



ADAGIO

ÉTUDE FOR THE PRACTICE AND PERFORMANCE OF PIANO

JAKOB LAWMAN




ADAGIO

ÉTUDE FOR THE PRACTICE AND PERFORMANCE OF PIANO

A Design Thesis Submitted to the
Department of Architecture and Landscape Architecture
of North Dakota State University

By
Jakob Lawman

In Partial Fulfillment of the Requirements
for the Degree of
Master of Architecture

 MAY 12, 2014

Primary Thesis Advisor

 May 12th, 2014

Thesis Committee Chair

September 2013
Fargo, North Dakota



TABLE OF CONTENTS

9	ABSTRACT		
11	PROBLEM STATEMENT		
I	STATEMENT OF INTENT		
14	TYPOLOGY, CLAIM & PREMISES		
15	UNIFYING IDEA & PROJECT JUSTIFICATION		
II	THE PROPOSAL		
18	NARRATIVE		
20	USER DESCRIPTION		
22	MAJOR PROJECT ELEMENTS		
24	SITE INFORMATION : MACRO		
26	SITE INFORMATION : MICRO		
28	PROJECT EMPHASIS		
29	PLAN FOR PROCEEDING		
30	DESIGN SCHEDULE		
32	PREVIOUS EXPERIENCE		
		III	PROGRAM DOCUMENT
		35	RESEARCH
		49	CASE STUDIES
		69	HISTORICAL CONTEXT
		77	PROJECT GOALS
		81	SITE ANALYSIS
		107	CLIMATE DATA
		117	PROGRAMMATIC REQUIREMENTS
		II II	THE DESIGN
		125	DESIGN PROCESS
		129	DESIGN SOLUTION
		173	FINAL INSTALLATION
		III II	FINÉ
		179	REFERENCES
		185	PERSONAL IDENTITY

{ LIST OF TABLES & FIGURES }

FG1	18	JINGLE BELLS	FG28	59	CIT 1
FG2	18	BEETHOVEN'S FIFTH	FG29	59	CIT 2
FG3	24	REGIONAL MAP	FG30	59	CIT 3
FG4	25	CITY MAP	FG31	60	CORK SCHOOL PLAN TO ELEVATION
FG5	26	CHICAGO SKYLINE	FG32	60	CORK SCHOOL SECTION
FG6	26	GRANT PARK	FG33	61	CORK SCHOOL GEOMETRY IN ELEVATION
FG7	26	830 MICHIGAN	FG34	61	CORK SCHOOL MASSING IN SECTION
FG8	27	SITE MAP	FG35	61	CORK SCHOOL HIERARCHY IN ELEVATION
FG9	39	CORTISOL LEVELS	FG36	62	CORK SCHOOL PLAN TO SECTION
FG10	44	C MAJOR DIATONIC SCALE	FG37	62	CORK SCHOOL NATURAL LIGHT IN PLAN
FG11	45	C MAJOR CHROMATIC SCALE	FG38	63	CORK SCHOOL STRUCTURE IN PLAN
FG12	46	GOLDEN, DIATONIC, AND CHROMATIC SCALES	FG39	63	CORK SCHOOL CIRCULATION IN PLAN
FG13	47	DIATONIC MAJOR AND MINOR SCALES	FG40	64	DEE AND CHARLES WYLY THEATRE
FG14	52	DANISH RADIO CONCERT HALL	FG41	65	WYLY FAÇADE
FG15	53	DR CONCERT HALL	FG42	65	WYLY RAMP
FG16	53	DR CONCERT HALL DETAIL 1	FG43	65	WYLY STAGE
FG17	53	DR CONCERT HALL DETAIL 2	FG44	66	WYLY THEATRE PLAN
FG18	54	DANISH RADIO PLAN	FG45	66	WYLY THEATRE SECTION
FG19	54	DANISH RADIO SECTION	FG46	66	WYLY THEATRE ELEVATION
FG20	55	DANISH RADIO MASSING IN ELEVATION	FG47	67	WYLY THEATRE GEOMETRY IN PLAN
FG21	55	DANISH RADIO HIERARCHY IN PLAN	FG48	67	WYLY THEATRE HIERARCHY IN ELEVATION
FG22	55	DANISH RADIO GEOMETRY IN SECTION	FG49	67	WYLY THEATRE MASSING IN ELEVATION
FG23	56	DANISH RADIO NATURAL LIGHT IN SECTION	FG50	68	WYLY THEATRE CIRCULATION IN PLAN
FG24	56	DANISH RADIO PLAN TO SECTION	FG51	68	WYLY THEATRE STRUCTURE IN PLAN
FG25	57	DANISH RADIO STRUCTURE IN PLAN	FG52	68	WYLY THEATRE NATURAL LIGHT IN SECTION
FG26	57	DANISH RADIO CIRCULATION IN PLAN	FG53	72	PIANOFORTE DE JOHANN ANDREAS STEIN
FG27	58	CIT CORK SCHOOL OF MUSIC	FG54	73	MUSIC & ARCHITECTURE THROUGHOUT HISTORY

FG55 85 A BIRD'S EYE VIEW OF CHICAGO FROM ELEVATION 700 FT. ABOVE LAKE MICHIGAN
FG56 85 YOUNG WOMEN'S CHRISTIAN ASSOCIATION (1894-2010)
FG57 85 JOHNSON PUBLISHING COMPANY BUILDING
FG58 85 YWCA
FG59 86 SITE PLAN WITH SECTION CUTS
FG60 89 MATERIALITY IN SECTION B
FG61 89 MATERIALITY IN SECTION A
FG62 91 SHADOW IN SECTION B
FG63 92 SITE SECTION A
FG64 92 SITE SECTION B
FG65 92 SITE SECTION C
FG66 95 THE "L" TRAIN
FG67 95 DIVVY
FG68 97 JACKSON & LAKE SHORE DRIVE
FG69 99 OAK STREET BEACH
FG70 101 LINCOLN PARK LAGOON
FG71 103 SOUTHEAST FROM WILLIS TOWER SKYDECK, 103RD FLOOR
FG72 104 SITE, NW
FG73 104 SITE, SW
FG74 104 SITE, W FROM SIDEWALK
FG75 104 SITE, W ACROSS STREET
FG76 105 GRANT PARK, NW
FG77 105 JOHN A. LOGAN STATUE, GRANT PARK, NW
FG78 105 AGORA, GRANT PARK, N
FG79 108 CLOUDGATE REFLECTION

{ ABSTRACT }

Adagio: Étude for the Practice and Performance of Piano explores the interaction between people and music in a community, and how the production of music can be available to anyone. Interaction with music has a multitude of health benefits that can have lasting effects, especially for those who play an instrument. The outcome of the project will be a 56,000 square foot Chicago Center for Piano, to be utilized for the practice, performance, education, and enjoyment of piano through practice rooms, a recital hall, and other performance spaces. An emphasis is placed on the optimization of acoustical qualities in architecture to meet specific instrumental criteria.

KEY TERMS

acoustics, piano, availability, production, performance, community, Chicago

{ PROBLEM STATEMENT }

How can a collaboration between people, music, and healthy living be addressed through architecture and the piano?



STATEMENT
OF INTENT

T Y P O L O G Y

A center for piano in Chicago, Illinois.

C L A I M

There are a lot of people who play the piano that simply do not have access to one. Producing and enjoying music has a multitude of benefits in regards to stress, health, and overall well-being. "Recreational music making could potentially serve as a rational stress reduction activity" (Yamaha, 2005). Providing a place for anyone to express themselves through listening to or playing the piano will encourage musical development and community involvement.

P R E M I S E S

ACTOR The piano is one of the most popular and widely recognized instruments in the world today.

ACTION Musical involvement has several health-related benefits, both physically and mentally.

OBJECT A center for piano in Chicago will be an architectural solution to provide the opportunity for musical development and community involvement.

UNIFYING IDEA

An outlet for musical development will provide benefits to experienced and aspiring pianists, and promote community involvement.

PROJECT JUSTIFICATION

Music is a therapeutic substance, whether one is listening to the radio, playing the guitar, or attending a concert. It has the power to inflict emotion and completely alter moods. The piano is one of the most powerful tools for expressing dynamic range and acoustical variation. Creating an environment to nurture learning, producing, performing, and enjoying this incredible instrument will encourage people to exercise their talents when they do not own a piano themselves. In addition, this public facility will allow the inexperienced to experiment with producing music and provide a place for the community to enjoy performances.



