Wenger®

Your Performance Partner

ENSURING YOUR SCHOOL MAKES SWEET MUSIC:

HOW TO STRIKE THE RIGHT NOTE

IN SCHOOL ACOUSTICS

Cristofer Gore, International School Specialist

October 2014

IB AFRICA, EUROPE & MIDDLE EAST
REGIONAL CONFERENCE 2014
ROME • 16–19 OCTOBER

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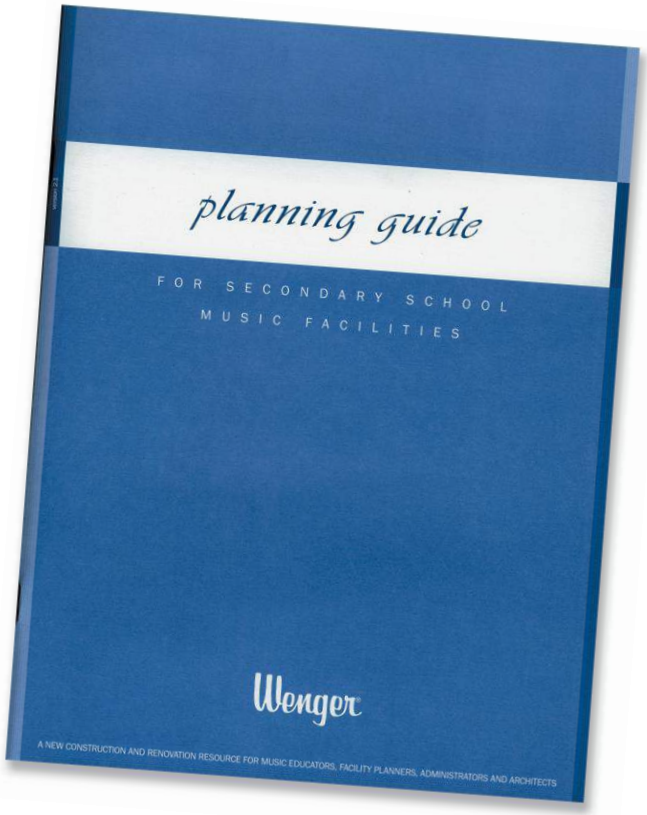
The Fundamental Requirements of a Music Suite



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Project Sequence

SCHOOL BOARD REFERENDUM


PRE-PLANNING


PROGRAMMING


SCHEMATIC DESIGN


DESIGN/ DEVELOPMENT


CONSTRUCTION DOCUMENTS

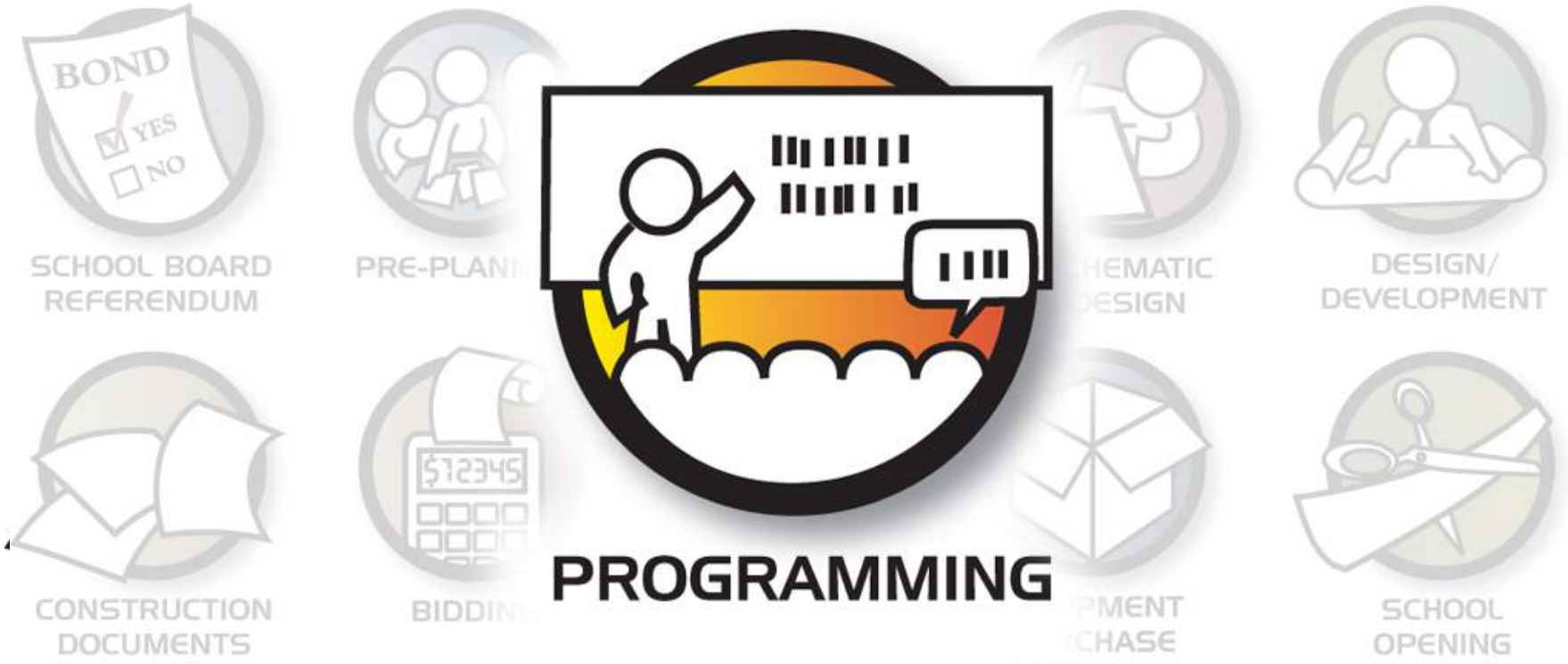
BIDDING


CONSTRUCTION


EQUIPMENT PURCHASE

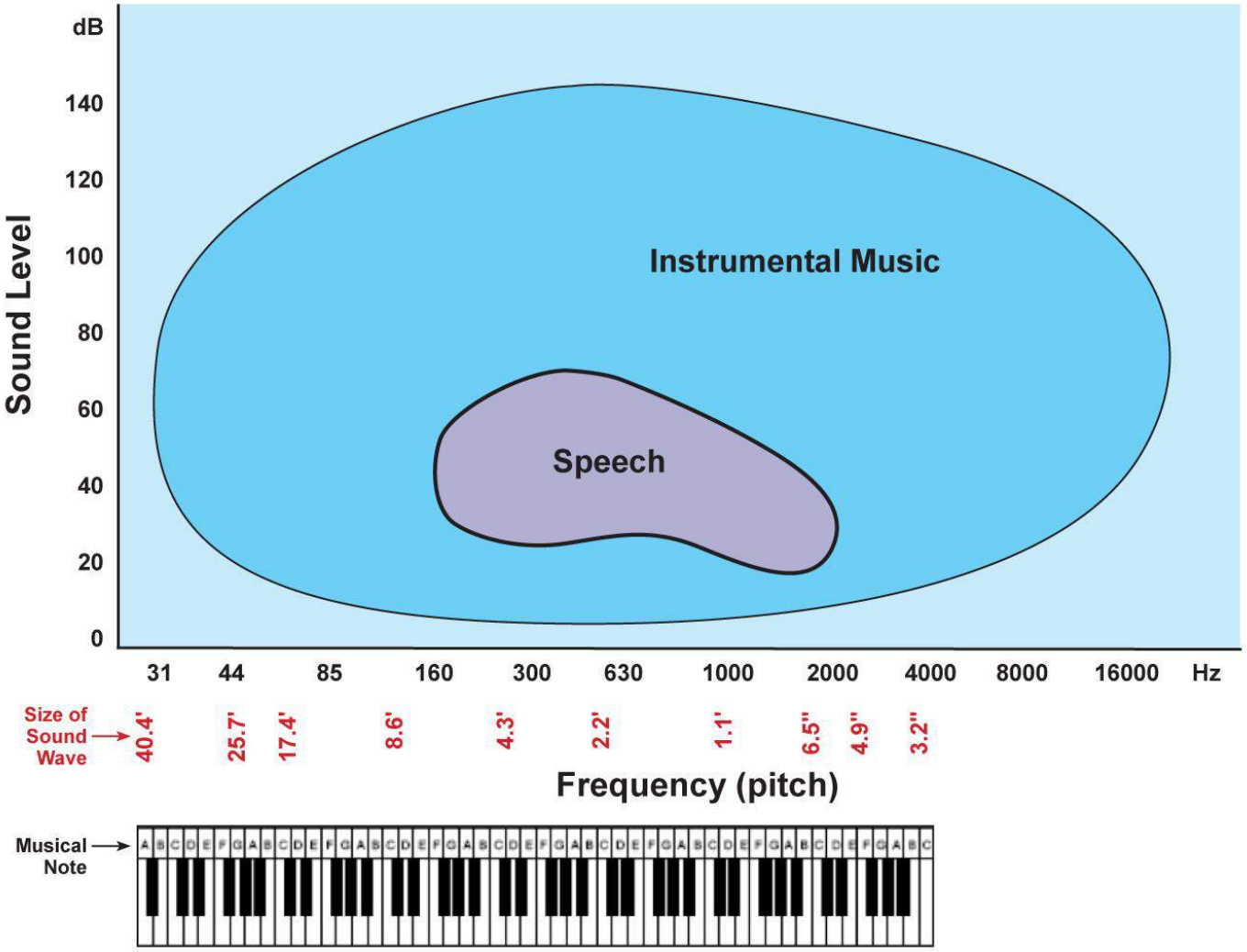

SCHOOL OPENING

Project Sequence



What makes the Music Suite so unique?

