QSC CINEMA

CERTIFIED THEATRE PROGRAM

The **QSC Certified Theatre Program** is intended to promote best practices in cinema design and overall presentation quality.

TARGET SPECIFICATIONS

The following specifications are practical guidelines which should be achievable with minimal cost impact if they are considered during the design stage of new cinema construction project. They are guidelines only. It is not expected that all theatres will meet each and every target specification in this document; compliance with a significant majority of these specifications may be all that is required to achieve QSC Certified Theatre status. Compliance will be verified during an onsite inspection by QSC (or its representatives), by written verification from the theatre operator, or a combination of these methods. Existing rooms with severe acoustical problems may require significant expense to mitigate these issues. Such expenses will be the responsibility of the theatre operator or dealer. In all cases, final certification status will be up to the sole discretion of QSC.

QSC Certified Theatres can be either new construction or existing rooms which are enhanced or modified to address these specifications.

1. Room Design

1.1. Ideal rooms for this program are **65 to 70 feet in length** from screen to last row seating.

1.2. Length to width ratio should be between **1.2:1 and 1.5:1**. When possible, side walls should be non-parallel, with the narrow dimension at the front of the house.

1.3. Demising walls should be constructed so that the intrusive sound level from adjacent theatres or other spaces is minimized, with an **STC rating of 60 to 65**. Masonry block with double layer gypsum and air gap is best; if single-stud, 2 or 3 layers of gypsum mounted on each side is suggested, with resilient channel on at least one side.

1.4. Baffle walls behind the screen provide many sonic benefits. In some theatres, a full baffle wall behind the screen may be required. In other cases, a “bafflette” or extended “wings” attached to the screen channel loudspeakers may suffice. In either case, the baffle wall or wings should be treated with 2 inches of acoustically absorbent material, such as open-cell foam (such as Sonex), batt insulation or Insul-Shield.

1.5. At the last row of seats, floor to ceiling distance should be at least **10 feet**. The surround loudspeakers at the last row should never be within reach of patrons.

1.6. Auditorium floor should be at least partially “stadium-style” slope.

1.7. The rear wall should not have indentations, cavities, or protrusions that create non-uniform seating regions in the back of the house compared to the rest of the room (Figure 1).

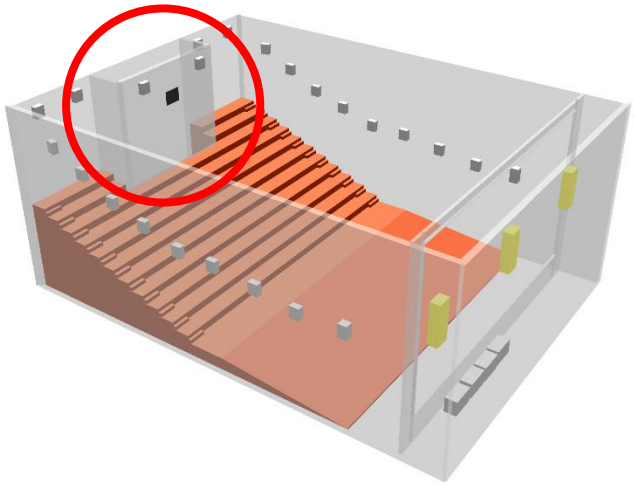

Figure 1 - There should be no "bump out" protruding into audience seating area.

1.8. Riser and cross-aisle railings should not impede sightlines for any seated patron.

1.9. Avoid excessively steep-raked stadium riser configuration, since this may cause an excessive projection down-angle, potentially increasing in image distortion (Figures 2 and 3).

