Chapter 3
Design

3-1. INTRODUCTION

Theater and concert hall design is both artistically and functionally complex. As in all architectural design, the making of qualitatively effective and technically functional space at an economical cost is paramount, but compared to other architectural building types, performance facilities are set apart by sophisticated electro/mechanical devices and technology needed to support performance. The ultimate fine-tuning of this balance of diverse, interdependent factors is the architect's and technical consultants' particular responsibility. However, during the process (outlined in Chapter 2) of designing an Army Music and Drama Center (MDC), many decisions must be made by the MDC staff and facilities engineers before the design professional is hired.

The MDC planners must be familiar with information in this chapter in order to complete the documentation required for project initiation and ensure that a project is in compliance with Army standards for good design. It is also strongly recommended that a technical consultant be brought into the design process as early as possible, preferably in the Project Development Brochure (PDB) planning stage of design.

In terms of project documentation this chapter provides basic information for development of the Design Criteria Requirements of the PDB. It should be utilized by using service staff, facilities engineers and technical consultants in program development, in formulating the functional requirements of the PDB and DD Form 1391, and in review of the Concept Design.

This Guide deals with the basic configurations and principles at work in performance facilities. Chapter 3 presents both general and specific guidance which affects the design for an MDC. The chapter is organized in three divisions corresponding to the three primary spatial divisions: the facilities which bring performers and audience together in one or more controlled relationships; the facilities which support performers and production; and the facilities which support the audience and audience involvement.

Each division begins with the largest, most inclusive definitions, disassembles them into manageable parts, points out how they are similar or dissimilar, and how they interlock. General standards for comparison and measurement will be developed along with the means for applying them.

Noise control ratings, illumination levels, anthropometric data, technical details and lists of equipment required will be further developed in Chapter 4.

To assist Design Guide users in finding relevant information within the logical context of its application, Table 3-1.1 summarizes the organization of Chapter 3.

DIVISION 1: THE ROOM

3-2. ROOM CHARACTERISTICS

A. EXTERNAL RELATIONSHIPS

The heart of any performance facility is the Room, the place of performance. The Room includes seating and stage. The definition of all other activities and spaces within the facility relates to the activity of performance and the Room, either directly or indirectly. Audience facilities are directly related in terms of capacity and access, and indirectly by the desired ambience and image to be created. Backstage facilities are directly related in terms of scene handling, stage form and stage access requirements, and indirectly by the use of the Room for rehearsals and set assembly.

B. INTERNAL RELATIONSHIPS

The three primary variables affecting physical characteristics of the Room are size, shape and arrangement of participants. These interact in the following ways: Size is implied by seating capacity, and by anticipated use of the stage. These factors vary with the formal relationship of the seating to the stage. Size is also linked to acoustic properties and perception of intimacy.

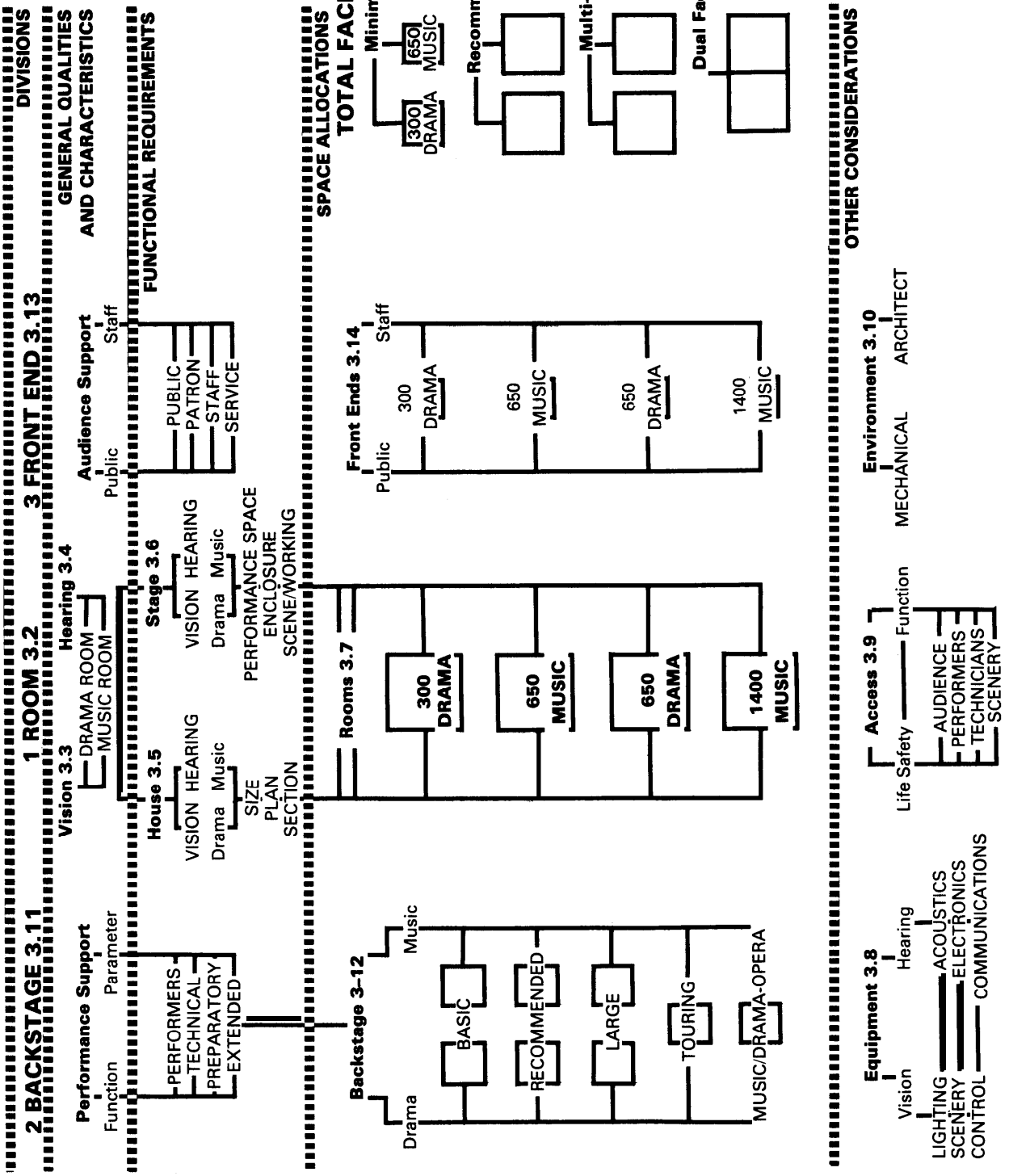


TABLE 3-1.1 ORDER OF CONSIDERATIONS

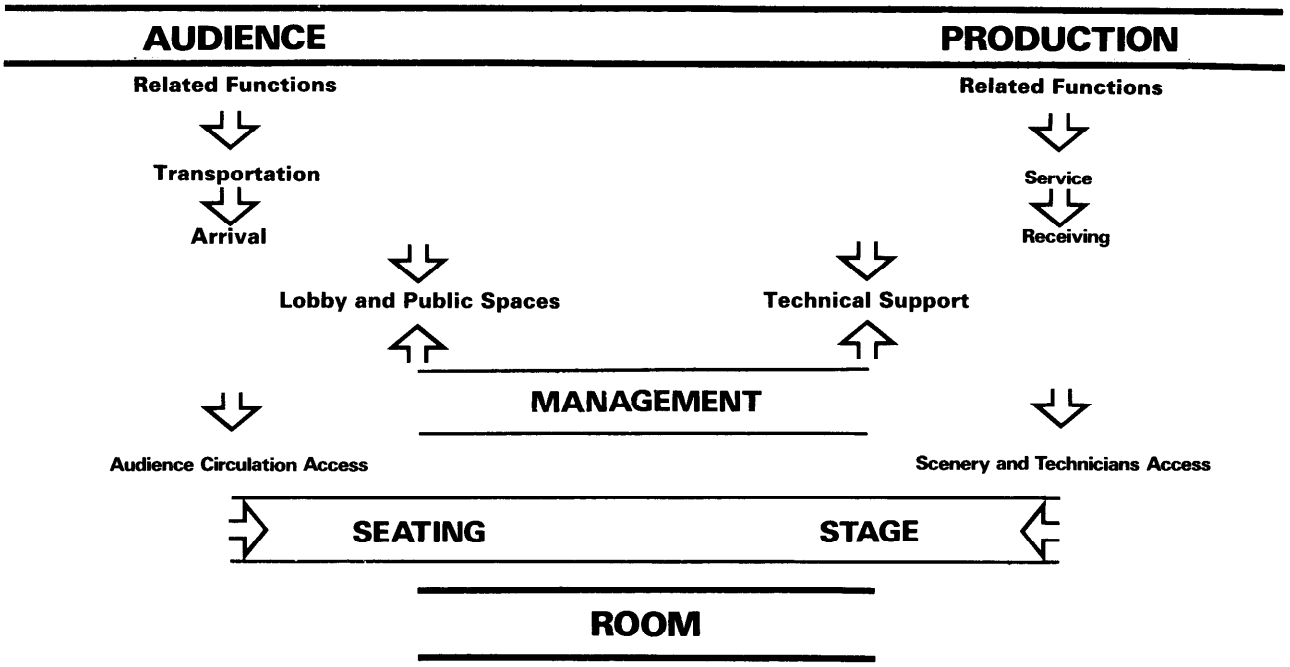


FIGURE 3-2.1 ROOM CHARACTERISTICS: EXTERNAL RELATIONSHIPS

Shape is implied by criteria for vision and hearing, and so interacts with size (volume and distance), but is most strongly defined by arrangement of people in the Room. Hence, the audience/performer relationship (arrangement) is physically and conceptually the first choice to be made. There are other variables; secondary considerations of accessory equipment, access to seating and stage, and appropriate environmental conditions also influence the physical character of the Room. Finally, questions of flexibility and adaptability stemming from the using service's program emphasis are very real factors of choice. These secondary and tertiary concepts will be introduced and developed as discussion goes on.

C. BASIC CHOICES

Major differences between music and drama first appear in Room design. However, there are a few important choices related to both uses, roughly corresponding to the three primary variables above. The choices are:

- ***Use of the Room for music, drama or both (shape).***
- ***Relationship of audience and performers in Frontal, Thrust or Surround form (arrangement).***
- ***Estimated seating capacity (size).***

In the context of Army Performing Arts program goals and constraints developed in Chapter 2, the force of logic favors answers that amount to "most likely" choices, although it should not preclude variation.

1. Uses

Will the Room be used for both music and drama, and if so, to what degree is each to be stressed? This question has many implications which will be discussed in conjunction with Room criteria for each use. This Guide assumes that in all cases one use will dominate according to program emphasis.

2. Arrangement of Participants

What will be the spatial and operational relationship of audience to performers? The most common forms this relationship takes all recognize the separateness of stage and audience. These forms are called Frontal (proscenium), Thrust (projected), and Surround (arena). In

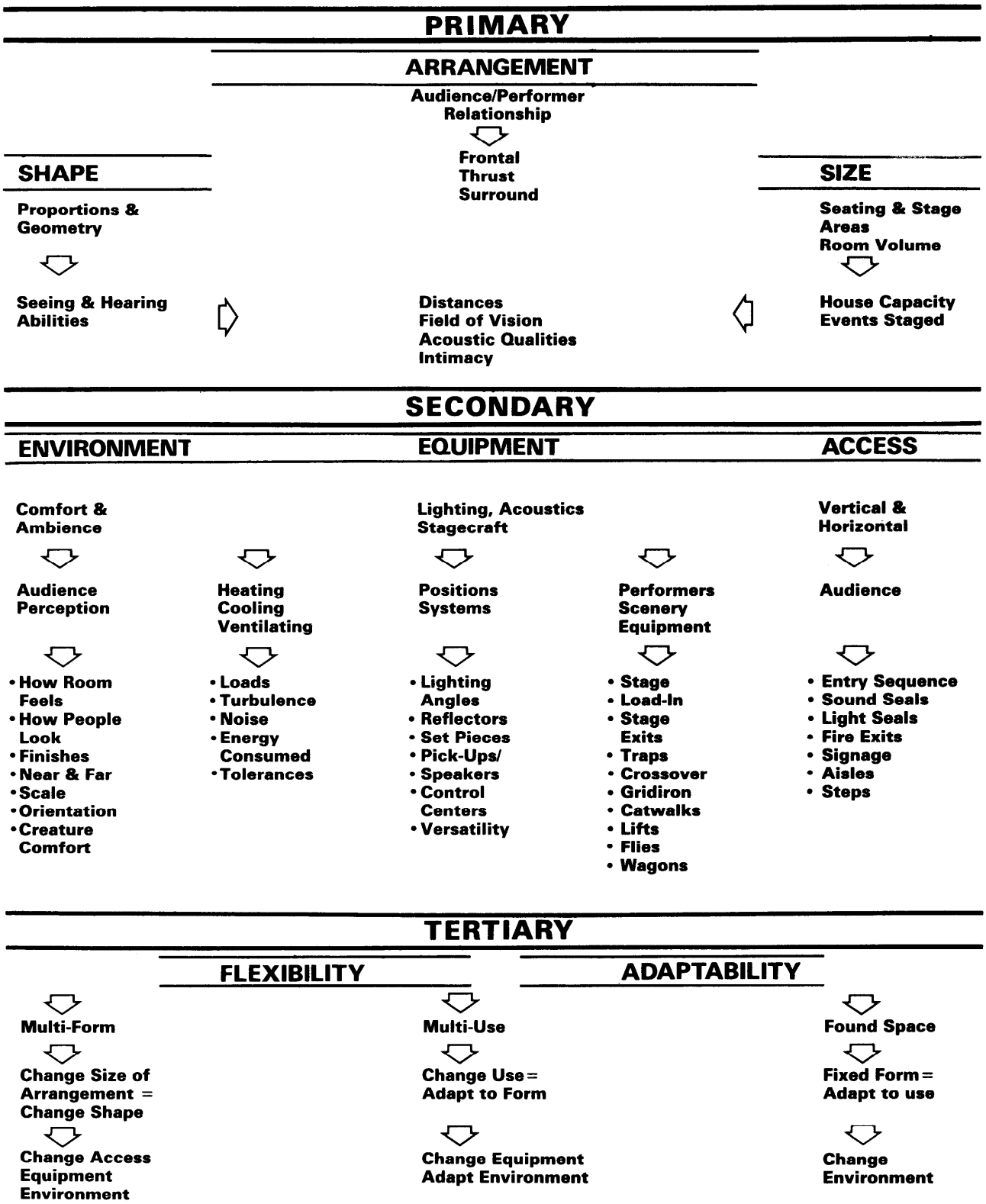


FIGURE 3-2.2 ROOM CHARACTERISTICS: INTERNAL RELATIONSHIPS

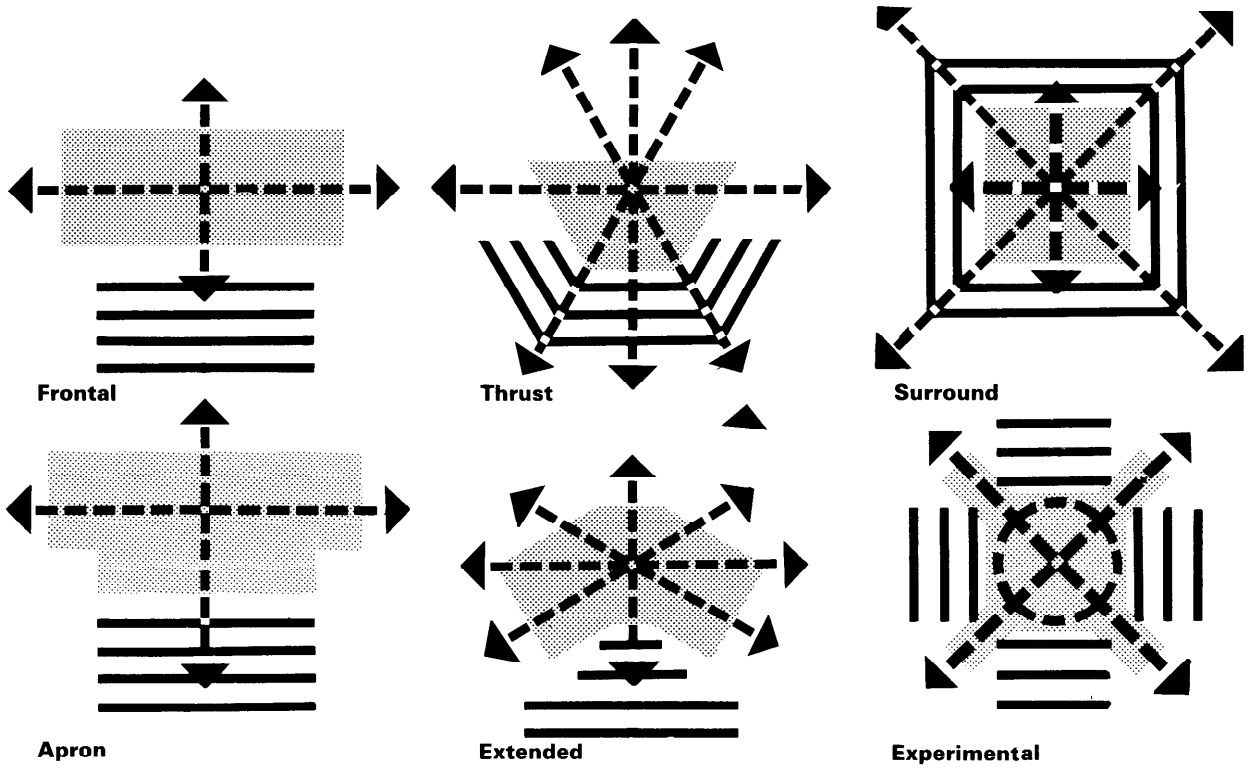


FIGURE 3–2.3 AUDIENCE-PERFORMER ARRANGEMENTS

Army performing arts activities the Frontal form offers substantial advantages, and in most cases this form will be chosen by Army Program Directors.

- ***a.*** *The bulk of repertory and music literature assumes Frontal.*
- ***b.*** *A proscenium is a ready-made frame of reference for actors, directors, and technical designers.*
- ***c.*** *Performers and audience have established expectations based on experience with the most common (proscenium) theater form.*
- ***d.*** *A proscenium generally results in maximum impact of scenic effect.*
- ***e.*** *Scenery creates opportunity for backstage involvement of non-acting participants.*
- ***f.*** *Pre-designed stage equipment relationships are most likely to provide consistent built-in production quality, with a 'memory" for improvements.*
- ***g.*** *Incoming touring shows are typically designed for the most common theater form.*

Moreover, the Frontal form is most versatile for the likely range of Army secondary uses (see Section 3-7 for detailed discussion):

- ***h.*** *Dance presentation will work if the stage is large enough.*
- ***i.*** *Variety revues find Frontal most adaptable to different acts.*
- ***j.*** *Public addresses, ceremonies and lecture demonstrations favor uniform viewing relationships.*
- ***k.*** *A range of music group sizes fit the stage, and established methods for adjusting acoustics are well developed.*

3. Audience Capacity

How large should the House be? How many seats? In terms of audience size, basic design criteria such as viewing distance and acoustical characteristics determine capacity according to performance type, Room volume, and Room configuration. However, in order to begin planning a new facility one must have some general idea of potential audience size, (see 2-4.d).

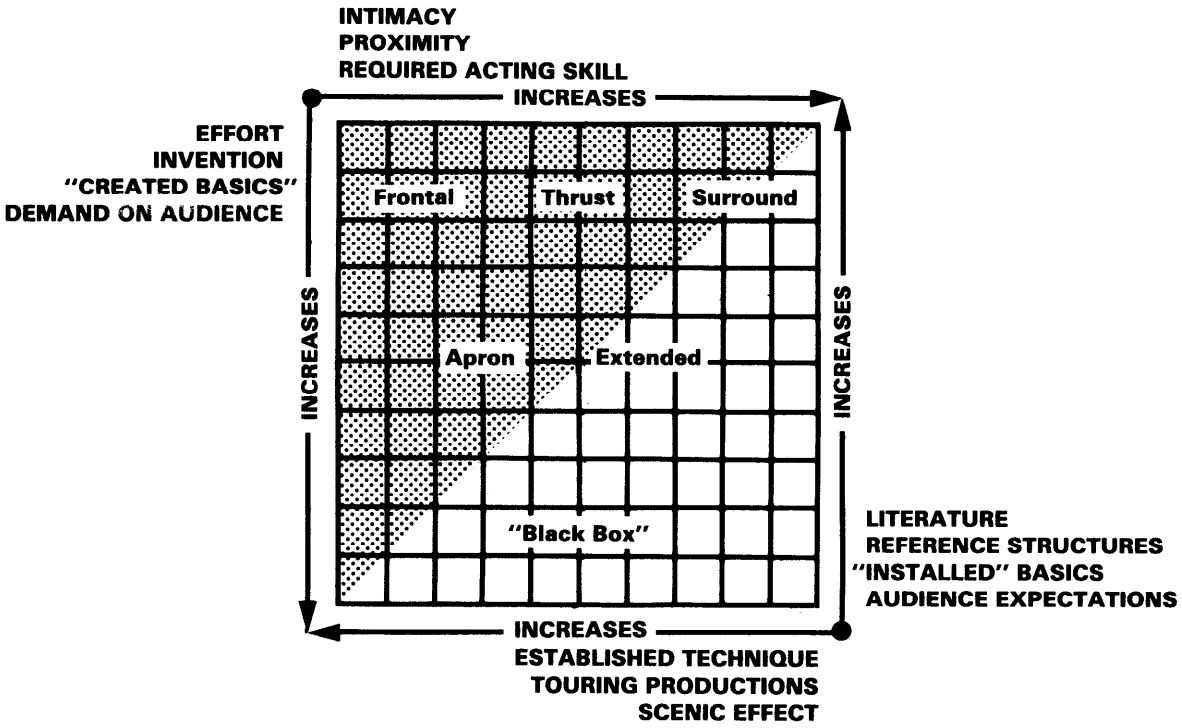


FIGURE 3-2.4 ROOM FORMS: PROBABLE CHOICES

This Guide will discuss three seating capacities as most likely choices for Army Music and Drama Programs. They have been chosen primarily because they work well with established music and theater design criteria. The capacities are approximate numbers which can give or take 100 seats.

Facilities of existing installations do not necessarily conform to these three groupings. Smaller houses of around 100 seats have been developed as dinner theaters adjunct to a regular drama program. Generally, dinner theaters require more square footage per seat, plus considerable food service area. They are most successful when an intimate relationship between audience and performer is established by the arrangement of the Room.

Many existing 300-500 seat Army facilities are conversions of former 1000 seat movie houses. The 300 seat range appears most commonly at small installations where space for support facilities (Backstage and Front End) are at a premium.

At an installation having a 500 seat facility used for varying types of activities, the Program Director found that 500 works well for most legitimate drama, is too large for "serious" plays, and too small for musicals which consistently sell out.

a. 300 Seats:

For technical reasons 300-seats represents a small legitimate drama house for a modest, local community audience. It offers economical production, which in turn encourages exploration and frequent turnover for varied experience and participation. Its concept is pre-professional or avocational involvement. A smaller house lacks "critical mass" to appeal to general audience interest and will find it difficult to justify the cost of equipment needed for a working plant.

b. 650 Seats:

Because it verges on the limit of optimum vision conditions in a Frontal house, 650-seats represents a large legitimate theater. Of course, there are many larger commercial theaters. For music 650 corresponds to the smallest music house likely to be built as a singular facility. Smaller rooms are not ruled out, but they are technically limited to music forms,

such as chamber quartets that comprise a very small portion of today's listening audience.

c. 1400 Seats:
By American standards 1400-seats represents a large recital-ensemble room, or a medium capacity concert hall. Most recent symphony halls, partly for economic reasons, seat 2300-2500 (a practical upper limit for Frontal design with natural acoustics).

While the Design Guide's emphasis of primary-purpose Frontal form facilities of three capacities is intended to add clarity in subsequent discussion, these "most likely" choices are also founded on functional and practical considerations special to the military context. In general, the economic forces and institutional motivations at work in civilian communities inevitably result in slightly different trends, toward large capacity multi-use stagehouse rooms and more modest open stage or non-Frontal theaters. However, basic design principles are similar.

Unlike many privately sponsored performing arts facilities which develop over many years, permanent Army MDC's are expected to be one time capital expenditures, completely operational on opening day. It will be advantageous to choose a theater design that provides today most of the physical plant and technical components foreseeable as future needs. The chance to add a stagehouse, orchestra pit or balcony, or to otherwise appreciably alter a permanent facility, is remote. In part, the Design Guide emphasizes the Frontal Room equipped with a fly-loft because it utilizes (and illustrates) the most frequently desired hardware lacking at existing (temporary) Army installations. In addition, there are many practical arguments favoring the proscenium theater/concert hall for military communities.

These considerations notwithstanding, open stage, Frontal, non-Frontal (Thrust or Surround) and adaptable configurations may be appropriate choices in some cases. Section 3-8A outlines important differences in the use of an open stage, but its main feature is the substitution of movement, lighting and relatively portable stage pieces for the more traditional scenic investiture.

A serious non-Frontal facility might be undertaken in response to a well-defined need in the community (for instance, if it already has a good conventional theater) or to a special set of program goals (such as minimal scenic repertoire and maximum role-playing development) or to unusual environmental factors (open air facilities, highly mobile installations, inaccessible locations). An isolated post need not worry about attracting attendance, critical acclaim, or regular commercial road shows, but it could have an extra requirement for intimacy. A highly transient population would best use performance facilities designed for spontaneity and minimal production time.

There are two categories into which appropriate non-Frontal Rooms may fall: large scale and small scale. Operating elements must be manageable in number and complexity to yield the maximum range of variation. Whereas a small Room can contain a kit of many parts, a larger Room should have a few major devices by which it effects change when needed: the orientation, extension or dressing of the stage; placement of an orchestra enclosure or choral risers; preset lighting configurations; portable acoustic absorption or reflectors; preset electronic sound reinforcement pattern.

Large-Scale Room:
The factor of scale makes inclusion of a large non-Frontal Room in the institutional context of the Army necessarily a very deliberate choice. Scale has its impact in cost, quality of acoustics and visual environment, potential technical snags and conflicts, and the importance of seat-filling performance. Failure is magnified more than success.

Small-Scale Room:
The small-scale versions will probably be 'alternative" Rooms-that is, Rooms in addition to a more typical facility-for the purpose of experimenting. Hence, these Rooms will be multiform spaces with readily transformed moveable seating and/or staging elements.

There are doubtless similar exceptions to the seating capacities recommended by this Guide. Existing Army theater facilities do not conform to these size categories, mainly due to constraints imposed by conversion of found space in repetitive (temporary) building stock. Smaller houses of around 100 seats have been developed as dinner theaters adjunct to a regular Drama program. Generally, dinner theaters require more square footage per seat, plus considerable food service area. They are most successful when an intimate relationship between audience and performer is established by the arrangement of the Room.

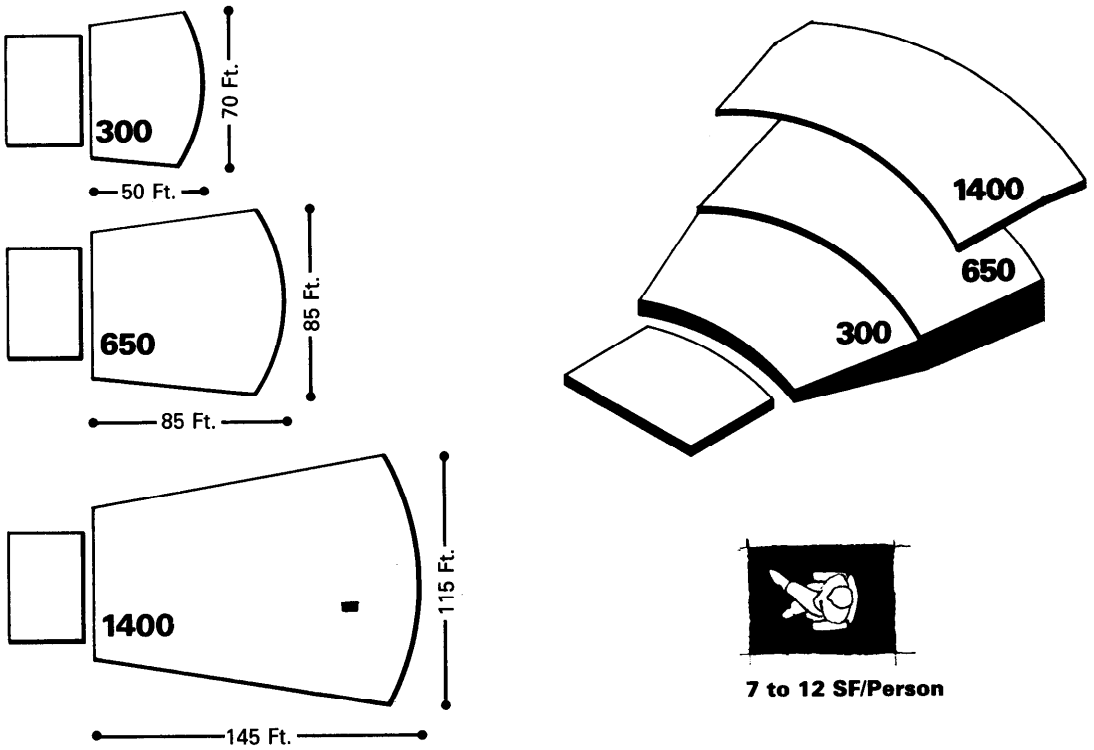


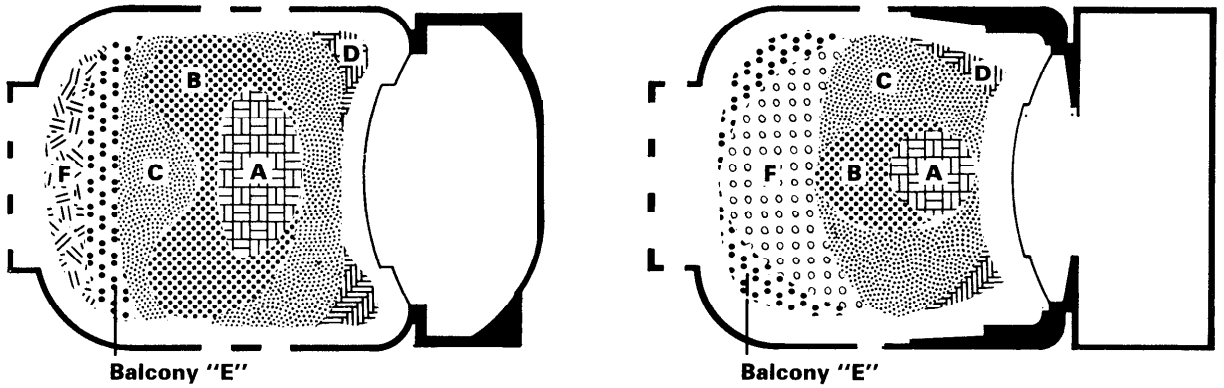
FIGURE 3–2.5 CAPACITY

Many existing 300-500 seat facilities are conversions of former 1,000 seat movie houses. The 10,000 SF movie theater ground plan was divided either to favor the Stage (with almost no audience support-only 1100 GSF) or the Front End (leaving only 2000 GSF for all stage functions). Lean-tos were added for dressing rooms and the house would seat 200-250. In most cases, additional space was borrowed for workshops, storage and rehearsal at remote locations. Often, administrative offices were shared or separately housed. These scattered, temporary facilities are a serious disadvantage and scarcely resemble a Music and Drama Center.

At an installation having a 500 seat facility used for varying types of activities, the Program Director found that it worked well for most legitimate drama, was too large for "serious" plays, and too small for musicals which consistently sold out.

It is presently difficult to find cause for building concert halls within the installation level Army Performing Arts Program, which tends toward the popular (amplified) music of today. Possibly in the future changing tastes and education could alter this. General assembly auditoriums seating 1000 are found on many Army installations, but they are not designed for Music. Large field houses, stadiums and amphitheaters seating thousands are available for massive events like rock concerts, with amplification the primary acoustic consideration. Therefore, 1400 seats was arrived at by eliminating the larger symphony hall as a special or occasional-use facility. A 70 piece orchestra, somewhat smaller band, a choir or combined vocal and instrumental presentation (or any of several possible smaller ensembles) would be best suited to a 1400 seat Room.

Finally, these are special constraints imposed by Army regulations. DOD 4270.1-M space allowance criteria were first applied to theaters in the early 1970's context of found space conversions and all-purpose recreation/entertainment centers. Section 3-15 of this Guide tabulates area requirements for a range of MDC types; the requirements of even minimum functioning facilities exceed the current DOD criteria of 14,000 and 20,000 GSF for small and large MDC's, respectively. The amount of difference is about equal to the Front End (audience support) com-



Music
Based on Auditory Quality

Drama
Based on Visual Quality

FIGURE 3–2.6 AUDIENCE SEATING PREFERENCES

ponent. Since, for the most part, cast quarters are minimal-well below professional standards-no reduction can be looked for in Backstage area.

Cutting the recommended seating capacities in half (150,300 and 500 seats according to whether Music or Drama programs are involved) would bring all but the Large Music facility within the current DOD criteria but essentially perpetuate existing inadequte conditions. It is expected publication of this Design Guide will bring about a review and adjustment of space allowance criteria.

D. ROOM QUALITIES

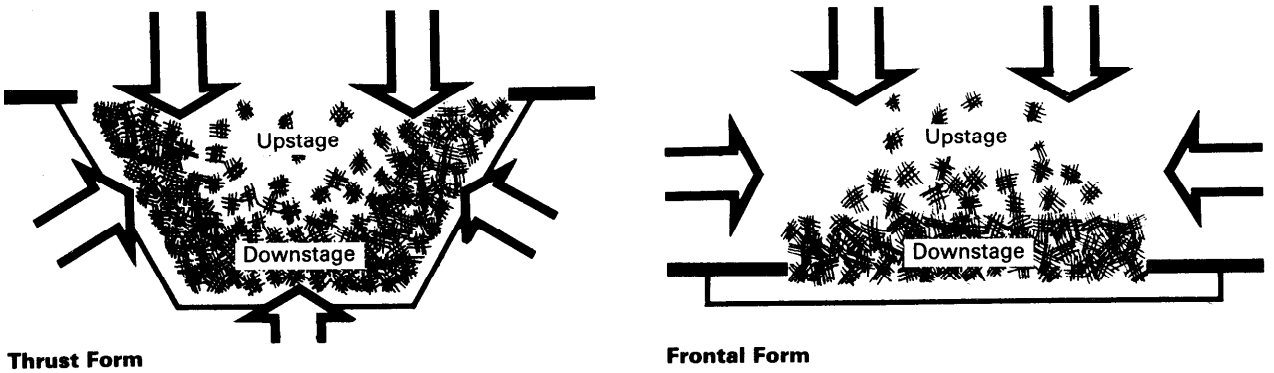
Performance is communication and Drama Rooms differ from Music Rooms according to the medium of communication between performers and audience. Drama works with visual illusion, movement, gesture and the articulation of spoken words. Music works with aural illusion, rhythmic patterns, tonal variations and subtle interactions of sound. In live performances, the give-and-take of communication relies on both vision and hearing, but each art form emphasizes one or the other. Desirable Room qualities vary accordingly. When these desired characteristics are followed out to their physical and functional implications, they describe different Rooms.

The following two sections discuss the qualities of Drama Rooms and Music Rooms sought by audiences, performers, writers and composers. Naturally, descriptive language tends to reflect their separate viewpoints. The Room must assist performers to deliver, and audiences to appreciate, the full content and embellishment of the literature. Because many works are written with a specific theater configuration or acoustic character in mind, directors for a given Room may have to select or modify productions to suit it, or modify the Room itself.

Between Drama and Music there are broad differences in the way quality is described. As long as the actors' speech can be clearly understood, vision qualities are the most important measures of Drama Rooms. For Music, the quality of sound is the dominant consideration. Good vision is easier to define in objective terms; the spatial relationships governing vision are relatively direct and geometrical. Good sound is a far more subjective impression. Human hearing combines direct and indirect sources, responds to pitch and intensity in a non-linear fashion, and is affected acutely by the additional dimension of time.

Analogies between the behavior of light and sound have been made to help describe subjective impressions, but these are inadequate for determining acoustic criteria and design guidance. The many similar terms that are used to describe both phenomena-color, warmth, clarity, tone, intensity, brilliance, intimacy-need examination and redefinition. This is the acoustician's specialty, no less a craft than stage and lighting design, involving variations of technique and conceptual inclination as well as science.

An overview of important considerations is furnished next. It begins to suggest the functional priorities inherent in Drama and Music.



Thrust Form Frontal Form

FIGURE 3–3.1 ACTING AREA ZONE

3-3. DRAMA ROOM QUALITIES

A. VISION FACTORS

A Room built for Drama should enhance the special qualities of live performance that cannot be transmitted in film, video or printed media. Among these are continuity and individual control of viewpoint and the communication of spontaneous reactions, shared with others and registered on the course of events. Some of this is verbal byplay, but theater is a place where images become as malleable as words. Certain qualities of the Room lend facility to this purpose.

1. Ability to See Stage

The best Rooms permit a clear view of the entire performance area and surrounding scene space. On a Frontal Stage, the most critical vision field is downstage for the width of the acting area. However, the acting ***space*** *must be seen in depth, too.*

2. Ability to See Action

A key element of Drama is movement, which is most readily perceived across the line of vision. For the Frontal form, this movement is basically side-to-side with respect to the centerline of the Room. A proscenium in the foreground is the major frame of reference, while scenic elements furnish context and scale. In the absence of a proscenium (open stage) action assumes an immediate, "in the same room" quality unless scenery and lighting contrasts are made to perform the proscenium function. For projected stage forms with no proscenium, action is perceived from several directions. In this case, perception of relationships among actors is critical and scenic material should not hinder vision. Dramatic and directors' interpretations may place different stress on foreground, context, and background references. Within limits, the same literature can be adapted to different stage forms.

3. Ability to See Detail

Dramatic performance emphasizes perception of actors' expressions, gestures, and body movements. Perception of detail is related to viewing distance and angle of address. Distorted perspective, usually a result of close quarters, and foreshortening due to elevation of the viewer, should be avoided.