- Learn by listening
- Large spaces/groups
- Expensive equipment
- Supporting multiple spaces for activities
- Dynamics of sound

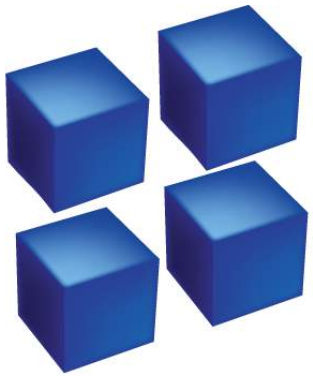

dB
140
120
100
80
60
40
20
0
Sound Level
Instrumental Music
Speech
31
44
85
160
300
630
1000
2000
4000
8000
16000
Hz
Size of Sound Wave
40.4'
25.7'
17.4'
8.6'
4.3'
2.2'
1.1'
6.5"
4.9"
3.2"
Frequency (pitch)
Musical Note

Critical Factors

1. Acoustics
2. Floor plan
3. Storage
4. Equipment

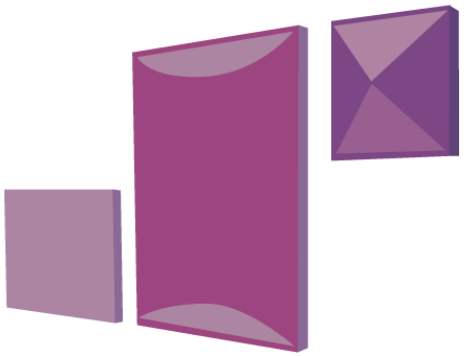
1 Acoustics

Four Elements of Acoustics



Cubic
VOLUME

Sound
ISOLATION

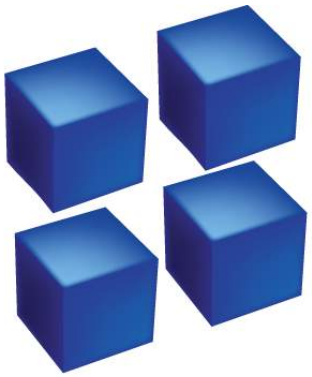


Acoustical
TREATMENT

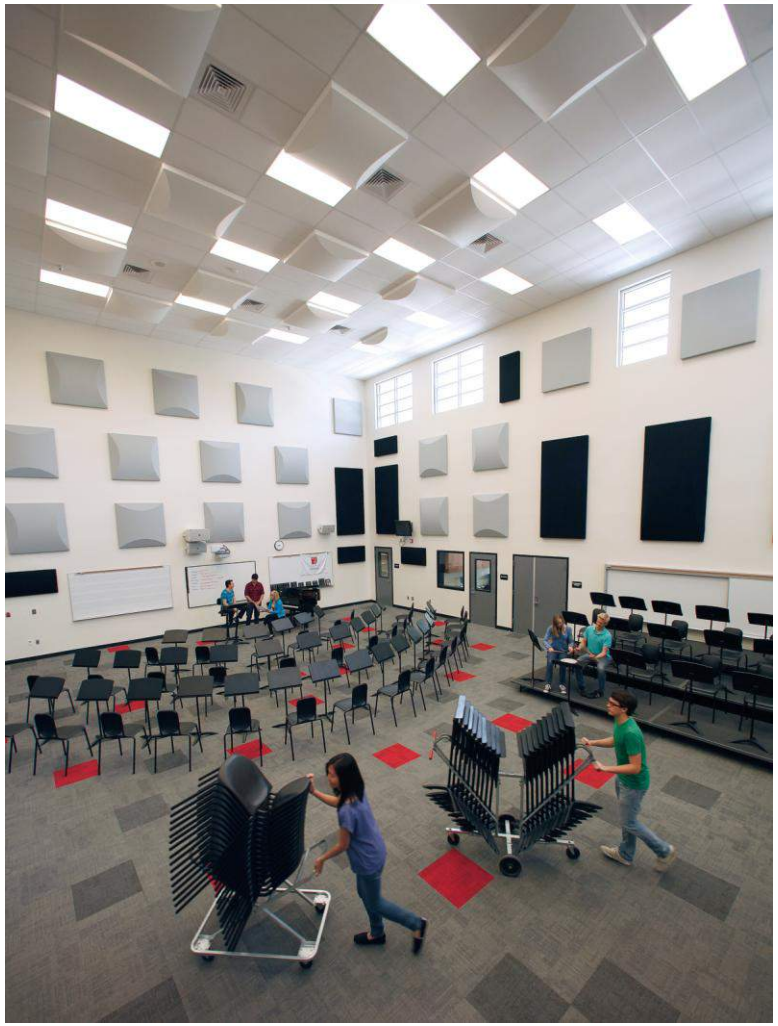
Mechanical
SYSTEMS

1 Acoustics

Element of Acoustics



Cubic VOLUME



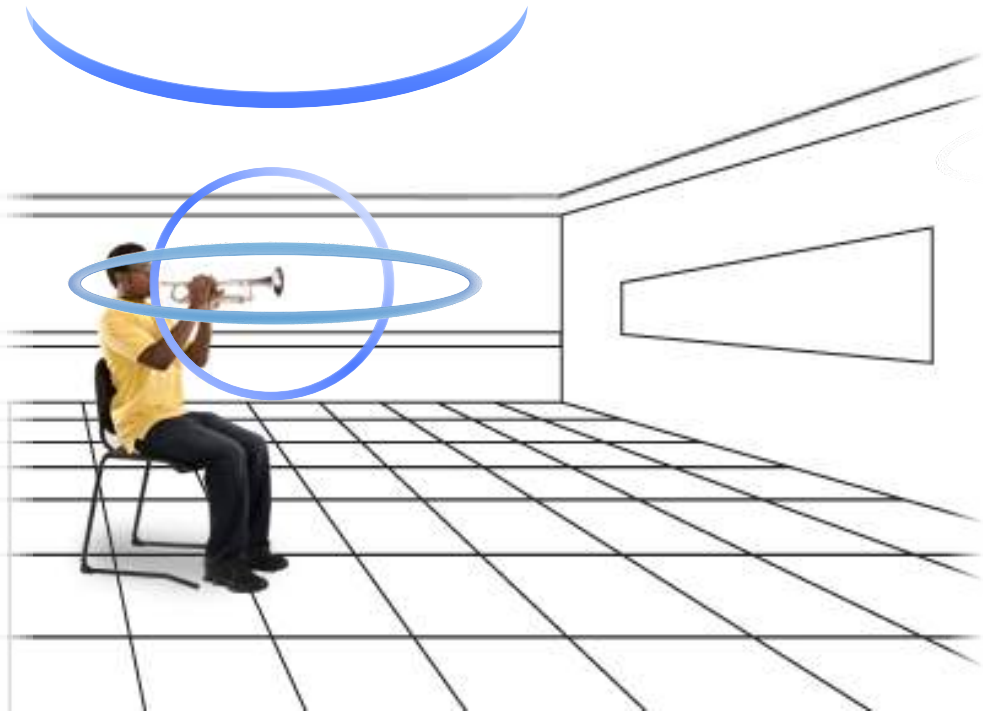
1 Acoustics

Cubic VOLUME

Why is Cubic Volume so important?

TOO SMALL

- Primary reflections return too quickly
- No intelligible feedback for musician
- Short reverberation time
- Loudness



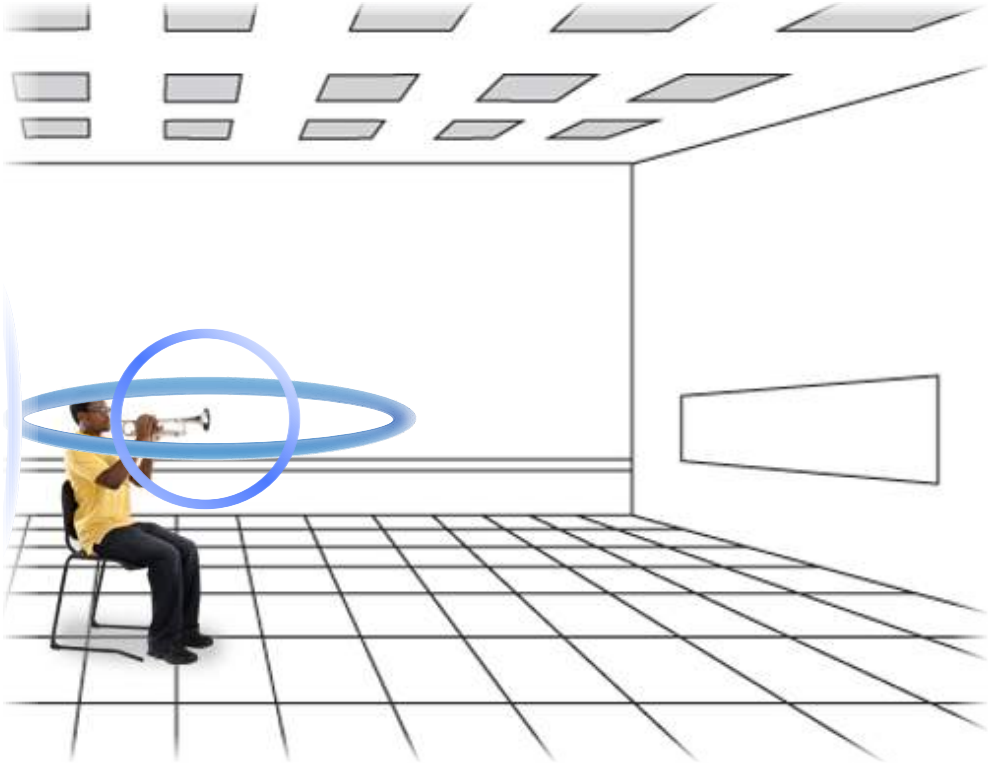
1 Acoustics

Cubic VOLUME

Why is Cubic Volume so important?

