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U.S. Cellular Center
Thomas Wolfe Auditorium
Asheville, North Carolina

Acoustic and Structural
Recommendations Report

10 July 2015

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Acoustic and Structural Recommendations Report with Conceptual Cost Estimate
Prepared for the City of Asheville, North Carolina
10 July 2015

Introduction

Constructed in 1939, the Thomas Wolfe Auditorium has been home to local performing arts, community events, athletic competitions (originally), and national touring productions in the Asheville area for over 75 years. Today, modern production requirements and more sophisticated acoustic tastes are necessitating an evaluation of the viability of the Auditorium as a community asset in the coming decades.

Scope of the Study

The purpose of this study is to evaluate the acoustic and structural capacity of the Auditorium by identifying the potential extent to which the building could be renovated to create a modern and acoustically supportive home to the Asheville Symphony Orchestra and improve the marketability of the venue for touring productions. The renovation options presented in this report should be considered conceptual in nature, and are based on the information available to the team. Moving forward, a complete feasibility analysis including architectural, theatrical, and MEP Systems input will be required.

Our team has identified additional renovation potential, beyond acoustic and structural evaluation, to the extent that our experience in performing arts buildings informs this study. These additional items include improvements to patron comfort and experience, technical crew production and operations, and potential code upgrades. Any recommendations beyond the acoustic and structural evaluation should not be considered expert opinions, but rather informed concepts that are included to provide a more complete picture of the investment that may be required to keep the Auditorium a viable performance venue for the coming decades.

This evaluation was conducted by Threshold Acoustics as the Acoustic Consultant and team coordinator, Walter P. Moore as the Structural Engineer, and Venue Consulting as the Cost Consultant.

Existing Conditions at the Auditorium

An important first step in our acoustic analysis of the Auditorium was to conduct a visual survey of the existing construction, and available existing architectural and structural drawings to understand the materials and shape of the space. We also learned a great deal about the operation and efficiency of the Auditorium while observing load-in, set up, and load-out of two different types of performances: a non-amplified music performance by the Asheville Symphony Orchestra; and an amplified Broadway-style performance of the touring show STOMP! Our team also attended both of the performances, sitting in different areas of the Auditorium in order to get a sense of acoustic nature of the space as well as the patron experience.

Acoustic Volume

Much of the original acoustic envelope of the Auditorium is still intact. The walls forming the house consist of plaster that appears to be directly applied to the structural masonry. The ceiling is also plaster and appears to be standard 3/4" to 1" three-coat application formed over metal lathe attached to wood framing suspended from the metal truss roof structure. The metal trusses align with the transverse plaster coffers below. The roof is framed with wood attached to the top chords of the metal trusses. A new membrane roofing system was installed this past spring. The substructure of the balcony and gallery rails could not be determined, but the finish surfaces are also plaster.

One significant deviation from the original structure within the Auditorium is a forestage proscenium prow and acoustic reflector constructed just in front of the proscenium below the original ceiling construction. We estimate that this was constructed in the 1970's, although no drawings were available showing the proposed construction. From what we can ascertain, this element appears to have been inserted just below the top of the original proscenium opening, and consists of two distinct angled fascia formed with overlapping hexagons (see upper image to the right). The prow/reflector splits as it extends from the proscenium to allow space for loudspeaker clusters. The loudspeakers themselves are quite outdated and appear to no longer be tuned to serve the Auditorium properly, although the systems are in use today primarily for amplified speech presentations. The ceiling coffer located immediately in front of the proscenium was encapsulated by the prow/reflector and loudspeaker housing but appears to remain as seen from the attic above. Black cloth located within the loudspeaker enclosure is currently in poor condition.

The second major change to the acoustic enclosure of the Auditorium from the original construction is the raking of the main floor seating and the construction of a tiered mezzanine seating area just in front of the balcony (see lower image to the right). We understand that this was added also in the 1970's, although no drawings are available showing its construction or exact geometry. The main floor of the Auditorium, originally flat to accommodate athletic events, was converted to fixed, raked seating when the new Arena was constructed to improve sightlines for music, theater, and spoken word performances. We know that much of the main floor seating area was raked (sloped) from the stage back to the current cross aisle. Behind the cross aisle, the tiered mezzanine seating extends up to the balcony rail. It was not possible to determine the construction of the sloped section, but the underside of the mezzanine can be seen from the mechanical equipment room below.

Patron Experience

In addition to attending a performance, patrons ideally want to be able to easily access their seats and restroom facilities, meet up with friends before and after the event, and have a drink or something to eat before the show starts or at intermission. The current accommodations for patrons of the Auditorium are not up to current standards expected for modern performance facilities. Of primary concern is the entrance and exiting sequence. All patrons must enter through the same set of doors located on the east end of the Auditorium, which connect to the lobby space constructed between the Auditorium and the Arena during the 1970's. While some patrons seated on the main floor choose to exit through the emergency egress doors on the south side of the building (exiting into the alley), most patrons exit through the same doors through which they entered. This creates a significant amount of congestion in the outer lobby space as patrons arrive, and then within the Thomas Wolfe inner lobby at the end of heavily attended performances.

Patrons seated in the balcony and side galleries must exit through the two stair towers located in the back corners of the balcony. These stairs empty into the same inner lobby space used by patrons exiting from the main floor, all must merge and exist through the east doors into the newer outer lobby. The result is that exiting from the balcony and galleries takes much longer than from the main floor. We observed this first hand after the orchestra concert on 22 March, when patrons were lined up in the aisles at the back of the side galleries after the conclusion of the performance, waiting to exit through the rear stairs. For quite a while after the entire main floor had been cleared, patrons were still lined up across the entire length of the gallery aisles (see image at left).

Restroom facilities are also contributing to a less than optimal patron experience. There is not enough restroom capacity for a venue of this size relative to modern standards. The main floor has only a single restroom for each gender, located just off the inner lobby of the Auditorium, adjacent to the east doors and stairs up to the balcony. A second set of restrooms are located in the basement immediately beneath the main floor restrooms but are not convenient and do not appear to be heavily used, and lack of adequate signage contributed to the limited use of these restrooms. There are no restrooms on the balcony/gallery level.

Handicap accessibility is not optimal for patrons of the Auditorium. Only portions of the main floor seating are accessible to persons in wheelchairs, and they are usually seated behind the back row of the orchestra level seating and within the space of the cross aisle. During the STOMP! performance, the center cross aisle as used for audio and lighting control, so all wheelchairs were located under the gallery overhangs just in front of the main floor entry doors. This creates a sense of separation from the rest of the audiences and also could restrict egress for other patrons. There are no companion seats installed for people attending a performance with someone in a wheelchair, so loose chairs were brought in and set up in those instances. There are no wheelchair accessible seats in within the orchestra level or mezzanine seating sections, and the aisles do not appear to be compliant with the guidelines of the Americans with Disabilities Act. There is no elevator access to the balcony or galleries, so persons with certain disabilities are not able to experience performances from those locations.

The theater seating of the Auditorium is in poor condition. Many of the seats are showing wear on the fabric, and we were informed that many seats have been breaking recently – an indication that the useful life of the seating is quickly approaching its end. In fact, we witnessed the results of a chair breaking just before a performance, with the patron being relocated to free-standing chair brought in and placed within the aisle. Sight lines from some seating sections are also sub-optimal. In particular, the side galleries require patrons to turn their heads nearly 90 degrees in order to see the performance. This issue becomes more problematic further from the stage. It is apparent that patrons avoid the most problematic areas, as we observed during the nearly-sold out performance by the Orchestra, when the far corners of the balcony (Sections D and K) had many empty seats. All other seating areas were nearly, if not completely, full.

Concessions are offered to patrons at only one location in the inner lobby area. Patrons seated in the balcony or galleries must return to the lobby to access concessions and restrooms, and the main circulation area to the restrooms and exits for all patrons becomes quite crowded. There was a food cart selling ice cream operating in the outer lobby, which appeared to be popular during intermission of both performances, but it was unclear whether this is a regular amenity or if the U.S. Cellular Center receives any revenue from this venture. A concession stand for the Arena is located in the lower level, just outside the perimeter of the Auditorium. We noted during testing and rehearsals that odors produced from this concession stand were infiltrating the Auditorium itself while the Home and Garden Show was operating in the Arena. This issue could be very distracting for patrons of the Auditorium if this occurred during a performance, and indicates a connections between the two areas that should be addressed.

Stage and Performer Spaces

The stage of the Auditorium was constructed at a time when stage and performer accommodations were much less than the typical facilities found in modern venues. The available stage area can accommodate only the smaller touring shows, and orchestral productions are challenged both with available stage space and area required for instrument cases and orchestra equipment. A particularly limiting feature is the lack of wing space to each side of the stage. On Stage Right (north side), a partial height wall on which electrical panels are installed sits just a few feet off the proscenium opening. This side of the stage is also home to the stack of former dressing rooms turned equipment storage and workrooms, access to the fly loft and Auditorium attic above, and an exit onto the roof of the loading dock for the Arena which provides an outdoor connection to that building. On Stage Left, an enclosure housing the mechanical unit serving the stage takes up a large portion of the wing space. It appears that this enclosure was added in the 1990s, although specific drawings were not available for this work.

The current orchestra shell (see image to the left) consists of Wenger Legacy portable towers that fold up and are stored in a pocket under the stage right dressing room stack, and ceiling panels that are stored in the stage house when not in use. This is a relatively lightweight system, and it is a standard product that is not optimized or designed specifically for the Auditorium. The tops of the shell towers are typically angled down when the shell is set up. Large gaps around the perimeter of the shell, above the tops of the shell towers, and between the ceiling panels allow a significant amount of sound to escape into the fly house above. Members of the Orchestra seated within the stage area have noted that they feel as if they are in a separate room from those playing on the stage extension in front of the proscenium. Cross-stage communication is weak and creates difficult challenges for any non-amplified instrumental or choral groups to overcome. The shell, the current forestage reflector, and the proscenium arch itself contribute to this experience.

Load-in to the stage from the loading dock serving the Auditorium requires that equipment be brought in by way of a very steep ramp up from the exterior loading dock to stage left (see image at right). This requires up to six men using an improvised rope and pulley system to simultaneously pull and push equipment up the ramp. This is at the very least a major inconvenience for load-in crews and might present a dangerous condition with certain pieces of equipment. Load-in crews must be large to assure reasonable load-in and load-out times due to this condition, increasing production costs for touring events or limiting the number of productions that can occur in the space.

Similarly, the rigging system is outdated. The current rigging is a hemp system, utilizing sand bags as counterweights and requiring the hemp ropes to be looped around the pin rail to hold them in place. The Thomas Wolfe joins a very select list of only a few performance facilities in the country to continue to operate with this type of system. The rigging lines do not have brakes or other safety features typical of modern rigging systems. Large crews are also required to operate the rigging, mostly to act as counter weight when moving lines. It was observed that several of the stage batons are severely bent. The grid consists of approximately 3” x 3” wood decking and lacks fall restraints.

Dressing rooms and a performer green room are located below stage. The dressing room level is not wheelchair accessible. A wheelchair lift does provide access from the audience seating to the stage, but the path to the lift may not be ADA compliant. Finishes, furnishings and toilet/shower facilities are dated in the dressing room area, and there are no large dressing rooms that could serve chorus members for touring shows or for an orchestral performance (see image at right for a typical dressing room). A portion of the below stage space is taken up by a mechanical room, which produces noise that is disruptive in several of the dressing rooms. Due to a lack of a backstage entrance, performers are also required to enter and exit the Auditorium through the same doors used by patrons at the front of the building. This is poor practice, and may be deterring certain performances and artists from coming to the Auditorium due to the inherent lack of security with this arrangement.

Audio, Video, and Lighting

The current Audio, Video and Lighting (AVL) systems within the facility are very outdated and do not meet technical requirements for a modern Broadway house or performing arts building. Current systems will not meet rider requirements for contemporary performances. This requires the venue to rent equipment and bring on additional personnel to set up AVL systems that will meet those rider requirements, costing the venue significant money in the long run.

The current loudspeaker system was designed with an emphasis toward enhancing speech while providing light musical playback. Keeping in mind the initial design intent of the loudspeaker system, it does not meet current programming requirements for the performances being produced within the facility. Current programming requires that loudspeaker systems be able to enhance instruments, vocals, speech, and playback material from the booth, with the volume varying anywhere from a light touch to a high impactful level. The loudspeaker system in its current state does not provide adequate coverage to all audience seating areas. The majority of the orchestra level seating section and side front gallery seating areas are outside the coverage pattern of current system. Audience intelligibility in these areas is very poor. The center gallery sections of seating and balcony seating areas are too far back for the loudspeaker system to produce a sound pressure level that is consistent throughout the facility. These areas are experiencing a 20 to 30 decibel drop in coverage as compared to the front seating areas. The amplification system for the loudspeakers is from the vintage age of tube amplifiers. This kind of amplification is hard to find replacement parts for and is costly to maintain.