4. Uniformity

This is a double-edged judgment of quality. Everyone should have a superb experience of the drama, but it will not necessarily be the ***same*** *experience. If one assumes the artist's purpose is to communicate to the audience a specific image, the uniformity of what every viewer sees is a positive value. This concept of "uniform effect" is sometimes considered an advantage of a Frontal configuration, based on maximizing seats near the Room centerline.*

Obviously, factors of distance and vertical angle can be equally important. If the artist's purpose is to communicate ***with*** *the audience, proximity and focus are also positive values. The quality of "intimacy" is more easily associated with the Thrust and Surround configurations that create the sense of audience and performers together in one space. A Frontal room can also be intimate, either because it is small enough to promote eye-contact or because the audience is aware it shares a mutual experience within the space.*

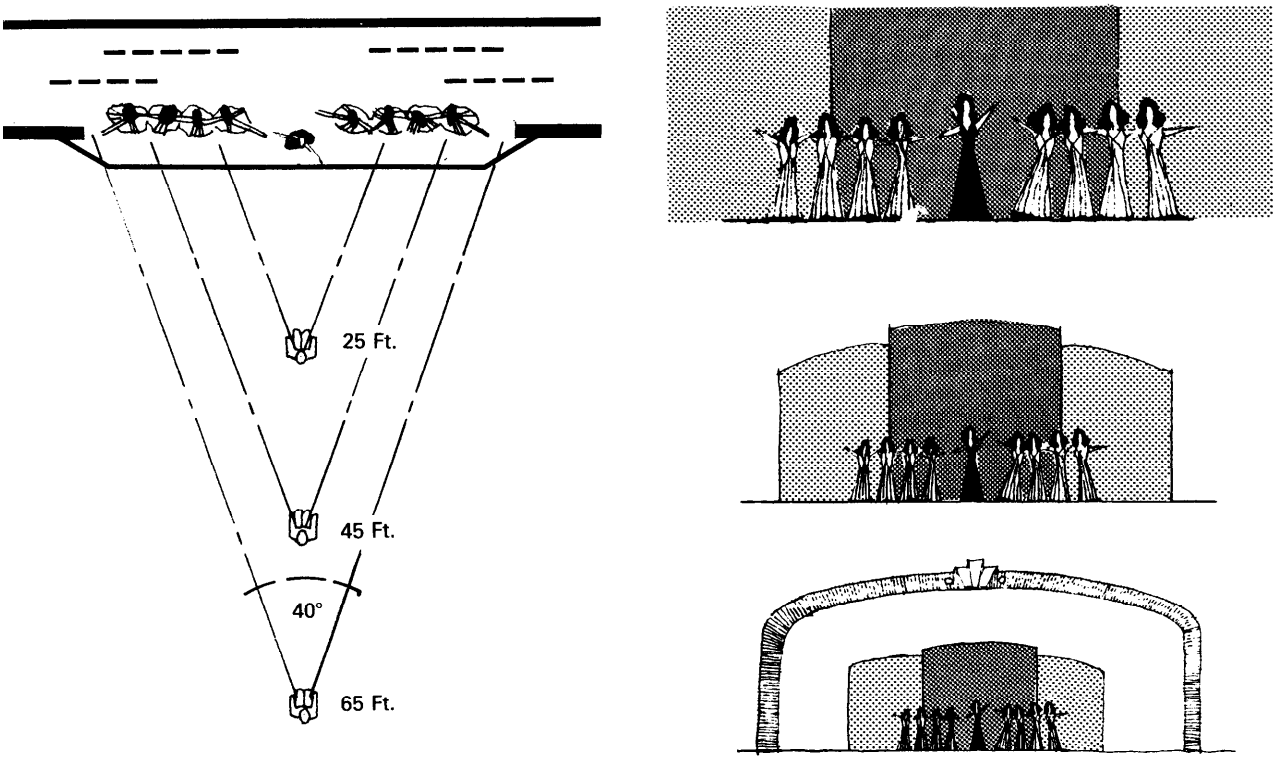


FIGURE 3-3.2 DISTANCE AND DETAIL

Uniformity comes to mean that everyone has an equal chance for a fine experience in a Room that may offer a variety of viewing positions, none of which can be easily labelled "better".

5. Actors' Ability to Orient

In the Frontal form actors orient to the proscenium and/or stage set, and gauge their movements accordingly. The shape and arrangement of the acting area can also be used to differentiate regions within the world created by the play. When there is little scenic material, this definition of "'place" assumes greater importance for both actors and audience.

6. Actors' Ability to Sense the Audience

Actors play to the audience. They need to see the audience response-another factor for audience proximity. Moreover, actors respond best to an apparently full house. The seating area should not be oversized; at least, its configuration should permit maximum use of near stage seating.

7. Functional Technical Support

Vision factors enter in to placement and selection of accessory equipment. Lighting angles affect an instrument's field of coverage and uniformity of intensity, while distance accounts for required power. Persons con trolling these instruments need to see the action from an audience point of view. Offstage prompters need to be seen by actors, and unseen by audience. Pit musicians need to see the conductor, who in turn must coordinate their efforts with the action on stage.

8. Overall Influence of Vision Factors, Drama

Geometric and psychological aspects of vision determine many point-to-point relationships in the Drama Room. Vision criteria are essential to setting the dimensions and positions of floor planes on which the audience sits, points in space where equipment is mounted, and the location of the proscenium and stage dressing-all in relation to the acting area.

B. HEARING FACTORS

For Drama, the implications of hearing criteria are less complex than for Music, but qualities discussed here are important to Drama.

1. Ability to Comprehend Speech

Articulation and intelligibility are essential. The

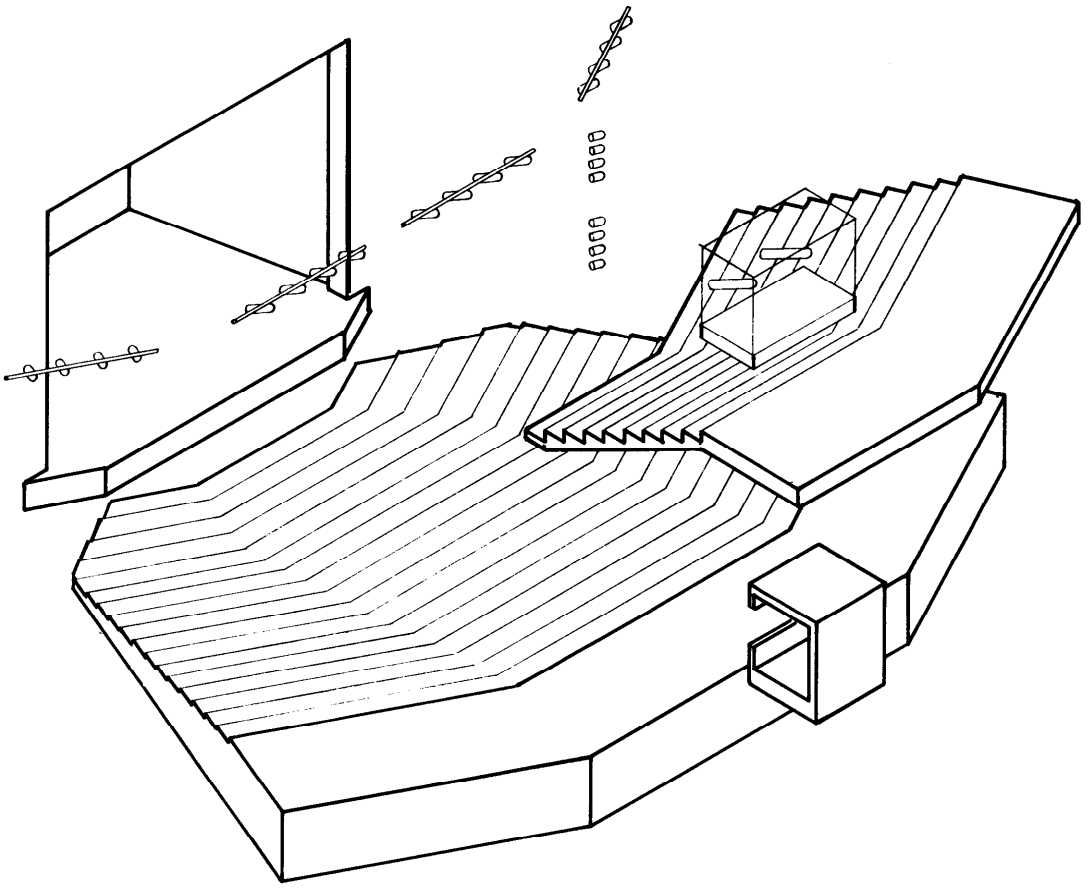


FIGURE 3-3.3 DRAMA ROOM-SHAPED FOR VISION

actors' voices should not be garbled by reverberations and echoes.

2. Ability to Hear

Speech sound levels must be high in every part of the house relative to background noise. The human voice is not especially powerful as a source without careful training, but the discriminatory powers of the ear are amazing. Forced loudness is immediately discernible as unnatural.

3. Freedom From Distraction

While continuous noise sets the level against which speech is heard, isolated, unrelated sound events and discontinuities in noise levels draw attention to themselves and constitute distractions and annoyances.

4. Congruence of Action and Sound

Both our ears and our eyes possess directional abilities. If our ears and eyes disagree about directions we are uncomfortable. Similarly, the nonsimultaneity of observed action with perceived sound can be disturbing. Dramatic impact often depends on close timing and convincing sound effects.

5. Ability to Assess Projection and Hear Cues

Actors have hearing requirements, too. They need to hear cues in order to coordinate actions. They also need to estimate the intensity of voice perceived by the audience. Hence, relative sound levels and qualities should be the same on stage and in the house.

6. Ability to Modulate Accompaniment

Musical accompanists need to hear the principal actors or singers in relation to their own sound production as the audience hears it. At the least, the conductor must be able to coordinate musical accompaniment with other sounds leaving the stage.

7. Ability to Adjust Sound Levels
Technicians must hear what the audience hears in order to adjust artificially produced sound levels, or to signal actors or musicians if an imbalance occurs.

8. Overall Influence of Hearing Factors, Drama
Hearing requirements set up criteria for reverberation, ambient noise levels, sound intensity, time delay and directionality that in general will be shown to relate to details of the Room's enclosure and boundary surfaces. Hearing factors also influence pit and stagehouse design, control locations, and sound system criteria.

C. OTHER FACTORS

Some desirable Room qualities stem from functional needs that have more to do with ease of use, economy, comfort and safety than with the performance experience. These have been called secondary and tertiary considerations (see 3-2b) to denote order of treatment.

1. Equipment
Lighting, rigging and scene handling activity involve a great deal of physical mobility during the performance and its preparation, but it must not impinge on or distract from the performance. Also, the design and location of this equipment in turn influences Room configuration, building structure and power system design.

Equipment quality refers to usefulness and sufficiency in application. Quantities of equipment can be rented when needed, but the basic systems must be completely thought out to anticipate a range of circumstances. Poor equipment limits production choices.

2. Access
Moving scenery and people on and off stage in various ways before and during performance is no small feat. Lighting and rigging equipment requires technicians' access for adjustment, control and maintenance in place. Moreover, the need for safe and efficient audience entry and exit paths will affect house layout. These all have direct consequences in physical form.

Access quality is judged by the ease and efficiency of its accomplishment. Poor access can limit production choices and lengthen production time. It can also prohibit adjustment of house capacity and arrangement.

3. Environment
Heat generated by lighting equipment and an assembled crowd must be dealt with by an air conditioning system that does not hinder performance activities, create noise and draft, or obtrude on enjoyment of the drama. Environmental systems should readily adjust to varying demand.

Environmental quality is measured by the absence of discomfort. A poor system can restrict audience size and stagecraft techniques employed. It can also be expensive to operate in the long run.

4. Flexibility
The ability to use the Room in different ways is to some extent proportional to the magnitude and flexibility of equipment systems. However, reliance on equipment can be a limiting factor, and very expensive, if equipment is not planned as accessory to the Room itself

*Flexibility is evaluated as the ability to accommodate **anticipated** uses, not just any use. This means providing the Room qualities for each use, some of which imply unchangeable concrete decisions that will rule out options for other qualities. The basic choice of arrangement (3-2c) must be made in anticipation of multiple uses. Poor planning for flexibility results in facilities that are not especially good for anything.*

If a Drama Room is to be used for Music, it will be easier to adjust for the vision factors than hearing (acoustic) qualities. Without sophisticated electronics, the Multi-Use Drama Room has distinct limitations in this regard.

3-4. MUSIC ROOM QUALITIES

A. HEARING FACTORS

A Room built for Music is intended to add to the sounds experienced, just as the Drama Room adds light, color, movement and continuity. We cannot define why music is pleasurable, but there are qualities of live performance that cannot be recorded and reproduced elsewhere; every space adds its characteristic stamp to the sound generated in it. Musicians adjust their technique in response to what they see and hear

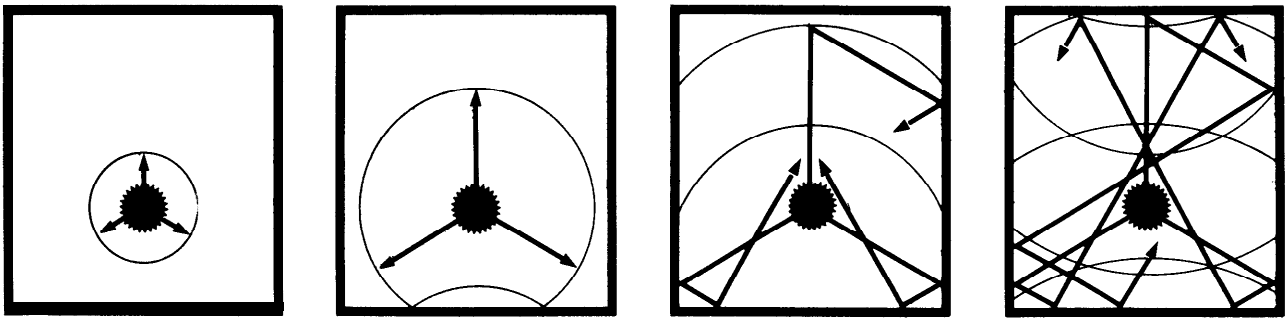


FIGURE 3–4.1 SOUND WAVE IN ENCLOSED SPACE

and listeners are caught up in the continuing improvisation, making for a fuller appreciation of subtle variations and combinations. Observation reveals certain qualities that enhance this experience.

1. Ability to Hear All Levels of Sound

This is sometimes generalized in terms of the dynamic range of music that can be heard in the Room. It is evaluated in terms of loudness, or the strength of sound perceived by the listener and the evenness of this characteristic over a range from the quietest (audience noise) to the strongest fortissimo that does not produce discomfort.

Loudness in music listening is a complex subjective measure. We hear the sound issuing directly from the performer and its reverberations in the Room as "one sound" unless something is very wrong acoustically.

2. Appropriate Reverberation

An important measure of Music Room fitness is decay of reverberation over time, or the persistence of audible sound after its source has stopped. Normally, two to three seconds elapse.

Like loudness, reverberation time is not a simple measure. One Room's reverberant characteristics will differ from another's and the pattern will also differ with musical pitch. Thus as the liveness also contributes to dynamic range, dynamic range can be one guide to how well a given piece of music or collection of instruments will be heard. In terms of loudness, reverberant characteristics are clues to tonal qualities and the styles of music that will sound "right". Composers write music with the reverberant environment in mind, be it a cathedral, recital hall or parade ground.

3. Enhancement of Musical Qualities

Subjective opinion, comparison with familiar models, education of the ear, and individual preference all enter into the judgment of what makes one Music Room better than or different from another.

The acoustician, musician, and critic do not lay claim to a precise science, but to observable phenomena. Rooms that are judged good from these viewpoints have been carefully examined for consistent evidence. As a result, acousticians have gathered a better understanding of how subjective impressions are formed and the conditions that produce them.

a. *The relationship of direct (source) sound to reverberant (reflected) sound influences many of the subjective impressions of quality. Loudness of direct sound falls off with distance and is affected by the design of the stage and its surrounding surfaces.*

A portion of this sound strikes reflective surfaces and reverberates, losing energy as it travels and bounces. Loudness of reverberant sound therefore falls off in proportion to the amount of absorptive materials (including people) in the Room and to the fraction of direct energy that does ***not*** *go straight to the listener. In a small Room, the direct/reverberant ratio is high and reverberation time short. Music sounds dry, sharp and even clinical.*

Increasing the volume will lengthen reverberation. Altering the "sending end" can increase the portion of sound directed into this volume versus that sent the listener. So doing results in a "fuller" tone.

b. *Tonal quality is a judgment of what the Room adds to or subtracts from the sound. "Brilliance" refers to enrichment of high*

frequencies relative to mid-frequencies. "Warmth" refers to fullness of bass tones. The reverberation time for mid-frequencies is the primary reference for these qualities and the measure of a Room's "liveness".

c. *"Definition" and "clarity" describe how distinctly sequential and simultaneous sounds are heard. It is a function of reverberation time, direct/reverberant loudness, and blend.*

d. *"Balance") the perceived relationship among sections of the orchestra, and "blend", the harmonious mixing of instrumental voices, are related to the disposition of the players and design of the stage enclosure.*

e. *"Intimacy" or presence is what we hear in a small Room. Our impression of a Room's size is determined by the time interval between hearing direct sound and its first reflection. Moreover, the direct/reflected loudness ratio must not be too small.*

4. Musicians' Needs

Musicians are sensitive to the ability to hear themselves. Two qualities are important: 'ensemble", ability to hear others and play in unison, and "attack", the immediacy with which first reflections return to the musician, and by which he may gauge the effects of his playing. Both are functions of the stage enclosure and nearby portions of the Room.

5. Absence of Aberration

Exaggeration or lack of any valued quality is an aberration. The worst aberration is echo, a long-delayed and sufficiently loud reflection that can be distinguished by the ear as a separate impulse.

Geometric focussing intensifies echo. Since the size of a given surface can selectively reflect certain wavelengths, particular frequencies may be concentrated at a point resulting in the perception of a sudden intense slap. Near-parallel surfaces will produce a flutter echo.

Standing waves arise between parallel surfaces spaced a multiple of one-half a given wavelength. A continuous tone will cancel itself at one point and double at another.

6. Limiting of Noise

Noise can originate within the Room or outside of it. Continuous noise generated within the Room by the audience and mechanical system operation forms the reference baseline of perception and dynamic range. Intermittent noises

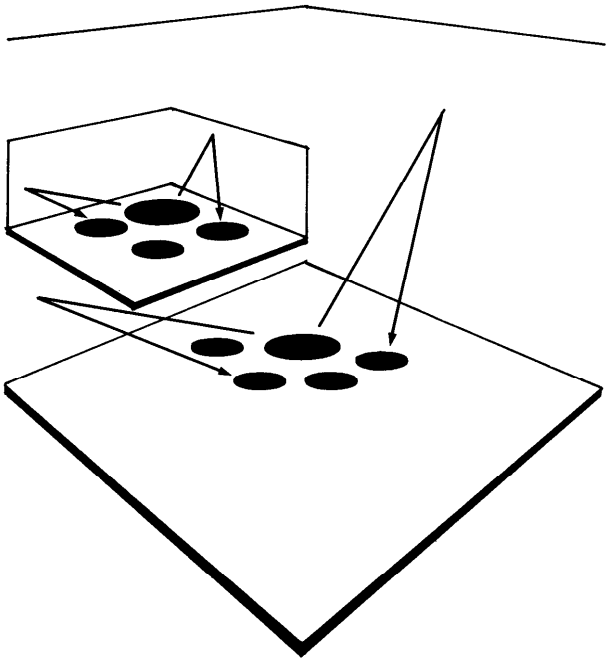


FIGURE 3-4.2 INTIMACY

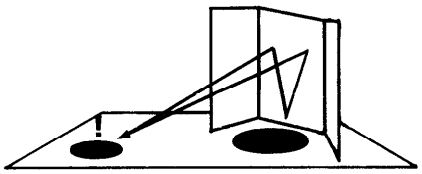
louder than this ambient level are annoying. Acousticians have developed empirical standards called preferred noise criteria (PNC) curves for various listening activities.

External noise is to be eliminated. The construction that retains sound energy in the Room generally excludes only air-borne noise. Sound can be transmitted by structure as well as by air. Hence, either the noise or the structure must be isolated.

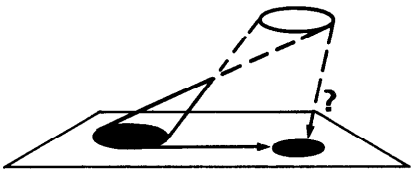
7. Fitness to Performance Type

Music types have varying properties and are intended to be heard in specific acoustic environments. A high degree of reverberant fullness is important to romantic works, while contemporary and chamber music profit from definition. Small orchestras and soloists emit less energy and should be heard in small Rooms. The composition of a marching band is designed for field house and parade ground.

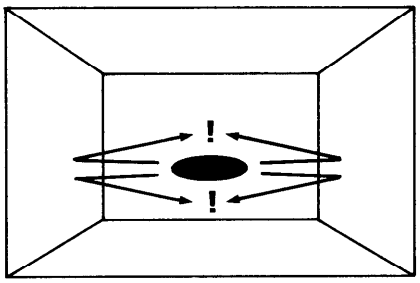
There is no average, all-purpose Music Room. It must be matched to the music intended to be heard. If the Room does nothing to enhance the listening experience, a good electronic playback



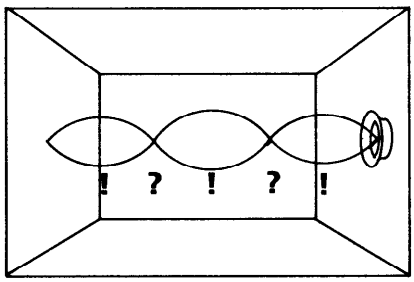
Focus
(Condensed Reflection)



Echo
(Delayed Recognizable Reflection)



Flutter Echo
(Rapid Series of Coincident Reflections)



Standing Wave
(Sound Pressure Build-Up/Cancellation)

FIGURE 3-4.3 ABBERATIONS

system is preferable; at least people don't risk disappointment that way.

8. Overall Influence of Hearing Factors, Music
Hearing (perceptual) and acoustic (physical) phenomena determine many of the desired characteristics of the Room enclosure and boundary surfaces, proportions, volume, materials, and connection to the external world.

B. VISION FACTORS

For Music, the influences of vision criteria are similar to those for Drama, but less crucial to success. Direct functional relationships dominate.

1. Performers' Ability to Read Music
Musicians are constantly looking away from the score and back again. For rapid accurate reading illumination levels, angles, evenness and relative contrast must be carefully controlled. Adequate space is needed to arrange awkward instruments and shared music stands.

2. Ability to See Each Other
Arrangement also permits needed eye contact among musicians and easy view of the conductor. Its importance increases when soloists or dancers are involved.

3. Ability to See the Audience
The best performance is one in which performers and audience respond to each other. Again, relative illumination and arrangement are important. Moreover, musicians are sensitive to the Room's ambience, its color values, and (statistics show) its "woodiness".

4. Functional Technical Support
Broadcast, recording, sound reinforcement and lighting technicians need to see performance activity, preferably as the audience does.

5. Audience Ability to See Musicians
The finest sound reproduction system cannot duplicate the experience of a live concert's extra dimensions of anticipation and participation.

6. Ability to Read and Navigate
Total absorption in performance is not characterisic of music audiences. In the absence of spoken narrative, reading the program notes adds to enjoyment and comprehension. Of course, listeners have to find their seats, the coatroom, restrooms, etc.

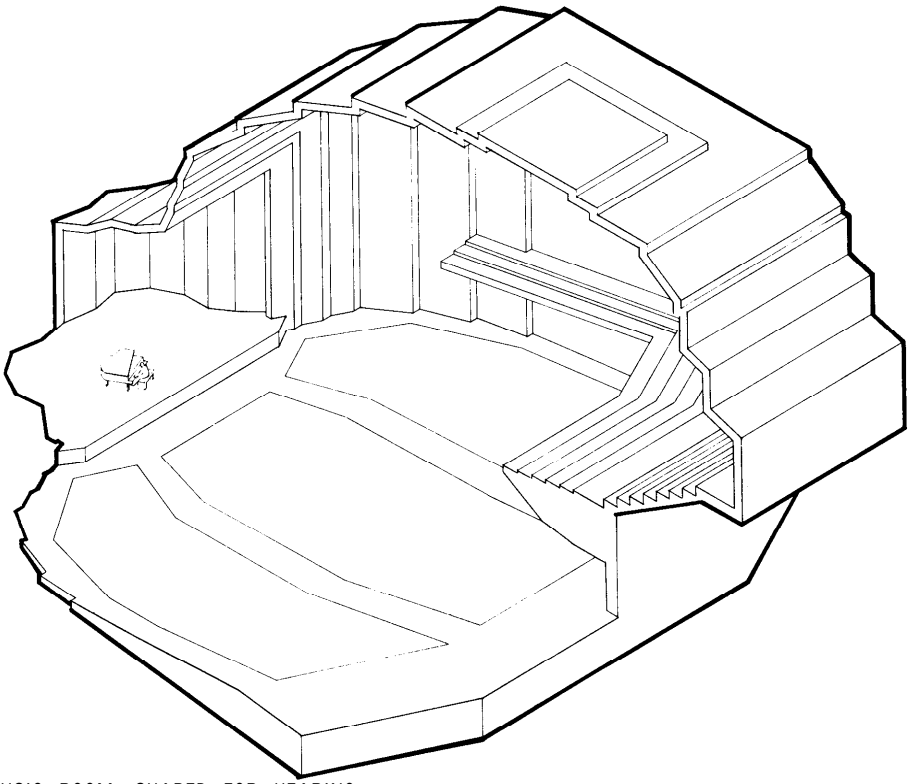


FIGURE 3-4.4 MUSIC ROOM–-SHAPED FOR HEARING

7. Perceptual Psychology

Room ambience is a description of how people look in terms of color and modeling of features. It is also how the Room looks in terms of color and "drama". Concert lighting is relatively simple. Since there is usually little movement, lighting shifts add interest and relative brightness focuses interest.

8. Overall Influence of Vision Factors, Music

Vision parameters mainly affect illumination, room finishes and arrangement of performers functionally. Physical design "improvements" for sight lines should be carefully weighed against potential ill-effect acoustically.

C. OTHER FACTORS

Four other factors (see 3-3c) have qualitative impact on Music Room design. Brief comments below indicate the emphasis regarding Music criteria.

1. Equipment

Accessory equipment for Music is typically less extensive in quantity than for Drama, but since it is most often custom made to suit specific needs, it is also more costly to replace. Therefore good built-in permanent equipment has real value. All theatrical equipment is subject to high standards of construction and installation to limit noise generation.

2. Access

There must be access to the stage for piano, chairs and stands, musicians and risers. Providing a suitable number and size of openings can affect the design of the orchestra enclosure. Doors, for audience access and egress, should be limited in number and carefully sealed to reduce sound loss and noise intrusion.

3. Environment

Since the audience is relatively sedentary, noise criteria are more stringent. Temperature and humidity stability are extremely important to maintaining musical instruments in tune. House lighting levels are slightly higher than for Drama.

4. Flexibility

In general, the ability to use the Room for different music presentation types depends a lot on repositioning sound sources (musicians) in relation to surfaces near them. These surfaces can

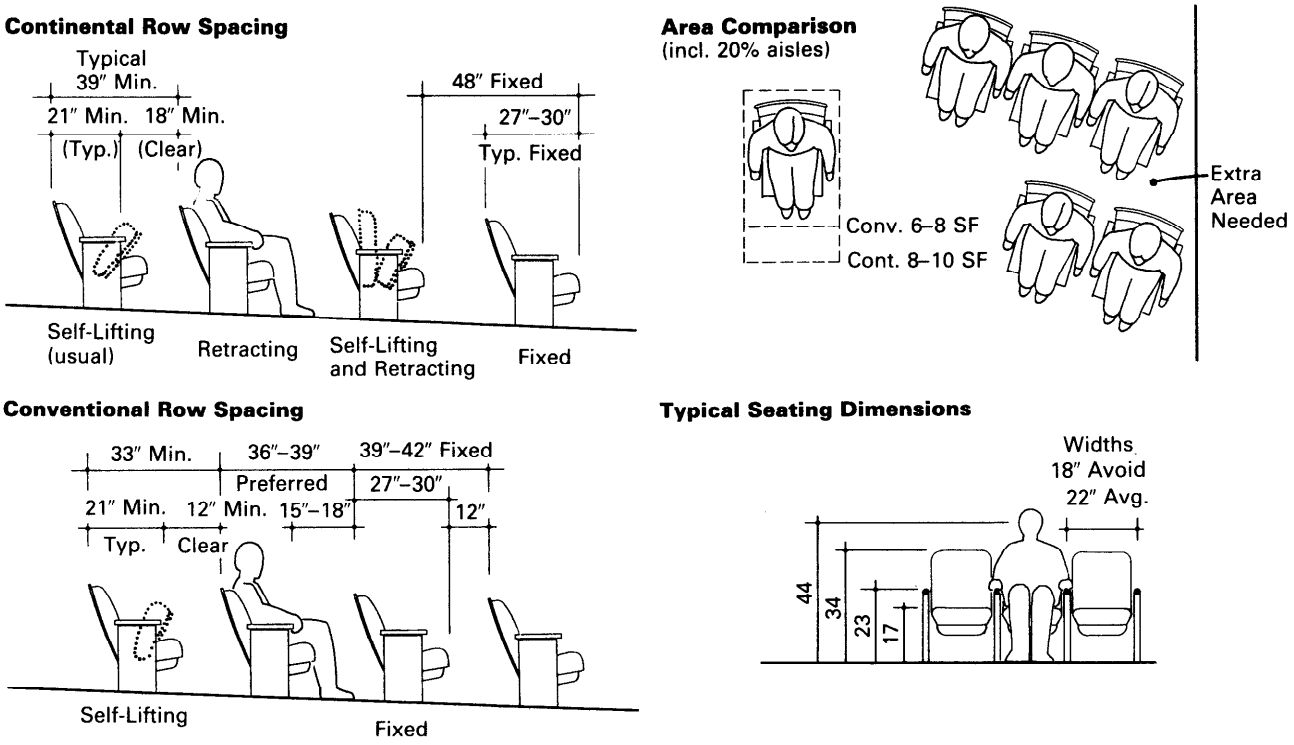


FIGURE 3-5.1 SEATING AREA UNITS

themselves be adjusted, but physical alteration of the enclosure should be undertaken with restraint, under supervision of a knowledgeable acoustician.

Flexibility refers to the conditions favorable for various music types, not strictly the number of musicians on the platform. Favorable conditions can often be accomplished by relatively small changes in several parts of the Room, balancing the type of music, number of musicians and size of the audience.

If a Music Room is to be used for Drama, it will be easier to adjust acoustic conditions than vision criteria. The Multi-Form Room concept is the most impractical for Music.

3-5. THE HOUSE

The House is one half of the Room. Investigation reveals two general concepts about it. Vision criteria, the major organizing principles of Drama uses, define the distribution of people in the House while hearing-criteria, the major organizing principles of Music uses, define the distribution of boundary surfaces. Second, varying the size of a Drama audience mainly influences the linear and planar geometry of the House, while varying the Music audience mainly influences volumetric geometry.

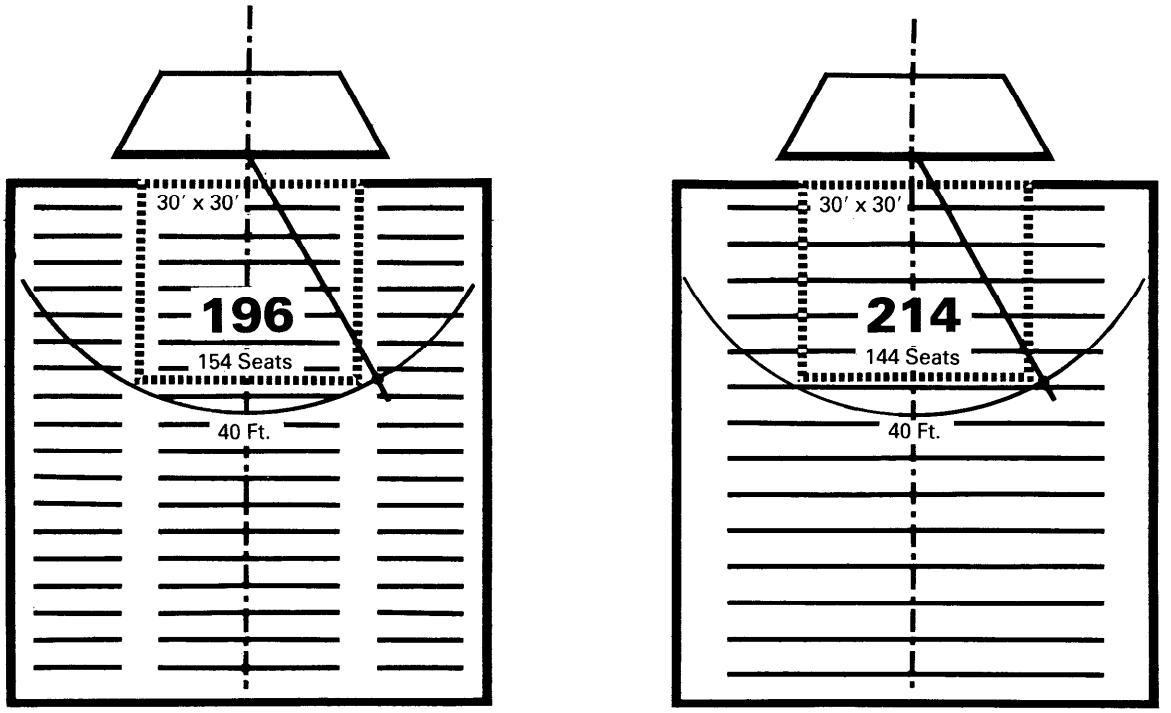
In this section, Drama (vision) and Music (hearing) considerations will be applied to the audience portion of a Room, in terms of the primary attributes of size, shape and arrangement. The effect of varying house capacity will be studied, but variations in the form of presentation will be addressed in discussion of the Stage (Section 3-6). For now, a Frontal arrangement is assumed, either legitimate drama or orchestra on stage. Details and technical data will be treated in succeeding sections and in Chapter 4 as appropriate.

A. DRAMA HOUSES

1. Seating Area Dimensions

The number and arrangement of seats defines the net floor area of the House (an aspect of size).

Reckoning of area includes allowance for aisles



CONVENTIONAL
(More Seats Centered)

CONTINENTAL
(More Seats Near Stage)

FIGURE 3-5.2 CONVENTIONAL VS. CONTINENTAL SEATING

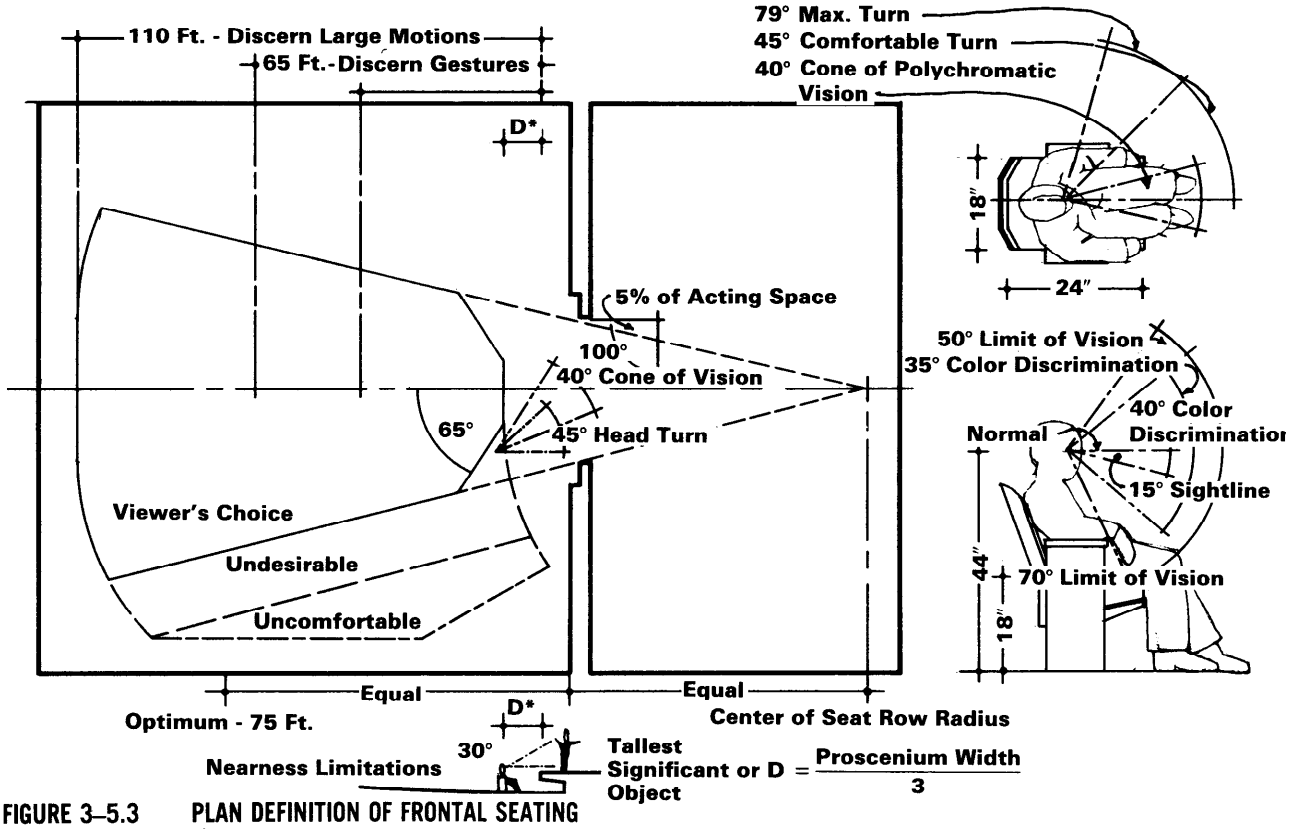


FIGURE 3–5.3 PLAN DEFINITION OF FRONTAL SEATING

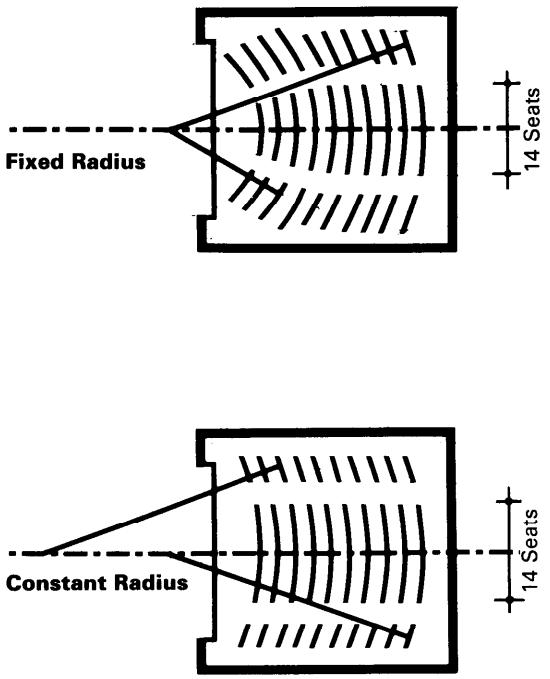


FIGURE 3-5.4 PLAN CURVATURE

and varies from 6 to 10 square feet per seat. Generally, a figure of 8 s.f. is good for first estimates although a higher number is usually needed for smaller capacities. This variation is caused less by differing seat dimensions than by conditions of arrangement. Sharp radius curves and ragged aisles introduce triangular residual areas. If seating is moveable, additional allowance must be made for imprecision and maneuvering clearances (13-15 s.f. is commonly used).