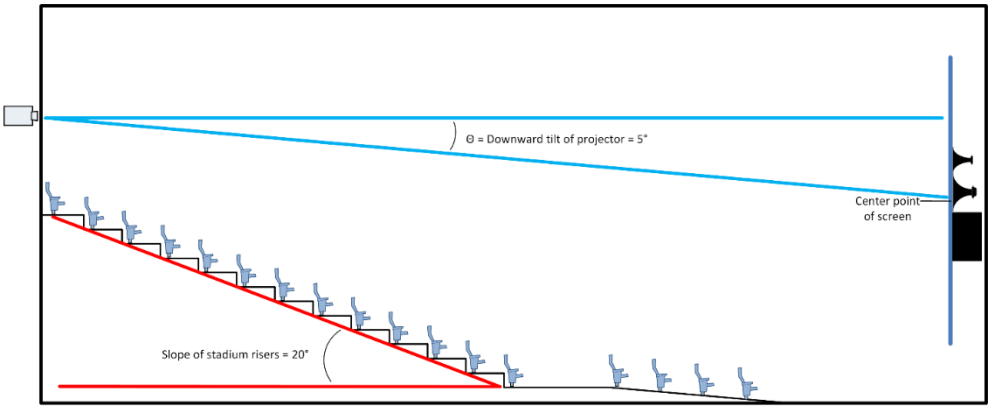

Figure 2 - Optimal riser slopes are generally between 15 and 20 degrees maximum.

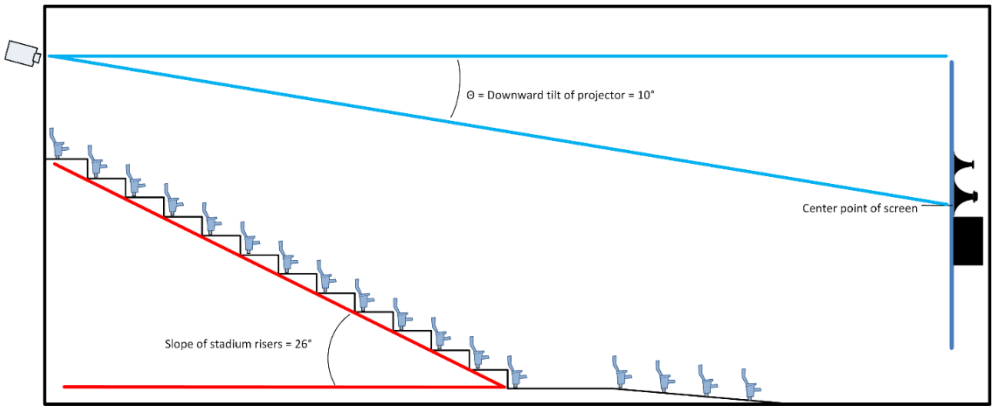

Figure 3 - Increasing stadium floor slope means raising the projector height, which in turn increases projection down angle – potentially increasing image distortion. Actual image distortion depends on multiple interacting factors, including image height, projection distance, screen angle (if any), lens type, etc.

1.10. Dimensions such as screen size, distance from screen to first row, and height from floor to bottom of screen should be geometrically optimized so that the first row of seated viewers can avoid head tilt of greater than 30 degrees (Figure 4).

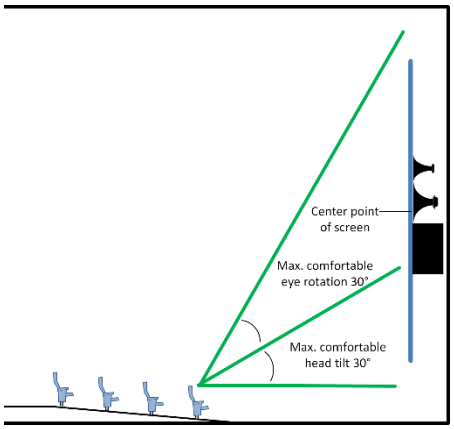

Figure 4 - Front row seated viewers (worst case) should not have to tilt their head more than 30 degrees, and should not have to rotate eyes upward more than 30 degrees.

1.11. Cross-aisle separation panels should not be hard reflective surfaces (eg., glass, drywall), or if they are, should be fully treated with acoustically absorbent materials.

