Film-Tech

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www.film-tech.com

T H X

Dedicated to defining and maintaining the highest quality standards in motion picture presentation in theatres and homes, the THX® Division is comprised of three programs: the Theatre THX Sound System program, the Home THX Audio System program, and the Theatre Alignment Program™ (TAP).

Originally developed in 1982 under the direction of Tomlinson Holman, Lucasfilm's corporate technical director, the Theatre THX Sound System began as a program to identify problems related to the presentation of theatre sound. Theatre audiences were not hearing sounds as they were created by the filmmaker – many of the subtle sounds were missing. Holman's innovative approach was to consolidate existing performance standards into a new system that considered and controlled all technical as well as design aspects of a theatre that affect the overall audio performance.

The Theatre THX Sound System requires customized acoustical design work for each theatre auditorium, a special screen speaker installation method, the use of a proprietary electronic crossover network, and rigorous audio equipment specifications. In order for an auditorium to become THX-certified, it must be tested to ensure that all of the criteria are met. The auditorium is subsequently re-tested once a year to maintain the same level of quality. Currently, there are over 650 THX-certified auditoriums worldwide.

The recent emergence of the home theatre market and the acceptance of the THX System as the standard by which theatre sound is judged led to the Home THX Audio System program. This licensing program develops strict performance criteria and proprietary technologies specifically for home audio component manufacturers. The THX-certified products of these manufacturers bring the same high-quality presentation standards to the home as in the theatre. A complete Home THX Audio System consists of the following components: a THX controller; power amplifiers; left, center and right front speakers; two surround speakers and a subwoofer. Dealers who sell and install Home THX products are specially trained and certified.

The THX Division also defines and maintains the standard in motion picture presentation through its quality assurance services for theatres, the Theatre Alignment Program (TAP). TAP's services generally begin once a feature film is ready to print at labs, and continues through the first two weeks of the film's release.

At the core of TAP's services are: post-production review of reels (as they are being produced at printing and/or sounding facilities); coordination of technical alignments at theatres scheduled to receive these prints; distribution of technical service instructions to these theatres; post-release evaluations of the print condition and performance of these theatres; and a monitored 24-hour hotline for technical assistance.

TAP's quality assurance services are available to film distributors for all release formats (70mm A-type, 70mm SR, 70mm CDS, 35mm A-type, 35mm SR, 35mm CDS). A milestone in TAP's history was the adoption of its "Criteria and Standards for Quality and Theatre Performance for Indoor Theatres" as the industry standard by the National Association of Theatre Owners.

LucasArts Entertainment Company

"Simply the Best Sound Around"

THX Sound System

The THX Sound System for the theatre, was developed in 1982 during the production of RETURN OF THE JEDI. Inspired by George Lucas' interest in upgrading film presentation standards in the industry, Lucasfilm's Corporate Technical Director, Tomlinson Holman, began to identify problems related to theatre sound. Holman noted theatre audiences were not hearing what was recorded in the film studio—many of the subtle sounds were missing. His innovative approach was to consolidate existing performance standards into a new system which included theatre acoustics as well as sound equipment. Referred to as the Tomlinson Holman eXperiment, THX (also named after Lucas' first feature film, THX 1138) is a sound system designed specifically to reproduce film sound exactly as it was recorded by the filmmaker.

The THX Program is the only system of its kind to consider all aspects of a theatre's audio performance, including architecture, acoustics and equipment. "THX is really a performance criteria; it's not a specific set of components," says Holman. The system was created to complement advances made by Dolby Laboratories in decoding sounds in the sound track which concentrates on the "A" chain. The THX Sound System concentrates on the "B" chain of a theatre's sound system. The "B" chain is comprised of customized acoustical design work for each auditorium, a special screen speaker installation method, a proprietary electronic crossover network, and rigorous audio equipment specifications and performance standards. Upon completion of a THX Sound System installation, the theatre is tested by a trained engineer to make sure it meets both THX technical criteria and recommended industry standards for high quality sound presentation. Theatres are re-tested every year to ensure that optimum quality is maintained. There are now more than 600 certified THX theatres worldwide.