To assure a speedy exit in emergencies, conventional seating usually limits row length to seven seats accessible from one aisle or fourteen from two, with rows spaced not less than 33". Row spacing must be greater for continental seating, which is practically unlimited in row length. Continental requires wider end aisles with closely spaced exit doors. Continental gives more legroom seated, but more interference from latecomers. It also heightens the sense of vastness in a large Room. On balance, floor area per seat is the same for both methods.

2. Plan Arrangement with Respect to Stage

Vision criteria define the horizontal proportions (plan shape) of the Room with reference to the

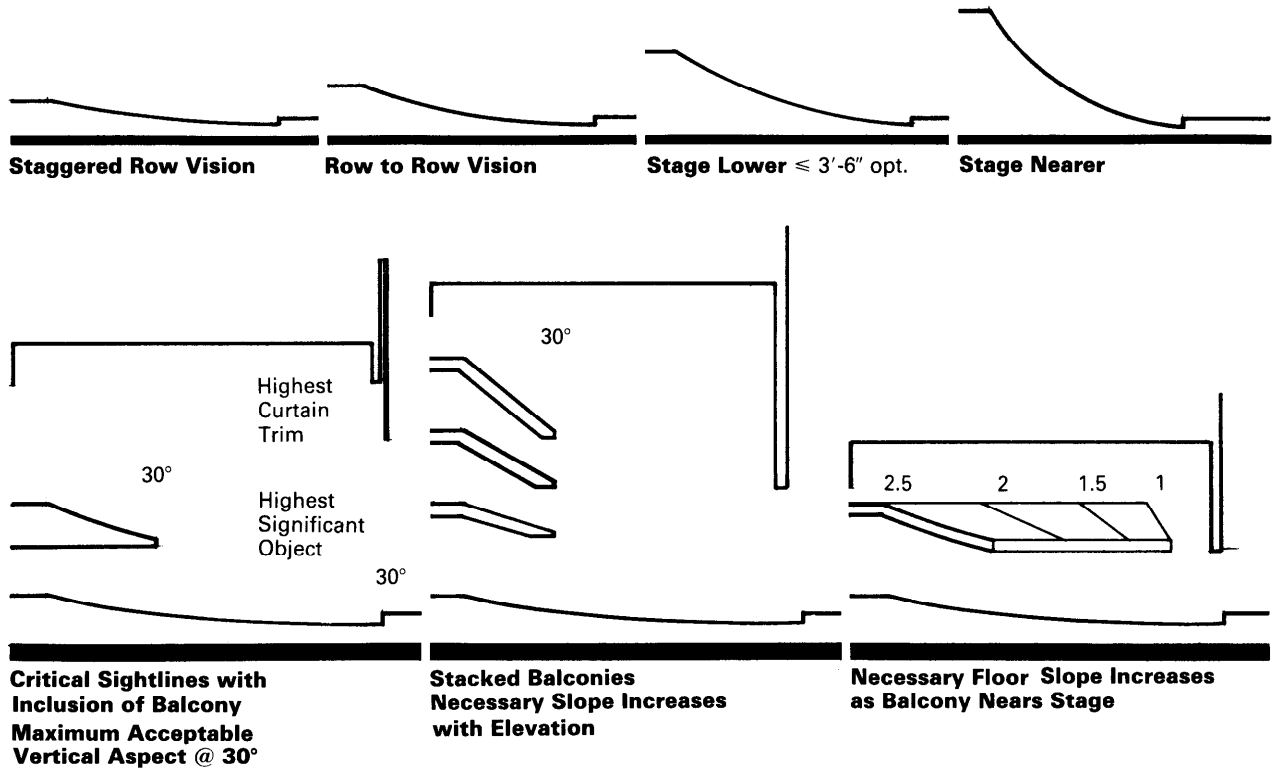


FIGURE 3–5.5 FLOOR SLOPE-SIGHTLINE RELATIONSHIP

stage configuration and proscenium width.

The dominant side-to-side movement on a Frontal stage places value on proximity to the Room centerline, while the desirability of short viewing distance works in the other direction. The objective logically should be to maximize the number of seats in the center front region.

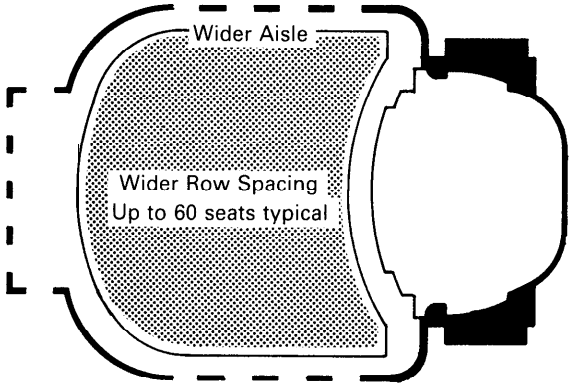
Actors' expressions are difficult to see beyond 40 feet, gestures past 65 feet, and only large body movements can be seen between 65 and 110 feet. Location of drama audiences should be within 65 feet, if possible. Viewing at an oblique angle foreshortens the image and may require neck craning. The normal cone of optimum vision covers 30 degrees vertically and 40 degrees horizontally. Viewing angle works against front corner seats, which have the most oblique view from which portions of the acting area may be obscured. For that matter, any "front row" seat requires a lot of head movement to take in the entire acting area. A 45 degree pivot is considered maximum tolerable exercise.

The intimacy of Drama is enriched by focused orientation. Curved rows reinforce the impression of uniformity by centering attention. If the center point of curvature is on stage, the nearest rows are sharply arched. But the longer the radius, the less appreciable its effect. If conventional seating is employed, (with longest rows of 14 seats) the radiating aisles eliminate a number of near-center seats. An alternate conventional plan places a cross aisle nearer the stage, which eliminates seats within the optimum vision distance. Continental seating avoids these radial geometry issues entirely.

Curved rows of gentle arc can have identical radius with the focus somewhat reduced, but allowing uniform, maximum row length and flush aisles with conventional seating. This "rectangular" arrangement requires varied seat unit size in order to provide staggered seats from row to row. Staggered seats permit one viewer to see between heads in the next row.

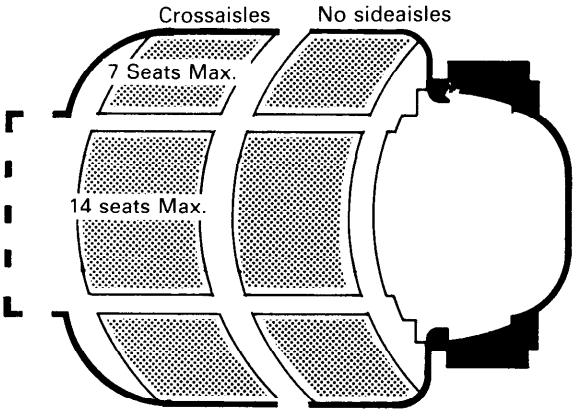
3. Vertical Arrangement with Respect to Stage
Sight line criteria in the vertical dimension help define floor slope (an aspect of sectional shape).

Flat-floor Rooms are limited in capacity by the problem of seeing past a few rows of people. A



Continental

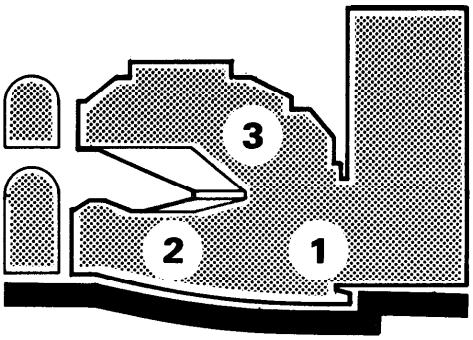
+Economic Use of Space
+More Leg Room
–Less Comfortable Seat Access
–Numerous Exit Doors



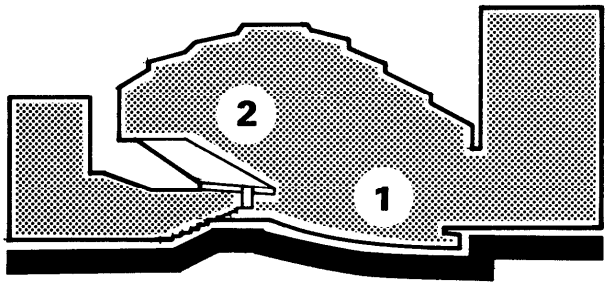
Conventional

+Easy Seat Access
+Fewer Exits
–Less Leg Room
–Aisles take up space

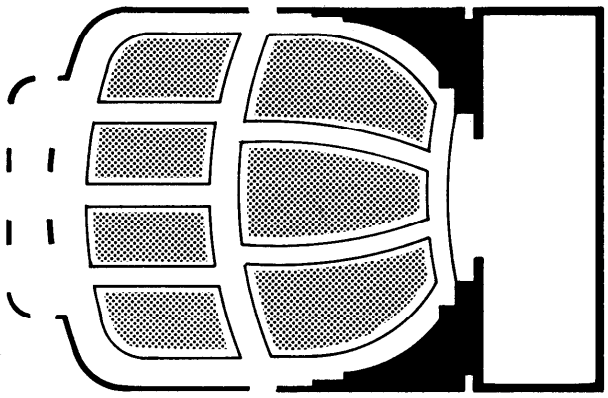
FIGURE 3-5.6 LARGE HOUSE PROBLEMS



Balcony: 3 places



Ledge: 2 places



Berry Patch

FIGURE 3-5.7 LARGER HOUSE SUBDIVISIONS

straight rake (ramped) floor improves conditions for a short distance only. With each successive row, the steepness of slope must increase in order to accomplish the same geometric sightline clearance from row to row-optimum 5 or 6 inches-every two rows if seats are staggered. The relative stage level is a factor here-a lower stage favors a steeper floor. Since concern for comfort and safety limits the maximum ramp slope and discourages single risers in aisles, a limit is implied for the number of rows before a cross aisle or other device breaks the pattern. Where steps are necessary, they should be between 4½" and 8" high and clearly marked or illuminated. Aisle slopes should not exceed one foot in eight.

Rising curvature is a difficult construction condition. When compounded with horizontal radii a "dish" or "teacup" is formed. Converging aisles become a necessity, which for safety should run in the direction of slope.

Dished floors present slight disadvantages in terms of adaptability to other arrangements. If level terraces are desired on a temporary basis (dinner theater or experimental forms) no section of infill platform is alike. A constant radius or rectangular plan is more easily adaptable at some expense to intimacy of focus.

4. The Large Room

Special problems are associated with size increase, including the impression of scale conveyed by a sea of people. It makes the performance seem more remote, the individual less important, the experience less intense (aspects of arrangement).

Continental "wall-to-wall" seating can heighten this impression, although it is more efficient at large capacities because cross aisles are not needed. Nevertheless, aisles do help define smaller units of seating, which may make the Room seem smaller.

As distances increase, the effects of floor slope are amplified. Entry and exit doors occur at greater elevational differences, not necessarily in equal increments, which affects design of surrounding spaces and access patterns. Further, as aisle length increases with conventional seating good practice requires cross aisles to ensure reasonable travel distance to exits. The cross aisle is a means of collecting exiting audience from more than one aisle, and is consequently quite wide. It eliminates two or more rows of seats.

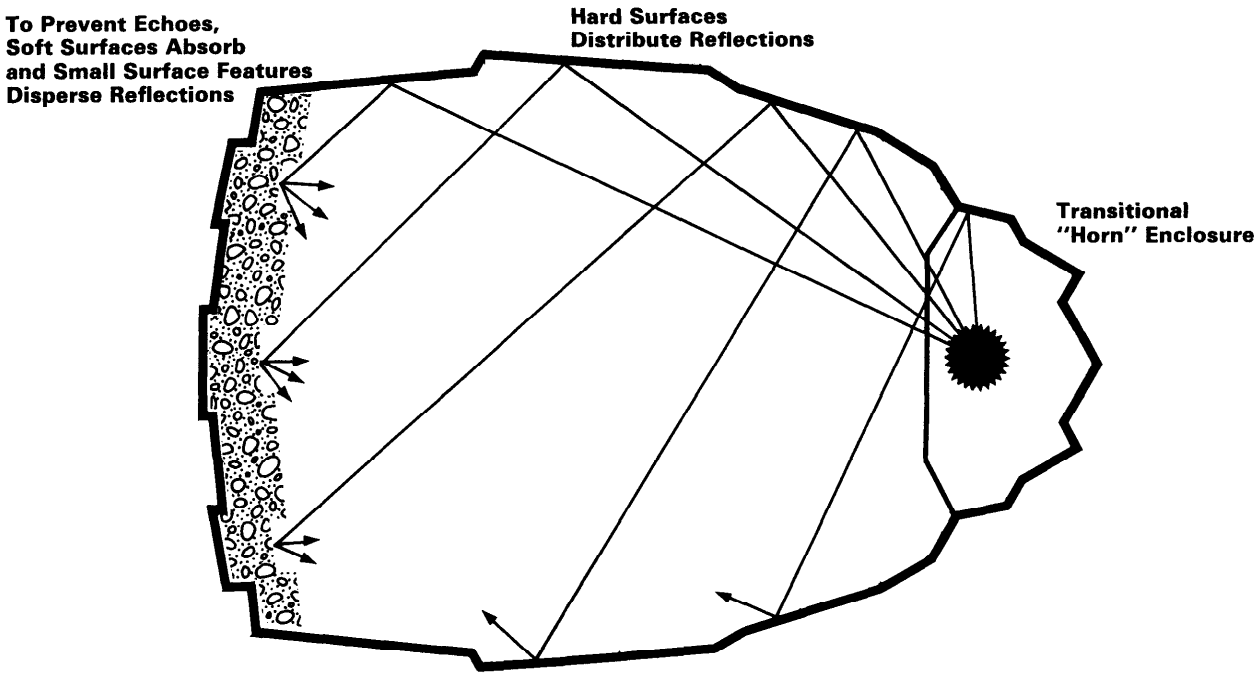


FIGURE 3-5.8 SOUND DISTRIBUTION FUNCTION

Increased seating area can also have a psychological effect on performers confronted with fractional attendance that seems even smaller relative to empty seats. There are several alternatives to choose from in countering the results of larger size.

Berry-patching, *or horizontally offsetting sections of the audience area, answers the questions of aisle length and to some degree identifies smaller reference units for viewers, but introduces cross-aisles.*

A ***ledge*** *may be incorporated, with or without a cross aisle, vertically offsetting the house floor and defining two places in the Room. Also, assigning seating priority to the lower section reduces apparent emptiness.*

Finally, a ***balcony*** *solution brings about three places of different flavor. Each place provides a strong visual frame of reference more intimate than the total.*

The ability to shutdown or darken the balcony effectively removes it from the actors' estimate of the house. The problem of aisle slopes exceeding maximum is removed; essentially, the

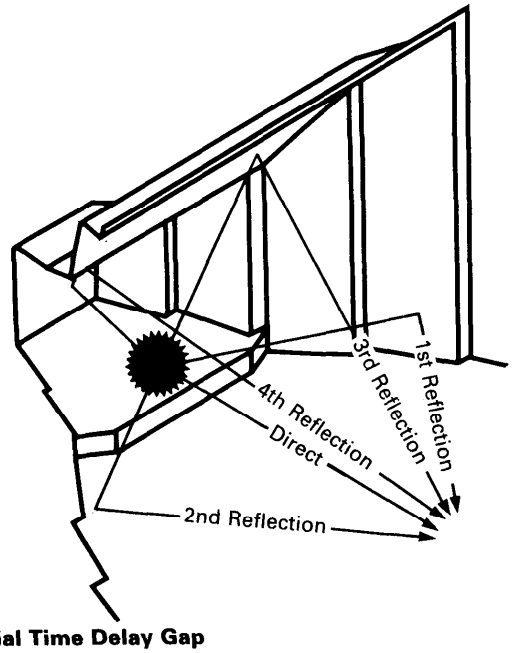


FIGURE 3-5.9 DIRECT AND REFLECTED SOUND

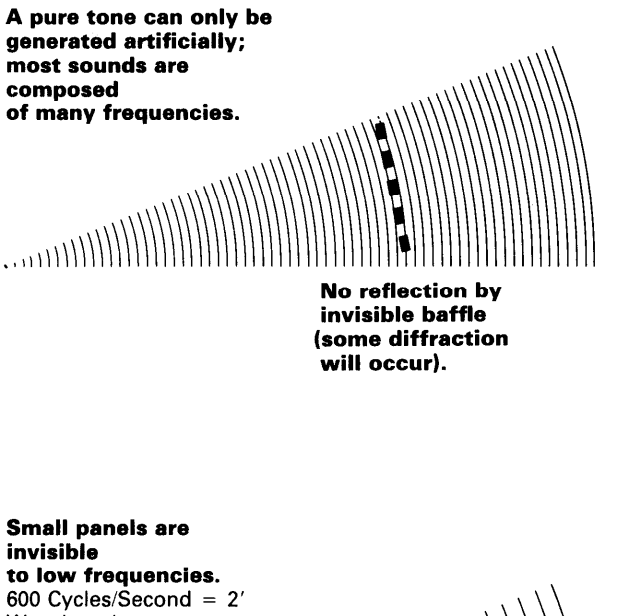


FIGURE 3-5.10 FREQUENCY SELECTIVE REFLECTION

steep area at the rear is lifted to form the balcony, acquiring an even steeper slope navigable by steps. Entry/exit is distinctly "two-story". Finally, lifting and tilting (the balcony) may enable it to be moved forward slightly, bringing more front row audience within range of the actor, and partially obscuring the rear of the house where the empty seats are.

Sitting under a very deep balcony can sometimes be like sitting in another room. The rearmost row should at least be able to see the top of the proscenium. Balconies also tend to blanket an area acoustically, preventing reflected sound from reaching back rows. The acoustically acceptable overhang can be greater for Drama than for Music since the reverberant contribution is smaller. Moreover, since speech intelligibility favors a proportionally high direct/reverberant ratio it improves with steeper floor rake and short throw.

If amplified or pre-recorded sound is employed, correct positioning of loudspeakers may influence Room shape. Normally, a central loudspeaker cluster is located over the stage so that actor and loudspeaker are equidistant from listener. The acoustic shadow cast by a low balcony can be a problem best dealt with by raising the balcony. (see Fig. 3-5.14).

B. MUSIC HOUSES

1. Seating Area Dimensions

The acoustical importance of the audience area is its contribution to the Room's total sound absorption, which is a significant factor in reverberation time. For a given Rt, absorption is proportional to volume (three-dimensional size).

The design of chairs for Music audiences is a critical concern because the most absorptive element in the Room is people. The acoustic character of the Room should not vary greatly due to attendance rates. Thus, the absorption spectrum of an empty chair should roughly approximate one occupied by a human body.

Since people absorb sound, tighter average spacing of seats (7-8 s.f.) may be called for to reduce total absorption area. This is more likely to be important for very large audiences when conservation of sound energy is critical. It is the total absorption of the Room that matters. Hence, absorption influences criteria for sound retentive construction as well as the volume required.

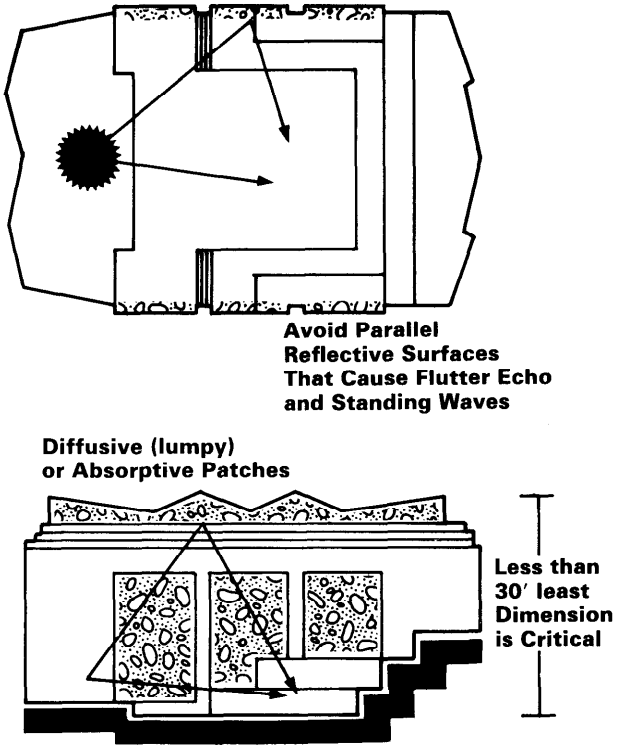


FIGURE 3–5.11 SMALL MUSIC ROOM CONSIDERATIONS

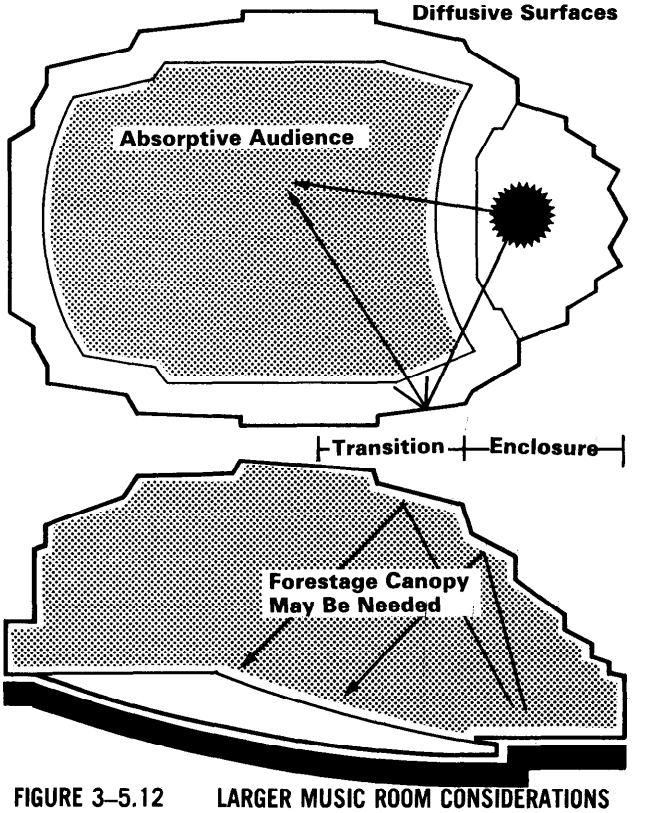


FIGURE 3–5.12 LARGER MUSIC ROOM CONSIDERATIONS

2. Plan Arrangement with Respect to Stage
Plan geometry for Music has as much if not more to do with wall positions than with the audience distribution.

The form of stage enclosure and its transition to the house influences Room shape. Musicians may be located in the Room on an open stage, or in an enclosure at one end. Small Frontal Rooms favor the orchestra-in-the-Room condition, larger Rooms the orchestra-in-enclosure.

Because direct sound dominates the small Room, the directional enclosure is less advantageous than a high ceiling (for reverberant volume). With increased absorption (people) and distance from source, the reverse is true; large Rooms have directional enclosures to boost direct sound levels.

The smaller of plan dimensions (usually width) may determine first reflection time (intimacy) and also the potential for troublesome standing waves. This dimension should be at least 30 feet for Music, 15 for speech. It is normally a concern for small Rooms. In larger Rooms, the proximity and orientation of surfaces near the stage control first reflections.

To avoid flutter echoes, no two walls should be parallel. Reflecting walls are shaped to distribute rebounding sound. Surface variations should include a large range of sizes "seen" by various wavelengths in the audible range (from ½" = 20,000 cps to 50 feet = 20 cps) and especially at mid-frequencies (3-8 feet). Great variation yields good diffusion and uniformity of blend.

Room length is related to potential for echo from long delayed reflections off the rear wall. The wall may be tilted or rumpled for diffusion.

Focusing curvatures are sometimes a problem of large Rooms that conform to vision criteria for seating. Fan-shaped Rooms must be examined for potential sound traps (acute intersections) and uneven distribution of reflections.

3. Vertical Arrangement with Respect to Stage
Sound is a spherical phenomenon; similar considerations apply to both horizontal and vertical shape.

Floor slope affects the portion of direct sound received at distant seats. Tilting the audience exposes them to a larger wedge of radiating en-

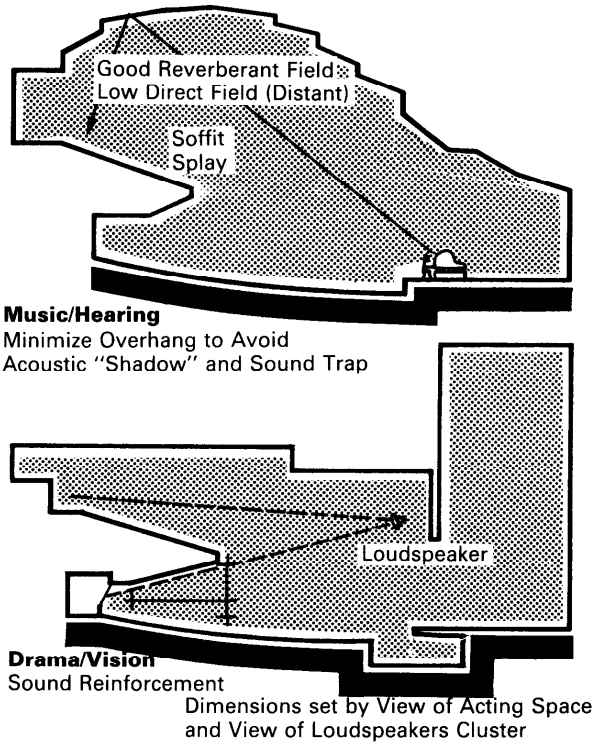


FIGURE 3–5.13 BALCONIES-MUSIC OR DRAMA

ergy. Small Rooms can afford to have flatter floors since the general level of direct sound is high. Increasing the available volume (which increases reverberant contribution) will permit steeper floors.

The factor of least (smallest) dimension applies vertically as well as in plan. Since the ceiling height of a small Room is likely to be less than or near 30 feet, it is wise to build in undulations ensuring its non-parallel relationship to the floor. As the Room size and height increases, the ceiling over center forestage plays a major role in providing early first reflections to center seats. If the ceiling must rise for volume, a partial suspended canopy may be required.

Reverberant field in large Rooms does not fall off so rapidly as direct sound. The evenness of reflected sound distribution is therefore important. Much of this characteristic relates to the ceiling transition shape, progressively slanted to reflect sound into the audience where it's needed.

Balcony seats have the advantage of nearness to the ceiling; initial-time-delay is very short and reverberant field rich. However, weak direct sound is a common problem in balconies of larger halls.

Balconies can have unpleasant consequences for occupants of other portions of the Room. Depth should be limited to 1-1/2 times vertical opening, and soffits splayed to reflect sound to seats. The upturned fronts can focus certain frequencies on the musicians platform and should be tilted and rumpled for diffusion.

Balcony or box seats near the front corners of the House typically have poor sightlines and receive late reflections. Nonetheless, this feature of traditional concert hall design is a useful way to provide diffusion and early reflections to the main seating area. With an orchestra in the pit, front box seats are often the finest.

3-6. THE STAGE

Stage dimensions and volumetric relationships have a fundamental effect in establishing the geometries of the House. This section will build on discussion of the House to help determine what makes one Stage configuration different from another. Afterward (Section 3-7) variations of Stage and House will be brought together for evaluation. The physical characteristics of the Stage are functions of its intended use. Seven performance types pertinent to Frontal Stage criteria will be looked at briefly to see where they differ. Four are especially relevant to Army facilities: legitimate drama, dance, musical drama, and music.

A. GENERAL CONSIDERATIONS

Variations among Stage forms have two levels of impact on Room design-Vision parameters (location of audience) and Hearing parameters (location of boundary surfaces).

1. Vision Parameters
These are related to the dimensions of performing (acting) area:

- ***Width/depth/shape of acting area.***
- ***Height of proscenium (if any).***
- ***Elevation and/or rake of stage.***
- ***Location of acting area relative to proscenium.***

2. Hearing Parameters
These are related to boundaries of the Stage enclosure:

- ***Size/shape of enclosing shell (if any).***
- ***Nature of coupled volumes (if any).***
- ***Absorptive properties of enclosure.***
- ***Location of sound source relative to enclosure.***

The corresponding functional elements depend on the use for which the Stage is designed. A few categorical terms will be of help in comparative treatments of stage types. Performing (acting) area is the portion of stage space meant to be seen. The stage enclosure defines a volume contiguous with the stage space, communicating with the house. Together, these constitute the bare minimum Open Stage. The stage floor may be stepped or sloped ("raked"). If a wall divides the stage space from the house the opening in it is the proscenium and the volume behind it is stagehouse.

For Music, an enclosure within the stagehouse is a shell, its overhead extension into the house a forestage canopy. If a portion of the remaining stagehouse volume communicates with the house, it is said to be coupled.

For Drama, scene space surrounds the acting space, and is surrounded by working space within the stagehouse-around, above or below. An open stage can have scene and working space, but scenic material may not be withdrawn vertically unless there is a proscenium wall and flyloft-i.e., a stagehouse-separable from the audience house by a fire curtain closure. Belowstage working space (trap room) must also be separated from the house except through the proscenium. An orchestra pit communicates with the house in front of the proscenium and fire curtain.

The reader will find it necessary to refer to other sections of this Guide for a more detailed treatment of some topics, such as performance accessory equipment, environmental systems and access considerations. However, there are a few "no option" requirements that relate to stagehouse construction especially. Safety is one; quantities of scene materials and fabrics suspended over hot lights, wood flooring, rigging lines, wiring and electrical equipment, power tools, and a lot of independent activity makes the theater stage a potentially hazardous region. The best protection is alertness and goodhousekeeping. Additionally, materials used in the stagehouse or stored there shall be fire-retardant.

If a flyloft is built, the proscenium wall must have a 2-hour fire rating and self-closing incombustible fire curtain, roof vents (at least 5% of floor area) activated by smoke and heat detectors, automatic sprinklers, and 2½" diameter firehose standpipes at each side. Sprinklers are required below the stage, too. If there is no flyloft (stagehouse ceiling less than five feet above proscenium) no fire curtain is required.

Stage floors are designed for 125-150 psf live load, gridirons for 75 psf with head and loft block beams designed for 250 plf. All permanent floor structure shall be non-combustible except the stage floor deck, which in almost all cases should be white pine or fir softwood tongue and groove, totalling 2" thick. It should have a matte finish and be built in sections enabling repair and replacement. This construction extends six feet past the proscenium offstage.

B. FUNCTIONAL REQUIREMENTS

The following are desirable Stage characteristics for various performance types. Also refer to respective sketches and to detail data of Chapter 4 regarding special equipment and construction criteria. Discussion here stresses key functions and design rationale.

1. Legitimate Drama
The medium includes speech, action and scenic context. The human figure is extremely important; scenic illusion refers to this for dimensional scale. Dominant movement across the acting area, entering left and right, makes other entries special events. Drama usually works through sustained continuity over a series of unfolding, developing events and situations; the ability to control changes in context, pace, center of attention and atmospheric tone is essential.

Performance Space: *Acting area is approximately 35' w x 20' d (40' x 25' usual maximum). This defines the downstage zone of most action; however, the full stage depth is utilized. It has a level floor that can be built upon, normally 30-36" above front row of house. Traps are recommended in key acting area.*

Enclosure: *A stagehouse is recommended, with a proscenium portal 35' w x 26' (can be larger). Stagehouse configuration is related to scene handling methods; flyloft is recommended strongly.*

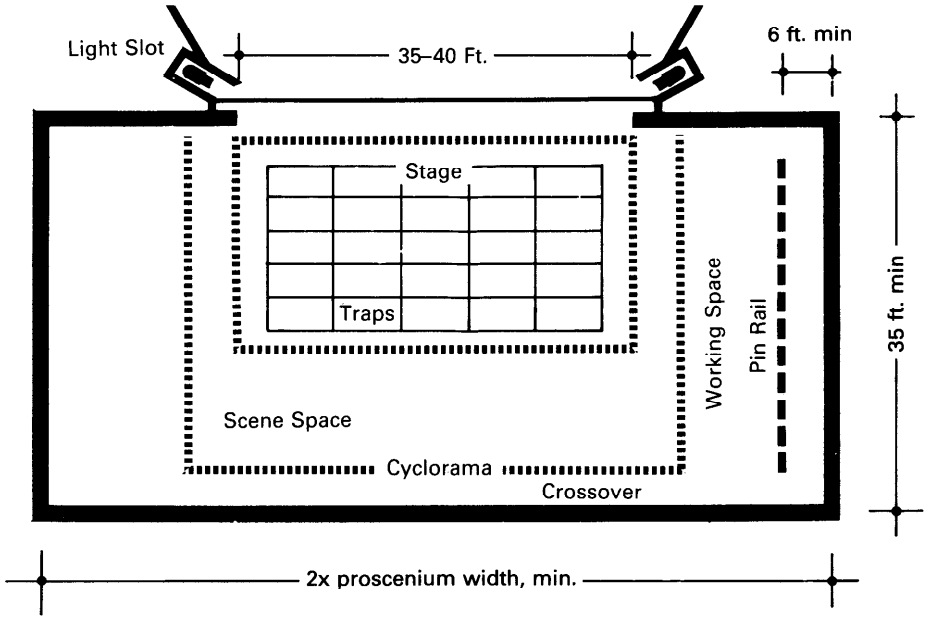


FIGURE 3–6.1 DRAMA STAGE

Scene/Working Space: *Wrap-around scene space is required for flats, drops, wagons. Allow ample horizontal working space for the largest set piece plus actors' passage, waiting areas, technicians' workspace, counterweights and pinrail, curtain space and switchgear. Use inside clearances and keep the plan shape compact and rectangular. Overhead working space must accept the longest flown piece plus borders plus gridiron and line space plus man-high passage above grid. Understage working space should be at least eight feet clear height. If any portion of working space is omitted by design,. stage level allocation should be increased 50%.*

2. Dance

The medium consists of action with music and some scenic context. Large movements of dancers in two directions (to-fro, side-side) physically occupy a region 15 feet above the floor. Dancers' entry from scene space on all sides is important. Scenery is often minimal, but not stage lighting. Although recorded music can be used, a dance facility should provide for a live orchestra. A dance concert usually consists of a series of separate pieces or events with rest periods between during which the stage is reset and the audience must be otherwise occupied. The technical qualities that help sustain continuity during performance should be versatile and sophistica ted, especially lighting controls. Also, music is to be heard on stage distinctly.

Performance Space: *Acting area is typically 50' w x 40' d, although 40' width will accommodate modern dance and small troupes. Higher sightlines (lower stage in steeper house) improve perception of deep movements. Construction of a resilient dance floor is essential, e.g. on built-up criss-crossed sleepers with neoprene cushions between. Sponge mats are not springy enough, and injuries can result. Often, a removable linoleum, vinyl or hardboard surface is put down, with seams taped.*

Enclosure: *A high proscenium is needed in large Rooms for clear view of the dancers' space, or no proscenium at all in intimate Rooms. Stagehouse requirements relate to scenery components.*

Scene/Working Space: *Scene space at each side is usually devoted to entry legs and tabs for the depth of the stage. A cyclorama or back-*

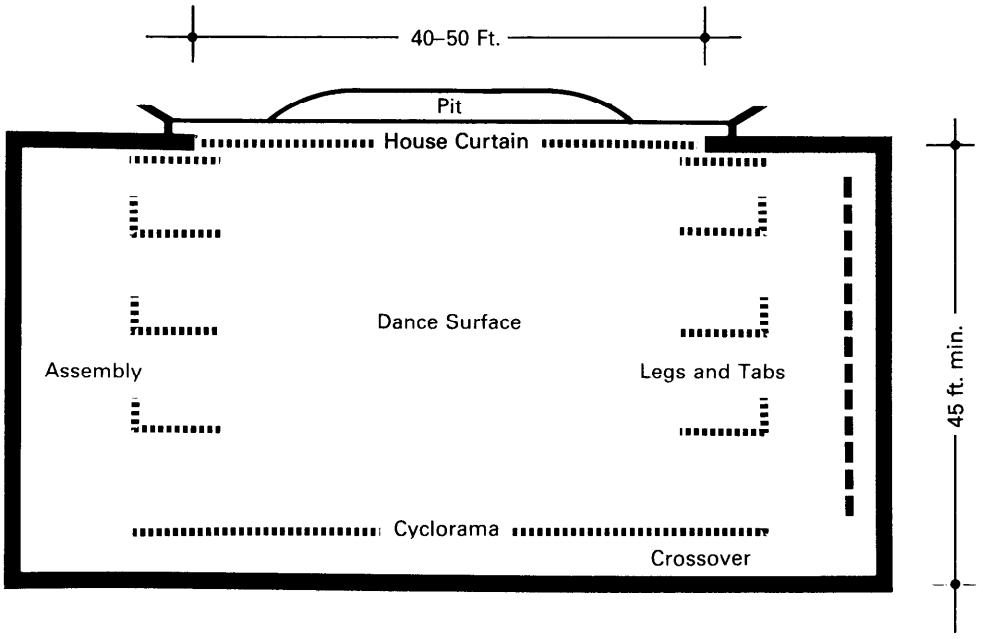


FIGURE 3-6.2 DANCE STAGE

drop is frequently used. Unimpeded crossover passage is very important, preferably wide enough for costumed dancers to pass each other without disturbing drapery, etc. Wing space must accommodate assembled dancers. An orchestra pit is very desirable, for 20-50 musicians.