THE PROPOSAL

{ NARRATIVE }

Music, in both its most basic and most complex forms, is a versatile tool that can be used to singlehandedly invoke emotional bliss and provoke emotional strife; it might be said that music is one of the most powerful tools mankind has stumbled upon, as it exists across both time and culture. A simple arrangement of just a few notes can instantly alter one's mental state. The song "Jingle Bells" can be recognized immediately following its first three notes—no other song starts the same way—and can be said to invoke cheer and delight. Beethoven's Fifth Symphony begins with a very familiar "dun dun dun dunnnn," of which the actual notes you may have just heard in your head or hummed aloud to recall the familiar sequence. Those first four notes invoke a dark curiosity—quite the opposite of the first three notes to "Jingle Bells."



Figure 2. Beethoven's Fifth.

There are two sides to perceiving music: on one side, your fingers are running madly across a set of 88 keys, and on the other side,

you plug your headphones into your iPod and hit play. Wearing headphones, you are absorbing the variation in key and disparate shift in tempo as your playlist shuffles from song to song. With your fingers running across keys, you set the tempo, rhythm, volume, and articulation as you crescendo and decrescendo from measure to measure, shuffle through arpeggios, and hold the fermata until the reverberation ends. You are creating music, utilizing one of the most incredible tools in the armory of mankind.

I have sat behind the keys of a piano since the age of seven, practicing vigorously and performing valiantly until playing piano became the most dynamic skill in my own arsenal of finesse. I have used the piano as a tool for relieving stress after a rigorous week, creating a sense of peace at my grandmother's funeral, and expressing insurmountable joy at a friend's wedding. Many people use the piano for the same purposes, whether it is concealed to oneself or exposed to an audience. Of course, other instruments are also used for the same reasons. The reason the piano becomes the main focus of this thesis is its place on the instrumental spectrum as one of the most versatile and widely recognized instruments on the planet. It is also one of the easiest instruments for a

person to become acclimated to, making it an ideal tool for introducing musical production to a population.

Chicago's role in all of this began early in the 20th century, with the introduction of Chicago style Blues and Jazz, and persists even today, harboring the origins of House music. The city has long been a haven for musical innovation, fostering the creation of several successful and well-known musical talents, including the creation of several successful and well-known musical talents, including Louis Armstrong, the Plain White T's, and Kanye West. It is also home to several concert halls, operas, clubs, and theaters that all cater to this versatile art form.

I chose Chicago as the city to host a Center for Piano because of its rich history and association with all kinds of music. My passion for piano has informed the typology for this thesis; I would like to share piano-based musical production and performance with the city and create a place for anyone to pursue a casual flirting or a blossoming hobby with piano. Research has shown how beneficial music is to the health of an individual and the interconnectedness of a community. I find it an important tool for boosting happiness and relieving emotional turmoil. Both listening to

and playing music offer these benefits, and it is the purpose of this thesis to make these benefits available to Chicago, while promoting the piano as a versatile tool for emotional alteration.

{ USER DESCRIPTION }

ADMINISTRATION

(D) DIRECTOR

manages all building operations.

(S) ADMINISTRATIVE ASSISTANTS

attend to user needs, schedule reservations, and grant memberships.

(I) PIANO TUNER

maintains the pianos and building acoustics.

(E) EVENT MANAGER

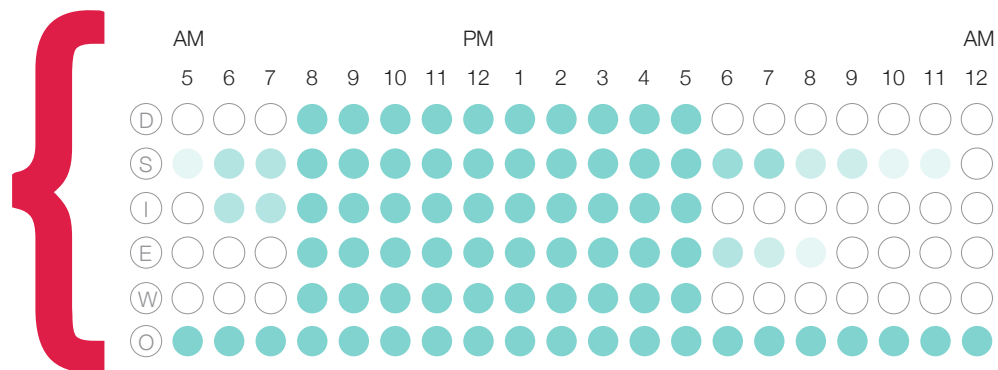
organizes recitals and performances.

(W) WEB & MARKETING STAFF

maintain a website that users can use to schedule reservations, as well as advertise through social media for upcoming events.

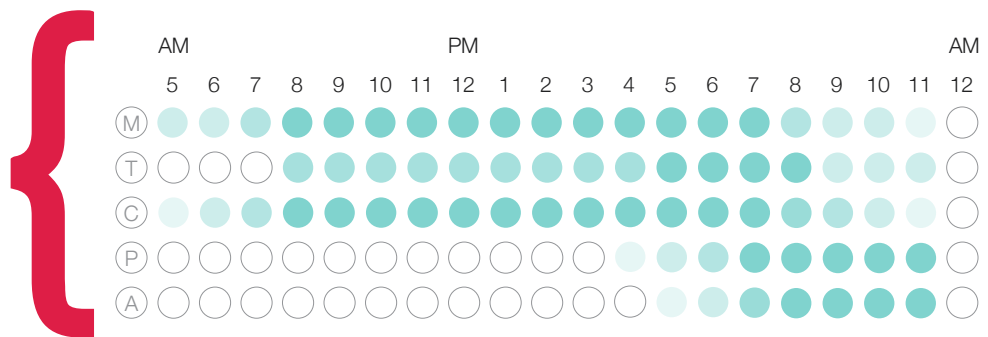
(O) SECURITY OFFICER

protects and secures the facility during all hours, but especially during the late night and early morning.



OCCUPANTS

- (M) MEMBERS**
 pay a monthly/yearly fee to use and reserve any practice room whenever available.
- (T) TEACHERS**
 are authorized to use Adagio's facilities to give piano lessons.
- (C) CASUAL USERS**
 pay hourly fees to use and reserve practice rooms, or can use free practice rooms if available.
- (P) PERFORMERS**
 rent out a performance space (via application or audition) and charge their own entry fee.
- (A) AUDIENCE**
 come to enjoy performances.



{ MAJOR PROJECT ELEMENTS }

PRACTICE ROOMS _____

FREE

available for anyone to play during Adagio's operating hours

BASIC

available for use by members via reservation and by any non-member via hourly rate and/or reservation

SPECIAL

contain special scenarios, such as two pianos or a microphone for a vocalist, and are available for anyone via reservation and hourly pay

STUDIO

rented out as studio space for use by only a person or group and may be used for teaching piano lessons or rehearsing

PERFORMANCE HALLS _____

STUDENT (150 SEATS)

for smaller performances, such as student piano recitals

RECITAL HALL (800 SEATS)