A certified THX theatre carries several important advantages for the movie goer. The audience enjoys a more naturally balanced sound that uniformly reaches every seat in the auditorium, improved dialog intelligibility and decreased bass distortion. Better stereo localization makes the sound appear to travel across the screen with the action. A frequency range that is wider by a full octave in both bass and treble allows patrons to hear higher highs and lower lows. The combined result is the reproduction of the same clear, dynamic sound originally created by the filmmaker

The exhibitor's challenge is to create an environment that keeps the magic of the big screen alive. The competition that began with the theatre down the street, and extended to the home, has now expanded to include the future.

LucasArts Entertainment Company
THX Division
P.O. Box 2009
San Rafael, California 94912
415-662-1900

THX®

Approved Equipment

THX Sound System

Effective March 1, 1993

IMPORTANT:

Equipment listed has been tested and approved for use based upon auditorium volume and dimensions.

This list is provided for general information only. Do not select components from this list without first consulting the THX Design Office.

LUCASFILM THX

Lucasfilm Ltd.
THX Division
P.O. Box 2009
San Rafael, California 94912
415-662-1900

Loudspeakers

Screen System

Make/Model Number
- Altec A10/MR945A
- Electro-Voice TS9040D-LX
- JBL 4675B-8LF

Compression Drivers
- Altec 906-8A
- Electro-Voice DH1A
- JBL 2445J
- JBL 2446J
- JBL 2450J
- KCS S - 801

Horns
- Altec MR-945A
- Electro-Voice HP9040T
- JBL 2360A
- KCS SC - 401

Woofers
- Altec 8254
- Electro-Voice TL606DW
- JBL 4648A-8
- KCS C - 215
- Peavey 215

Subwoofers
- Cerwin Vega SW18
- Electro-Voice TL3512
- JBL 4645
- JBL 4688/4788
- KCS C - 218
- Peavey 118
- Smart DS574

Surround Speakers
- Boston Acoustics A70T
- Electro-Voice FR12-2B
- Electro-Voice TS8-2
- Frazier F2350
- JBL 8330
- Kintek KT 340
- Peavey TSL1

Booth Equipment

Power Amplifiers
- AB International 600LX
- AB International 900A
- Altec 9442A
- Altec 9444B
- Altec 9446A
- ART SS1200T
- Ashly FET-2000M
- BGW GTB
- BGW 750G
- BGW 7500T
- Bryston 4B
- Carver PM 600
- C-Audio RA 2000/tx
- Cinemeccanica C600
- Crest Audio 1501A
- Crest Audio FA 901TX
- Crest Audio FA 1201 TX
- Crest Audio LA 901TX
- Crest Audio LA 1201 TX
- Crown Micro Tech 600
- Crown Micro Tech 1200
- Crown PS400
- Dynacord PAA 560TX
- Dynacord PAA 990TX
- Electro-Voice AP2300
- Electro-Voice AP2600A
- Electro-Voice AP3200
- JBL 6230
- JBL 6260
- JBL 6290
- JBL ES 150
- JBL ES 300
- JBL ES 600
- KCS P - 900
- KCS P - 1400
- Kintek 1100
- Kintek 1110
- LAB. GRUPPEN 1000t
- Peavey CS 400
- Peavey CS 800
- Perreaux 8000C
- QSC 1400
- QSC 1700
- QSC MX 700
- QSC USA850
- QSC USA1300
- RAMSA WP-9220
- Smart TA-440
- Sonetic SA425
- Sonetic SA650
- Soundcraftsmen 900X2
- TOA P150-D
- UREI 6300
- XeTRON XPA-240X2
- Zetka 600 Series II