BETTER

- Slight delay of primary reflections
- Sound energy dissipated – loudness is reduced
- Provides envelopment – “presence”
- Reverberation time



1 Acoustics

Calculating Cubic Volume

- Ceiling Height – Impact on cubic volume
- Early Reflections – 30 to 50 msec
- Sound travels at approx. 1000’ per sec. – or 1’ per msec
- Performer in sitting position 4’ off the floor: 20’ ceiling = 16’ up, 16’ back is 32 feet or 32 msec

Acoustics

Cubic VOLUME

Interior equipment can reduce cubic volume

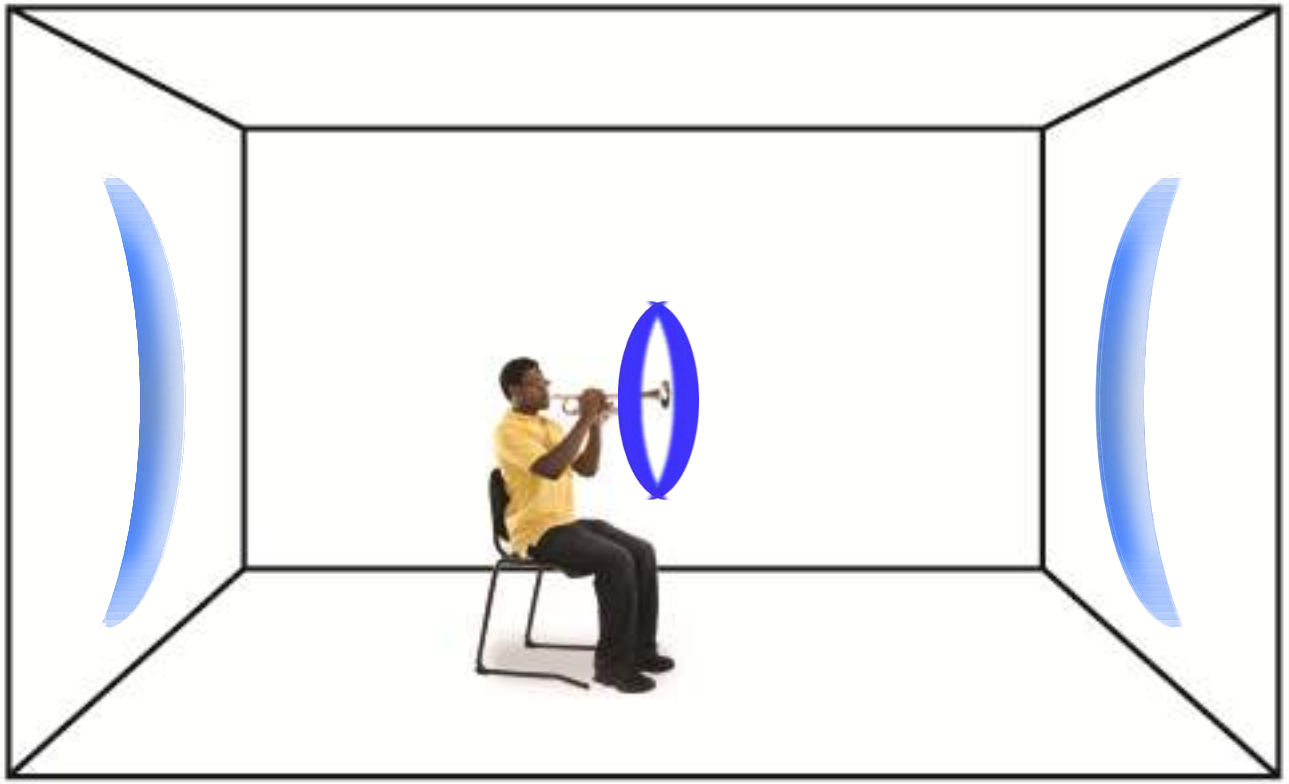
Consider: portable risers

1 Acoustics

Cubic VOLUME

Room Shape

Untreated Parallel Walls Cause Flutter Echo

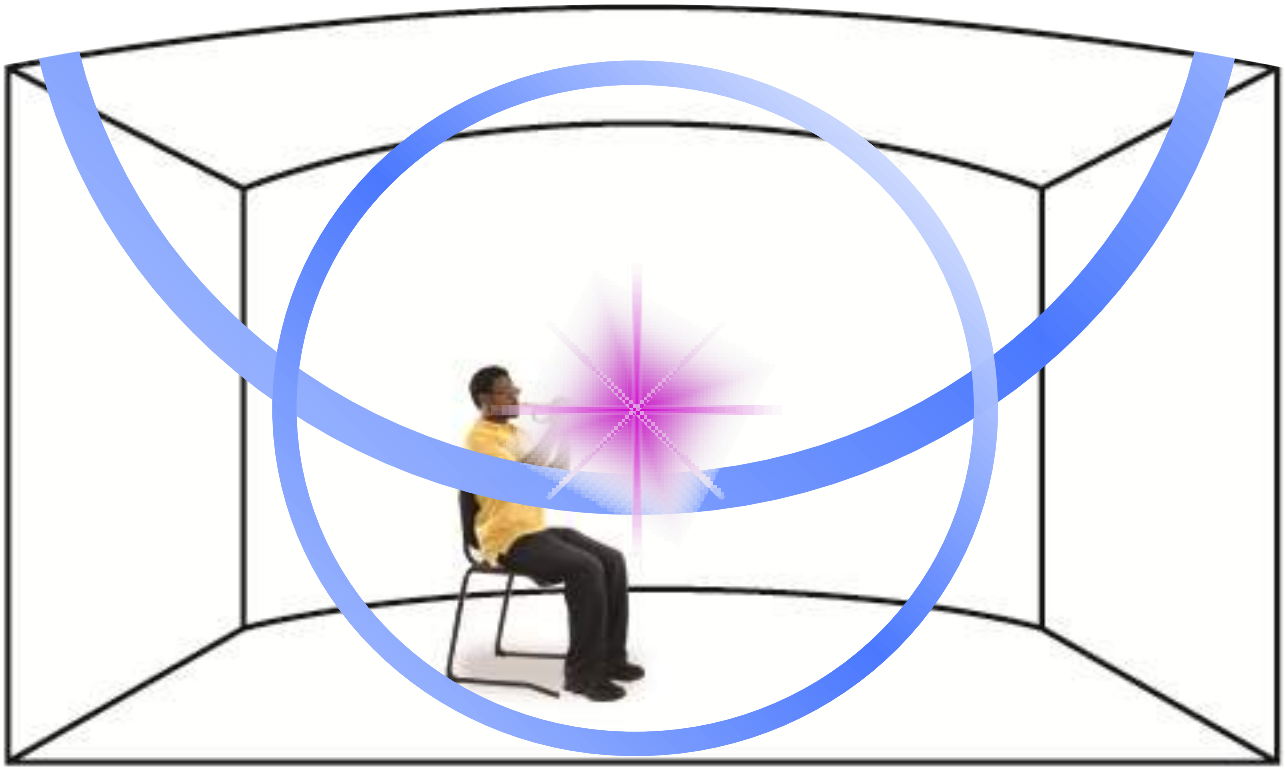


1 Acoustics

Cubic VOLUME

Room Shape

Curved walls or domed ceilings focus sound creating a hot spot



Acoustics

So what is the recommended Room Shape?

