.
- (7) [Technology Implementation Services and Seminars](#) - By providing customized on-site training in acoustics, noise and vibration testing, material characterization, vibro-acoustic modeling, and more, Owens Corning helps clients accelerate the technical learning curves and timeline required to enhance a laboratory or product development initiative.

NOISE AND VIBRATION SERVICES PROGRAMS

Standard Services

- [N&V Engineering and Consulting Services](#)
- [Benchmarking and Acoustic Performance Target Setting](#)
- [Standard N&V Testing](#)

Special Services Programs

- [Engineering for Product Innovation](#)
- [Acoustic Performance Marketing Services](#)
- [Rapid Response Services](#)
- [Technology Implementation Services and Seminars](#)

N&V Engineering and Consulting Services

Experimental and Analytical Problem Solving

Owens Corning will use source identification technology to define the root cause of noise and vibration concerns under artificial excitation, as well as, real world operating conditions. Then experimental methods and analytical modeling studies will be used to develop countermeasures and tune acoustics.

Sound Quality Analysis

The staff assists clients in determining how to measure the specific sound features that are influencing the sound character of a product. The Sound Quality team helps our clients take noise and vibration engineering beyond the basics of sound reduction to include shaping the sound spectrum to retain the desirable sound features while eliminating the objectionable sounds. Specific metrics or *Acoustic Performance Specifications* can be developed by using advanced digital signal processing and a library of frequency and time domain algorithms. Owens Corning assists our clients in implementing these approaches to improve product sound quality, reduce warranty costs, meet OEM performance targets, differentiate products, meet environmental regulations, pass/fail parts in production, and more.

Acoustical Applied Research

The Acoustics Laboratory conducts basic and applied acoustical research. Some typical basic research areas are sound absorption of materials, sound transmission loss studies of materials or systems, acoustical intensity analysis, acoustical impedance and other fundamental acoustic properties of materials, and computer modeling of acoustical performance of material and systems. Typical applied research areas are residential noise control, characterization of the acoustical performance of materials or systems, evaluation of interior space mock-ups, appliance, HVAC and transportation noise control.

Product / Prototype Development

The Owens Corning laboratory has staff and facilities to help you test, evaluate, and design new products or concepts. Physical prototypes can be minimized using analytical models to conduct virtual testing. For example, we can evaluate a variety of materials or systems to provide data for your use in searching for and selecting the best material design for your application.

Manufacturing N&V Quality Assurance

Owens Corning provides the engineering services and consulting to assist clients with the implementation of production line noise and vibration testing. Manufacturers of products ranging from consumer appliances and HVAC equipment to automotive systems are looking for noise and vibration detection methods to identify manufacturing error, product variability, and products that don't meet performance criteria. Furthermore, today's methodologies coupled with statistical analysis allow the manufacturer to identify the root cause of a given noise concern or process anomaly and assist in the databasing and tracking of each product's noise signature. Owens Corning combines industrial noise control experience and digital signal processing expertise to define the best strategy, acceptance criteria, and implementation to fit our clients needs and budget. The project team will also work with a large array of hardware and software suppliers in order to help the client integrate a complete solution.

Industrial Noise Control

The laboratory is experienced in conducting noise surveys and recommending noise control treatments in an industrial environment. Many noise problems are caused by vibrating equipment. The laboratory staff is capable of measuring industrial equipment vibration levels, and making recommendations to reduce excessive levels of vibration or noise.

Material Characterization, Model Correlation, and Databasing

Porous media propagation constant and characteristic impedance can be measured at the Acoustics Laboratory. These properties can then be incorporated into acoustic models and material databases. Lossy transmission line models allow staff to provide performance predictions on layered assemblies of porous media, membranes, and perforated plates. The model can be validated by measurement of the

normal incidence absorption, and/or small-scale measurement of transmission loss by the intensity method.

Vibro-Acoustic Analyses & Modeling

Three-dimensional vibro-acoustic models are developed by Owens Corning staff using *finite element*, solid and acoustical capabilities, as well as, *boundary element approaches*. *Statistical energy analysis (SEA)* methods allow the to study the dynamic response of complex structures at high frequencies. SEA is used by to predict interior noise and vibration in aircraft, automobiles, and off-road vehicle cabins. SEA has also been effectively applied in the evaluation of complex multi-path systems such as architectural components, whole buildings, appliance cabinets, and in industrial environments. Finally, *ray tracing methods* predict sound quality metrics of interior spaces such as conference rooms, auditory, and factory spaces.