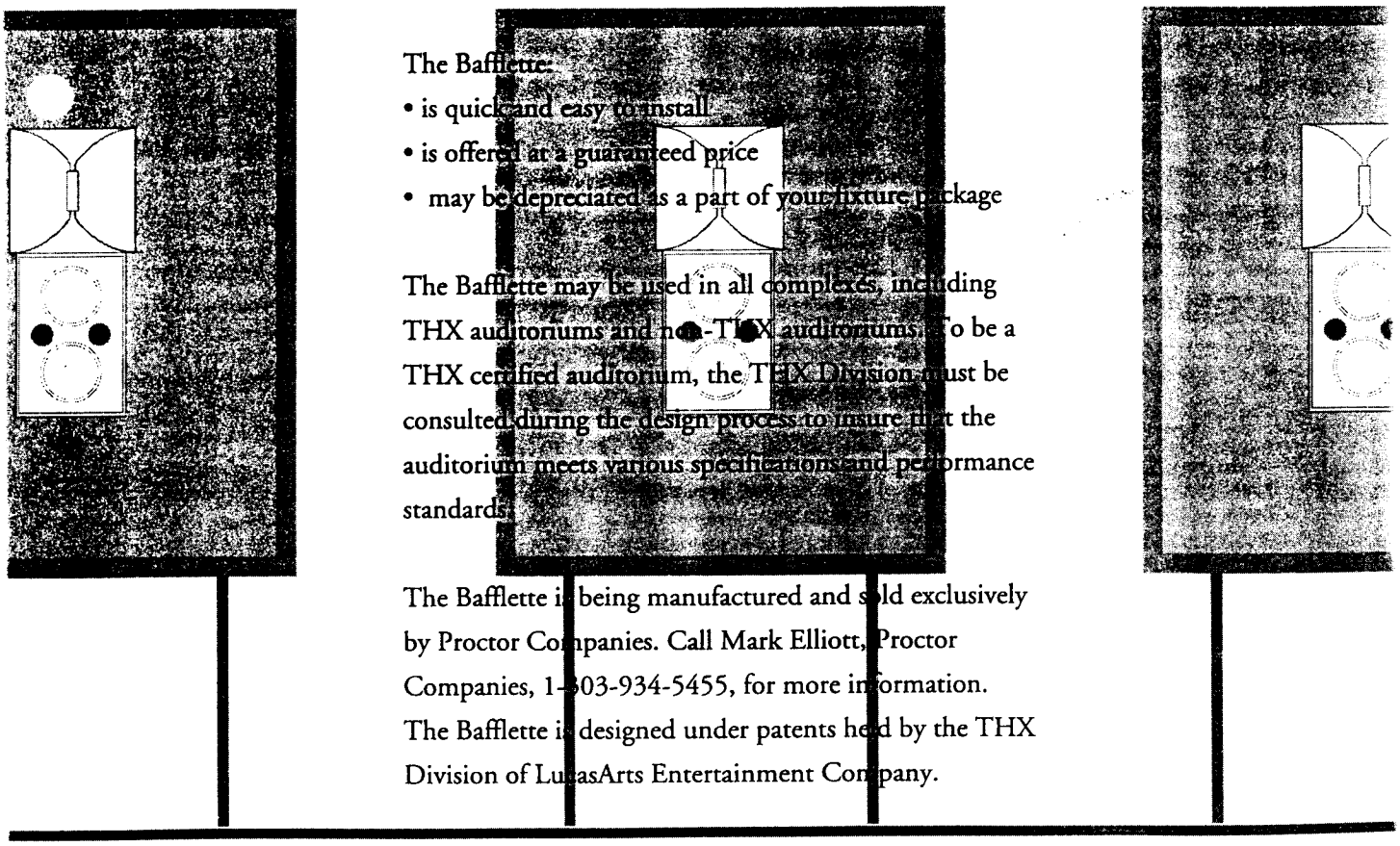
Monitor/Crossover Card Frame
- THX Monitor 3417

Processors
- Dolby ® CP-200
- Ultra Stereo JSX-1000

The THX Division Has Been Listening!

In response to the expressed needs of worldwide exhibition for a simple, flexible, and low cost effective THX baffle wall system that may be included in fixture packages, the THX Division is proud to introduce the new THX patented product ... the Bafflette™.