- Rectangular or Trapezoidal
- Avoid cubes, domes and curves

1 Acoustics

Element of Acoustics

Sound ISOLATION

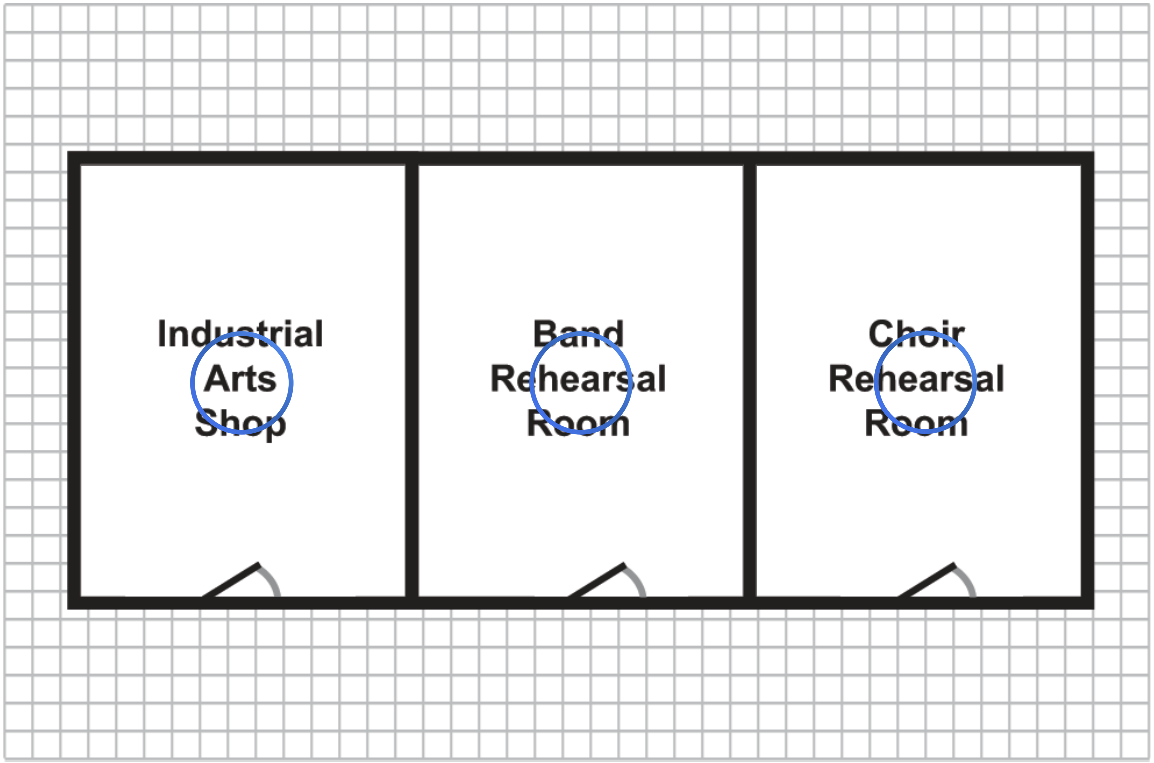
1 Acoustics

Sound ISOLATION

Room Configuration

Be critical of adjoining walls between rooms

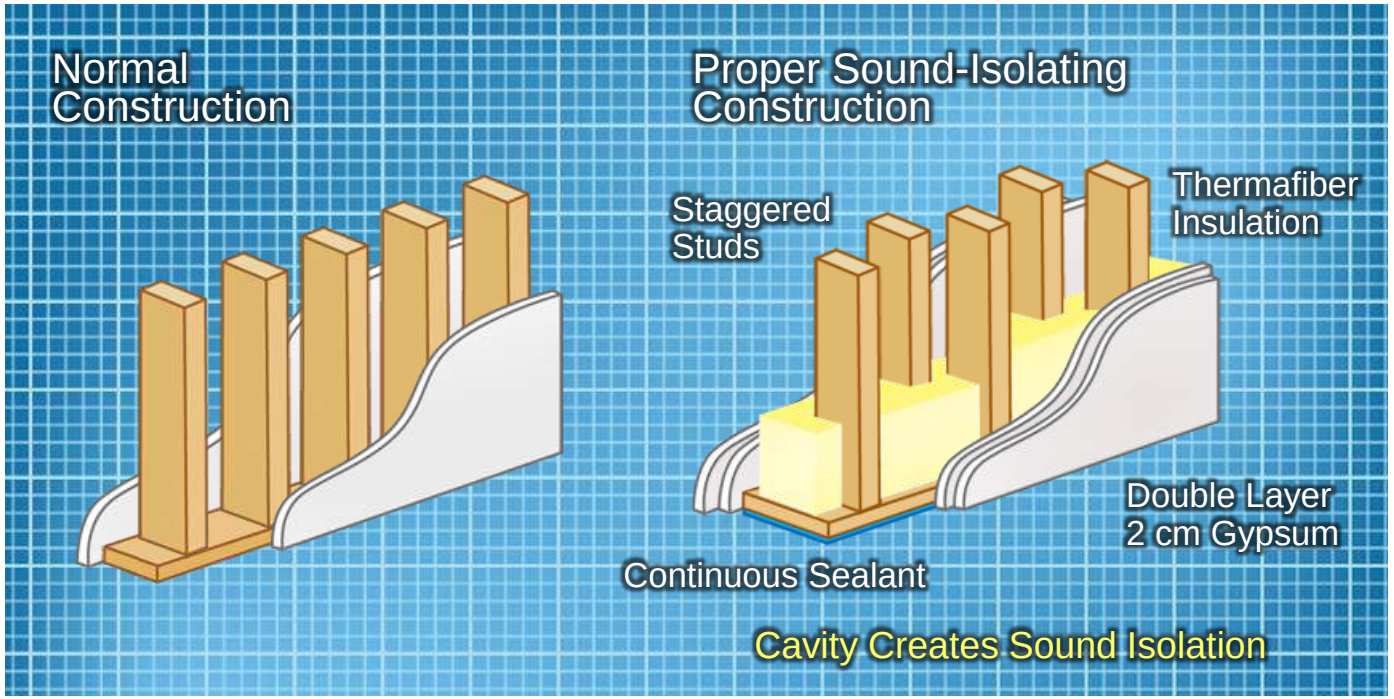
--allow for at least 4.8 – 10.2 cm "air space" between adjoining walls



1 Acoustics

Sound ISOLATION

The Complexity of Sound Isolating Wall Construction



1 Acoustics

Sound ISOLATION

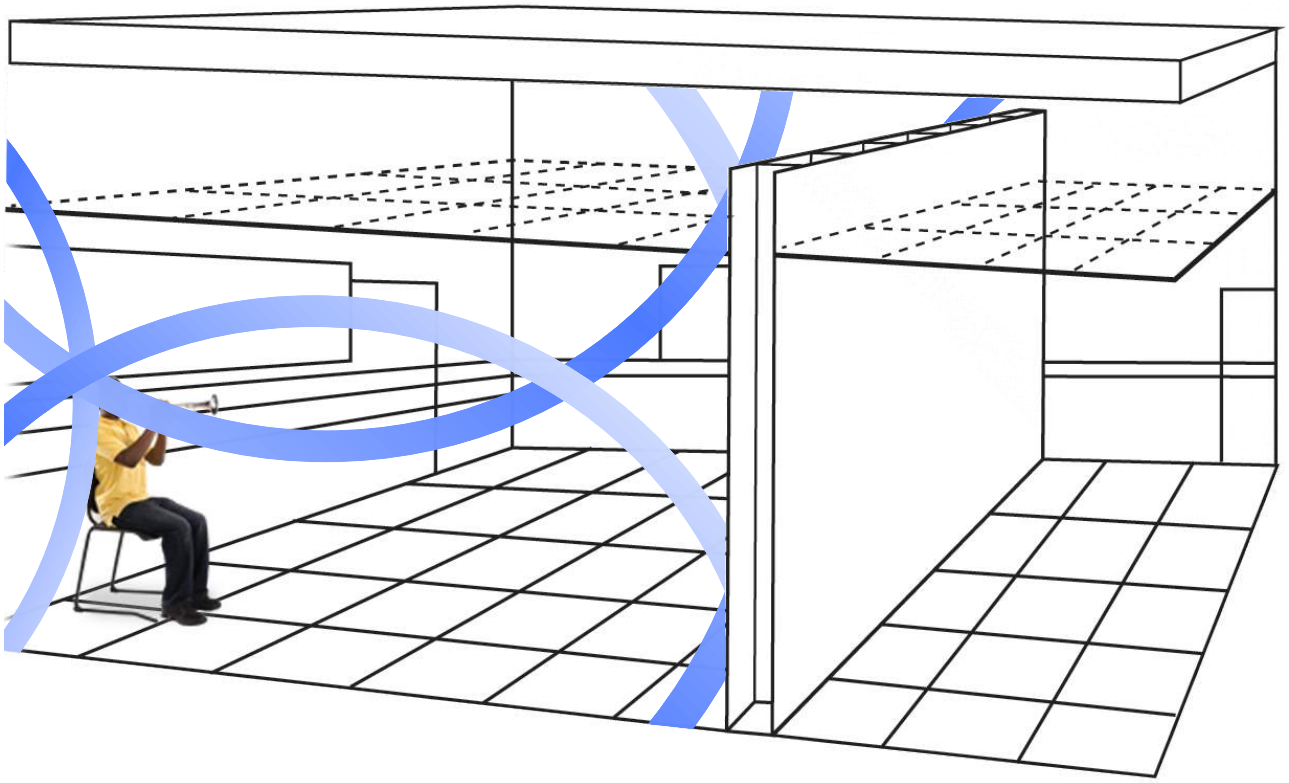
The Complexity of Sound Isolating Wall Construction