for performances by famous (or local) professional pianists

PUBLIC SPACE _____

LOBBY

reception area for accessing both the practice rooms and the performance halls

MUSIC STORE

for the sale and rental of sheet music

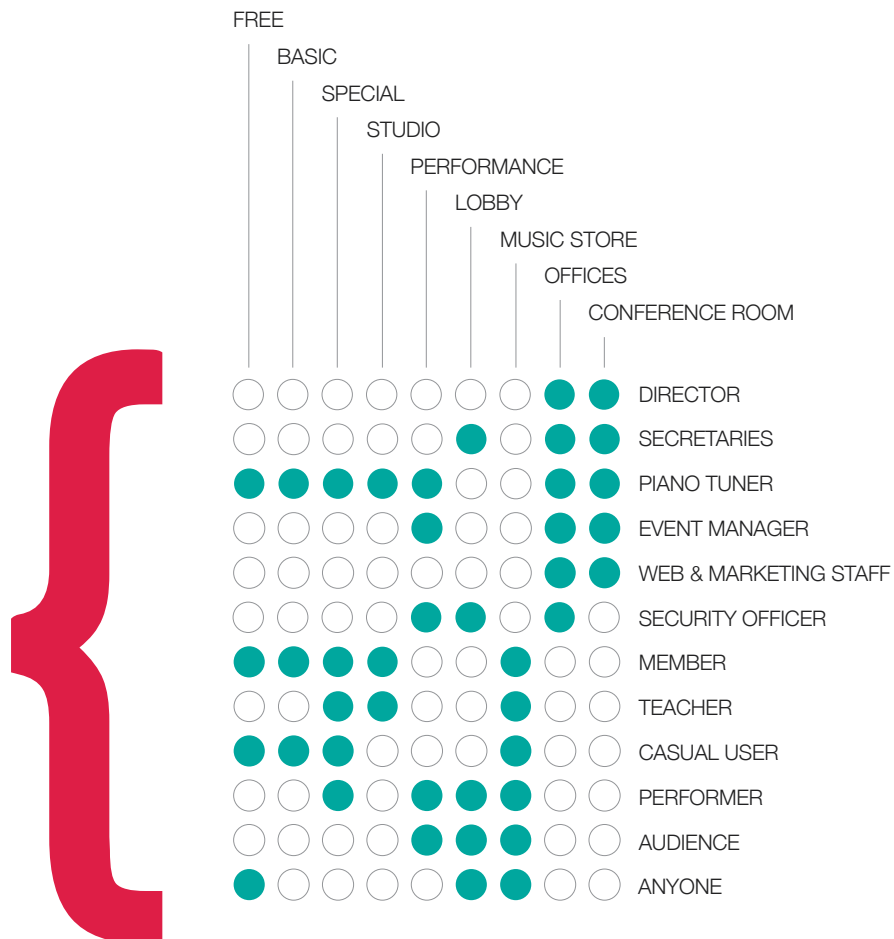
ADMINISTRATIVE SPACE

OFFICES

for employees (director of operations, piano tuner, event planner, etc.)

CONFERENCE ROOM

for hosting meetings within the administrative team or potential performers



{ SITE INFORMATION | MACRO }



Figure 3. Regional map.

CITY

Chicago, Illinois

POPULATION

2.7 million

AREA

234 square miles

COMMUNITY

The Loop

RESIDENTS

29,283 (CLA, 2011)

WORKFORCE

275,000 (CLA, 2011)

Chicago was selected as the city for this project because of its importance in the history of musical evolution and the abundance of performances that take place in the city every year. Music is a defining feature of Chicago's culture, and emphasizing that through a place where anyone can get their hands on a musical instrument is one of the primary goals of this project.

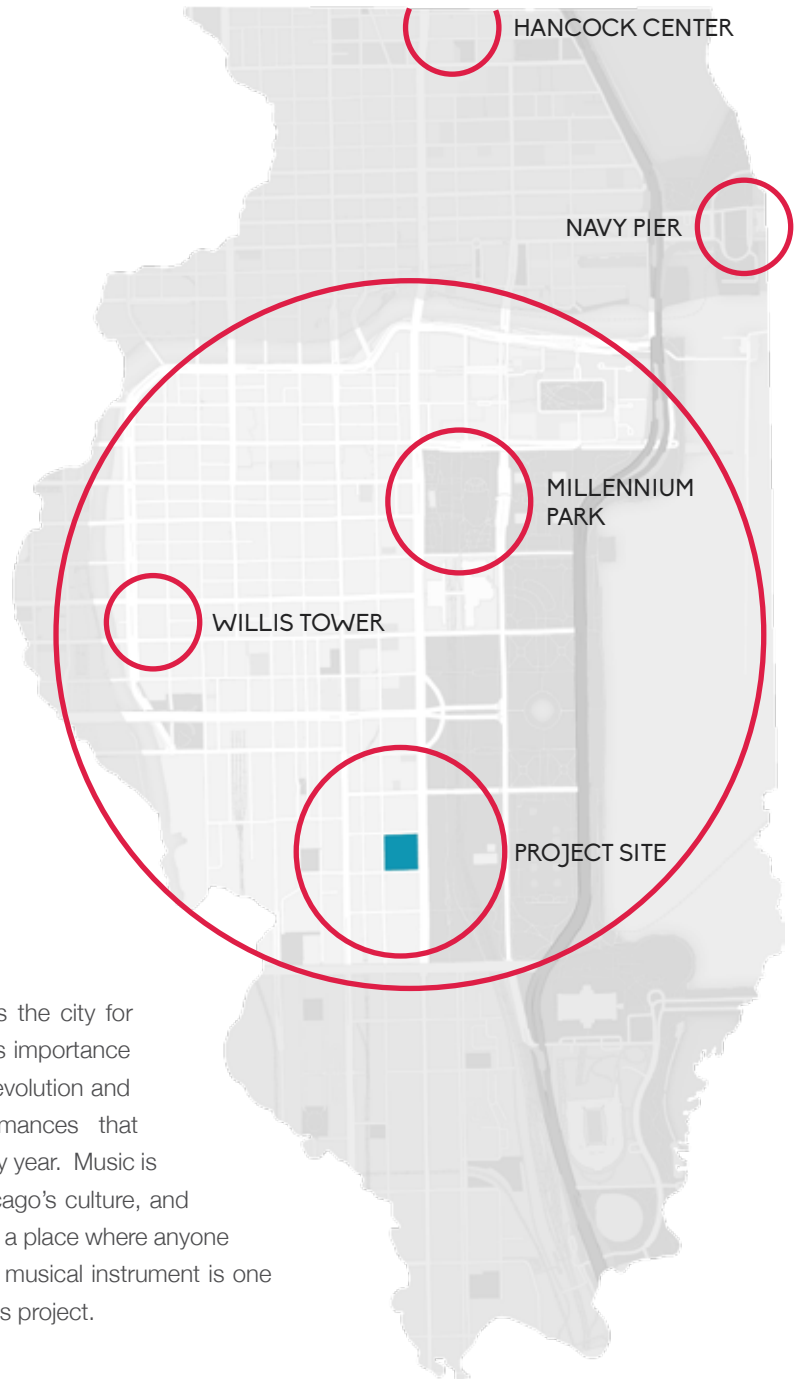


Figure 4. City map.

{ SITE INFORMATION | MICRO }

830 SOUTH MICHIGAN AVENUE

The site is located on the south end of Michigan Avenue, across the street from Grant Park, and consists of two city lots divided by an alley. The area has a high amount of pedestrian traffic and the south end of The Loop is also home to colleges with focuses in music and performance. These were both important factors in determining the location of the site.



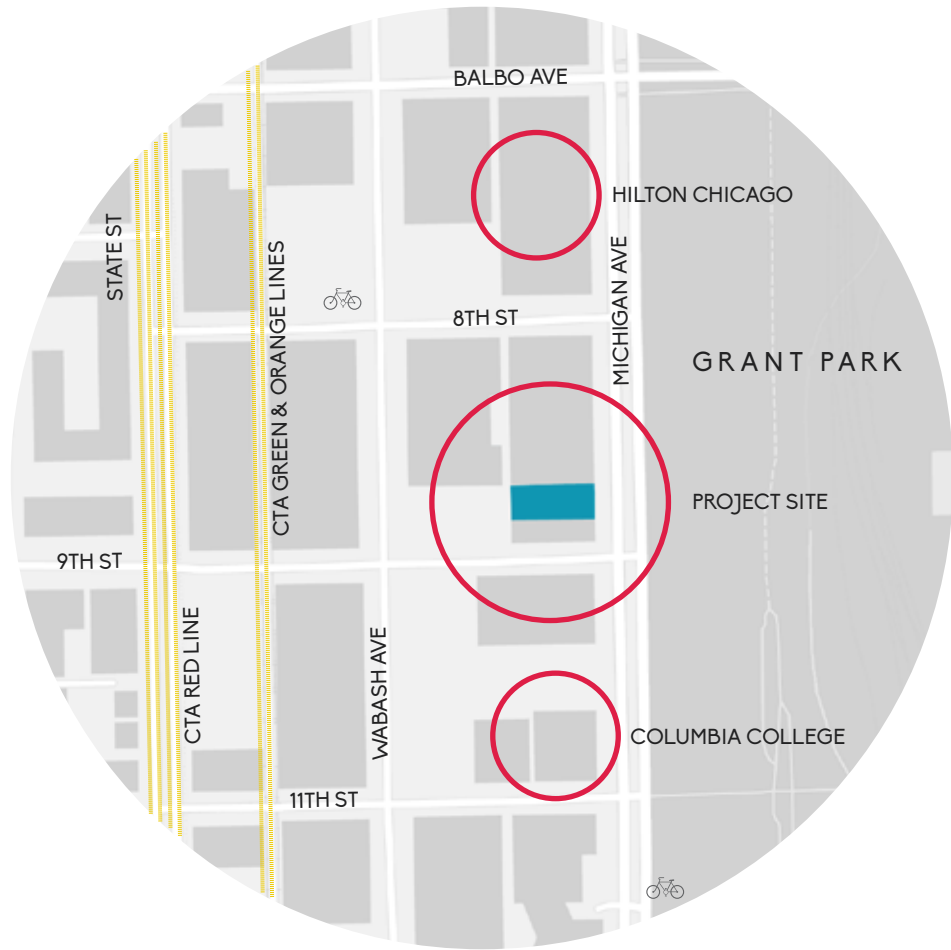


Figure 8. Site map.