The Bafflette is a modular, vertical wall which is located between the screen and rear wall and contains the screen loudspeaker system for one stage channel. The easily transported and installed Bafflette system is an extension of the THX patented concept which provides reinforcement of low frequencies while absorbing unwanted high frequencies. The Bafflette can be used in rooms up to 80,000 cubic feet.



The Bafflette:

- is quick and easy to install
- is offered at a guaranteed price
- may be depreciated as a part of your fixture package

The Bafflette may be used in all complexes, including THX auditoriums and non-THX auditoriums. To be a THX certified auditorium, the THX Division must be consulted during the design process to insure that the auditorium meets various specifications and performance standards.

The Bafflette is being manufactured and sold exclusively by Proctor Companies. Call Mark Elliott, Proctor Companies, 1-303-934-5455, for more information. The Bafflette is designed under patents held by the THX Division of LucasArts Entertainment Company.

LUCASFILM

THX

ARCHITECTURAL SUGGESTIONS

I. What THX Needs From Architects

A. Updated Drawings

1. **Floor Plan**
An indication of seating area allows us to ensure even sound coverage of the audience through speaker placement and aiming.

2. **Interior Elevations**
Elevations are needed for room volume calculation and coordination of surround speaker placement with interior details.

3. **Common Wall Construction Details**
THX checks for appropriate isolation between theatres.

4. **Roof Plans - HVAC**
THX checks placement of roof top units and ducting.

B. **Early Warning**

1. **Bid Set Date**
We understand the importance of avoiding Change Orders and will work with you to meet Bid Set deadlines.

2. **Opening Date**
This helps us plan our design and field certification test schedules.

3. **Changes**

a) **Floor Slope**

b) **Ceiling Height**

c) **Exits**

d) **Screen Sizes**

e) **Corridors Behind the Screen**

f) **Interior finishes**

g) **Mezzanine Overhang**

h) **Anything Else**

II. Environmental Criteria

NOTE: The recommendations made in this section are general. An acoustical consultant should be retained to make site specific recommendations so that the THX criteria established in our Architect's and Engineer's Manual and restated below are met.

A. **Isolation Walls**

1. **Suggested minimums**
THX is initiating a study of minimum acceptable isolation for our theatres. Our preferred constructions yield lab measurements of Sound Transmission Class (STC) 65 and greater. Please refer to the wall construction details in the Isolation Section of our Architect's and Engineer's Manual.

2. **Constructions**
Avoid penetrations in theatre common walls. Perimeters of all isolation walls should be well caulked using acoustical sealant. Resilient mounting of the wall to the roof deck should be employed with constructions using gypsum. If it is not employed, deck deflection could deform the gypsum providing a flanking path for sound.

B. **Reverberation**
An acoustical consultant should be brought in to calculate the absorption needed to meet the reverberation specification supplied by THX.

1. **Specific**

a) **Sidewall**
If the sidewalls are too reflective, a "flutter" or side to side "slap" echo will be heard. The absorption needs to be brought down to approximately seated ear height. A minimum of 1" fiberglass must be used, with 1" or 2" of air space behind the absorptive treatment preferred.

To avoid side to side reflections, the design of non-parallel sidewalls is recommended.

b) **Projection Wall**
Much heavier absorption needs to be used on the projection wall to avoid delayed reflections of dialogue reaching the audience from the rear. A minimum of 2" of fiberglass should be used here also with an air space behind it.

2. General

a) **Low Frequency (20Hz - 250Hz)**
Excess reverberation in the low frequencies makes the theatre sound "boomy". Generally, low frequencies are absorbed by thick material, up to 6" spaced off of a surface by 2"-4". Because of the long wavelengths involved, large cavities or air spaces are also needed for low frequency absorption. Lay-in tile ceilings with a large air pleneum above can be very useful in this way. 6" of batt insulation above the suspended ceiling absorbs low frequencies well. In climates where pipe freezing is a possibility, this technique should be limited to the front (screen) half of the auditorium. The use of fiberglass tile instead of mineral fiber tile is also good for absorbing low frequency. Fiberglass allows sound to pass through it more easily than mineral fiber, however. Thus sound from the area above the tile will tend to pass into the auditorium more easily. Therefore when using fiberglass tile, extra care must be taken to reduce breakout from the ducts or other sources of unwanted noise above the lay-in tile ceiling.

