VERSION 3.1

planning guide

FOR SCHOOL MUSIC FACILITIES

Wenger®

Your Performance Partner

A NEW CONSTRUCTION AND RENOVATION RESOURCE FOR MUSIC EDUCATORS, FACILITY PLANNERS, ADMINISTRATORS AND ARCHITECTS

INTRODUCTION

This Planning Guide is designed to help you — music educators, administrators, facility planners, architects and consultants — focus on the fundamental requirements of the Music Suite. Though it is written from the perspective of the music educator, your entire planning team can use this information to create a Music Suite that is both effective and exciting.

The following guidelines are the culmination of over 60 years of Wenger experience. By visiting with thousands of music educators, we understand what it takes to make a Music Suite successful and what seemingly insignificant design elements can jeopardize its effectiveness.

Use our expertise. If you have questions, a Wenger representative is always just a phone call away.

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USING THIS GUIDE

This guide provides brief explanations of the critical factors affecting the Music Suite. By applying this information to your needs and using the worksheets included, you'll be able to communicate music area fundamentals to architects and administration more quickly and clearly. You'll get the most out of this guide if you use it in the following fashion:

- Read the guide thoroughly.
- Use the information to establish the fundamental needs of your music facility.
- Apply these fundamentals to your specific project.
- Use the Planning Guide worksheets as the basic programming documents you'll share with architects.
- Most importantly, start now. The most critical decisions are often made years before construction begins. And, as the project progresses, changes become difficult and cost-prohibitive.

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THE MUSIC SUITE

CONSIDERATIONS

Definition All rooms or areas designed and used for music education constitute the Music Suite.

First Priority Learning within the Music Suite is accomplished by critical listening; the success of the design is measured by how well teachers and students can hear within this special environment. Every aspect of the rehearsal and practice areas must be designed to promote clear hearing. As a result, the acoustical considerations of music areas are the first priority.

Space Requirements Because of the sheer number of music students and the physical nature of music education, music activities require more room, greater flexibility, and more fresh air than other classrooms.

Real Costs Sound isolation, quieter mechanical systems, additional room volume, and other specialized needs make music suite construction costs per square-foot typically double that of other school areas. This guide will show why cutting corners in the Music Suite will cut the effectiveness of your music education program.

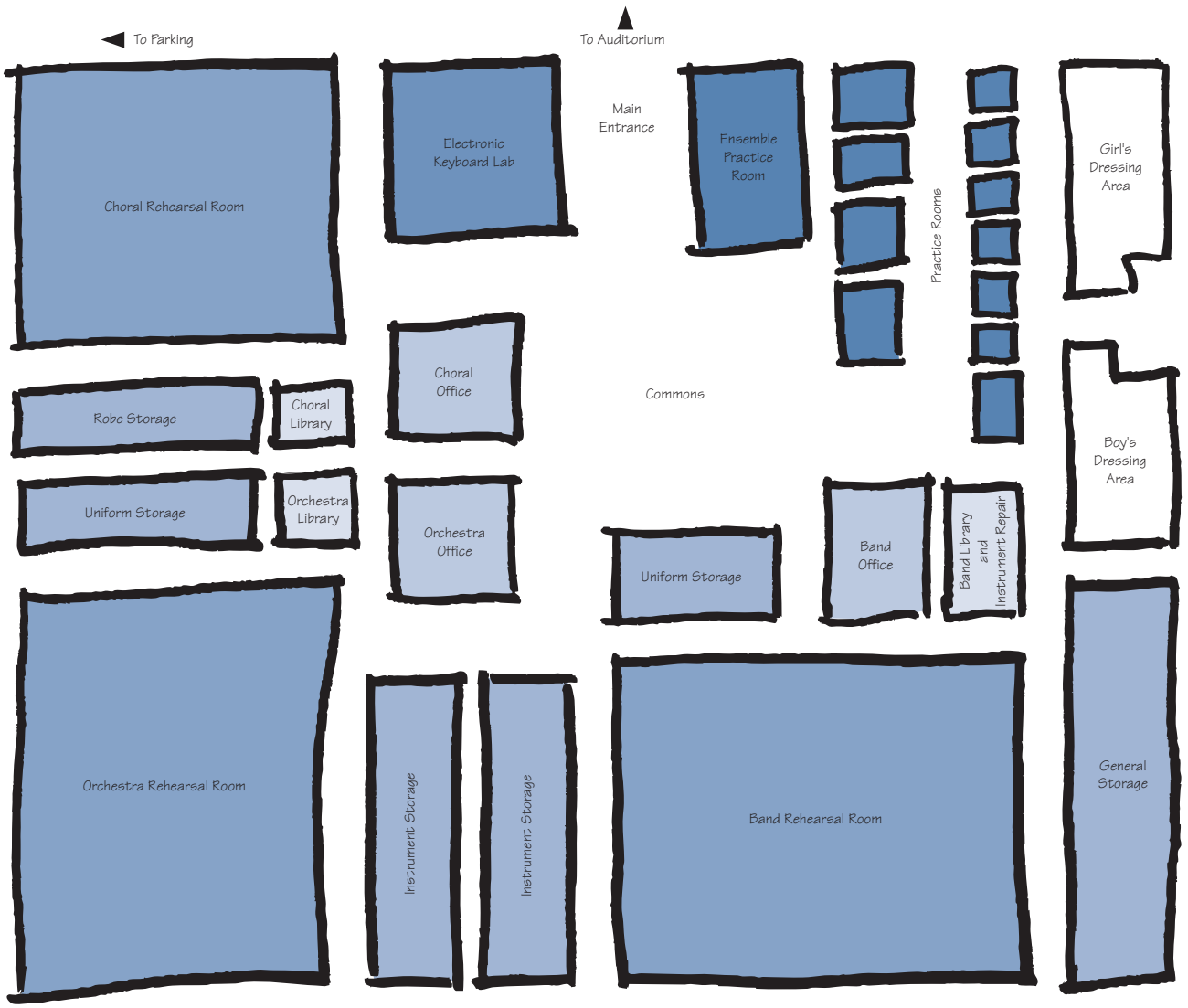
MUSIC SUITE LAYOUT

The Music Suite is a complex environment with many different areas and unique dynamics. This Planning Guide was created to help you understand these dynamics and needs so that your Music Suite design ensures effective education — and no surprises down the road.

Electronic music lab
for electronic music instruction

Performance areas
auditoriums and multi-purpose rooms for concert

Practice rooms
for small group and individual practice



Rehearsal rooms
for band, orchestra and choral ensembles

Storage rooms
for instruments, uniforms, robes, garments, marching band equipment, choral risers, microphones, amplifiers, speakers, pianos — and more

Offices and studios
for Music Directors

Music libraries
for sheet music storage

THE CONSTRUCTION PROCESS

GET INVOLVED

Proper planning and continued involvement are essential to creating the Music Suite you want. Use this information to get involved early so you can put, and keep, the project on the right track.

CONSTRUCTION PHASES

The following phases are the basic steps in a new construction or renovation project.

Phase I
Pre-Planning:

In this phase the planning committee is formed and facility goals are defined. The most successful committees consist of administrators, district officials and educators. Keep in mind that it is very important to include teacher representatives from non-typical environments such as the fine arts, athletics and music.

Phase II
Programming:

Programming is an architectural term for the process of defining the activities and requirements of spaces to be designed. **This is the committee's most important phase, and the gathering of input should begin as soon as possible. The longer you wait, the more it will cost and the more unlikely it becomes that your Music Suite will be what you need it to be.**

Now is the time to create a "big picture" of everything you want the Music Suite to be. Use the programming documents in this guide to present ideas to an architect, making clear what is desired and what makes the area unique. And though budget will ultimately determine the scope of the project, anyone who's been through the process will agree — "You'll never get what you don't ask for."

The architect will need to know how much space you require, how each space within the Music Suite is used, and how all spaces relate to one another. Our Rule of Thumb charts for square footage considerations were specially devised to help you determine these needs. This is also the best time to compile your equipment lists so you know how much money to set aside for purchasing fixtures, furniture and equipment (FF&E).

Phase III
Schematic Design:

Following the programming documents and budget constraints, the architect will proceed to diagram the facility. He or she will present drawings in different stages so the planning committee can help fine tune the design. Be sure to agree upon the final schematic, because any subsequent changes will be more difficult.

PROJECT SEQUENCE

The Bond can be approved during any of the initial stages.

Music educators should concentrate the majority of their involvement during these initial stages. This is when your Music Suite design takes shape, and trying to alter the design or add ideas later in the process becomes very expensive.

I. PRE-PLANNING	II. PROGRAMMING	III. SCHEMATIC DESIGN	IV. DESIGN DEVELOPMENT
Formation of the Planning Committee and identification of facility needs.	The architect solicits input from school personnel regarding program requirements.	Considering the input and budget, the architect creates preliminary sketches of the proposed facility.	The architect refines the design and creates the blueprint.

CONSTRUCTION PHASES

Phase IV
Design Development: The architect next creates blueprints. Exact room dimensions, ceiling heights, door and window locations, and electrical, plumbing, and mechanical systems, are finalized. These blueprints must be inspected very carefully, because all bidding and construction will be firmly based on this plan. Future changes are very expensive.

Phase V
Construction Documents: Before talking with contractors, the architect will develop construction documents that clearly define what is being built and to what specifications.

Phase VI
Bidding: With final blueprints and construction documents in hand, it's time to open the project to bids from general contractors, as well as electricians, carpenters and other subcontractors. After a review of bids, the contract is awarded to a general contractor. Next it's time to buy products — such as storage cabinets, acoustical treatments and pre-engineered practice rooms — installed during construction.

Phase VII
Construction: This is the final opportunity to make sure that the Music Suite is being built according to specifications. Visit the site often. And, if something isn't following the agreed-upon plan, be sure to discuss these concerns with the architect and administration.

Phase VIII
Equipment Purchasing: While the building is being constructed, the furniture and equipment identified in Phase II should be specified, bid and purchased — for delivery prior to the school opening.

Phase IX
School Opening: Congratulations.

V. CONSTRUCTION DOCUMENTS	VI. BIDDING	VII. CONSTRUCTION	VIII. EQUIPMENT PURCHASING	IX. SCHOOL OPENING
Preparation of necessary documents outlining the construction requirements.	The project is open to bidding and a contractor is selected.	The actual building of the facility.	Specify, bid and purchase equipment with delivery prior to opening.	Congratulations!

THE FOUR CRITICAL FACTORS

SUITE ESSENTIALS

The following four critical factors will determine the effectiveness of your facility. Every decision involving your Music Suite must put all four of these factors at the top of your priority list. Along with these brief descriptions, you'll find all four factors covered in detail in this guide.

acoustics

How well your facility promotes critical listening is directly proportional to how effective it will be.

floor plan

The layout of your Music Suite determines whether it is effective, ineffective, or even unusable.

storage

Storage not only affects equipment, but also acoustics, traffic flow and security.

equipment

Choosing proper equipment is the final step toward guaranteeing a successful Music Suite.

CRITICAL FACTOR *acoustics*

The study of music is dependent upon the ability to hear and learn differences in intonation, dynamics, articulation and balance. This skill, called critical listening, can be developed only in a learning environment with proper acoustics.

To guarantee that acoustics promote critical listening and effective music education, your facility's design must pay close attention to the following elements:

- Cubic volume and room shape.
- Sound isolation between rooms.
- Acoustical treatments to walls, ceilings and furnishings.
- Properly designed mechanical systems.

The following section will help you understand how you can effectively enhance acoustics and reduce the noise and interference that jeopardizes quality music education.

CUBIC VOLUME AND SHAPE

CONSIDERATIONS

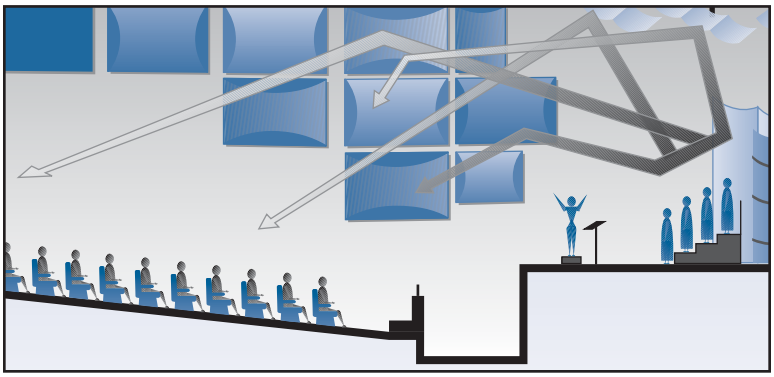
The cubic volume of your rehearsal room and shape of its walls have a profound effect on the quality of its acoustics. To ensure excellent sound, start by following these basic principles:

Cubic Volume

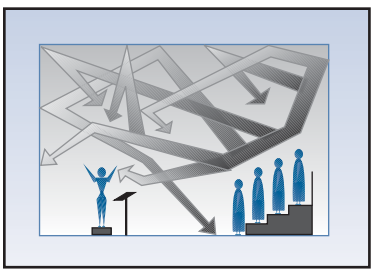
- Never cut corners on cubic volume; it is the single most important place to put your Music Suite dollars.
- Cubic volume is equal to floor area multiplied by ceiling height. Reducing this space can make your room unresponsive, excessively loud, and may also be impossible to completely correct.
- Low ceilings are a common cause of poor music room acoustics.
- Use portable risers instead of poured concrete tiers. Concrete dramatically reduces room volume and increases loudness, while the space beneath portable risers, if left open, will not reduce cubic volume.

Wall Shape

- Untreated parallel walls cause flutter echo. This annoying ringing or buzzing sound can be corrected with acoustical treatments that diffuse and absorb sound.
- Non-parallel and splayed walls can reduce flutter echo, but these solutions cost significantly more per square foot than acoustical treatments. Take the money you save on splayed walls and put it into more cubic volume, improved sound isolation, or better HVAC systems.
- Avoid visual acoustics. These are designs — such as curved walls and domes — that look attractive and appear to have good acoustical properties but in reality are often disastrous to the acoustic environment.
- Square or cube-shaped rooms with parallel walls create additive wave lengths, called "standing waves," that over-emphasize certain frequencies, making them abnormally loud. Creating a rectangular room by varying one dimension 30% or more is a typical solution.



