# PROFESSIONAL ACOUSTIC ASSESSMENT

*Preliminary Acoustic Analysis and Design Recommendations*

| | |
|---|---|
| **Project** | XXXX Home Theater |
| **Submitted by** | XXXXXX |
| **Prepared by** | XXXXXXXXX |
| **Room** | 23 ft x 18 ft x 8 ft 3 in |
| **Report status** | Preliminary design guidance - test project |

*This report is based on submitted dimensions, photographs, system information, and project goals. Final treatment locations and quantities should be verified after construction is substantially complete and before permanent acoustic treatments and decorative finishes are installed.*

## 1. Executive Summary

The proposed 23 ft x 18 ft x 8 ft 3 in dedicated theater is a favorable candidate for integrated acoustic treatment. Its rectangular geometry, absence of windows, two-row layout, and planned fabric-covered millwork bays provide useful opportunities to conceal effective treatment while maintaining a finished architectural appearance.

The principal design issues are expected to be low-frequency variation between the two seating rows, strong side-wall and ceiling reflections, rear-wall energy affecting the second row, and possible over-absorption if every fabric bay is treated identically. The recommended concept is therefore zoned rather than uniform: deep absorption at the screen and rear walls, broadband treatment at early-reflection zones, corner bass trapping, targeted ceiling clouds, and hybrid absorption/scattering toward the rear of the room.

| Priority | Recommendation | Reason | Expected benefit |
|---|---|---|---|
| Critical | Treat the full screen wall and both front corners | Controls front-wall reflections, SBIR effects, and corner pressure buildup | Cleaner dialogue and smoother upper-bass/lower-midrange response |
| Critical | Install deep rear-wall absorption | Rear row is comparatively close to the rear boundary | Reduced delayed reflections, comb filtering, and rear-seat bass buildup |
| High | Treat side-wall first-reflection zones | Parallel drywall and strong early reflections reduce clarity | Improved imaging, localization, and dialogue intelligibility |
| High | Add ceiling clouds around, not over, Atmos speakers | Painted drywall ceiling remains a strong reflective boundary | Reduced ceiling bounce and improved front-stage clarity |

| Priority | Recommendation | Reason | Expected benefit |
|---|---|---|---|
| High | Improve low-frequency distribution; consider a second subwoofer | One subwoofer is unlikely to provide uniform response across eight seats | Better seat-to-seat bass consistency |
| Moderate | Use hybrid rear-side treatment rather than uniform absorption | Prevents the room from becoming excessively dry | Maintains spaciousness and surround envelopment |

## 2. Project Information

| | |
|---|---|
| **Room use** | Dedicated home theater |
| **Dimensions** | 23 ft long x 18 ft wide x 8 ft 3 in high |
| **Approximate volume** | 3,415 ft3 |
| **Seating** | Two rows; rear row on riser |
| **Floor** | Wall-to-wall carpet |
| **Walls / ceiling** | Painted drywall with planned fabric-covered wall sections |
| **System** | Submitted as 7.1.2 with one subwoofer |
| **Primary goals** | Improved dialogue, greater immersion, reduced flutter echo, and general acoustic improvement |

## 3. Overall Room Assessment

- Enclosed room with no windows and nearly rectangular geometry.
- Sufficient length for two seating rows without forcing all listeners directly against room boundaries.
- Millwork bays are well suited to concealed acoustic materials.
- The room is still unfinished enough to integrate treatment before decorative finishes are installed.

The treatment should not consist of identical absorption in every fabric bay. Different room regions perform different acoustic functions, so the system should use deeper bass control at pressure boundaries, broadband absorption at first reflections, and controlled scattering or reflective facing toward the rear.

## 4. Low-Frequency Analysis

The strongest axial modes are associated with the room length, width, and height. Calculated values below are approximate and assume a speed of sound near 1,130 ft/s.

| Direction | 1st | 2nd | 3rd / higher relevant |
|---|---|---|---|
| Length - 23 ft | 24.6 Hz | 49.1 Hz | 73.7, 98.3, 122.8 Hz |
| Width - 18 ft | 31.4 Hz | 62.8 Hz | 94.2, 125.6, 156.9 Hz |
| Height - 8.25 ft | 68.5 Hz | 137.0 Hz | 205.5 Hz |

Interpretation: The most consequential range is approximately 25-140 Hz. Modal clustering is expected around 63-74 Hz, 94-98 Hz, and 123-137 Hz. These overlaps can produce audible peaks and nulls that differ substantially between the front and rear seating rows.