3. Music-Drama

Speech, music, action and scenic components are all incorporated in this form of presentation, sometimes called light opera or musical comedy. It is similar to straight drama in its storyline continuity, which demands directorial skill in successfully alternating speech, song and dance, and also relies heavily on stagecraft and technical support. The musical component is a key feature of transitions, requiring expert control. A relatively large cast and crew is typical with up to 50 people on stage at once and quantities of scenery to manage. Coordinating all this activity is a major problem requiring, besides extensive preparations, an excellent communications system during performance.

Performance Space: *Although principal attention is generally focused downstage, background "chorus" activity and the ability to have "cross talk" at the same time makes a wide, deep acting area desirable, about 60' x 45' deep. For a given production, this can be masked down. The floor should be danceable, although it needn't be very sophisticated in construction; the ability to build on and anchor to it is as important. Traps and pit-type cyclorama are desirable.*

Enclosure: *A 30'-35' high proscenium arch is recommended, along with flyloft stagehouse. Stagehouse proportions recognize that wingspace is as important as loft space.*

Scene/Working Space: *Wrap-around scene space must accept a large variety of rather elaborate scenery. The dimension of this zone must allow for structural support of stand-up sets with recesses and overhangs, often in combination with flown portions. Wagon sets are very useful as well, but require substantial working space in addition to that for cast assembly, other properties and technicians. Symmetrical working space is advised, to simplify maneuvering during scene changes. Since live music is essential, provide an orchestra pit for 15-30 musicians.*

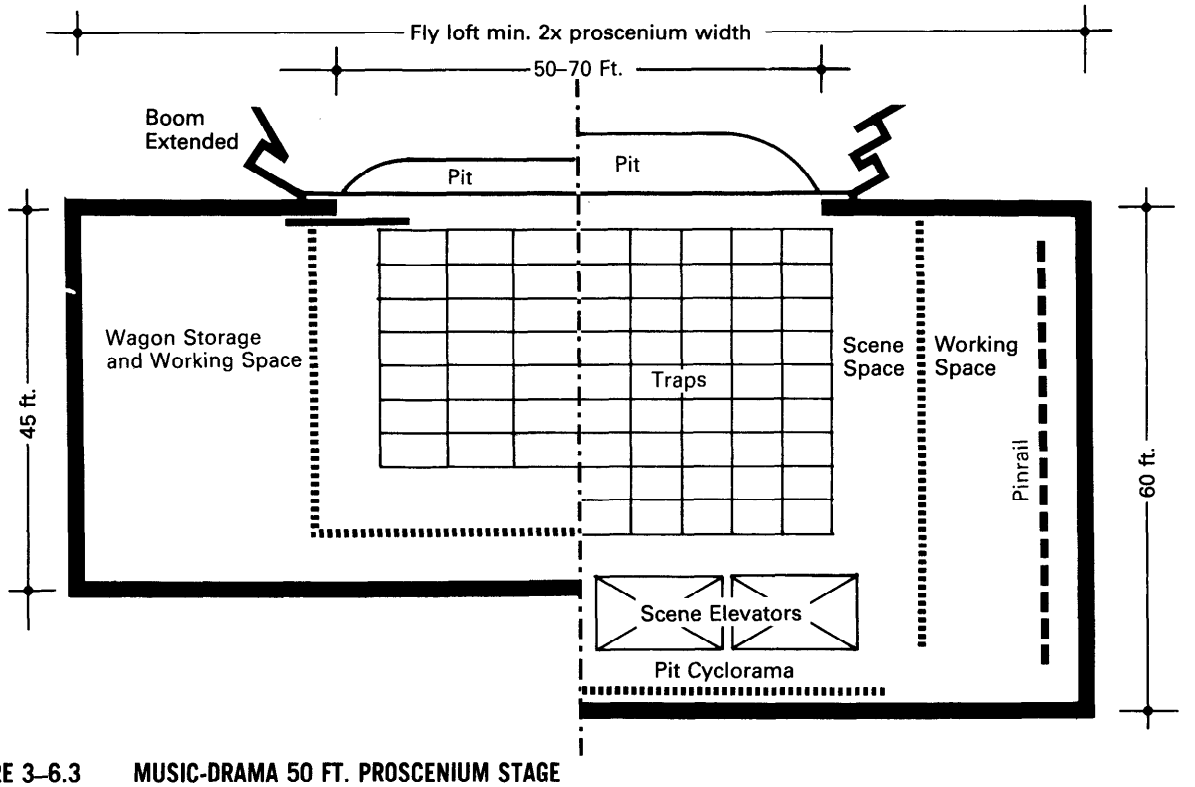


FIGURE 3–6.3 MUSIC-DRAMA 50 FT. PROSCENIUM STAGE GRAND OPERA 70 FT. PROSCENIUM STAGE

4. Orchestral Music

First identify the kind of orchestra for which the facility is primarily intended. Both its size and instrumental composition have a part in determining its characteristic sound, intensity, the literature emphasized, and requirements of physical arrangement. This suggests a Room designed for its "most likely" users nevertheless involves tolerances for variations. Music concerts consist of a series of uninterrupted performance periods of varying length. In the intervals instrumental components may be changed, reorganized and *retuned while the audience, immobilized during performance, refreshes itself. The sometimes* subtle alterations must *be* carefully prearranged *in a rehearsal situation as similar to concert conditions as possible.*

Performance Space: *Orchestra set-ups are usually as compact as practicable, in order to* hear each *other, see each other, and share sheet music. Stage area averages 16-20 square feet per musician and proscenium widths range from 55-80 feet. For various groups, this amounts to:*

- ***Ensemble or band, 30-50 musicians, 800-900 S.f.***
- ***Medium orchestra, 50–80 musicians, 1200–1500 s.f.***
- ***Medium orchestra and chorus, 50–100 voices, 1800–2300 s.f.***
- ***Symphony orchestra, 80–125 musicians, 2000–2400 s.f.***
- ***Symphony and large chorus of 100–200 voices, 2800–3500 s.f.***

Flexibility will help achieve sectional balance. A flat floor with portable riser platforms is advised, although some orchestras will not use risers. Performances with musicians and chorus often require extension forward and split-level arrangement with chorus behind orchestra. This can be accomplished on a large symphony stage with reduced orchestra, or by extension of an apron over the pit. Moving the orchestra forward alters the relationship to the enclosure. Smaller music ensembles and bands can be accommodated on a theoretically large stage with suitable adjustment of enclosure and musician arrangement. Therefore, the suggested approach is to size the stage for the largest likely group. Stage floor construction noted under 3-6a is applicable, provided the deck is mounted with felt cush-

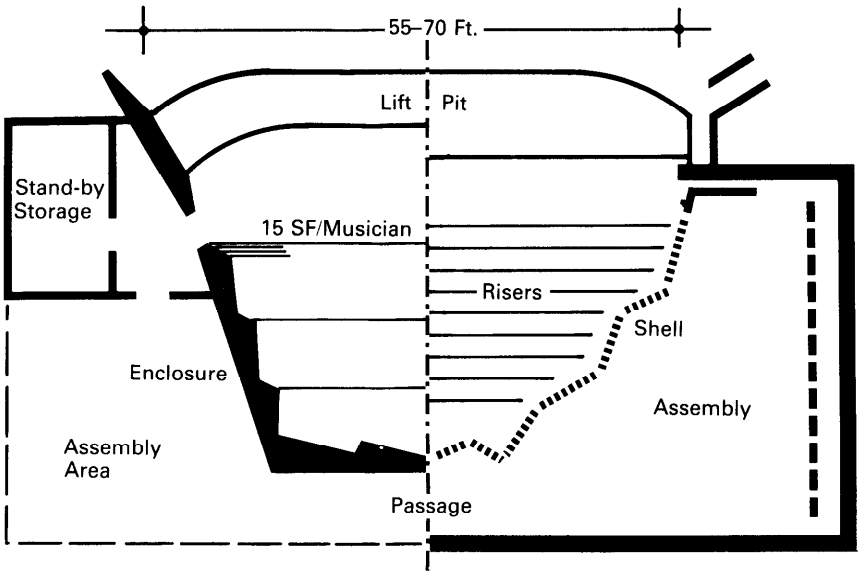


FIGURE 3-6.4 ORCHESTRAL-CHORAL STAGE

ions under sleepers variably spaced to dampen resonant vibration. If understage is unused, the structural base can be a ground slab.

***Enclosure:** Disregarding open stage forms applicable to small Rooms, two kinds of "sending end" enclosures are possible: the "hole in the wall" associated with traditional drama proscениums and the "'horn" that gradually becomes the Room. The latter is permanent construction especially designed for Music use, with structural qualities similar to the House. The first type (proscenium) is normally employed in multi-use Rooms or theater conversions, consisting of a demountable shell erected in the stagehouse. Both types have a degree of geometric adjustability.*

***Scene/Working Space:** Stagehouse functions, if any, are minimal for Music; most support activity takes place backstage or from control areas in the House. However, space adjoining the performance area should be allotted for performers' assembly and temporary instrument standby (pianos, extra chairs and stands). There may also be separate rooms for broadcast, recording equipment and lighting switchgear. If there is a story below stage, thoughtful planning of freight lifts is needed to make stage loading efficient. Installing a lift platform in the orchestra pit is recommended only if the acoustic enclosure design makes provision for the platform's use as performance area–i.e., if a proper forestage canopy is installed.*

5. Recital

Instrumental and vocal recital rooms are the most intimate music spaces. The presentation format is similar to orchestral concerts, but musicians are fewer in number and share a much more personal relationship with the listener. Recital acoustics provide greater definition among instruments.

***Performance Space:** The platform area depends somewhat on anticipated music group sizes, 400-600 square feet typically. A low elevation, 24"-30", is usual and portable risers may be employed for the larger groups or for choral performances.*

***Enclosure:** The surfaces near the platform may be treated with adjustable panels that are reflective, absorptive or both. These are normally intended to adjust hearing on stage rather than project sound to the house, and a*

high degree of diffusion is desirable. The ceiling over the stage, or suspended reflectors, should be within 20 feet and no walls parallel. Occasionally, a false or open work proscenium is used to support and screen lighting and audio equipment.

Scene/Working Space: *No scenery is involved, unless the Room has secondary uses. Piano, risers and chairs are stored adjoining the stage. There should be a lounge to which musicians may retire, and dimmers for house and stage lights.*

6. Choral

Basically a musical medium, group singing can have some of the characteristics of dramatic speech depending on the literature presented. Intelligibility is more important for secular works in terms of lyric continuity than for liturgical and choral-symphonic combinations. Choral requirements fall somewhere between those of a large recital hall and medium-sized orchestral facility, depending also on the number of voices.

Performance Space: *A rather close packing of singers is desirable in most cases to facilitate their mutual hearing and visual contact. Instruments and music stands are not involved. Singers may be seated for long or intermittent performance, or may stand throughout. Between 5 and 9 square feet of stage area is needed per singer. Additional area should be allowed for piano or instrumental accompaniment. Portable adjustable risers in 8 inch increments are a definite advantage over fixed risers. The floor area is normally twice as wide as deep.*

Enclosure: *Recital or orchestral considerations are similar, although a shaped enclosure or shell is more likely to prove successful in larger Rooms. The human voice is relatively directional but not as powerful as many instruments until carefully trained, and rarely for sustained periods. The enclosures' function to blend, balance and contain sound energy is important.*

Scene/Working Space: *Similar considerations pertain to recital, although offstage assembly space must be larger and is best with entries provided from both sides of the performance area. For orchestral accompaniment a pit is desirable, and actually necessary for large scale events. The alternative is a very large open stage arrangement.*

7. Opera

Musical drama is the middle ground between operatic recital and grand opera, since it makes more or less equal use of song, speech, music, dance and scenic elements. Operatic recital emphasizes music and song over action and scenery, and grand opera may be considered song, music and spectacle. The storyline is often well-known and diminishes in importance compared to musical execution. Traditionally lavish costumery and settings are involved along with a large cast of singers and musicians supporting lead soloists. Opera recital may involve two or more small groups on a stage similar to that for musical drama or smaller, with minimal scenic devices and dance activity. Grand opera involves a great deal of background movement, multiple entry points, stagecraft, special effects, and scene changes.

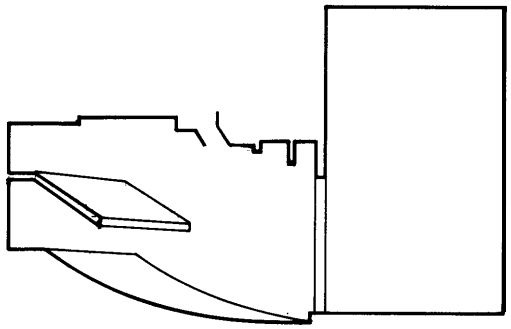
Performance Space: *Wider and deeper than others, it is typically 75' x 55' d. Traps, multilevel constructions, stage elevators and lifts are used extensively. The great depth and width of stage is not merely a tradition, nor the requirement of elephants, camels and chariots. Dramatic part-singing demands a great deal of movement on stage, reassembling of voices, and accommodation of a large chorus. Since it is difficult to sing while moving, the cast moves to new relationships with the soloists.*

Enclosure: *The opera proscenium is typically 65-80' wide and 40-50' high. This promotes acoustic coupling of the deep stage to the house and recognizes the probable height of a multi-tiered audience requiring good sightlines. The enormity of stage and stagehouse places premium value on trained, powerful voices and drama tic presence.*

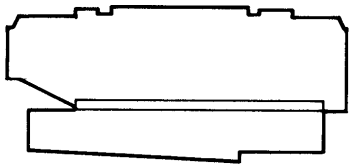
Scene/Working Space: *Opera stages are often the most technically sophisticated, the scenery vast and expensive because of its importance to performance. A person on an empty opera stage is dwarfed. He must move from prop to carefully selected prop, in order to maintain continuity of scale. Grand opera requires substantial scene space and offstage working space on all sides. A large, fully equipped flyloft, or a combination with scene elevators from below stage, is also needed. The flyloft must furnish generous flexible lighting points behind the proscenium and above stage, often including sidelighting towers in the wings.*

An orchestra pit is essential to grand opera. The pit locates musicians properly relative to

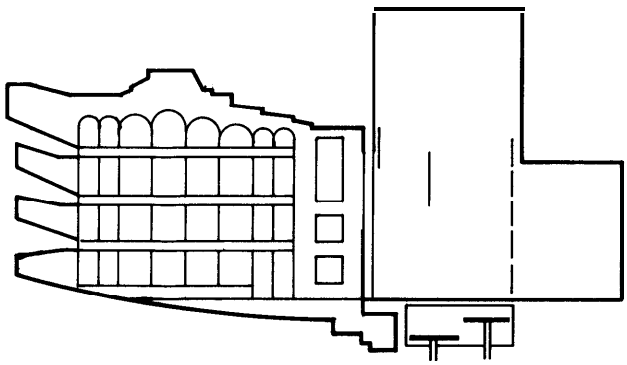
the action, but out of direct line of sight. It enables eye contact between the conductor and musicians and singers. It also enables singers and musicians to hear themselves best. Grand opera requires an especially large pit (80 musicians) and careful acoustic design. This design often reflects the nature of opera music; the pit has a mainly reverberant contribution at low intensity so as not to overpower voice intelligibility. The deep Bayreuth pit was developed expressly for Wagnerian opera, giving an eerie non-directional sound.



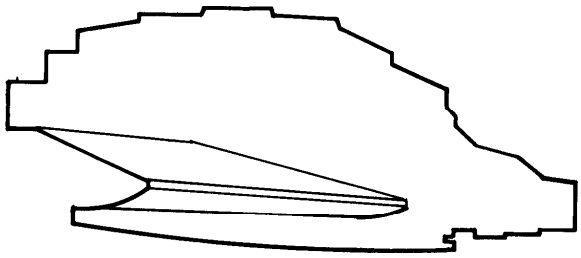
Drama



recital Hall



Opera or Dance



Orchestral

FIGURE 3-7.1 FOUR KINDS OF SINGLE-PURPOSE ROOMS

3-7. PRIMARY AND SECONDARY USES

A. FUNCTIONAL RELATIONSHIP OF STAGE TO ROOM

No single stage form can best satisfy the functional requirements of all performance types.

But a given stage form can often accommodate more than one performance type:

1. *Where the secondary performance type makes the best of the circumstances and accepts/ adapts to limitations of the primary form.*
2. *Where some or all of the necessary additional facility is built into the primary form.*
3. *Where temporary demountable modifications are provided to facilitate secondary use.*
4. *Where the best primary configuration is compromised to adapt to secondary uses.*

In terms of primary use, the four alternatives above are listed in descending order to desirability. While single-purpose Rooms are typically best suited to their uses, the likelihood is that some degree of multi-use will exist. Unfortunately the prevalent tendency to begin with multi-use as a major design objective too often leads, to disappointing, costly failures. Attempts to "install" flexibility take the form of mechanical devices; apron lifts and moving walls are the usual culprits. See Section 3-8 for discussion. Careful attention must be given to the Program Emphasis considerations discussed under 2-3, Establishing Program Goals. Section 3-15, Com-

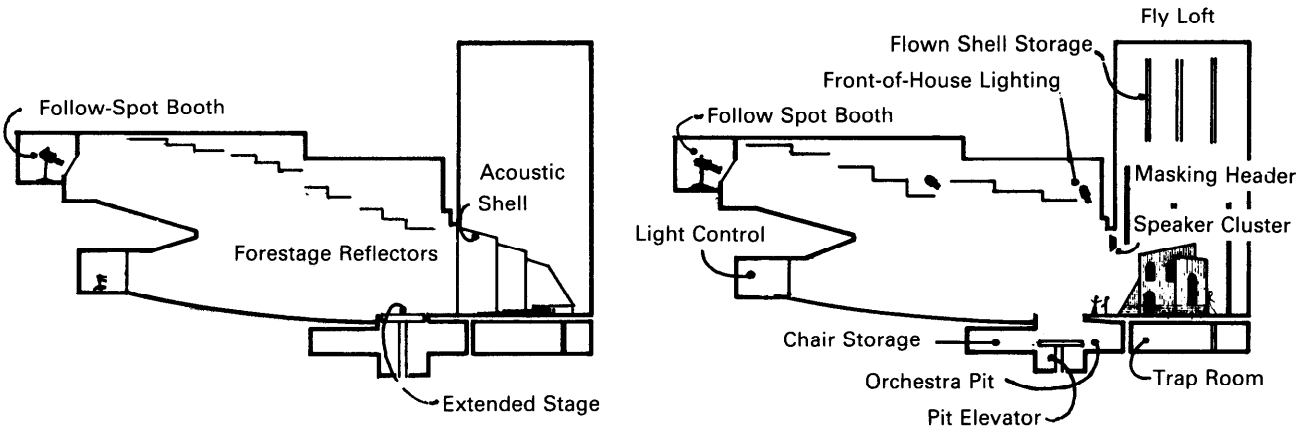


FIGURE 3–7.2 THE MULTI-USE ROOM

posite Building Programs, is also recommended as an overview of alternative approaches to the multi-use MDC.

Performance types can be grouped according to similarity of stage requirements as a first step, but it is important to bear in mind that both Stage and House are interdependent parts of the total Room. Any alteration of selection criteria for one has impact on the other particularly with regard to vision and hearing parameters. The audience arrangement in the House is based on the task of seeing action on the Stage, and this basis changes with the stage form and type of performance. The enclosure construction for both House and Stage corresponds to hearing tasks, and if the tasks or any part of the enclosure varies, adjustment may be required to obtain the best conditions.

B. SECONDARY USE CONSIDERATIONS

Section 3-2 identified four Frontal Room types to be elaborated, two capacities for Drama and two for Music, Sections 3-3 and 3-4 discussed the principal functional requirements of Drama and Music, and Section 3-5 developed some of the physical implications for design of the House. Having examined seven performance types of varying Drama and Music composition related to Stage requirements, the task remains to put Stage and House together again. A useful approach begins with the four Rooms of Section 3-2, exploring the major characteristics of each by noting adjustments required to accept any of six secondary uses.

1. 300 Seat Drama Room

Consider a 300 seat House with Legitimate Drama Stage of minimum acceptable proportions: 35' wide proscenium with flyloft, 35' deep to backwall, approximately 3000 net s.f. in the stagehouse. The fairly compact, intimate audience area will occupy 2400 net s.f., but an allowance of 10% for structure and inaccessible areas, plus at least 15% for control booths, service spaces and connecting circulation locks yields a total Room of at least 7200 gross square feet. The reverberant decay period (see Chapter 4) for drama should be between 0.9 and 1.2 seconds. Based on an average of typical absorption spectrum for drama houses, Room volume will be about 75,000 cubic feet, for an average ceiling of 25' (all such figures are intended to be plausible-not model calculations).

For the six other performance types, secondary use considerations follow:

a. Dance:

- *Proscenium preferably wider than 35'. Stage depth therefore deeper to permit crossover, and sightlines adjusted to take in deep stage.*
- *Flyloft should extend full depth if used.*
- *Require leg and tab drapes for entry both sides.*
- *Require smooth resilient dance floor.*
- *Require music source, live or recorded,*

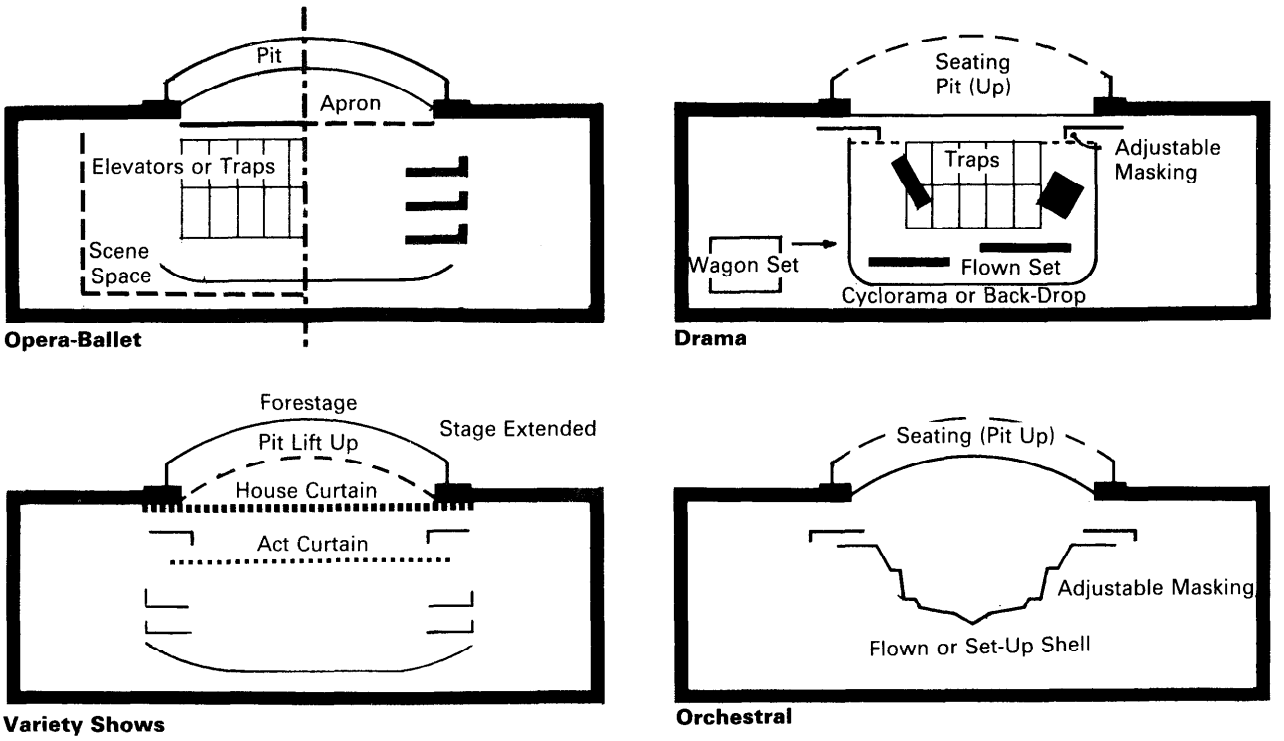


FIGURE 3-7.3 THE MULTI-USE STAGE

and appropriate Room acoustics, possibly an orchestra pit.

- *Multiple, high quality followspots.*
- *High-rake house seating preferable, with short view.*
- *Reverberant decay depends on music source; 1.0-1.2 seconds for electronic system. Suggests slightly live (reverberant) initial design.*

b. Musical Drama:

- *Stage configuration similar* to Dance.
- *Extra stage depth essential for scenery.*
- *Wingspace essential for scenery and cast entry.*
- *Pit for musicians essential.* Pit space will consume a part of prime audience seats.*
- *Proper reverberant decay 1.2-1.4 seconds = about 86-100,000 cu. ft. = avg. 36 foot ceiling. Room must have sufficient volume for music (over-large for 300 seat drama) or electro-acoustic enhancement.*
- *Typically large "market" implies larger house, higher production cost, fewer performance units.*
- *Conclude larger Room desirable if substantial amount of Musical Drama is anticipated.*

c. Orchestral:

- *Music shell may be necessary in stagehouse.*
- *Greater volume needed rules out large groups.*
- *Small groups (dance band and chamber ensemble) require acoustic consideration of Room shape and volume, or electronic adjustment.*
- *Dance band with sound system requires 1.0-1.2 seconds, may be compatible.*
- *Classical chamber music requires 1.4-1.7 seconds, needs help.*

d. Choral:

- *Small choral group concerns are similar to Orchestral, but Room volume not as great a problem. 1.2-1.6 seconds prefer-*

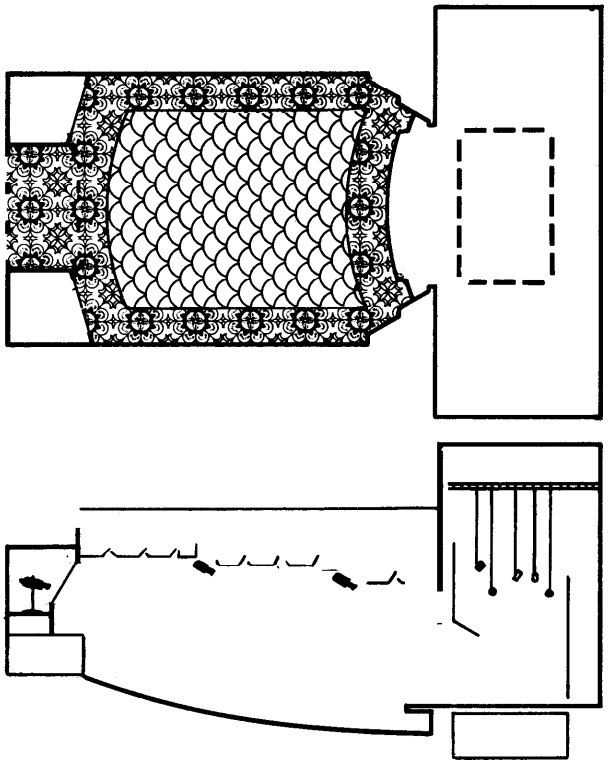


FIGURE 3-7.4 DRAMA ROOM-300 SEAT

able, perhaps attained with adjustable absorption, coupled volume, or electronics.

- *Stagehouse reflectors or shell desirable.*

e. Recital:

- *Longer reverberation desirable, 1.4-1.7 seconds (similar to chamber orchestra).*
- *Intimate scale desirable-low stage and close proximity to audience.*
- *Enclosure from stagehouse desirable, probably necessary.*
- *Room proportions preferably narrower than likely Drama House, or use forestage canopy reflectors.*

f. Opera:

- *Not reasonable except as voice recital of simplest character.*

2. 650 Seat Drama Room

Consider the same Legitimate Drama Stage as for the 300 seat Room. For a 35' wide proscenium, the first row and its aisles would not exceed 45' in width, and 300 seats would be within 50' viewing distance-an intimate Room. But 650 seats arranged in a rectangle would have the last row 115' from the Stage, well in excess of the optimum of 65'. In order to bring this row to 65' an average House width of 80' is needed-the last row would be 115' long-with side aisles more than 30 degrees to the centerline. Such an extreme wedge might be acceptable for Thrust or Open Stage configuration, but not for Proscenium.

Locating 500 seats on the main floor within 65' of the stage results in a wedge 75' at the rear-most row with side aisles just 13 degress to centerline. The remaining 150 seats would occupy a six row rear balcony-a good number, since six rows do not exceed 20' as a dead end aisle. An additional 5' rear aisle, control booths, etc., will create about 800 GSF in the balcony and 5333 GSF on the main floor. Adding the stagehouse results in a total Room area of 11,333 GSF. For the appropriate reverberation period (0.9-1.2 seconds) between 130,000 and 160,000 cubic feet of volume is needed. Discounting by 50% the acoustically shadowed balcony area, an average ceiling of 30' is probable. The balcony would have an overhang ratio of about 2:1.

Here are the secondary use considerations:

a. Dance:

- *Stage configuration concerns similar to 300 seat.*
- *Sightlines become more critical for larger house, may require wider proscenium or projected stage. However, balcony mitigates the problem.*
- *Balcony design to consider acoustics and vision, and to accommodate multiple follow-spots.*
- *Acoustical adjustment is more feasible than for Small Drama, suggesting desirability of live music and orchestra pit. Pit location to consider impact on seating capacity.*
- *1.4-1.7 second delay preferable for modest orchestra, or 1.2-1.4 with sound system.*

b. Musical Drama:

- *Stage design should reflect need for more scene handling space (3600 net s.f.) and direct loading from trailer trucks in addition to minimum requirements suggested for 300 seat house.*

- *Preferable to build-in pit space if Musical Drama is a substantial use.*
- *This is a reasonable capacity for Musical Drama, small for professional road shows but modest for community theater.*

c. Orchestral:

- *House size begins to be viable. With a substantial flown orchestra shell a 40-piece group could be comfortable within the 35' proscenium. Retractable legs permitting enlargement of the opening by 10' would accommodate 70 musicians.*
- *As the orchestra increases in size, longer reverberation is generally desirable for blending of sound. At 1.5-1.9 seconds, for contemporary works or Mozart symphonies, Room volume would preferably be 50% greater (250,000 cu. ft.). However, this creates a relatively "live" house unsuitable for primary Drama use. If medium-size orchestra is contemplated as a fairly regular event, electro-acoustic enhancement is advised.*
- *Conclude that primary Drama use is not readily compatible with larger orchestral works.*

d. Choral:

- *A demountable shell designed to reduce sound losses in the stagehouse would make choral presentation possible.*
- *Substantial choral works are typically written for orchestral accompaniment, and are therefore likely to be limited according to pit accommodations for musicians. A string/woodwind ensemble and 40 voices could reasonable occupy the stage without pit.*
- *Decay time slightly longer (1.2-1.6 seconds) than for Musical Drama would be appropriate for choral compositions in which lyrics must be intelligible.*
- *Choral music that needs blending (Handel) should have 1.7-2.0 seconds decay. An electronic system is recommended.*
- *Liturgical music, composed for reverberation extending 2-3 seconds or more could not be finely accomplished even with electronics. The audience will immediately note the artificial character of "big sound" in a small Room.*

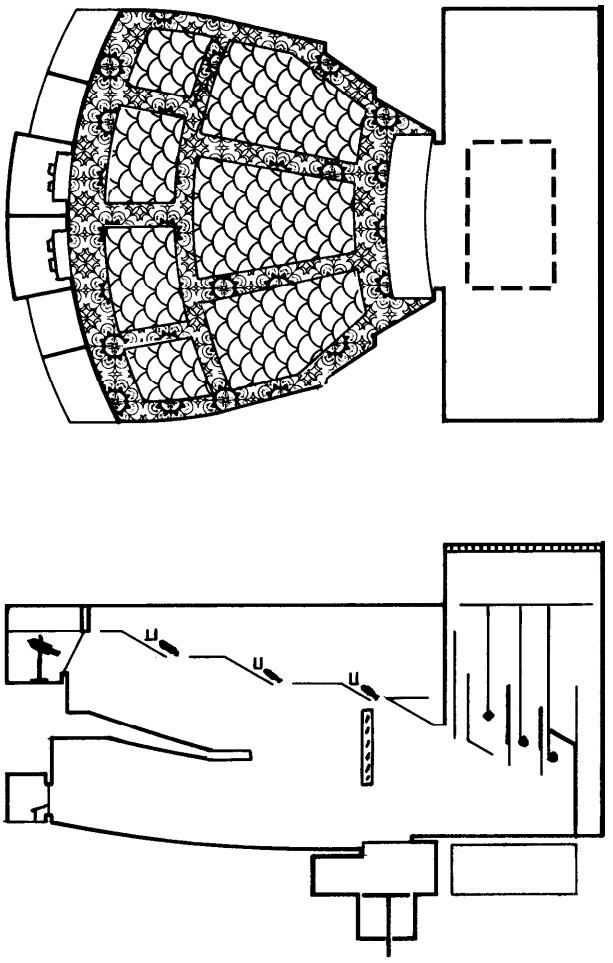


FIGURE 3-7.5 DRAMA ROOM-650 SEAT

e. Recital:

- *Comments noted under 300 seat similar.*
- *Absorptive quality of the drama house and scale of stage tend to make recital problematic without electronic assistance and careful visual setting.*
- *The first problem, absorption, is especially critical with a balcony arrangement that is a bit too deep. Over-sizing the volume for Music and introducing added absorption for Drama, the primary use, will compromise voice audibility and require speech*

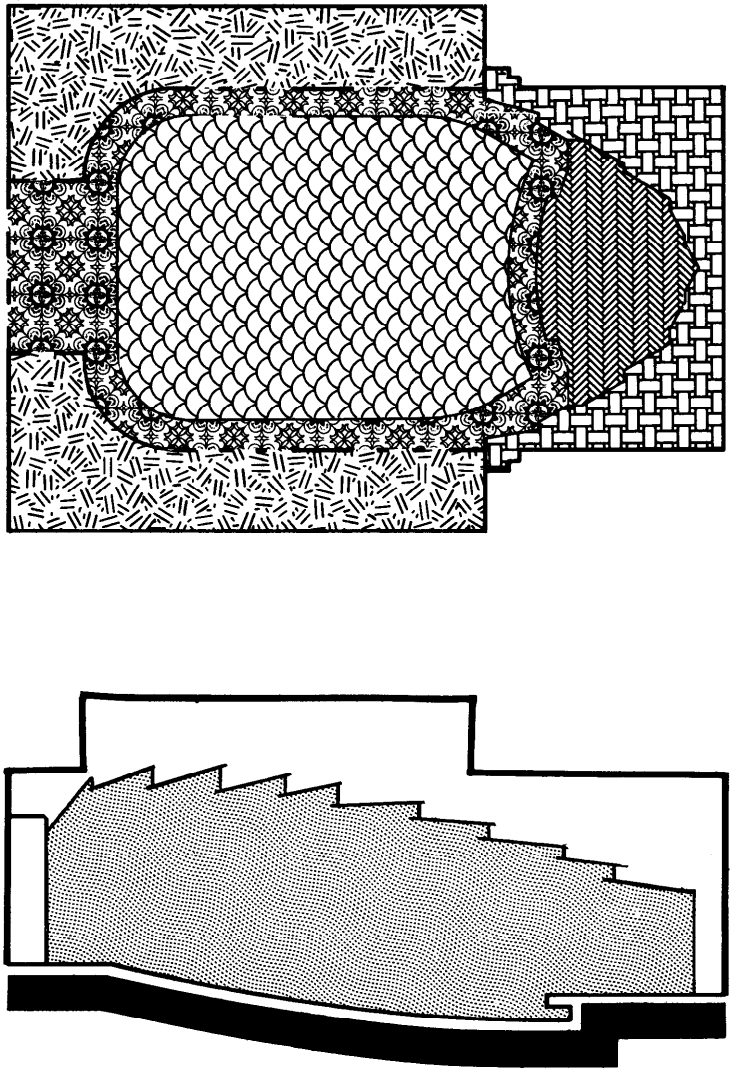


FIGURE 3-7.6 MUSIC ROOM-650 SEAT

amplification.

- *The secondary problem, stage scale for solo or small group music, can be overcome by design and provision of a shell.*
- *If Drama use is primary, recital should have electronic assistance.*

f. Opera:

- *Light opera amounts to Musical Drama, although somewhat longer reverberation improves music quality.*
- *A. reduced version of classical opera, verging on operatic recital, could be managed on a Musical Drama stage enlarged slightly. The lack of reverberance would be noticeable as would the small orchestra accommodated in the pit.*
- *Professional opera singers would definitely require rehearsal to modulate the intensity of their voices in a small Room.*

3. 650 Seat Music Room

Consider a Room shaped for 650 seat Music pres-

entation. It may have an Open Stage with suspended canopy, or an enclosure transitional with House surfaces, the ceiling turning down behind the platform equipped with reflective elements of various sizes. The 1400 s.f. platform (55 x 25) would accommodate 70 musicians. Seats and aisles will occupy 4600 net s. f. on one level, the farthest seat about 80' from the stage. Reverberation time of 1.8 seconds or more would be provided by 225,000 cubic feet of volume in a Room averaging 40' in height, but not necessarily rectangular in three dimensions. Continental seating would require many doors (about 10) to corridors on each side; total gross area of 9000 s.f. yields a net/gross ratio of 67%.
Small and moderate sized instrumental groups are most appropriate. Long reverberation would suit most symphonic works, and could be shortened. A rehearsal curtain is probably required.