A 65-person ensemble creates enough sound energy to fill an auditorium.



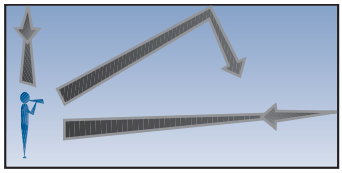
If the rehearsal room in which that ensemble performs does not have enough cubic volume and is not acoustically treated, the sound energy created will overwhelm the space,

CUBIC VOLUME

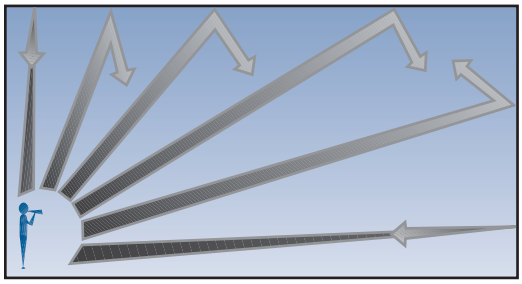
Excellent acoustics demand adequate cubic room volume that results from higher ceilings and ample floor space.

When room size is too small, the first sound reflections return to the musicians' ears so quickly that they do not hear their sound in the room. When adequate cubic volume is achieved, however, sound takes longer to reflect off more distant walls and surfaces, enveloping the musicians with sound and providing a sense of presence. When a room provides this envelopment, musicians can hear better, creating an environment in which real learning can be achieved by listening. This is the minimum goal of spaces designed for music learning, both instrumental and choral. All too often, rehearsal rooms are designed so small that musicians simply cannot hear the full range of musical sound. Remember, music is learned by listening.

Rooms that are too small also result in dangerously high sound-pressure levels. There simply isn't enough space to dissipate and absorb the loudness generated by musical ensembles. Rehearsing in an excessively loud room is extremely stressful for both students and teacher and can cause permanent hearing loss over a period of time. Concert bands, marching bands, orchestras and jazz bands generate especially high sound-pressure levels and special care should be taken to control loudness in areas where these groups rehearse and perform.



SMALL REHEARSAL ROOMS
Primary reflections return in under 30 milliseconds, making the room excessively loud, unresponsive, and can even damage a person's hearing.



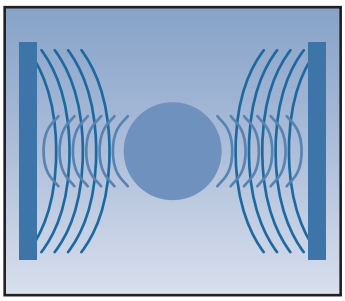
LARGE REHEARSAL ROOMS
Primary reflections are slightly delayed and envelop the musician. Loudness is dissipated.

CUBIC VOLUME REQUIREMENTS

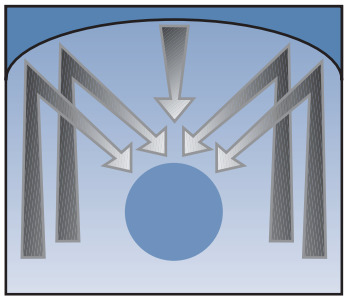
ROOM	CLASS SIZE	CEILING HEIGHT	TYPICAL FLOOR SPACE	RESULTING CUBIC VOLUME PER MUSICIAN
Choral Rehearsal	60-80 students	16-20 feet	1,800 sq. ft.	350-500 cu. ft.
Band/Orchestra Rehearsal	60-75 students	18-22 feet	2,500 sq. ft.	550-700 cu. ft.

WALL & CEILING SHAPE

Wall and ceiling shapes play a crucial role in acoustics because they determine how sound will be reflected and diffused within the environment.



FLUTTER ECHO
Untreated parallel surfaces cause undesirable flutter echoes and standing waves. You can dramatically enhance acoustics by adding sound absorbing and sound diffusing panels on opposing surfaces.



VISUAL ACOUSTICS
Concaves and domes are representative of Visual Acoustics — designs that look great to the eye but are usually disastrous to the ear.

For instance, sound is reflected by concave planes and domes, creating hot spots of concentrated sound.

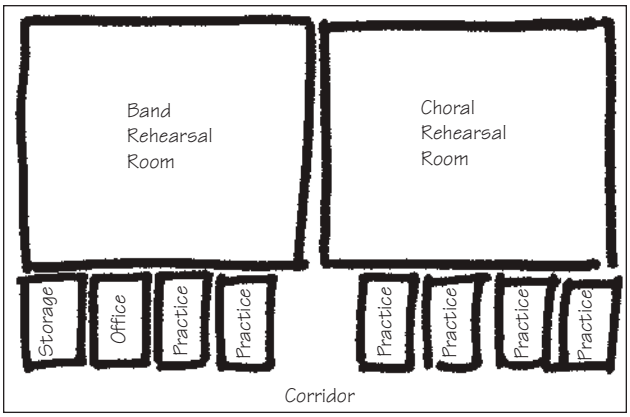
SOUND ISOLATION

CONSIDERATIONS

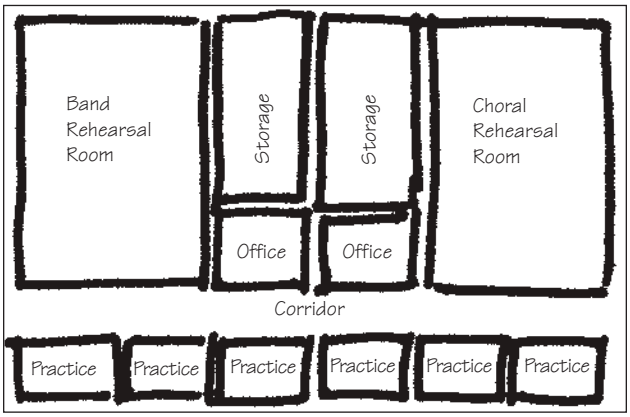
Good sound isolation is the result of effectively blocking the transmission of sound from one room to another. It is one of the surest and most cost-effective ways to get the most out of your Music Suite investment. Start by following these basic principles:

- Use full-height, sound-isolating walls, with an airtight seal to the building structure at both the floor and roof deck.
- Buffer zones, such as corridors and storage rooms, are better sound isolators than single walls.
- Practice rooms should be quiet and are not effective buffers; put them as far away from major rehearsal rooms as possible.
- If individual practice rooms must be near rehearsal rooms, separate them with sound isolating walls and buffer zones.
- Modular practice rooms offer better sound isolation than most built-in rooms and also provide greater flexibility. Costs are comparable, sound isolation is guaranteed, and they can be moved or resized as needs evolve.
- Specify doors and windows that have an acoustical rating equal to the wall construction.
- Keep doors and windows to a minimum to reduce sound leakage.

ROOM ADJACENCIES



INCORRECT ROOM ADJACENCIES
Rehearsal and practice spaces placed adjacent to one another make sound isolation impossible without complex and costly construction.



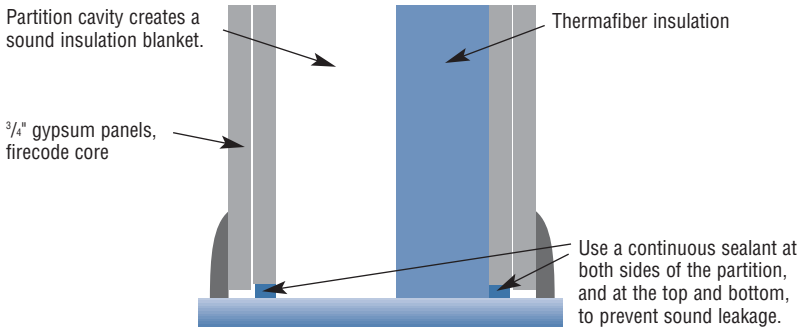
CORRECT ROOM ADJACENCIES
Used as buffer zones, non-playing areas — such as storage, offices and corridors — are a far superior means of isolating sound.

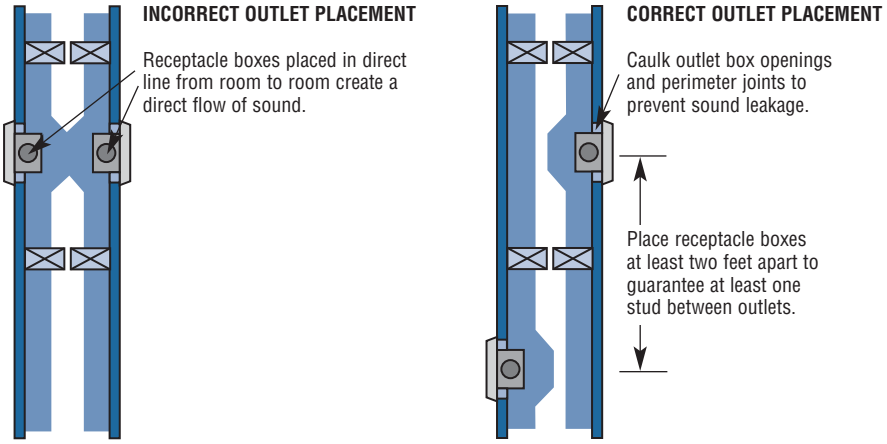
WALL SEAMS

Wall seams are a common source of sound leakage. Make certain that sealed construction is noted in the design.

- Check wall seams at roof deck, floor, electrical outlets, and ventilation ducts.
- Spaces that allow air to move from room to room also allow sound to move from room to room.
- Note: An entire sound-isolated wall can be rendered ineffective by something as seemingly insignificant as a room-to-room electrical box, or a gap as small as one-square-inch.

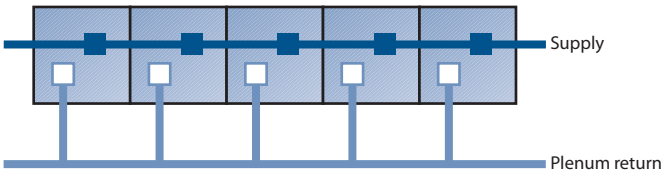
WALL SEAM CONSTRUCTION



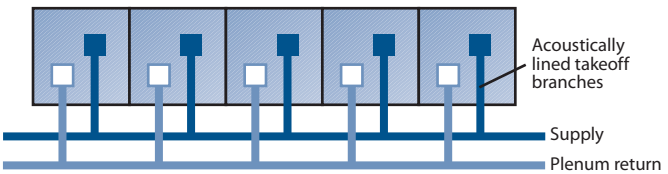


VENTILATION

Ventilation systems are notorious for transferring sound between rooms, especially between practice and rehearsal rooms. The most effective solution is routing acoustically lined takeoff branches into each room from the supply source placed outside the rooms. See page 17 for additional information on mechanical systems.



INCORRECT VENTILATION
Direct ventilation supply ducts channel mechanical noise and carry sound directly from room to room.



CORRECT VENTILATION
Individual takeoff branches feed each room from the supply duct positioned outside the rooms.

ACOUSTICAL DEMANDS

CONSIDERATIONS

Good acoustics are dependent upon the ideal combination of absorption and diffusion of sound. Start with these basic principles:

- Music environments must be individually treated, depending upon their shape, volume, etc.
- An environment treated only with absorber panels will only reduce loudness. Diffusive surfaces are necessary to scatter sound and improve communication from one part of the room to another.

REVERBERATION TIMES

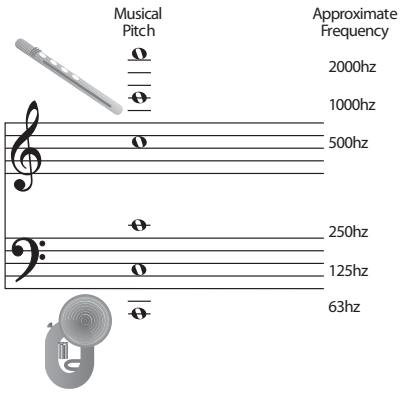
ROOM	REVERBERATION TIME
Choral Rehearsal	up to 1.3 seconds
Band/Orchestra Rehearsal	0.8 - 1.0 seconds
Performance Area	1.25 - 2.25 seconds

Every room is different, but ideal reverberation times would fall within these guidelines.

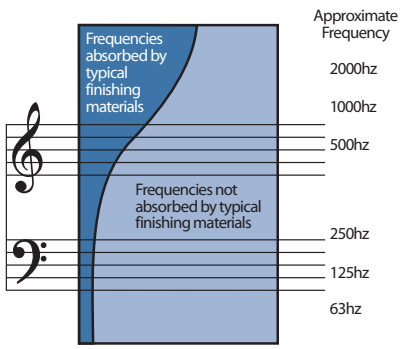
FREQUENCY RANGE

The frequency range of sound in the Music Suite is very different than the frequencies produced in other areas of the school, and must be treated accordingly.

- Common finishing materials — such as carpet, drapes, and upholstery — absorb higher frequencies but not lower frequencies.
- In rooms that only utilize high-frequency absorption, flutes, violins, sopranos and other high frequency sounds, including the high overtones of most instruments, can be lost; intonation, articulation and timing can be blurred; and critical listening becomes impossible.
- Similarly, the remaining low frequencies become overpowering, and acoustics within the environment will lack clarity and become loud and boomy.
- All finishing materials must be evaluated for their effect on the variety of frequencies produced within the music environment.



The sound frequencies produced by different instruments react differently when they come into contact with different surfaces. Flutes and violins, for example, produce high frequency sounds which are easily absorbed by a wide variety of common materials. Tubas and drums, on the other hand, produce low frequency sounds that are more difficult to absorb; they also produce easily absorbed overtones in higher frequency ranges that are critical to good intonation.



The dark shaded area represents frequencies absorbed by typical finishing materials such as carpets and drapes. The lighter shaded area represents the lower frequencies that are not so easily absorbed, resulting in spaces that can be loud and boomy. Due to the complexity of musical sound, and the need to both absorb and diffuse specific frequencies, it is critical that treatments be specifically designed to cover this broad range of needs and acoustical materials be used which are rated by the frequencies they are designed to affect.

