

Summary:
architectural
acoustics services
assignment



Develop details for acoustical treatments Prepare specification language for required materials and products Ensure conformance to acoustical details during construction Conduct on-site sound measurements for existing buildings The acoustical consulting profession developed rapidly following the end of World War II, when architects and government agencies engaged individuals and firms to research and study practical applications in various fields related to transportation, housing, and electronics. The field has now matured but is still growing as the population increases and people become more sensitive to noise selective about sound quality.

Architectural acoustics embraces acoustical analysis, design, and control in new and existing buildings. Acoustical services that architects may be involved with can be categorized into one or more of the following groups: ; Product and materials testing, measurement, and reporting ; Control of noise related to transportation systems ; Control of noise from building systems ; Environmental noise control within and near buildings ; Vibration and seismic control ; Electronic reinforcement and enhancement of sound (electrostatics) CLIENT NEEDS Acoustical services involve all kinds of spaces in and around buildings and are needed when clients are, or should be, concerned about the quality of sound throughout a completed building.

Recent areas of concern are the effects of noise on office workplace performance and on classroom teaching and learning. More traditional engagements are for auditoriums, courtrooms, performing arts facilities, broadcast and recording studios, worship spaces, and the like. Specific reasons clients may need acoustical services include the following: ; They are designing spaces specifically for audience listening (e. G. Theaters.

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Auditoriums, concert halls, rehearsal halls, education rooms in music and theater facilities, dance theaters, etc.). ; They are designing a school building in which speech intelligibility in auditoriums and classrooms is paramount. They are designing facilities for which a satisfactory acoustic environment is perceived to be important to the project's success (e. G. , restaurants, libraries, trading floors, dining rooms, executive offices, research facilities, nightclubs, etc.). ; They are designing multiple-use spaces. CHRISTOPHER GAFFE is president of Gaffe Holder Scarborough Acoustics, a 41-ear-old consulting company in Norwalk, Connecticut. Gaffe received the AI Year 2000 Institute Honors for Collaborative Achievement Award. RUSSELL COOPER is director of architectural acoustics for Gaffe Holder Scarborough Supplemental Architectural Services 02000 AI ; They are designing flexible, expandable spaces. A feasibility study is being conducted for a building located near a noisy site (e. G.. Highways, airports, industrial complexes, etc.). ; There is a requirement for an environmental impact statement that includes a noise assessment component. ; Complaints are being achieved about excessive noise or vibration in a building (e. G. , lack of acoustical privacy, acoustics not suitable for the programmed activity in the space due to echoes or other acoustical anomalies, etc.). ; They are in need of conformance testing to meet applicable standards, codes, or specifications, such as residential noise codes or industry standard marketing ratings. From the very outset of any building development, the selection of the site, the location of buildings on the site, and even the arrangement of spaces within the building can, and often do, influence the extent of the acoustical problems involved. The materials and construction elements that shape the finished spaces will also determine how sounds will

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be perceived in that space as well as how they will be transmitted to adjacent spaces. " William J. Caving and Joseph A. Wilkes, *Architectural Acoustics, Principles and Practice* (1999) The chief benefit of acoustical services for an existing problem is the assurance of a solution that works from the outset, thus saving time and money because a client won't have to try multiple unsatisfactory solutions.

In the case of new construction or a building renovation, acoustical analysis can result in commendations that avoid surprises once the building is in use. Fees for professional acoustical services vary according to geographical region, facility type, length Of time services are provided, and, Of course, scope Of the project. When the detailed scope and time frame of the study are known, acoustical studies are generally conducted on an hourly or per diem basis plus direct costs for travel, instrument use. And so on. Long-term projects are individually priced based on a percentage of the cost of construction or of the cost of the equipment that may be specified.

Postsecondary evaluations may uncover acoustical problems, among others.

SKILLS Unnaturally, people still consider acoustics-? especially architectural acoustics to be more art than science. Successful acoustical consultants generally are experienced practitioners who know how to apply acoustical science to real buildings and understand how people respond to various acoustic environments. Since acoustical success is based on both objective measures and subjective impressions, guarantees cannot be made that all users will come to the same conclusion regarding the acoustic quality of a particular design. However, just as in judging the quality of architectural design, the risk of dissatisfaction is greatly minimized by applying good <https://assignbuster.com/summary-architectural-acoustics-services-assignment/>

acoustical analysis and design in collaboration with the entire project design team.