b) **Mid Frequency (250Hz - 2000Hz)**
Excess reverberation in the mid frequencies lessens dialogue intelligibility. Absorption is easily dealt with by 1"-2" fiberglass mounted on wall surfaces.

c) **High Frequency (2000Hz - 16000Hz)**
Excess reverberation in the high frequencies makes the dialogue too sibilant. In most theatres, absorption in this range is usually not a problem due to the absorption from air in large volumes and the high absorption coefficients (at high frequencies) of typical acoustical panels.

C. Background Noise

1. HVAC as a Noise Generator

a) **Roof Top Units (RTU)**

(1) **Structure**
Low frequency noise can be transmitted structurally in the form of vibration through walls or the roof deck. Avoid this by providing isolation (spring curb mounting), short-circuiting vibrations to ground (mounting RTUs over a load bearing wall), or distance (mounting RTUs as far away from the theatre as possible or in the worst case, over the projection booth). If possible, avoid locating any mechanical equipment directly above the theatre. When using spring curbs, attention must be paid to spring deflection. Deflection is determined by frequency of the vibrations, stiffness of the roof deck, and weight to be mounted on the curb. It is best to request an acoustical consultant or mechanical noise specialist to specify the exact isolation springs for a given mechanical unit.

(2) **Roof**
Avoid mounting RTUs mid-span over an auditorium. This causes the roof deck to act as a diaphragm creating low frequency noise problems which are difficult to reduce. The more the deck deflects, the more severe the problem.

(3) **RTU Duct Exit**
A side exit from the Roof Top Unit allows a large amount of the airborne sound to dissipate in the first turn (more if the duct is lined).

b) **Ducts**

(1) **Turns**
In general, the more turns between the Roof Top Unit and the diffusers, the more noise attenuation. Turns also produce turbulence so the last run up to the diffuser needs to be straight. The longer this straight portion is the less turbulence will contribute to the noise.

(2) **Lining**
Fiberglass duct lining absorbs airborne noise (especially at turns). Ten to fifteen feet lined ductwork is a good minimum for each auditorium's feed.

(3) **Breakout**
Sound leaving the duct through its walls can be avoided by boxing in the duct with a frame and gypsum board which does not touch the ductwork. This enclosure may also be lined with fiberglass to provide even more duct breakout absorption.

c) **Diffusers**

(1) **Air Flow Recommendations:**
(a) Supply should be 350-425CFM per register maximum.

(b) Return should be 420-510CFM per grille maximum.

(2) **Rattles - There should not be any.**
This can be easily tested by generating a slowly varying sine wave signal through the sound system. As the frequency is increased, different parts of the theatre construction will rattle. Identify the sources and eliminate the rattles by tightening, damping, or fastening them down. Common rattles occur from lay-in ceiling tiles, HVAC grilles, and loose lighting fixtures.

2. **Reciprocating Equipment e.g. Compressors, Pumps and Related Ducts**
Spring isolation mounting should be used. Box enclosures should be used in extreme cases. All ductwork connected to vibrating equpment will also transmit vibrations along its path. The use of flex duct is recommended at the beginning of the duct run and isolation hangers should be used wherever the ducts need to be suspended or supported to a nearby wall/ceiling construction. Avoid mounting any mechanical equipment and ducts directly on demising theatre constructions. This includes locating concession stand equipment directly adjacent to the theatre.