The audio system backbone for microphone and line level inputs is in poor condition and many lines are not functioning properly. Input plates on stage left and right are poorly labeled, and many input jacks are in poor or non-working condition. The audio backbone is very small and does not provide enough input capability to support programing requirements of modern concerts or Broadway shows. The system does not provide any stage monitoring capabilities, providing only mic and line level inputs. This requires that any events needing monitoring on stage to rent such a system.

Microphones, mic stands, and mic cables are very limited in both supply and quality in regards to input sources and ancillary equipment. The current audio mixer has a small input capability and cannot provide input and system mixing requirements for modern performances. The current microphone inventory and ancillary equipment to support microphone and system inputs is lacking in quality, working order, and supply to meet programming requirements.

Video system equipment and infrastructure is non-existent within the facility, requiring that all video equipment needed for a presentation or production be rented.

AV distribution system and program paging within the facility is also non-existent. The current system does not provide the capabilities for audio or video distribution of program content occurring in the auditorium to be provided in the lobby, main entrance, bathrooms, ticket booth, dressing rooms, or green room. Such systems provide not only critical communication for back of house areas, but also a warm welcoming environment for audience members entering the facility or using the restroom during a performance. Distribution systems also provide critical paging that is needed to inform both performers, audience members, and technical crew with important information.

A technical com system currently exists only between the control booth and one stage location. This provides extremely limited communication capability. A technical com system typically should be provided throughout the back stage area with multiple connection points on stage and in all performer areas, within the house at all AVL positions at the control booth, a guest mixing location, and ticket booth at the front of house areas including the head usher lobby location.

Technical power is non-existent within the facility. Current power supply for AV systems is shared with the general building power. This creates a "noisy" line for AV systems and can inject interference that is audible on loudspeaker systems and AV distribution systems. Current power sub panels for AVL systems are in great need of replacement because they contain antiquated twist fuse-style breakers. Company switches for tying in audio, video, and lighting power for touring shows are not true company switches but general electrical panels outfitted to accept cam lock power connections. These panels do not provide a breaker that is designed to be disconnected multiple times. Current power supplied to all panels does not meet the needs for a modern production house. The overall amp capacity provided is on the low side, which is creating difficulties in providing adequate power for productions and the rental equipment needed for some productions. We also noticed many breakers with tape over them and were informed that many of the lines have a short in them. This made us question all the electrical wiring within the facility, leading us to recommend a full replacement of power infrastructure.

Lighting dimmer system and the lighting control console are very outdated and not in full working order. Multiple dimmer channels do not work, nor do multiple control faders on the console. It is likely that no parts are available for repairing current broken channels on this system due to its age. We witnessed breakers and dimming channels going out multiple times due to overload and shorts within the system. The dimmer system also lacks the capability to control large quantities of theatrical fixtures, modern LED fixtures, and robotic lighting. A rental console, dimmer system, and robotic power distribution would need to be rented for programming requiring that type of enhancement. Controls for the theatrical dimming system are located on stage and do not allow the operator visually judge lighting levels or access areas needing to be lit. The lighting system also lacks the availability for total venue control of the house lighting and theatrical lighting form one control console. The whole system does not meet rider requirements for current programming.

The house lighting system is not adequate to meet requirements for current programming. House lights are non-dimmable, resulting in house lights being shut off lights completely. This does not allow patrons to read their program as is often required for translation of orchestral choral programs. Additionally, step lights are not provided to guide patrons through a darkened auditorium. General controls for house lighting are not provided at any of the entrances to the auditorium, which is problematic for janitorial staff or technical crews entering or existing the space. Currently, some lighting units must be left on continuously in order to provide ample light to reach the control switches on stage, unnecessarily using energy and causing more frequent bulb replacement.

There is currently only one position within the house for hanging theatrical lights, located within an opening in the plaster ceiling. This position is not easily accessible and is lacking standard catwalk structure (see image at left). The ships ladder heading to a hole cut in the wall for access at attic area has no fall arrest system in place. There is also no transfer platform between the ships ladder and hole cut in wall, requiring the crew to step out from the ladder over the stage. Wood planks currently connect from the path between the attic access and the attic lighting position, which is nowhere near current performance space standards.

Stage theatrical lighting positions are limited, and the current hemp rigging system cannot hold much weight on the setlines. Stage side wash and downstage side wash lighting positions, often needed for Broadway-style performances are non-existent. The theatrical lighting inventory is very limited and only provides basic white lighting for a stage wash. Programming requiring additional lighting or more advanced lighting schemes currently require rental.

Temporary rigging points for chain motors are not provided within the facility. Rigging points are needed in front of the proscenium, within in the house, and on stage to meet programing requirements of modern performances.

The current control booth is located in a position that does not provide adequate aural representation of the auditorium space for an audio engineer to mix a show. The auditorium does not have a permanent secondary mixing location for implementation of mixer and engineer for programs requiring critical mixing. The current control booth also does not include positions needed for video system control and lighting system control. This creates a challenge for shows needing advance lighting and video control, requiring them to operate from the main floor and run cables within the aisles along seating areas (see image above). This creates a noticeable eye sore for audience members in the main floor seating area.

Mechanical, Electrical, and Plumbing Systems

Currently, the Auditorium is served in part by two mechanical units which are housed in plywood/drywall enclosures suspended within the depth of the metal roof trusses above the plaster ceiling. Both units connect to a single mechanical louvre housing mounted to the roof. The proximity of these units to the Auditorium does not allow sufficient distance for attenuation of fan noise. Additionally, the units do not appear to be sufficiently isolated, resulting in vibration of the building structure and plaster ceiling. The result is significant noise during operation that causes distraction for listeners and acoustically covers the sound. Two additional units are located beneath the mezzanine seating section behind the concessions stand. As with the attic units, there is not enough distance from the units to sufficiently reduce fan noise. The high noise levels produced by these four units limit dynamic range and clarity of sound for all presentations in the Auditorium but have the most detrimental impact on non-amplified events.

Exact installation dates of these four units could not be determined, but the units below the Mezzanine appear to have been installed during the renovation work that was done to the Auditorium in the 1970's. It is suspected that the attic units are of a similar vintage, but could be older. The stage is served by a mechanical unit located in a raised concrete block enclosure constructed on stage left. This unit, and the enclosure around it, appear to be newer than the units serving the auditorium, but similar limited distance between the unit and stage outlets is resulting in higher than desired levels on the stage as well.

We were not able to access the mechanical room in the dressing room area, but the sound level in this area from the unit is quite high, with a significant amount of low frequency sound that presents a considerable problem for music warm-up as well as simply being much louder than is comfortable for any prolonged exposure.

Comments on the electrical and plumbing systems, beyond what has been provided above, are not part of the scope of this study. We recommend that a complete review be conducted of all mechanical, electrical, and plumbing systems throughout the Auditorium building as part of a future study.

Acoustic Testing Report

During our team's visit between 21 March and 24 March 2015, we had the opportunity to observe the acoustic response of the Auditorium on four occasions. Two of these opportunities were performances – an acoustic concert by the Asheville Symphony Orchestra utilizing an extended stage and an amplified performance of STOMP! by the national touring company in a typical proscenium set up. For the other two opportunities, we listened to a symphony rehearsal in the extended stage configuration and heard various small ensembles and solo players arranged by the symphony in a more typical proscenium configuration with the orchestral shell. We utilized our acoustic testing equipment to analyze the response of the room in both of these configurations.

Observations from the Asheville Symphony Orchestra Performance

The performance by the Asheville Symphony Orchestra on 22 March 2015 was the finale concert for their week-long Amadeus Festival. The Orchestra erected a significant extension to the stage that brought the entire Orchestra forward of the proscenium. Audience seating was set up on risers on the stage behind the Orchestra, and the orchestra shell was not in use. This is the first time the Orchestra utilized this set up, which was done partially in response to some of the acoustic issues experienced by Orchestra members and the audience. In particular, according to members of the Orchestra, communication between players at the front of the ensemble with those at the back, and vice versa, is difficult in their standard arrangement because players at the back of the orchestra are well within the stage house behind the proscenium while those seated at the front are within the volume of the Auditorium in front of the proscenium. The proscenium opening itself acts as a significant acoustic impediment to this communication.

Information was also relayed to us by the Orchestra that the sound produced by the ensemble is not consistent throughout the audience when they are performing in the more typically proscenium set up. The mezzanine seating section, located behind the cross aisle on the main floor and in front of the balcony, was noted as being the most popular seating area with relatively good sound coverage. Other areas of the Auditorium experience weak or distant-sounding coverage. We noted while working with the Orchestra during their Saturday rehearsal that the proportions of the room are not ideal for non-amplified music performances, which is part of the cause for some of the issues being experienced by the audience. Specifically, we noted the following:

- The Auditorium is quite wide at approximately 100 feet in width. This is too wide to provide proper side-wall reflections to support the direct sound throughout the room. In particular, the room stretches to its full width immediately in front of the proscenium where acoustic support is most needed. This results in echoes and unfocused sound energy, thus weakening the impact of the sound produced on stage.
- The Auditorium is also very deep at nearly 200 feet. Unless well supported through acoustic reflections from the ceiling and side walls, sound energy at the rear of the room is naturally at a much lower level than at the front of the space.
- The ceiling is quite low, which exacerbates the challenge of getting sound to the furthest reaches of the room because sound emanating from the stage is too quickly reflected back down to the audience. In addition, a lack of upper volume in the room does not provide sufficient height for proper reverberation development required for non-amplified orchestral performances.

During our observation of rehearsal, and through subsequent discussions with members of the Orchestra, it became apparent that relocating the entire ensemble within the volume of the Auditorium was eliciting generally positive reactions. We were not able to observe the Orchestra performing in their typical stage set up during our visit, but the Orchestra appeared to readily adapt to the extended stage. The audience, as well, appeared to be quite receptive to this new set up.

This stage arrangement was not without difficulties. A good quantity of seats could not be sold because they were located either under the stage extension or too close to the stage extension to provide sufficient sightlines. The number of seats omitted from this performance was estimated to be around 250. Some seating areas in the galleries had less than optimal sight lines to this stage extension, with some seats only able to see about two-thirds of the stage. Even with the entire Orchestra located within the room in this expanded stage configuration, on-stage communication was limited due to the inconsistent support offered by the prow/acoustic reflector and echoes from the wide side walls in front of the proscenium opening. Flutter, defined as sound caught in a repeating pattern between two parallel surfaces, was readily apparent for the Orchestra members seated in the zone between the proscenium wall and the ends of the side galleries. The strength and experience of the performers seemed to adequately overcome this effect.

During the performance, each member of our team sat in a different location within the Auditorium, switching seats at intermission, and we compared notes afterward. Generally, it was agreed that the mezzanine seating is receiving adequate sound coverage due to good overhead ceiling support and beneficial reflections from the upper side corners of the space. The rear of the Balcony feels isolated as it is acoustically separated from the rest of the space by the deeper truss overhead and cut off from side wall reflections by the control/follow spot booth. There is unwanted low-frequency build-up at the rear of the balcony that muddies the sound. Much of the side Gallery seating had limited sightlines to the expanded stage, and while the seating in the Galleries receive good reflections off the ceiling, sustained flutter between the upper side walls results in a harshness to the sound. Echoes from the rear of the balcony are also quite noticeable within the Gallery areas, which is impacting clarity. Seating below the Gallery overhangs on the main floor was better than expected with direct sound reflection from the underside of the Galleries, but sound is extremely dry in all areas forward of the main floor cross-aisle. Lack of good overhead support and the wide side walls create significant clarity problems for seats in the front half of the main seating level.

Background noise from HVAC systems was notably disruptive to the performance from most seating levels, but particularly from the rear sides of the main floor and at the Gallery/Balcony level. Additional information on measured levels is provided in the Test Results section of this report.

Observations from the STOMP! Performance

The touring production of STOMP! stopped at the Auditorium on 23 March 2015. This production is a very specific type of percussive performance, and the tour's own sound system was utilized for this performance. We can infer from this how touring sound is typically handled in the space.

The stacked loudspeaker towers used for this performance were located on each side of the proscenium on the stage floor. It was noted that the upper portion of the balcony, at the very rear of the room, was quite "boomy" – in other words, low-frequency sound became trapped in this area. The ceiling above the rear of the balcony steps up from the height of the rest of the Auditorium ceiling at this point, which is exacerbating this effect. We anticipate that this issue is problematic for many types of amplified performances. Bass build-up was less extreme in the Galleries but noted there as well, which is due to undiffused heavy masonry walls flanking the Galleries.

We did not review the condition of the existing sound system in the Auditorium in detail. While it is used for speech presentations, the system is antiquated and requires full replacement.

Observations from Players in Standard Shell Configuration

We had the opportunity to work with several of the musicians from the Asheville Symphony Orchestra on the morning of 24 March 2015 with the stage set up in the typical Orchestra configuration, including the orchestra shell towers and ceiling panels. The musicians performed various works as we walked around the house and stage areas, listening for to the acoustic characteristics of the stage and auditorium. With the ability to adjust the location of the musicians and the style of music, we were able to pinpoint some of the peculiarities we had previously observed, while others were discovered during our listening that morning.

