threshold

MEMO

To:	Sue Hains – Grimm & Parker; Wesley Paulson - Clear Space Theater Company
Copy:	David Oakes – Grimm & Parker
From:	Carl Giegold, Chris Springthorpe
Date:	21 January 2021
Project:	Clear Space Theater
Topic:	Property Noise Level Study - Additional Comment

This memorandum summarizes the items highlighted by Mr. E. Carr Everbach's analysis of our "Property Noise Level Study" dated 4 December, 2020, for the Clear Space Theater in Rehoboth Beach, Delaware. We appreciate his review of our document and are pleased to provide additional clarity and reassurance about the building's performance relative to the town's noise ordinance.

What follows is discussion of Mr. Everbach's commentary along with recommendations for improving the performance of the building enclosure should Clear Space determine that is in the best interests of the project.

Clarifying Information

Loudness Within the Theatre

While sound pressure of 112dB may well be measurable at the bell of a trumpet, the loudness measured in the audience areas and at the perimeter walls of the performance space itself is unlikely to exceed the 95 dB we assumed in our report. This reduction is due in part to the distance from the trumpet bell to the audience and in part to the absorption of seats, architectural finishes, theatrical draperies, and the audience itself, all of which helps to reduce overall loudness within the space.

Similarly, audience applause in our experience rarely exceeds 85 to 90 dB at mid frequencies in theatre spaces. The acoustically absorptive finishes and draperies that result in excellent speech intelligibility in a drama space also serve to control loudness.

While Clear Space regularly presents musicals, the band typically consists of keyboards, bass, guitar, and digital drum kit with no strings, woodwinds, or brass. The planned audio systems are not capable of generating 95 dB levels in this room, and Clear Space has emphasized that they have no intention of generating levels that high from either natural or amplified sources.

Noise Ordinance

We appreciate Mr. Everbach's observation that the residential noise levels govern in the case of this site, and we have added the Residential reference line on our graph accordingly.

The Ordinance does make allowances for 'Impulsive Noise' (peaks generally less than 1 second in duration that significantly exceed ambient noise levels). In Residential districts during daytime hours there is no limit on these short-duration peaks, but there is a 120 dB limit in Commercial districts. It should be emphasized that we anticipate that 95 dB will be the peak levels *within* the theatre space and that the levels we have graphed are also peak levels only reached momentarily and infrequently, largely because of Clear Space's interest in maintaining the comfort and hearing of its audiences.

Factor of Safety

Since the 95 dB levels used in our report represent peak levels, not sustained ones, there is considerable factor of safety built into our calculations in that manner - the vast majority of time, activity in the Theatre will be inaudible above ambient background noise outside.

For predicted levels resulting from roof construction, we have only considered attenuation by distance - as if all noise from the roof were emitted right at the north edge of the roof. We thus ignored the beneficial effects of the parapet in directing sound upward and away from the residential properties and also ignoring that the roof most efficiently radiates sound upward, perpendicular to the roof plane rather in-plane with the roof deck. The calculations presented in our graph are indeed conservative. Please see the Recommendations section below for further discussion.

Building Use Affecting Exterior Noise Levels

Since the daytime levels govern until 11pm, and performances rarely, if ever, run that late, the daytime ordinance levels seem appropriate to use for this assessment. The doors within the North façade of the Theater, as indicated in the report, are for emergency egress only. It is our understanding that patrons will not be exiting out of this side of the building except during emergencies.

Also note that the new theatre building itself will significantly reduce noise from the commercial street as heard in the back yards of the residential properties from which the street is now visible.

Regarding the potential for a standing wave developing between the north façade and the fence, we note that the ten-foot distance between wall and fence would result in a standing wave below 60 Hertz (Hz), but the fence construction is not capable of sustaining sound at such a low frequency. Further, the predicted 60 Hz sound is already well below the Ordinance curve and likely inaudible above ambient noise levels.

Recommendations

With the above as context, we remain confident that our calculations of likely sound pressure levels are appropriate to the circumstances and that peak levels resulting from 95 dB peak sound levels inside will be 5 dB or more below the residential daytime maximums in the Ordinance.

The installation of noise monitoring outside the Theater might be helpful, but unless it also records the noise that is being measured, it will not be possible to distinguish theatre noise from the many other potential sources in the area (aircraft flyovers, noisy traffic on the street, backyard activity in the residential yards themselves). An exterior monitor could thus result in an endless conversation over who or what is causing which bits of noise. Our hope is that Clear Space and its neighbors end up on good terms, and our recommendations are made with that as the goal.

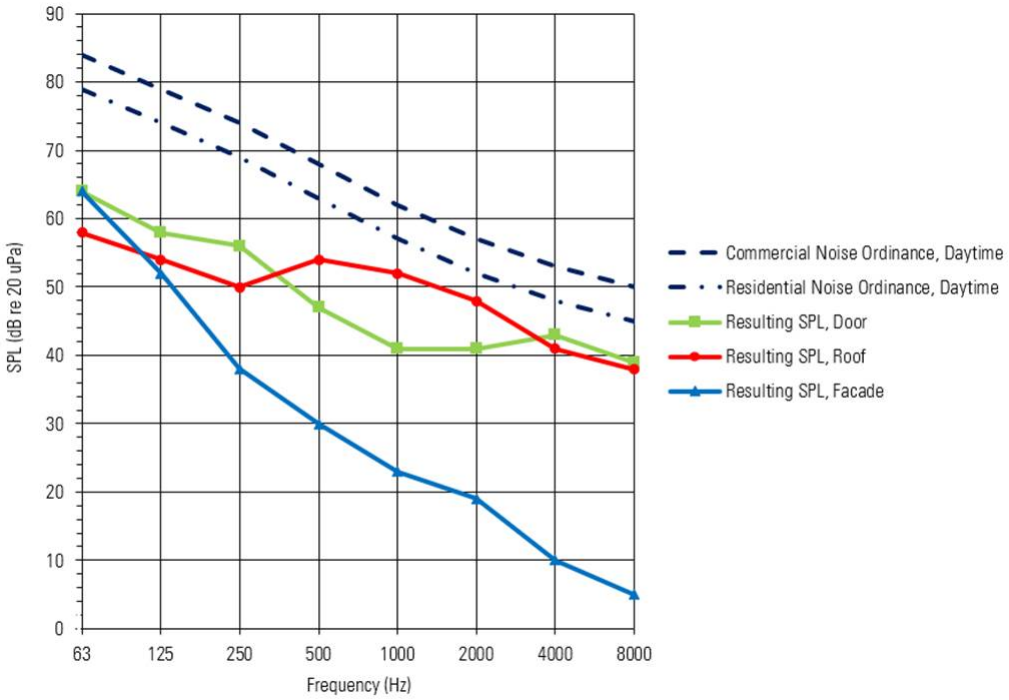
In response to Clear Space's request that we investigate ways of improving the acoustic performance of the building enclosure, we turned our attention to the doors and the roof construction since the façade construction performs quite well in the predictions. We can offer the following recommendations to increase the factor of safety:

- Change the two exterior doors to ones carrying an acoustic rating of STC 45 or higher.
- Add a layer of exterior gypsum sheathing to the roof system.

These two changes to the design will move the resulting peak noise levels at the residential property line still further below the required levels in the Ordinance as shown on the graph below.

We do not recommend increasing the mass of the fence along the property line. Resources would be better spent on improving the exterior doors and roof construction.

The graph below indicates the predicted levels resulting from the improvement to the doors and roof construction.



We appreciate Mr. Everbach's contributions to the study and look forward to further conversation if the above discussion leaves the Clear Space neighbors with unanswered questions.

* * * * *