3. **Environmental Sources**
Special steps may need to be taken if the outside noise threatens to interfere with the quiet of the theatre. Resiliently mounted suspended ceiling isolation, exterior wall isolation, and sound rated doors with neoprene head and jamb gasketing are recommended.

a) **Trains**

b) **Subways**

c) **Airports**

d) **Traffic**

e) Discos

f) City Streets

g) Lobbies

D. Projection

1. Projection Port

a) **Double Glass**
Two panes of glass help isolate the noise of the projection room from the auditorium. The frame construction should have neoprene perimeter gasketing to create a tight seal and eliminate sound leakage around the edges.

b) **Angled Glass**
Angled glass on the projector side avoids a reflected image from being sent back into the projector lens. Our general recommendation is a 7 degree outward tilt from the perpendicular plane of the projector.

Angled glass on the auditorium side avoids sound from the screen being reflected to the audience.

c) **Removable Glass**
This is necessary to provide access for microphone test cables and communication between the booth and the auditorium.

2. **Projection Angle**

a) **SMPTE Standard**
Image distortion due to the horizontal or vertical projection angle should not exceed 5%, and 3% maximum is preferred.

3. **Viewing Angle**

a) **Horizontal**
The angle subtended by the left and right edges of the Cinemascope image and the last center seat in the auditorium is recommended to be 36° with a minimum of 26°.

b) Vertical
The angle at which the person in the front center seat needs to look up in order to see the center of the screen. SMPTE notes that discomfort begins at 15°.

III. Sound System

A. Baffle Structure

1. **Construction**
Please refer to the details supplied in the Arichitect's and Engineer's Manual. It is important that with each site specific baffle drawing set supplied by the THX design office, overall dimensions, materials specification, and installation directions be closely followed.

2. **Speaker Holes**

a) **Placement**
The placement of the speaker holes in a THX baffle structure is very specific and is determined by the image sizes. A new baffle drawing must be generated by the THX Design Office if the image sizes change.

b) **Size**
The size of the speaker holes is determined by the equipment chosen from the THX approved equipment list. This choice is usually made by the engineering staff of the theatre circuit.

3. **Isolation Pads**
One Mason "Super W" pad (Durometer 40) is used under each corner of each speaker to isolate the vibrations of the speaker from the baffle structure. A list of Mason Industries' representatives is available from the THX Design office.

4. **Absorption on Face**
The entire face of the baffle structure is covered with 1" Linacoustic, a 1.5 lb per cubic foot duct liner manufactured by Manville Corp. This is a specific product. No substitutes are accepted unless the acoustical properties of the material in question are the same as that of the Linacoustic. In this case, a sample and specification of the material must be submitted to THX for approval.

5. **Exit corridors Behind Screen**
   In general, corridors behind the screen are difficult to deal with but they can be accommodated in most cases. If your theatre has screen wall exit corridors, make sure to send elevations to the THX Design Office for coordination.

6. **Absorption on Demising Wall**
   The area behind the baffle structure should be covered with 2" of fiberglass. This should include the rear wall, one side wall and the ceiling.

B. **Surround Speakers**
The surround speaker array is designed by THX to provide uniform coverage of the audience. THX supplies spacing, height above finished floor, and aiming angle for the loudspeakers.

If you have any sidewall treatments or interior design details with which you would like to coordinate the speaker layout please let the THX design office know.