Secondary uses are possible as follows:

a. Legitimate Drama:

- *In the Open Stage version, a large motorized wall might divide house volume in half, 50 seats placed on part of the stage, and absorption added to help offset 41,000 cubic feet of excess volume. This would yield a 375 seat Drama House needing electronic reinforcement.*
- *The resulting square plan would have minimal scenery; actors' entries would have to be considered in platform design, and traps built in.*
- *Improbable for legitimate theater.*

b. Dance:

- *It is conceivable that limited dance presentation is possible without stagehouse and scenic material.*
- *Musicians (small ensemble) could be seated on stage or house floor.*
- *Extension into the house is limited by fixed seat orientation.*
- *Stage proportions would preferably deepen, perhaps with an apron extension. A dished seating plan would make this more feasible.*
- *Alternatively, simple drapery or freestanding masks might serve the entry/proscenium function.*

c. Musical Drama:

- *Importance of scenery, orchestra pit, stagehouse and cast size, as well as fire safety, etc., prohibit this use in any practical sense.*

d. Choral:

- *Risers required on stage.*
- *Piano accompaniment may be sufficient for very large chorus (200); instrumental accompaniment requires balance adjustment of enclosure for combined 150 voices and 15 instruments all on stage. Larger orchestra and chorus combinations involve stepped stage extension and additional adjustable reflectors or electronics.*
- *1.8 second reverberation just right for most choral works, could be adjusted.*
- *Substantially good Room for choral performance.*

e. Recital:

- *This is close to "one room" intimacy, appropriate visual scale attained with careful lighting.*
- *Room proportions important to avoid "big sound" or hollowness; a bit large. Careful location of music source may also compensate first reflection weaknesses, or adjustment of enclosure and canopy.*
- *Reverberation a bit long for recital (should be 1.4-1.7 seconds) and will tend to increase due to empty stage.*
- *Instrumental or vocal recital possible.*

f. Opera:

- *Opera recital appropriate-especially with addition (3000 s.f.) of simple wingspace and false proscenium. A relatively high stage or split level construction to counter low angle of audience vision obviates need for pit.*
- *Reverberation a bit long-should be 1.3-1.6 seconds.*
- *Grand opera not reasonable without scenic element.*

4. 1400 Seat Music Room
An orchestra platform in an end-of-Room enclosure approximately 70' wide and 35' deep (2450 net s.f.) will seat 115-125 piece symphony orchestra. Seats occupy 9800 net s.f.; a rectangle

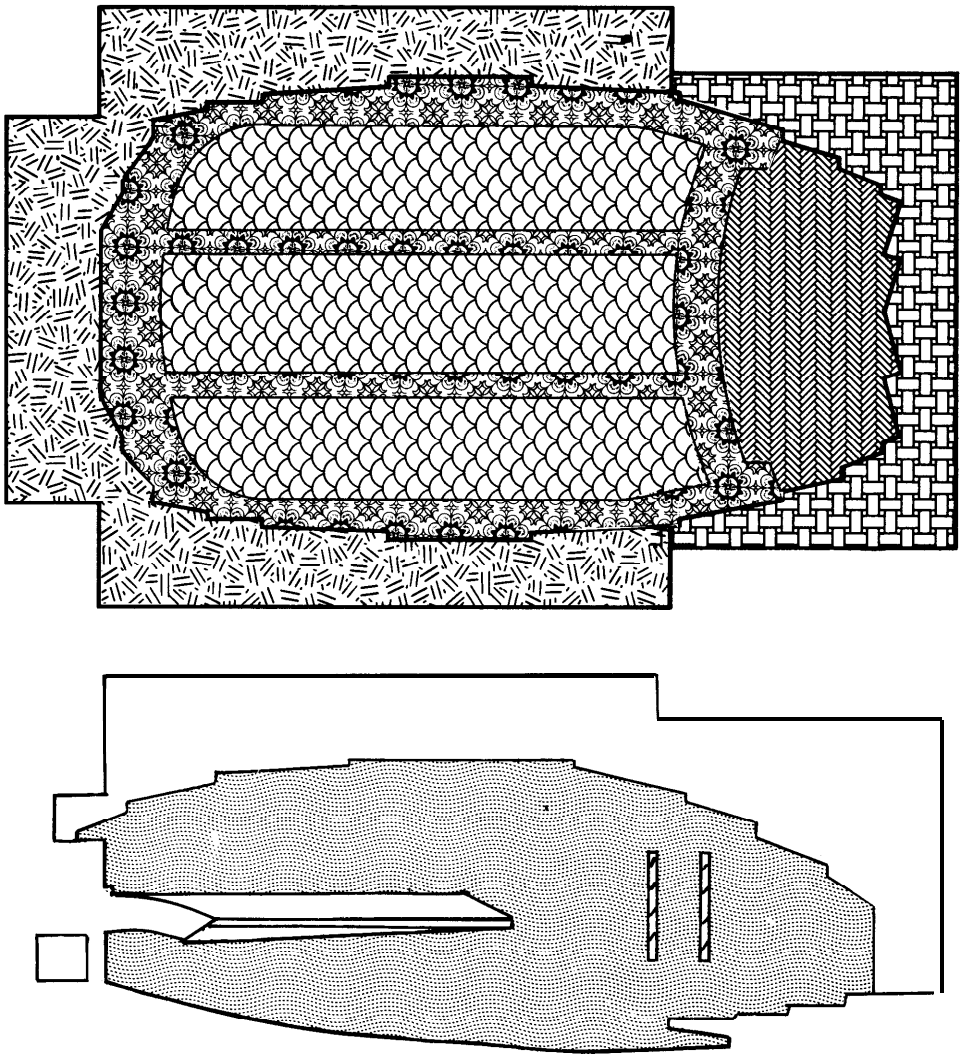


FIGURE 3-7.7 MUSIC ROOM-1400 SEAT

70' x 740' (with conventional seating, 2 sections of 14 seats per row, 50 rows deep) would be too long for vision and direct sound levels. Make one shallow, three-legged balcony seating 300, leaving a main floor 110' long.

The balcony is five rows deep at rear and two rows deep at sides, which extend 70' toward stage. Gross area of the Room (including Stage) is about 14,500 s.f., but balcony access will require corridors and stairs, for total 16,500 GSF (75% net/gross). Reverberation time of 1.6-2.0 seconds requires 450-480,000 cubic feet, for an average ceiling of 45'.

The Room described is a traditional concert hall. It will be suitable for full symphonic music. Its reverberant volume is medium for symphony, since a smaller House than typical for American halls means a proportionally higher component of direct sound relative to reverberation; however, definition and clarity of tone is considered desirable for contemporary music.

Secondary uses are limited:

a. Legitimate Drama:

- *Not possible.*

b. Dance:

- *Similar concerns of 650 seat Music, without benefit of Open Stage suspended grid.*
- *Existence of balcony improves potential for Dance, although house size would mean extreme distance from rear seats.*
- *Extension into audience would be more feasible, especially with 3-side balcony, but extension introduces problems of entry of dancers, stage lighting, and reorienting fixed seats. Not likely except for "rug concert" seatless occasions.*

c. Musical Drama:

- *Provision of stagehouse and pit (4500 s.f.) essential.*
- *Stagehouse accommodations may dispense with flyloft if generous offstage and wingspace is included. This means compromise of primary use by requirement of demountable orchestra shell.*
- *Orchestra pit is essential for reasonably unobstructed vision and Drama lighting angles.*
- *Reverberation time should be cut drastically. Introduction of sufficient absorption will select out mid and high frequencies, resulting in a weak, unnatural voice quality. Selective sound reinforcement would be desirable.*
- *House size and viewing distance sightlines acceptable for infrequent Musical Drama use, or Broadway revues.*

d. Choral:

- *50 musicians and 200 voices could occupy the stage described, without pit.*
- *With an extended stage for more musicians, large works (Beethoven's Ninth Symphony) are possible.*
- *With 50 musicians in an 800 s.f. pit, major choral works for 350 voices might be heard.*
- *Reverberation time would be just right (1.7-2.0 seconds desirable).*

e. Recital:

- *Chamber music and small ensembles would not suffer greatly if some adjustment were made, especially at the stage enclosure.*
- *Skillful lighting and backdrop design can mitigate apparent distortion of human scale.*
- *The Room is slightly large for recital intimacy, and too reverberant (1.4-1.6 seconds desirable).*

f. Opera:

- *Provision of stagehouse and pit essential (5000 s.f.).*
- *Operatic drama begs for a flyloft, deep stage and generous orchestra pit. Operatic drama also fares better with shorter sightlines and more intimacy than afforded by the plan described. This typically leads to the high, tiered horseshoe plan.*
- *Serious consideration of opera would begin at this capacity normally, in particular "intimate" opera as opposed to Wagnerian spectacle.*
- *Treated as light opera, Musical Drama considerations would apply with somewhat less success dramatically, but better performance musically.*
- *If serious effort is to be devoted to opera, consider designing the Room for it, since opera criteria combine requirements for orchestral Music and large scale Drama.*

3-8. ACCESSORY EQUIPMENT

Accessory equipment includes fixed and moveable devices, fittings, scenic properties, draperies, rigging and control systems that are desirable and often necessary to each performance type. Equipment design cannot be separated from or sequential to the Room design; it should not be thought of as "added to" the building. Acoustical design and theater stage technology are subjects for specialized technical consultants.

The architect's role is to coordinate consultants' efforts with the concerns of using service and

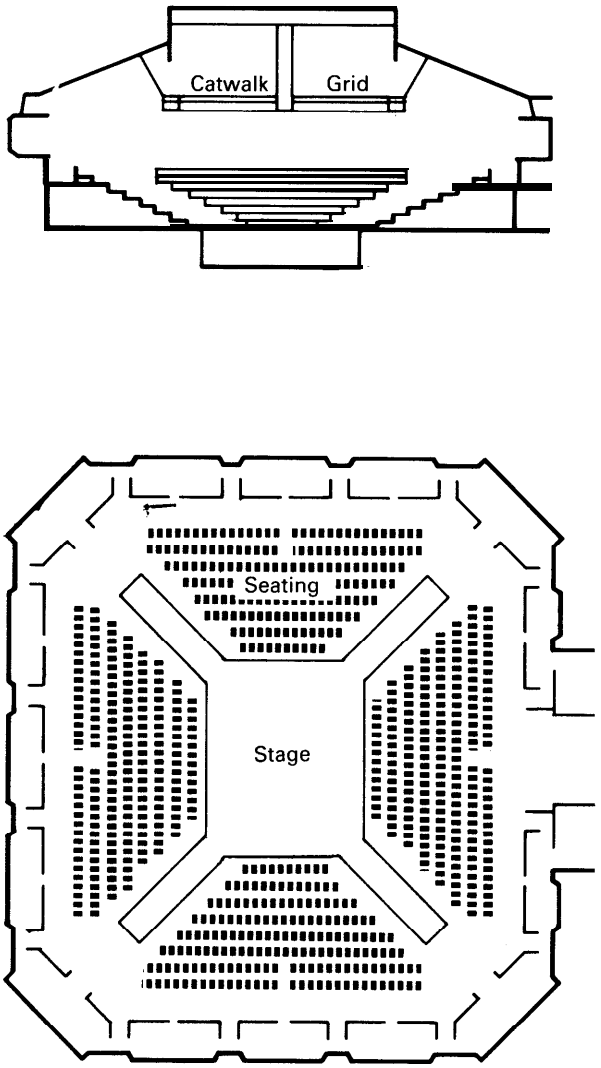


FIGURE 3-8.1 NON-FRONTAL ROOM

construction service. Room configurations must account for location and functional operation of accessory equipment in harmony with other criteria.

While detailed recommendations and technical discussion will be found in Chapter 4 of this Guide, the purpose of this section is to identify equipment's place in overall facility design by noting its general function, position and circumstances of use. Support and attachment, power supply, service access, enclosure, etc., are provisions that will be made for it in the architectural design.

A. GENERAL CONSIDERATIONS

1. Non Frontal

It is assumed the vast majority of Rooms will be Frontal in concept, and subsequent discussion reflects this. Departure from the Frontal form gives rise to a host of differences in the concepts of equipment use and placement. Certain principles hold true while their physical implications change greatly. Nevertheless, non-Frontal configurations do have application as potential Army facilities, especially where conversions of existing buildings or found space, independent rehearsal rooms, outdoor staging and exploratory programs are involved. A few general statements should be kept in mind regarding non-Frontal and Open Stage equipment.

The Open Stage relies less on a framed view, elaborate scenery and hidden devices than on lighting and suggestion for visual impact. Similarly, electronic and acoustic supplements and tuneability acquire greater value relative to enclosure design. As concealment becomes impossible, equipment assumes an important role visually. Careful detailing and good housekeeping can turn this into a gratifying, even exciting experience for all.

Perhaps the most significant benefit of non-frontal and Open Stage theatercraft is derived by users who have limited technical manpower, production funds or time for preparation. The absence of traditional stagehouse facilities frees them from production inertia and the obligation to fulfill ingrained audience expectations.

In general, non-Frontal and Open Stage forms are appropriate for small scale, intimate Rooms for legitimate drama, modern dance and small ensemble music. Equipment is lightweight, low-power, short-throw, portable and flexible in application. The stagehouse function is accomplished by a catwalk grid suspended 22-26 feet above the stage with supplemental low-angle lighting from positions in the house, installed in balcony fronts, clamped to railings, wall or ceiling bars. Very little scenery is hung or flown; there are no house curtains, etc. Without wingspace, entry points from the house itself are necessary via runways, vomitories and a trapped stage. The stage is sometimes the lowest point in a steeply raked initimate Room. Portions of seating may be demounted and rearranged to alter acting area configuration. In the typical small Room of this kind, acoustical precision is less practicable than for fixed Frontal arrangements, and less important.

2. Frontal

Most Rooms under discussion in this Guide are Frontal, one of three capacities or sizes, for presentations of four varieties: drama, dance, musical drama, and music. The following discussion is concerned with accessory equipment's basic purpose and functional impact within such Room environments.

B. CLASSIFICATION OF ACCESSORY FACILITIES

Accessory functions may be grouped according to the communicative media they enhance. Here they are listed in two groups associated with Vision and Hearing.

Vision:

1. *Lighting of performance and sets, and special effects.*
2. *Masks, screens, closures.*
3. *Backgrounds.*
4. *Sets, properties.*
5. *Visual monitoring for control of lighting and action.*
6. *Television for broadcast.*
7. *Film projection.*

Hearing:

1. *Source positioning, risers, pits.*
2. *Enclosures, shells.*
3. *Reflectors, diffusers, absorbers.*
4. *Additive/subtractive volumes.*
5. *Electronic audio systems.*
6. *Aural monitoring for control of electronic systems.*
7. *Communication systems*

The existence and operation of these accessories in the Room has impact on the total environment in both physical and perceptual terms. The kind and quantity of accessories is related to the nature of performance in much the same way desired Drama and Music Room qualities are associated with vision and hearing parameters.

C. VISION-RELATED ACCESSORIES

Beyond the needs of operational utility, the purpose of vision-related accessories is to enhance visual perception emphasized in performances of legitimate drama, musical drama, and opera. Dance and operatic recital should be provided with a modest facility for scenic effects and dramatic lighting. Music presentations, including choral and recital forms, require the smallest amount of visual enhancement in the form of concert lighting, and in some cases profit from backdrops and masking to set scale and conceal distracting equipment.

1. Lighting

This is the most important drama accessory. It furnishes color, mood, atmospheric effects on stage; indicates change of context, passage of time, symbolic change of scene; and it centers attention on specific actors or regions of the stage.

Theatrical lighting is not like architectural or exhibition lighting; it is constantly changing during performance and no two productions are likely to repeat a given array. Every sequence of dramatic events has a corresponding series of lighting events. At any point, there may be half a dozen ways to light an actor, a group of actors, a set piece, a single property, a backdrop, the stage floor and enframement. Each may involve several angles, colors, intensities and beam widths. When the actor moves the light moves with him, or it may move without him. In short, the lighting scenario is as much an element of theater arts as the reading of a script. Lighting systems must be able to facilitate change with the greatest range of options.

A combination of portable fixtures, on-stage adjustable attachment points, and house wall and ceiling positions allows the selection of several basic types of lighting:

On The Actor

- *Downlighting, creating pools of light on the floor from above.*
- *Sidelighting, giving form and color to the actor's body.*
- *Backlighting, making the actor stand out from the background.*
- *Frontlighting, coloring his body from the front.*
- *Area lighting, providing basic reference visibility from the front.*

On Scenery

- *Deck lighting, washing the floor with color from striplights overhead.*
- *Cyclorama lighting, coloring the backcloth with striplights over it or along side.*
- *Droplighting, coloring legs, borders and other drops with striplights.*
- *Specials, lighting specific pieces of scenery, such as sunlight through a window.*

Each instrument employed during the performance must be fed power from dimmer circuits that allow one person to control relative brightness from a central location. Each mounting position includes one or more circuits routed to a patch panel where they are selected or combined for separate or simultaneous control.

The majority of theatrical lighting instruments are located in the stagehouse. About 25% are located on the audience side of the proscenium.

a. Stagehouse Lighting

Positions must be provided over the stage at various elevations interspersed with rigging lines and battens. Lighting is also mounted on vertical booms at either side of the acting space.

While instruments may be assembled to pipes at stage level and hoisted as a unit, final adjustment is accomplished from portable ladders. Stages without flylofts provide a network of catwalks for attachment of overhead lighting.

In general, stagehouse lighting helps create the context of action; the parameters of its disposition are non-interference with movement on stage and invisibility from the audience. It is especially important for performance with minimal set material, such as dance.

b. Proscenium Lighting

Positions above and alongside enable the curtains to be washed with color. Troughs with deck plate covers can also be installed at the leading edge of the stage, or pop-up footlights. Proscenium lighting functions to establish foreground attention at the curtain line, which can be useful between scenes and as a transition between concentration on the play and the general illumination of the house.

c. Forestage Lighting

An elaboration of proscenium lighting occurs in some instances where a deep forestage apron or pit elevator extends into the house. The effective use of this projected area requires overhead lighting from a position equivalent to stagehouse lighting. It will also require adjustment of lighting from the house which is normally directed at the downstage curtainline zone.

The usefulness of an apron in straight drama is therefore questionable since it also alters sightline considerations and defeats the purpose of a stagehouse; it is neither a Proscenium Stage nor a Thrust Stage. The forestage concept arises from multi-use considerations where a music shell installation requires a canopy for acoustics anyway (it can be motorized and retracted), or where occasional enlargement of the stage by covering the pit is deemed valuable for specific uses. The canopy position may also be occupied by loudspeakers and other electronic equipment. The pit itself can usually be lighted from house ceiling positions.

d. Lighting From The House

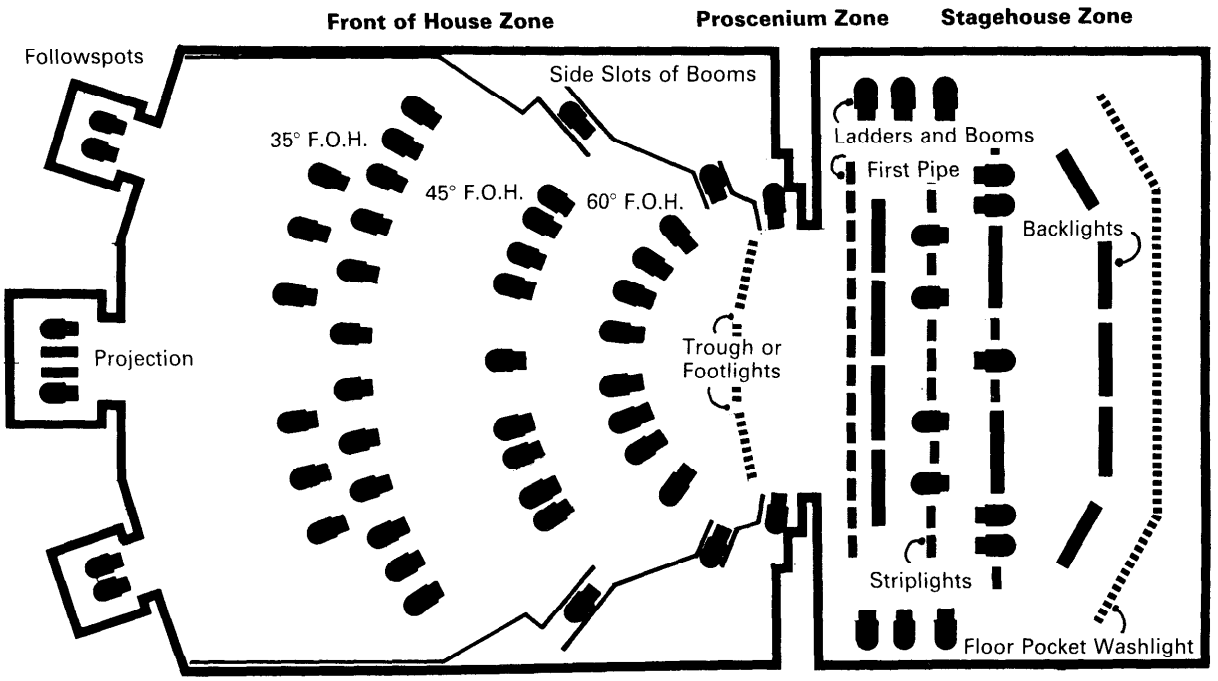
The principal illumination of actors must occur at an angle from behind the audience to avoid the distorting effect of long vertical and diverging shadows. Most of this lighting is directed to the forward portion of the stage from vertical pipes concealed in the sidewalls of the Room and from catwalks near or above the ceiling.

This lighting imparts the modeling component of shadow important to perception of features, shapes and textures. The catwalks, ladders and/or booms are permanent construction on which the portable fixtures are mounted and adjusted. Their location should allow incident angles of 60 and 45 degrees from horizontal. Balcony fronts near the stage often serve as mounting points also.

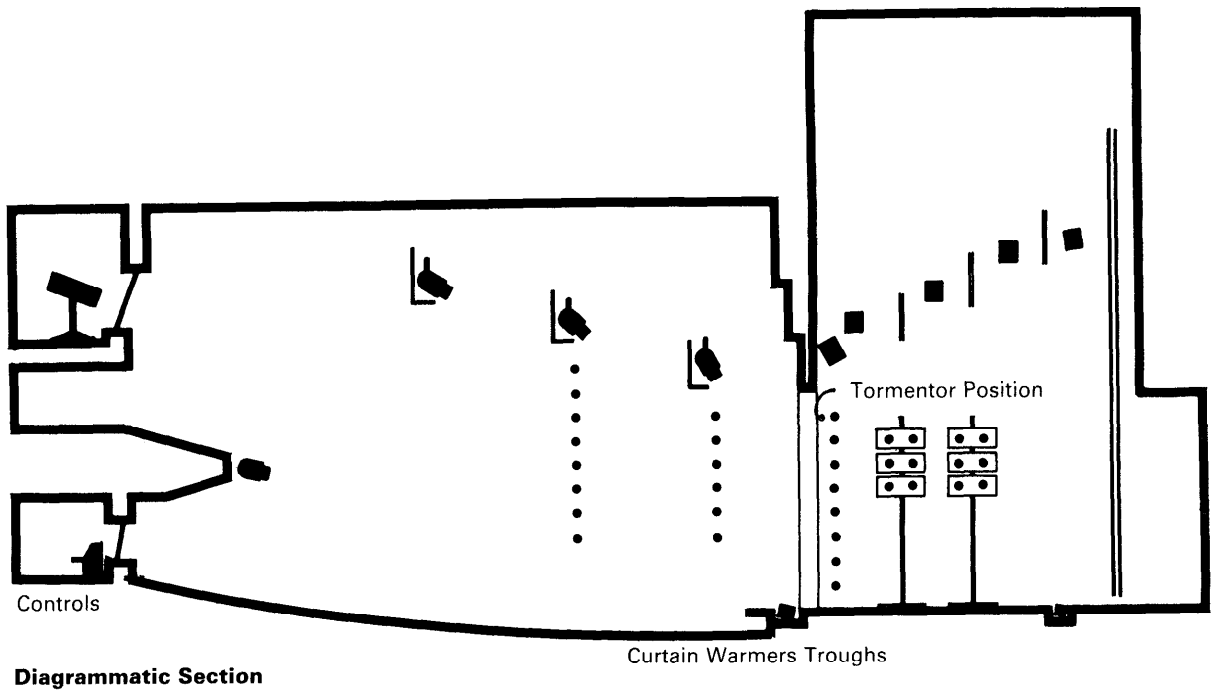
Give special attention to the distance relationship involved in obtaining these necessary lighting angles. Beam control decreases while fixture size, cost, power consumption and heat generated increases with distance. It is generally more economical and flexible to make the most of positions within 40 feet of the subject.

e. Follow Spots

The lowest line of lighting (30 degrees) is mainly devoted to manned followspots, although a few ellipsoidal projectors are often useful at this angle too. Small portable followspots on stands with a maximum throw of 60' are very useful for drama, and may be used from platforms in the house.



Diagrammatic Plan



Diagrammatic Section

FIGURE 3-8.2 LIGHTING POSITIONS

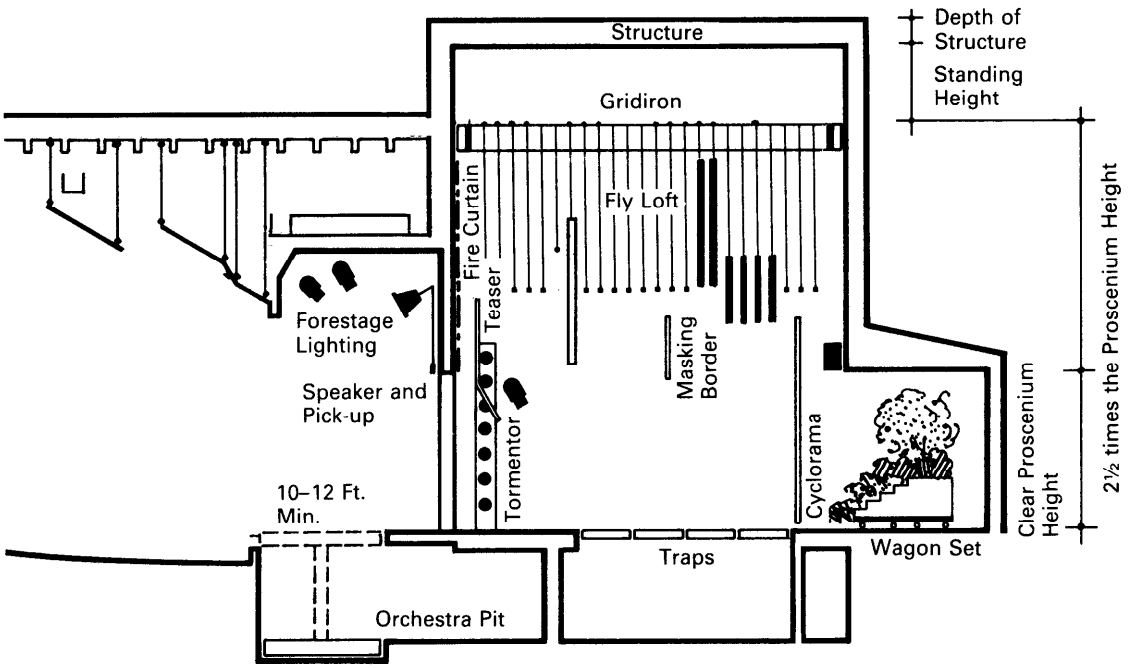


FIGURE 3-8.3 STAGEHOUSE ACCESSORIES-VISION RELATED

Carbon arc followspots with a maximum throw of 200' generate poisonous fumes that must be mechanically vented; they are operated from an enclosed booth. This booth is at the rear of the house, often near or just below the ceiling. It contains at least two permanently mounted carbon arc lights with interchangeable color filters.

f. Houselights

Permanent auditorium illumination is mentioned here because its operation parallels theatrical lighting. Separate dimmers are used, controlled from the theater lighting console. A preset dimmer sequence is often used to gradually reduce intensities of separate sources progressively, at the same time bringing up aisle lights and exit signs. In Music Rooms, the houselights rarely go dark; about 20 footcandles is often maintained for program reading.

g. Concert Lighting

Music Rooms without a stagehouse have a less extensive lighting system-because stagehouse and proscenium requirements are greatly reduced along with the need for a constantly changing program of color and intensity. Nevertheless, adjustable lighting from the house, followspots and enclosure/stage lighting need be furnished with suitable controls and dimmers. The ability to alter the color composition and pattern of concert lighting is important to obtaining desired mood and scale relationships for the occasion. Performance area lighting must also be adapted to musicians' comfort and seeing tasks, requiring high angle fixture placement, 70 footcandles with low specularity, and a relatively bright background field.

h. Touring Companies

Road shows and troupes, especially commercial entertainment and drama groups, often travel with their own lighting equipment including instruments, controls and cable. Facility for temporary equipment becomes important. Depending on the situation, portions of the installation's equipment-in-place may be used, especially on the house side. Therefore, the selection of compatible standard interlocks and modular systems is advised; the management should be very clear about what it has to offer and what the touring group anticipates using or connecting. In any case, a company switch is provided for visitors' direct power takeoff.

2. Masks, Screens, Closures

These are usually the function of draperies, which define acting and scenery spaces; screen equipment, sets and actors entries from view; surround stage space with light and color, or frame it in darkness; and close off or screen the stage from view between scenes. Draperies are discussed at greater length in Chapter 4.

The relationship of draperies, lights and scenery within the stagehouse is best understood in terms of flyloft layout for the traditional Proscenium Stage. It also makes clearer the conceptual differences of the Open Stage. (See 3-9e and Chapter 4 regarding the mechanical workings of the flyloft).

Rigging flyloft stage equipment is accomplished with parallel pipes slightly longer than the proscenium is wide, normally able to be hung every six inches from the proscenium to the back wall of the stagehouse. These pipes are suspended by hemp and wire ropes from a gridiron high above the stage floor, in order that drops and drapes may be drawn up clear of the acting space. A large number of lines is required because of the many pipes (or battens) and because each batten has several suspension points to limit deflection.

Rigging the open stage is accomplished from a lighter-weight grid fixed 25-30 feet above the stage floor, about where the top of a proscenium would be. It functions as an attachment network for light pipes and drops, but very little is ever drawn up (or flown) above it. This grid is often a series of catwalks to which lines, pipes and lighting instruments are clamped directly. Variations include wire net “trampoline” grids through which lines are dropped.

The proscenium wall is a substantial piece of structure, since it must span a large opening, bear part of the heavy gridiron load and separate the audience from the stagehouse with fire resistive construction.

a. Fire Curtain

It is hoped this apparatus need never be used, and certainly will not be in the normal course of performance. Although it is not a vision-related accessory, it is always the first line of actual closure between the stage and house, operating automatically and independent of performance rigging upon activation of smoke and heat detectors. It retards the passage of flames, smoke and toxic gases in the event of fire, providing a margin of safety for evacuating the building. (See also remarks under 3-6a).

Non combustible construction of asbestos fabric and/or steel slats similar to a coiling tambour door is typical. It has been found that asbestos cloth loses its structural integrity under high heat; when used, it is incorporated in a steel frame. In some circumstances (see NFPA Standard 101), a water-flood system may be used to soak the house curtain or the fire curtain for a specified period, in lieu of or additional to shuttering.

b. Forestage

Depending on Room configuration and uses, certain functions can take place in front of the proscenium. The stage may be equipped with a forestage or motorized pit lift capable of forming an apron in front of the principal curtain. In some cases, the proscenium is expanded in depth over this region and may contain supplemental borders and drapes, lighting, acoustical equipment, loudspeakers and movie screen.

This arrangement can be useful where music or small scale performances are interspersed with full drama productions, allowing rehearsal and set up to take place within the stagehouse without interference from ongoing programs. Forestage draperies, etc., are typically simple by comparison, especially since the fire curtain function cannot be effective.

3. Backgrounds

Including the fabric drops mentioned above, backgrounds may be the blank backwall of the stagehouse, or elaborate “‘murals”. One useful form of background is the cyclorama, which wraps around the scene space and may curve in two directions-vertically and horizontally. The cyclorama used to be a curved white plaster wall, but is now more often constructed of cloth, hung or stretched over a pipe frame at the back wall, white or medium gray in color. It has the advantage of portability and ease of maintenance, and can accept film projections from either side.

4. Sets And Properties

Scene elements are created or selected for the specific literature presented. Scene pieces are constructed and vary in complexity from painted drops and flats to elaborate multilevel structures,

replica interiors and the like ("box sets"). The term properties generally refers to individual pieces within the acting space, such as furniture, vehicles and items carried by the performers. Sets and properties may be broken down and reassembled or revised for several different productions.

5. Visual Monitoring For Control

Coordination of performance accessories over time requires a viewpoint approximating that of the audience. Hence, a control room is best located at the rear of the house, unobtrusive but in communication with the stage, lighting and rigging technicians, and performers. It must have complete surveillance of the action.

6. Television Broadcast

If video recording or broadcast is contemplated, required facilities must be anticipated in planning the Room. Camera placements should not interfere with audience sightlines and should not divert attention. If fixed or concealed camera positions are provided, they must be carefully preplanned. Also note that higher illumination levels (150 footcandles) are required for TV, especially color-casts. These circumstances must be evaluated for their influence on performance. A broadcast control booth need not impinge on the Room, since camera control deals with video images. Most broadcast networks furnish mobile vans for this purpose and require only cable entrance and camera positions as built-in components.

7. Film Projection

Except for its use as a scene accessory this capability is not an essential element, but after other functional requirements are met, slide and movie film projection may be deemed a useful accessory.

The similarity between drama and cinema ends with the audience facing a framed image in a darkened room. Generally, a Frontal Room designed for drama can accommodate film by providing a flown screen, with projectors adjacent to the lighting control booth addressing the screen at a right angle to avoid distortion of the image. Obviously, available projector locations may be less than satisfactory if their accommodation is not considered in the design.

16MM movies and 35MM slides are the most likely formats, but standard portable equipment does not have the light output sufficient for distances exceeding 30 or 40 feet. More powerful projectors, and equipment for 35MM and 70MM movies of commercial variety require enclosed, ventilated, fire protected booths and permanent mounts, much like carbon arc followspots. While large format film can be ruled out, it is still recommended that a suitably positioned booth with at least two projector ports be installed at the rear center of a small house. For occasional use in a larger house, power supply to a demountable platform within range of the screen may be desired.

D. HEARING-RELATED ACCESSORIES

Electronic amplification, recording and playback, microphones, loudspeaker systems, and intercommunications readily come within the definition of accessory equipment as do any non-electronic adjustable acoustic devices such as reflectors and absorbers. But it should not be forgotten that seemingly commonplace fittings like chairs and risers are equally important equipment components for the enhancement of performance quality and flexibility.

A more thorough discussion of equipment functions and techniques is contained in Chapter 4. This section (3-8) is concerned with their implications in architectural (Room design) terms. Decisions about the seven topics treated below will affect dimensional, structural and material considerations.

1. Sound Source Positioning

Successful music presentation requires the ability to locate musicians in varying relationships to each other and to the Room. This is important to balancing sound emerging from the stage. It provides essential flexibility for group size, instrumental makeup, and differences of presentation content.

Consideration of accessory devices need be given to the two principal areas of music performance - the stage (or platform), and the pit.

For instance, the musicians' elevation relative to the audience tends to increase direct sound levels. Also, the position of musicians relative to the stage enclosure walls can be especially critical in elliptical and parabolic geometries sometimes found in large Rooms, and where sources of uneven intensity must be balanced (such as soloists and ensemble, strings and brass).

Similarly, a deep orchestra pit yields primarily reverberant sound. The treatment of the pit or the decision to do without one has considerable impact on the use of the Room acoustically quite

as much as operationally; the pit is more than a convenient place to tuck the orchestra out of the way. For dance or musical drama, the pit substitutes for the enclosure needed by musicians to hear themselves. It also serves to blend and subdue musical accompaniment relative to voice on stage.

Pit musicianship is a specialized art requiring experience and precision (so does stage singing). If a less experienced group is involved, the pit treatment can help by introducing absorption to reduce sound levels and allow for electronic amplification. Consider two examples of all-music presentation-chorus and orchestra.

a. Chorus

The chorus is compactly arranged on risers for geometric reinforcement, maximum projection, and ability to hear each other in circumstances that reflect maximum energy into the house. In this case, the orchestra is often located in a recessed pit, contributing reverberant tones without interfering with articulation of voices in the direct sound field. Rooms have often been designed primarily for chorus or orchestra with no pit, due to the misconception that a pit is a drama accessory.

b. Orchestra

Arrangement of musicians on stage should be at the conductor's option. Some orchestras prefer to set up on the flat, others on risers. Smaller groups and contemporary material may benefit in particular from steep riser arrangements or careful location horizontally; many halls have developed "'soloist points". Finally, recall that musical instruments exhibit handedness, especially those with resonant chambers and sounding boards (violins and pianos) that may dictate a proper orientation to the listeners. Brass instruments are highly directional; the musician may have difficulty assessing the intensity of his efforts perceived by others. All of these are conditions tempered by position and arrangement.

Among the devices to have on hand is a good assortment of portable riser platforms stored convenient to the stage. The most commonly used arrangements may be fitted to the stage, but should be modifiable by reassembly as need arises. A 4' x 6' folding unit is a practical large size, with interchangeable legs in 8" increments. Normally, 36"-40" tiers are wide enough for seated musicians and singers, while 24" widths are better for standing chorus. Musicians' chairs should be carefully selected. They should be firm, "four-square" in stability, broad rather than contoured, and of unitized squeakless construction.

2. Enclosures and Shells

These function to condense spherical wave radiation and direct it toward the audience and into the house volume. In a Room without a shell (Thrust or Surround) vocal sound emerges with a 5db drop to the side and 10db to the rear. A 10db drop means the sound seems half as loud.

An enclosure is built into the Room permanently. However, some degree of adjustability is usually incorporated in the enclosure itself, including moveable panels, additive reflective components or absorptive elements. These enable the enclosure to be "tuned" to varying music group sizes, instrumental makeups, and desired sectional balance, though its effect is probably most noticeable in smaller Rooms and recital halls. For large Rooms, adjustment is mainly for the benefit of the musicians.

The shell may be more easily understood to be "equipment" since it is demountable. It is necessary for a multi-purpose Room with stagehouse. The shell can be wholly or partially disassembled for storage off stage if there is no flyloft. The decision to have a shell, its design and placement, depends very much on the volume and shape of the Room, and all the uses to which it will be put.