The piano quartet began performing in a tight cluster, with the strings seated immediately in front of the piano, which was located at center stage. We separated the group, placing the violin far downstage right, the viola far downstage left, and the cello at upstage center, just in front of the shell towers. The piano remained at center stage. The separation made it difficult for the ensemble to stay together. In particular, the cellist was consistently playing about a half a beat behind. The existing shell is much more open than would be desired, resulting in significant loss of energy to the stage as compared to a custom shell enclosure, but it is effective enough to be directing sound energy into the auditorium where it is being reflected back to the stage quite late relative to the direct sound produced by the musicians. Because reflections on the stage are not much louder than the echoes that are retuned from the room, the cellist could not distinguish the direct sound from strong reflections, causing his delayed playing. While upstage musicians have likely adapted to this condition in this space, it is an issue that must be corrected to allow the orchestra to truly play as an ensemble rather than relying on the conductor's baton to keep the beat.

Echoes reflecting back toward the stage were notably more prevalent with the shell in place than was heard when the shell was not in use and the orchestra was located on the extension. To some degree, this is due to less sound directed out into the room in the first place, but the stage drapery without the shell was absorbing sound returned to the stage, reducing the energy level on stage for these late reflections to the extent that they were no longer problematic. The typical curved arrangement of the shell towers is also focusing this energy and exacerbating the problem. An alternate, straight line arrangement of the towers would help reduce this effect until renovation work can be done to correct the echo problems in the auditorium.

We asked the cellist to play alone both upstage within the shell and downstage on the typical stage extension. It was noted at that time that the instrument sounded warmer when located upstage but had better clarity when located downstage. These subjective results are borne out in the testing analysis that has been done as well.

A woodwind quintet played located in the typical position for woodwinds on the stage. They were all located at the same position on stage, so the echo conditions were not as prevalent for them as for the separated quartet. It was noted that flutter and echoes as heard within the auditorium were more prevalent with the louder, more directed sound of the wind instruments.

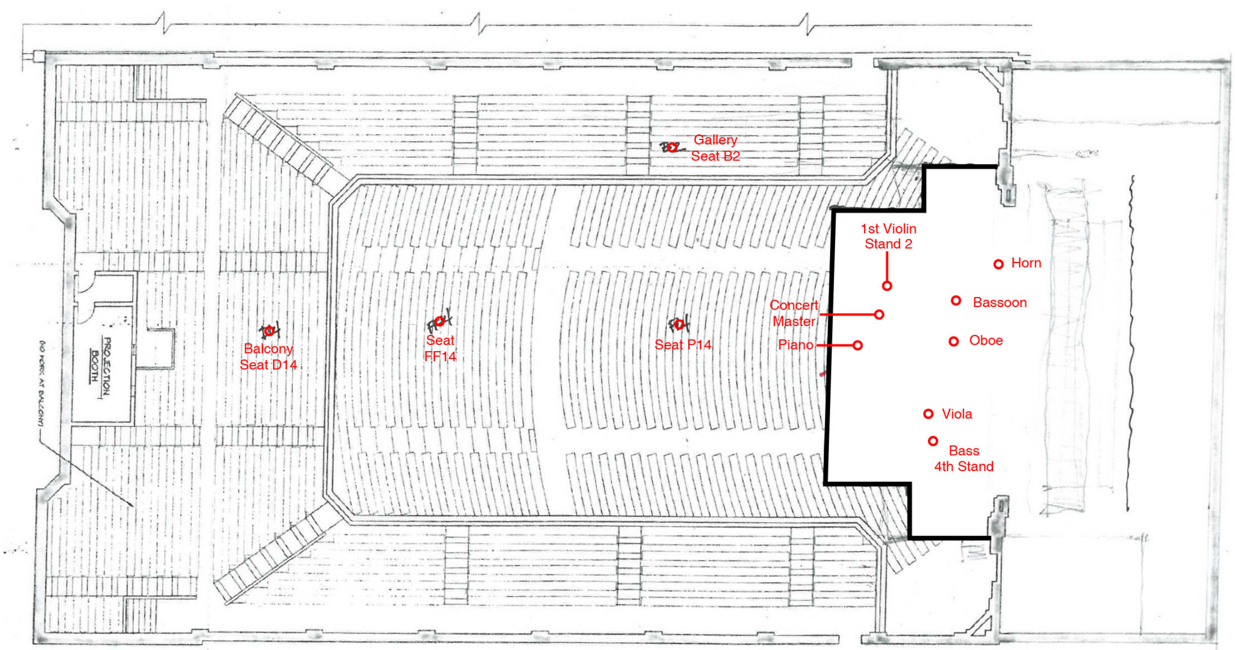
We worked with a solo tuba player during this session. We have found in past work that isolating low frequency sound within a space can reveal certain characteristics that are often covered by mid- and high-frequency sound. In this instance, we discovered a low-frequency "ring" within the Auditorium while the tuba was playing a low A. This indicates a material or geometrical resonance at that particular frequency. Heavier construction, such as plaster on brick, supports low frequency reflection better than thinner construction, such as plaster over an airspace. Stiffening materials in the room will be a primary focus of renovation work, but changing the overall room geometry will also begin to address the issue that was revealed. In working with the tuba, the low-frequency "ring" was similar to an effect heard the evening before during the amplified Stomp performance, so room reconfiguration will benefit all uses of the space.

On the opposite end of the spectrum, the solo piccolo also revealed some challenges with the acoustics of the Auditorium. Most notably, the instrument became distant while playing in the upper register. We suspect that this was a result of the instrument exciting echo conditions in the room that were more biased to higher frequencies, which covered the direct and added the sense of acoustic distance.

Extended Stage Configuration Testing

Our first round of testing with our equipment occurred after the Orchestra rehearsal on 21 March 2015, while the Auditorium was set up in the extended stage configuration for the concert the following day. Our testing was focused on the acoustic characteristics of the Auditorium, specifically analyzing how and when sound produced on the stage arrives at various points throughout the space. To perform this testing, we utilized our dodecahedron, 12-sided loudspeaker that distributes sound equally in all directions. As we performed each test, we moved the dodecahedron to a position on stage corresponding to the location of a particular instrument of the Orchestra. We performed tests from four locations: solo piano, Concert Master, Oboe, and 4th chair Bass.

We also set up eight microphones around the room to record the sound as it reached each position. Four of these positions were located on the stage extension, with each of those located at a seat for a specific instrument: Violin 1 stand 2 (directly behind the concert master); Viola stand 4; Principal Bassoon; and Horn 2. The other four microphones were located throughout the audience: Seat P14 on the orchestra level; Seat FF14 in the mezzanine; Seat D14 in the balcony; and Seat B2 in Section B at the house left gallery. The floor plan below shows the general locations of the source (dodecahedron) and the receivers (microphones).

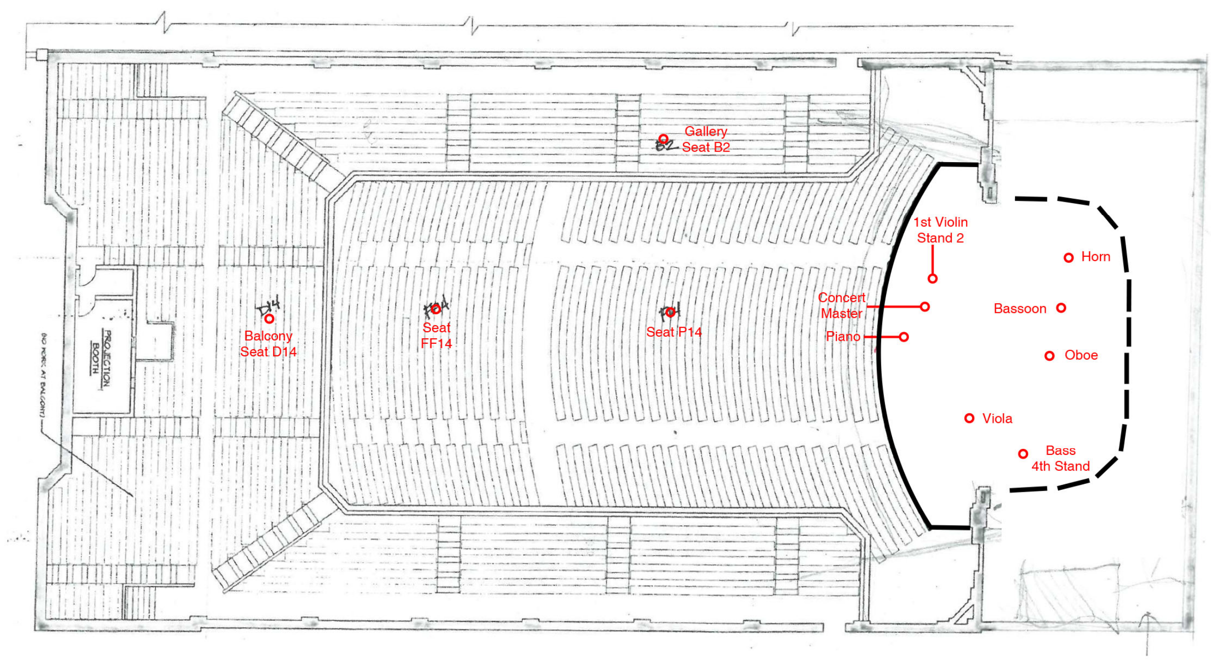


For the tests, mechanical systems were turned off, other ambient noise was minimized as much as possible, and no audience was present. All other characteristics of the Auditorium remained as they would be for the concert. Results of this testing area are outlined in the Test Results section that follows.

Proscenium Stage Configuration Testing

Following the performance of STOMP!, the stage was reconfigured into the more typical proscenium set up used by the Orchestra. This configuration included the Wenger Legacy folding shell towers owned by the Orchestra with accompanying overhead reflectors. The tops of the shells were angled down, as is typically done with this product. Cross stage communication and support is challenged by the inadequate stage shell configuration and the inconsistent support provided by the prow/acoustic reflector in front of the stage. The existing shell is lightweight plywood construction, and the open shell ceiling and limited height stage towers allow a significant amount of energy to escape into the stage house.

To complete the testing, we maintained all the similar characteristics of the Auditorium established during the extended stage configuration testing, including turning off the mechanical units. We set up the four audience microphones at the same seats as those used in the extended stage configuration testing. We located the remaining four microphones at the performer chairs corresponding to the same instruments used in the extended stage configuration testing. Similarly, we positioned the dodecahedron at the instrumental locations corresponding to those used in the extended stage configuration testing. In this way, we can directly compare the behavior of sound in the space for the two different performance configurations. The floor plan below shows the general locations of the source and receivers in the proscenium stage configuration.

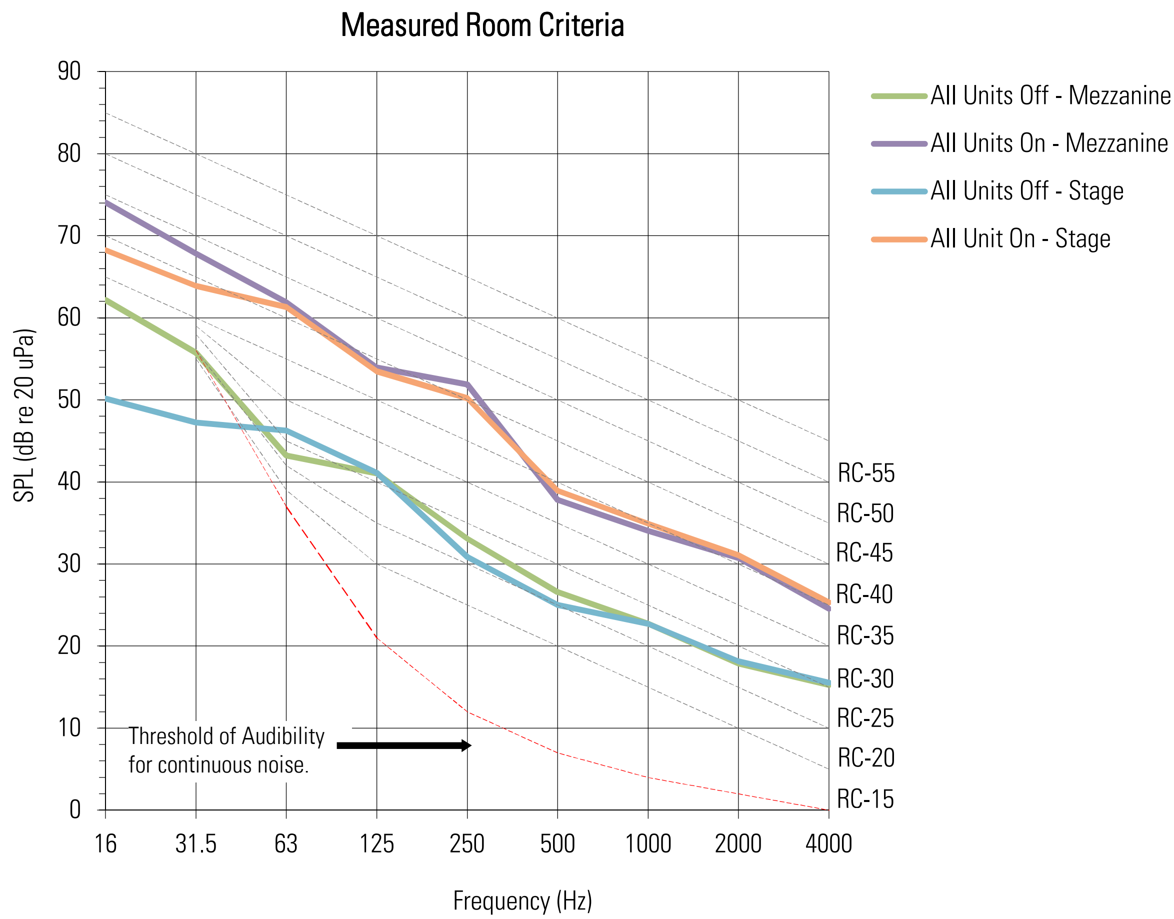


For the tests, mechanical systems were turned off, other ambient noise was minimized as much as possible, and no audience was present. All other characteristics of the Auditorium remained as they would be for a typical concert. Results of this testing area are outlined in the Test Results section that follows.