IV. What Architects Should Expect From THX

A. **Drawings**

1. **Baffle**

2. **Surround Speaker Layout**

3. **Single Line Electrical**

B. **Reverberation Limits Curve**

C. **Equipment List**

D. **Resource Materials**

1. **EG-18**

2. **THX Architect's and Engineer's Manual**

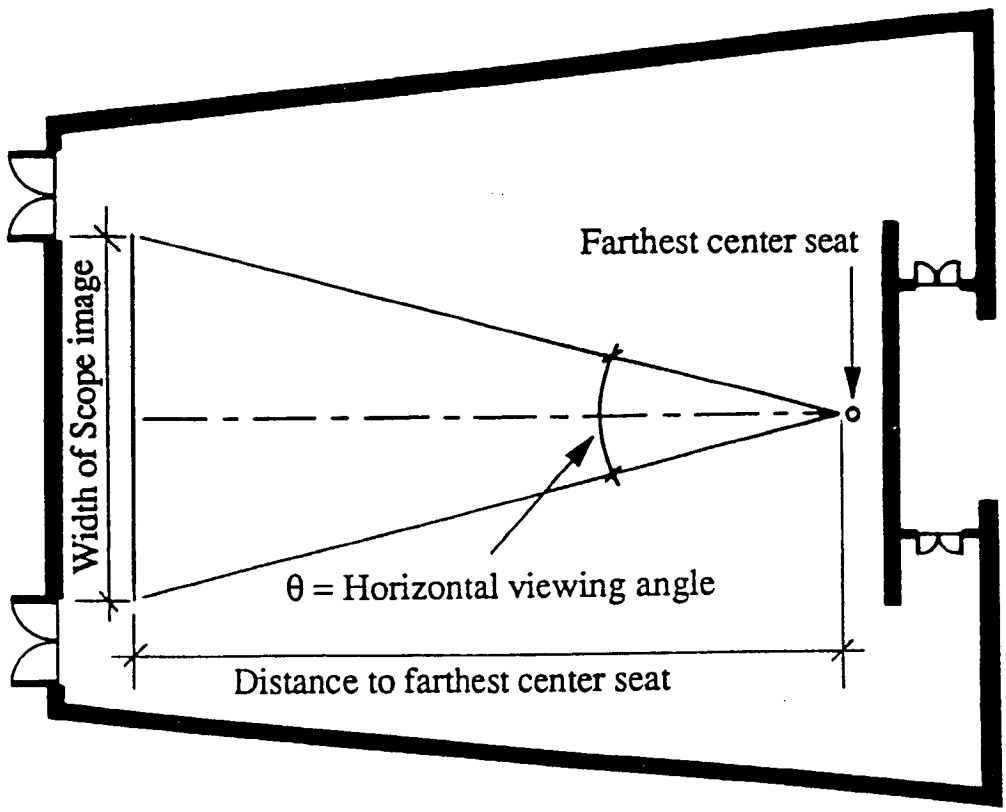
ARCHITECTURAL SUGGESTIONS

E. Advice

1. **Equipment**
2. **Construction**
   a) **Common Wall**
   b) **Baffle**
   c) **Absorption Material**
3. **Installation**
4. **Projection**
   a) **Images**
   b) **Sight Lines**

Horizontal Viewing Angle

The THX program recommends that the audience viewing angle for a Scope image (2.35:1) from the farthest seat in the center of the cinema be 36 degrees horizontally. A horizontal viewing angle of less than 26 degrees is unacceptable for the THX Sound System. For additional information, please consult SMPTE Engineering Guideline 18.



Horizontal Viewing Angle =

2 x ARCTAN [(0.5 x Width of Scope image) / (Distance to farthest center seat)]

Site Information Form

City _____ State/Country _____

Postal/Zip code _____ Contact name _____

Circuit contact name if different from above _____

- ***Acoustical Consultant:***

Company _____ Phone _____

Street _____ Fax _____

City _____ State/Country _____

Postal/Zip code _____ Contact name _____

Circuit contact name if different from above _____

- ***Equipment Supplier:***

Company _____ Phone _____

Street _____ Fax _____

City _____ State/Country _____

Postal/Zip code _____ Contact name _____

Circuit contact name if different from above _____

- Will the supplier also install the equipment? _____
  If not, supply the following installer information:

Company _____ Phone _____

Street _____ Fax _____

City _____ State/Country _____

Postal/Zip code _____ Contact name _____

Circuit contact name if different from above _____

LUCASFILM THX

Screen Information Form

- What Dolby Spectral Recording (SR) unit will be used? _____
- What mains voltage is available at this theatre? [] 120V [] 240V
- Is the theatre near an unusual noise source (airport, subway, railway, etc.)? Use extra sheet if necessary.

_____

_____

_____

- If you have chosen speakers and amplifiers, please enter that information:

Screen loudspeaker system _____ Amplifier _____

-OR-

Horn loudspeaker _____ Amplifier _____

Low frequency louspeaker _____ Amplifier _____

-AND-

Subwoofer _____ Amplifier _____

Surround loudspeaker _____ Amplifier _____