Recommendation: Use meaningful low-frequency absorption behind the screen wall, in the front corners, and at the rear wall. Treat the riser cavity where accessible. A second subwoofer should remain a serious future option because treatment alone may not make one subwoofer uniform across all eight seats.

## 5. Speaker-Boundary and Front-Wall Control

The screen wall should function as the most absorptive boundary in the room. This reduces reflected energy returning through the screen, limits lower-midrange congestion, and helps mitigate speaker-boundary interference effects.

- Provide 4 in minimum semi-rigid mineral wool or fiberglass behind the acoustically transparent screen.
- Add a 2-4 in air space where framing depth permits.
- Use black acoustically transparent facing fabric.
- Treat behind and around the left, center, and right loudspeakers and adjacent to the subwoofer.
- Install floor-to-ceiling traps in both front corners where architecture permits.

## 6. Side-Wall Reflection Control

The front half of each side wall should receive broadband absorption at the principal reflection zones. Four-inch treatment is preferred at primary locations, with two-inch treatment acceptable in adjacent less-critical bays. Thin one-inch material should not serve as the primary treatment because it removes treble while doing little for lower midrange or bass.

Toward the rear, use a mixture of absorption and scattering. Suitable hybrid assemblies include 2-4 in mineral wool behind acoustically transparent fabric with wood slats, battens, or perforated facings over selected sections. Approximately 30-50% reflective surface may be retained in rear-side zones, subject to final visual design and field verification.

## 7. Rear-Wall Treatment

The rear wall is one of the most critical boundaries because the second seating row appears comparatively close to it. A hard rear wall can produce delayed reflections, bass reinforcement, comb filtering, and reduced dialogue clarity.

- Use 4-6 in broadband absorption with a 2-4 in air gap where practical.
- Prioritize the central rear wall and areas directly behind rear-row listeners.
- Add thickness or corner trapping at rear corners where possible.
- Avoid deep geometric diffusion immediately behind the second row unless adequate listening distance can be demonstrated.
- A shallow slatted or binary-style hybrid surface over absorption is safer than a deep quadratic diffuser in this location.

## 8. Ceiling, Riser, Door, and Flutter Echo

Ceiling: Install 2-4 in absorptive clouds above the first row and between the first row and screen, with a 2-4 in air gap where headroom permits. Keep the two Atmos loudspeakers unobstructed and preserve clear radiation paths.

Riser: Fill the accessible cavity with fiberglass or mineral wool so it does not behave like a drum. Deliberate perimeter or floor-level venting may improve low-frequency absorption, but vent locations should be designed rather than added randomly.

Door: Use perimeter seals, an automatic door bottom or threshold seal, and a solid-core construction. Treatment on the room-facing side may be appropriate if the door occupies an important rear reflection zone.

Flutter echo: The unfinished parallel drywall surfaces make flutter plausible, but the recommended side-wall treatment, rear-wall absorption, ceiling clouds, and fabric-covered bays should control it without resorting to thin foam or indiscriminate full-room absorption.

## 9. Expected Acoustic Results

- Cleaner and more intelligible dialogue.
- More stable front-stage imaging and localization.
- Reduced flutter and ceiling bounce.
- Lower reverberant buildup and less harshness.
- Improved surround envelopment without making the room excessively dead.
- Better, though not necessarily uniform, low-frequency response across both seating rows.

## 10. Final Verification Requirement

This preliminary assessment should guide framing depth, treatment zoning, speaker and seating coordination, riser access, and decorative fabric planning. When the room is substantially built - but before permanent acoustic treatments and decorative finishes are installed - submit a complete updated photograph set, confirmed dimensions, equipment coordinates, and any construction changes. Resonance Design can then refine exact treatment locations and quantities before expensive finishes are committed.

Prepared by John Bubernak - Resonance Design