Test Results

Background Noise Levels

In addition to the impulse response testing described above, we tested the ambient (background) noise of the Auditorium to establish a baseline room criteria (RC). We performed this test from the stage and from the mezzanine seating section, and in both locations with all mechanical units shut off and again with all mechanical units turned on. The following chart shows the results of this testing:



Measurements taken on the stage were very similar to those taken in the mezzanine seating area. With all the units off, the room has a measured room criteria of RC 22. With all the units on, this increases to RC 35. This significant jump shows how much of an impact the mechanical noise is having during performances. Even low-level mechanical noise can be distracting when cycling on and off during a performance. At the Thomas Wolfe Auditorium, continuous or intermittent mechanical noise at this level is loud enough to impact the patron's experience, making it quite difficult to clearly hear speech or music unless at a loud level. This is especially problematic for non-amplified performances and for audience members seated in the balcony, where they are furthest from the stage and are also in close proximity to the air handlers serving the Auditorium.

When we design a new room with similar programming as the Thomas Wolfe Auditorium, we typically specify that the room achieve an RC 15-20 background noise level. Even without the mechanical units on, the ambient noise of the Auditorium is above this level. A significant amount of mechanical renovation will be required to bring the room criteria down to a level acceptable for modern performances, including new units relocated to areas of the building to reduce sound transfer.

Although we did not capture the sound of passing sirens, the background noise level in the Auditorium is raised significantly when emergency vehicles or activities outside the building intrude into the space. Much of this is passing through the relatively lightweight and non-gasketed doors, and attention to better sealing the space from the exterior and Arena activities is important for future operations.

Reverberation Time

A second baseline that we established for our testing was the reverberation time (RT) of the room. We performed this testing with both the extended stage configuration and the typical stage configuration with the orchestra shell, and tested on stage and within the house for both configurations. We measured the following average reverberation times:

Extended stage configuration, average of stage positions	1.15 ms
Extended stage configuration, average of house positions	1.15 ms
Typical stage configuration, average of stage positions	1.32 ms
Typical stage configuration, average of house positions	1.36 ms

The inclusion of the shell with the typical stage configuration increased the RT by approximately 0.2 milliseconds. This is not as significant an increase as we would expect to see with an orchestra shell, which is the result of the significant gaps in and around the current shell. As mentioned above, the current shell is not designed specifically for this room. An orchestra shell that is engineered to the particular stage, proscenium, and room size will have minimal gaps, to retain as much sound energy as possible to project it into the room, aid in cross-ensemble communication, and ultimate result in a higher RT.

The desired RT in any given room varies depending on the room volume, the size of the audience, type of presentation, and many other variables. The measured RT for the Thomas Wolfe Auditorium is much lower than needed for non-amplified performances, causing sound to die away quickly and the room feeling acoustically dry. Note that the measured data is without audience and the space will have less reverberation with the people present. Sound in the Auditorium today is absorbed too quickly and is not allowed to develop to provide a warm, pleasing acoustic experience. Ideally, the average RT for the Auditorium should be increased to between 1.5 and 1.8 seconds when occupied, with the shell installed, and without variable acoustic elements deployed.

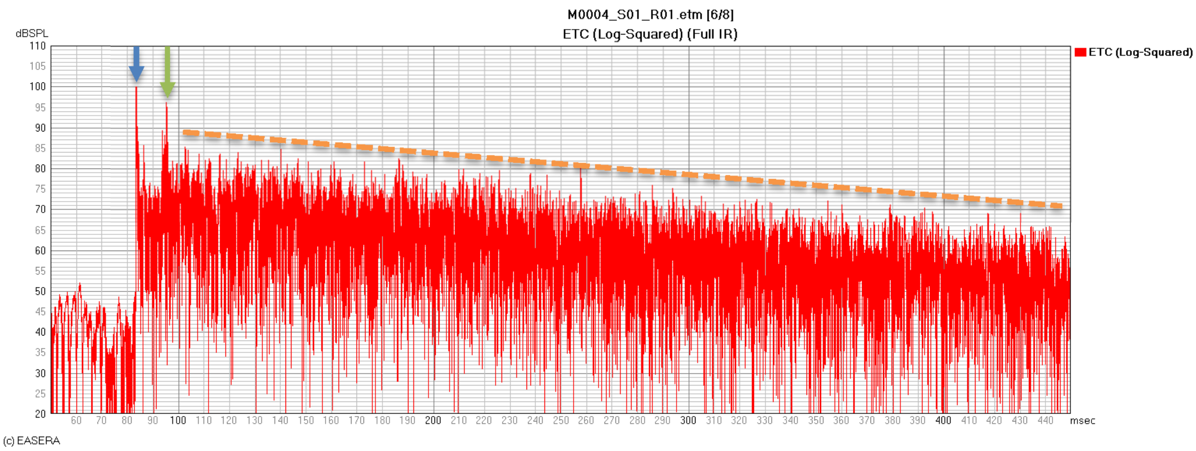
The target reverberation time is too long for most amplified presentations and would have to be controlled with a series of variable acoustic elements in the room. This approach is typical for multipurpose venues such as the Thomas Wolfe. The orchestra shell is the first and most critical variable element in the space, which would be stored in available wing space when not in use. Secondarily, a series of acoustic curtains and banners will reduce reflections within the room for heavily amplified productions.

Impulse Responses (Mapping the Sound Signature of the Room)

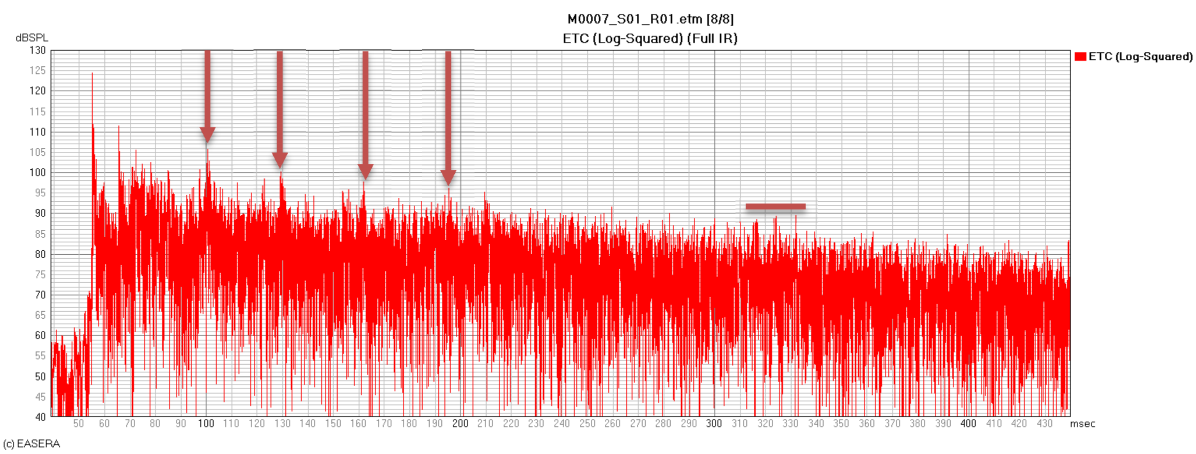
With the baseline measurements established, we analyzed the reflection structure signature of the room as gathered during our testing, conducted utilizing the dodecahedron and eight microphones. The result is an Impulse Response showing the level of direct sound between a given source and receiver location and the subsequent reflections that are heard at that receiver position as sound decays in the space. We analyze this data to look for information on the timing of helpful early reflections or undesired late reflections, echoes, gaps in sound coverage, flutter, and early decay timing. Generally speaking, helpful early reflections arrive within 50 to 60 milliseconds of the arrival of direct sound. Any distinct reflections that clearly rise above the reverberant sound level beyond that time are often indicative of echo conditions that can make the sound less clear or sound farther from the listener (distant) than a performer is in reality.

Tests were conducted with 4 or 5 source positions on stage during each of the conditions tested to a series of 4 receivers on stage and 4 positions in the auditorium. Receiver positions were distributed on stage and in the house as previously described with care taken to give us the best understanding of sound distribution throughout the room.

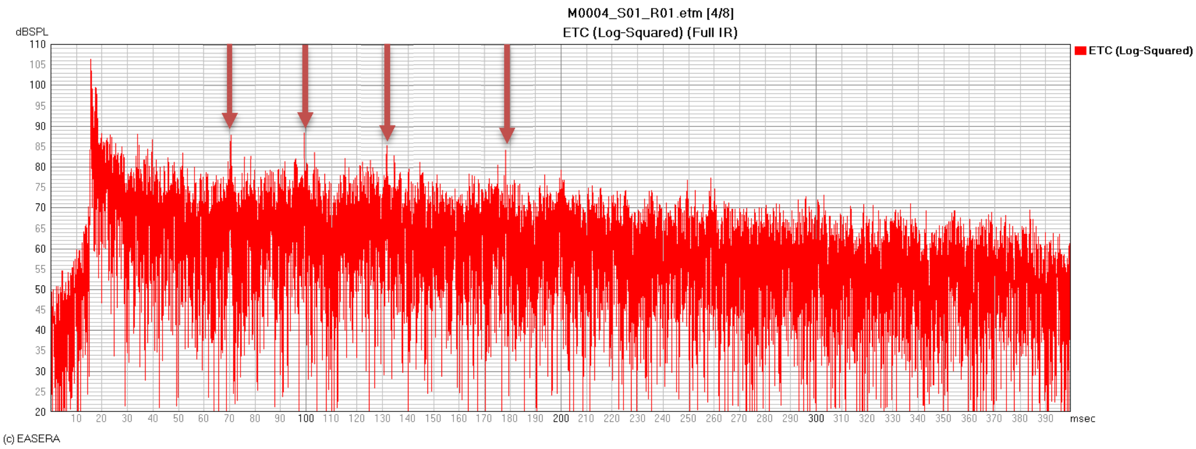
When looking at the impulse response graphs for a receiver located in the mezzanine seating area, it becomes clear why this section is the most popular among patrons. The chart below shows the impulse response of a receiver in the mezzanine with a source located at the Oboe chair in the extended stage configuration. A strong, helpful reflection (indicated by the green arrow) arrives off the ceiling just after the direct sound (indicated by the blue arrow). The decay of the sound (indicated by the orange line) is fairly consistent. There are only a few discernable late reflections, none of which are strong enough to significantly impact the sound quality. Additional support would be beneficial following shortly after the arrival of the reflection off the ceiling to provide greater fullness and impact to the sound, but this response is the best of all locations tested in the Auditorium, as was confirmed by our listening observations as well.



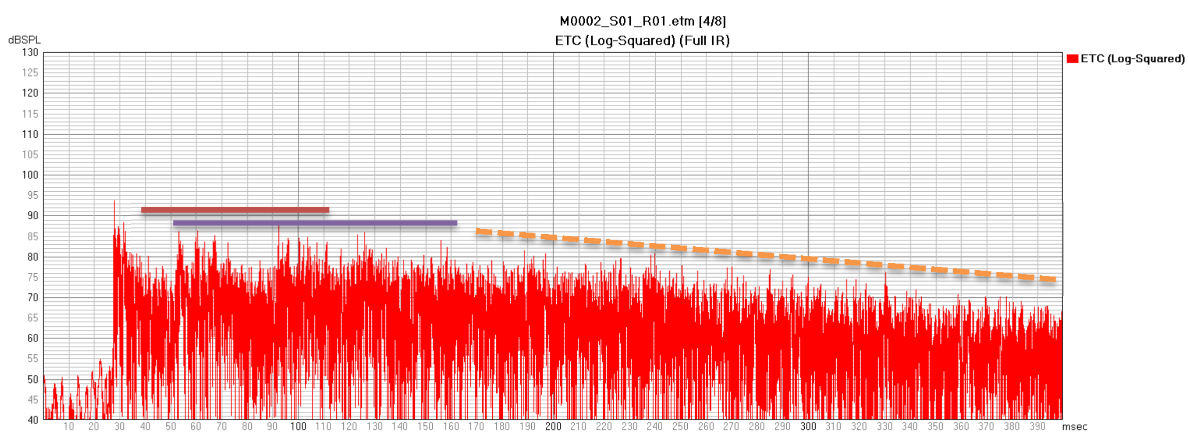
For comparison, the following graph is taken from a test conducted with the typical stage configuration, with a source at 1st Violin Stand 2 and a receiver in Section B of the house left side gallery. This graph clearly shows strong, repeating reflections (indicated by the red arrows), most of which arrive outside of 50 milliseconds after the direct sound, demonstrating the presence of flutter between the side walls of the house. Flutter in this location not only muddies the sound, but also gives the sound the harsh quality that we experienced here. This location also receives a strong cluster of late reflections (shown under the red line), illustrating the echo coming from the rear wall of the Auditorium that was audible in our listening.