SITE AREA

11,500 square feet

ZONING

downtown mixed-use

DIMENSIONS

160' x 75'

OPPOSITE, TOP
Figure 5. Chicago skyline. *Photo by Jakob Lawman.*

OPPOSITE, BOTTOM LEFT
Figure 6. Grant Park. *Photo by Jakob Lawman.*

OPPOSITE, BOTTOM RIGHT
Figure 7. 830 Michigan. *Photo by Jakob Lawman.*

{ PROJECT EMPHASIS }

The main emphasis of this project is to create a place where anyone can develop their skills on the piano. Beginners and experts alike will be sharing the facility to improve and share their musical abilities with the community. A secondary emphasis that I would like the project to focus on is the acoustical quality of each space.

{ PLAN FOR PROCEEDING }

RESEARCH DOCUMENTATION _____

Research will be conducted on the health benefits of musical performance, recital halls, practice spaces, acoustics, historical context, site analysis, and programmatic requirements.

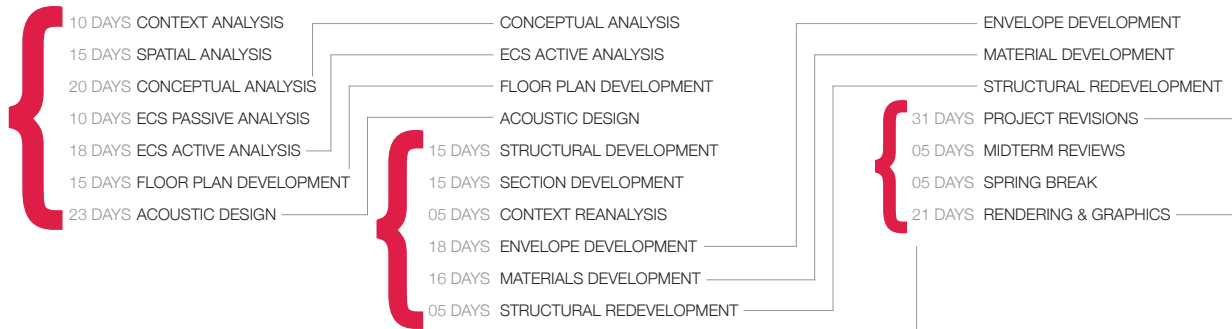
DESIGN METHODOLOGY _____

The research for this project will follow a mixed method approach, utilizing both qualitative and quantitative data and employing graphical analysis, digital analysis, and physical observation. The analysis, interpretation, and integration of collected data will occur throughout the research and project development and presented in both text and graphics.

DESIGN DOCUMENTATION _____

The documented research will be compiled in writing, physical media, and digital graphics. It will be made available in the final thesis book and to scholars in North Dakota State University's institutional repository upon completion.

{ DESIGN SCHEDULE }

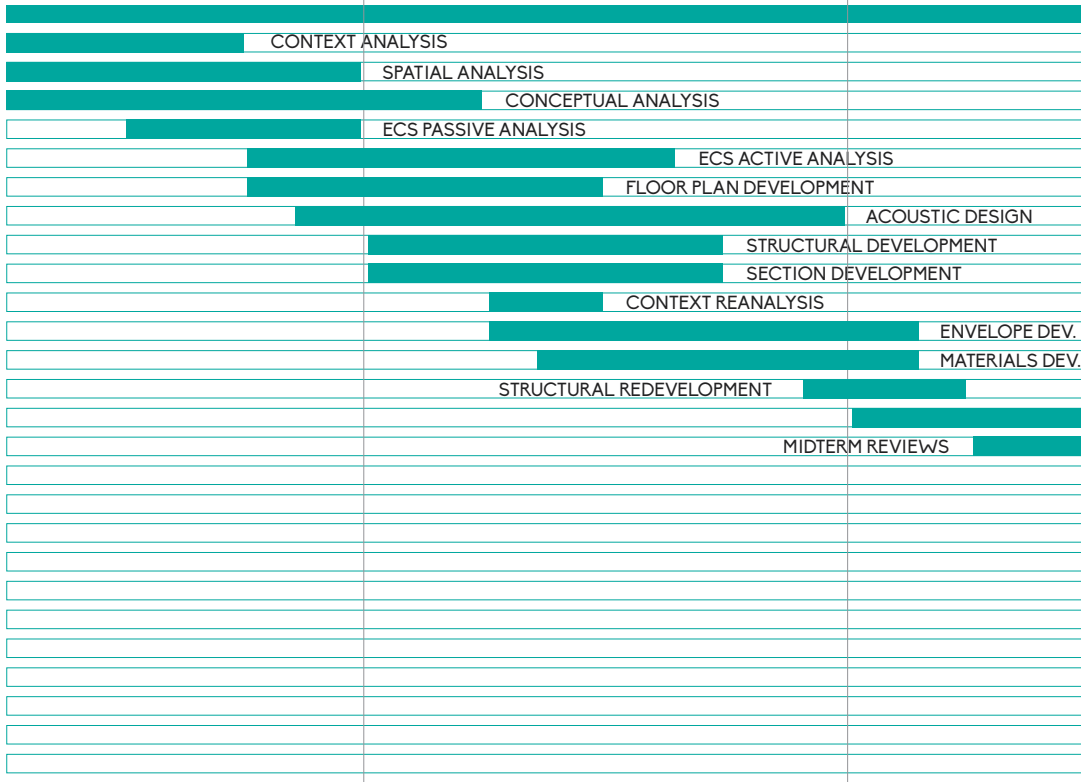


JANUARY

FEBRUARY

MARCH

13 14 15 16 17 20 21 22 23 24 27 28 29 30 31 03 04 05 06 07 10 11 12 13 14 17 18 19 20 21 24 25 26 27 28 03 04 05 06 07 10 11 12 13 14



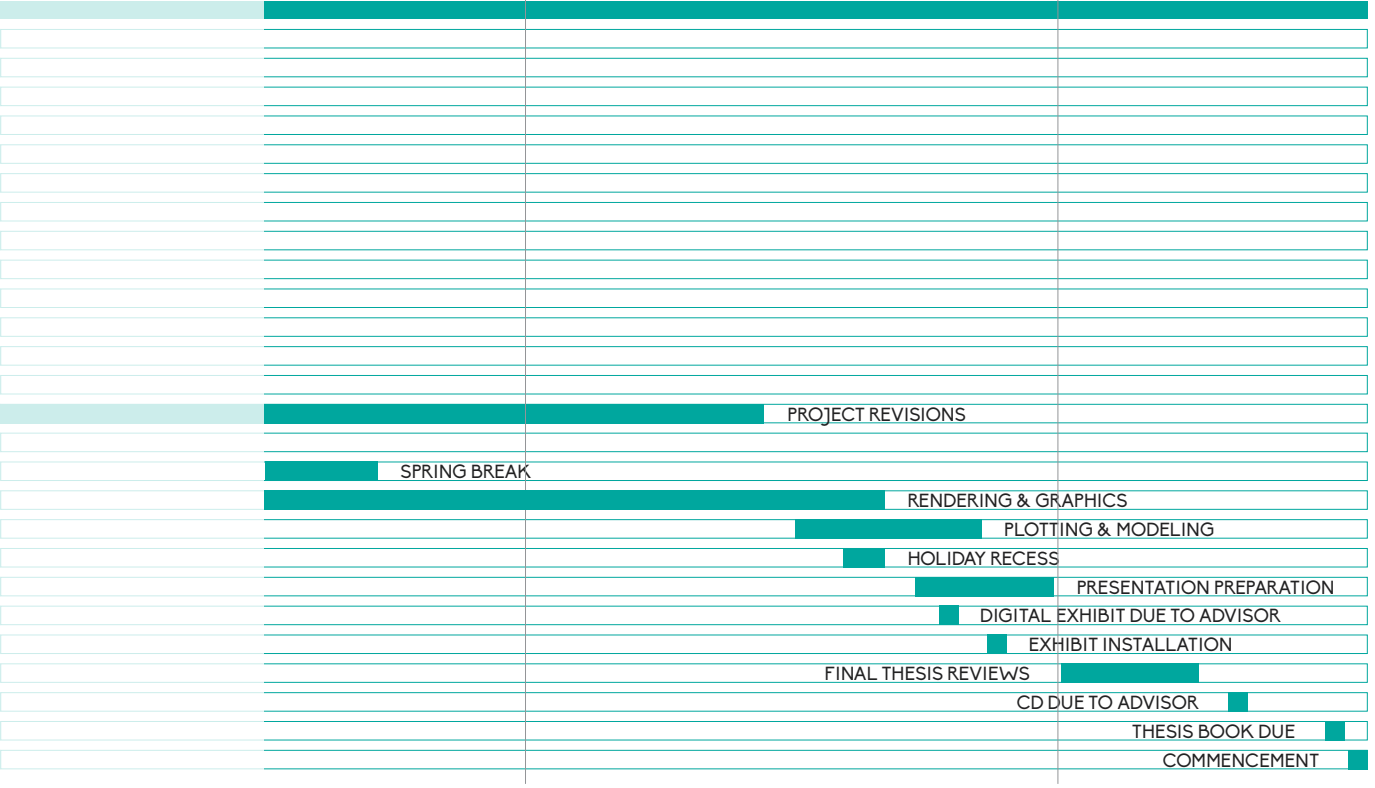
- PROJECT REVISIONS
- RENDERING & GRAPHICS
- 08 DAYS PLOTTING & MODELING
- 02 DAYS HOLIDAY RECESS
- 06 DAYS PRESENTATION PREPARATION
- 01 DAY DIGITAL EXHIBIT DUE TO ADVISOR
- 01 DAY EXHIBIT INSTALLATION