ABSORPTION & DIFFUSION

The ideal Music Suite has the proper combination of absorption and diffusion to control excessive loudness and scatter sound throughout the environment, providing a sense of "ensemble."

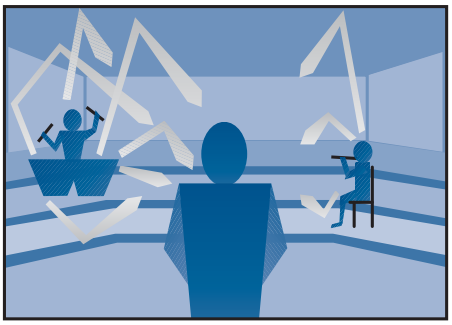
Absorption

Sound absorption can generally be defined as the reduction of sound energy that occurs when sound comes into contact with various surfaces and materials. When sound strikes a hard, dense surface — such as a gymnasium floor — there is nominal absorption. When sound comes into contact with thick, fibrous materials — such as a theater's curtained walls and acoustical panels — a great deal of sound energy can be absorbed, and less sound is reflected back toward its origin.

Diffusion

Sound diffusion can generally be defined as the scattering and redirection of sound caused by acoustically reflective surfaces. Diffusion of musical sound is necessary so that it can be clearly heard from all points in a facility. The extravagant ornamentation, columns and plaster work in historic theaters, for example, provides many angled, acoustically reflective surfaces which result in excellent diffusion.

- Different music environments require varying degrees of absorption and diffusion depending upon shape, volume, etc.
- The right balance of absorption and diffusion is also necessary to create proper reverberation times, which give instructors a more accurate account of student performance and progress.



UNTREATED ROOM

- Parallel walls create flutter echo.
- Carpet, drapes and upholstery absorb higher frequencies only.
- Remaining lower frequencies become overpowering, reverberant and indistinct.
- Loudness is excessive and nearly impossible to control.

TREATED WITH ABSORBER PANELS ONLY

- Panels absorb high and low frequencies, reducing flutter echo and boomy sound.
- Loudness is also reduced, but overall acoustics are unbalanced.
- Lack of diffuser panels severely limits sound reflection, which adversely affects communication within the ensemble.

TREATED WITH DIFFUSER PANELS ALSO

- The ideal combination of absorber and diffuser panels creates an acoustically balanced environment.
- Flutter echo, reverberation and boomy sounds are eliminated.
- Loudness is controlled and balanced over the full audible range.
- Performers hear themselves and others.
- Instructors hear balance with accuracy.

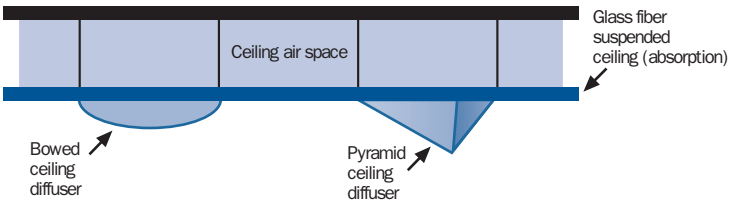
PASSIVE ACOUSTICAL TREATMENTS

CONSIDERATIONS

Every surface in the music environment has a direct effect on how sound and acoustics work within the environment. This can significantly impact the ability to hear and learn differences in intonation, dynamics, articulation and balance (critical listening). The following treatments affect the interior acoustics of the room.

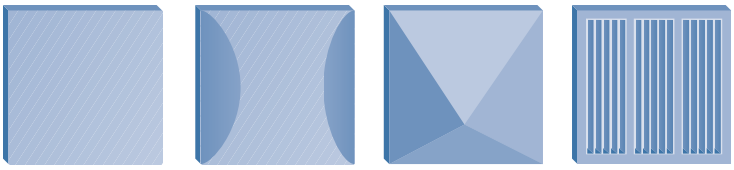
CEILING FINISHES

- The ceiling is the largest unencumbered square footage area available for acoustical treatment.
- Suspended ceiling treatments create air space needed to trap low frequency sounds.
- Suspended fiberglass panels provide the broad range frequency absorption required for the typical band room and are twice as effective as typical mineral board ceilings; plus, diffuser panels can be hung from the suspended ceiling grid.
- Be sure to specify absorptive fiberglass, which is often identical in appearance to mineral-board ceilings.
- Note: Ceiling height should always be measured from floor to suspended ceiling.



WALL FINISHES

- Walls must be treated with a combination of absorber and diffuser panels.
- Absorption panels on the lower wall behind the percussion and lower brass sections will significantly reduce loudness.
- The thicker the fiberglass treatment, the lower the frequency it can absorb. Three-inch fiberglass is a good minimum thickness for effective, wide-range absorption of musical frequencies.
- Reflective diffusers are available in a variety of shapes and sizes.



FLOOR FINISHES

- Carpeting absorbs high frequency sounds. If carpet must be used, select thin industrial carpet that is nearly acoustically transparent.
- Excessive use of even thin carpet will reduce your ability to hear high frequency sounds.
- Most musicians prefer wood or other hard-finish floors for several reasons:
  - — Bare floors are easier to clean.
  - — Most performance areas are hard surfaces.
  - — Emptied water keys from brass instruments can make carpet stale and musty.

FURNISHINGS

- Instrument storage cabinets with solid doors reduce cubic volume, occupy wall space better served by acoustical treatments. They should be kept outside of rehearsal rooms, if possible.
- Cabinets that must remain in rehearsal rooms should use grille doors. Unlike solid doors which reduce volume, grille doors open cabinet interiors and act as diffusive surfaces.
- If the ceiling height of the rehearsal room is less than the recommendation (page 50), consider using acoustic instrument storage cabinets to provide absorption and diffusion.
- Be cautious of furnishings that may resonate when exposed to high sound levels (things that may buzz, rattle or ring). These can be distracting to the group, especially during music passages that have dramatic changes in loudness.

ABSORPTION
Absorption is the reduction of reflected sound energy that occurs when sound comes into contact with various surfaces and materials. More information and diagrams can be found on page 5 of our *Acoustics Primer.*

DIFFUSION
Diffusion is the scattering and reduction of sound that occurs when sound strikes an acoustically reflective surface.

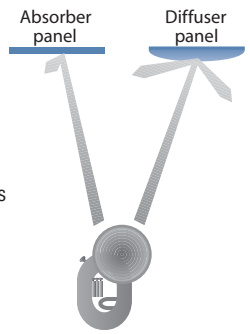
ACTIVE ACOUSTICAL TREATMENTS

CONSIDERATIONS

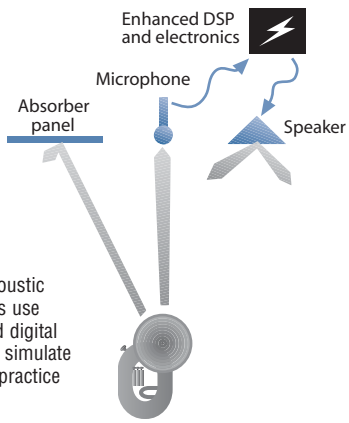
Active Acoustics use electro-acoustic elements — advanced microphones, speakers, and digital signal processing (DSP) — to positively treat acoustics.

It's important that the space be treated with effective passive treatments before Active Acoustics are installed. The environment must already have good sound isolation and adequate cubic volume.

- An Active Acoustic System uses passive absorber panels as its foundation.
- Speakers replace diffuser panels to provide improved diffusion throughout the environment.
- Digital signal processing (DSP) can change the acoustics in the room with the push of a button.
- Acoustics in the room can be switched to simulate center stage of an auditorium, a recital hall, or any other environment.
- This flexibility allows instructors and students to practice in environments that simulate the acoustics of the space in which they frequently perform.



PASSIVE ACOUSTICS
Absorber and diffuser panels applied to walls and ceilings balance the way sound is absorbed and distributed within the environment.



ACTIVE ACOUSTICS
Using a base of passive acoustic treatments, active acoustics use speakers, microphones and digital signal processing (DSP) to simulate acoustic environments for practice and performance.

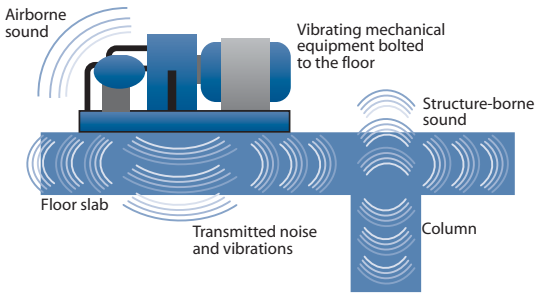
MECHANICAL SYSTEMS

CONSIDERATIONS

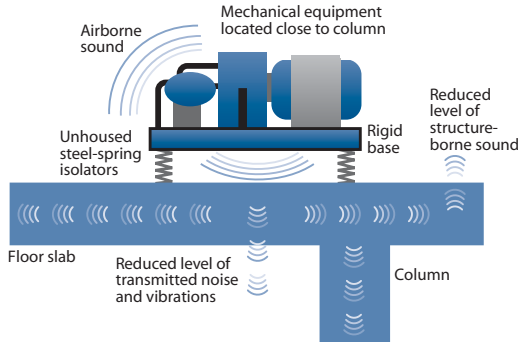
Hissing. Humming. Blowing. Vibration. These typical mechanical sounds are so commonplace we are rarely disturbed by them. Except in the Music Suite.

Your facility's plans must avoid these disruptive sounds which can totally mask the music that teachers and students are trying to make.

- The Music Suite is a physically active environment, requiring an air exchange rate that is double that of other classrooms.
- Use larger ducts and vents with larger grilles to reduce the whooshing sounds caused by increased air volume and velocity.
- Mechanical equipment causes vibration and should not be directly connected to the Music Suite structure. It's imperative that your HVAC contractor provide low vibration alternatives.
- Computer and electronic equipment labs also require additional air flow to cool the increased heat generated by the equipment.
- Ventilation systems, notorious for transferring sound between rooms, can be quieted by routing acoustically dampened and isolated takeoff branches into each room.
- The Music Suite has a lighting requirement of 70-100 foot candles necessary to help musicians read music scores.
- Certain fluorescent lighting generates a slightly flat B-flat pitch, creating a constant sense of discordance that can make it impossible for students to tune to concert A or concert B-flat. Use fluorescent lights with electronic quiet-rated ballasts, or place ballasts outside the room.
- Place items such as drinking fountains outside of rehearsal rooms where compressor noise won't cause a distraction.



INCORRECT
Mechanical equipment bolted to the floor transmits vibration directly to the structure. This construction method is unacceptable in the Music Suite.



CORRECT
Mechanical system vibration can be reduced by mounting the equipment on steel spring isolators.

CRITICAL FACTOR *floor plan*

What is true in other areas of the school is not necessarily so in the Music Suite. The Music Suite requires more square footage, per student, than any other area of your school, and your floor plan must reflect that.

Space is only one concern. An effective Music Suite design must successfully integrate the following elements:

- Floor space.
- Traffic flow.
- Access to related areas.
- Teacher monitoring.
- Flexibility for multiple activities and future needs.

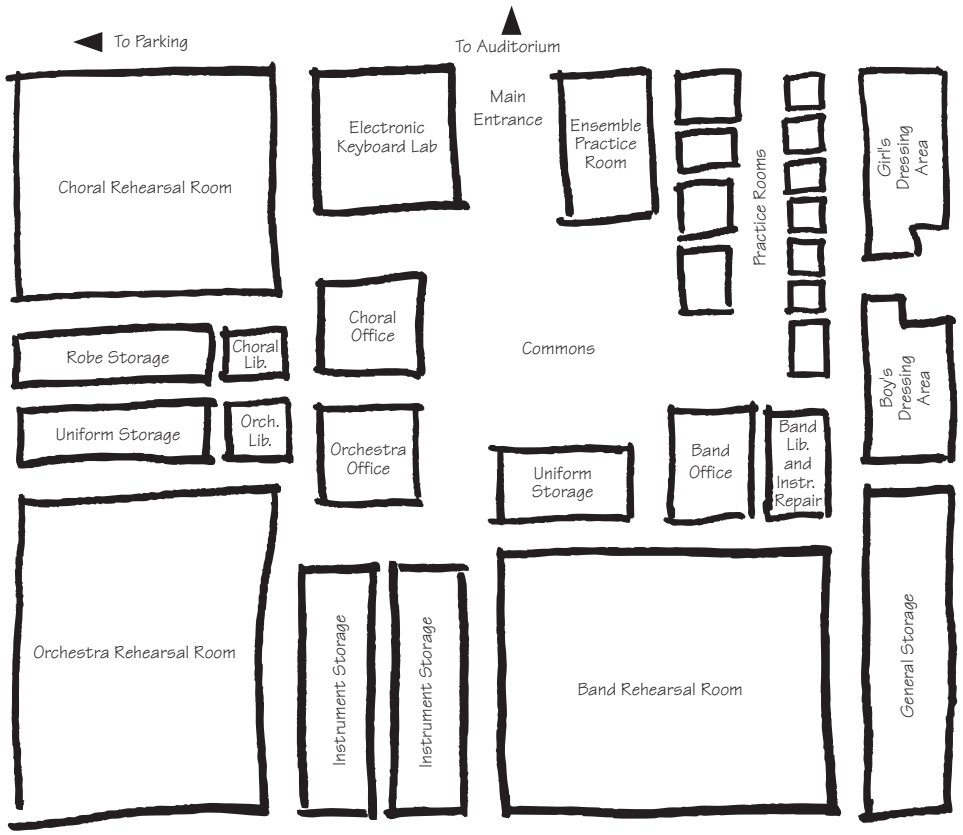
The following section will make it clear how much space you need, why you need it, and how you can put all of the above elements into a single, effective floor plan.