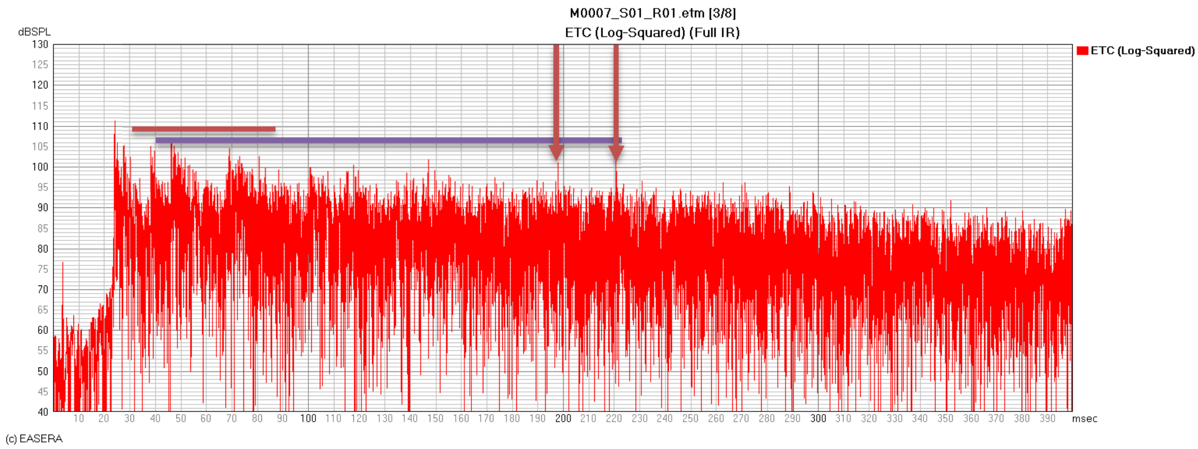
This same effect is demonstrated on the next chart, which was measured during the extended stage configuration testing, with a source at the Oboe chair and a receiver at Viola 4th Stand. The viola section was seated just in front of the proscenium between the two parallel side walls. Flutter in this location was the cause of the confusing nature of the sound experienced by members of the orchestra while performing on the stage extension.



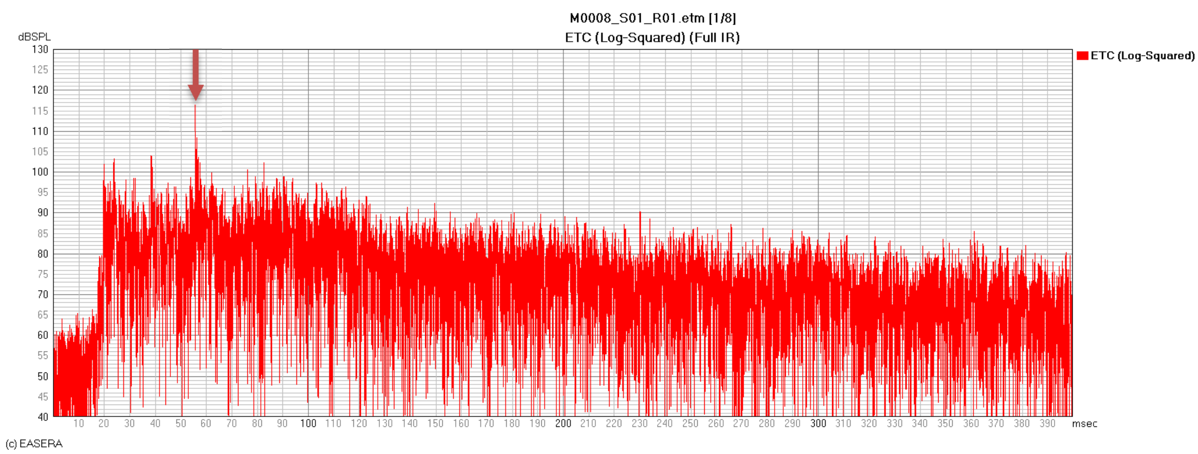
Testing in the extended stage configuration also confirmed the concern we had in first seeing the significant gap in the current forestage reflector. The gap in the center of the reflector, created to house the loudspeakers, causes a corresponding gap in sound coverage both on stage and to the front of the main level of seating. The following graph shows a test measured with a source at 1st Violin 2nd Stand and a receiver at Viola 4th Stand, located on opposite sides of the stage from each other. There are no helpful early reflections to the receiver (in the area under the red bar on the graph) similar to what was illustrated previously for the Mezzanine seating level because of the gap in the reflector. Furthermore, the response level is generally flat for the first 150 milliseconds (in the area under the purple bar) before the reverberation decay begins to take shape (indicated by the orange dashed line). This points toward an indistinct quality to the sound that masks or confuses the direct sound occurring just before this later sound energy.



The support for cross-ensemble communication is not much better in the typical stage configuration with the current shell. The next graph shows a test in that configuration with a source located at 1st Violin 2nd Stand and a receiver at the Horn chair. The sound at this location suffers from poor support due to indistinct early reflections (in the area under the red line on the graph) due to the large gaps in the ceiling elements of the forestage reflector and orchestra shell ceiling panels. The prolonged pattern of nearly level sound energy is similarly problematic at this location (in the area under the purple bar). This receiver location also shows strong echoes (indicated by the red arrows) that are likely coming off the doors at the rear of the main floor of the Auditorium. These echoes, combined with the lack of early supportive reflections, clearly show why the cellist performing as part of the piano quartet had a hard time keeping in sync with his fellow players while seated upstage.



Echoes are quite strong for performers seated in front of the proscenium in the typical stage configuration. Below is the graph showing a source at the Oboe chair and a receiver at the Concert Master chair. An echo stronger than even the direct sound (indicated by the red arrow) shows focused sound energy that would make it impossible to acoustically distinguish the initial sound and this strong reflection. Ensemble timing in this case could only occur with players carefully watching the conductor's baton.



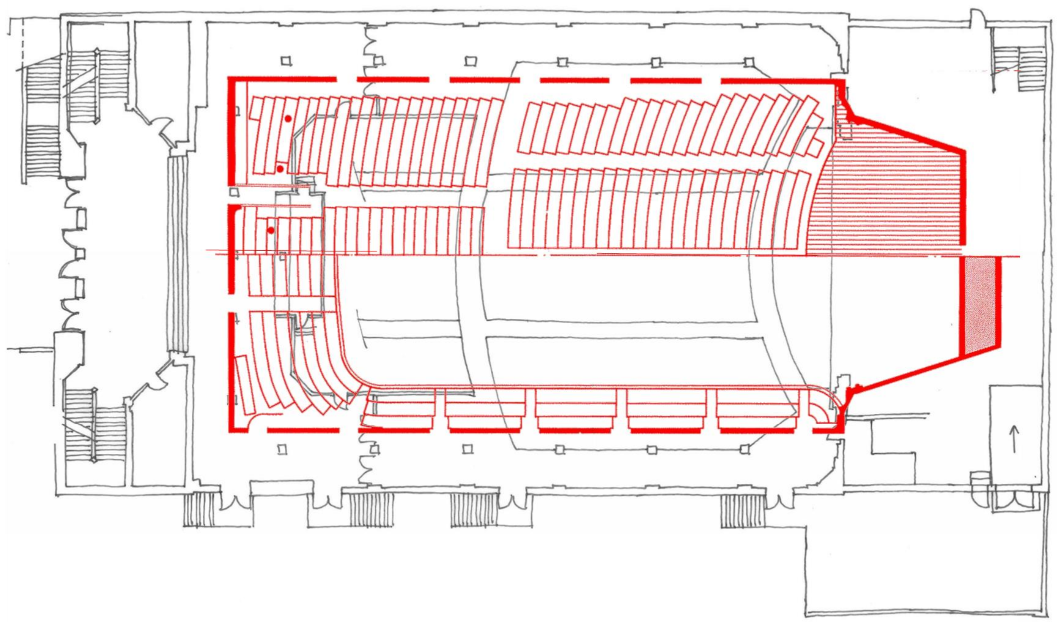
Similar echoes were experienced in this configuration with receivers located at the Bassoon chair and the Horn chair.

Room Comparison

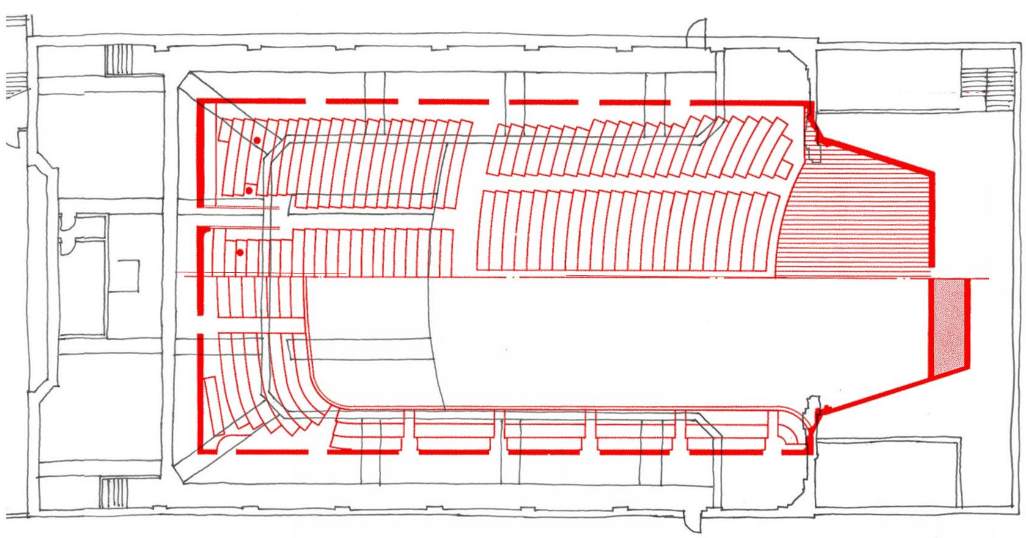
Comparing the shape, dimensions, and volume of the Thomas Wolfe Auditorium to those of other rooms that have generally been acknowledged as having good acoustics is beneficial to help determine the extent to which the Auditorium needs to be reshaped. We compared the Auditorium with several other rooms, and have identified four that are particularly helpful to our analysis. The floor plan comparisons that follow show the outline of the Thomas Wolfe Auditorium in black, with the floor plan of the room to which it being compared overlain in red.