- 06 DAYS FINAL THESIS REVIEWS
- 01 DAY CD DUE TO ADVISOR
- 01 DAY THESIS BOOK DUE
- 01 DAY COMMENCEMENT

APRIL

MAY

17 18 19 20 21 24 25 26 27 28 31 01 02 03 04 07 08 09 10 11 14 15 16 17 18 21 22 23 24 25 28 29 30 01 02 05 06 07 08 09 12 13 14 15 16 17



{ PREVIOUS EXPERIENCE }

SECOND YEAR

FALL 2010

tea house
boat house

DARRYL BOOKER

fargo, nd
minneapolis, mn

SPRING 2011

montessori school
birdhouse
dwelling

JOAN VORDERBRUGGEN

fargo, nd
fargo, nd
marfa, tx

THIRD YEAR

FALL 2011

city museum

MIKE CHRISTENSON

fargo, nd

SPRING 2012

agricultural research facility
urban infill

MILTON YERGENS

dove creek, co
fargo, nd

SUMMER 2012

unicorn park restoration

JAY KOST

fargo, nd

FOURTH YEAR

FALL 2012

high rise

BAKR ALY AHMED

san francisco, ca

SPRING 2013

“het eilandje” urban design

PAUL GLEYE

antwerp, belgium

FIFTH YEAR

FALL 2013

Research on integrating LEED
criteria with BIM environment

GANAPATHY MAHALINGAM

*R.L. Engebretson
fargo, nd*



PROGRAM DOCUMENT

{ RESEARCH }

MUSIC & PEOPLE

The piano is one of the most popular and widely recognized instruments on the planet today. It was originally invented in 1700 by Bartolomeo Cristofori, who sought an instrument that could produce a broader dynamic range than the harpsichord, a piano-like instrument that had been around for several centuries (Phillips, 2006). By the late 1800s, the piano was perfected into the instrument it is today, and has continued to become available to a wider audience. In 1850, just a few thousand pianos were sold, but by 1909 that number had risen to over 365,000. (Phillips, 2006).

In recent years, it has been recognized and subsequently proven that playing the piano provides a multitude of health and developmental benefits for everyone. “Playing the piano offers proven benefits—from physical and intellectual to social and emotional—to people of all ages” (Steinway & Sons, 2013).

According to the Music Teacher’s National Association website, one of the physical benefits of playing the piano is improved hand-eye coordination and motor skills for

people of all ages (Benefits of Music Study, n.d.). Dr. Arthur Harvey, a retired professor at the University of Hawaii at Manoa, has confirmed that playing the piano “activates the cerebellum and therefore may aid stroke victims in regaining language capabilities. It has powerful therapeutic effects as well, including lower blood pressure, reduced anxiety and cardiac complications, and a strengthened immune system” (Steinway & Sons, 2013).

As far as intellectual benefits are concerned, a 2011 study conducted by E. Glenn Schellenberg of the University of Toronto at Mississauga divided 132 first-graders into four groups for after-school activities: singing lessons, drama lessons, piano lessons, and no lessons at all. The students who participated in piano lessons saw an average increase of 7 IQ points from the beginning of the year to the end of the year. The other groups saw a maximum increase of 4.25 IQ points. The difference in IQ gains has been attributed to the long, intense periods of concentration associated with playing the piano (Steinway & Sons, 2013). David Sprunger, a piano teacher from Medford, Massachusetts, states in a personal account of how playing the piano affects his life, “So many things in our lives involve trying to get something accomplished,

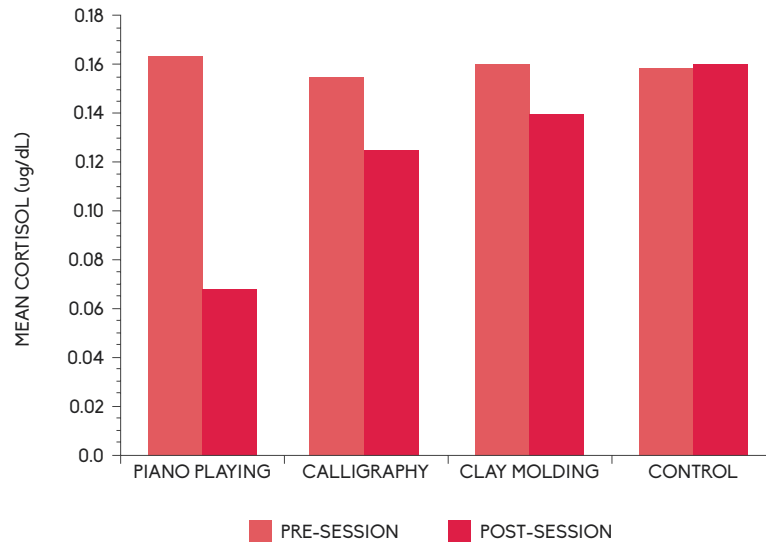


Figure 9. Cortisol levels.

but music is an end destination. It is nice for me to have my piano playing where I am just immersed in the moment instead of thinking about what I have to do next week or one year from now” (Martin, 2010). Because I play piano myself, I can relate to this statement, as I am sure many who play the piano can.

Stress reduction is often attributed to playing the piano; it has been scientifically proven to reduce stress levels in the body. “The hormone cortisol is associated with the damaging effects

of stress such as hypertension and impaired cognitive function. Many studies have shown that listening to music reduces the level of this hormone” (Singer-Knight, 2013). A 2011 study by Kumiko Toyoshima, Hajime Fukui and Kiyoto Kuda studied the effects of different creative activities on cortisol levels in the body (See Figure 9). It was discovered that the creative session involving playing the piano demonstrated the greatest reduction in cortisol levels in the body (Toyoshima, 2011). Previous research had proven that *listening* to

music reduced the body's cortisol levels, and now it has been shown that producing music has the same effect.

The implementations of this study include a reinforced reason to include music education in schools. The original purpose of including music education in school curriculums was to help students understand cultural heritage. Now, in addition to transmitting our cultural past, music education programs will help "regulate personal psychological and physiological states and have a vital function in enhancing mental fitness" (Toyoshima, 2011).

Even without delving into the realm of scientific studies, listening to testimonies from experienced pianists provides a personal level of evidence for the stress-reducing benefits of playing the piano. "Music and creativity in general helps people release a part of themselves that gets locked up in everyday work and the stress of life," says Donn Rochlin, a Portland piano consultant. "But music has a relaxing quality that helps stimulate the immune system because it helps people feel better and lowers stress" (Martin, 2010). The Music Teacher's National Association lists several benefits of taking piano lessons (Benefits of Music Study, n.d.):

- ∅ Enhanced abstract reasoning skills
- ∅ Increased cognitive development
- ∅ Lowered levels of depression and loneliness
- ∅ Strengthened hand-eye coordination and fine motor skills
- ∅ Teaches discipline and encourages dedication

These benefits are more easily obtained as a younger student, while the mind is still developing, but older students benefit as well. More research done by Dr. Arthur Harvey, retired professor at the University of Hawaii at Manoa, has shown that older students practicing the piano saw increased levels of human growth hormone, which slows phenomena associated with aging, such as osteoporosis, wrinkling, reduced sexual function, loss of muscle mass, reduced energy levels, and general aches and pains (Steinway & Sons, 2013).