FLOOR SPACE

CONSIDERATIONS

Wenger square footage recommendations are based on successful facilities and the physical requirements of music education. We can assure you that reducing these figures will have an adverse affect on your suite. Consider the following:

- Adequate room size is necessary to achieve effective acoustics.
- Music education is a physical activity; vocalists and instrumentalists need room to move.
- Instrumentalists need even more space than vocalists to accommodate instruments and music stands.
- Student traffic is more concentrated and hurried in the Music Suite, as students must quickly move from storage to rehearsal areas, and back again, during a single class period.
- Pianos, podiums, risers and other equipment require permanent space in the rehearsal room.
- Other items — such as sheet music, garments and instruments — also require additional storage.
- Plan for the program you expect in three to five years, including program growth, curriculum changes, scheduling changes, computers and technology, expansion, etc.

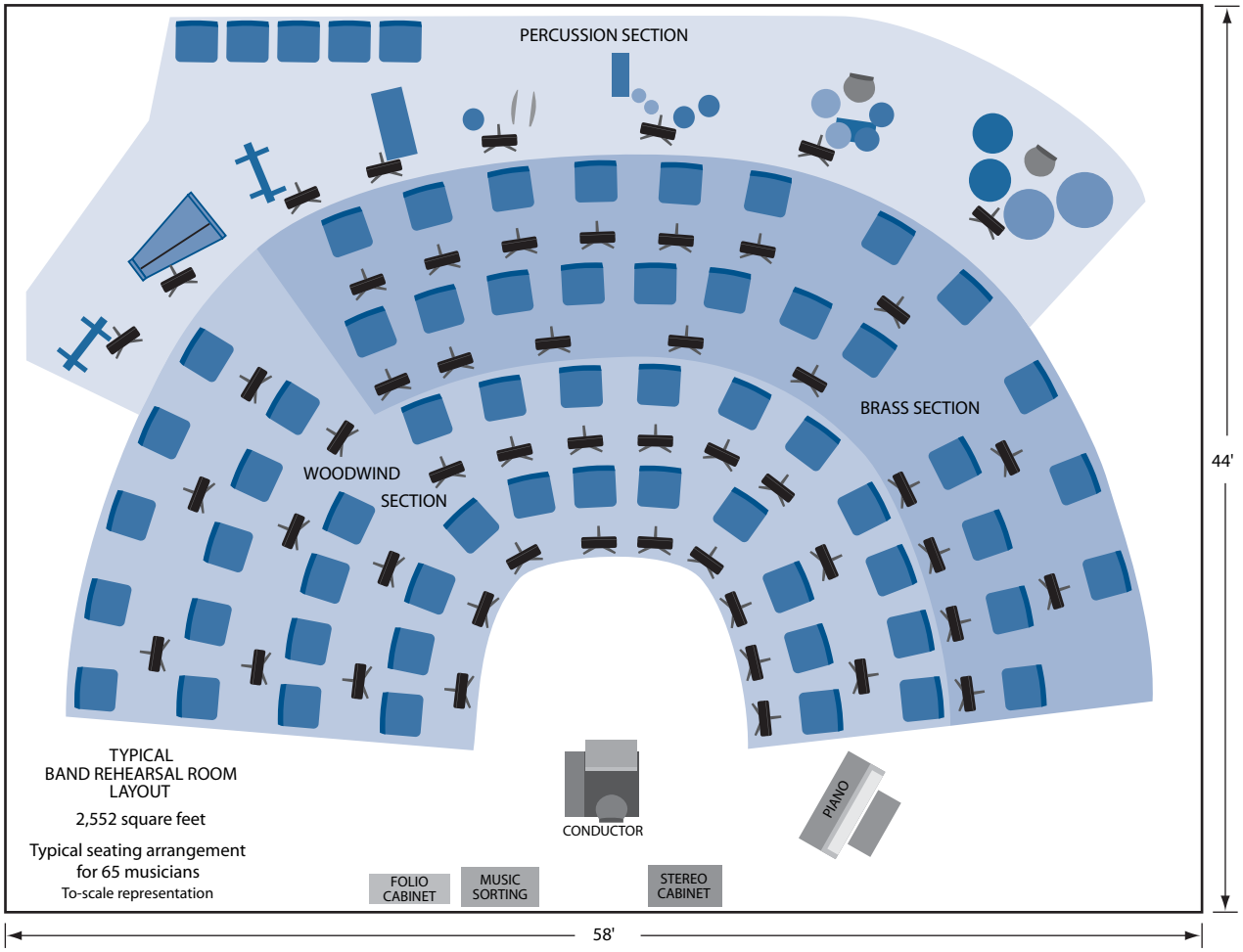


An effective floor plan provides adequate space for vocalists and instrumentalists, who need room to perform. The space also accommodates equipment, storage, and heavy student traffic, as well as the necessary cubic volume for proper acoustics.

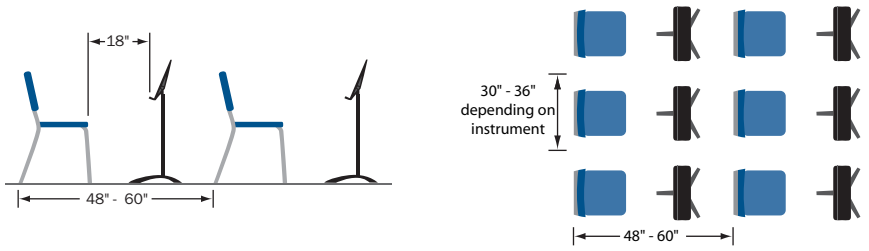
REHEARSAL ROOMS

When designing rehearsal rooms, remember that music is a physical activity. Instrumentalists need space for their instrument and the elbow room to play it. Choir members need space for vocal exercises and choreography. The space must also accommodate equipment and traffic flow. For these reasons, and to meet acoustic requirements, we recommend the following guidelines.

You should start with a minimum of 1,800 square feet for choral and 2,500 square feet for band even if the ensembles are small. Otherwise, use the "per vocalist" number if your group is larger than 60-75 instrumentalists or 60-80 vocalists.



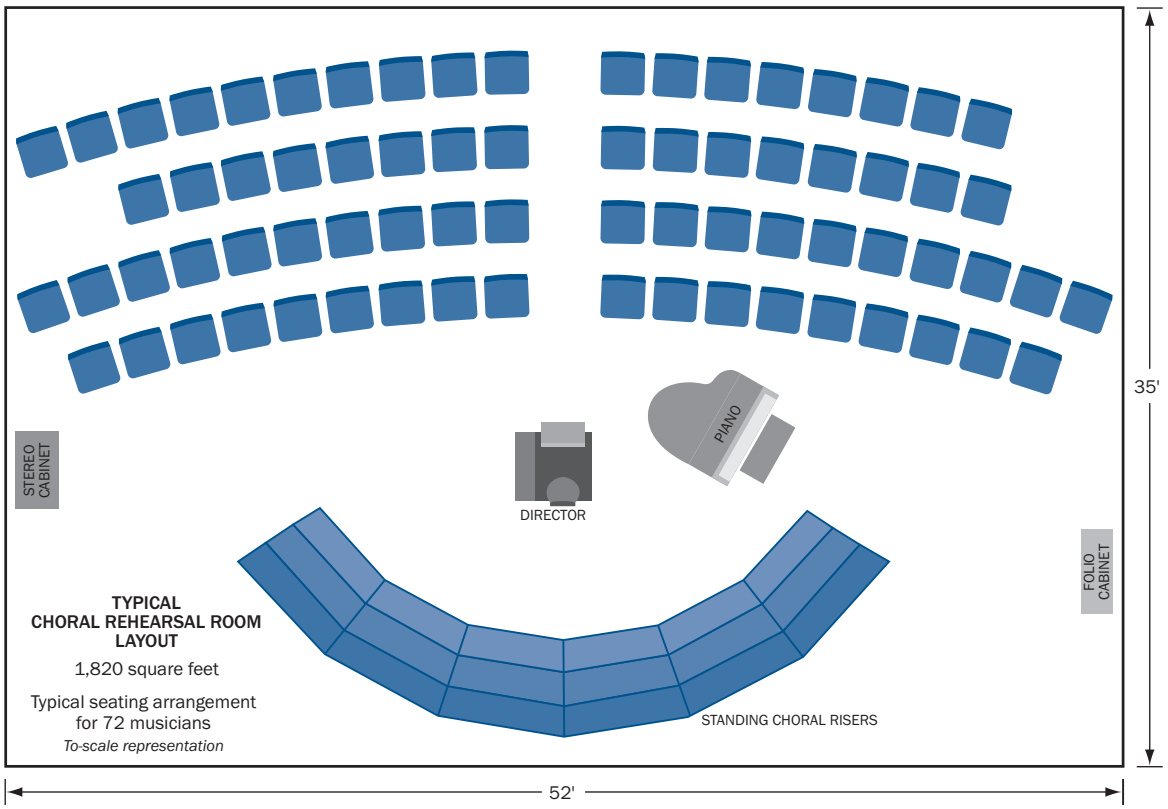
TYPICAL CHAIR AND STAND SPACING FOR BAND REHEARSAL ROOMS



BAND REHEARSAL ROOM GUIDELINES

ROOM	RECOMMENDED FLOOR AREA	FORMULA
Band/Orchestra Rehearsal Room	2,500 sq. ft. minimum for 60-75 students	30-35 sq. ft. per instrumentalist*

*The total per-musician square-footage requirement is not equal to the foot-print of a musician within the room. Instead, it is a means for calculating total additional rehearsal room size for larger groups and it takes into consideration additional space requirements such as aisles, storage, etc.



TYPICAL CHAIR SPACING FOR CHORAL REHEARSAL ROOMS

REHEARSAL ROOM GUIDELINES		
ROOM	**RECOMMENDED FLOOR AREA**	**FORMULA**
Choral Rehearsal Room	1,800 sq. ft. minimum for 60-80 students	20-25 sq.ft. per vocalist

*The total per-musician square-footage requirement is not equal to the foot-print of a musician within the room. Instead, it is a means for calculating total additional rehearsal room size for larger groups and it takes into consideration additional space requirements such as aisles, storage, etc.

PRACTICE ROOMS

Quality pre-engineered practice rooms are superior to most permanent rooms because they guarantee sound isolation and can be moved or altered as needs change. Achieving an equivalent level of sound isolation with built-in rooms usually requires construction that is more expensive than pre-engineered rooms.

A properly designed Music Suite will have a mix of different size practice rooms to accommodate all department activities.

PRACTICE ROOM GUIDELINES

ROOM	PURPOSE	MAXIMUM CAPACITY	FLOOR SPACE
Small Practice	individual practice	1 student	35-40 sq. ft.
Keyboard	private lessons, keyboard practice	2 students	55-60 sq. ft.
Small Group	small group practice and rehearsal	4 students	75-80 sq. ft.
Medium Group	medium group practice and rehearsal	6 students	95-100 sq. ft.
Ensemble Practice	group rehearsals and lessons, sectionals	15 students	350-450 sq. ft.*

*Additional ceiling height should be planned for larger practice rooms.

STORAGE ROOMS

The Music Suite requires more storage space than any other part of the school because of its wide assortment of equipment, instruments and garments. See pages 26-31 for additional storage information.

STORAGE ROOM GUIDELINES

TYPE OF STORAGE	FLOOR SPACE
Instruments	600-800 square feet*
Choral Robes	2.5 sq. ft. per garment or 150-250 sq. ft.* (2-4 inches per hanging robe)
Band Uniforms	3 sq. ft. per garment or 300-400 sq. ft.* (4-5 inches per hanging uniform)

*Square footage requirements given are for a 60-80 member program.

COMPUTER LAB

Computer labs have high square-footage requirements to accommodate MIDI and computer workstations. They also require a surge-protected power source, multiple electrical outlets, and indirect lighting to eliminate screen glare. They must be designed to provide multiple connectivity via phone lines, coaxial cable and LAN (Local Area Networks).

COMPUTER LAB GUIDELINES

TYPE OF STORAGE	REQUIREMENTS	WORKSTATIONS	FLOOR SPACE
Electronic Keyboard Lab	secured space, for classes and independent study, requiring many electrical outlets with surge controls	11-21 workstations	500-750 sq. ft. minimum or 35-45 sq. ft. per workstation

ADDITIONAL ROOMS

The most successful floor plans place a variety of application-specific rooms in strategic locations. Your plan, at the very least, must provide adequate floor space for each room.

ADDITIONAL ROOM GUIDELINES

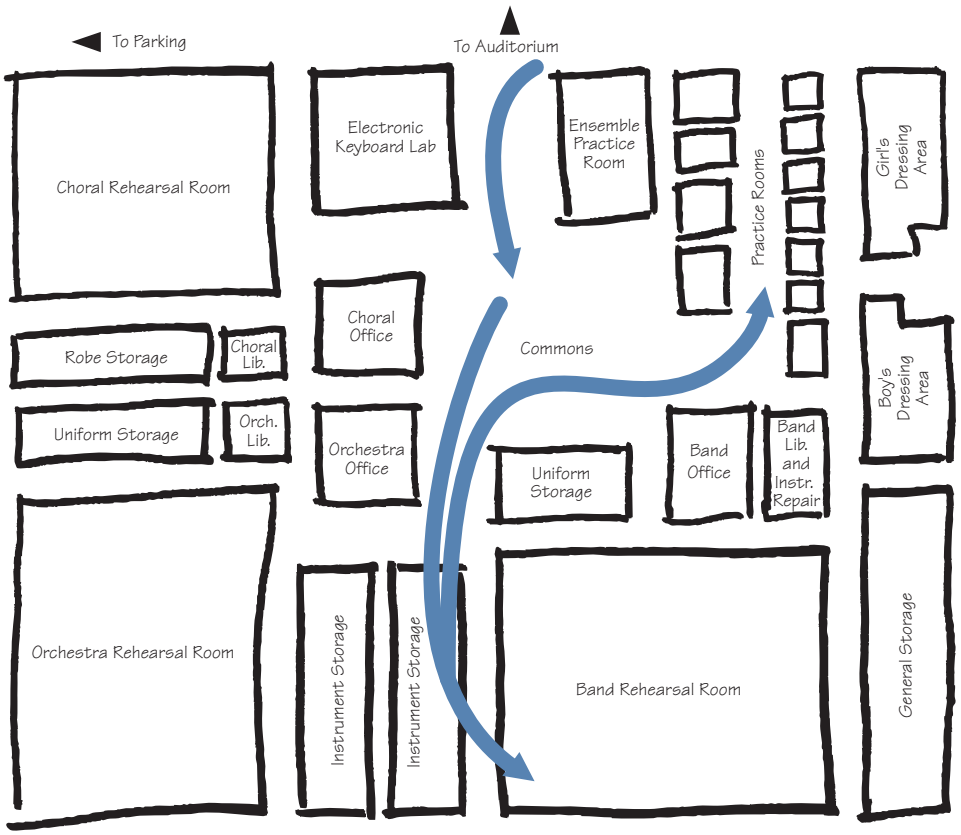
ROOM	PURPOSE	ACCOMMODATES	RECOMMENDED FLOOR AREA
Offices	administrative needs, private lessons, equipment, piano	1 teacher	100-200 sq. ft.
Music Library	sheet music storage	music for 150 students	150-200 sq. ft.
Instrument Repair	minor repair requiring sink, 8' counter, storage for parts and tools	1-3 people	50-75 sq. ft.
Commons Area	a gathering place to promote the department with conversation areas, awards displays, etc.	large groups and activities	500-700 sq. ft.