Wall must seal at Roof Deck and Floor

1 Acoustics

Sound ISOLATION

The Complexity of Sound Isolating Wall Construction

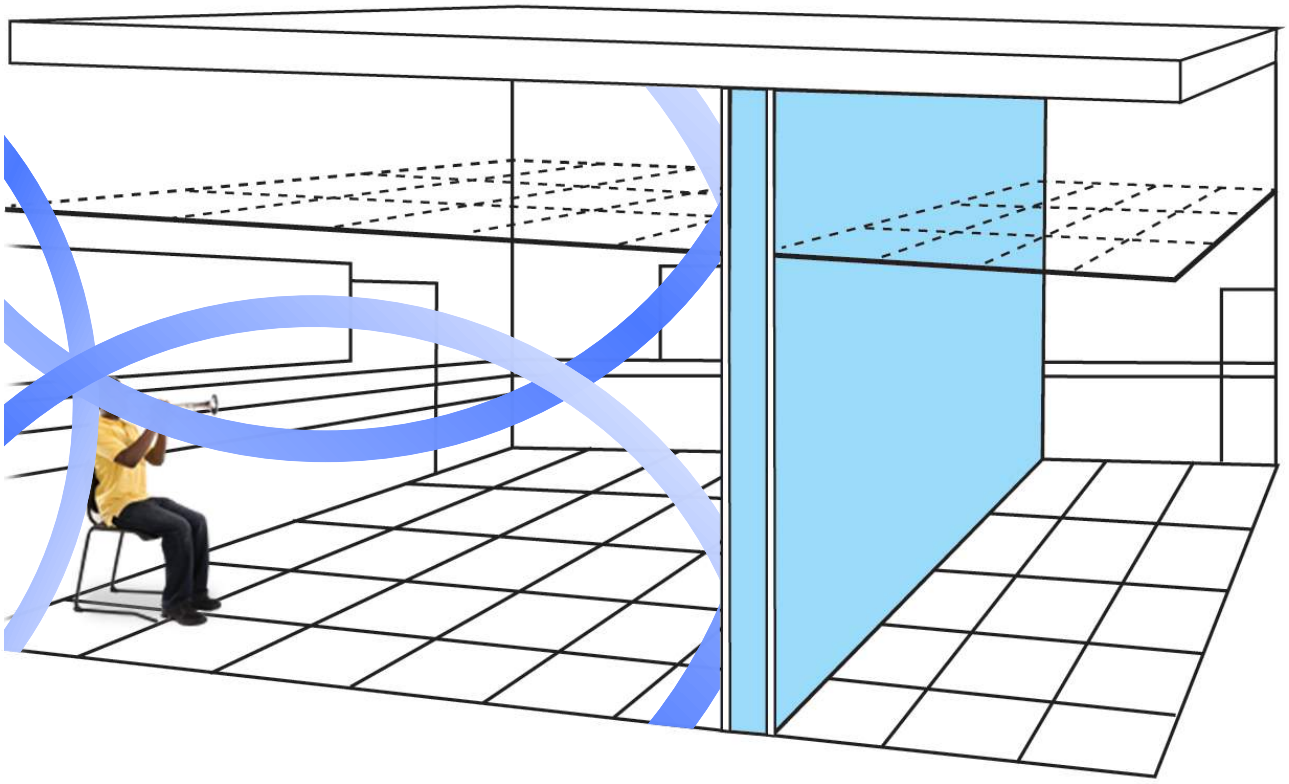


1 Acoustics

Sound ISOLATION

The Complexity of Sound Isolating Wall Construction

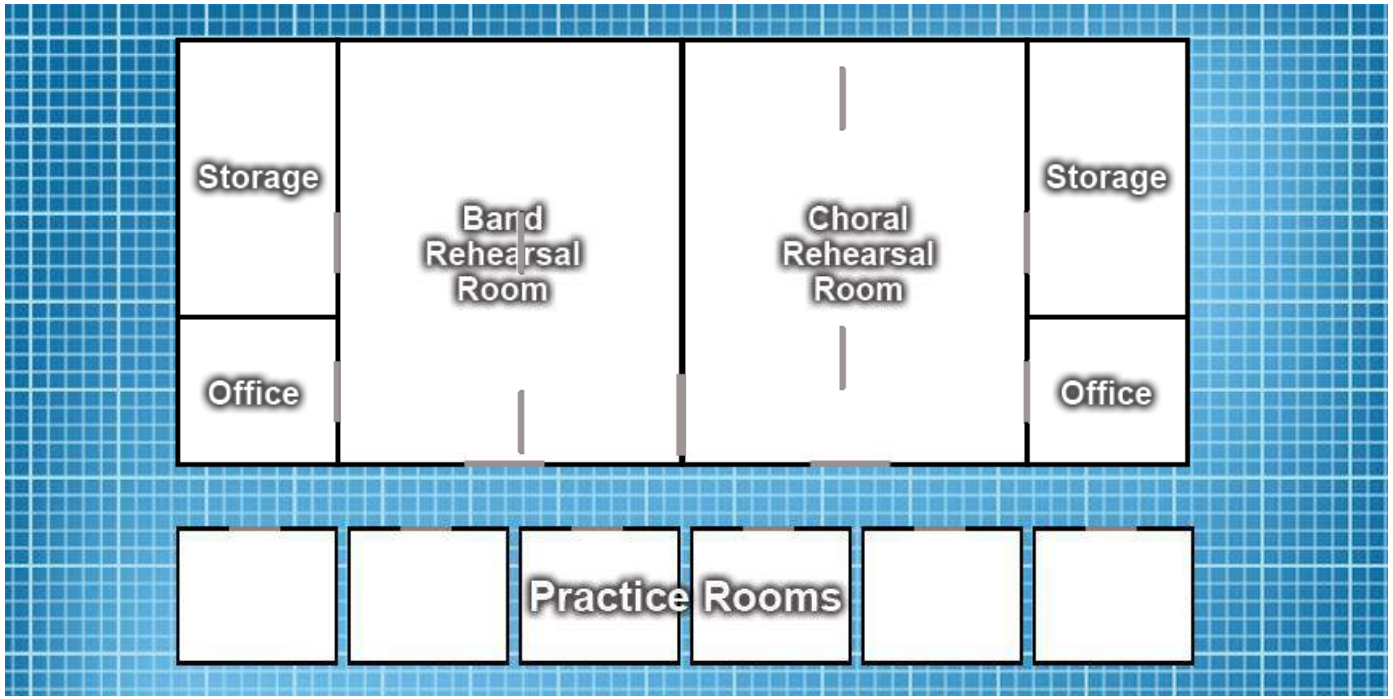
Wall must extend to permanent roof deck and seal at floor



1 Acoustics

Sound ISOLATION

Buffer Zones



Acoustics

Sound ISOLATION

Buffer Zones

Non-adjacent rooms can often be designed with pathways for sound.

Acoustics

Sound ISOLATION

Buffer Zones

Don’t forget the sound-isolating doors!

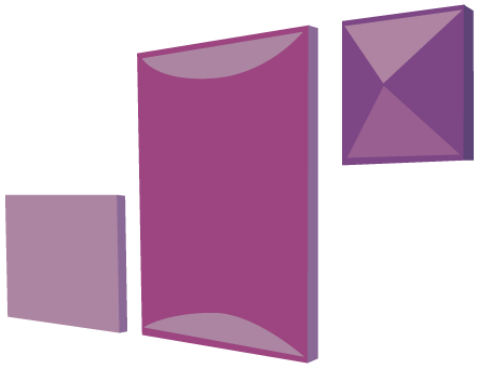
1 Acoustics

Sound Isolation Summary

- Walls sealed at base and ceiling
- Use of buffer zones is important
- Wall construction factors