It is now apparent that there are many benefits to playing the piano that can affect people of all ages. But why does music have such a positive effect on people?

MUSIC & PHILOSOPHY

At its core, music is simply an arrangement of different sounds. But to be considered music, these sounds must be organized to form a sequence. This sequence of sounds, if arranged in an order deemed appropriate, becomes a performance or song. Thomas Carson Mark, a musician and philosopher, has researched this philosophical phenomenon. He replaces the word “performance” with the phrase “instantiating sequence of sounds,” the difference between the two being that every instant of an instantiating sequence of sounds exists regardless of the circumstances, whereas a performance or song exists only once it has been created.

It is the organization of these sounds that determines how a person will react to it. If composed without care or thought, it remains an instantiating sequence of sound, nothing more. If composed correctly, the sequence of sounds will have the power to influence emotions. What is it about music that can grant it the ability to make a difference in a person’s life? Mark Changizi asks in his 2009 *Scientific American* article, “why doesn’t music feel like listening to speech sounds, or animal calls, or garbage disposals? Why is

music *nice* to listen to?” Despite countless studies, it still is not clear how and why music can impact our emotions and trigger such profound experiences. Music has no intrinsic value, like food or sex. The impact of music also varies from person to person. One person may prefer country music while another might prefer alternative rock. Music also has no profound impact on animals—it is strictly a human experience.

A recent study by Nidhya Logeswaran and Joydeep Bhattacharya from the University of London found that music influences the way we visually perceive the world. Participants in this study listened to a short piece of music classified as either happy or sad and were then shown a face to rate as either happy or sad. The study found that when listening to happy music, people would perceive neutral faces as happy, and participants who heard sad music would perceive neutral faces as sad. In some cases, happy music would turn frowns into smiles, and sad music would turn smiles into frowns, depending on the participant and the emotional power contained by the music (Changizi, 2009). This study demonstrates that human emotions can be very easily influenced via auditory stimulation, and can go so far as to alter visual perception.

People commonly associate sounds with events in their lives. We often associate the sound of a siren with emergencies, and if accompanied by flashing red and blue lights in the rear view mirror, we associate it with fear or anxiety. A “ding” is usually attributed to something that needs attention: microwave popcorn is done, someone is at the front door, or the elevator has arrived. Many of these stimulations occur across most cultures. Similar associations are made with music, except music is usually attributed to more specific events. Every time I hear “The Prayer” by Celine Dion and Andrea Bocelli, I experience sadness—despite it being an uplifting song—as it was sung at my grandmother’s funeral. “The Adventure” by Angels & Airwaves reminds me of a project I did my freshman year of college, having listened to it on repeat for hours at a time while working on the project. In this case, it did not necessarily evoke an emotion (other than, perhaps, the torment associated with the project), but it brings me back, very vividly, to those moments where I was listening to the song and working on the project.

Experiential association happens between all the senses. Certain smells, sounds, sights, tastes, and feelings evoke memories. This could be one reason that we associate music with emotions. Our past experiences are

constantly informing our new experiences. Therefore, the emotional influence a piece of music has will depend on the person and the details of his or her past. Movies are an excellent example of how music affects us based on past experiences. Watching a movie is incredibly mentally engaging. We process the visual information, music, dialogue, sound effects, and our interpretation of the plot simultaneously, often thinking ahead to predict what might happen next. The music helps set the mood, while the visuals and dialogue simultaneously give mood to the music.

How is it then, that when the visual stimuli is removed and we put in a pair of headphones, we are still emotionally influenced by music we have possibly never heard before? There have been times when I am listening to music while working, and suddenly my train of thought is broken, chills are sent down my spine, and the only thing occupying my mind is the music. While this experience may be brief, it is incredible that a simple “sequence of sounds” can have such an abrupt and profound impact on one’s experiences. In a 2011 study published by Valorie N. Salimpoor in *Nature Neuroscience*, it was discovered that for certain people, sudden changes in music stimulates a neurological “reward pathway” in

the brain, triggering a flood of dopamine to the striatum, part of the brain that is usually associated with addiction, reward, and motivation. Usually, more drastic changes in the music will have a greater impact on our mood. People with more musical inclination than others—those who play an instrument or are constantly listening to music—experience this phenomenon more frequently than those who are less musically involved, simply because a musically inclined brain becomes adept at subconsciously analyzing music and predicting what might come next.

Using the emotional influence found in music, what kind of implications can its properties have in relation to architecture? Can music influence the emotional impact that architecture has on its users?

MUSIC & ARCHITECTURE

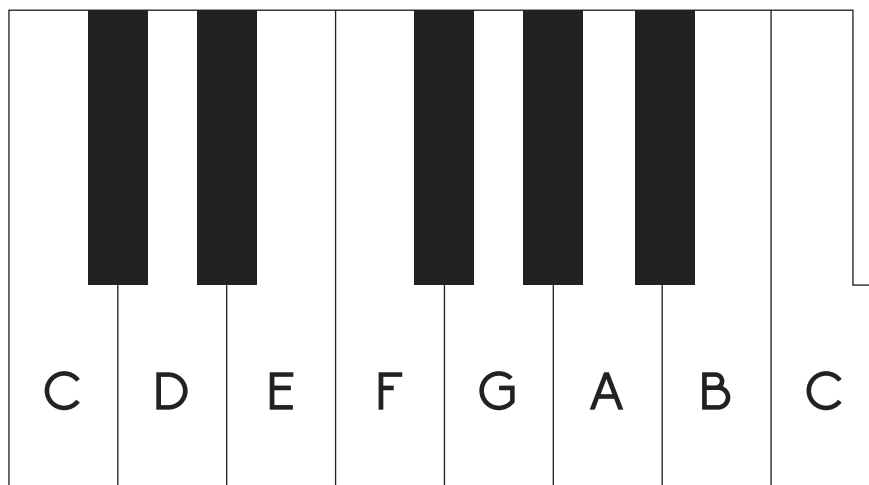
There exists a mathematical phenomenon in nature that we have come to define as the Golden Ratio. If the ratio of two quantities is the same as the ratio of their sum to the larger of the two quantities, these quantities form a Golden Ratio. In architecture, this ratio shows up most commonly as the Golden Rectangle, in which the ratio of the long edge of a rectangle to the short edge is the Golden Ratio: 1.618. Le Corbusier utilized the Golden Ratio, along with the proportions of the human figure, to develop an architectural proportioning system he called the Modulor (Zuk, 2013).

To create the Modulor, Le Corbusier also took inspiration from the musical scale, stating that “music and architecture alike are a matter of measure” and “...music rules all things ... or, more precisely, harmony does that” (Zuk, 2013). According to research by Radoslav Zuk, of the School of Architecture at McGill University, Le Corbusier explored the relationship of ratios in his Modulor proportioning system to ratios found in music, of which there are many. There is the Diatonic scale, consisting of eight notes, where the top and bottom note are the same pitch,

the top having a frequency double that of the bottom (referred to as an Octave). On a piano, the Diatonic scale includes only the white keys. Each note in the scale is assigned a ratio based on its relationship to the bottom note. The bottom note has a ratio of 1:1 and the top, a ratio of 2:1, since its frequency is double that of the bottom note. There are seven intervals between the top and bottom notes, designated as the Second, Third, Fourth, Fifth, Sixth, Seventh, and Octave (see Figure 10). The ratios produced by these

notes depend on their frequencies, measured in Hertz.