Shell design requires expertise. If a shell is to be used intermittently, lightweight highly portable construction is needed. Lightweight, however, means less low-frequency energy is reflected. This is typical of the flown shell, which may have self-supporting wall panels. If a shell will remain in place for some time, a more substantial bolt-together articulated panel system is common. The ceiling should be 20-25 feet above the musicians, and in large Rooms, may extend into a forestage canopy.

3. Reflectors, Diffusers, Absorbers

Hard, dense surfaces of varying sizes reflect varying wave lengths. Convex and irregular surfaces break up and distribute reflections of characteristic wavelengths in many directions. Porous surfaces absorb high frequencies. Dense hangings and pliant material (such as people) absorb midfrequencies. Large resiliently mounted surfaces with cavities behind them absorb low frequencies.

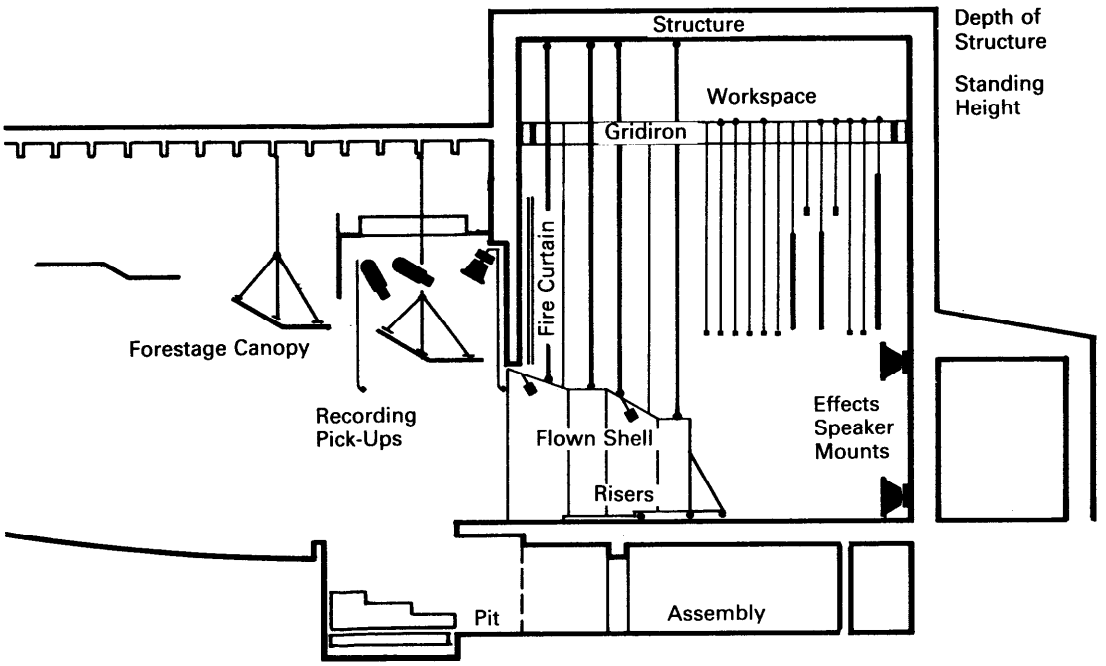


FIGURE 3-8.4 STAGEHOUSE ACCESSORIES-HEARING RELATED

The materials and details of construction enclosing a Room are critical factors in its performance acoustically. Reverberant decay is a function of the net reflective property of boundary surfaces and the volume in which the sound rattles around. While this is a general Room quality, adjustment in specific areas can be an accessory function.

Typically adjustable reflector positions include the region over musicians (either in the stage enclosure or in a forestage canopy for pit orchestra), the region above and between musicians and audience (forestage canopy), and trouble spots likely to occur in found space conversions (acute corners, domes and focusing coves). Reflectors should almost always incorporate diffusion to scatter reflected waves. This is accomplished with convexity and surface irregularities.

Absorption devices may be employed for several purposes:

- *Reduce the reverberation time of a large volume for adaptation to speech.*
- *Permit rehearsal in a highly reverberant empty house.*
- *Compensate for low attendance rates.*
- *Alleviate echoes and focused reflections.*
- *Reduce sound levels emanating from the pit.*

However, absorption must be properly used. Its addition results in lower overall sound levels, which may necessitate installation of electronic amplification. Absorptive material can be frequency-selective resulting in unnatural or unbalanced attenuation just as non-diffuse reflectors can intensify a given frequency.

The common practice of alleviating harshness, focused reflections or flutter echoes by hanging draperies on one wall, would often yield more satisfactory results if diffusion were employed instead. Long, even reverberation is gained by provision of cubic volume in correct proportion to absorption; adding absorption when it isn't needed essentially defeats a Music Room's intent.

4. Additive/Subtractive Volume

This is a recent approach to variable reverberation based on the volume/absorption principle. Efficient coupling or separation is critical to success. Subtraction is possible by sealing off a por-

tion of the Room, or by moving musicians out of the enclosure and sealing it behind them. Addition is possible by two methods with variations: physically expanding the volume of Room increases reverberation time generally, and coupling other volumes in proximity to the source increases reverberation of a portion of the frequency spectrum.

The sophisticated technology involved tends to limit application to special circumstances arising from Room configurations dictated by unusual program goals; the likelihood of such circumstances is small and more readily solved by firm decision. Although adaptive electronic systems will probably prove more feasible, consideration of coupled volumes may help avert related problems.

Actually enlarging or decreasing effective Room volume at will is rarely practical. Given a deep upper balcony, it is possible to close it off by drawing a heavy, specially designed sectional partition between its front row and the ceiling. Schemes to mechanically raise and lower the ceiling itself have been plagued with problems of acoustical seals, integral lighting and mechanical systems and great weight. Annexing adjoining spaces and corridors fails on account of their contents, and practical dimensions determined by normal use. The coupled volume must become part of the Room.

The most useful volumes are in proximity to the music source. Their use results in strengthened low frequencies for added "warmth". One of these volumes is the stagehouse itself, connected through a large proscenium. The installation of a partially "transparent" shell reflects mid and high frequencies. Low frequencies enter the stagehouse where they reverberate and emerge into the house a short time later, effectively lengthening low frequency decay. However, the volume must be relatively free of absorptive materials, which limits the kind and quantity of drops stored there.

Perhaps a more practical possibility is the utilization of understage volume in a similar fashion, with the ability to control absorption. In this case, the stage floor behaves like a drumhead or violin body. When the volume is coupled with the Room it enhances reverberant field for the audience near the stage especially, who often suffer from high direct/reverberant ratios. This method has had application in non-stagehouse Rooms, too.

Coupling has also been accomplished electronically, using the stagehouse as a reverberant chamber connected by microphones to speakers in the house. The advantage of electronic coupling is ability to turn it off in multi-use Rooms, so that undue scene change noise is not transmitted during drama performances. Air-coupled volumes must be mechanically separated, with absorptive draperies added to deaden the space. There are also issues of fire separation to contend with.

The practice of closing the proscenium or orchestra enclosure and staging small scale music performances in front of it carries with it the need for reflective surfaces around the musicians. These may be set up on the apron or lowered from a forestage canopy. The proscenium closure must be more dense and reflective than the typical house curtain.

5. Electronics and Sound Systems

As with demountable shells, it is easier to think of electronic components as accessory 'equipment". They serve three general functions in terms of performance acoustics: enhancement of natural acoustic qualities, amplification of sound, and theatrical sound effects.

In terms of Room design impact, the first function (electro-acoustic enhancement) is most significant, as it deals with objectives that could otherwise be effected only by physical changes in the structure. This system's sole purpose is to increase reverberation time by electronically introducing very small delays between input and output. The system must be designed for the Room and should only be undertaken by a qualified acoustician.

Amplification (sound reinforcement) raises the level of direct sound radiated into the Room. This too must be designed by a well-informed specialist. Its architectural implications reside in the placement of loudspeakers, the choice of which must belong to the acoustician. Depending on

Room use and configuration, loudspeakers may be located in a central cluster above the proscenium, in several groups above the proscenium, on both sides of the proscenium, or distributed in the house. Improper placement of loudspeakers and microphones can destroy the usefulness of the Room.

An audio effects system provides the aural equivalent of visual (lighting and scenic) con-

tent-illusion, atmospheric mood and color, and thematic continuity. The effects system will be independent of the reinforcement system, for the very reason that directional illusion (or realism) may demand that sound effects originate offstage or behind the audience or in a moving pattern. Multiple outlet jacks are required for portable speakers controlled through a special effects console.

6. Monitoring and Control

Production lighting control from the lighting booth is especially relevant to drama productions where visual monitoring is essential. By the same token, sound control where electronic systems are involved should be properly monitored from an audience reference point, also normally located in the rear quarter of a frontal house.

Whereas lighting control is often separated from the house by plate glass to avoid audible intrusion on the audience, sound control requires the actual sound in the Room be heard for appropriate balance adjustment to be made. The control console "cockpit" is best located in the audience area. Solid state electronics allow it to be quite compact, tied into remote power amplifiers of the reinforcement system. Location and control wiring connections will be specified by the system designer.

7. Communications

There are several important systems of communications to be considered. The principal design requirement is separation of message channels to limit them to those for whom the message is intended. This may involve separate wiring, input and output sources, and isolated enclosures. In this category are public address, broadcast and recording, performance monitoring and production communications.

The purpose of public address is to make general announcements to groups of people, which may mean the seated audience, those assembled in the lobby or out-of-doors, and those assembled in the stagehouse or backstage during rehearsals. Its key architectural implication is the acoustic separation of message zones and restricted control of input channels to prevent unwitting intrusion on performance activities. This demands appropriate door seals (and the discipline to keep them closed) and level adjustments of the loudspeakers, with master controls in the control booth and stage manager's console.

Archival recording and broadcast functions utilize signals from monitor microphones suspended in front of the proscenium over the first few rows of seats (or derived from the reinforcement system inputs) which hear what the audience hears. These signals may be fed directly to a remote broadcast/control booth where an announcer's voice-over can be dubbed in, and/or to a recording control booth. Broadcast programs are either recorded for replay or relayed to the station for transmission. The architectural requirement is for cable entry to the building and provision of a soundproof announcer's booth with a view of the performance.

The function of performance monitoring is twofold: to communicate the performance to latecomers waiting in a lobby area separate from the Room, and to artists and technicians backstage, permitting them to follow the performance from remote locations. It is intended to minimize interruptions and milling around while waiting to be seated or to enter the stage. The monitor system should be adjusted to operate without supervision and without being heard in the Room. The requirements of public address systems apply here as well.

Finally, production communications are necessary during performance. One of these is actors' call, enabling the stage manager to alert actors waiting for entry cues backstage. This may be a visual signal light system operated from the stage manager's position in the wings and/or a voice communication "squawk box" from the control booth.

A headset system connects the stage manager with technical staff in lighting positions, fly gallery and rigging control points, trap room and orchestra pit, sound reinforcement and effects control consoles, lighting control, projection and followspot booths-in short, with all the action stations to be coordinated. Normally, a two way single channel system (all-talk, all-listen) is sufficient for this activity. Jacks must be provided at all relevant positions, unless wireless receivers are employed.

Selective station-to-station communication should also be provided via house telephone, connecting stage manager, house manager, control booth, stage door security, and similar points. This may be an extension of the outside line telephone system.

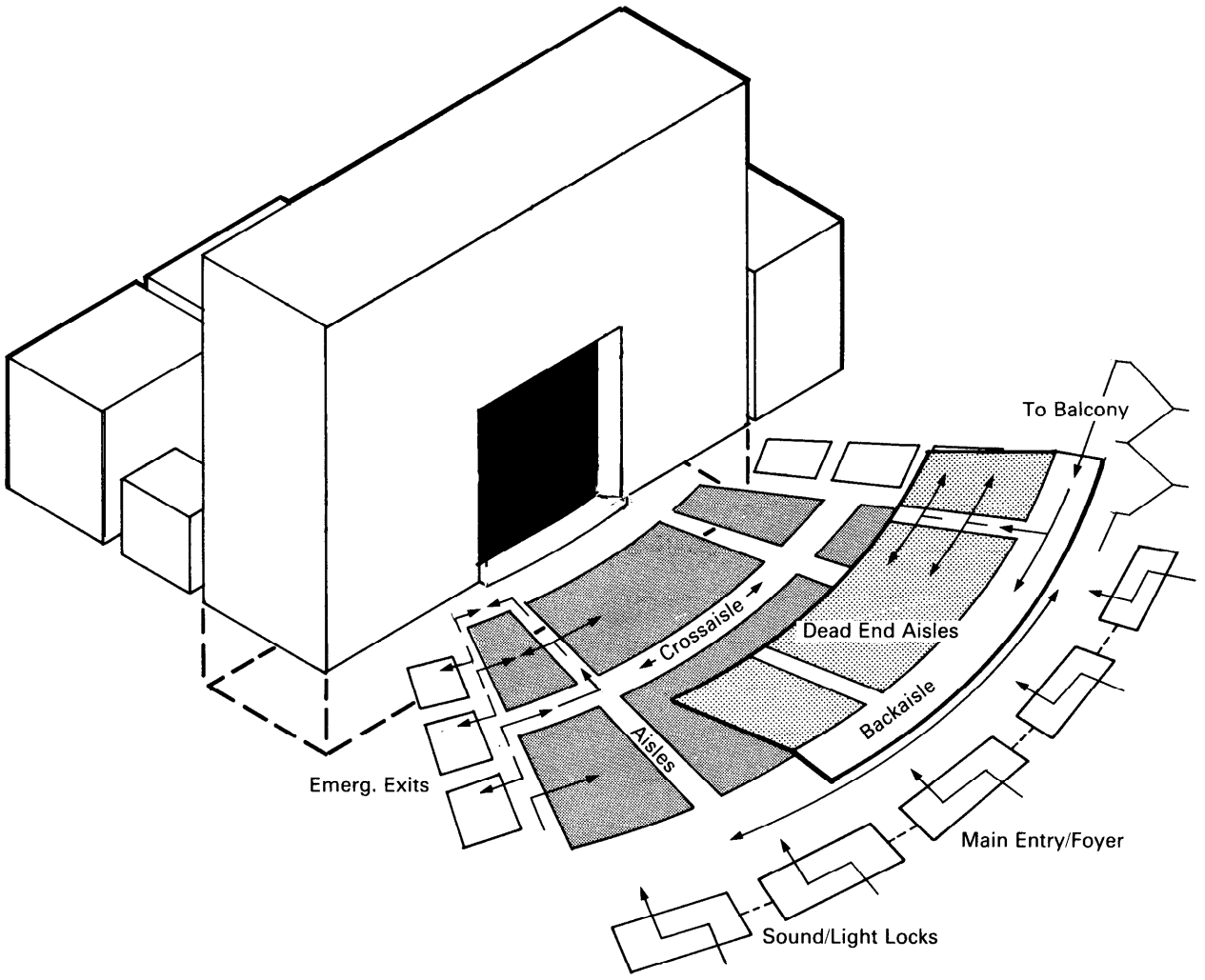


FIGURE 3-9.1 ACCESS SYSTEMS-AUDIENCE

3-9. ACCESS

Planning of circulation and access systems is necessarily integral with space planning for specific facilities. Access is influenced by external relationships to adjoining facilities and by site characteristics. Moreover, access and circulation systems have considerable impact on the realization of a Room design. While individual requirements will vary, this section (3-9) provides a checklist of the questions that must be answered. The basic approach is to define major functional access criteria for the following users:

- Audience, *to ensure firesafety exiting, Room entry orientation and control, and access to public facilities during performance.*
- Performers, *to permit firesafety exiting, movement within stagehouse and between it and backstage areas.*
- Technicians, *to prevent injury, and allow control point and equipment mount access.*
- Scenery and Properties, *to facilitate both horizontal and vertical movement.*

The required information has two sources-recognized codes and standards, and functional operating requirements of performance-related activities. DOD criteria recognize guidelines set forth by the National Fire Protection Association in its Pamphlet No. 101, Life Safety Standards, with particular reference to Chapter 8, Assembly Occupancies. Several functional requirements are also discussed in preceding sections of this Guide.

A. AUDIENCE ACCESS

1. Life Safety and Exit Parameters

Life safety considerations have the greatest influence on the design of audience circulation and access. The best practice is to go directly to the referenced standards, paying careful attention to the design implications of categorical definitions. Chief among these is the size of the audience related to the number, size and location of means of egress. The main entry shall not be expected to handle more than 50% of the occupants, and if two additional exits are provided, each shall accommodate at least one third. 1000 or more occupants require at least three exits of equal size in addition to the main exit.

Next, consider the line of travel to the nearest enclosed (2 hour rated) exitway for positioning exits, which should not exceed 150 feet (or 200 feet if the room is sprinkler-equipped). It should not be possible to travel more than 20 feet to a dead end; the guiding principle is to ensure each occupant has a choice of at least two exits. Note that continental seating, because it slows movement, requires many more exit doors, and that no exitway or aisle may diminish in width toward the exit.

Exit doors must be equipped with non-locking panic bolts, open in the direction of exit, and be identified with illuminated signs. Aisles and exitways must also be illuminated, fitted with battery-packs or emergency generator power systems in case of power failure.

Ramped aisles are limited to a gradient of 1:8; and the rules governing maximum step riser heights differ for the main floor (7½") and balconies (8'). These factors form limits to the theoretical functional considerations developed in Section 3-5.

2. Functional Parameters

Entry to the Room must account for sound and light barriers, which are vestibules and door seals. Where acoustic separation is important double door sets are superior to extra special door seals on a single set since the seal doesn't function when the door opens. Vestibules should be of a size to admit several people and/or wheelchair occupants easily, so that the first door set can close behind before the inner set is opened.

Except for exit considerations, the location of entries and layout of aisles are determined by factors discussed under Section 3-5 and by external relationships to audience support facilities (Section 3-13) and the building exterior. The Room's organization should facilitate newcomers' ability to find their seats without confusion. Entry patterns should minimize disturbances of sea ted patrons.

Although entrance from the rear of the House is typical (perhaps because public areas tend to be zoned toward the street side of an urban building lot), entrance facing the audience tends to be more ultimate and social in orientation.

Recognizing such options may mean the design can take advantage of site features or respond to other program relationships.

B. PERFORMER ACCESS

1. Life Safety and Exit Parameters

Similar concerns apply to audience and performers-two ways out, short travel, adequate illumination, and non-hazardous routes. The performance area should be separated from the house, although final exit may converge in an enclosed passage provided there is no confusion as to direction of exit. Performers must also be able to exit from dressing rooms and backstage areas without entering the house or stagehouse.

2. Functional Parameters

Multiple entry and circulation opportunities are essential to performance. Entry to performance space includes provision for crossing the stage unseen, entry from below via traps, pit access, and entries from the house side which are especially important in Thrust and Surround configurations. This last is usually accomplished from actors' vomitories in the audience area rather than from audience aisles, but even Frontal Rooms should allow access to the Stage from the House via demountable or permanent steps at each side.

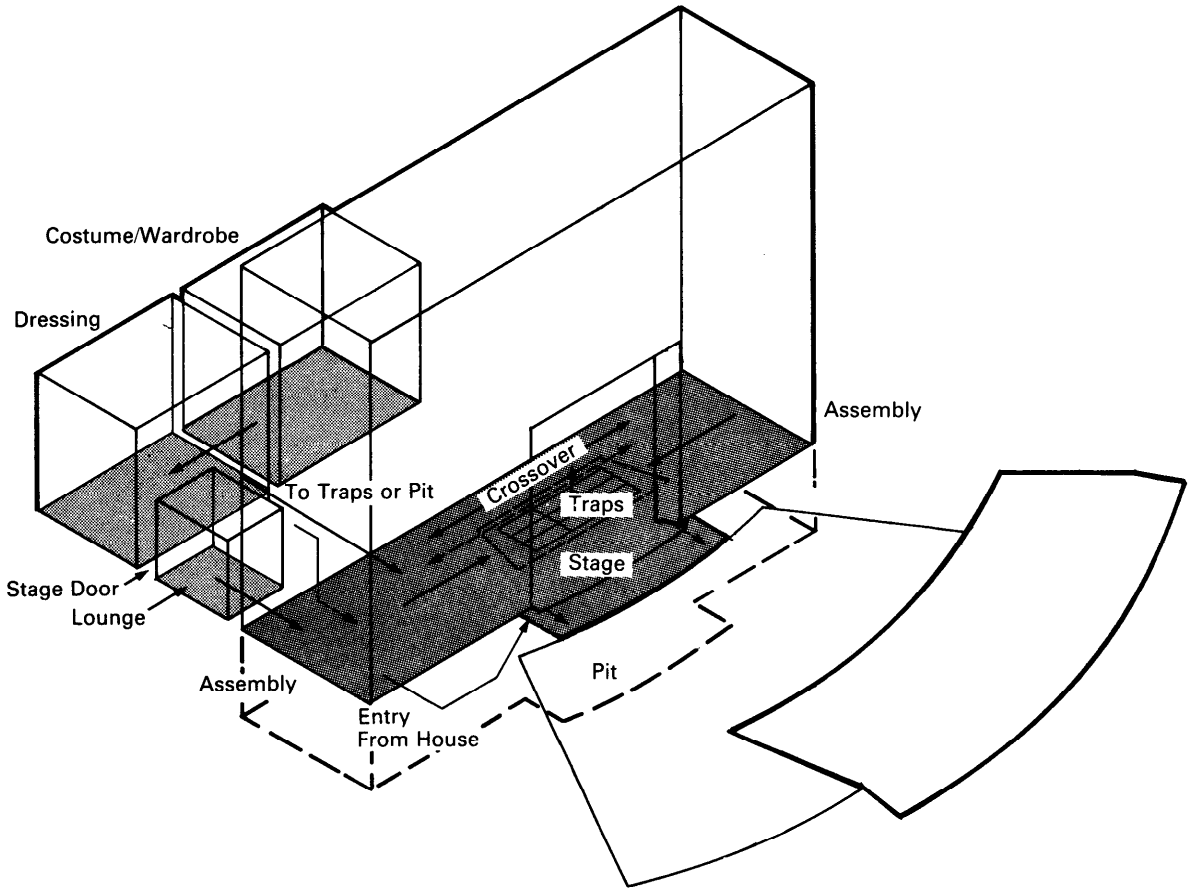


FIGURE 3-9.2 ACCESS SYSTEMS-PERFORMERS

Access to sets and musicians' risers at several levels should be considered, especially where a permanent acoustical enclosure is combined with portable platforms; door openings of sufficient height are needed.

Space must be allowed for performers to assemble just before entering the stage or pit, perhaps carrying instruments, etc. Assembly area is in addition to backstage artists' lounges and warm-up areas. The number of cast members onstage at one time depends on anticipated performance types. The recommended approach is to plan for critical circulation, such as crossover and assembly area, in addition to performance, scene and working space, for the most effective and flexible use of valuable stage area. Circulation space need not occupy the full height of a stagehouse.

C. TECHNICIAN ACCESS

1. Life Safety and Accident Prevention

The emphasis in technicians' areas is on prevention of injuries to themselves, bystanders and cast and audience members. Common sense, discipline, and a healthy respect for potential

consequences of negligence are the most important guidelines; in many situations, technical systems cannot be both functional and foolproof. Reference to OSHA Safety Standards will help identify hazardous conditions and methods of abatement.

Most access to equipment leads through other activity areas, such as the stagehouse and house balcony, and shares fire exit-ways. High fire hazard uses, including followspot and projection booths, are enclosed in noncombustible construction provided with two exits. Exits from other workstations are governed by the number of occupant technicians. The same is true for stairways and ladders, which normally need not conform to public egress requirements. They should, however, be noncombustible, non-slip, with adequate handrails and cages.

Technician accessways are used all the time, not just during performance. An even higher level of safety consciousness is required to prevent missteps and personal injuries when the audience is not a present reminder and work effort is great. Observance of this intent will keep personnel passages clear of obstructions, provide safety nets and toeboards to catch falling objects, and allow for secure equipment mounting with safety lines. Thorough grounding of electrical equipment and its location away from traffic will minimize occurrence of shocks and burns.

2. Functional Parameters

Access to performance equipment has greatest influence on Room design where technical operations are concerned. The position of lighting and rigging devices must be set by functional requirements, and access follows. It is best to integrate them structurally wherever possible, as in gridiron, front-of-house lighting catwalks, and boom towers. With the possible exception of border lights on winched battens, all lighting equipment must be accessible for final adjustment in place. In the stagehouse, this can be accomplished from portable ladders and manlifts, but front-lighting should always be associated with catwalks.

Manned instruments, such as short-throw followspots and TV cameras should have preplanned locations including necessary power and communications jacks. Access to these locations, control booths and consoles should not conflict with audience access or vision, nor with fixed instruments. Onstage, working space must be generous to permit crew movement around waiting set pieces and a location should be provided for the stage manager's work-station. Other work area access includes the gridiron loftblocks and weight loading gallery or pinrail. Ample clearance is needed around electrical equipment racks and dimmer banks which in some cases are located at one end of the stagehouse.

D. SCENERY ACCESS

1. Life Safety

The primary goal is to remove people from danger as efficiently as possible; protection of property and equipment is a secondary concern. But inasmuch as retarding the spread of smoke and flames adds to the margin of safety for existing personnel, scrupulous attention need be given fire protection and detection systems in the stagehouse.

All material used in the construction of the stage, stagehouse and scenery must be flameproof or fire-retardant, with a flame-spread rating of 25 or less. Treatment of draperies and fabrics should be repeated annually. Where hemp rigging is employed, it is wise to provide wire or chain safety lines on stored or unmoving battens and drops. And in addition to sprinklers and firehoses, strategically located fire extinguishers are highly recommended, including carbon dioxide and foam cannisters near electrical equipment.

2. Functional Parameters

The operating aspects of scenery movement are major influences in stagehouse design. Even Rooms without stagehouses and productions using fixed sets must facilitate the entry and assembly of substantial amounts of equipment, platforms and backdrops. A concert grand piano will be 5½ feet wide and up to 12 feet long, weighing 1000 pounds. While scenery drops and flats are relatively light in weight, they are unwieldy in size and very fragile. A demountable orchestra shell, depending on its design and purpose, may be both heavy and bulky.

While the diverse characteristics of scenic material and accessory equipment establish the immediate parameters for design, early planning decisions have tremendous impact on the way these needs are best met. It is essential to match initial investment and known operating resources for long term effectiveness. A key factor is the cost and availability of manpower.

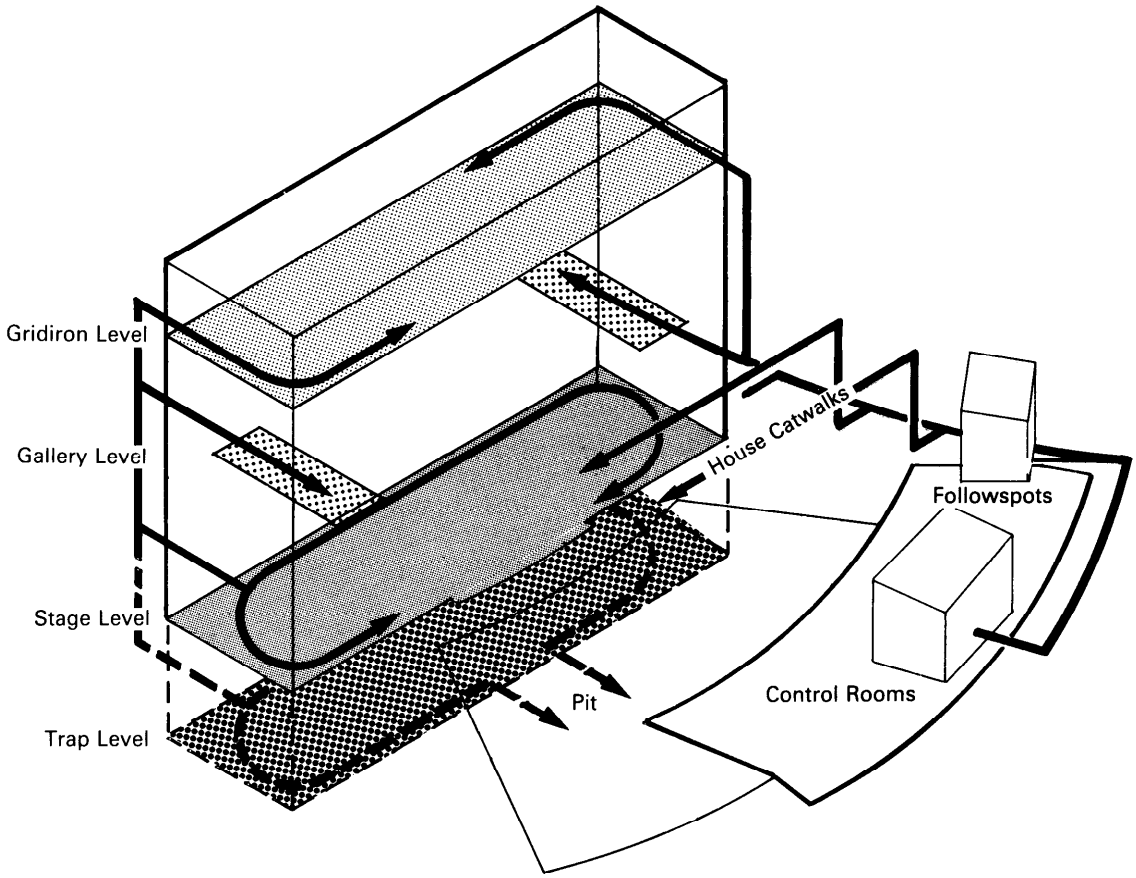


FIGURE 3-9.3 ACCESS SYSTEMS-TECHNICIANS

For example, lighting instruments are costly and require special handling. They must be frequently repositioned unless remounting can be reduced by keeping a large stock in place at all times. Similarly, sets can be broken down into small units and reassembled for each new production, or they can be stored and reused in large units.

While the Army and other volunteer-participation programs benefit from comparatively abundant labor, there are some counter-productive aspects of reliance on predominantly manual effort: inability to accommodate first-rate bus-and-truck touring shows with preassembled equipment and scene components; inability to move swiftly from production to production or to have a recurring cycle of various performance formats; inability to consistently repeat success as the crew roster turns over; and inability to "revive" demonstrably successful repertoire after a season. Mobility is the important factor, whether achieved through stage mechanical equipment or by the application of many willing, well-directed hands. It is a mistake to suppose provision of motorized platform lifts, elevators, folding

walls and sophisticated rigging systems will alone take care of these issues. Without forethought, half this equipment will be underutilized, purchased at the expense of vital needs, leaving many of the problems unsolved. Planners should invest enough time to thoroughly model and enact on paper the entire sequence of every production activity envisioned.

In part, this planning relates to support facilities (workshops, storage, dressing, warm-up, construction-rehearsal-performance conflicts), in part to the intended primary use of the Room, and in part to external factors dictating the physical relationship of building zones, site access, facility sharing, and budget constraints.

a. Horizontal Access

The path of loading onto stage should be plotted from the receiving area (truck dock), storage area and workshop for continuous clearance in height and width and preferably on one level. loading is usually from the side of the stagehouse opposite the pinrail or counterweight pit, but occasionally through the backwall. Loading through the backwall needs a deep stage, careful placement of gridiron columns, scheduling of deliveries so as not to interfere with sets on stage, and maintenance of actors' crossover passage during performance. Loading from the pinrail side requires a very high pinrail and weight gallery with special line systems and weight hoists.

No loading door should be less than 8' x 8', and for theaters, 10' wide by 14' high is not exceptional. Consider the longest batten in calculating turning chords of indirect passages. Road shows or use of a remote scene shop make loading direct from trucks important. Provide a receiving vestibule or weatherhood at the dock. Allow sufficient indoor space to completely unload a truck, with clearance remaining to reload it with material already on stage-about 400, but not less than 300 square feet.

Scene changes can be handled horizontally, as in open stage configurations, by a variety of means. The use of scene wagons requires ample working space surrounding the performance area for the advance and withdrawal of sets. The more space, the more varied the complement of sets can be. A considerable amount of construction work must take place on stage or in a closely related shop. Modular set design should be coordinated with wagon arrangements. Such sets are difficult to store for long periods. Variations on the scene wagon have included belts and turntables, both of which impose scene design and technical limitations that should not be first choices for new construction.

b. Vertical Access

Where site conditions or other considerations warrant bi-level facilities, planning requirements are not unlike those for direct horizontal loading except in the matter of expense. It may be that loading can be accomplished at stage level where other facilities, such as repair shops or rehearsal rooms, are below stage. Frequent use of a trapped stage or orchestra pit can require a piano lift in the pit or stage floor. Additional substage activities will justify a freight elevator.

Loading at other than stage level poses problems because of the vertical clearances needed. Truly bi-level facilities have great floor-to-floor heights and large-platform, multi-cylinder lifts. Where level changes are smaller, but too large to navigate in 10% maximum ramps, installation of cruder pneumatic or screwjack lifts may be feasible in the loading area. It is most important to define real needs; there are great differences in cost and application of motor driven cable hoists, screwjack and pneumatic piston mechanisms, geared freight elevators, and oil-hydraulic cylinder lifts. Second thoughts will usually reveal a simpler, equally satisfactory solution.

Scene changes in the vertical mode refer to flyloft capabilities, although very lightweight properties may be hoisted from a catwalk grid over an open stage, using rope lines tied off at a pinrail or at the catwalk rails. Fly systems require a stagehouse more than twice as high as the proscenium, in order that flown sets can be withdrawn from line of sight.

Evaluating possible combinations of flown and/or horizontal scene handling suggests that a well-developed fly system is in order for most new Army MDC's. In a generous stagehouse, elements of horizontal systems can be employed to advantage, but full development of ***both*** *methods entails an enormous stagehouse volume, high costs and technical wrinkles that may be self-defeating. On the other hand, conversions of existing spaces are most successfully approached as open-stage Rooms having generous offstage working area.*

Loft rigging with wire lines and counter-weight sets is discussed more completely in Section 3-8 and Chapter 4. In general flown sets have the advantage of traditional techniques most

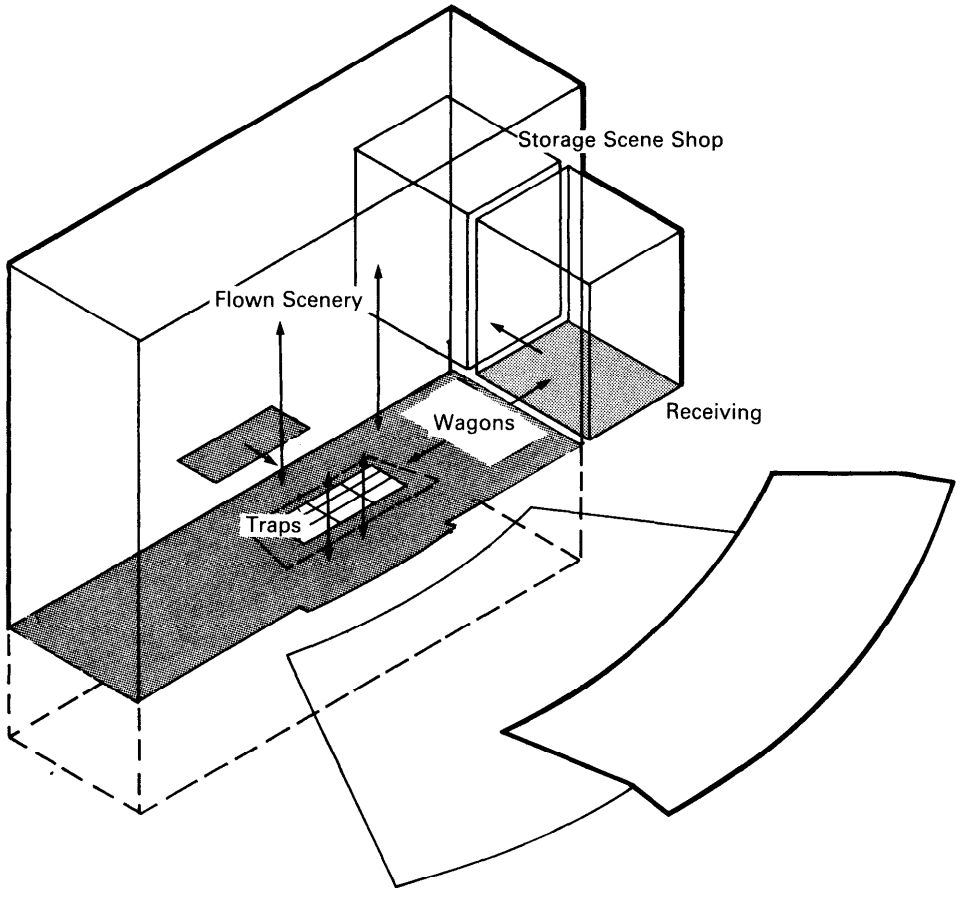


FIGURE 3-9.4 ACCESS SYSTEMS-SCENERY

used by touring shows, rapid access for scene changes, and holding capacity (storage) especially useful for fast-paced program turnover.

3-10. ENVIRONMENT

Physical and psychological environmental factors are a part of the total performance experience. In a sense, Theater is the creation of special environments of light, images, sounds and symbols. The ordinary creature comforts we expect must also be furnished if the whole experience is not to be marred. Interestingly, human abilities to distinguish and delight in subtle differences of pitch, harmonics, color and brightness over a broad natural spectrum do not extend to our tolerance of temperature variations except after lengthy periods of acclimation.

In terms of architecture and engineering, performance activities generate extremes of environmental control problems. Large numbers of people occupy a confined seating area while per-

formers undertake some of the most strenuous sustained exercise in human capability. A battery of high power lights and motorized devices emit still more heat into a carefully sealed enclosure, wherein the engineer is called upon to maintain comfort conditions without attracting the notice of the occupants. At the same time, the architectural design must maintain (and periodically vary) environmental characteristics that are at best subjectively defined. The patron who was absorbed in the presentation must at some point return to the everyday world, collect wraps and go home, satisfied.

A. MECHANICAL SYSTEM FACTORS

1. Heat Gain

During performances, mechanical systems are devoted to cooling and ventilating. Cooling loads are the product of people, power consumption, and local climate conditions.