1 Acoustics

Elements of Acoustics



Acoustical TREATMENT

1 Acoustics

Acoustical TREATMENT

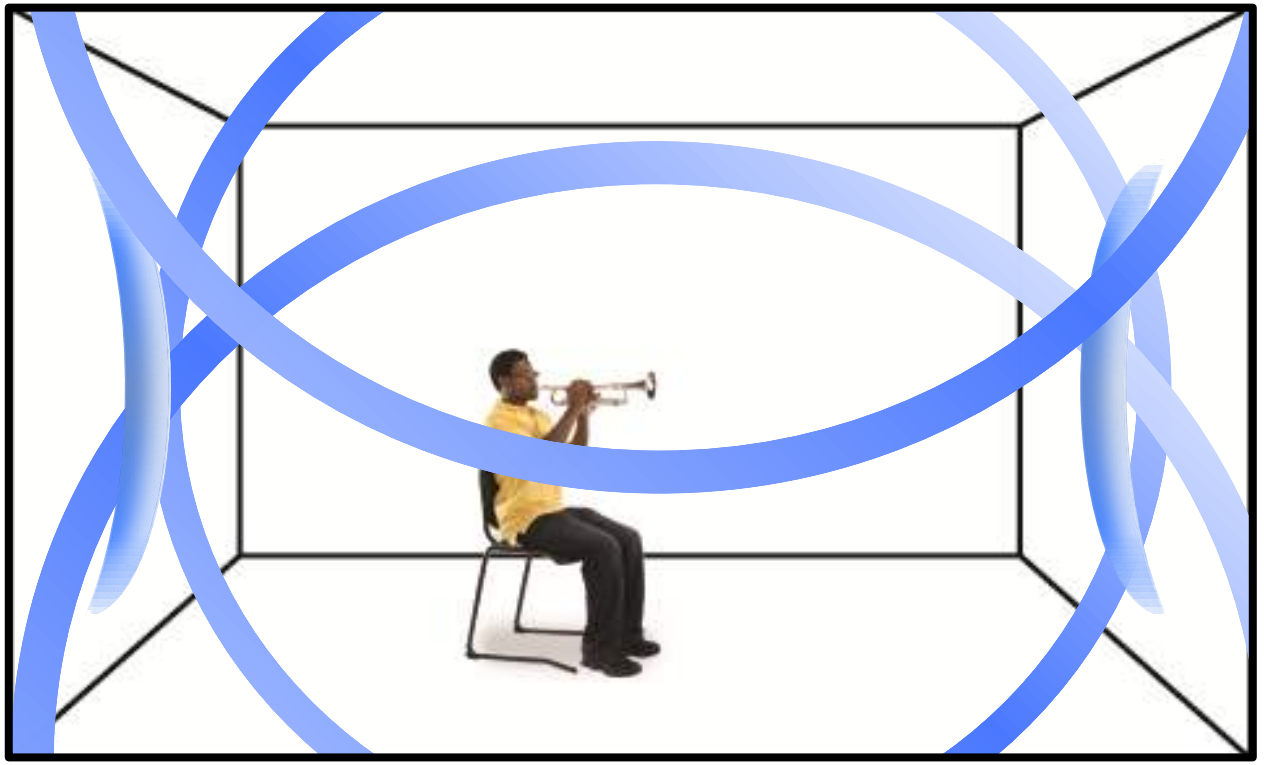
Absorption and Reflection

1 Acoustics

Acoustical TREATMENT

Sound Diffusion

Without treatment, sound can be distorted



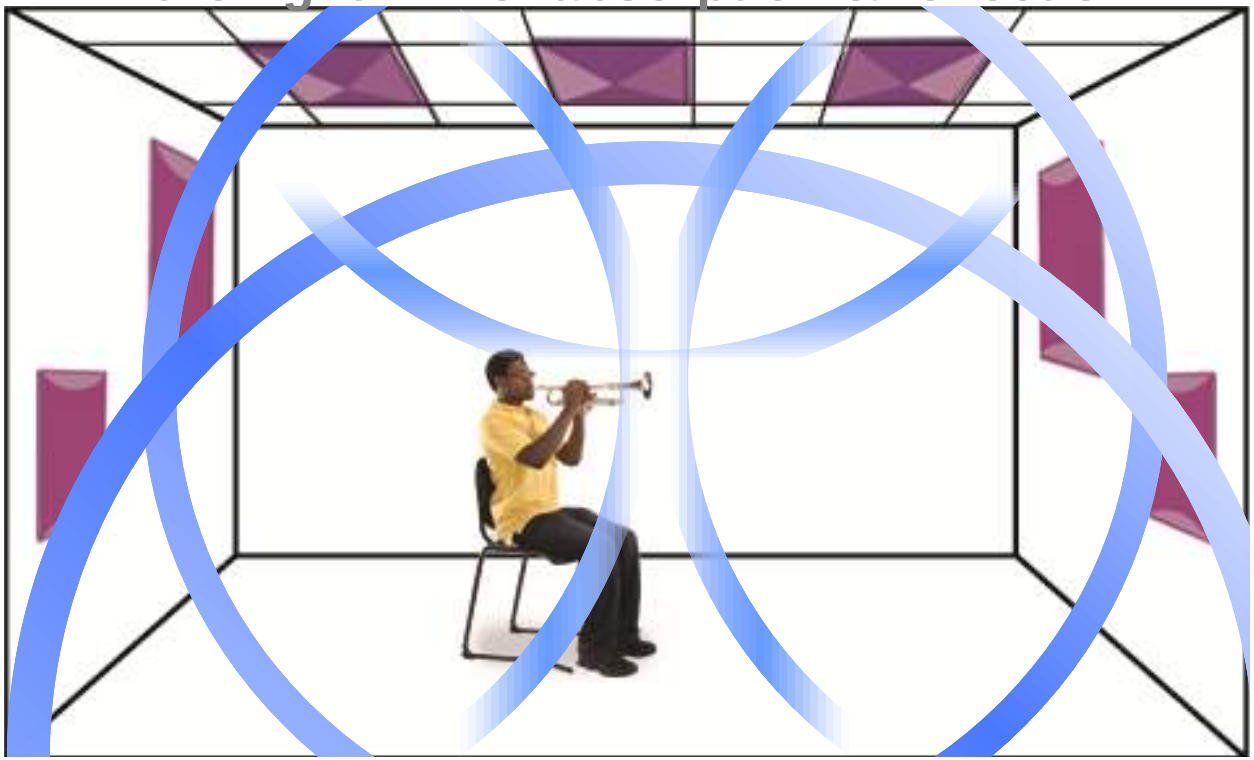
1 Acoustics

Acoustical TREATMENT

Sound Diffusion

Diffusion is the scattering and blending of sound

--the right mix of absorption & reflection



1 Acoustics

Acoustical Treatment Summary

- 2.54 cm (1”) thick ceiling tile
- Minimum wall absorption thickness = 7.62 cm thick (3”)
- Consider room design – white board, windows; what else will be on the walls?
- Use hard surface floor covering -- no carpet!

1 Acoustics

Element of Acoustics

Mechanical SYSTEMS

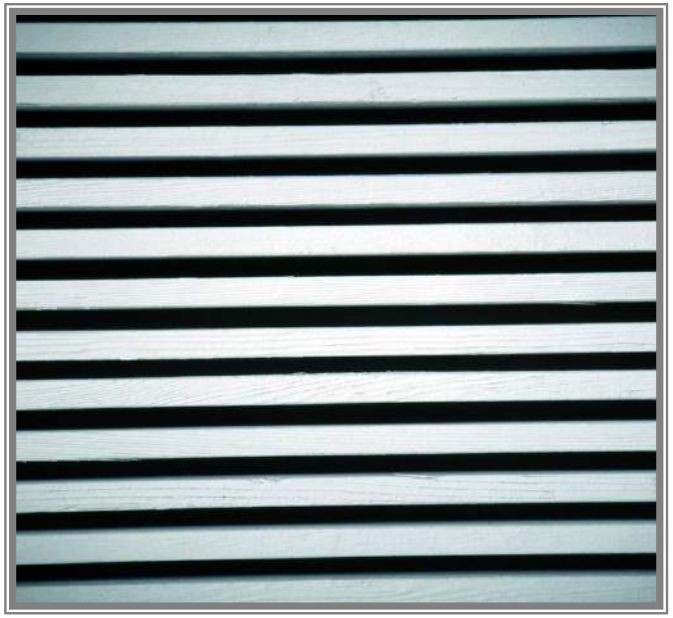
1 Acoustics

Mechanical SYSTEMS

Airborne Noise

PROBLEM

Airborne noise from restrictive air vents & noisy ventilation.



SOLUTION

Replace restrictive air vents with open grille and increase duct size.

Larger is quieter

1 Acoustics

Mechanical SYSTEMS

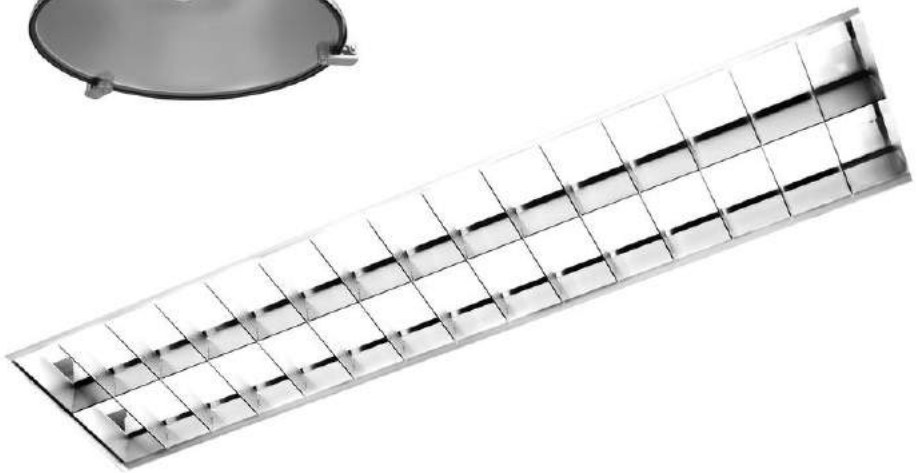
Lighting Buzz

PROBLEM

Some fluorescent and tungsten light bulbs cause an audible “buzz”.