<u>Boston Symphony Hall</u>

At approximately 2,600 seats, Symphony Hall in Boston has a slightly larger capacity than the current configuration of the Thomas Wolfe Auditorium. This is possibly partially due to quite narrow seating and efficient layouts not possible today. In plan, the two spaces are both rectangular rooms. Symphony Hall is not as deep as the Auditorium due to the overhang of balcony seats at two levels. The overhang of seating only at the side galleries of the Thomas Wolfe Auditorium results in spreading the seating areas wide and deep as shown on these comparisons. The extreme difference in width of the two spaces can be clearly seen in the following overlay:



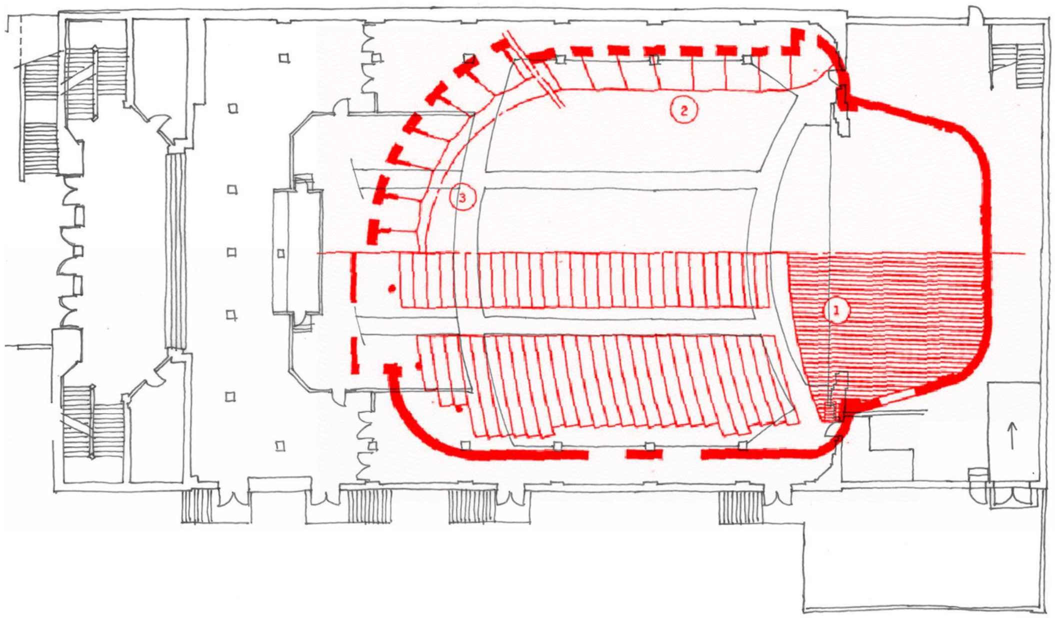
Additional seating capacity in the Hall results from a second balcony and side galleries, which is accompanied by a ceiling significantly higher than that in the Auditorium. This height increases the volume, providing for greater support for reverberation within the room. The Thomas Wolfe Auditorium has a deep balcony level which extends far deeper than Symphony Hall, as shown in the following balcony overlay:



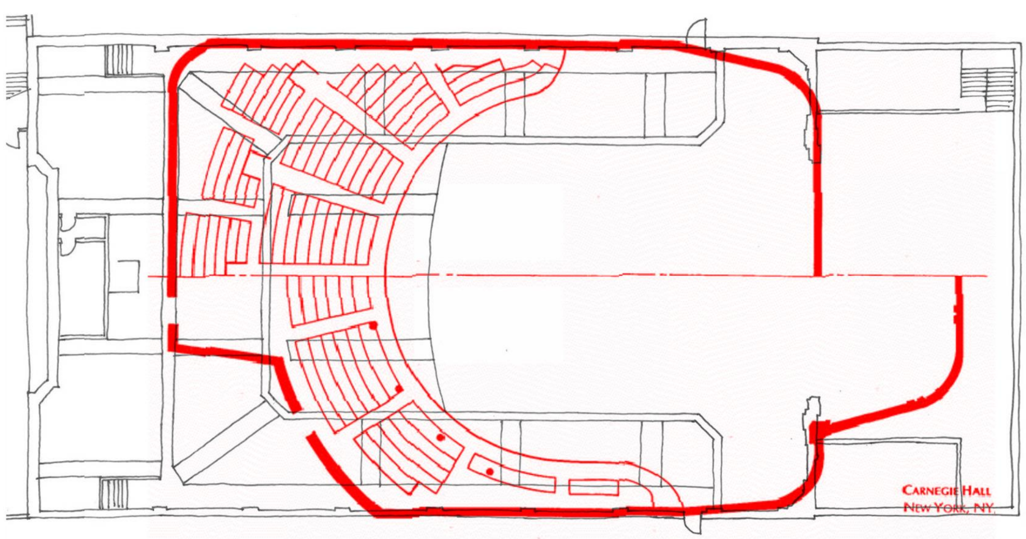
threshold

Carnegie Hall

Carnegie Hall in New York City also has a slightly larger capacity than the Auditorium, at approximately 2,800 seats. Carnegie has a much different layout than the Auditorium. Despite having a lot of volume and greater width than Symphony Hall in Boston, Carnegie feels much more intimate because the room is less deep than the Auditorium from stage to back wall. Here is a comparison of the main floor plans of both rooms:

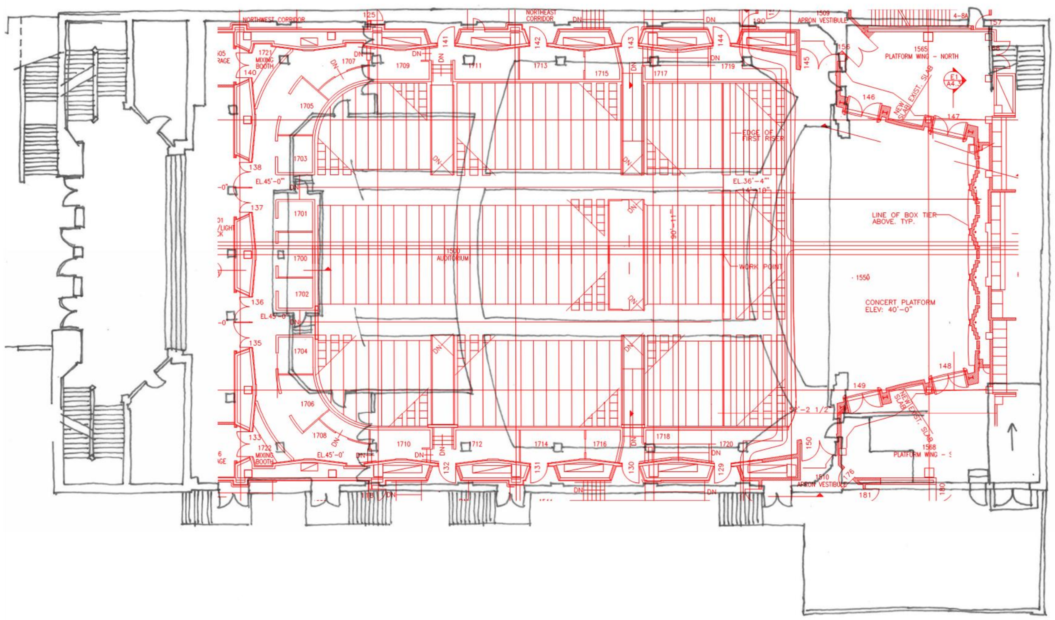


Carnegie Hall becomes larger in the upper volume of the room, eventually becoming as wide as the Thomas Wolfe Auditorium at the highest balcony, as shown on the following balcony overlay. Carnegie, however, never gets as deep as the Auditorium, contributing to its intimate feel. Similar to Symphony Hall in Boston, Carnegie is significantly taller than the Thomas Wolfe Auditorium.



Kennedy Center for the Performing Arts

The Concert Hall at the Kennedy Center in Washington D.C. is comparable with a capacity of approximately 2,450 seats, but as with the previous two examples, the room is much more vertical than the Thomas Wolfe Auditorium. Threshold has been studying the Kennedy Center Concert Hall for some time, and we have identified an issue there that is also being experienced at the Thomas Wolfe Auditorium. Both rooms widen abruptly just in front of the proscenium line, causing sound energy to quickly spread out rather than be supported close to the stage. Communication on stage is difficult due to this configuration and the Kennedy Center, which is similar to our experience at the Thomas Wolfe Auditorium.

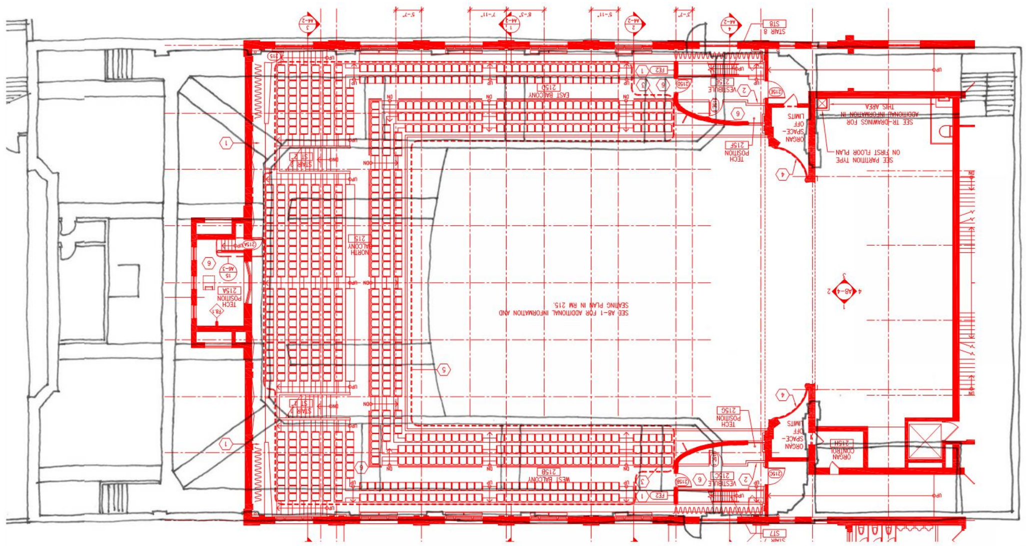


Aalfs Auditorium

The most directly comparable room in our study is the Aalfs Auditorium at the University of South Dakota. Built in 1925, Aalfs is very similar to the Thomas Wolfe Auditorium in layout and architectural style, including the large coffers in the ceiling and a single balcony and side gallery level. Aalfs Auditorium is shallower, accounting for the smaller capacity at approximately 1,300 seats, but has nearly identical dimensions in width and height as those of the Thomas Wolfe Auditroium.

Just as at the Kennedy Center Concert Hall, the Aalfs Auditorium widened significantly just in front of the proscenium prior to a renovation of the space which narrowed the main floor and added cheek walls at the balcony level. These changes allowed the stage to move forward into the room and improved listening conditions for the performers and audience.

It is interesting to note the great difference in depth between the Aalfs and Thomas Wolfe Auditoria. We could not find a comparable space in depth at a similar seat count range, which illustrates the challenge presented by the depth of the existing Thomas Wolfe Auditorium. This is clearly shown on the following overlay:



Recommendations

Based on our direct observations of the Auditorium, the observations of others reported to us, our acoustic testing within the space, and the drawing review and visual inspection of the structure by Walter P. Moore, we have developed a series of conceptual changes that will improve the acoustics of amplified and non-amplified events in the Thomas Wolfe Auditorium. We have also included conceptual recommendations pertaining to improving the patron and performer experience and production efficiency.

The recommendations presented below are separated into two categories. The first, a Moderate Renovation, includes recommendations that we feel are the minimum amount of investment required to bring the Thomas Wolfe Auditorium up to the expectations and needs of modern productions. This level of renovation will create an acoustic environment that will support programming by the Asheville Symphony Orchestra yet provide acoustic flexibility to provide a better listening experience for amplified presentations. Modifications are recommended to better accommodate touring productions to improve the viability of the venue for a wide range of performance types. The second set of recommendations, a Major Renovation, explores the maximum extent to which the building can be renovated to improve the competitive nature of the Auditorium when attracting productions to the region and maximize the patron and performer experience within the context of a reasonable cost of renovation. Renovations beyond this extent would likely require a more in-depth review of the viability of further investment in the Thomas Wolfe Auditorium versus construction of a new performing arts facility.

While we have identified areas of work beyond acoustic and structural considerations, this study did not include a comprehensive architectural or engineering review which would likely identify additional work to include in both of these renovation options.

Plan and section drawings of both sets of recommendations are included at the end of this report. Refer to these drawings for more information on the recommendations. We have also included renderings of the Moderate Renovation Project to provide a conceptual idea of the visual impact of our recommendations.