Although the major loads are internal, the required properties of building enclosure will have bearing on the contribution of external loads. Insolation (glass gain) will be small, but large surface areas are involved. The acoustic benefits of massive masonry construction for Music facilities, in particular, necessitate a concern for thermal lag contribution to the load at peak evening hours.

Special characteristics associated with Drama activity include a proportionately higher contribution from extensive lighting equipment and hoist motors, as well as from strenuous effort occasioned by dancers and scene handling crews. Special characteristics for Music activity include lower lighting and effort loads, but typically a larger total occupancy. Moreover, the duration of critical tolerances extends beyond performance hours in the interest of maintaining constant conditions for musical instruments. This includes relative humidity near 50%, which will incur additional power consumption depending on outdoor conditions.

2. System Characteristics

Drama facility systems will encounter high peak cooling loads and high peak power loads, and must be able to handle large fresh air changes. Loads peak rapidly as the audience enters and the performance begins. The logical tendency to start-up systems in advance of curtain time often results in a period of discomfort until actual loads catch up.

On the other hand, many Rooms have inadequate noise reduction details built into their systerns. As a result, the systems are shut down during performance, causing increasing discomfort that must be offset between the acts with high load cycling. In comparison, initial discomfort is preferable.

Music facility peak cooling and power loads will be less exaggerated. Considerable sophistication of control systems is involved, and the acoustic noise control criteria applied to air distribution and mechanical devices are among the strictest practicable. Acoustic linings, sound traps and isolators, and required low velocity at supply grilles necessitates extensive ductwork and the treatment of large amounts of outside air.

DOD Construction Criteria recognizes ASHRAE standards and procedures in most details. However, the latest reference ASHRAE Handbook and military technical manuals should be checked to be sure the critical noise control, pressure balances and humidity criteria are correctly identified before design begins. Designers should be certain that every relevant factor is pinned down and included in the final load calculation, including all appliance loads, occupants, orientation of the building and ventilation requirements.

Recommended ventilation at 30CFM per person includes fresh air at 15CFM per person when no air conditioning takes place. In mild weather, preperformance cycling of this kind may be sufficient, but as heat loads increase, cooling and dehumidifying become necessary. Since the stale air is being filtered, treated, and mixed with fresh air, conditioned air may be supplied at a lower rate-25CFM per person-with only 10CFM of outside air. This should provide a comfortable 8 air changes per hour and a reasonable economy in the cooling cycle.

3. Typical Approaches

Because of the closed nature of performance Rooms, heat generation needs will be relatively low. Considering fuel resources nationally, it will be wise to consider convertible sources-such as interruptible gas and stored fuel oil combinations-or electricity. Since many Army installation community cores are relatively compact, available or proposed central steam generation should be evaluated, recognizing the relatively low carrying load for heating. Cooling is the principal demand. Absorption cooling using steam supply may be feasible if excess capacity in yearround steam generation exists at peak perfor-

mance facility hours. Otherwise, central complex or individual facility chillers and centrifugal compressors are likely candidates. There are long hours during the day when the Room is occupied by only a few people without attendant lighting loads, at which time low level air conditioning is required. Heat pump applications should not be overlooked if a substantial facility with a high level of active programming is expected. Since performance hours coincide with winter heating demand in some latitudes, the excess heat of the facility can be transferred to neighboring rooms or buildings.

Effective zoning is an important consideration in system design, especially where Room use is intermittent while support facilities are occupied on a regular daily schedule. Central incremental hot and chilled water generation is often employed with separate air handling units for each zone. Where support facilities are insignificant, remote, or separately dealt with, the performance Room air distribution system will usually have its own central air handling unit, since the major supply zone is a single space. However, it is not unreasonable to consider a multizone package unit for a small facility, provided adequate modifications of standard fabrication can be obtained to account for noise reduction and control system criteria.

The largest of the facilities proposed in this Guide might make use of medium pressure variable volume supply in connection with support facilities, kicking in the main space system as required. The key requirement in all cases is a separate, carefully preset and balanced Room system to minimize noise, disturbing air currents and pressure differences that can cause curtains to billow.

In the House, air is supplied from the ceiling, the side walls, and the edges of balconies at low velocity. In order to obtain uniform distribution, return air is drawn from the center of the seating area through 'mushrooms" under the seats, sometimes using the wedge shaped space below the floor as a plenum (return ducts are preferred for the ability to regulate volume and control noise). For shallow balconies, the side wall supply is usually sufficient, but deep balconies require overhead soffit supply and perhaps some underseat returns. A small amount of air should be exhausted from the ceiling to prevent formation of hot pockets that can have a radiant effect. However, 40-60% of the lighting load can be removed by exhausting air around the instruments, which is especially relevant to front-of-house booms and catwalks, followspot booths and on-stage power panels.

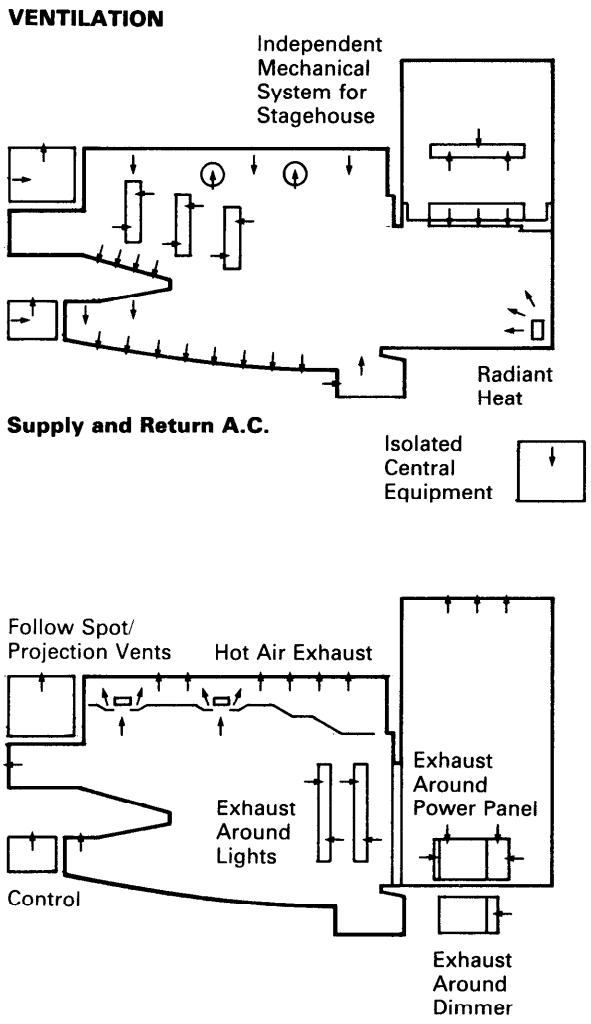


FIGURE 3-10.1 HVAC SYSTEMS

Design of the stagehouse system is most critical. To prevent billowing curtains and movement of lightweight scenery it is essential to carefully balance air pressures between Stage and House. The best practice is to pre-cool before the curtain goes up, relying on the house systems to maintain tolerable conditions during performance. Therefore, the essential ingredients are control of the stagehouse system from the stage itself,

and balanced supply and return ***both*** *within the stagehouse volume.*

There is very little room for ductwork in the stagehouse. Recommended practice is a "dump-down" low velocity supply under the fly gallery with a wall return grill just above, obviating the need to *cool the* hot *air of upper regions* which *is exhausted. For low-load, non-performance hours, fin-tube or electrical radiation may be required* along exterior *walls.*

The upper level exhaust out-take can serve double duty for smoke removal in emergency mode by cutting in fans activated by detectors above the gridiron and by manual throw fire alarm. Normally, heat and smoke detectors are located in return ducts serving the House.

B. ARCHITECTURAL DESIGN FACTORS

1. Functional Considerations

Measurable environmental criteria are readily obtained from such standards as the ASHRAE Handbook referred to above, IES Illumination levels for various tasks, and empirically determined preferred noise criteria (PNC) for various space uses. These most often relate to equipment systems and details of construction.

A more general criterion of good design relates to the organizational clarity of public assembly facilities, the ease of orientation and fulfillment of expectations. It makes little sense to arbitrarily "design" complexity into ordinary activities like finding one's seat. Comfort involves relaxation and a sense of control.

Public space design must naturally minimize questions of procedure. Inherent clarity in architectural space results in functional efficiencies, too-in operating factors like anticipated depreciation and repair, the number of directional signage devices needed, the prevention of accidental injury, and effective security control.

A second functional concern involves the acoustic and visual effects of materials and finishes in performance facilities. No furnishings, fixtures, draperies, paints or wall coverings should be installed without investigation of their properties with respect to desired Room qualities.

While this is especially true for acoustic criteria, a poor selection of lighting fixtures, a paint pigment that behaves oddly under performance lights, a glossy material in the wrong place can wreak havoc on a carefully crafted visual presentation. As a general rule, finishes at the stage end of the Room should have the characteristics of matte surface; black, white or neutral color; and ease of maintenance, cleaning or replacement.

2. Ambience

Concern for environment extends beyond measurable functional needs. The need that generated *the performance is not measurable, yet it must be reckoned with. Gatherings of people are social events-an opportunity to see and be seen by others in a particular context. The appearance of the Room, and of people in it, is an essential quality. This quality translates to a simple rule; the people should be seen first and best. Finish selection, lighting color, level, softness, and modeling effect should be keyed to human features and skin tones. A little glitter gives a helping hand to social dress, but it should not distract. The scale of detail and pattern against which people are seen should match human dimensions. Finishes should be considered in their relationship to people (next to, near, and far away), and in terms of richness and warmth, contrast, and finally overall tone.*

DIVISION 2
THE BACKSTAGE

3-11. PERFORMANCE SUPPORT

This section discusses the second major component of a performance facility-backstage production support. The process of identifying priorities is made easier by the selection of stagehouse functions. The task is to match an appropriate complement of support facilities with the range of anticipated presentations. Many of the choices can be approached by asking who is to use and

Type of Show	Actors		Plan Dressing Rooms For		Stage Hands	Musicians	Managers	Directors	Designers
	Principals	Extras	Principals	Extras					
Pageant	10–50	100–200	40	500	50	100	4–10	3	3
Grand Opera	4–10	20–100	10	100	50	80	2–4	3	3
Presentation	4–10	20–100	10	50	30	30–200	2–4	3	3
Vaudeville/Revue	4–10	20–50	10	50	30	10–30	2	0–3	0–3
Operetta Musical Comedy	4–10	20–50	10	50	30	10–30	2–4	3	3
Legit. Drama	2–20	10–50	20	30	3–30	8–20	1–4	1	3
Motion Picture Palace		None			2	0–50	0	0	0
Neighborhood Cinema					0	0	0	0	0

TABLE 3-11.1 TYPICAL CAST AND CREW SIZES

benefit from support facilities and in what way.

Since the performance types dealt with in this Guide will consist of various blends of music and drama activity, it is useful to discuss backstage functions in terms of Music and/or Drama support. Begin by identifying basic, minimum supports for a functioning facility, and enlarge on or specialize them to answer further demands.

A. GENERAL CONSIDERATIONS

While the production needs of Drama are quite different from those of Music, within each category basic needs are similar regardless of house capacity or specific presentation types (choral vs. instrumental music, for example). With the possible exception of scene handling support (simple open stage sets vs. flyloft box sets and wagons), basic needs are also similar for various stage forms.

The required quantity and quality of specific facilities are related to program objectives and operating levels. MDC planners and designers should refer to procedures of Chapter 2, and be sure to account for the anticipated rate of production turnover, the ratio of professional touring shows to those locally produced, the relative emphasis of training, education and skill development, and the categories of use to which future budgets may pertain. Since construction resources are limited either by dollars or space allowances, some crucial facilities will be implemented at the expense of others less vital.

B. CLASSIFICATION OF PERFORMANCE SUPPORT

Allocation of limited resources among potential support functions is aided by differentiating the activities served. Three classes can be defined:

- ***Performers' facilities*** *are those that accommodate cast activity during scheduled performances (including dress rehearsals).*
- ***Technical facilities*** *accommodate activity accessory to scheduled performances.*
- ***Preparatory facilities*** *are for production and maintenance activities prior to performances, which in most cases continue year-round and day-to-day.*

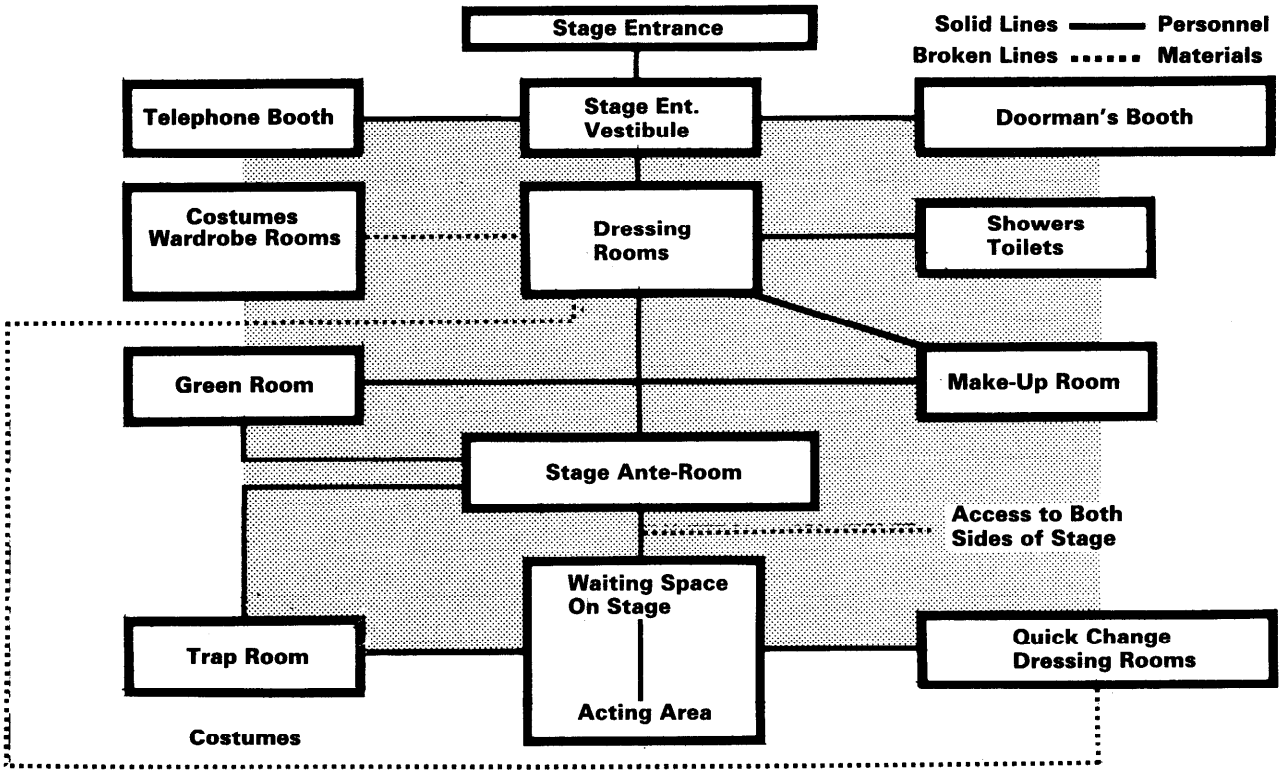


FIGURE 3–11.1 PERFORMERS' TRAFFIC PATTERN

In general, performers' facilities for Music or Drama are similar in functional objectives while technical and preparatory facilities reflect the differences of vision and hearing criteria. Unfortunately, when ambitions are pared down to match resources, technical and preparatory facilities too often suffer undue diminishment.

Selecting appropriate emphasis requires understanding the parameters that influence scope (size or quantity) of facilities. Quality has more to do with understanding of function. Both scope and quality are proportional to cost.

C. PERFORMERS' FACILITIES

1. Parameters

The anticipated size of the most likely cast is a key factor, as well as its composition by sex and by artistic discipline. Comparative cast sizes are mentioned in Section 3-6, but much depends on the dramatic literature and interpretive technique employed by the director. There are usually equal facilities for men and women, but the choice between group and individual dressing facilities may affect ability to vary this ratio. The needs of musicians and actors differ and respective facilities are often separate. Finally, planners must weigh the merits of recognizing "billing" of performers (prima, star, soloist, lead) as an incentive or as an undesirable qualification. Large MDC's anticipating exceptional professional touring programs may find guest artist suites an important consideration.

2. Functions

Dressing, toilets, artists' lounge, green room, stage door, and pre-entry assembly areas are commonly provided for all performing arts disciplines. Musicians' dressing is typically locker room fashion. Showers are especially important for drama and dance. Choice of group or individual dressing areas depends on the parameters noted above. An artists' lounge gains importance when group dressing facilities are provided; it is a place where performers can relax, wait for their calls and refresh themselves. The green room is slightly more formal, a place to meet invited guests and the press, and may sometimes double for small rehearsals and cast parties. It is accessible from the House or public lobby. The stage door provides controlled entry to backstage away from the public entry, often

with a security post offstage. Assembly areas are discussed under stagehouse access.

Drama facilities must provide makeup areas, often separate from dressing, with suitable mirrors, lighting, countertop and washbasins. A costume wardrobe is recommended, communicating with dressing rooms. Full length mirrors are needed for dressing, makeup and assembly areas.

Musicians need areas for warm-up and tuning prior to performance. If none can be provided, a more generous sound proofed dressing room is essential. Instruments too large to be carried through dressing should have a locked standby area offstage.

D. TECHNICAL FACILITIES

1. Parameters

The relative dominance of Music or Drama content in primary presentation types will be reflected in technical needs, as will the extent and magnitude of accessory equipment. This is discussed more fully in Section 3-8. In general, no element of basic technical facility can be done without, although varying levels of development should be considered carefully; certain additional functions may be judged important for special purposes (see 3-11f Extended Facilities and 3-12 Space Allocations).

*The nature and size of technical facilities greatly depends on the number of non-performer crew-*persons *and whether they are touring personnel or resident production staff.*

2. Functions

Basic technical facilities for both Music and Drama include lighting and sound control, manned equipment positions and accessways, and *the stage* manager's *command post. A substantial stage crew may require a waiting lounge and locker area of its own.*

E. PREPARATORY FACILITIES

1. Parameters

There are two sorts of basic preparatory activities corresponding to performers' and technical facilities and similarly qualified by respective parameters. The performer who prepares by repetition and practice can sometimes use the Room and its support facilities for rehearsal between actual performances. It is decidedly desirable to limit this situation to dress rehearsals only. Technical preparations, however, require a set of quite different facilities which should therefore have priority status in construction plans. In either case, the scope of these facilities is proportional to the rate of production turnover and program variety.

Since the performance Room is literally a single space, conflicting use cannot be concurrent. Auditions, part-reading, dance exercise, orchestra rehearsal, set-building and lighting run-throughs are mutually exclusive. Scheduling this activity in alternate time periods sometimes results in very few productions per season and limits the occasions when touring shows can be fitted in. As voluntary leisure activity, most preparation takes place in the evening, which is also prime performance time. The ability to separate greatly conflicting activities, handle them simultaneously, and free the Room for regular performances is vital to a healthy MDC program.

2. Functions

Every performing arts facility requires a loading door and receiving area (see Section 3-9e) with associated trunk storage (for road boxes) and general storage (for bulk material). At least a maintenance *shop* with tool storage *should be provided adjoining the stage crew quarters and office. Ideally, rehearsal space should be readily accessible from these areas, unless a remote rehearsal facility is provided.*

Drama facilities require a scene shop rather than (or in addition to) a maintenance shop. As a minimum, it should be nearly as large as the performing area of the stage and directly accessible to the stagehouse. The layout of the shop is important to the smooth flow of work from general storage to fabrication and assembly, then to the finishing area before moving the piece on stage or to temporary set storage. A separate shop is needed for costume fabrication and maintenance. Even a modest repertory theater should have generous wardrobe storage to protect its substantial investment. Long-term storage can be at a remote location if necessary. The production wardrobe work area itself adjoins the dressing areas. Space for the storage and repair of lighting instruments and electric gear should also be provided in a separate, secure room furnished with workbench, cable reels, shelving and wall mounted or overhead hooks and clamping bars for fixture storage.

Music facilities tend to require fewer technical construction spaces and more for preparing the performer. These consist of several small practice rooms for individuals, at least one for piano and voice coaching, and a sectional warm-up room for rehearsing portions of the resident orchestra or chorus. The total complement of practice room uses and sizes ultimately depends on the music program. They should be accessible from the dressing areas and stage during performance hours. An MDC designed primarily for Music will have instrument storage and a repair shop in addition to general storage and maintenance, plus chair, stands, riser and lighting storage, and probably a score library.

Musical drama and dance require both scene production and practice facilities according to the MDC's primary emphasis. It is most likely that the Drama preparatory facilities will dominate with the possible addition of a dance rehearsal and warm-up studio.

F. EXTENDED SUPPORT FACILITIES

1. Parameters

The preceding discussion of production facilities has focused on minimum basic requirements in support of performance. While frequent actual performance is the ultimate objective, catalyst and measure of the Army Performing Arts Program, significant goals of community and skill development are also reached through collective activities that involve people and educate audiences. If the first objective-adequate performance-oriented facilities-can be obtained within available resources, the extension of selected support facilities may be contemplated. These are not strictly required for performance support, but reinforce and enhance resident programs. As such, they have important application to Army program goals.

Selection of extended facilities is based on evaluation of each installation's program, context and population characteristics. Desire for a high level of amateur participation may mean extensive skill development is needed to form a reservoir of potential cast members. If no similar cultural facility exists in the community, skill development opportunities will attract and educate an audience as well. On the other hand, the military and/or civilian community may have an exceptionally well-educated population that demands a level of sophistication attainable only by intensive training for special skills.

The combined factors of audience demand for performing arts, ready availability of professional touring companies, and the mix of non-appropriated and appropriated funds in the MDC's operating/production budget may make for a very full performance schedule. If not, intervals between productions can be programmed with community educational activity.

Extended facilities will regularly involve more people or accommodate a broad range of participatory activities, or both. Consequently, multi-use and combined Music and Drama MDC's are likely choices. (See also Section 3-15.)

2. Functions

Any MDC may have extended support facilities in the form of a large multi-use rehearsal room with associated equipment and chair storage. This may be structurally and mechanically independent of the performance plant. In fact, the small dinner theater popular at many installations is an extension that encourages frequent small-scale entertainments and builds support for main facility programs. Other extensions may provide for classrooms, workshops, studios and instructors' offices shared by several branches of MSA programs in the community center. These are not specifically MDC functions, and the performance facility should not attempt to serve many masters. But cooperative use of certain shared facilities can have many benefits by bringing together active, creative minds and increasing awareness of the arts.

Drama facilities may develop special uses such as a literature and script library; a permanent dance studio; a film or video studio and auditing library with facilities for recording, instruction and equipment loan. A full performance schedule can involve many non-actors in an expanded scene and costume shop or set and lighting design workshops.

Music facilities may have score and record libraries that are not duplicated in unit subprogram facilities. The MDC can also provide larger, more specialized rehearsal rooms or a recording studio with professional equipment, instruction and editing facilities.

3-12. PERFORMANCE SUPPORT SPACE ALLOCATION

The following is a series of net area tabulations suggested for various levels of performance support. The basic allocation corresponds to the simplest functioning facility. Recommended adjustments are noted as the next step toward improved quality of service.

Special and extended programs address requirements resulting from uncommon facility size, purpose, guest performance use, and multi-use.

Figures in parentheses have been accounted for in Room tabulations (Section 3-7b). Section 3-15 will sum up all parts of representative MDC facilities, and Chapter 4 will furnish technical criteria and dimensional detail.

A. BASIC DRAMA SUPPORT

This is the minimum recommended backstage support requirement consistent with small scale infrequent productions with an average cast of thirty.

Facility	Net Area (SF)
• group dressing—2 @ 300	600
wardrobe	80
make-up	200
• toilets & showers—2 @ 200	400
• artists' lounge	300
• assembly onstage—2 @ 80	(160)
Performers' Areas	**1580**
• lighting control	(100)
• sound control	(60)
• tech. positions onstage—3 @ 40	(120)
• followspot positions in house—2 @ 40	(80)
• stage crew waiting lounge	150
Technical Areas	**150**
• loading/receiving	300
• general storage	1000
• shop—tool storage and assembly	1500
• costumes storage	500
• costume workroom—assembly	300
• laundry & dye works	150
• lighting instruments storage	150
• electrical shop	120
• tech. crew office/design/toilet	440
Preparatory Areas	**4460**
	6190
	+20%
Basic Drama Support Total	**7500 Gross SF**

B. RECOMMENDED ADDITIONAL DRAMA SUPPORT

An MDC that expects to maintain a moderate-to-full level of Drama programming, including (if desired) professional touring companies, will require backstage support comparable to that shown below. In particular, enlargement of preparatory areas is needed to handle resident scenic repertory. A cast of thirty or more is likely.

Facility	Net Area (SF)	Added (SF)
• add 4 double dressing private or 5 singles in suite	1320	+720
• separate group makeup (2 @150)	300	+100
• lounge becomes green room	500	+200
• add vending or kitchen unit	50	+ 50
• add "stage door" waiting	100	+100
• other Basic areas	480	
Performers' Areas	**2750**	**1170**
• enlarge lighting and sound control	(260)	+(100)
• add record/playback booth	(60)	+(60)
• allow 3 followspots	(120)	+(40)
• enlarge stage crew, lockers	200	+ 50
Technical Areas	**200**	**50**
• enlarge receiving	400	+100
• enlarge storage, long & short term	1500	+500
• enlarge scene shop, construction, and assembly	2000	+500
• add property storage, small items	200	+200
• enlarge costume storage and wardrobe	1000	+500
• enlarge lighting storage	250	+100
• other Basic areas	1010	
Preparatory Areas	**6360**	**1900**
	9310	3120
	+20%	
Recommended Drama Support Total	**11,200**	**Gross SF**

C. BASIC MUSIC SUPPORT

The minimum recommended Music support requirement is established here for fifty performers. It includes no rehearsal space and the most spartan accommodations for incoming touring groups and performances prepared in other locations.

Facility	Net Area (SF)
• dressing and lockers	600
• toilets and showers (2)	400
• warm up areas (2)	200
• artists' lounge	400
• assembly area offstage	(500)
• conductor dressing	180
Performers' Areas	**1780**
• lighting control	(75)
• sound control	(75)

• followspots—2 @ 40	(80)
• technical onstage—2 @ 40	(80)
• stage crew waiting	100
Technical Areas	**100**
• loading/receiving	300
• general storage	200
• maintenance shop	300
• instrument storage	400
• stands and chair storage	75
• score storage, duplicating	80
• technical director's office	100
• electrical shop/storage	200
Preparatory Areas	**1655**
	3535
	+20%
Basic Music Support Total	**4300 Gross SF**

D. RECOMMENDED ADDITIONAL MUSIC SUPPORT

For Music programs that anticipate developing their own "resident" orchestras in addition to a modest schedule of professional guest performances, it will be necessary to incorporate rehearsal and practice facilities and to improve performers' facilities for fifty or more musicians. Preparatory facilities are about equivalent to a modest high school music department

Facility	Net Area (SF)	Added (SF)
• add 4 soloists private dressing	1000	+400
• lounge becomes green room	500	+100
• add storage/kitchenette	50	+ 50
• add "stage door" reception	100	+100
• other Basic areas	780	
Performers' Areas	**2430**	**650**
• enlarge control/projection	(250)	+(100)
• add third followspot	(120)	+(40)
• enlarge stage crew quarters	200	+ 100
Technical Areas	**200**	**100**
• enclose and enlarge receiving	600	+300
• add trunk storage minimum	150	+150
• enlarge shop, shop storage	500	+200
• piano storage	550	+150
• riser storage	225	+150
• enlarge T.D. office (stage manager)	200	+100
• add rehearsal room	800	+800
• add recording control/storage	150	+150
• add practice rooms—2 @ 300 + 2 @ 90	780	+780
• other Basic areas	480	
Preparatory Areas	**4435**	**2780**
	7065	3530
	+20%	
Recommended Music Support Total	**8500 Gross SF**	

E. SPECIAL REQUIREMENTS FOR MULTI-USE AND EXTENDED PROGRAMS

1. Large Scale Music Facility

Large installations located near major cities will be able to draw on the skills and sophisticated audience interest of the urban population. This may be especially true of new fast-growing metropolitan areas short on cultural facilities but long on educated, active young families.

The large scale music facility may also be applicable to installations with an existing strong Music program ready for professional quality facilities or interested in consolidating far-flung outmoded accommodations.

The large scale music facility described below is about equivalent to a college music center suitable for visiting symphonic groups and a resident contingent of 120 performers. It is an expansion of the Recommended Music Support (3-12d).

Facility	Net Area (SF)	Added (SF)
• near double dressing & warmup	1800	+1100
• add concert master dressing	180	+ 180
• enlarge green room	700	+ 200
• add artists' lounge	500	+ 500
• other Recommended areas	1230	
Performers' Areas	**4410**	**1980**
• add broadcast control and announcer	(75)	+ (75)
• add stage manager to crew area	250	+ 50
Technical Areas	**250**	**50**
• enlarge offstage storage	500	+ 275
• enlarge trunk & instrument storage	1300	+ 600
• enlarge score library	230	+ 150
• enlarge general storage	500	+ 300
• add for 2 sectional warm-ups @ 400	800	+ 200
•'1 string warm-up (for 60)	1200	+1200
• add 6 practice rooms @ 120	900	+ 720
• other Recommended areas	2450	
Preparatory Areas	**7880**	**3445**
	12,540	5475
	+20%	
Large Scale Music Support Total	**15,000 Gross SF**	

2. Extended Program Drama Facility

The installation that has a strong Drama program and a population that shows an avid interest in participation and skill development will wish to involve more of them in a broad range of activities. This can have the spin-off benefit of improved production quality and variety, which builds audiences and morale as well.

Extended drama support increases the scale of production to a cast of fifty and adds to the recommended technical and preparatory facilities. It enables more kinds of theater art specialization on an on-going basis, with provision for instructional workshops.

Facility	Net Area (SF)	Added (SF)
• enlarge group dressing & makeup	1920	+ 300
• enlarge production wardrobe	180	+ 100
• enlarge toilets and showers	550	+ 150
• add artists' lounge	300	+ 300
• other Recommended areas	650	
Performers' Areas	**3600**	**850**
• add stage mgr. to crew area	350	+ 150
• add video broadcast control/ record	(100)	
Technical Areas	**350**	**150**
• enlarge electrical shop	220	+ 100
• enlarge costume assembly, wig room	600	+ 300
• enlarge laundry	200	+ 50
• add scene paint shop	2450	+ 450
• add script library	100	+ 100
• dance studio/rehearsal room	1800	+ 1800
• film/video studio and control	600	+ 600
• editing and equipment	200	+ 200
• other Recommended areas	3790	
Preparatory Areas	**9960**	**3600**
	13,910	
	+ 20%	4600
Extended Drama Support Total	**17,000**	**Gross SF**

3. Touring Group Accommodations

Installations anticipating a heavy schedule of professional road shows are advised to further supplement backstage support facilities. The intent is to separate touring group from resident areas to reduce conflicts with on-going activities. This will permit visiting troupes engagements of varying duration and allow for rapid loading-in and out for the fullest performance calendar.

An MDC used for professional touring shows should begin with better than basic support facilities. For frequent incoming shows, the following net areas are added. Large music centers are also advised to provide truck trailer enclosure adjoining the receiving area in which musical instruments can be maintained at indoor temperature and humidity conditions.

Facility	Added (SF)
• add guest artist's dressing	+ 250
• add roadbox storage	+ 500
• add road manager/ technical office	+ 180
• enlarge offstage storage	+ 300
	1230

Touring Group Accommodations

With Recommended Drama (9310)	**10,540 (Net)**	**13,000 Gross**
With Extended Drama (13,910)	**15,140**	**18,000**
With Recommended Music (7065)	**8,295**	**10,000**
With Large Scale Music (12,540)	**13,770**	**16,500**
Add Tour Trailer Garage @ 600	**14,370**	**17,250**

4. Musical Drama/Opera Facility

The ability to perform musical dramas and operas is largely determined by the nature of Room facilities, but the ability to develop and produce them requires a combination of drama and music support activities. In most cases, a modest Drama program will include musical drama by obtaining an orchestra's services for the performance run. Unfortunately, the orchestra's work schedule may not coincide with that of the drama group; there will be insufficient rehearsal dates, for instance, or inability to "'hold-over" a wildly successful production to meet audience demand. Installations that can support a strong musical drama program may find it wise and efficient to add Basic Music Support to backstage facilities.

The following example presupposes a strong Drama program with facilities for the development of drama-related skills and technically fine stagecraft. The Extended Drama Support facility required is modified mainly by the addition of musicians' quarters and storage for equipment. The addition does not duplicate technical or preparatory spaces, nor does it include music rehearsal and instruction. The resulting MDC would be appropriate if the installation operates an exchange program with a neighboring college music department or with another installation's strong Music program. It may also apply to an installation with existing well-developed Music Subprogram activities housed in unit-level facilities. This example provides for a cast of 50 actors and 40 musicians.

Facility	Net Area Combined (SF)	
• Extended Drama performers' area	3600	
• Basic Music performers' area	1780	
Performers' Areas	**5380**	
• Extended Drama technical area	350	
Technical Areas	**350**	
• Extended Drama preparatory area	9960	
• enlarge offstage storage	+300	
• less film/video installation	−800	
• add piano storage, voice practice	+550	
Preparatory Areas	**10,010**	
	15,740	
	+20%	
Musical Drama/Opera Support Total	**19,000**	**Gross SF**

DIVISION 3
THE FRONT END

3-13. AUDIENCE SUPPORT

A. GENERAL CONSIDERATIONS

Front End activity consists of the group of functions aimed at securing, organizing and serving the public occupancy of a performing arts facility. Compared to the Room and Backstage divisions, it is the least dependent on the specific performance type for function definition and physical planning.

Physical planning does follow Room design in its relationship to access patterns, but special functions derive from the using service's objectives, orientation toward the public, and identification of needs beyond common requirements. For this reason, careful attention must be given to the results of Chapter 2 evaluations in order that Front End design fits anticipated audience development and intended secondary uses of the MDC.

B. CLASSIFICATION OF AUDIENCE SUPPORT

There are three classes of Front End facilities defined by their users' activities.

1. Public Facilities
These accommodate visitors and audience members. At performance times, they serve to control entry, provide for waiting and circulation of many people, and permit social interaction appropriate to community gatherings. In off hours, they may be used for other group activities and include standard subfunctions required for assembly purposes, such as rest-rooms, drinking fountains and coin telephones.

2. Staff Facilities
These accommodate the administrative management. Except for box office activity and house security, most use occurs between performances. Regular activity includes promotional work, arranging bookings, accounting and clerical, advance and mail order ticket distribution, program planning and general office work.

3. Service Facilities
These accommodate operating staff and special functions arising from public assembly activity. Custodial, office supply storage and staff lockers are needed, as are coat rooms, food and beverage service, and first aid equipment for the public and staff.

C. CHARACTERISTICS OF AUDIENCE SUPPORT FUNCTIONS

Every performing arts facility intended for public presentations requires all three classes of audience support. The dimensions and treatment of each depends on the using service's objectives as much as on the size of the audience.

1. Public Functions
These reflect established operating procedures and common-sense requirements for dealing with large numbers of people in an orderly fashion. However, an attitude toward public participation is also conveyed, and for this reason the definition of functions should be predicated on a clear statement of purpose. The visitor's initial experience prepares him for the central purpose of the facility. A receptive state of mind is essential to enjoyment, which in turn registers with the performers and adds greatly to general sat-

isfaction. Crowding, confusion, long waits and discomfort lend a negative note at the outset.

The desired social ambience of a live performance can be reinforced by the architecture. This is less a matter of decor and finishes than of emphasis, scale and organization of space use, attributes that can establish impressions of grandness, ceremonial ritual, participatory involvement, club-like exclusiveness, or community openness. Any of these images may be appropriate, but one should be chosen and expressed by design.

The public's introduction should of course be related to primary performance content and the way the Room "feels". Since the Room design is of primary importance, its development precedes and aids that of public support space. The relationship may be by contrast, providing a distinctly inviting, lively, open environment in relief to a closed, centered interior. It may also be related by gradation, formal symmetry and recurrence of design theme culminating in the Room experience.

A second consideration is the environmental context of the MDC. Public entry is a transition. The building's setting will also have a strong influence on the function of public spaces (see discussions under Sections 2-5 and 2-9). Physical conditions of topography, climate, access and egress routes, site dimensions and neighboring land and building uses must be taken into account. For instance, an axial rectangular geometry may be impractical even if appropriate.

The function of transitional design is to adjust to external factors in a natural way, in order to spare the Room this necessity. A building in an urban setting is usually expected to respond to the order and scale of its neighbors and give something to the quality of the street. A building in a natural or suburban setting is usually expected to conform to landscape features and refrain from intrusion on the daily lives of inhabitants. On the other hand, the building may have special meaning and pride of place to the community, justifying a prominent stance.

2. Staff Functions

The definition and organization of staff offices is related to staff size and level of activity. A busy production schedule entails extensive clerical work, bookkeeping, mail handling and telephone communications. Generating such a schedule is the work of a Program Director (or Bookings Manager for a heavy schedule of incoming touring shows and professional musicians). This effort must be matched by the Technical Director's ability to meet production schedules with a high level of artistic quality. The routine operations of maintenance, inventory upkeep, ticketing and administrative direction is the task of the House Manager. Peak output involves both combined and separate activity at various times, so an efficient but flexible office design is very important.

Administrative facilities are usually located adjacent the public entry for efficiency; although program emphasis may make other arrangements more beneficial. The administration represents the facility to the public and should be accessible. Location and accessibility of staff is a factor in establishing a public image.

Entry control and ticketing are staff operations of an on-going nature, and public access for other than audience purposes should be confined to avoid interruption of performance preparation. This will also make for efficient building operations since office activity during regular hours does not always coincide with artistic and technical activity.

Then again, an extensive "hands-on" training program or road show schedule can shift the non-performance activity center to the backstage areas, making administrative facilities there a convenience that allows public spaces to be shutdown when not in use. The main concern is that box office and limited daytime public access is not impeded; administrative activity does not usually occur during performance hours.