SOLUTION

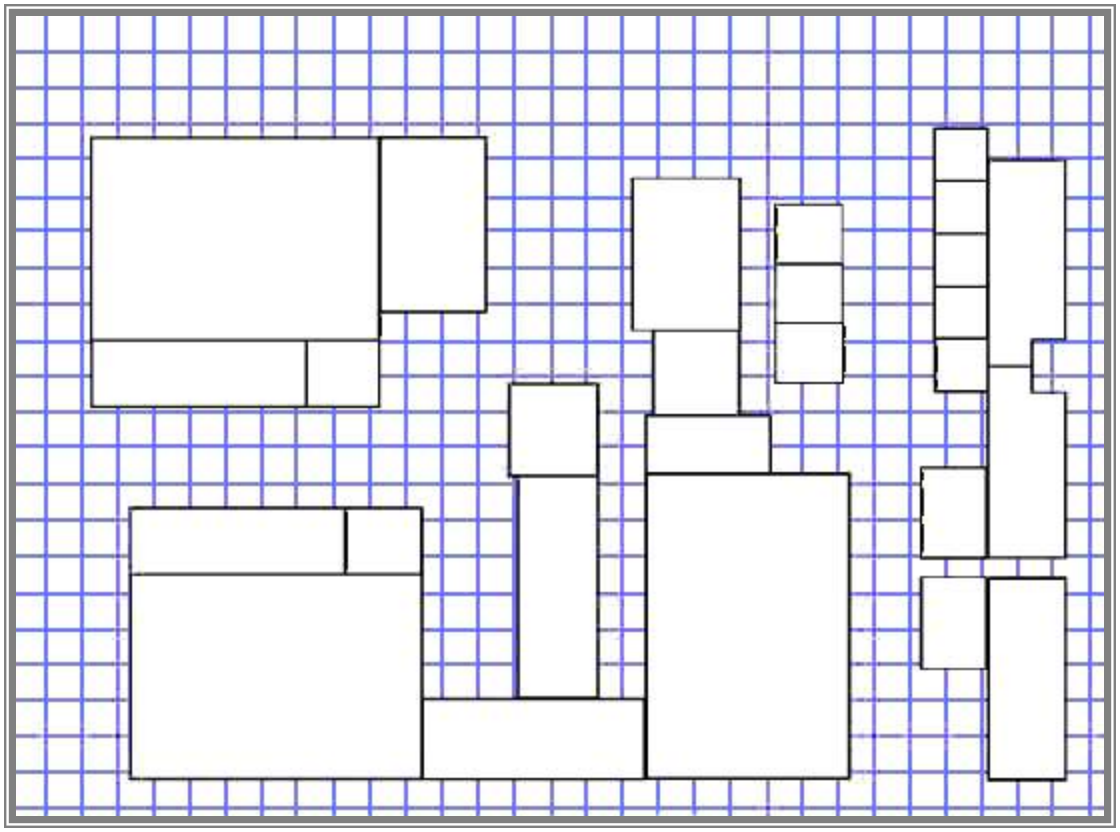
Replace with incandescent or other lighting.



2 Floor Plan

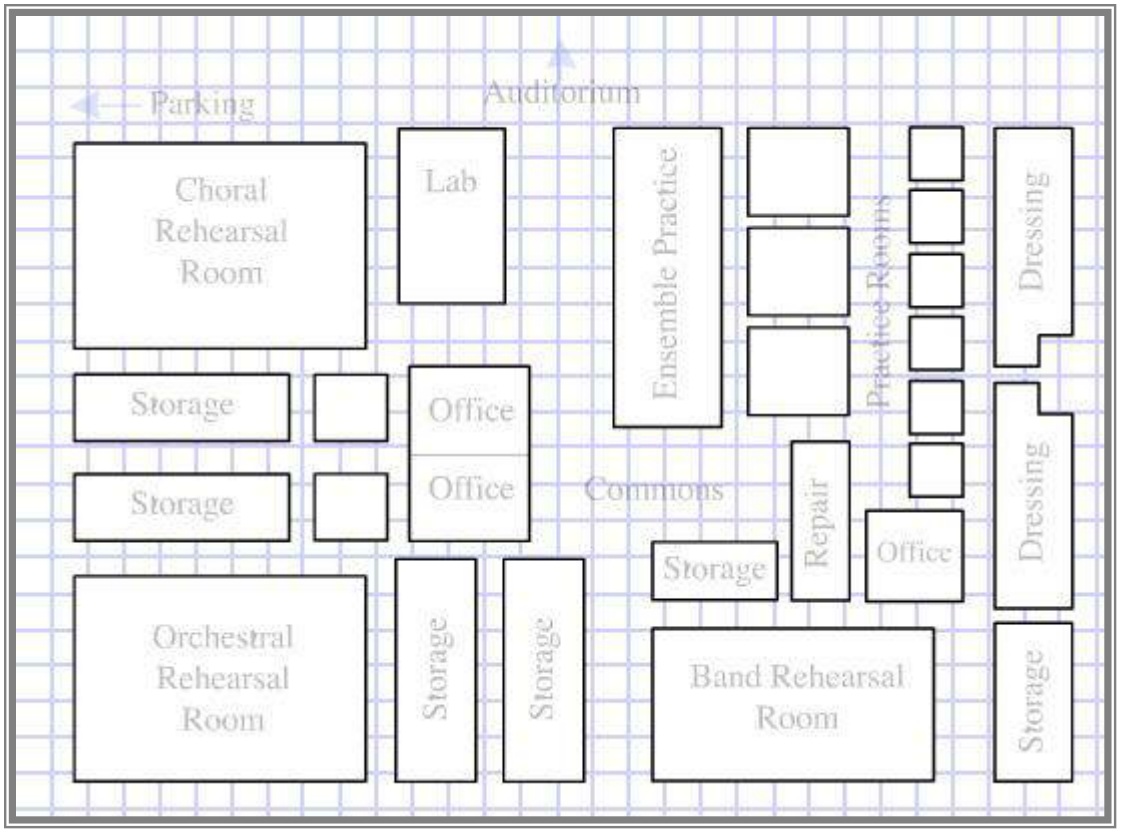
2 Floor Plan

How should the space be arranged?



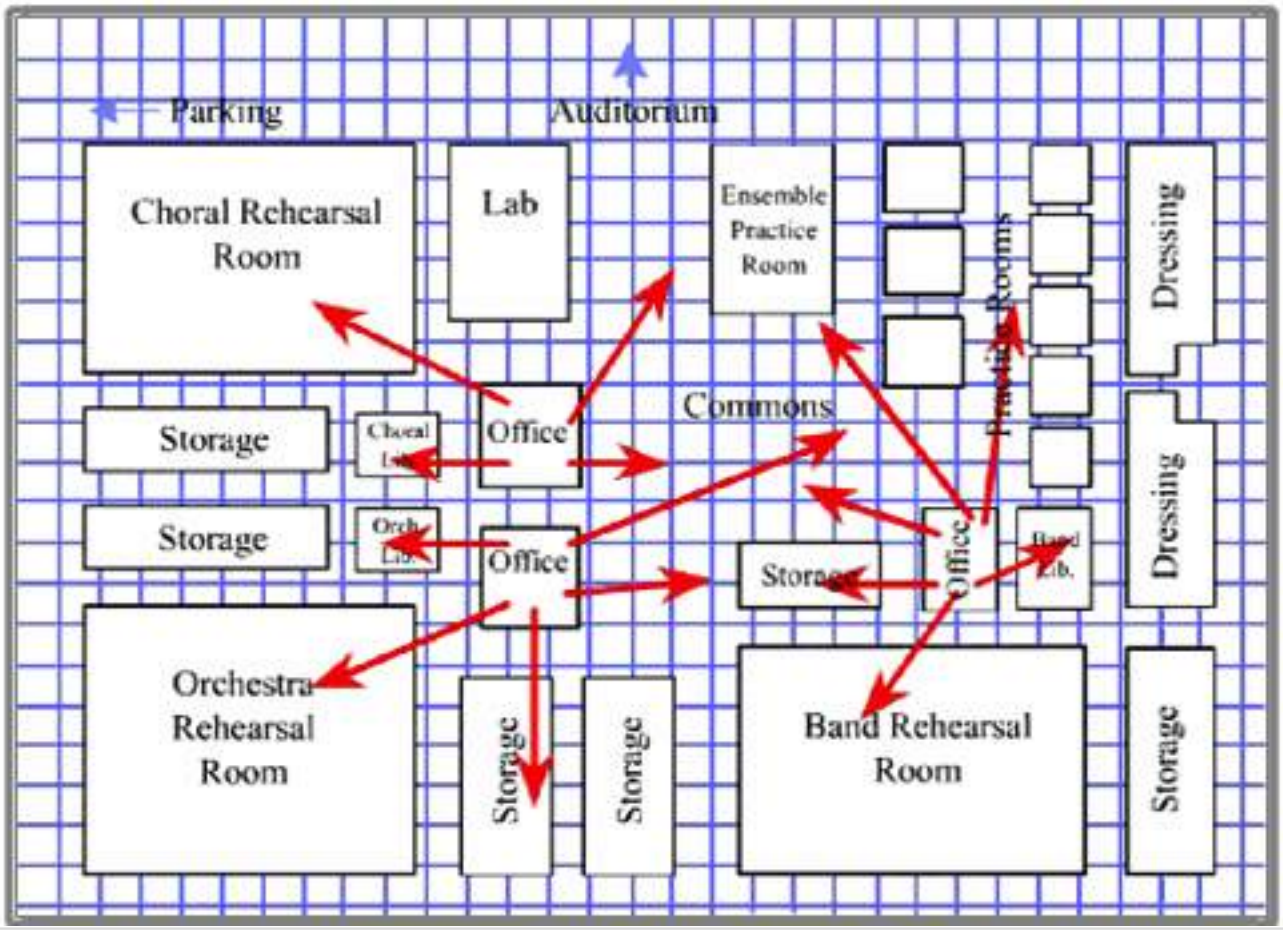
2 Floor Plan

CONSIDERATIONS



2 Floor Plan

LINE OF SIGHT



Critical factor number 3:

3 Storage

3 Storage

Instrument storage areas are among the toughest

CAUTION:
Sufficient storage is the most overlooked element in schools! There is never enough!