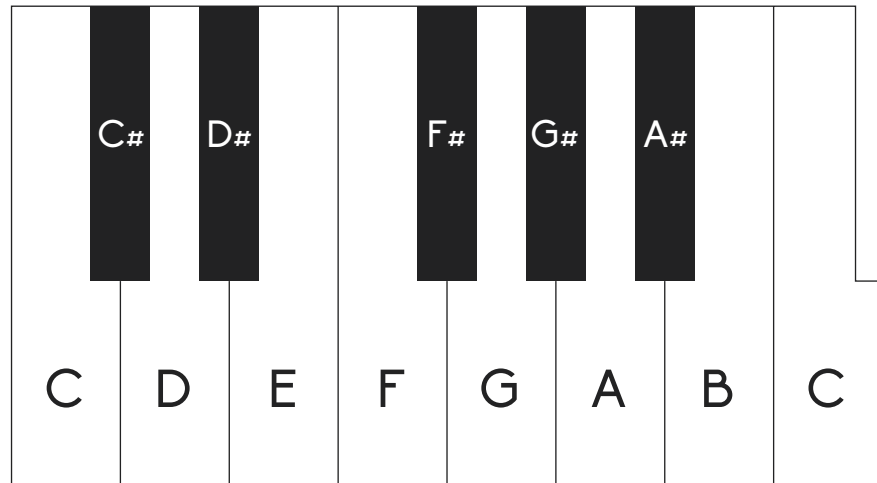
The other type of scale is the Chromatic scale, in which all keys on the piano are used. It works similarly to the Diatonic scale, but there are now thirteen notes (twelve intervals), the top and bottom still the same pitch, but with more steps in between each note. The names of each interval are different, with the introduction of the black keys. Intervals are still Second, Third, Fourth, etc., but can



NUMBER	1	2	3	4	5	6	7	8
NAME	MIDDLE C	SECOND	THIRD	FOURTH	FIFTH	SIXTH	SEVENTH	OCTAVE
FREQUENCY	261.626	293.665	329.628	349.228	391.995	440.000	493.883	523.251
RATIO	1	1.125	1.25	1.33	1.50	1.67	1.875	2

Figure 10. C Major diatonic scale.

2	4	7	9	11
MINOR SECOND	MINOR THIRD	TRITONE	MINOR SIXTH	MINOR SEVENTH
277.183	311.127	369.994	415.305	466.164
1.0625	1.1875	1.425	1.595	1.785



NUMBER	1	3	5	6	8	10	12	13
NAME	MIDDLE C	MAJOR SECOND	MAJOR THIRD	PERFECT FOURTH	PERFECT FIFTH	MAJOR SIXTH	MAJOR SEVENTH	PERFECT OCTAVE
FREQUENCY	261.626	293.665	329.628	349.228	391.995	440.000	493.883	523.251
RATIO	1	1.125	1.25	1.33	1.50	1.67	1.875	2

Figure 11. C Major chromatic scale.

also be Major, Minor, Perfect, Augmented, Diminished, or Tritone (see Figure 11).

How do these scales relate to the scale of the Golden Section? The Golden Section consists of only four ratios, whereas the diatonic and chromatic scales have eight and thirteen, respectively. The relationship between these ratios is not very clear, as seen in Figure 12. 1.236 on the Golden scale is similar to 1.25 (E) in the C Major Diatonic and Chromatic scales, while 1.618 does not really correlate well, falling closest to 1.59 (G#) in the C Major Chromatic scale and 1.67 (A) in the C Major Diatonic scale.¹ The main consistency

between them is the philosophical notion of an organization system based on ratios derived from natural occurrences.

Another example of the correlation between these two art forms, where music is actually influenced by the architecture, predates Le Corbusier by several centuries. Santa Maria del Fiore, more commonly known as the Cathedral of Florence, was constructed in 1436 in Florence, Italy, by Filippo Brunelleschi, the “father of Renaissance architecture” (Warren, 1973). On the cathedral’s day of dedication, the Papal choir performed a motet written by Guillaume Dufay, specifically



Figure 12. Golden, Diatonic, & Chromatic scales.

¹ If a scale is Major, the Diatonic and Chromatic scales will retain the same ratios. If a scale is minor, the Chromatic scale will remain the same, but the Diatonic scale will shift (Figure 13), exchanging certain notes with the Chromatic scale.

for this event. The most interesting thing about *Nuper rosarum flores* is its relationship to Brunelleschi's architecture.

Dufay used a system of proportioning, called the *proporzioni musicali*, the same system that Brunelleschi used in his works of architecture, to compose this motet. This system works by "multiplying the sides of the squares consecutively by the numerical equivalent of the square root of [a musical octave (2:1)] and rounding off the reduced series to the nearest whole numbers" (Warren, 1973). The *proporzioni musicali* was consistently a ratio of 6:4:2:3. Dufay's *Nuper rosarum flores* is written in four sections, with the number of beats in each section equivalent to "the number of braccia contained in the modular scheme based on twenty-eight braccia squares" multiplied by the *proporzioni musicali*, resulting in a beats-to-section ratio of 168:112:56:84, staying true to Brunelleschi's method of proportioning.

Throughout history, architecture and music have borrowed from each other to inform some of the greatest works of art on record. The creativity involved within the fields of both music and architecture is filled with potential beyond capacity. Their combined power is strong enough to change the world, as they have done several times over in terms of periods throughout history. From the ancient Greeks and Romans to the Renaissance architects of the 1500s to the Baroque musicians of the 1700s, music and architecture have evolved together, influencing the ever-changing cultural evolution around the globe.



Figure 13. Diatonic Major and minor scales.

{ RESEARCH SUMMARY }

Music is intertwined with a vast assortment of other fields of study and work, positively influencing aspects of human culture and personal identity.

PSYCHOLOGY & SOCIOLOGY

It has been scientifically proven to influence the chemistry and physiology of the human mind. It is powerful enough to influence the emotions of anyone who hears it, as an individual or a group. A single piece of music can have a different effect on every person who hears it. Interpretation of music is a very personal experience, or one that can be shared with a specific group of people. Memories are created in association with auditory stimulation, often creating a link between a piece of music and an event or occurrence in one's life.

HEALTH & WELLNESS

Studies have shown that involvement with both listening to and performing music have a positive effect on several health aspects of one's life. As a child, the act of performing music increases cognitive development and increases motor skills with benefits that last throughout life. Elderly musicians experience the decreased effects associated with aging, such as wrinkles and memory

loss. Engagement with any instrument, most notably the piano due to its popularity and ease of use, will have a positive impact on any life, reducing stress and increasing fine motor skills regardless of one's age or ability

PHILOSOPHY

The question is, what makes music, music? What differentiates a song from the noises produced by a crowd of people? How can a "substantiating sequence of sounds" be transformed into musical composition? What are the differences between a random assortment of notes and an arranged composition? The differences lie within human perception. We find certain strings of notes and combinations of chords aurally pleasing, while the wrong sequence of sounds will cause discomfort to the brain's auditory cortex and pleasure center. It is not entirely understood why our brains are wired to enjoy some sounds and cringe at others, but it is accepted that when music strikes the right chord, our minds light up and recognize a sequence of sounds in the same way it does food or sex.

HISTORY & CULTURE

Vocal music has existed since the beginning of human culture, followed by percussion

and horn instruments, written composition, brass and string instruments, and electronic composition in today's world. Throughout history the style of music has been greatly reflected in the different periods of history, often associated with cultural phenomenon in arts and humanities, including painting, sculpting, writing, theatre, photography, and architecture.

ARCHITECTURE

Music and architecture share a special bond with one another. This bond was formed over two thousand years ago and continues today. Beginning with the Greeks and enduring through today with postmodernism, music and architecture have shared the same styles and artistic approach. Both have evolved in simplicity and elegance with a reduction in extraneous details, while simultaneously becoming more complex. The relationship between the two lies far deeper than history though. Both fields follow a system of metrics used in their compositions. Architecture is often influenced by ratios, a notable example being Le Corbusier's Modulor system of proportioning, inspired by the Golden Section. Music is based on the musical scale, notes A through G, with a multitude of different chords and accidentals to alter

their composition, leading to seemingly endless combinations. The composition of architecture is also endlessly complex with trillions upon trillions of compositions based on shape, size, proportions, material choice, location, and level of detail. Both forms of art contain limitless possibilities of arrangements.

INFLUENCE ON THESIS

The Chicago Center for Piano will address each of these areas, engaging with the emotions and mental health of its users, the physical interpretation of architectural spaces and how they relate to music, and the cultural impact music has on a population. An architectural system of proportioning will be developed to convey the building's interpretation of the piano and the musical scale. The piano is the strongest instrument to accomplish the goals of the thesis, due to its ease of use and popularity. Since pianos are more difficult to own than other instrument, due to the piano's size and financial commitment, the Chicago Center for Piano will provide the convenience of being able to play without the commitment of care. The piano contains so many components necessary to deliver sound, it will act as a versatile tool for interpretation throughout the design.