Individuals in the field of acoustics have backgrounds in science, math, and engineering. However, architectural acoustics is an interdisciplinary field involving many aspects of both the arts and sciences. A broad background is needed, including understanding of music, theater, architecture, building construction techniques, and other disciplines inherent to the building design process. Noise and vibration control requires specialized knowledge of acoustically sensitive equipment, how noise is generated, and how it is propagated in the air or through a structure. Electronic sound reinforcement and enhancement design requires further background in electrical engineering or electronics.

Experience is a critical factor in determining the qualifications of acoustical consultants for a particular assignment. Also, architects seeking acoustical consulting services should consider the ability of the consultant to effectively communicate technical information orally, in writing, graphically, or with physical or computer modeling to the architect or client. Acoustical consultants are familiar with the use of both simple and complex sound-measuring instruments such as sound level meters. Some employ highly sophisticated equipment such as real-time analyzers that measure, store, and analyze a sound's frequency, time length, and intensity or level. Some instruments are hand-held, while others are the size of a small suitcase.

Occasionally the best architectural acoustics solution for a space is to supplement the natural acoustical deficiency of a space with electrostatics

enhancement. The concept of enhancing the sound quality of a space through electronic means has been well understood since the sass. However, not until recently has digital technology been able to provide cost-effective, electronically stable systems that musicians and audiences are willing to accept. When this technology is needed, the architect should seek acoustical consultants who are experienced in its application. AI continuing education programs periodically Offer workshops and Other courses on architectural acoustics. Check the continuing-education page at the AI Web site, BMW. AI. Org. 02000 AAA PROCESS

Numerous project factors affect the scope of acoustical services, such as whether a project is new construction or a renovation and whether it will include design only or comprehensive services from initial design through construction administration. To the extent needed for a particular assignment, architects should seek out consultants or specialists in acoustics to bring acoustical expertise to the project team. An acoustical consultant's staff is typically set up in the same way as an architect's and consists of a principal consultant in charge, a project manager, and various staff consultants working together as needed on ACH project. The principal in charge is usually responsible for establishing the acoustical criteria and initial acoustical design concepts. The project manager is the day-to-day point Of contact for the architect and client.

The project manager may also provide acoustical design in keeping with the principals concept. Project consultants provide assistance to the project manager and principal for specialized expertise and for calculations, measurements, detail drawings, submittal reviews, and the like. Consultant <https://assignbuster.com/summary-architectural-acoustics-services-assignment/>

selection. Before engaging an acoustical consultant, the architect should determine to the extent possible what services are warranted. Some questions to ask are: ; Does the client understand the need for and desirability of having acoustical services? ; Would having acoustical expertise on the project be beneficial or even essential to the desired end result? ; Does the client prefer to engage the acoustical services of a consultant located in the same region as the project? ; What level of architectural and/or acoustical quality is the client (and ultimately the building tenant) looking for? AI Document C 141 , Standard Form of Agreement Between Architect and Consultant, is suitable for use when an architect contracts with a consultant for acoustical services. Answers to these questions will determine if it is beneficial to have an acoustical consultant on the team and give guidance about what type of consultant would be suitable. Often due to an insufficient budget for consultant services, acoustical expertise is brought on board well after a project begins.

It is preferable, however, to bring acoustical expertise into a project as early as possible. It can be extremely difficult to undo decisions that have been accepted by a client and architect. When brought in at a later point, a consultant may have to critique or evaluate a design instead of participate in its creation. The introduction of a new team member late in the process may also produce a poor working relationship among project team members. For performing arts projects, qualified theatrical consultants should be considered for the team as well. A close working relationship between all consultants on a project is essential for proper coordination and the success of the overall design.

Architects may contact the National Council of Acoustical Consultants for a directory of acoustical consultants by country, region, state, or discipline. Experience is best judged by word of mouth; references, friends, and associates in the business may be helpful. When contacting acoustical consultants, an architect should request the overall firm biography and a list to pertinent completed project types. Resumes for individual consultants who may be involved should also be requested. Work plan. Fifth scope of work encompasses the entire design and construction process, the first step is to establish acoustical criteria for each space within the facility.

This can be done in the programming phase with input from user groups in a separate document, prepared by the acoustical consultant, based on an assessment of the architectural program (especially if there are no users involved at this point). After the acoustical criteria have been established for all spaces and the quality of the sound as it relates to the budget has been determined, schematic design commences. Programming. The acoustical criteria depend on the program uses for each space. An example of this for a dedicated concert hall would be that the background sound level must be very low noise criterion (NC-15) and the reverberation time relatively long (ART about 1.5 seconds). If the space is to be used for Broadway musicals that have reinforced sound systems, the criteria could be NC-25 with ART of 1.8 seconds.