2. Acoustics

2.1. RT60 in the auditorium should not exceed **1.2 seconds** (broad band)**. Note that** RT60 is heavily frequency-dependent.

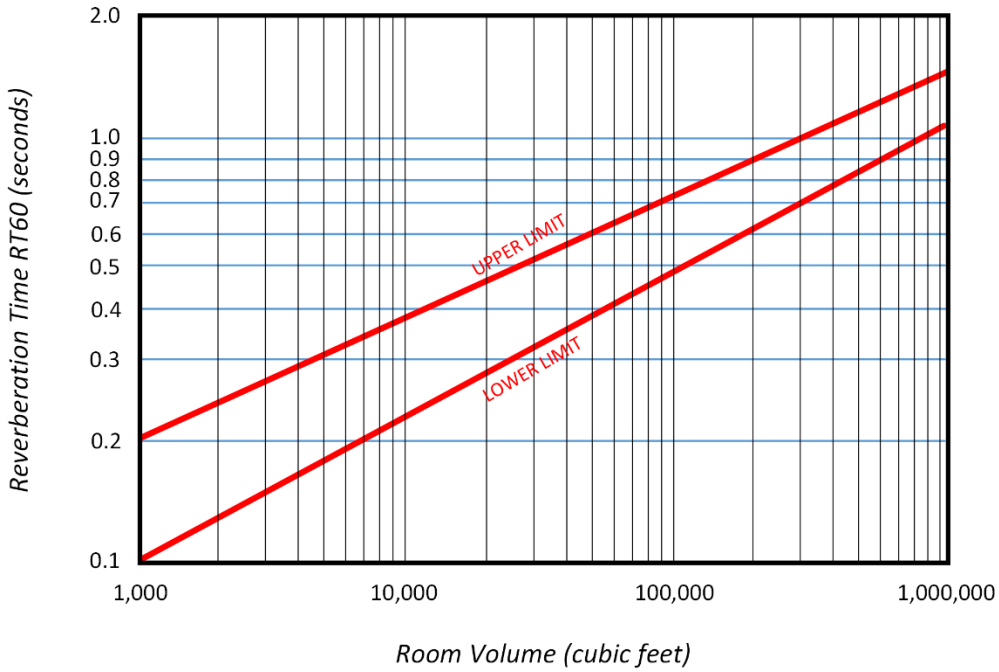

Figure 5 - This chart shows preferred reverberation times for the 500 Hz octave band for various room volumes.

Frequencies above 500 Hz are easily absorbed with acoustic material on side and rear walls. Low frequency energy below 500 Hz is increasingly difficult to control, especially when there is a large volume of space above acoustical tile ceilings and building deck. To make the ceiling appear more similar to wall barrier (and thus absorb some LF energy), **at least 4 inches of cotton fiber or fiberglass material should be placed above ceiling tiles.** One provider of such materials:
http://www.acousticalsurfaces.com/echo_eliminator/bassbust.htm

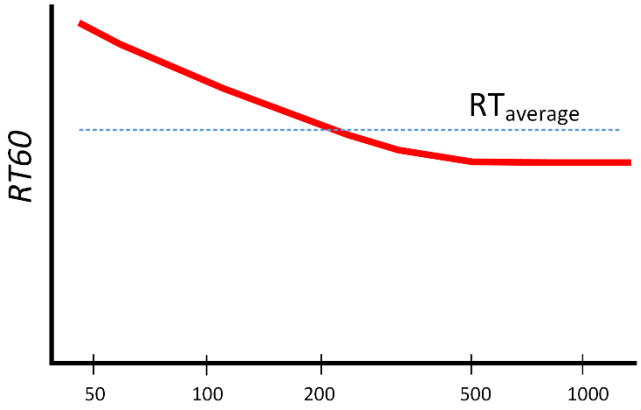

Figure 6 - Reverberation times are higher for low frequencies. It is typical for the reverberation time for low frequencies to be some 30% higher than the overall average broad-band reverberation time.