TRAFFIC FLOW

CONSIDERATIONS

The Music Suite is a center of activity, and your floor plan must promote easy movement in and out at all times.

- Large numbers of students enter and exit together within minutes; good traffic flow must provide natural routes and adequate space for these groups.
- The start of class can be frenzied, as students find their music, get their instruments from storage, and take their seats for rehearsal — all in a four-minute window.
- The time window at the end of class is just as small, as students rush to put away instruments and music, gather their books, and get ready for their next class.
- Small groups often move from large rehearsal areas to smaller practice rooms in the same period.
- Many individuals use the suite throughout the day for private lessons and study.
- Equipment and instruments are constantly moved from one part of the suite to another.
- Many activities are going on at once in the Music Suite, and traffic should be designed so that the flow doesn't disturb any activity or area within the suite.
- Traffic flow solutions include separate entry and exit doors to reduce congestion, a design that moves traffic flow away from rehearsal areas to reduce distractions, and designing doorways, hallways, corners and ramps so they can facilitate the movement of large equipment.



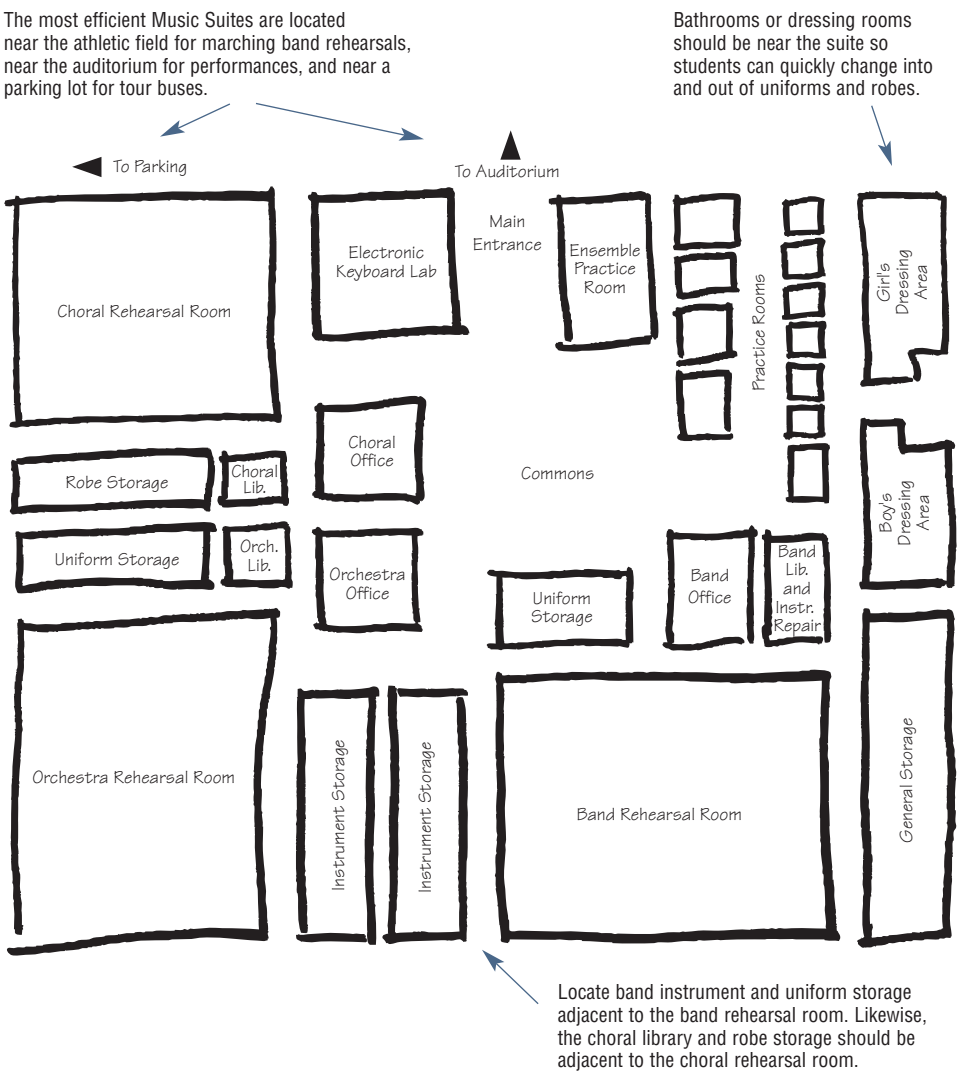
Good traffic flow must provide natural routes for large groups so they can get what they need from storage and take their places as quickly and quietly as possible.

ACCESS TO RELATED AREAS

CONSIDERATIONS

An effective floor plan positions related areas adjacent to one another within the Music Suite, and also positions the Music Suite itself in a strategic position within the school.

- The suite should be located near ramps, rather than stairways, to facilitate movement of large equipment and instruments, such as timpani and pianos.
- Doorways should be wide and unobstructed. Hallways and corners should be wide enough to accommodate grand pianos.
- The Music Suite is often busy with activities after hours and on weekends. Students and instructors must have access to the suite at these times without opening the entire school. Bathrooms and performance areas must also be nearby and accessible.
- The Music Suite should be located away from the general student traffic flow to reduce noise and help prevent vandalism and disruption.

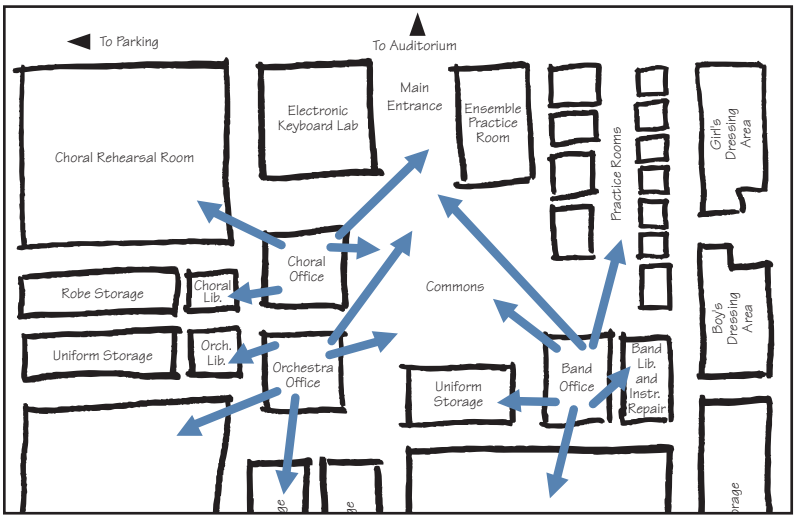


TEACHER MONITORING

CONSIDERATIONS

Music department faculty frequently supervise many students and several activities at one time. They need to see as much of the suite as possible at all times to improve monitoring and control.

- Ideally, all areas of the Music Suite should be visible from suite offices.
- Offices should be centrally located, with large windows for clear sight lines.
- Offices should also have a clear view of entrances and exits.



To improve monitoring, Music Suite offices should have a clear view of the entire suite at all times.

FLEXIBILITY

CONSIDERATIONS

Flexibility for multiple activities

Along with daily routines, an effective floor plan must also accommodate marching drills, choreography practice for musicals, dance line rehearsals, even community events. Flexibility within the suite is crucial.

- Rehearsal rooms should be able to be reconfigured easily for various uses.
- Use portable seated risers, instead of built-in tiered seating, for increased flexibility.
- Flat, open floors give you more space options for more activities.
- Portable equipment also frees you to make better use of space.

Flexibility for future needs

Start by estimating future enrollment, and recognize that technology will have an affect on your suite. Plan for computer rooms and connections to cable, telephone and network lines.

CRITICAL FACTOR

storage

Storage needs in the Music Suite are great and varied, and your floor plan must provide adequate storage for instruments, robes, uniforms and music.

Because most music equipment is fragile, expensive and prone to theft and vandalism, storage spaces must be durable and secured. You'll also want to make these vital elements your main concern throughout the process:

- Types of storage.
- Traffic flow.
- Security.

The following section will help you create a floor plan with the best storage layout for your Music Suite.

TYPES OF STORAGE

CONSIDERATIONS

Underestimating storage needs is a very common problem. Make sure you plan for enough space and that the storage equipment you choose is durable and secure.

INSTRUMENT STORAGE

- Music instrument storage should also be large enough to store the student's books, jacket, etc.
- Areas should maintain consistent, year-round temperature and relative humidity levels to help prevent damage to instruments, such as cracking, loosening of glue joints, and corrosion.
- Temperature should remain constant between 65˚ and 72˚F, and relative humidity should stay between 35% and 50%.

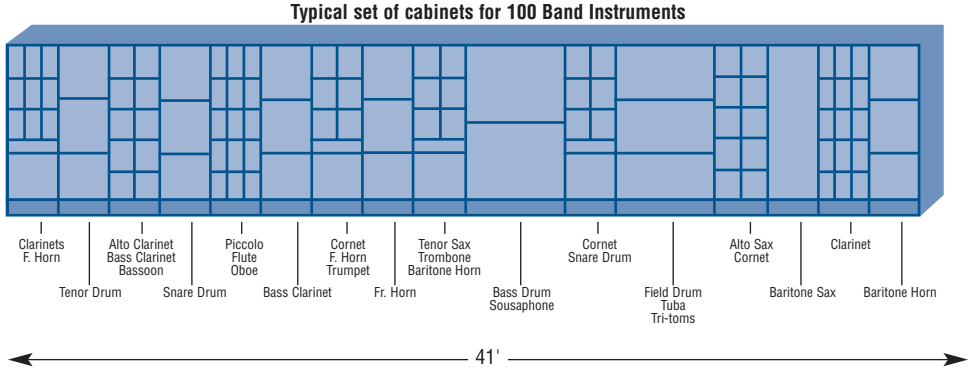
Average distribution of band instruments

INSTRUMENT	PERCENT
piccolo	1%
oboe	3%
flute	12%
clarinet	24%
alto clarinet	3%
bass clarinet	3%
bassoon	4%
alto sax	5%
tenor sax	1%
baritone sax	1%
cornet/trumpet	14%
french horn	6%
baritone horn	4%
trombone	6%
tuba	4%
snare drum	6%
tenor drum	2%
base drum	1%
	100%

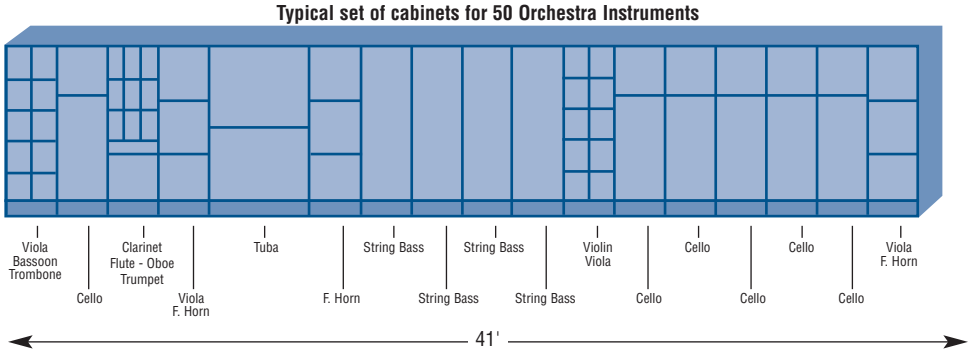
Average distribution of orchestra instruments

INSTRUMENT	PERCENT
violin	25%
viola	19%
cello	14%
double bass	8%
flute	3%
clarinet	3%
trumpet	6%
trombone	4%
tuba	1%
french horn	11%
oboe	3%
bassoon	3%
	100%

Typical set of cabinets for 100 Band Instruments



Typical set of cabinets for 50 Orchestra Instruments



INSTRUMENT STORAGE GUIDELINES

TYPE OF STORAGE	ACCOMMODATES	FLOOR SPACE
Instrument	150-200 instruments	4 sq. ft. per instrument or 600-800 square feet*

*Square footage requirements given are for a 60-80 member program.

GARMENT STORAGE

Secure, ventilated storage will prevent mildew and protect robes, uniforms and other garments.

GARMENT STORAGE GUIDELINES

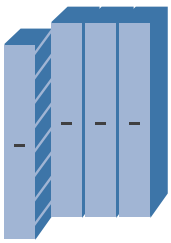
TYPE OF STORAGE	GARMENT QUANTITY	FLOOR SPACE
Choral robes	100 robes	2.5 sq. ft. per garment or 150-250 square feet* (2-4 inches per hanging robe)
Band uniforms	100 uniforms	3 sq. ft. per garment or 300-400 square feet* (4-5 inches per hanging uniform)

*Square footage requirements given are for a 60-80 member program.