3. Service Functions

These are generally related to public use although a split front-end arrangement mentioned above may result in split services accordingly. Functions requiring public access or contact, are of course associated with the lobby. Functions limited to staff access may be situated in association with administrative offices.

Public access services typically include a coat checking facility, food and beverage service or vending machine area, first aid and ladies lounge. Staff access services typically include ushers' lockers, a supply room for sundries, programs, chainposts, etc., and a custodial supply and mop closet. Some special service functions are not essential to the conduct of performance, but are included if deemed important to program goals. They might be found in education-oriented fa-

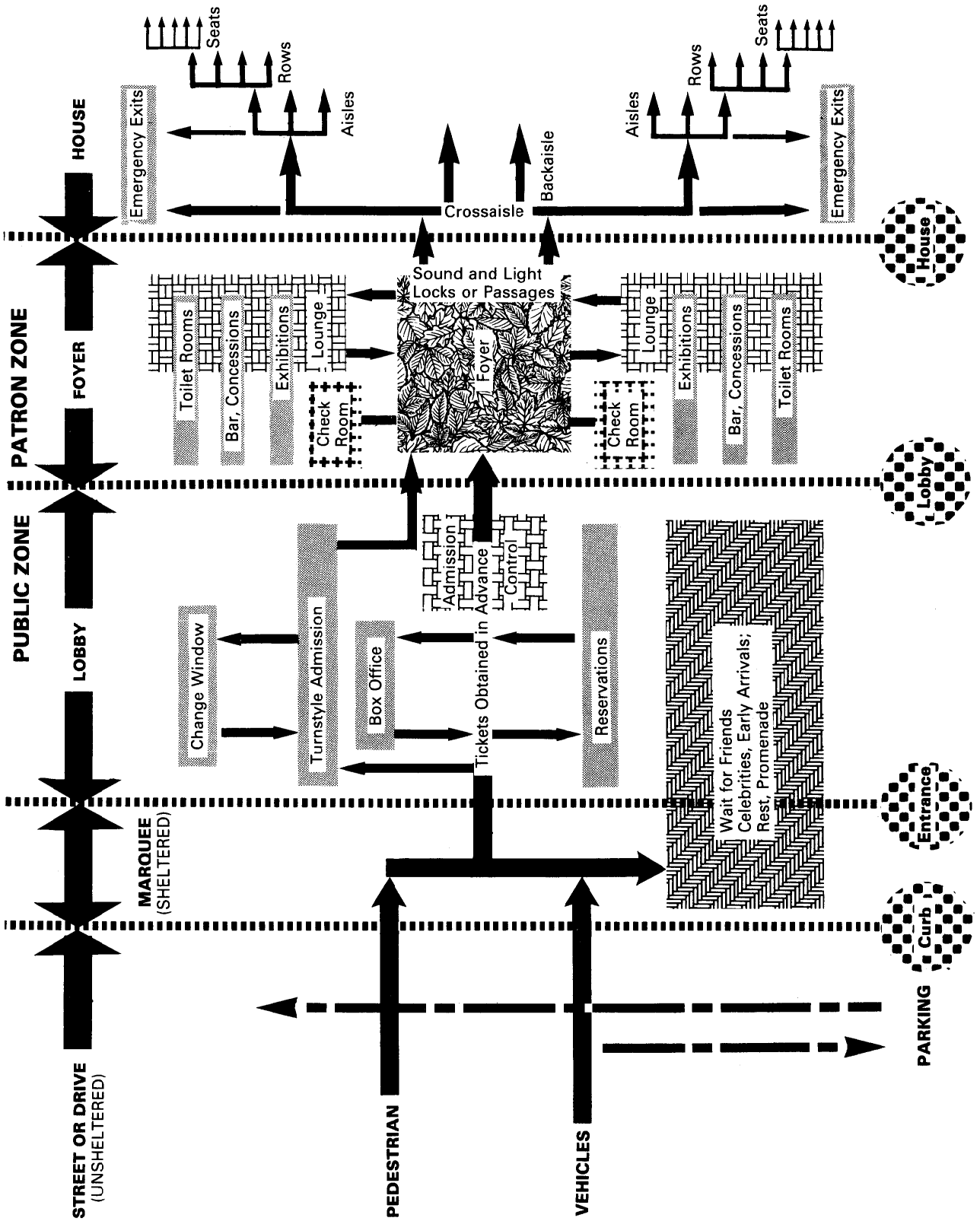


FIGURE 3–13.1 AUDIENCE'S TRAFFIC PATTERN

Statistical Averages	Opera and Concert	Legitimate and Musical	Movies and Spectaculars
% of audience which waits to meet friends in the Lobby	6	10	Negligible
% of audience which buys tickets within 20 minutes of curtain time	8	20	100
Time spent in line for tickets purchased or reserved	2–15 Min.	2–5 Min.	Negligible
Time spent in line to ticket taker	1 Min.	1 Min.	0
Overall time, curb to seat	4–12 min. depending upon location. 4 min. to box.	6 min. to orch. 8 min. to mezz. 9 min. to balcony.	2–5 Min. depending upon location.
% of audience which checks its wraps	18	10	Negligible

FIGURE 3–13.2 ARRIVAL CHARACTERISTICS

cilities seeking to develop audiences and amateur participation.

Special services include a children's play area or nursery, a library for score, script, film, tape and book collections and a lounge equipped for visual arts exhibitions. Clearly, these functions may be regarded as extensions and variations of formal lobby and administrative uses, but involve consideration of fittings that may not otherwise be foreseen. Moreover, inclusion of such functions may indicate design decisions as to scale, arrangement and access quite different from typical audience support.

D. FUNCTIONAL REQUIREMENTS OF AUDIENCE SUPPORT

Approved military standards furnish detailed criteria for determining load capacity, exit size and number, fire protection, gradients, fresh air ventilation and plumbing fixture counts generally in proportion to the number of persons assembled. This discussion is primarily concerned with the logical order and nature of spaces.

1. Public Spaces

The organization of public spaces is established by entry sequence and control. Two distinct zones are created by means of ticket-taking, which may be called the public zone and the patron or audience zone.

***The public zone** includes all spaces accessible from the entrance without surrendering one's ticket, and indeed without having one. In temperate climates, this may be an outdoor sheltered area under a marquee or pentroof. When enclosed, it is referred to as a Lobby, which may communicate with one or more spaces beyond, or with multiple performance facilities. (Terminology varies; it is sometimes called a Foyer-a term this Guide uses differently below.)*

Activities of the public zone are arrival, vehicular drop-off, waiting for friends or for the doors to open, lining up for tickets or admission, purchase of advance tickets, obtaining the season schedule or coming events information.

The extent of this zone depends on schedule conditions and management policies. If the bulk of tickets are sold at the door, accommodating lines of people at peak hours is of concern. This can be relieved by permitting early entry for ticket holders and provision of adequately delineated queuing areas that do not obstruct entry or exit of previous audience. Two separate ticket windows are advised if a full schedule of events is expected to yield advance sales.

The Lobby is an ideal information and promotion center generating interest in upcoming productions. It may also serve as a circulation "valve" directing off-hour visitors to administrative or other spaces. If a large enough indoor space cannot be provided, ticket windows should be accessible from outdoors with the Lobby functioning as a vestibule.

The double door vestibule is in any case impor-

Statistical Averages	Performance Type	
	Opera and Concert	Legitimate and Musical
% of audience which leaves seats during intermissions	75	60
Walking time: seat to lounge	4 Min.	4 Min.
Time in lavatory line	1 Min.	6 Min.
Time spent in line at check room after show	3 Min.	5 Min.
Seat to curb time (without checkroom stop)	5 Min.	6 Min.
Waiting time for cab or car	0–15 Min.	0–15 Min.

FIGURE 3-13.3 INTERMISSION AND DEPARTURE CHARACTERISTICS

tant as a sound barrier, and must be provided in sequence with the Lobby, or in some cases between the Room and audience support spaces to stop both light and sound.

The patron zone *includes all spaces communicating with the House after surrendering one's ticket. It is important that all essential services, such as restrooms and checkrooms, be accessible without recrossing the control point.*

Besides permitting circulation to seats, the patron zone includes a Foyer where the audience may foregather or retire during intermissions. Treatment of the Foyer largely sets the tone of audience consciousness in its transition to the performance.

A small Lobby warrants a generous Foyer. Low-keyed comfortable appointments and spatial dimensions calculated to respect human scale and focus small clusters of people, are appropriate to the intimate facilities suggested. Lighting and color selections should compliment human skin tones, with enough sparkle to highlight the social occasion. Monumental spaces may be appropriate in larger urban centers where a transition space may capitalize on the excitement of large crowds and celebrity glitter. But most Army installations are small communities in which the same people are encountered on a daily basis. Every effort should be made to encourage a relaxed, cordial atmosphere in which workday role relationships are discreetly levelled.

Pre-performance gathering may involve snacks or beverage service, conversation, and polite sociability. Intermission leg-stretching allows for discussion of the performance and use of restrooms or powder rooms. Post-performance gathering permits the patrons to meet the cast, await transportation, reclaim wraps, and in general make an orderly departure. (Note: opening or closing night cast parties, press conferences and guest artist receptions are typically limited by invitation and often occur backstage-specifically, in the green room if one is available).

Coat checking is often omitted, although the best Music Rooms deserve this consideration. Despite discomfort, patrons are often reluctant to check wraps, which add to the absorptive content of the Room. Encouragement by way of free attended checkrooms or keyed lockers is reinforced by providing an unhurried after-theater atmosphere. Allowances for emergency situations demand a first aid room or supply locker, usually supervised by the ushers or theater staff.

Circulation to seating is the main activity influenced directly by Room configuration, and circulation may in turn affect planning of audience support. Long travel distance and vertical separations discourage intermission activity, which may in part be compensated by sub-foyers or loggias at balcony levels, terminations of cross-aisles, or along both sides of a house having continental seating.

For small Rooms, side spaces can defeat the purpose of the Foyer by dilution of activity. Therefore the small house may be equipped with doors that are direct exits for emergency while normal circulation is directed through the Foyer. Audience entry can take any of several relationships to the house. (See 3-9b).

For the larger Room, and especially for concert

halls, every exterior door is a potential sound leak and noise entry. An unoccupied, absorptive vestibule can often be less costly than comparable door seals. If this same space is extended as a buffer corridor or sub-foyer it does double duty between performances as access to services and convenient milling space. Coat lockers may also be located here, near one's seat, and a gradual adjustment of illumination levels is permitted.

2. Administrative Spaces

The staff may spend many hours here each day. Office task illumination and environmental control are essential, daylight and exterior views aye desirable. The choice of individual versus open office space depends on the using service requirements. A mobile, multi-functional or largely volunteer staff may find a single space most efficient to control and use flexibly. A heavy schedule of events, however, will keep the House Manager and clerical staff routinely busy, in which case separate offices are advised. Touring show programs may operate with different rhythm, as will the promotional activities for coming events; these also benefit from relatively independent operation. Functionally separate Directors' offices enable private telephone and conference conversation for each individual, and intercommunication among them. Intercommunication should extend to the backstage and control room, and include performance monitoring. At least one private conference area should be available for interviews, counseling, budget reviews and the like.

Box Office facilities should be separate from general administration, especially where cash receipts are involved; furnish door security, wicket shutters, and a safe. The ticket sales area should accommodate more than one person. Ticket racks should be within easy reach and internal communication possible without leaving the window.

A general staff work area is desirable for joint planning, coordination, program assembly, mailings, and miscellaneous clerical work.

3.14 AUDIENCE SUPPORT SPACE ALLOCATION

Planners can generalize about Front End area allowances with about the same precision applicable to Room figures; a great deal depends on shape, arrangement, intended use and the total number of people served.

Since Front End facilities are less critical to performance quality than the Room and Backstage components, the using service and design agency is invited to view audience support allocations creatively. Much will depend on justifiable attendance expectations, climate and neighborhood context.

A. PUBLIC USE AREAS

In typical civilian facilities, net public spaces (Lobby and Foyer) range from 5 to 8 square feet per seat, excluding corridors, stairs and vestibules. Twenty percent may be added for circulation areas. If a portion of the audience is seated immediately, a definable Main Foyer having 5 SF per seat is minimum. Ingenuity in using "left-over" corners, outdoor extensions, mezzanines, and compact shapes (minimum dedicated to circulation) improves both apparent spaciousness and actual efficiency. Another 20% will normally account for services like toilets, closets, first aid room and coat storage.

Checkrooms should have 50 SF per hundred patrons. Restrooms are not directly proportional to capacity: allow 260 SF for 300 seats, 350 SF for 650 seats, and 500 SF for 1400 seats. Recommended minimum for an entry vestibule is 150 SF for limited ticket sale, or 500 SF for moderate queuing.

The best balance between public and patron (free and paid) zones for a given facility can only be estimated case by case, according to operating conditions and practices. A generous public zone is justified where regular daytime, pre-performance activity takes place. If a rich schedule of events attracts many varied interest groups, or if the facility is part of a larger complex, an attractive entranceway invites advance ticket sales and spontaneous participation. It may sometimes be necessary to purposely generate supporting activity, such as food and beverage service, exhibitions and other entertainments which the facility's locale does not provide. In urban neighborhoods, it will be more natural to walk in off the street and be seated promptly, as in a Broadway theater.

	Public Lobby per seat	Patron Lounge per seat
Opera House	2 SF	8 SF
Commercial Theatre	1.8 SF	6 SF
Noncommercial Theatre		6 SF
School	1.2 SF	6 SF
College and University	1.4 SF	8 SF
Community	1.4 SF	2 SF
Summer Theater	1 SF	10 SF out of doors (veranda, lawn, garden, patio)

FIGURE 3-14.1 TYPICAL FREE AND PAID ZONE ALLOCATIONS

A generous patron zone is justified by consistent full house capacities. The patron zone serves the performance audience rather than the prospective audience. It's easy to undervalue audience comfort as a factor contributing to success, except when one facility faces direct competition from another (more likely among commercial houses). However, bui!t-in discomfort may inhibit audience growth; there is no advantage in beginning with it. Pre-performance is the key time period. People will arrive earlier if they can expect comfort; this ensures a punctual curtain preceded by the least tedium.

B. STAFF AND SERVICE AREAS

Staff space allocations depend more on staff size than house capacities. Commercial and civic performance facilities often devote 15% of the Front End area to offices alone. Military facilities tend to have a much smaller permanent staff that seems to function "family style." Directors' offices of 120 to 150 SF each are suggested for prolonged use. If smaller, a 150 SF conference room is advised. The House Manager requires 100 SF in connection with ticket sales of 60 SF for small houses, twice that for the largest. General office space should reasonably be 200 SF for one fulltime clerical and occasional group activity, plus 70 SF for storage and duplicating.

A small contingent of ushers may share with first aid an area of 120 SF; a separate lounge is recommended for the largest capacity. At least one custodian's mop closet is required at each floor, plus storage for Foyer and Lobby fittings (chairs, etc., at least 75 SF.). Another 50-75 SF may be devoted to snack and beverage service equipment, more if secondary banquet uses are contemplated. Special services should not escape attention. If a tape or reading library of the simplest nature is planned, 125 SF of storage controlled by administration personnel is needed.

Here follows summary allocations for four typical performance facility Front Ends. The Drama facilities allow for simple, minimum public spaces. The Music facilities are slightly more generous to compensate for typically tighter seating patterns in the Room.

C. 300 SEAT DRAMA AUDIENCE SUPPORT

Facility	Net Area (SF)	
• Vestibule (not including marquee)	200	
• Foyer ("living room" image assumed)	1800	
• mini-kitchen unit	30	
• storage	70	
• toilets and J.C.	260	
• circulation (25%)	600	
Public Uses	**2960**	
• Director's office	150	
• general office	280	
• Box Office	60	
• Storage	50	
Staff Uses	**540**	
	3500	
	525	
Total simplest Front End + structure and mechanical (15%)	**4025**	**Gross SF**

D. 650 SEAT DRAMA AUDIENCE SUPPORT

Facility	Net Area (SF)	
• Lobby	350	
• Foyer ("art gallery" image assumed)	2600	
• food/beverage	60	
• storage	75	
• toilets and J.C.	350	
• balcony foyer (open to Main Foyer)	600	
• entry locks and circulation (25%)	1000	
Public Uses	**5035**	
• Directors (2 @ 150)	300	
• House Manager	100	
• Box Office	60	
• general office	180	
• storage/duplicating	80	
• library storage	80	
• ushers	120	
Staff Uses	**920**	
Total Medium Front End	5955	
+ structure and mechanical (15%)	895	
	6850	**Gross SF**

E. 650 SEAT MUSIC AUDIENCE SUPPORT

Facility	Net Area (SF)	
• Lobby	350	
• Main Foyer	3000	
• sub-foyers	1000	
• food/beverage	60	
• storage	75	
• toilets and J.C.	350	
• checkroom	300	
• circulation (20%)	1030	
Public Uses	**6165**	
Staff Uses (same as 650 Seat Drama)	920	
Total Modest Front End	7085	
+ structure and mechanical (15%)	1050	
	8145	**Gross SF**

F. 1400 SEAT MUSIC-DRAMA AUDIENCE SUPPORT

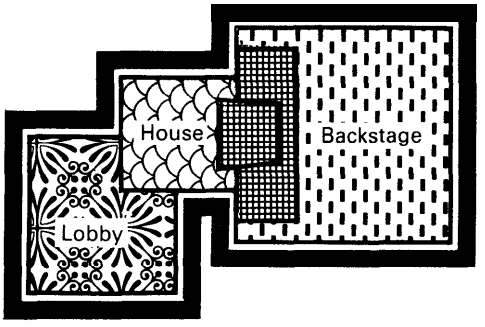
Facility	Net Area (SF)	
• Lobby	600	
• Grand Foyer	5000	
• Upper Foyer	1800	
• food/beverage (2)	125	
• storage (2)	150	
• toilets and J.C. (2)	650	
• 700 coat lockers, circulation (30%)	2500	
Public Uses	**10,825**	
• Directors (2 @ 150)	300	
• publicity	120	
• House Manager & security	180	
• Box Office	130	
• general office	180	
• workroom	150	
• storage/duplication	80	
• library	125	
• ushers	150	
• first aid room	190	
Staff Uses	**1605**	
Total Large Front End	12,430	
+ structure and mechanical (15%)	1,870	
	14,300	**Gross SF**

3-15. COMPOSITE BUILDING PROGRAMS

This last section of Chapter 3 examines the possible results of adding up major divisions of performance facilities selected from the examples developed to this point. The Guide has identified the three functional parts of a performance facility, likely variations of program, parameters of Music versus Drama production, and factors of scale. Only single Room facilities have been discussed, each to be used primarily for one form of music or drama presentation while recognizing that multi-use is to some extent inevitable. Referring to Sections 3-7, 3-12, and 3-14, minimum functioning facilities can be described for each of the four capacity-and-use programs discussed in Sections 2-4 and 3-2.

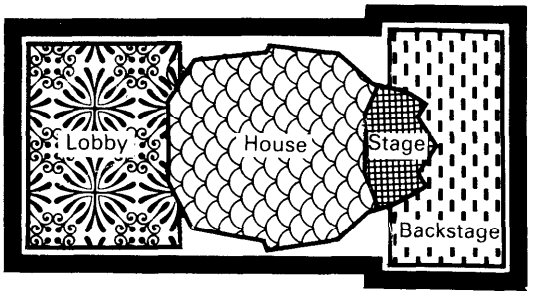
A. MINIMUM FUNCTIONING FACILITIES

Facility	Room Backstage Front End	Total Building Area
		18,725
Small Drama	.7200	GSF
300 seat legitimate drama	.7500	
	.4025	
		25,700
Large Drama	.11350	GSF
650 seat legitimate drama	.7500	
	.6850	



18.725 GSF
"Minimum" Facility
Conventional Seating
Offset Stagehouse

FIGURE 3-15.1 300 SEAT, DRAMA HALL



23.350 GSF
"Minimum" Facility
Conventional Seating
Single Purpose

FIGURE 3-15.2 650 SEAT, MUSIC HALL

		23,350
Small Music	.9000	GSF
650 seat concert hall	.4300	
	.8150	
		39,300
Large Music	.16500	GSF
1400 seat concert hall	.8500	
	.14300	

These provide single-purpose facilities only, for legitimate drama and 70-piece orchestra respectively. No stagehouse or pit is provided for Music Rooms, no pit or flexibility for the relatively small Drama stage to accept dance or musical drama. The total areas nevertheless exceed current DOD 4270.1-M space allowance criteria of 14,000 and 20,000 GSF for small and large MDC's, respectively. The amount of difference is equal to the Front End component.

Cutting the seating capacity in half would bring all but the Large Music facility within the DOD criteria, which implies constraint on House capacity equal to 150,300 and 500 seats according to whether Music or Drama programs are involved. For the most part, cast quarters are minimal-well below professional standards. Consequently no reduction can be looked for in Backstage area.

These results appear to approximate the Army Performing Arts program's situation in the early 1970's, at about the time the DOD criteria were first applied to theaters. Preparations for this Design Guide indicated that Army facilities of the above capacities had typically been established in converted movie houses having none of the stage and backstage facilities needed.

The 10,000 SF movie theater ground plan was divided either to favor the Stage End (with almost no audience support-only 1100 GSF) or the Front End (leaving only 2000 GSF for all Stage functions). Lean-tos were added for dressing rooms and the house would seat 200-250. In most cases, additional space was borrowed for workshops, storage and rehearsal at remote locations. Often, administrative off ices were shared or separately housed. These scattered, temporary facilities are a serious disadvantage and scarcely resemble a Music and Drama Center.

The Minimum facilities described above will not permit frequent or varied productions of quality.

Simple improvement of each facility, without greatly improving multi-use potential, will require additions mainly to the Backstage spaces.

B. IMPROVED FUNCTIONING FACILITIES

Facility	Added Area	Total Area
Small Drama		
300 seat legitimate drama with Recommended support	+3700	22,425 GSF
Large Drama		
650 seat drama with pit with Recommended support	+4200	29,900 GSF
Small Music		
650 seat concert hall, pit, with Recommended support, more public space	+7500	30,850 GSF
Large Music		
1400 seat concert hall, 120-piece orchestra with Large Scale support	+6500	45,800 GSF

In order to provide multi-use facilities of satisfactory quality, able to deal with a full schedule of events including well-known touring shows, MDC's of the following sizes are adequate, though not top notch. Additions to the improved single-purpose facilities are in the Stage and Backstage areas.

C. MULTI-USE FUNCTIONING FACILITIES

Facility	Added Area	Total Area
Small Drama		
300 seat community theater with 20 piece pit and more audience support	+1440	23,915 GSF
Large Drama		
650 seat facility with Extended Drama support minus video studio, with 20 piece pit	+7000	36,850 GSF
Small Music		
650 seat concert hall, with modest stagehouse, Basic Drama dressing and scene shop	+7200	38,050 GSF
Plus road show accommodations and Recommended dressing to include professional light opera	+9700	40,550 GSF
Large Music		
1400 seat concert hall with dance stage, grid, and Basic Drama dressing	+2950	48,820 GSF
Plus stagehouse and pit for touring musical drama	+5650	51,520 GSF
Plus scene shop to produce light opera	+7150	53,020 GSF

Comparison with the Minimum figures first given illustrates the breadth of possibility, mindful that these increases must be carefully weighed against the likelihoods of effective utilization of these capabilities now and in the future. Area allocations given here are miserly. As a benchmark, a typical frontal symphony hall seating 2400 for Music only (no stagehouse) found in many major U.S. cities, will total more than 110,000 GSF with only modest support spaces. The most luxurious facility above is comparatively austere.

D. MULTI-USE VERSUS MULTI-ROOM

The question is: at what point has the single multi-use facility capabilities (and constraints) in excess of specific user needs? None of the Rooms described need be especially advanced technologically. But can a more efficient distribution of the same resources serve better purpose?

For instance, it may be supposed the 53,000 GSF, 1400 seat music facility fulfills the requirements of enabling Drama and/or Music performances with a fair degree of quality in the same facility. In fact, mounting an intimate amateur production there would be quite difficult. Such a Room is best suited to professional management with an eye to commercial demand. Music and Drama would essentially take turns with road shows, and probably come out the worse for low attendance. There are very few semi-professional orchestras of 120 pieces with a substantial repertoire.

However, it is quite possible that a multi-use 650 seat music facility of 38,000 GSF would be a suitable choice, permitting musical drama and popular bands and ensembles a regular schedule. The using service is still faced with a Room that is neither fish nor fowl, and the necessity of adjusting it for alternate uses.

This Guide's basic contention has been that for each Room, one sort of use should be primary. If both Music and Drama are important programs, two different Rooms should be provided. The choice and planning of dual facilities naturally includes considerations previously developed, with an assessment of financial resources. If on this basis a dual facility is feasible, refine-

22,475 GSF
"Improved" Facility
Continental Seating
Extended Stagehouse

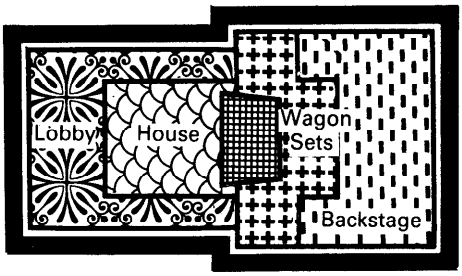


FIGURE 3–15.3 300 SEAT, DRAMA HALL

29,850 GSF
"Improved" Facility
Conventional Seating
Balcony
Bi-Level Foyer

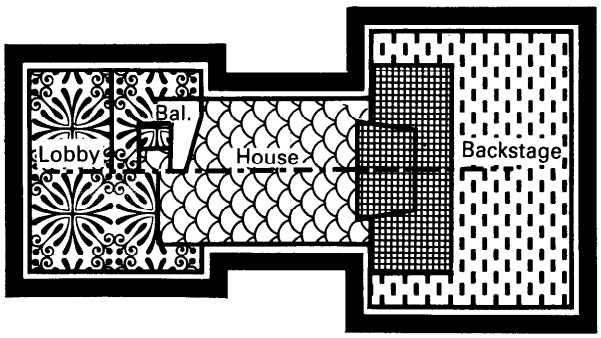


FIGURE 3–15.4 650 SEAT, DRAMA HALL

45,870 GSF
"Improved" Facility for
Symphonic Support
Conventional Seating, Balcony

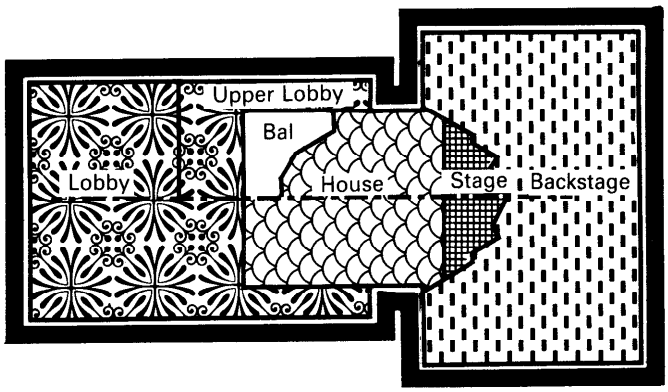


FIGURE 3–15.5 1400 SEAT, MUSIC HALL

36,850 GSF
"Extended" Multi-Use
Continental Seating

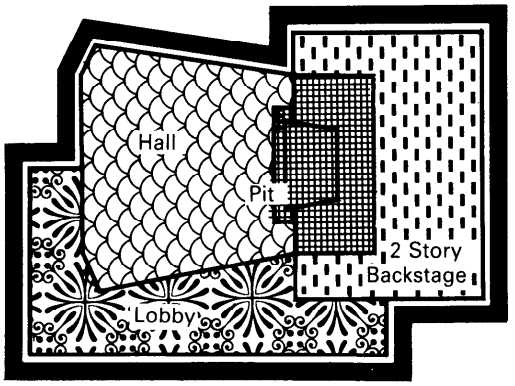


FIGURE 3–15.6 650 SEAT, DRAMA HALL

38,050 GSF
"Multi-Use" Modest Musical
Drama Support
Conventional 'Berry-Patch' Seating

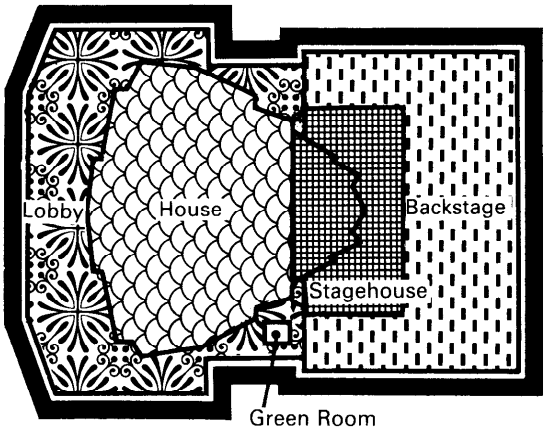


FIGURE 3–15.7 650 SEAT, MUSIC HALL

51,520 GSF
"Multi-Use" Facility with
Generous Support
Continental Seating,
Balcony

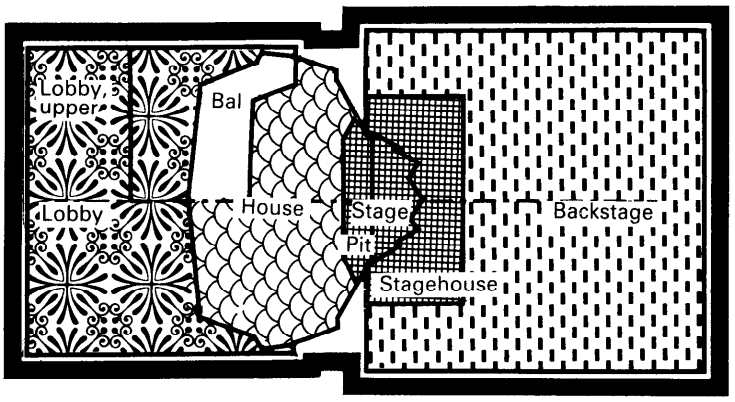


FIGURE 3–15.8 1400 SEAT, MUSIC/DRAMA HALL

ment of planning deliberations may reveal strengths not yet addressed.

E. DUAL FACILITIES

One activity and its audience supports and adds to another, in terms of public awareness and audience-building. Various performing and visual arts overlap; a constant supply of inspiration and skilled personnel working simultaneously will help fill practical gaps too, at those awkward times when the principal dancer falls ill or the pit musicians go on strike. Many technical support systems and facilities need not be duplicated for two Rooms, and indeed, one Room may serve as preparatory site for production in the other. Public and administrative facilities often benefit from combinatory scale and space-borrowing.

Without retreading previous ground at this time, here are two sample descriptions of combined-use facilities differing in scale and rationale. The first (smaller) facility addresses the desire for frequent varied presentations of manageable scale for primarily amateur casts. It offers stimulating involvement of many people with many interests and trades. Such a facility is developed with participation especially in mind.

The second (larger) facility attempts to fill two needs. The first is involvement of amateurs and semi-professionals with local audiences in relatively small-scale productions. Second, it affords the opportunity for those with a serious interest in a potential career to rub elbows with professionals. Moreover, a professional house will attract audiences and critical notice most amateur playhouses can't. The shared limelight serves the Army's public relations interest as well as the striving artist's.

1. Dual-Use Facility Alternate One: Combined facilities:

- *200-250 seat Chamber Recital Hall, flat floor.*
- *500 seat Frontal/Thrust Theater*

This combination of two performance places stresses the theatrical (drama) program, since the flat floor chamber hall can double as informal experimental theater, dance studio, or rehearsal space. The larger theater would be a different kind of Room with multi-use options.

The larger theater will have a stagehouse, flyloft and orchestra pit for proscenium form. It could also be set as an apron Thrust stage, allowing productions rehearsed in the other Room to be presented with minimum change-over interference. Preparations for the next major presentation can be taking place behind the proscenium concurrent with the Thrust performance run. The small Room would then be available for short-run experimental productions, music presentation, or other general assembly. Thus, a continual schedule of varied presentations is possible.

The small Room would be designed for natural acoustics, permitting small group presentations from a low platform at one end. It could contain a lighting grid and moveable seating to clear the floor for dances or cabaret activity and for rehearsals, or it could be set with a center stage and arena seating.

Common stage level and loading/storage/workshop/dressing facilities would enhance production turnover. This would also offer maximum educational exposure in theater arts and stagecraft.

Concentration on common backstage facilities is probably more important than common audience facilities. Most non-military combined facilities stress generous shared public space because the sales appeal of luxury plus the economics of commercial enterprise make this a cost-effective choice. The priorities are here reversed: distinctions between players and audience are less clear, the audience is more "captive", and profit motive hardly enters the picture. Efficiency of labor intensity and energy direction backstage is of the essence. It is possible that a single audience/lobby/box office facility can serve both Rooms, but modest separate lobbies would not be out of the question.

Estimated Building Program, Dual Use Facility One:

Components	Areas (GSF)
• 250 seat house	3250
• platform	600
Room Total #1	3850
• 500 seat house	5000
• stage house	3000
Room Total #2	8000
• dressing, makeup, showers	1440
• two double dressing	480
• musicians' lockers	480
• warm-up	240
• green room	600
Performers' Facilities	3240

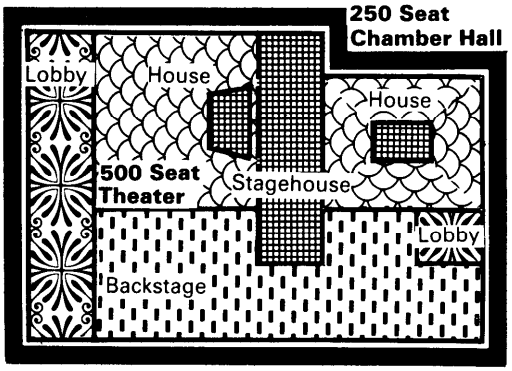


FIGURE 3-15.9 DUAL USE FACILITY 1

• lighting and sound control (both Rooms)	480
• lighting positions (500 seat)	170
• crew lounge	240
Technical Facilities	890
• Basic Drama shops, storage, loading +1000 SF	5200
• instruments, musicians' chairs, scores (500 seat)	600
• technical director/stage manager/ design area	650
• chair/riser storage (250 seat)	240
Preparatory Areas	6690
• Rooms	11,850
• Backstage	10,820
• Front End (sim. to 650 seat drama)	6,800
Total Facility	29,470 GSF

2. Dual-Use Facility Alternate Two: Combined Facilities:

- *1200 seat Opera/Concert Hall*
- *450 seat Experimental Theater*

This MDC is the largest suggested by this Guide and probably least typical. Careful preplanning and study would of course take place to target actual needs, but a large capacity hall may be called for at a major installation adjoining an urban civilian community that has no similar facility, or whose facilities are remote, fully programmed for other purposes, or economically prohibitive for Army cooperative use. Or, a cooperative arrangement with a nearby university may make full programming and joint use feasible where neither institution could alone generate the activity and support.

A smaller, highly flexible working theater provides the constant level of involvement important to Army objectives, permitting frequent hands-on productions and short term amateur exposure needed to generate the interest and skilled crew for more ambitious undertakings. The larger house is more attractive to full-fledged professional road shows and popular entertainment.

The successful management of the larger Room probably demands a different set of administrative functions, including bookings and advertising, House Manager, Technical Director and staff. Perhaps a system of visiting or rotating Artistic Directors would develop around a General Manager.

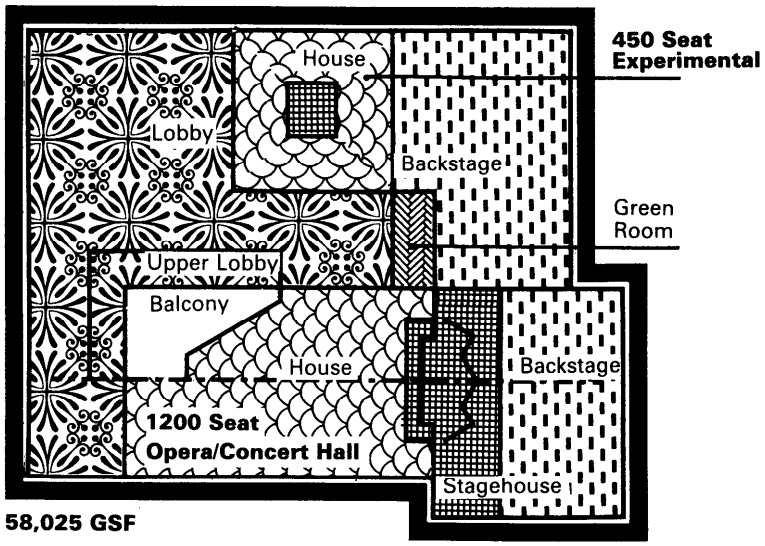


FIGURE 3-15.10 DUAL USE FACILITY 2

The large Room should have a full stagehouse complement including a flown orchestra shell and pit, and a stage suitable for dance, Broadway musicals and light opera. Special attention should be given to loading in from trucks. However, the actual production plant might be more closely related to the smaller theater, so that traveling shows and orchestral presentations are disentangled from on-going scene construction. A typical Broadway theater packs in a large crowd but has the barest of performers' facilities and almost no preparatory spaces.

Given the larger formal Room, the smaller should be the most malleable, flexible "machine" possible, perhaps spartan in appointments, but well-equipped technically. In this case, common public facilities seem to be in order-to conserve building plant, for one thing, and to identify both Rooms as important rather than "big and little." Nor will production activity create this impression, as it is likely the smaller theater will have its own schedule of events, and may in fact be more active.

Estimated Building Program, Dual Use Facility Two:

Components	Areas (GSF)
• 450 seat house	5000
• stage and traps	1500
Room Total #1	6500
• 1200 seat house	11,000
• stagehouse and pit	5,000
Room Total #2	16,000
• dressing, warm-up, and green room	4200
• receiving, trunk and set storage, workshop	4200
• technical facilities	1050
Large House Backstage	9450
• Basic Drama backstage +2000 s.f.	10,050
Small House Backstage	10,050
• public uses for 1400 seats +1500 s.f.	14,200
• staff uses for 1400 seats	1,800
Front End	16,000
• Rooms	22,500
• Backstage	19,500
• Front End (+15%)	16,000
Total Facility	58,000 GSF