Rooms with particularly troublesome room modes or standing waves may require more extensive low frequency attenuation strategies, such as “bass traps”, resonators, etc.

The Noise Floor, when no sound/projection equipment or HVAC is operating, should be below **NC-30.**

2.1.1. Wall surfaces – side and rear walls should be dark colors (flat or matte black is preferred) solid and faced with sound absorbing materials. Avoid hard flat parallel gypsum wall surfaces that face each other. **Side walls nearest the screen should be HF absorbent**, since far Left and Right screen channel loudspeakers will deliver significant energy (creating potentially destructive reflections) to these areas.

2.1.2. Floor surfaces – floor surfaces should be carpeted wherever possible, especially between the screen and first row of seats.

2.1.3. Acoustic tile ceilings with an **NRC rating of 0.90 or greater** should be used, with 4” cotton fiber or fiberglass batt on the plenum side (see 2.1). Surfaces facing the audience should be painted flat black.

2.1.4. Avoid lighting fixtures or other decorative elements that have large, hard acoustically reflective surfaces.

2.2. Sightlines

2.2.1. Maximum viewing angle for center-seated viewer should be no more than **35 degrees** from bottom of image to the top.

2.2.2. Bottom of screen should be high enough from floor so there are no obstructed sightlines for any seated viewer (depends on room size, floor slope, etc.).

2.3. Ambient light

2.3.1. Ambient light level reflected by the screen should be no more than **0.01 ft L**. Light reflected from the screen negatively affects image contrast. Sources of ambient light that impact the screen can sometimes be hard to identify; aisle lighting, Exit signs, light from windows in entrance doorways can all have a deleterious effect on image contrast, and should be minimized as much as possible within the tolerance of local codes.

3. Equipment

3.1. Audio

3.1.1. QSC will assist in the specification of appropriate signal processing, amplifiers, and loudspeakers as well as system design and loudspeaker layouts. All sound system design specifications must be reviewed and have final approval from QSC Cinema technical staff.

3.2. Projection

3.2.1. Contrast – sequential contrast should be at least **2000:1**. Checkerboard (or "intra-frame") contrast should be at least **150:1**. Contrast is enhanced by dark or black colored side walls and ceiling tiles. Walls nearest to the screen should be flat black for at least the first 10 feet from the screen.

3.2.2. Brightness – center screen luminance should be at least **14 foot-lamberts**, with no more than **20% fall-off** at outer edges of the image.

3.2.3. Image – there should be no detectable keystoning of image shape in any format.

3.3. Screens

3.3.1. Screens should be sized to the so that the subtended viewing angle at the last row of seating, on center, is no more than **36 degrees**.

3.3.2. Screens should have adjustable masking systems. Any masking that obstructs the screen channel loudspeaker coverage must use acoustically transparent cloth. Floating screens are not preferred.

3.3.3. Slightly curved screens are preferred. A general rule is 1 foot of chord depth for every 20 feet of screen width. Screen and lens manufacturers may have optimization software to "fine tune" the exact shape of the screen for a given room.

3.3.4. Masking for flat and scope aspect ratios should be provided. All side should be exactly parallel and image corners should be precisely square, and cropping of the image should be limited to no more than 5%.

4. Fixtures and Furnishings

4.1. For acoustic purposes, fabric seating is far preferable to leather or synthetic leather-like materials. Leather and synthetics can be highly acoustically reflective, which can negatively affect dialog intelligibility.

4.2. Wall surfaces, whether painted or covered by fabrics or acoustic panels, should be dark-toned colors.

4.3. Aisle and Exit lighting should never causes reflections or shadows on the screen (see 2.3.1).

5. Installation Practices

5.1. Industry standard best practices should be followed in all cases.

5.2. Loudspeakers should be flush mounted into baffle wall and located behind the screen so that the distance between the screen and the mouth of any MF or HF horns is minimized, or no more than **6 inches**.

5.3. All loudspeaker cabling should be at least 12 gauge.