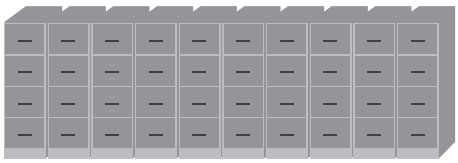
MUSIC LIBRARY

Few people outside of music departments realize how much space it takes to store sheet music. Music libraries need to be convenient, so music can be located quickly, easily, and quietly.

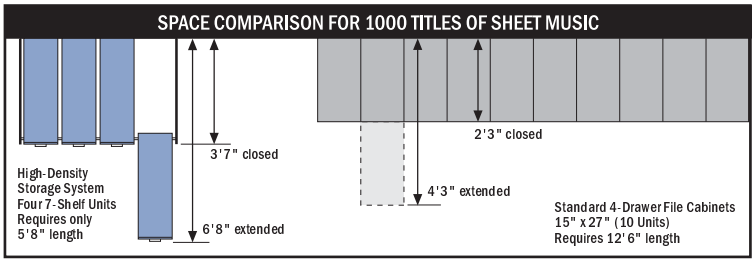
- Place sheet music storage in or near the music director's office to control access and security.
- Place storage systems in the corner of the room to maximize space utilization.
- Pull-out music storage designs work best on tile, wood, or other hard-finished surfaces.
- Plan for an adjacent area where you can quickly and easily sort, collect and distribute music.



High-density storage



Standard 4-drawer file cabinets



High-density storage lets you store the same number of titles in less than half the space of typical storage solutions.

SHEET MUSIC STORAGE GUIDELINES

NUMBER OF TITLES	HIGH DENSITY STORAGE SYSTEMS FLOOR AREA REQUIRED	STANDARD FILE CABINETS FLOOR AREA REQUIRED
500	35 sq. ft.	65 sq. ft.
1,000	70 sq. ft.	130 sq. ft.
2,000	140 sq. ft.	260 sq. ft.
3,000	210 sq. ft.	390 sq. ft.

OTHER STORAGE NEEDS

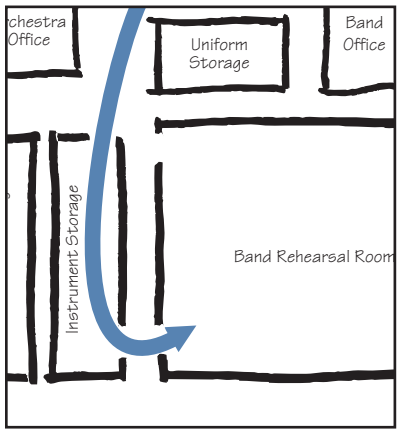
- Plan space in your main rehearsal rooms for portable storage of music folios, small percussion instruments, and stereo/recording equipment.
- Portable storage units allow you to easily move instruments and equipment between music areas.

TRAFFIC FLOW

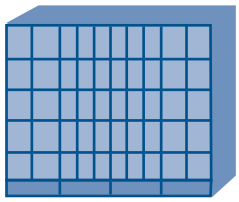
CONSIDERATIONS

Music Suite storage areas are prone to congestion. Without a floor plan that promotes smooth traffic, valuable class time can be wasted.

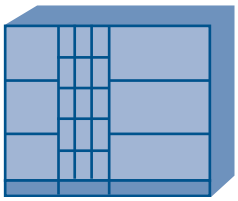
- Instruments should be stored in a separate area outside the rehearsal room so students can retrieve instruments without disturbing rehearsals.
- Instrument storage and robe/uniform storage rooms provide excellent sound isolation when used as buffer zones between rehearsal rooms.
- If instruments must be stored in the band or rehearsal room, place the cabinets near appropriate instrument sections to prevent confusion and congestion.
- Instrument cabinets in the rehearsal room should also use grille doors to help diffuse sound and eliminate flutter echo. And unlike solid doors, grille doors don't reduce cubic volume.
- Grille doors also allow visual inspection and increase ventilation.
- Cabinets should always be arranged to reduce congestion in any given area.
- Doors at each end of the instrument storage room promote excellent traffic flow and eliminate congestion at the beginning and end of class.
- Allow a 3' minimum between cabinets and opposing walls, and 6' between rows of facing cabinets to reduce the likelihood of instrument damage.
- Avoid placing double door cabinets next to one another to prevent doors from swinging into each other. This will also make sure students don't have to wait for another cabinet's doors to close to gain sufficient access to their own cabinet.



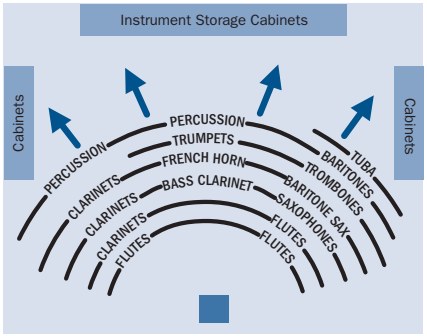
Doors at each end of instrument storage rooms promote excellent traffic flow and help eliminate congestion at the beginning and end of class.



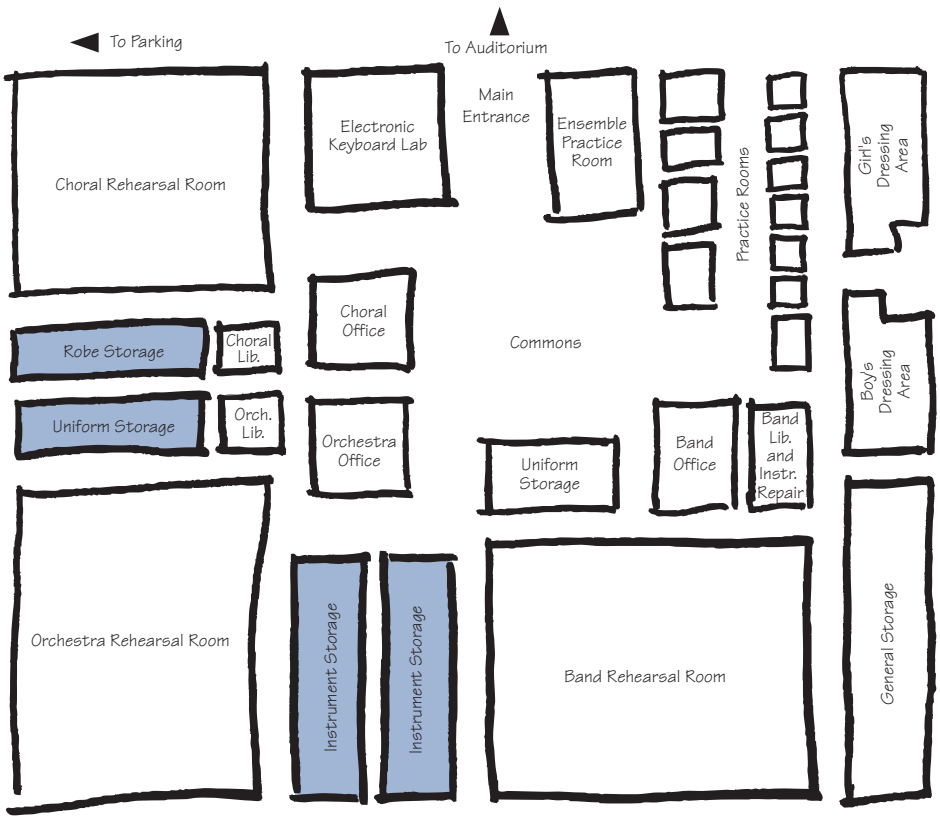
INCORRECT CABINET LAYOUT
Multi-compartment cabinets placed together or near a room entrance will create congestion.



CORRECT CABINET LAYOUT
You'll reduce congestion and facilitate traffic flow by putting cabinets with many compartments next to cabinets with only a few. This will spread out students as they retrieve or replace their instruments.



- If instruments must be stored in the band or rehearsal room, place the cabinets near appropriate instrument sections.
- Acoustic instrument storage cabinets are recommended for use in this space.



Storage areas provide excellent sound isolation when used as buffer zones between rehearsal rooms.

SECURITY

CONSIDERATIONS

Expensive equipment and instruments are stored throughout the Music Suite, making security a top priority for any successful facility.

- For maximum security, plan for separate, lockable rooms with lockable cabinets inside.
- Motion detectors help prevent unauthorized entry and vandalism of keyboards and computers in the electronic media lab.
- Position storage rooms where they can be visually inspected from Music Suite offices.
- The Music Suite should be secured from the rest of the school for maximum security during after-hours and weekend activities.

EQUIPMENT	AMOUNT INVESTED
Musical Instruments	$100,000
Choral Robes	$20,000
Band Uniforms	$50,000
Sheet Music	$100,000
Music Stands	$3,000
Music Chairs	$10,000
Choral Risers	$3,000
Stereo Equipment	$2,000
CD's, Tapes, Records	$1,000
Acoustical Shells	$15,000
Computers	$20,000
Electronic Keyboards	$8,000
Total	$332,000*

*Based on a typical music program

The Music Suite stores some of the school's most costly investments, making high security a top priority.

CRITICAL FACTOR

equipment

The final step in planning your Music Suite is choosing equipment specially designed for your music activities. And although furniture and equipment are normally not included in the general building contract, your advanced planning will make sure you have a budget large enough to purchase the equipment you need.

The following section provides basic worksheets that will help you equip the Music Suite with everything required for quality music education.

QUALITY EQUIPMENT

CONSIDERATIONS

Choose quality equipment for your Music Suite to ensure a successful, functional, durable music environment. When selecting equipment, consider the following:

- Music Suite equipment should be considered a long-term investment that guarantees priceless returns — successful music students.
- Sturdy, functional, well-designed equipment is not only your best long-term value, but it also helps teachers and students get the most out of their daily efforts in the Music Suite.
- Chairs designed specifically for music posture help students produce better tone and thus become better musicians.
- Chairs should be stackable for easy storage; chair carts make it easy to transport chairs between performance and rehearsal areas.
- Music stands should be wobble-free and designed to withstand heavy use and abuse; stand carts also make it easy to move stands between performance and rehearsal areas.
- Conductor's equipment should match the conductor's style and facilitate good teaching.
- Portable risers allow greater adaptability to changes in your music program and, unlike poured concrete risers, they don't reduce cubic volume or adversely affect acoustics.
- Flexibility is the key to selecting equipment. Choose products that adapt easily to changes in the music environment and also facilitate changes to meet future needs.

Furniture and Equipment Worksheet SAMPLE	BAND REHEARSAL ROOM	CHORAL REHEARSAL ROOM	ORCHESTRA REHEARSAL ROOM	ENSEMBLE ROOM	PRACTICE ROOMS	ELECTRONIC MUSIC LAB	OFFICE	PERFORMANCE AREA	INSTRUMENT STORAGE ROOMS	MUSIC LIBRARY	GARMENT STORAGE	TOTAL	BUDGET
largest class size	75	75	60	20	-	20	-	-	-	-	-	-	
school-owned instruments	50	-	25	-	-	-	-	-	-	-	-	75	
music posture chairs	75	75	60	20	17	20	2	-	-	-	-	267	
chair storage carts	4	-	4	1	-	-	-	-	-	-	-	9	
music posture chair with tablet arm	-	30	-	-	-	-	-	-	-	-	-	30	
music stands	65	-	50	20	17	-	2	-	-	-	-	154	
music stand storage carts	3	-	3	1	-	-	-	-	-	-	-	7	
portable seated risers	1 set	1 set	1 set	-	-	-	-	-	-	-	-	3 sets	
portable standing choral risers, 6-unit set	-	1 set	-	-	-	-	-	1 set	-	-	-	2 sets	
conductor's chair, music stand, podium	1 set	1 set	1 set	1 set	-	-	-	-	-	-	-	4 sets	
piano/keyboard	1	1	1	1	1		-	-	-	-	-	5	
portable music folio cabinet, per room	3	3	2	-	-	-	-	-	-	-	-	8	
stereo equipment components	1 set	1 set	1 set	-	-	1 set	-	-	-	-	-	4 sets	
cabinet for stereo equipment	1	1	1	-	-	1	-	-	-	-	-	4	
portable acoustical shell, 12-unit set	-	-	-	-	-	-	-	1 set	-	-	-	1 set	
computers	1	1	1	-	-	20	1	-	-		-	24	
electronic keyboards	1	1	1	-	-	20	1	-	-	-	-	24	
workstation for computers/keyboards	1	1	1	-	-	20	1	-	-	-	-	24	
teacher's desk, per teacher	-	-	-	-	-	-	1	-	-	-	-	1	
teacher's file cabinets, per teacher	-	-	-	-	-	-	2	-	-	-	-	2	
instrument storage	-	-	-	-	-	-	-	-	15 cab.	-	-	15	
sheet music storage	-	-	-	-	-	-	-	-	-	6 units	-	6	
robes and uniforms	-	-	-	-	-	-	-	-	-	-	10 cab.	10	

See page 46 for complete worksheet.

performance areas

The performance space in your facility is where you showcase your work, whether it's large ensembles, chamber music, solos, or any number of other performances. A significant amount of planning is necessary to create the most functional space, and you'll need to acknowledge certain truths if you are to make your performance space a success:

- This is a complicated design task, requiring expert assistance.
- You are creating a shared space that is not dedicated to a single user.
- Even the most basic auditoriums are expensive to build.
- Your auditorium will house extensive amounts of expensive equipment.

MULTIPLE USES

CONSIDERATIONS

Unlike practice and rehearsal spaces, which tend to have dedicated users, performance spaces are typically used by many groups for many purposes.

- The music department uses these spaces for performances by bands, orchestras and choirs.
- The drama department uses these spaces to stage plays and musicals.
- The school administration uses these spaces for lyceums and meetings.
- Other schools, and even the community, use these spaces for an assortment of other needs.
- Creating an effective multiple-use facility requires that departments work together to meet the needs of as many users as possible. This also increases the likelihood that you'll receive sufficient funding to build an effective facility.
- Because of the complexity of these spaces, an architect and other related consultants should be contracted to design the facility within the appropriate budget and programming guidelines.
- Performance spaces must also accommodate many pieces of equipment, some large and expensive.
- Establishing the specific needs of the music department requires thorough analysis of the intended uses, or programming, of the space.
- Other departments using theses spaces should communicate their programming needs in a similar perspective fashion.