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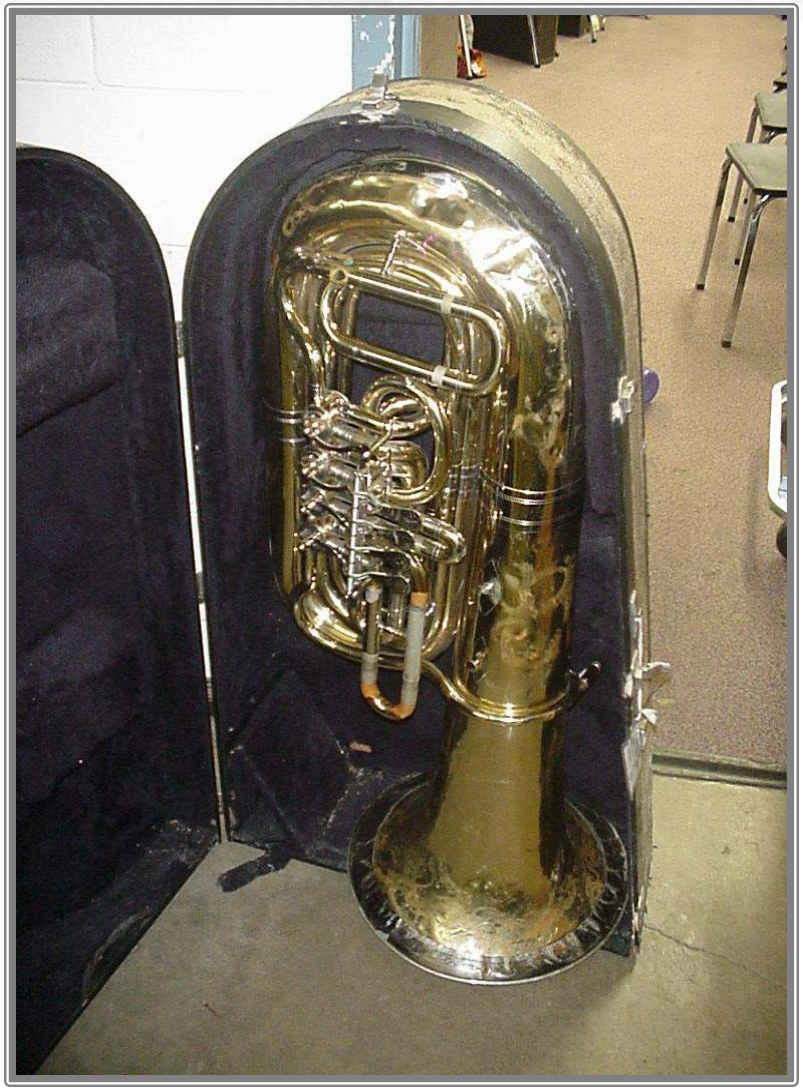
3 Storage

Protect your school's investment with proper storage

A typical international school can spend between US$50,000 up to US$500,000 on instruments alone!

Examples:
One Cello = US$2,500 to $4,000+
One Tuba = US$3,500 to $5,000+
One Violin = US$800 to over $2,000

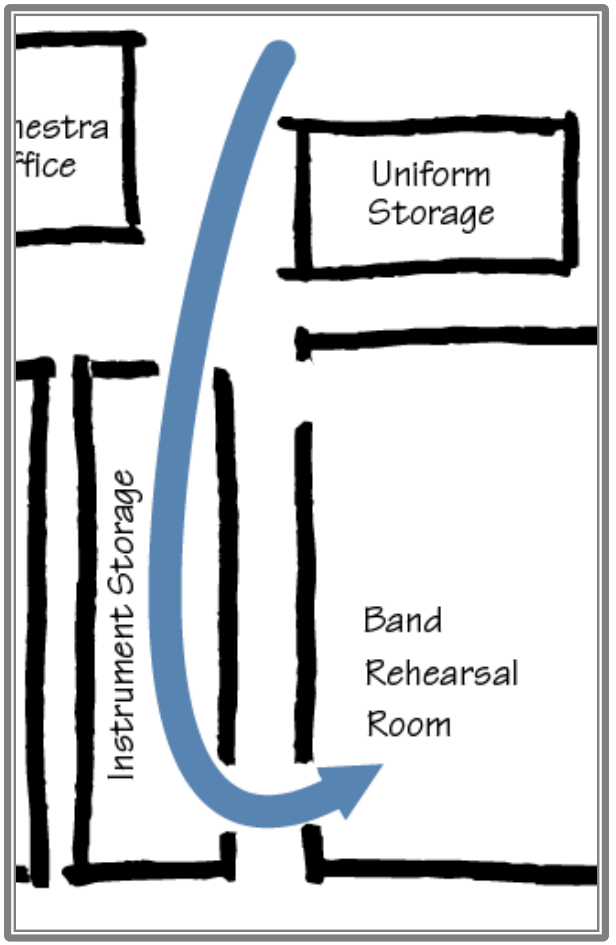


Types of Storage

- Small Instruments
- Large Instruments
- Percussion
- Orchestra
- Marching Band
- Robes
- Uniforms
- Costumes
- Flags & Props
- Audio / Cables
- Sheet Music
- DVD & Video Storage

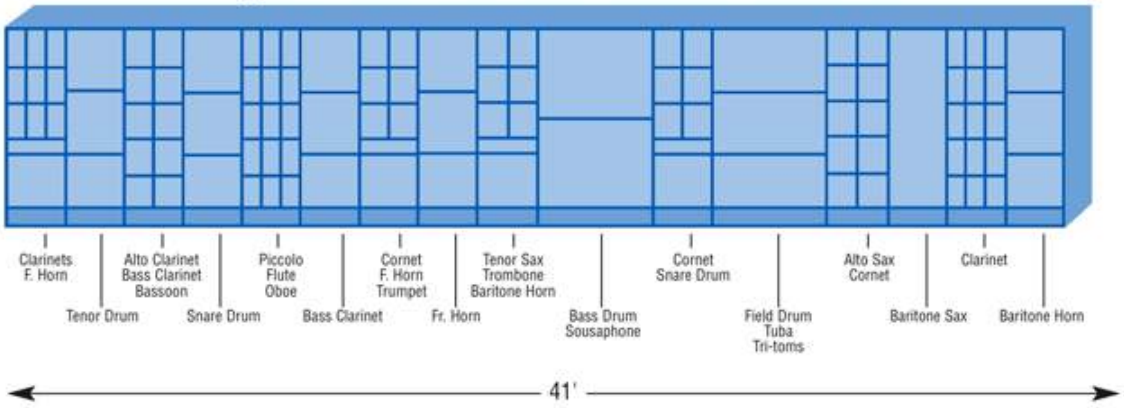
Storage Location

can improve traffic flow, reduce congestion and save space

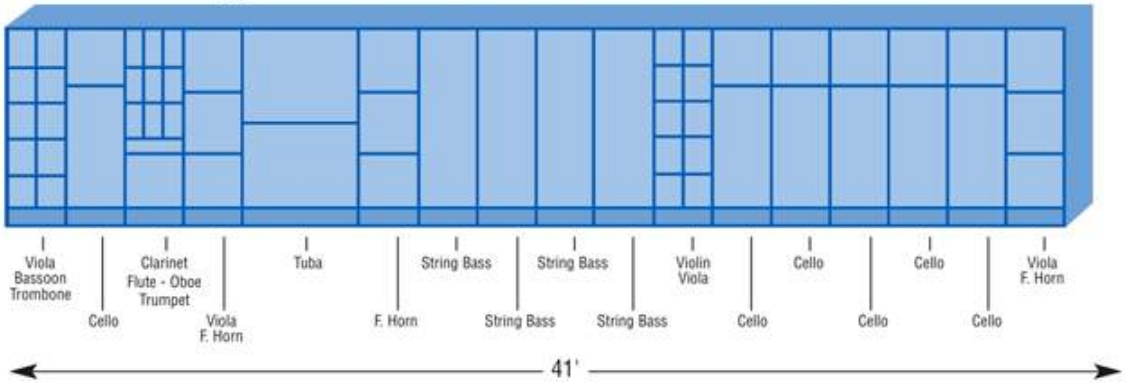


3 Storage

Typical set of cabinets for 100 Band Instruments



Typical set of cabinets for 50 Orchestra Instruments



4 Equipment

4 Equipment

What kinds of other equipment may be needed?!

- **Music library cabinets (sheet music storage)**
- **Mobile cabinets (room to room)**
- **Storage and carry carts for chairs and stands**
- **Portable choral risers**
- **Portable acoustical shells**
- **Conductor's stand and podium**
- **Staging, side and back rails, skirting, curtains**
- **Marching band accessories**
- **Music stand lights**
- **Large instrument storage, including pianos**

4 Equipment

Durable, High Quality Equipment is Less Expensive in the Long Run

Final Thoughts

• Early collaboration is important: solicit input from the school's music educators & principal, BOD's and other stakeholders

• Ask about future plans for music suite expansion & flexibility for new programs (choral, drama, jazz ensembles, etc)

• Check with other schools for their suggestions and "wish list" ("if only we had known…."or "if only we had thought to do this….now it's too late…"); no regrets!

• A proper music suite can lead to productive teaching and engaged, enthusiastic students

•Acoustics, acoustics, acoustics!

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THANK YOU-GRAZIE-GRACIAS-MERCI-DANKE

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