However, a concert hall with a very low tolerance for extraneous sound and a sufficiently reverberant quality may be far more costly to construct than a Broadway house. Which could tolerate a higher level of noise and have a less reverberant acoustical characteristic. ACOUSTICAL DESIGN PROCESS STEPS
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Programming Discovering client needs Conduct user interviews Perform acoustical survey, including measurements Determine uses-? single or multiple Determine number of seats Identify audio system needs Establish acoustical criteria ; Background sound level (NC), (RCA), (NC) ; Volume per seat (V/S) ; Reverberation time (ARTS) ; Adjustable acoustics? Orchestra shell?

ROOM ACOUSTICS SOUND ISOLATION NOISE AND VIBRATION CONTROL

AUDIO SYSTEMS Schematic Design Establishing a design direction Determine volumes and dimensions Determine room locations and adjacency's

Determine amount of adjustable acoustic material Broad discussion of mom finishes Identify acoustic doors, windows, floating floors, sound control ceilings Provide outline of partitions, floors, and ceilings Determine the structural system and acoustical requirements (acoustic joints?)

SOUND ISOLATION Identify mechanical equip- Develop preliminary audio systems description meet locations Provide noise and vibration control guidelines Establish budget for audio systems Design Development

Developing the design ROOM ACOUSTICS NOISE AND VIBRATION CONTROL AUDIO SYSTEMS

Determine adjustable acoustic material and locations Discuss room finish options Provide partition details Review mechanical duct and pipe distribution and sizes Provide preliminary locations and sizes of audio system speakers

Provide acoustic door, win- Provide penetration details Refine audio systems DOD, floating floor, and budget ceiling details Provide layouts for arches- Provide intersection details tram Shell and risers Construction Documents

Detailing the design ROOM ACOUSTICS SOUND ISOLATION NOISE AND
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VIBRATION CONTROL AUDIO SYSTEMS Provide guideline specifics- Provide guideline specifics- perform acoustical calculations for acoustic materials actions for acoustic materials actions and provide recommend constructions and constructions emendations for acoustical treatments Review theater consultative structural engineered mechanical instant's comments needs documents needs documents Review architect's Review architect's documents documents ROOM ACOUSTICS SOUND ISOLATION NOISE AND VIBRATION CONTROL Prepare audio systems bid documents (drawings and specifications) Review bids Construction Administration Implementing the design Prepare submittal review list Prepare submittal review list Prepare submittal review list Monitor audio contractors progress Review submittals and Review submittals and Review submittals and shop drawings of acoustic shop drawings of acoustic shop drawings; perform materials materials and construction site inspections, and prepare punch lists Perform site inspections Perform site inspections and prepare punch lists and prepare punch lists Perform site inspections and prepare punch lists Vasoconstriction Tweaking the design SOUND ISOLATION Tune adjustable acoustic systems for each program use Set the orchestra shell for each program use Measure ARTS and Other architectural acoustical parameters Measure sound isolation Measure background for conformance to criteria sound levels for conformance to criteria Tune the audio system and verify speaker aim and positioning, settings, and controls Make recommendations if Make recommendations if Train system users necessary to resolve prop- necessary to resolve elms problems Similar criteria are established for determining how much sound can enter a space. Again, the program use of the space dictates this. An outdoor rock- and-roll amphitheater next to a residential complex

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would require an extreme amount of sound mitigation, while an office building next to the same residential complex might not require any noise control measures.

Music practice studios may need to be isolated from each other, but in the corridor it might be quite acceptable, even pleasant, to hear some music emanating softly from the rooms. For a multipurpose space, with varying programmatic needs that require different acoustical qualities, an acoustical consultant may recommend using an adjustable acoustic system to vary the reverberation time to suit the different programmatic requirements. If a project is a renovation, an acoustical survey may be desirable to assess the quality of the existing acoustics. This usually involves equipment for measuring and analyzing sound as well as interviews with key user groups. An assessment of facility audio system needs is also undertaken, through interviews or a survey of existing equipment (if applicable).