Benchmarking and Acoustic Performance Target Setting

Owens Corning offers the fundamental facilities, the sound quality analysis technology, and the experimental and analytical expertise to develop, allocate, and implement *Acoustical Performance Targets*. In order to define the desirable acoustical performance of a car, bulldozer, washing machine, or computer, a methodology for obtaining repeatable, objective measures of a value that correlates to the desirable acoustic performance of the product must be established.

Owens Corning helps clients achieve this desirable acoustical product performance by customizing an effective process for developing, allocating, and implementing noise and vibration performance targets or specifications for their particular product. Generally, in order for this process to achieve the desirable product sound, it must be an integral part of the initial product design and development efforts.

Acoustic Performance Specification or Targets are simply quantifiable objective measures of product noise and vibration that are related to the customer perception or satisfaction with the product. They are often driven by “best in class” standards. Once these targets are established it is important for the product manufacturer / designer to break these targets down into two fundamental types:



- 1) Primary Targets
- 2) Allocated Component Targets

The primary targets quantify a value for what the customer directly hears or feels. The allocated targets are values for component level measures of characteristics that contribute to the primary responses. The allocated targets are generally determined from an experimental or hybrid analytical-experimental energy path model that is developed from an experimental characterization of the product and the energy paths.

Defining a Acoustic Performance Target Setting Project with Owens Corning

It is nearly impossible for Owens Corning to develop a project schedule, budget, and technical plan for a target setting project if the scope of the project has not been thoroughly defined. This type of project is fundamentally driven by the following issues:

1. The number of noise and vibration concerns (breadth)
2. The desired detail of acoustic performance specifications for each concern (depth)
3. Existing client databases and test methods for each concern (database, experience)
4. Desired Implementation of the *Acoustic Performance Specification* process

[Contact Owens Corning](#) to discuss how an *Acoustic Performance Specification* Development, Allocation, and Implementation program can be customized for your products and systems.

Standardized Acoustic Testing

Measurements to meet your special needs (customized, national or international standards) may be possible in the laboratory or in the field. Many tests are performed according to standard test methods. For other products or applications where no standard test method exists, we can recommend a test protocol.

Standardized tests regularly conducted at the Owens Corning include:

- Air flow resistance of acoustical materials (ASTM C522)
- Normal incidence sound impedance and absorption (ASTM E1050)
- Diffuse field sound absorption (ASTM C423)
- Sound transmission loss (ASTM E90)
- Sound power (ISO 3741)
- Sound power (ANSI S12.31)
- Sound Intensity (ISO 9614)
- GM Specification Testing

Very often these tests are used to support acoustic modeling efforts. Acoustic modeling is done in order to predict and then optimize the performance of a material or system using computer simulation. By using the output from the above material property characterizations, a simulation of materials or layers of materials can be created by our Acoustic material specialists using specialized modeling programs. These models can determine the *Transmission Loss* of complex composite materials and systems as well as their *Absorption Coefficients*. This allows the engineer/designer to evaluate hundreds of different configurations of materials and systems without having to build expensive test components. The Owens Corning staff can work with your engineers to help create these models and help to optimize the acoustic properties of their designs.

Engineering for Product Innovation

The Product Innovation program enables Owens Corning to work as part of a team to develop and take to market special products or components designed to improve noise and vibration performance of your product. Generally, this program includes root cause analysis followed by countermeasure development. Then Owens Corning supplies the subjective, objective, and visual data for the product acoustic performance validation and market segment differentiation. Using this program Owens Corning is willing to set-up special payment programs which truly make the Owens Corning incentives consistent with our clients. This is accomplished with the "PAY FOR PERFORMANCE PLAN" which means the cost of the project is based upon one of the following criteria:

- Pay for COST SAVING
- Pay for PERCENTAGE OF REVENUE
- Pay for PERFORMANCE IMPROVEMENT
- Pay for DESIGN IMPROVEMENT

Success stories include product innovations and patents in automotive, appliance, HVAC, and building materials industries. The OCARC has also produced innovative test hardware products and specialized test and analysis user programs.

Acoustic Performance Marketing Services

In today's consumer markets the noise levels and sound quality of products has become significantly important to a customer's buying criteria. Sound Performance shows up in advertising campaigns and in government regulations. There is even a growing trend in placing **Noise Ratings** and **Sound Labels**

directly on the products (i.e “America’s Quietest Dishwasher”). In years past the engineer was challenged with communicating the acoustic effect and value of proposed design alternatives. Today, it is critical for a product manufacturer to communicate the acoustic performance and “acoustic value” to their customers. Many of the same engineering tools used in the product development labs are being applied by Owens Corning to assist manufacturers, marketing firms, legal litigators, and consumer advocate groups communicate with visual and auditory techniques:

, The technology at the heart of these services includes:

- (1) Sound Quality and Jury Analysis
- (2) Nearfield Acoustic Holography
- (3) 3-Dimensional Product Modeling
- (4) Competitive Benchmarking and Assessment
- (5) Owens Corning Acoustic Performance Ratings: **A-Ratings™**

Owens Corning is serving the automotive, heavy equipment, small engine, consumer appliance, and aerospace industries with these services.

