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May 22, 2013
Mr. Am'r Rusty Malik, AIA
Quisenberry Acari Architects
318 Main Street
Farmington, CT 06032

Subject: Auditorium visit findings and recommendations
Farmington High School
Farmington, CT
Acentech Project No. 623329

Dear Mr. Malik,

We visited Farmington High School on April 23, 2013 to measure the acoustical conditions of the Auditorium and to discuss the goals for the Auditorium renovation with you and Farmington HS staff. This letter summarizes our findings and recommendations for improving the acoustics of the Auditorium.

CURRENT CONDITIONS

The current Farmington Auditorium is a roughly fan-shaped hall with a low ceiling made mostly of an acoustical ceiling tile (ACT) grid, with an area of GWB mounted in the ceiling grid at the front of the hall. The reverberation time is around 0.7 seconds at mid frequencies, which is too short to support unamplified speech or music in a room of this volume. This short reverberation time is due to the excessive sound absorption provided by the ACT ceiling. Additionally, the fanned walls direct early sound away from the audience and into the absorptive rear wall, leaving little to no early reflections to support sound from the stage. This lack of early reflections and reverberation make projecting sound from the stage very difficult.

The auditorium stage has deep wings and a low, hard proscenium, which results in trapping sounds from sources upstage of the proscenium inside the stage house rather than projecting into the hall. The school has a stage shell, which helps ameliorate this problem. However, the current shell has substantial open space, including a large gap at the bottom, and its light weight construction is insufficient to reflect bass energy.

The current mechanical system is also too loud to run during performances. We measured a background noise level of NC-47 on the stage and NC 40 in the audience, both far above the NC 20 (or less) we would recommend for a performance space.

SUGGESTED IMPROVEMENTS

The acoustical goals of the renovation should be to increase the reverberation, deliver more early energy to the audience, and to allow as much sound as possible to leave the stage house and reach the audience. It will also be important to lower the background sound level of the Auditorium, although this is not part of this round of evaluation. We suggest the following as initial design items, in order of importance:

- **Remove the current ACT ceiling, and replace it with hard reflectors.** This will greatly increase the volume of the hall and remove a large amount of absorption, both of which will increase the reverberation time. The hard reflectors will allow ceiling reflections to supplement the weak sidewall reflections. Reflectors are available in

GWB, wood, and wood veneer from manufacturers such as Wenger, Kinetics Noise Control, and RPG, Inc. It is also possible to field-construct the ceiling reflectors by using gypsum board or plywood. We will be glad to advise on the construction of the reflectors if you decide to field-construct the ceiling reflectors.

- **Add absorption to the rear wall.** Some additional absorption will be needed to balance the room if the ACT ceiling is removed. We recommend treating 2500 sq.ft. of the rear wall if the sidewall curtains are included. If sidewall curtains are not included, we recommend 1500 sq.ft. of absorption be added to the sidewalls above audience height. The recommended treatment material is 2" thick glass fiber panel with an NRC of 1.00. The final amount of treatment should be decided when the design is more developed.
- **Box in the fanned sidewalls, with an angled bottom to reflect sound to the seats.** This will bring the overall geometry of the hall closer to the preferred "shoebox" shape. An angled bottom will provide side reflections without having to redesign the current doors. (See Figure 1.)

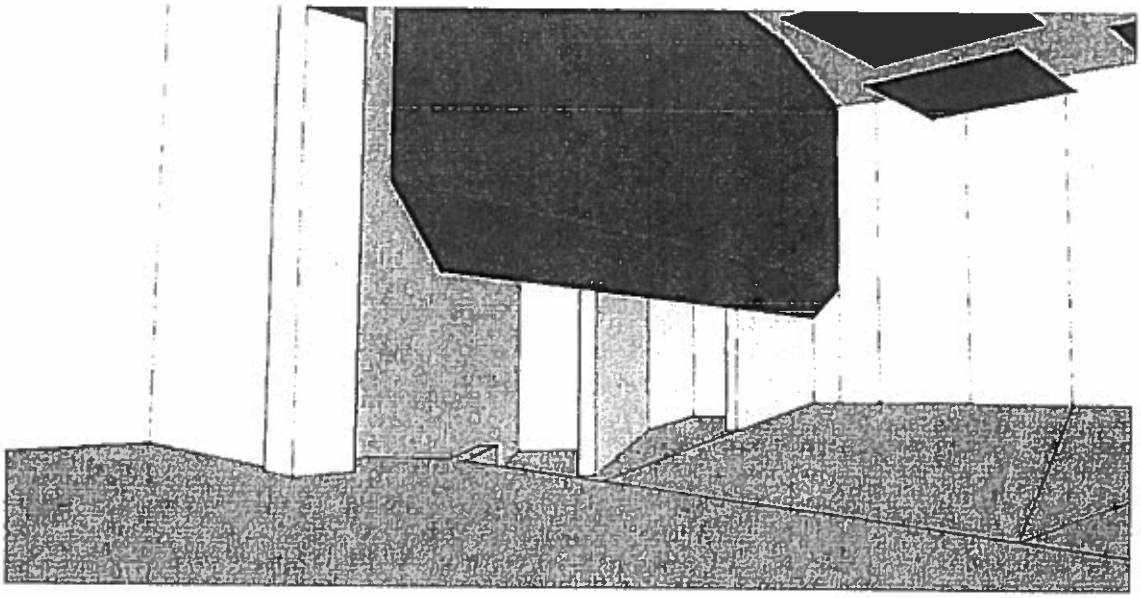

Figure 1: Auditorium sidewalls, "boxed in" to square the sides, including an angled reflector at the bottom.