Fifth end user is not yet available, the acoustical consultant develops an audio system description and budget based on experience and requirements for each space. Schematic design. In the schematic design phase, recommendations for achieving the acoustical criteria are provided in broad terms. For example, information about the following may be specified: volumes of spaces; dimensions; location of spaces and their adjacency's; structural concerns: mechanical equipment locations and guidelines; and a brief outline of major irritation types, special floor or ceiling assemblies, area requirements for variable acoustic elements, identification of need and budget for an orchestra enclosure, and other items that may affect the budget in an extraordinary way.

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An experienced acoustical consultant is highly valuable at this Stage because he or she can identify items that will affect the budget long before a concerted design effort has reached a detailed level. Electrostatics design services during schematic design usually include a schematic audio systems description and an installed-systems cost estimate for various options. It is useful for project team members to have a schematic design acoustical report prepared at this point. This document can become the basis for further acoustical design development. There is nothing more frustrating to an architect and client than to be surprised by new acoustical requirements late in a project.

Although it is impossible to foresee all potential problems in advance, an experienced acoustical consultant should be able to identify and document most of the issues early in the process. Design development. Deliverables include partition details, penetration details, ND sketches for acoustic doors, windows, and floating floors. Room finish options are also developed. Mechanical duct and pipe sizing and distribution are discussed. The acoustical consultant reviews Preliminary location and sizes of speakers and adjustable acoustic systems and electrocutions drawings prepared by the outs of orchestra enclosures or shells are shown on drawings. Architect and the architect's consultants Construction documentation, Construction document services usually to ensure that recommended acoustical include many reviews of drawings and specifications to ensure that the acoustical reassures are addressees poor more on emendations have been incorporated correctly. The electrostatics consultant documentation services, see prepares a set of plans and specifications to be bid. However, it is

important to underproduction Documentation-? stand that the architectural acoustics consultant does not provide a set Of drawings Drawings and specifications that go into the bid documents. Instead, the consultant provides recommendations in the form Of sketches, drawings, reports, memorandums, letters, meetings, and so on for the architect and engineers to incorporate into the documents.

Even when a consultant prepares CSS specifications, these should be reviewed by the architect or engineer before they are incorporated in the Materials associated with the acoustical bid documents. Since most acoustical consultants are not licensed practitioners and benchmarks recommended by the signal engineers, the burden of professional responsibility lies on the archeological consultant are defined in the specificity and engineers whose documents bear their name and stamp. Actions. The development of these specifications An exception to this is in electrostatics, in which consultants is coordinated with the velveteen of project do provide drawings and specifications to be bid by an audio contractor. Ranging as described in Construction This is acceptable, since most audio systems are low-voltage and do not Documentation-? specifications require the license of a professional electrical engineer. However, close cooperation and coordination between the electrostatics designer and the electrical engineer is necessary to ensure that the full scope of the work (low and line voltage) is properly documented. Sound Reflection Study Illustrated is a ray tracing or sound reflection study of a ceiling shape proposed y an architect. Sound “ rays” are traced from a source on the stage along a surface and then, according to the formula

stating that the angle of incidence equals the angle of reflection, reflected to areas in the audience.

The study is conducted to ensure there are few areas that do not receive reflections and that sound isn't focused in any individual area. Sound Isolation Constructions Illustrated are partition and door markups of an architectural plan for a music school. Acoustician often communicate sound isolation requirements by creating partition details rather than using single-number acoustical acquirement such as " SIC-SO wall," which leaves the construction open to interpretation. The acoustician has determined the placement for these partitions by comparing the expected sound pressure levels to be generated in the source room to the background sound criteria in the receiving room.

Each of these partitions has a laboratory-rated performance and must be weighed With the deficiency that will occur in the real-world construction process. During construction, the acoustical consultant monitors the installation of materials, components, and systems to determine if the intent of the acoustical sign is being met, Noise and related acoustical problems may be revealed during a commissioning process that includes on-site performance testing and evaluation of building systems. Construction administration. This phase of the project is a very important (and on some projects essential) part of the scope of architectural acoustical services.

Site visits for inspections are necessary to help contractors understand how the construction details coordinate with the proper acoustics end product.

Most contractors are less experienced in buildings for Which acoustics are Of

ajar concern, so it is important to communicate to them why in acoustically critical projects some of the details are complex and what can go wrong if the designs are not properly implemented. For example, strategically scheduled site inspections are necessary to inspect construction that is vital to sound isolation but may be covered up early in the construction process. For example, a small connection of steel members across a structural isolation joint may short-circuit the acoustical isolation for a music hall.