[Contact us](#) to discuss your product marketing needs and initiatives.

FACILITIES & EQUIPMENT

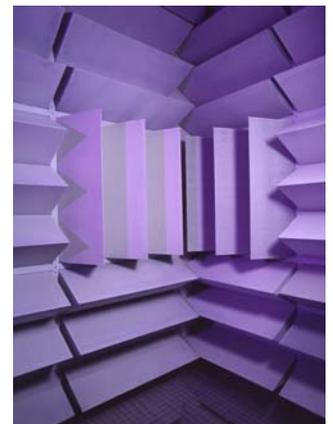
Owens Corning conducts projects at our own *Acoustics Laboratory* located in the Owens Corning Science and Technology Center in Granville, Ohio or at your site, in the field, or at other testing partner’s facilities. The Owens Corning acoustic test laboratories include:



- A 10,000 ft³ reverberation chamber (for sound absorption, sound transmission loss, sound power and insertion loss tests)
- An adjacent 4,300 ft³ reverberation chamber (for sound transmission loss testing)
- A two-room ceiling chamber used for ceiling sound attenuation tests
- Small scale test apparatus for measuring acoustic impedance, normal incidence sound absorption, airflow resistance of materials, and sound intensity.
- A fully anechoic chamber convertible to hemi-anechoic (interior dimensions are 21 ft by 17 ft by 11 ft high; lower qualified cut off frequency of 60 Hz).
- Spatial transformation of sound fields (STSF) system which provides the customer with a detailed image of the noise emitted (intensity pattern from the surface of the test specimen to the far field).
- Sound power mapping capability using standard intensity methods.
- A scanning laser vibrometer system (allows non-contact measurement of surface vibration). Data can be converted to topographical images of surface movement.

Data from these facilities are recognized worldwide and used throughout the industry.

- Sound quality recording and analysis systems are used to correlate subjective responses to objective measurements. Sound files can be



generated and played back to demonstrate how the N&V control treatments (theoretical or actual) effect a product's sound quality.

- Portable analyzers and noise sources allow field measurements of noise and vibration levels, and sound -- intensity, transmission loss, and absorption. DAT recordings of up to eight channels of data can also be made in the field for later analysis in the laboratory. Time Energy Frequency (TEF) technology allows transient room response to be measured including time delay spectrometry, and maximum length sequence.

PROFESSIONALISM, QUALITY, AND CONFIDENTIALITY

The OCARC is proud of maintaining a level of professionalism that differentiates us from the field of engineering services suppliers. The staff members are focused on delivering the highest quality results within the scope of the project. Owens Corning maintains responsibility for project management so that clients know that solutions will be delivered on-time and within budget. By default, all project information and intellectual property is treated with the confidentiality that is appropriate to meet our client's requirements. Although the laboratory is an asset of Owens Corning Corporation, customer samples and data is not openly shared outside the laboratory. The laboratory is located on a remote portion of the Owens Corning Science and Technology campus that limits the accessibility to lab for any person who does not work in the lab.

The center is staffed with very capable engineers and technicians who have a number of years of testing to support industrial manufacturing, research, and developmental objectives. The team are members and active participants of ASTM, INCE, and SAE.

VEHICLE INDUSTRY

The OCARC conducts full vehicle, component, material testing, analytical modeling and design projects in the automotive and heavy vehicle industries. A successful track record of custom NVH products and custom testing and modeling techniques has been established. Owens Corning applies the latest acoustic and sound quality sciences to develop better automotive NVH solutions in the areas of:

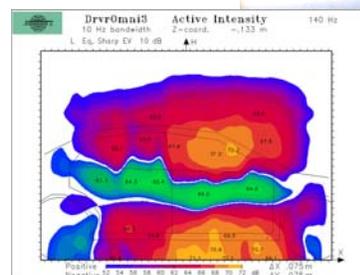
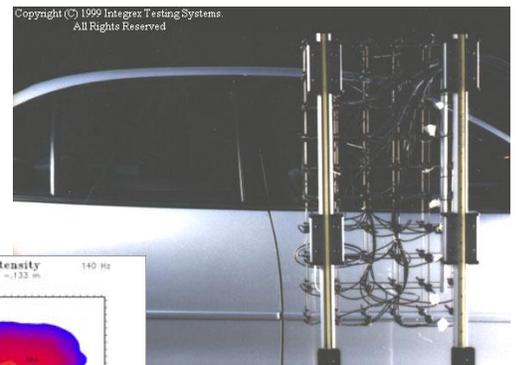
- Powertrain noise
- Road noise
- Wind noise
- Exhaust /muffler noise
- Accessory component noise
- Electric motor noise
- Pump noise
- Brake noise
- Pass-by noise
- Vehicle masking/background noise
- Environmental vibration
- Acoustic absorption and barrier treatments



The sound absorption and sound transmission loss testing facilities at INTEREX support engineering studies on:

- Trim and seat components
- Engine compartment treatments
- Headliners
- Pillars and cavity inserts
- Trunk liners
- Interior insulators
- Acoustical carpets
- Barrier materials
- Adhesive sheet metal treatments
- And more...

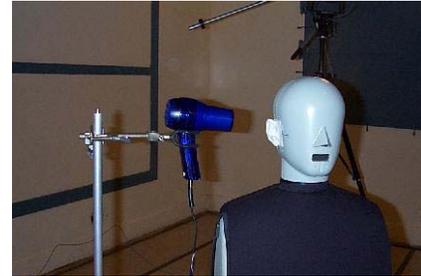
Talk to us about applying sound quality technology to your product, developing custom acoustic bench tests, optimizing acoustic packages, or correlating model results. Let experienced staff assist you in solving NVH problems quickly and effectively by applying test and analysis tools driven by proven success, product experience, and acoustical expertise.



CONSUMER APPLIANCE /HVAC INDUSTRIES

Manufacturers of consumer appliances and HVAC systems face a growing demand for quieter products to meet a market of noise conscious customers. Appliance and HVAC noise and sound quality is affected by the proper design and tuning of many sound sources and noise paths. The noise generally is a combination of many factors such as:

- Fan noise
- Duct noise
- Motor noise
- Compressor noise
- Pump noise
- Masking or background noise
- Component isolation
- Cabinet noise radiation
- Room reverberation
- Acoustical absorption and barrier treatments
- Muffler attenuation



Owens Corning can use experimental and analytical techniques to identify noise sources, develop countermeasures, and synthesize the new product sound before prototype components are ever produced. Statistical energy analysis has also been used to successfully implement acoustic prediction methods for systems with high frequency noise concerns and numerous complex noise paths. These approaches address the structure borne, airborne, and fluid borne noise concerns.



Owens Corning will partners with manufacturers to identify “best in class” sound quality standards and set and achieve *Acoustic Performance Specifications* required to meet customer expectations.



BUILDING MATERIALS AND INDUSTRIAL NOISE CONTROL

Formerly known as the Owens Corning Acoustic Research Laboratory, the OCARC has provided data on acoustical properties to almost every acoustical reference or text used throughout the industry. Owens Corning applies this expertise to conducting noise surveys and acoustic treatment recommendations in manufacturing plants, churches, schools, offices, and testing environments.

Owens Corning applies acoustical analysis techniques such as finite element analysis, boundary element analysis, ray tracing, and statistical energy analysis to predict acoustic behavior and optimize material and noise control solutions in offices, homes, classrooms and more.

[Contact us](#) is you would like to discuss our services in any of the following or related areas:

- Manufacturing Noise Control
- Residential Noise Control
- Home Theater Design
- Office Environments
- Classrooms and Theaters
- Acoustical Product Testing and Development
- Porous Material Characterization



Owens Corning SOLUTION BRIEFS:

Owens Corning Solution Briefs present real-world applications of noise and vibration engineering technology. These are just a few of the many ways in which the OCARC can assist you in developing better products, quicker.

- 0 Muffler Bench Test - Transmission Loss Factor
- 0 Acoustic Modeling of Porous Material
- 0 Acoustic Performance Ratings and Target Setting
- 0 Source Identification Using STSF
- 0 Sound Quality Synthesis of Consumer Appliances
- 0 Home Theater Design
- 0 Achieving Classroom Acoustics That meet Gov't Regulations
- 0 Manufacturing QA Using Noise and Vibration Acceptance Criteria
- 0 Advantages of the *Propogation Constant* and *Characteristic Impedance* in Acoustic Modeling
- 0 Advantages of Conducting a ASTM E1050 in place of the ASTM C-384 Sound Absorption Test

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