PROGRAMMING

ESTABLISHING NEEDS

A good place to start analyzing the musical requirements for your performance spaces is by compiling a list of the sizes of recent and upcoming performances, paying particular attention to performing group and audience sizes. Use the table below to create a specific list of needs. List all performances, followed by anticipated growth or new uses. You'll also want to create a separate list of performances in other spaces, such as gymnasiums and cafetoriums, to give yourself a complete picture of what you expect from your performance spaces.

Performance Areas
Programming Worksheet

SAMPLE

DATE OF USE	USER	PERFORMANCE	ENSEMBLE SIZE	AUDIENCE SIZE	SET UP TIME	STRIKE TIME	EQUIPMENT	REHEARSAL TIME	NOTES
March 15	concert band	spring concert	80	450	3 hours	2 hours	shell, chairs. stand, podium	one day prior to concert	audience too big for space. Need better lighting

See page 47 for complete worksheet.

As facility plans progress, your programming needs and budget will determine the final design of the performance space.

- Before your plans proceed too far, you must determine the total number of performance spaces within the facility.
- It's often a smart use of space — and funds — to assign specific types of performances to specific areas, including a theater, cafetorium, gymnasium, and outside.

OTHER USES

Other users of the performance spaces should fill out the same table and answer the same questions. Likely users include the following:

- The drama department, school administration, large lecture classes, other schools in the district, community organizations, and concert series organizers.
- If you plan to build a multi-purpose space, such as a gymnasium or cafetorium, non-performance uses should be included in the programming documents you prepare for the architect.

SPECIFIC CHANGES

Asking yourself the following questions, and writing down the answers, will help you crystallize what you want — and don't want — in your performance spaces:

- What do you appreciate most about your existing spaces?
- What features in your existing spaces would you most like to change?
- What general features, in order of importance, would you like to see in your new spaces?

AUDITORIUM ACOUSTICS

CONSIDERATIONS

For any music department, acoustics should be first on the list of design requirements. To understand your acoustical needs, you'll need to analyze the different uses of the space before making appropriate design and construction recommendations.

- Acoustics within performance spaces are extremely complex. We recommend that you hire an acoustical consultant.
- Acoustical needs for school performance spaces vary significantly. An acoustical consultant will help make sure that you get the most out of your space and your budget.
- School facilities can be designed with variable acoustic elements, called Active Acoustics, as well as other specialized equipment to meet more needs and satisfy more users.

FACILITY SIZE

The size of the facility should be driven by programming needs and available budget.

- Major programs should be given priority when determining room volume and acoustic design.
- If instrumental music is the major user, for instance, then the acoustic needs of this group should be the primary focus of the overall design.

STAGE SIZE

Use the following guidelines to determine the space you'll need on stage.

STAGE SIZE GUIDELINES

PERFORMANCE	SQUARE FOOTAGE REQUIREMENTS*
Orchestra and Band	20-30 sq. ft. per person
Choir	3-4 sq. ft. per person
Sitting Choir	7-9 sq. ft. per person

* Adapted from Planning New or Renovated Music Facilities, Howard, Boner, Holden and Wetherill.

- These numbers do not reference total stage size — they are guidelines for space requirements for performers only. You'll also need to consider other space needs.
- Dramas and musicals typically require much more space.
- You'll also need to take into account backstage, wing space, storage, etc.

ONSTAGE ACOUSTICS

- Overhead reflectors improve hearing.
- Stage walls enhance blend and balance.
- Risers improve seeing and hearing for ensembles.
- Stage shells help make theaters more usable as acoustic spaces.
- Small groups on a large stage need a chamber shell.

AUDIENCE ACOUSTICS

- Proper volume for this space is critical.
- A sloped floor generally improves both acoustics and sightlines.
- A balcony can add seats that aren't too far from the stage.
- The space's basic shape — fan, shoebox, etc — will have a significant impact.

EARLY REFLECTIONS

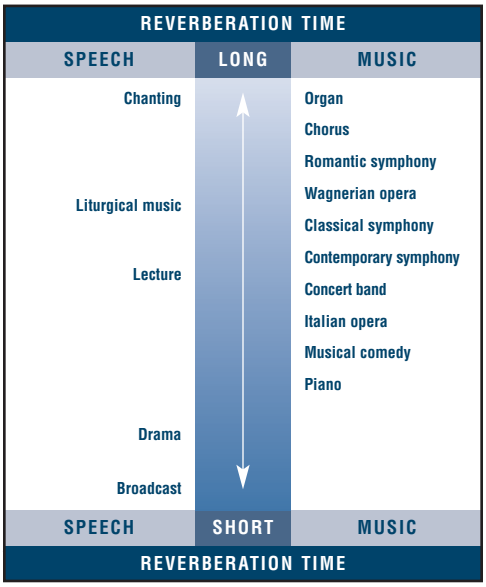
The acoustical design of the performance space must ensure that sound reflects within certain time intervals.

- Early reflections are critical for clarity and articulation.
- The areas directly around the stage, the shapes of the side walls, box and balcony details, and the ceiling all reflect direct sound and greatly impact what the audience hears.

REVERBERATION

Proper reverberation creates the feeling of envelopment, richness and warmth.

- You achieve effective reverberation through the proper use of sound-absorptive and diffusive/reflective materials.
- To accommodate a variety of acoustical needs, reverberation can be adjusted and programming varied with the use of moveable banners, curtains and baffles.



Relative ideal reverberation for various types of performed music and speech.

Chart adapted from Theater Design, by George C. Izenour, McGraw Hill, 1977, diagram B.B.N.

SOUND ISOLATION

Sound isolation is mandatory to eliminate noise and disruptions to performances.

- Effective designs eliminate outside disturbances, including traffic and weather.
- Adjacent spaces— such as classrooms, common areas, or other performance spaces — must be isolated from the performance space.
- Mechanical and HVAC systems must be isolated so the noises they create are not heard in the performance area. See page 17 for additional information on mechanical systems.

ACTIVE ACOUSTICS

Active Acoustics can be used in place of some architectural elements.

- Electronics help distribute sound in performance spaces with extra large audience areas and balcony overhangs.
- Electronics can improve acoustics and enhance room volume that cannot be changed.
- Electronics can allow significant adjustment of acoustic properties.

EQUIPMENT

CONSIDERATIONS

Performances by school music programs require a significant and varied collection of equipment.

- Acoustic and sound equipment can include portable acoustical shells and sound systems used for a variety of performances.
- Platforms and risers are typically used for large instrumental and choral ensembles, as well as smaller jazz ensembles and show choirs.
- Furniture requirements include chairs and music stands for performers, a podium and stand for conductors, and other varied pieces of equipment for musicians.
- Proper lighting is essential to allow musicians to see their music and help the audience see the performance.
- Upright and grand pianos are commonly used in the performance area.

FLOOR PLAN AND STORAGE

CONSIDERATIONS

An effective floor plan takes into account all the uses of the performance area, as well as adjacent areas. You'll also need to plan for the storage and movement of various equipment.

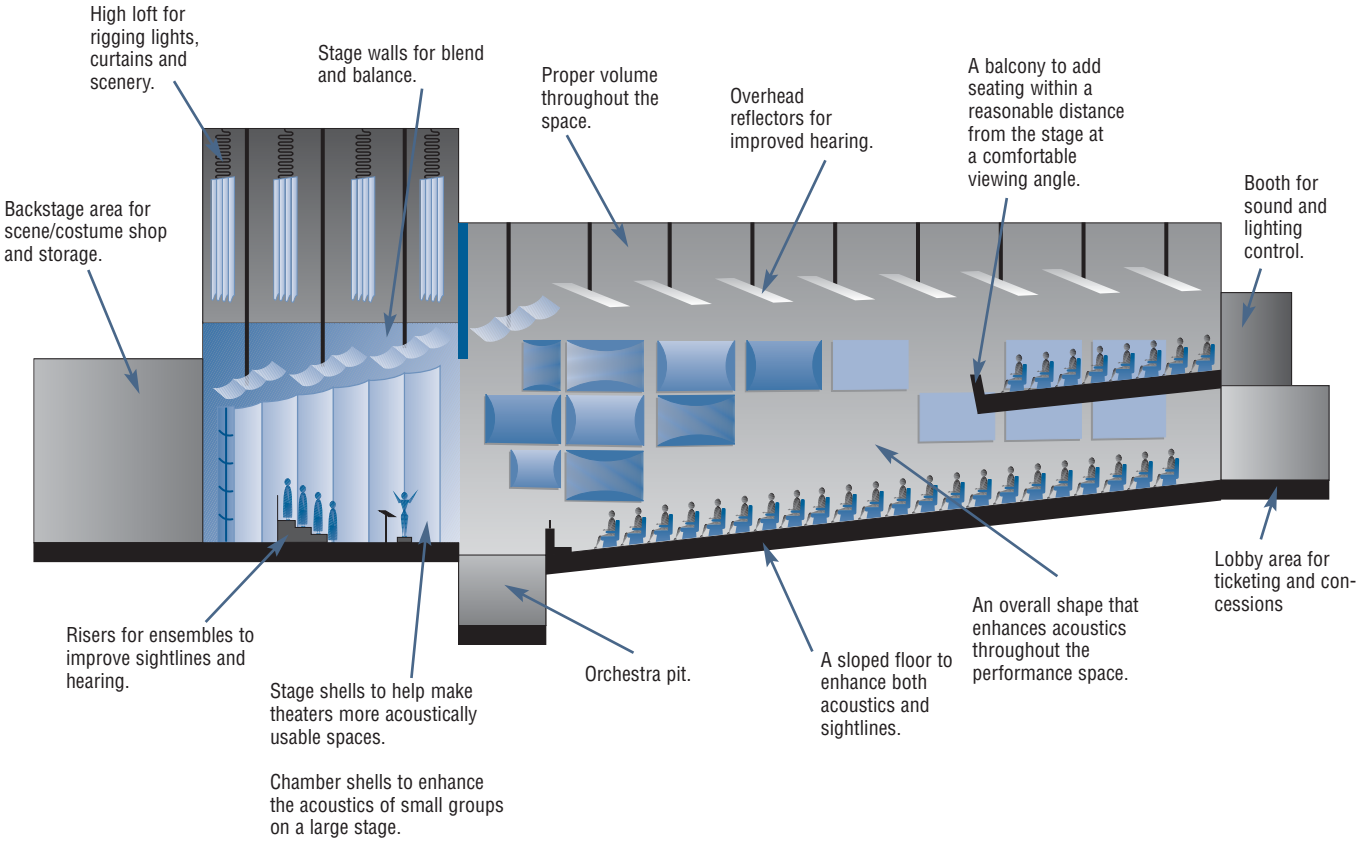
- Equipment and materials are commonly moved from rehearsal spaces into performance spaces and back again.
- The performance area should be located in proximity to rehearsal and dressing rooms as students with instruments and furniture frequently move between these spaces.
- Backstage areas are often used as warm-up spaces. Performers also use the backstage area to change clothes, store their instrument cases, and wait for their performance.
- Traffic moves on and off stage throughout a performance. These adjacent areas should be separated from the audience and foyer to prevent disturbances.
- You'll need dedicated storage areas for many large pieces of equipment, including staging, risers, shells, furniture and pianos.
- This equipment must be frequently moved into other areas to allow stage use by various groups.
- You'll need an orchestra pit if musical theater, operetta and opera are part of your theater's programming. Extensions and covers make the pit usable at the stage and at several floor levels.
- Other performance area users will have significant equipment needs of their own.

DEDICATED SPACES

PROSCENIUM THEATER

This theater type is probably the most common dedicated performance space found in high schools throughout the U.S. because it accommodates so many users and so many needs.

- Inherent flexibility supports both drama and instrumental productions.
- An excellent space for a vast array of other formal uses.

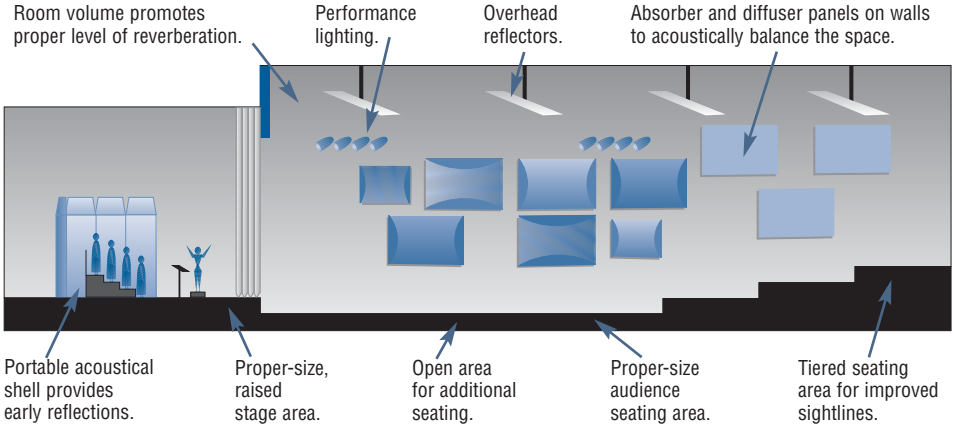


MULTI-PURPOSE SPACES

CAFETORIUM

Many schools, especially middle schools, use this multi-purpose space because it stretches facility dollars by accommodating numerous functions.