- **Raise the edge of the proscenium.** Opening up the proscenium will allow more sound out into the hall; curtains can then be used to create a visual break at whatever height is desired. The opening should be at least 24 ft. tall.
- **Add retractable curtains in front of the sidewall boxes.** Curtains that can be extended to cover as much of the sidewalls above standing height as possible will allow for a substantial variability in reverberation time. Ideally, these will extend from the upper edge of the box's angled reflector to the deck and cover approximately 2500 sq.ft. of the sidewalls.
- **Upgrade the stage shell.** A more substantial stage shell, ideally with a ceiling, will allow sound to fully project into the hall. A shell similar to the Wenger *Forte* series would be ideal. A shell similar to Wenger's *Legacy* series would be a lower-cost option.

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The setup process for the *Forte* shell can be seen in this video: http://youtu.be/LIQEYSRfouA .

- **Upgrade the mechanical system.** The mechanical system should be upgraded to provide a background noise level of no more than NC 20.

The current and suggested designs can be seen in Figures 2 and 3. Additionally, we have attached the SketchUp model used to illustrate these design recommendations. The current structure to remain is on "Layer0", with current structure to be removed on the layer "CurrentCeiling", and the suggested additional structure on the layer "SuggestedAdditions".

These suggestions are given with ideal acoustical performance as the only concern. We realize that coordination with stage lighting and the unknown mechanical and structural construction above the current ceiling will require the modification of this "ideal" design. Particularly, enclosing the wall niche closest to the stage would require altering the lighting positions, and the ceiling reflectors will likely need to be lower to accommodate the mechanical system and lighting catwalk. However, we feel that this is the best possible starting place for the acoustical design.

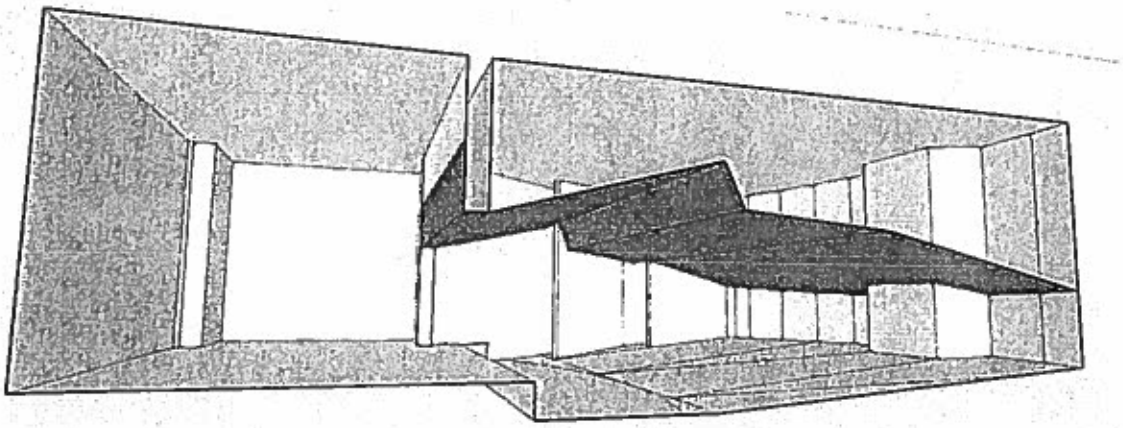

Figure 2: Farmington Auditorium, current structure to be removed in Blue.

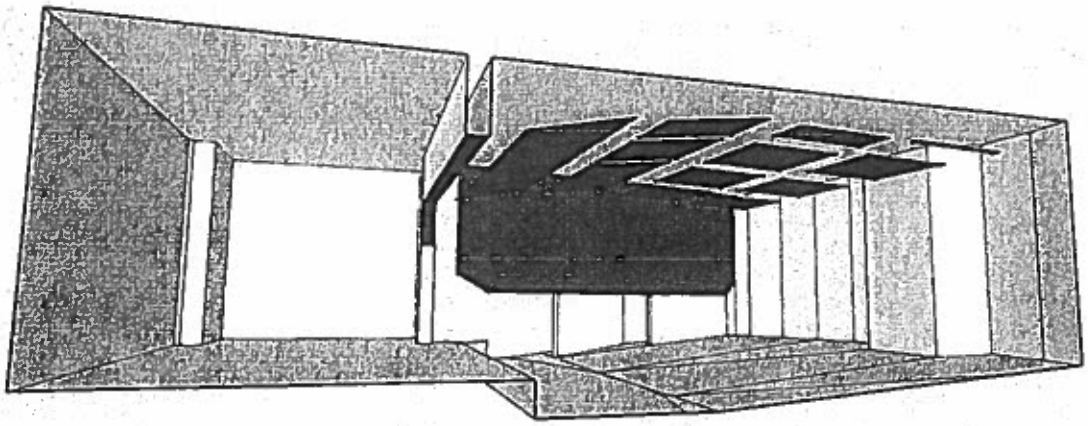

Figure 3: Farmington Auditorium, suggested structure to be added in Red.

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I trust this report provides the information that you are seeking at this time. Please call me at 617-499-8059 if you have any questions about this information.

Sincerely,

ACENTECH INCORPORATED

Matthew Azevedo
Consultant in Acoustics

Encl: SketchUp model: Farmington HS Auditorium – suggested improvements
CC: Rose Mary Su, Acentech

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