Moderate Renovation Project

Improvements to the Acoustic Volume

This study focuses the acoustic and structural capacity for improving sound, patron experience, and overall production value in the Thomas Wolfe Auditorium. Considerations for acoustic improvements for touring and amplified presentations are included in this set of recommendations, although the most stringent requirements are those changes necessary to provide a more supportive environment for the Asheville Symphony Orchestra and other non-amplified performances. The recommendations to improve the acoustic volume of the Auditorium focus on three strategies to accomplish these goals:

1. Isolate mechanical noise within the space to the greatest extent possible and minimize other ambient sound
2. Increase the interior acoustic volume to better support reverberation development within the space, particularly at lower frequencies
3. Shape the room and reconfigure seating areas to provide better projection and support of sound from stage with more even sound coverage throughout the audience and elimination of problematic flutter and echo conditions

To achieve these strategies we recommend the following improvements:

- The existing plaster ceiling should be removed in its entirety, including the wood and metal lathe support structure, to open the attic volume to the Auditorium. This is required to increase reverberation time in the space for non-amplified events.
- The installation of a minimum of four layers of drywall resiliently hung below the newly exposed wooden roof deck will be required to provide sufficient isolation of exterior noise (specifically rain noise and emergency sirens) and support low-frequency reverberation within the upper volume of the room.
- The newly gained attic volume should be as free of obstructions as possible to allow sound to freely move within this area and contribute to increased reverberation. To maintain the delicate profile of the steel trusses, it is recommended that intumescent paint be applied where required for fire protection to newly-exposed trusses. Standard cementitious fireproofing should not be used. Structure and other surfaces not requiring fire projection should be painted to provide good acoustic reflection.
- A soffit along the upper side corners of the room, within the height of the trusses, running the full length of the room should be provided to house ductwork, support reverberation development within the truss zone, and provide useful reflections from the intersection of the wall and underside of the soffit to audience seating within the space. This soffit should be constructed of metal framing and a minimum of four layers of drywall and may be painted or provided with a wood finish material as to be determined with an architect.
- A new network of catwalks will be required supported between the newly-exposed trusses to ease production lighting and house follow spots currently located in the rear booth. Catwalk construction and detailing will be determined working with a theatrical consultant.
- A forestage grid is recommended to be installed between the proscenium wall and the first truss, immediately in front of the proscenium opening. This structure will be used to rig new house loudspeakers as well as temporary box trusses and scenic elements. This structure may also be used to support a new forestage reflector as described below.
- Review of the original drawings indicates that false plaster construction comprises the existing proscenium opening. This false construction should be removed to allow the height and width of the existing opening to increase and improve the acoustic connection between the stage and the Auditorium. In conjunction with this work, new shaping must be provided above and at the sides of the proscenium opening as follows.
- A new forestage reflector will be hung in the area between the proscenium opening and the first truss in the Auditorium. This may be supported from the forestage grid or other structure added in this area. It may be necessary to rig the forestage reflector to fly all or a portion of it out of the way for amplified presentations. A structured honeycomb panel is anticipated for this element.
- Acoustic reflections from the ceiling will be augmented by the use of additional mid-house reflectors hung in coordination with the new catwalks. Exact configuration and number of reflectors will be determined as part of the overall architectural design of the renovated space. Structured honeycomb panels are anticipated for these elements with finish to be determined. Acoustically sound-transparent ceiling elements may be desired architecturally in conjunction with the acoustic reflectors, but such visual treatments have not been included in the pricing at this time.
- Working in concert with the new forestage reflector will be newly constructed curved cheek walls on both sides of the auditorium immediately in front of the proscenium opening. These elements will extend from the orchestra seating level to the underside of the roof deck. To reduce loading on the structure, it is anticipated that these walls will be constructed of metal framing with multiple layers of gypsum board or structured honeycomb panels to provide sufficient acoustic stiffness for full-frequency reflection. These walls will encapsulate the ends of the gallery structure and may be faced in wood pending the architectural vision for the renovated space.

- The new cheek wall enclosures on both sides of the house will allow the construction of new stairs connecting all areas of the seating with the stage level. It is anticipated that new stair access will also be provided to the catwalks, significantly improving on the existing ladder access. A new wheelchair lift should be provided within the cheek wall enclosure on house left to provide an accessible route.
- A new orchestra shell will be designed that works in tandem with the new forestage reflectors and cheek walls to provide unified shaping from stage to house that creates a single acoustic volume when in use to properly project non-amplified sound into the Auditorium. For initial pricing, it is assumed that 11 towers 25 feet tall and three new stage ceiling panels with integral lighting will be provided. Finish is to be determined but use of some wood is highly recommended.
- A new, larger stage extension system should be provided that can be manually deployed and disassembled. It is recommended that the new system have the ability for two options for stage extension size: the first a moderate extension useful for typical orchestral performances and some amplified productions or presentations, and a second addition to the first allowing the stage to extend far into the house for particular orchestral performances.
- New walls are required along the sides of the orchestra seating level to narrow the room beyond the new cheek wall construction. We anticipate this to occur roughly along the column line supporting the side galleries, between the new cheek walls and the existing cross aisle location. These new walls will extend from the floor to the underside of the side galleries and will be constructed of metal framing and multiple layers of drywall similar to the cheek wall construction. The new lower side walls may be shaped to control flutter across the room or diffusive elements will be installed as the final finish.
- The upper side walls of the Galleries are plaster applied directly on masonry which is an ideal construction for full-frequency support. To eliminate the flutter condition created by these parallel wall surfaces, diffusive elements will be designed and applied directly to the upper side walls of the Galleries from the cheek walls to the rear wall of the space. For pricing purposes, it has been assumed that this treatment consists of pre-fabricated plaster panels or similar material. Exact diffusion shaping and material will be determined as part of the overall renovation design.
- The main floor seating plane may be maintained in its current configuration, assuming that issues of ADA access can be resolved. It is strongly recommended that the Mezzanine, Balcony and Galleries be reconfigured to reduce the overall size of the Auditorium, reconfigure sightlines, and improve acoustic relationships between seating areas and new elements installed within the Auditorium. The existing mezzanine structure, added on top of the original flat floor, should be demolished allowing the construction of a smaller Mezzanine seating area associated with the main floor seating area. The Balcony should be moved forward by approximately one structural bay with part of it replacing the existing mezzanine structure and the remainder built up on top of the existing balcony structure. The rear wall of the space should be moved forward to align approximately with the location of the last truss that currently cuts off the upper rear section of the balcony. These changes will move the best seats in the house forward and eliminate the worst of the seats at the sides of the follow spot room.
- New walls will be constructed at the rear of the balcony and new Mezzanine seating. These surfaces will be acoustically sculpted to diffuse sound and provide useful enveloping reflections for the audience and response to the stage that is not overwhelming yet provides needed feedback for performers.
- The side Gallery railing will be revised to provide more beneficial acoustic shaping and tie into the new Balcony and Mezzanine seating areas.
- Variable acoustic systems will be required in the newly renovated space to control the longer reverberation time and provide a better acoustic environment for amplified sound. This system will include: draperies along the new rear

balcony wall; a drape or banner system along the new Mezzanine wall; banners hung within the truss zone that will provide reflection control for the upper side walls; and curtain along the proscenium wall or forestage grid area. All of these elements will be housed in pockets or located outside the acoustic volume when not deployed.

- New vestibules will be created at all entry locations into the main level and balcony seating as a part of the wall reconfiguration in these areas.

Improvement to the Patron Experience

During our study, we identified some opportunities to improve the experience patrons have when attending an event at the Auditorium.

- Replace the theatrical seating throughout the auditorium. Re-space the orchestra level seating section to accommodate a more discerning modern patron.
- Renovate the existing restrooms located off the main floor lobby and the lower lobby (a total of four restrooms).
- Provide updated concessions areas within the Auditorium
- Remove the brick infill from the locations of the original windows along the upper galleries on both sides. Install new acoustically-rated window assemblies in the exposed original penetrations along the galleries on both sides.

Improvements to Stage and Performer Spaces

This section focuses on two key factors that improve the viability of the venue as a road house for higher-caliber performances. The first is production efficiency and operational systems upgrades. Load-in accommodations, in particular, are a major impediment in this area, and is a legitimate deterrent to a touring production choosing the Thomas Wolfe Auditorium over other venues in the area. The second consideration in this section is the comfort and accommodations of the performers and production crew. Current dressing rooms are outdated, and there are no chorus dressing rooms, reducing the chances of attracting performances with larger casts. Our recommendations to improve the stage and performer spaces include:

- The existing hemp rigging system and wood grid should be replaced. Detailed system recommendations will require the input of a theatrical consulting, but installation of a new steel grid and new double-purchase rigging system could be provided to utilize the existing fly loft. Rough pricing estimates assume the installation of 24 fly lines, including 3 electric lines and 3 lines dedicated to the new orchestra shell ceiling as described earlier in this report.
- Access to all technical areas of the stage should be modified.
- The mechanical unit serving the stage located in the enclosure on stage left should be relocated and this enclosure demolished in its entirety to provide much needed wing space and area for new shell storage.
- The abandoned mechanical located in the lowest basement level should be removed to allow the relocation of stage and dressing room units to this location that is more remote from the stage and Auditorium.
- The entire existing dressing room level should be renovated to provide new star and group dressing rooms, restrooms, showers, and a green room. It is assumed that 2 small (approximately 100 square feet) star performer dressing rooms with their own single-stall restrooms and showers, and four medium (approximately 200 square feet) dressing rooms sharing two single-stall restrooms with showers will be provided as a minimum.
- It is recommended that space be located within adjacent areas to construct two large chorus dressing rooms, each with their own 4-person restroom and a single shower.

- It will be necessary to construct an addition on the southeast corner of the stage and house to improve the loading conditions for the Auditorium. Minimally, the structure underneath the new platform lift and loading dock can be exposed steel pylons, but the following area recommended as part of any renovation work in the facility:
    - A new platform should be constructed off the existing alley loading level to connect the loading dock to a new large platform lift to transition between existing dock and stage levels. New large loading doors will be provided into the stage at stage level, and new passenger elevator and stairs should be provided for access to dressing room areas and transition between stage and house levels.
    - Expand the loading dock platform outside the new addition to create additional staging area for loading and unloading of trucks.

Improvements to HVAC Systems

- Remove the two mechanical units suspended above the existing ceiling of the auditorium (which will be demolished as part of this renovation) and all accompanying ductwork, including the supply air doghouse. Patch the roof as required to fill in holes left from the removal of mechanical ductwork penetrations.
- Install new mechanical units to serve the auditorium. Locate these units on the roof above the lobby addition constructed in the 1970's to the east of the Auditorium. Provide the necessary ductwork to the auditorium through the newly installed soffits in the upper volume of the room (as described above).
- Remove the mechanical unit serving the stage located in the enclosure constructed on stage left. Demolish this enclosure in its entirety to open up stage left for wing space.
- Remove abandoned equipment in the lowest basement level below the Auditorium and stage to allow space for relocation of the stage and dressing room units. New supply and return ductwork will be coordinated with stage and theatrical equipment.

Improvements to Audio, Video, and Lighting

A significant number of improvements to the technical systems of the Auditorium are required. The recommendations included in this section are intended to bring the Auditorium up to the requirements of modern productions that would be hosted in the venue. Because this is a critical item to the Auditorium's existence, all improvements to audio, video, and lighting are included in the Moderate Renovation section. Recommendations include:

- Demolish the existing electrical panels on stage right and the partial height clay block wall on which they are hung. Provide new stage electrical panels located either on the upstage wall or the far stage right wall.
- Implement separate company switches for audio, video, and lighting.
- Install a K-series transformer, dedicated AV circuits, and an isolated ground system for AV.
- Increase power for AVL system to meet modern performance requirements.
- Construct dedicated rooms with proper cooling for amplification racks and dimmer racks.
- Install new dimming system for both theatrical and house lighting.
- Install a new control system with capabilities of controlling both theatrical and house lighting on a main control console, and multi button preset stations at entrances of auditorium and stage to turn lighting on in a desired mode.
- Construct a new control booth location for main audio, video and lighting control.

- Provide a new secondary mixing location for performance shows requiring critical sound mixing.
- Increase the number of theatrical lighting positions in the house by adding new dimming capabilities within the new proposed catwalk system, tormentor bars near the proscenium for side wash lighting positions, and build-outs upstage for side lighting wash positions.
- Install chain motor rigging points within the house area, proscenium area, and stage house to accommodate rental systems and touring groups.
- Permanently install a rider friendly loudspeaker system consisting of a center cluster, center seating delay zone, far balcony delay zone, front upper and lower side fills, and a flown center subwoofer array to enhance speech, light to moderate instrumentation enhancement, and vocal enhancement.
- Provide removable rider friendly left/right line arrays, front fills, and ground sub loudspeaker system to provide impact enhancement for concerts, pops orchestra, and Broadway shows needing full musical reproduction within the room. Arrays need to be removable to allow touring shows with their own PA system to be implemented if they would prefer, and to remove visual impact within the auditorium for programing not requiring an impactful loudspeaker system. Portable front fills will also need to be provided with a permanently installed loudspeaker system to meet programming for certain shows.
- Install a new portable large format digital audio mixing console with a digital snake to meet rider requirements and programming needs of different events of all sizes.
- Install a new 3-way isolated microphone splitter system allowing dedicated inputs for front of house, rental monitor mixing console, and future multitrack recording suite.
- Install a new large-scale AVL backbone to include microphone inputs, audio tie lines, video tie lines, monitor tie lines, network tie lines, and DMX tie lines. AVL patch plates should be located in multiple locations throughout stage, house, control booth, secondary mixing location, catwalks, lobby, and back of house green room area.
- Provide new loose equipment inventory, including audio monitors, microphones, mic stands, mic cables, instrument cables and direct boxes to meet current and future programming requirements.
- Install a new hearing assistance system with a sufficient number of receivers to meet new governmental ADA requirements for performance facilities.
- Install a video system with advanced switching capabilities for providing enhancements to video and presentations, along with full-scale backdrops for orchestra concerts and Broadway shows. The video system will also provide projector-mapping capabilities on top of orchestra performance area to create modern visualization and storytelling experience.
- Install a new AV distribution system to provide audio and visual information from programing produced within the auditorium. The AV distribution system will provide enhancements throughout lobby, bathrooms, stage manager position, control room, dressing rooms, green rooms, and any VIP rooms. The system will also provide necessary paging needed for critical information for audience in lobby and back of house staff.
- Install a technical intercom system for communication needed during shows in providing direction of talent, calling of AVL cues, and lobby-to-technical staff coordination. The technical intercom will be implemented in multiple locations throughout front of house, auditorium, stage, and back of house areas.