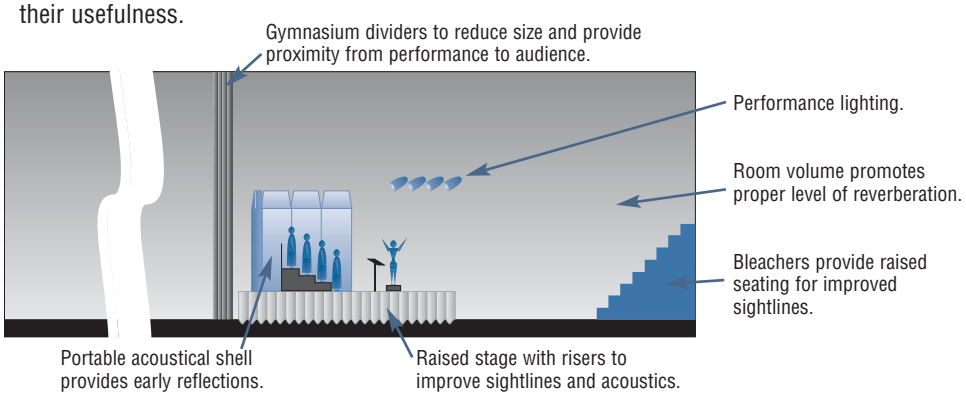
- The cafeteria, commons areas, performance areas and large meeting areas can be creatively combined to create a flexible, functional space that meets user and budget guidelines.
- These spaces generally lack the acoustics needed for music performances. But with proper design elements and materials — including absorber and diffuser panels and acoustic shells — these spaces can become very useful performance areas.
- These spaces also typically lack appropriate seating arrangements required for proper audience sightlines and adequate lighting for both performers and the audience.
- Portable equipment — including shells, risers, and tiered seating — can also help make this space functional for music, and it can be moved to other areas for other uses. Be sure to plan for storage of this equipment.



GYMNASIUM

Few spaces at the school are asked to accommodate so many needs.

- Besides a full schedule of athletic events — basketball, wrestling, gymnastics, volleyball, phy ed classes — gymnasiums are also frequently used for dances, rallies, concerts and more.
- On the plus side, gymnasiums provide ample space for large audiences and bleachers offer fairly effective audience seating.
- On the downside, acoustics and lighting are often overlooked in the original design.
- Although gymnasiums are not ideal performance environments, proper planning can increase their usefulness.



N O T E S

GLOSSARY

Absorption
Absorption is the reduction of reflected sound energy that occurs when sound comes into contact with various surfaces and materials. When sound comes into contact with thick, fibrous materials such as drapery, a great deal of sound energy can be absorbed and less sound is reflected back toward its origin.

Active Acoustics
Active Acoustics use Passive Acoustics as their base, but also use electro-acoustic elements — speakers, microphones, digital signal processing — to positively affect the acoustics of an environment.

Diffusion
Diffusion is the scattering and redirection of sound that occurs when sound strikes an acoustically reflective surface. Diffusion is necessary so that sound can be clearly heard from all points in a facility. The extravagant ornamentation in historic theaters, for example, provides many angled, acoustically reflective surfaces which result in excellent diffusion.

Echoes
Echoes are produced when different surfaces reflect sound to a listener long after the direct sound from the original source has already been heard. Trombonists onstage often produce echoes off the back wall of an auditorium. While both absorbers and diffusers can be used to control echoes, diffusers are generally preferred.

Flutter
Flutter occurs when a sound source is situated between parallel, sound-reflecting surfaces. A rim shot played on a snare drum inside an untreated rectangular classroom will produce the prolonged, buzzing sound of flutter. Diffusers are generally the best cure for flutter.

Frequency
Frequency is the physical description of musical pitch. A thick carpet absorbs a portion of the high-frequency sounds of a piccolo but has little effect on the low-frequency energy of a tuba.

Loudness
Excessive loudness occurs when an ensemble plays in a room that is too small or acoustically untreated. Absorber panels can help control excessive loudness.

Masking
Masking occurs when a noise conflicts with a musical sound similar or higher in pitch. Building mechanical system noise can easily mask the sound of basses and cellos in an orchestra rehearsal hall.

Noise Criteria (NC)
Background noise within an environment is measured via a Noise Coefficient, or NC. Different spaces require different NC values.

Passive Acoustics
Passive Acoustics is the use of specially designed products to treat the acoustics within a room. These absorption and diffusion products are applied or placed in a space to balance the way sound is absorbed and distributed within the treated environment.

Presence
Presence is achieved within a room when the primary reflections of sound from room surfaces, such as walls and ceilings, arrive back at the musician's ears within 30 to 80 milliseconds (thousands of a second). This delay cannot be achieved without significant room size — the distance from the musician to the walls and ceiling — or active acoustics.

Reflection
Sound reflection off a hard, flat surface can be compared to the reflection of light off a mirror. Vocalists often stand back from the edge of a stage so that their sound can be reflected off the platform into the audience.

Resonance
Resonance is the emphasis of a particular frequency. This may occur when there is vibration of materials or furnishings that are exposed to high sound levels. The sympathetic vibration then may create a sound on its own.

Reverberation
Reverberation is the buildup of reflected sound in an enclosure that affects the character and quality of music. The sound of a band in a fieldhouse is reverberant because it is reflected many times before it dies away. The same music played outdoors does not reverberate because there are no walls or ceiling to contain it. Absorbers are required to control excessive reverberation.

Transmission
Sound transmission can occur through materials as light as air or as dense as concrete and steel. The sound of bouncing balls in a gymnasium is transmitted into an adjacent choir room primarily through the building structure while the majority of the sound of a choir heard in an adjoining corridor is transmitted through the gaps around the rehearsal room door.

Visual Acoustics
Visual Acoustics are designs within the Music Suite that feature visually attractive elements that have an adverse affect on quality acoustics. Curved walls and domed ceilings, for instance, create hot spots where sound concentrates and sound quality suffers. The domes and concave walls, though pleasing to the eye, are terrible to the ear.

PROGRAMMING WORKSHEET

Use this programming worksheet to determine the square footage you'll need for a successful Music Suite. Be sure to follow the Rule of Thumb Charts located on the inside back cover.

PROGRAMMING PLANNING WORKSHEET

MAJOR INSTRUCTION AREA	RELATED ADJACENT SPACES	ESTIMATED SQUARE FOOTAGE
BAND REHEARSAL ROOM		
	Practice Rooms #_____	
	Band Office	
	Instrument Repair	
	Instrument Storage Room	
	Band Music Library	
	Ensemble Room	
	Marching Equipment Storage	
	Uniform Storage	
	Other	
CHORAL REHEARSAL ROOM		
	Practice Rooms #_____	
	Choral Office	
	Choral Music Library	
	Ensemble Room	
	Choir Robe Storage	
	Other	
ORCHESTRA REHEARSAL ROOM		
	Practice Rooms #_____	
	Orchestra Office	
	Instrument Storage Room	
	Orchestra Music Library	
	Ensemble Room	
	Uniform Storage	
	Other	
ELECTRONIC MUSIC LAB		
COMMONS/MAIN ENTRY WAY		

EQUIPMENT WORKSHEET

Use this equipment worksheet to determine the types and amount of equipment you'll need for your entire Music Suite. Use the sample worksheet on page 33 as your guide

EQUIPMENT PLANNING WORKSHEET	BAND REHEARSAL ROOM	CHORAL REHEARSAL ROOM	ORCHESTRA REHEARSAL ROOM	ENSEMBLE ROOM	PRACTICE ROOMS	ELECTRONIC MUSIC LAB	OFFICE	PERFORMANCE AREA	INSTRUMENT STORAGE ROOMS	MUSIC LIBRARY	GARMENT STORAGE ROOMS	TOTAL	BUDGET
Largest class size													
School-owned instruments													
Music posture chairs													
Chair storage carts													
Music posture chair with tablet arm													
Music stands													
Music stand storage carts													
Portable seated risers													
Portable standing choral risers, 6-unit set													
Conductor's chair, music stand, podium													
Piano/keyboard													
Portable music folio cabinet, per room													
Stereo equipment component													
Cabinet for stereo equipment													
Portable acoustical shell, 12-unit set													
Computers													
Electronic keyboards													
Workstation for computers/keyboard													
Teacher's desk, per teacher													
Teacher's file cabinets, per teacher													
Instrument storage													
Sheet music storage													
Robes and uniforms													
Other													

PERFORMANCE AREA PROGRAMMING WORKSHEET

Use this performance area programming worksheet to help determine the requirements for your auditorium. You can also use this worksheet for other performance areas such as the gymnasium or cafetorium.

PERFORMANCE AREAS PROGRAMMING WORKSHEET

DATE OF USE	USER	PERFORMANCE	ENSEMBLE SIZE	AUDIENCE SIZE	SET UP TIME	STRIKE TIME	EQUIPMENT	REHEARSAL TIME	NOTES

ACKNOWLEDGEMENTS

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- Architectural Acoustics, M. David Egan, McGraw Hill Co., Publishers, New York, NY 1988
- Music Facilities: Building, Equipping, and Renovating, Harold P. Geerdes, MENC 1987
- NASM Guide to New and Renovated Music Facilities
- Planning New or Renovated Music Facilities, by Michael R. Howard, Charles R. Boner, Mark A. Holden, Ewart A. Wetherill. Presented at the National Association of Schools of Music workshop, Dallas, November, 1996
- The School Music Program: Description and Standards, 2nd Ed., Music Educators National Conference, MENC 1986
- Theater Checklist, from the American Theater Planning Board, Wesleyan University Press, Middletown, CT, 1969
- Theater Design, by George C. Izenour, McGraw Hill, 1977

RESOURCES

The following resources are excellent places to find names, numbers and addresses of acoustic and theater professionals.

- NCAC Directory, National Council of Acoustical Consultants, 66 Morris Ave., Suite 1A, Springfield, NJ 07081-1409, (201) 564-5859, FAX (201) 564-7480
- ASTC Directory of Theater Consultants, American Society of Theater Consultants, 12226 Mentz Hill Road, St. Louis, MO 63128. (314) 843-9218, FAX (314) 843-4955

OTHER WENGER PUBLICATIONS

The following are additional resources made available by your Wenger representative.

- An Acoustic Primer
- Acoustic Problems & Solutions
- Elementary Planning Guide
- Performance Spaces (coming soon)

THE CASE FOR SPACE

CONSIDERATIONS

Wenger square footage recommendations are based on successful music facilities. And though they may seem high to the inexperienced, they represent fifty years of determining what works and what doesn't in Music Suites all around the world. Reducing these figures in any way will have an adverse affect on your suite's success. Consider the following:

- Proper acoustics require specific amounts of space, measured in cubic volume.
- Music education is a physical activity that requires more space than other curriculum — vocalists and instrumentalists need room to move and perform.
- Instructors need room to demonstrate, observe and also perform.
- Instrumentalists need more space than vocalists to accommodate their instruments and music stands.
- Student traffic is more concentrated and hurried in the Music Suite and the floor plan must provide adequate space to eliminate congestion and ensure excellent traffic flow.
- A vast amount of valuable equipment requires secure storage.
- You must plan space to meet expansion needs.
- Wenger square footage recommendations account for all the elements that make the Music Suite a unique space with very specific — proven — space requirements.
- Rooms designed for choral music must have a minimum of 1,800 square feet and 28,800 cubic feet of volume, regardless of group size. Band rooms must be a minimum of 2,500 square feet and 45,000 cubic feet of volume, also regardless of group size. Groups larger than 60 students should use the Rule of Thumb charts to determine adequate square footage.

RULE OF THUMB GUIDELINES

Use the following Rule of Thumb Guidelines to determine square footage and volume for your Music Suite. These numbers are based on Wenger's over 60 years of experience with successful Music Suites around the world; reducing them will severely jeopardize the effectiveness of your facility. We've also included rehearsal room guidelines for small, medium and large class sizes for your convenience.

REHEARSAL ROOMS

ROOM	CLASS SIZE	FLOOR AREA TOTAL	FLOOR AREA PER MUSICIAN	CEILING HEIGHT	RESULTING CUBIC VOLUME
Choral Rehearsal	60-80 students	1,800 sq. ft.	20-25 sq. ft.*	16-20 ft.	28,800-36,000 cu. ft.
Band/Orchestra Rehearsal	60-80 students	2,500 sq. ft.	30-35 sq. ft.*	18-22 ft.	45,000-55,000 cu. ft.

*The total per-musician square-footage requirement is not equal to the foot-print of a musician within the room. Instead, it is a means for calculating total additional rehearsal room size for larger groups and it takes into consideration additional space requirements such as aisles, storage, etc.

PRACTICE ROOMS

ROOM	ACCOMMODATES	FLOOR SPACE
Small Practice	2 students	35-40 sq. ft.
Keyboard	2 students	55-60 sq. ft.
Small Group	4 students	75-80 sq. ft.
Medium Group	6 students	95-100 sq. ft.
Ensemble Practice	15 students	350-450 sq. ft.*

*Additional ceiling height should be planned for larger practice rooms.

COMPUTER LAB

TYPE OF STORAGE	WORKSTATIONS	FLOOR SPACE
Electronic Keyboard Lab	11-21 workstations	500-750 sq. ft.

ADDITIONAL ROOMS

ROOM	ACCOMMODATES	RECOMMENDED FLOOR AREA
Offices	1 teacher	100-200 sq. ft.
Music Library	music for 150 students	150-200 sq. ft.
Instrument Repair	1-3 people	50-75 sq. ft.
Commons Area	large groups and activities	500-700 sq. ft.

STORAGE AREAS

TYPE OF STORAGE	ACCOMMODATES	FLOOR SPACE
Instrument	150-200 instruments	4 sq. ft. per instrument or 600-800 sq. ft.*
Choral robes	100 robes	2.5 sq. ft. per garment or 150-250 sq. ft.* (2-4 inches per hanging robe)
Band uniforms	100 uniforms	3 sq. ft. per garment or 300-400 sq. ft.* (4-5 inches per hanging uniform)

*Square footage requirements for a 60-80 member program.

SHEET MUSIC STORAGE

NUMBER OF TITLES	HIGH DENSITY STORAGE SYSTEMS FLOOR AREA REQUIRED	STANDARD FILE CABINETS FLOOR AREA REQUIRED
500	35 sq. ft.	65 sq. ft.
1,000	70 sq. ft.	130 sq. ft.
2,000	140 sq. ft.	260 sq. ft.
3,000	210 sq. ft.	390 sq. ft.

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