Improvements to Structural Elements

Refer to the attached report from Walter P. Moore for information on structural improvements that correspond to the items listed as part of the Moderate Renovation Project.

Visualizing the Moderate Renovation Project

The recommendations outlined above will have a significant impact on the look of the Thomas Wolfe Auditorium. Although a full design process would need to be undertaken by a team that includes an architect, MEP engineers, and a theatrical consultant, we have prepared renderings that give a glimpse into the impact of the improvements included in the Moderate Renovation Project. These renderings are, therefore, highly conceptual. We rendered the renovated auditorium in two configurations. The first is for a non-amplified performance, such as a performance by the Asheville Symphony Orchestra. This setup includes the new cheek walls, overhead reflectors, and orchestra shell on stage. The second configuration is for an amplified performance, such as a touring Broadway-style show. This configuration includes the deployment of variable acoustic elements to control the buildup of sound within the space. For comparison, we have also included renderings of the existing conditions of the Auditorium.

A rendering of the existing Auditorium, viewed from the balcony.

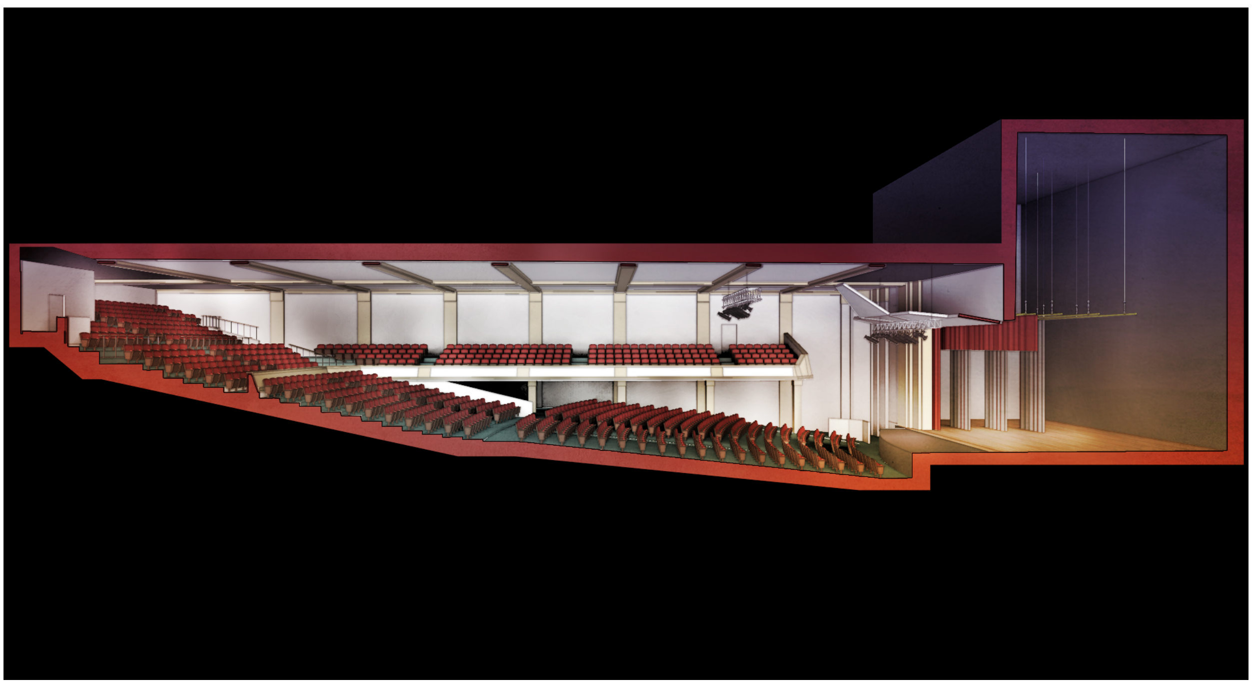
A conceptual visualization of the renovated Auditorium viewed from the balcony, set up for a non-amplified performance, such as with the Asheville Symphony Orchestra.

A conceptual visualization of the renovated Auditorium viewed from the balcony, set up for an amplified performance, such as a touring Broadway-style show.

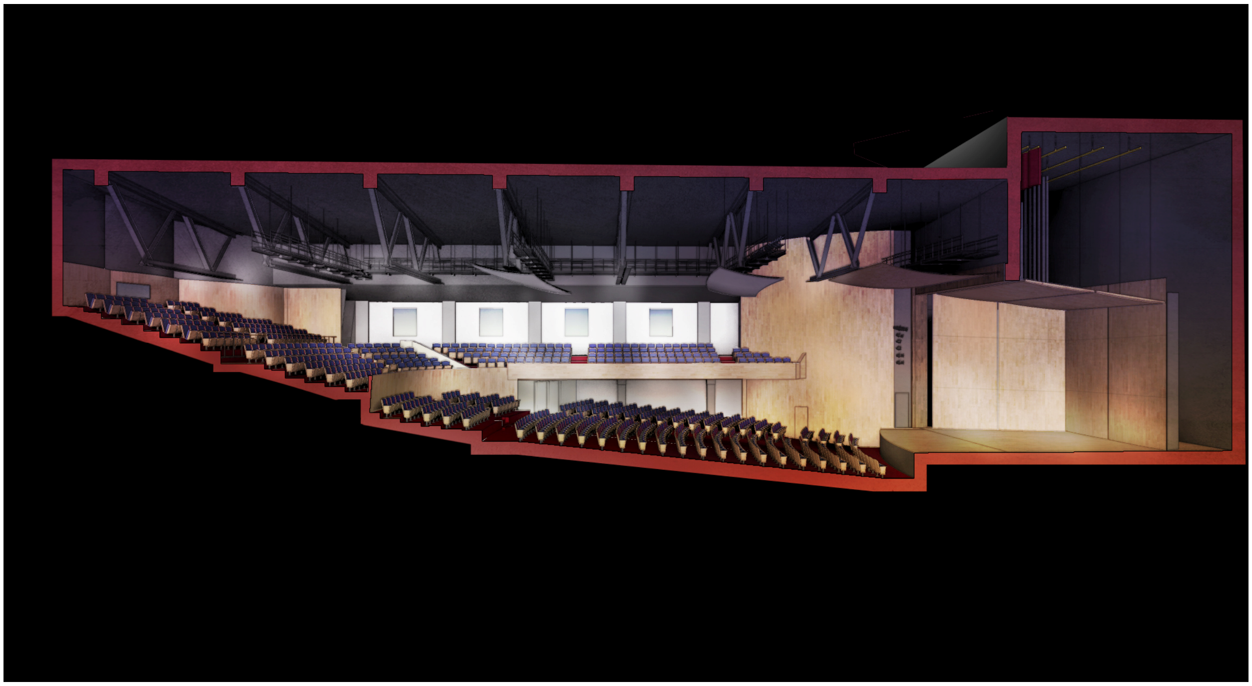
A rendering of the existing Auditorium, viewed from the stage.

A conceptual visualization of the renovated Auditorium viewed from the stage, set up for a non-amplified performance.

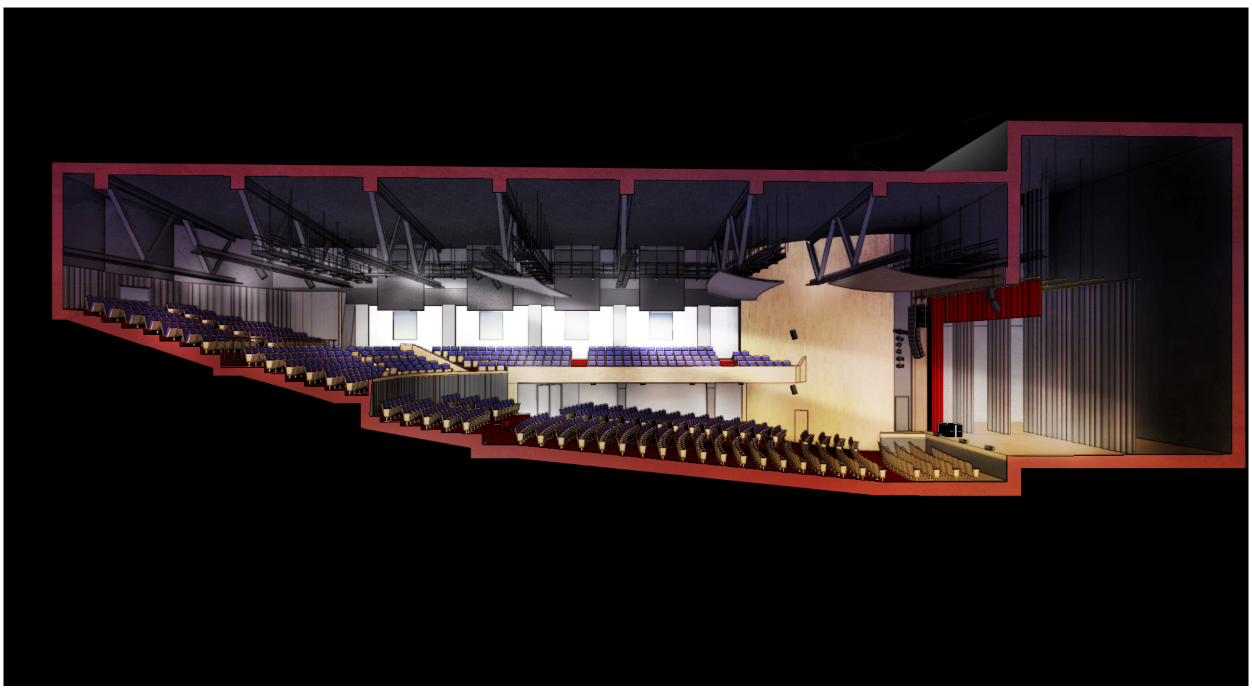
A conceptual visualization of the renovated Auditorium viewed from the stage, set up for an amplified performance.



A sectional rendering of the existing Auditorium.



A sectional rendering of the renovated Auditorium, set up for a non-amplified performance.



A sectional rendering of the renovated Auditorium, set up for an amplified performance.

Major Renovation Project

Improvements to the Acoustic Volume

Due to the prioritization of acoustic improvement to the Auditorium, most opportunities to improve the acoustics are included in the Moderate Renovation Project, as described above. For a Major Renovation Project, the same improvements would be implemented, but the level of design and the quality of finishes could be increased, resulting in a more refined and integrated appearance of the acoustic volume.

Improvement to the Patron Experience

A number of additional improvements to the Auditorium could be made to greatly improve the comfort of patrons

- Create a vomitory connecting the cross aisle of the new balcony to the existing conference room located above the lobby constructed in the 1970's to the east of the Auditorium. Include doors to create a sound and light lock, and construct ramps along the connecting path as required to accommodate the elevation difference between the cross aisle and the conference room (approximately two feet). Create penetrations through the existing back wall of the auditorium building (the former exterior wall of the auditorium).
- Renovate the existing conference room into an event space serving the Auditorium. Uses would include pre-performance galas, intermission concessions, or VIP receptions.
- Construct two additional multi-person restrooms adjacent to the new event space to serve the attendees of events in this space as well as patrons seated in the balcony.
- Demolish the first two rows of both of the side galleries to improve sight lines to the larger stage extension. Install a new fascia and rail along the exposed face of the shortened side galleries. Assume prefabricated diffusive plaster panels installed over a framed wall.
- Construct raised seating sections in front of the new side walls at the orchestra seating level. The sections will create an intermediate level of seating between the orchestra-level seating and the side galleries, and will feature shaped plaster fascia that will assist in project sound into the room.

Improvements to Stage and Performer Spaces

- Install a pit lift and stage extension system consisting of:
  - One pit lifts which can be positioned independently at a new wagon storage level, an orchestra pit level, audience seating level, and stage level.
  - Modifications to the basement level upstage and downstage of the new lift penetration to create chair wagon storage area as well as storage for large instruments, stage equipment, and stage extension platforming.
  - Provide a stage extension system working in conjunction with the lift to extend the stage far into the house for particular orchestral performances
  - Note that this option would be in lieu of the purchase of the dual stage extension system as described in the Moderate Renovation Project.
- Construct a performer's entrance and security check point at the southeast corner of the building with access to a passenger elevator and stairs connecting to the loading dock, dressing rooms, and stairs.

- Install a new crossover corridor behind the stage. Construct with framed walls with exterior masonry cladding. Assume the corridor addition is constructed on exposed metal structure below (not enclosed).
- Demolish the three levels of the old former dressing rooms and the fly loft located stage right.
- Construct a new fly loft located stage right midway up the height of the stage house (positioned to work with a double-purchase system) to maximize the wing space available under the loft. Install a spiral stair in the northwest corner of the stage to connect stage level to the new fly loft and the new grid.
- Construct a new pinrail gallery located stage left midway up the height of the stage house (level with the new fly loft). Construct a spiral stair connection stage level to the new pinrail gallery.

Improvements to Structural Elements

Refer to the attached report from Walter P. Moore for information on structural improvements that correspond to the items listed as part of the Moderate Renovation Project.

End of Acoustic Report