{ CASE
STUDIES }

DANISH RADIO CONCERT HALL

LOCATION COPENHAGEN, DENMARK
ARCHITECT ATELIERS JEAN NOUVEL
FLOOR AREA 210,000 SQUARE FEET
COST \$325,000,000
COMPLETED 2009



The Danish Radio Concert Hall was constructed in a developmental “desert” south of Copenhagen known as Ørestad North, a mixed-use area connected to the city by an elevated, driverless metro. The concert hall is part of a massive project to replace obsolete industrial and shipping facilities in Copenhagen, to be completed in the 2040s (Newhouse, 2012). The architecture of the interior is staged behind a 592,000 square foot glass cube cloaked in a royal blue glass-fiber mesh. Since the concert hall is part of the larger Danish Radio Broadcasting Building, the glass and blue mesh was meant to evoke the background of a television screen. During the day, the façade is a blank blue sheet, but at night, it becomes animated by “continuous projections of huge abstracted, music-related forms” (Newhouse, 2012).

The building’s interior is comprised of six levels, housing a restaurant, a bar, three music studios, and a 1,809-seat concert hall. The concert hall is situated in the upper part of the building, supported by a poured-in-place concrete structure. The seating in the concert hall is contained in fourteen angular balconies, cantilevered over each other. The upper portion of the auditorium contains “alternat[ing] grooved walls of birch-veneer



OPPOSITE
Figure 14. Danish Radio Concert Hall. *Photo by Jakob Lawman.*

TOP
Figure 15. DR concert hall. *Photo by Agnete Schlichtkrull.*

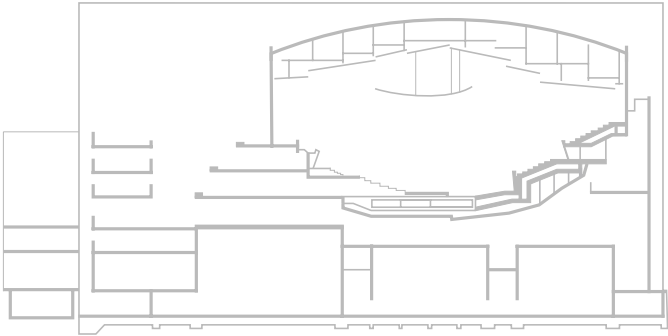
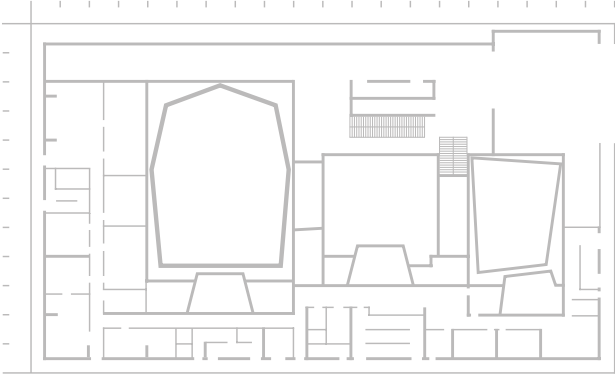
MIDDLE
Figure 16. DR concert hall detail 1. *Photo by Agnete Schlichtkrull.*

BOTTOM
Figure 17. DR concert hall detail 2. *Photo by Agnete Schlichtkrull.*

board with undulating gypsum board painted in autumnal colors” (Newhouse, 2012). The hall’s acoustics have been praised by the audience, though there have been complaints from the orchestra having trouble hearing itself.

In addition to the concert hall, there are three smaller music studios located on the level below grade, custom designed for specific

types of performance. Studio 2 is adorned with photographs of famous musicians, seating 540 for rehearsals and concerts. Studio 3 is decorated in black-and-white-lacquer, seating 170 for jazz performances. Studio 4 contains adjustable wall panels to alter the sound absorption and reflectivity for recording and rehearsal.



TOP.
Figure 18. Danish Radio plan.

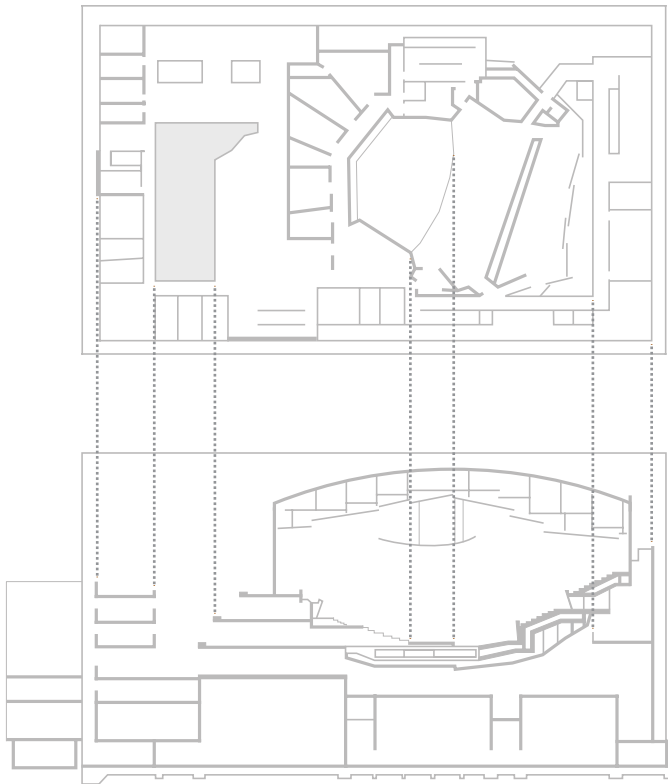
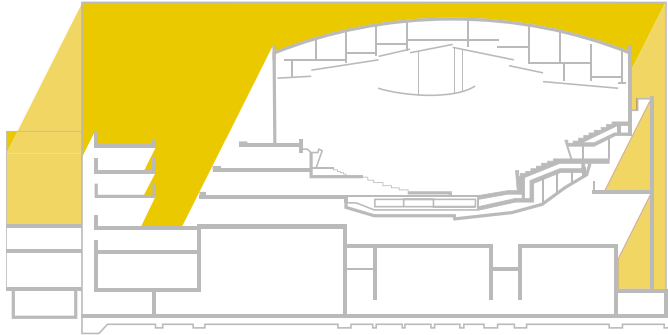
BOTTOM.
Figure 19. Danish Radio section.



TOP.
Figure 20. Danish Radio massing in elevation.

MIDDLE.
Figure 21. Danish Radio hierarchy in plan.

BOTTOM.
Figure 22. Danish Radio geometry in section.



TOP.
Figure 23. Danish Radio natural light in section.

BOTTOM.
Figure 24. Danish Radio plan to section.

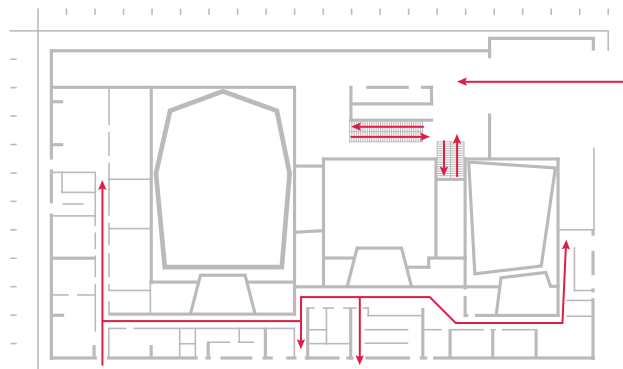
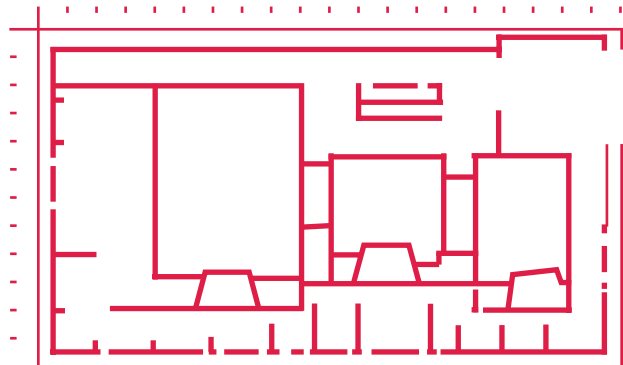


The idea was to create a kind of small world belonging to the Concert Hall with a lot of specific singular details, materials and spaces, so when you open a door from one studio to another it is always a new feeling, a new ambience. That is really the basic architectural idea of the building.



- Jean Nouvel

(Ateliers Jean Nouvel, 2009)



TOP.
Figure 25. Danish Radio structure in plan.

BOTTOM.
Figure 26. Danish Radio circulation in plan.

CIT CORK SCHOOL OF MUSIC

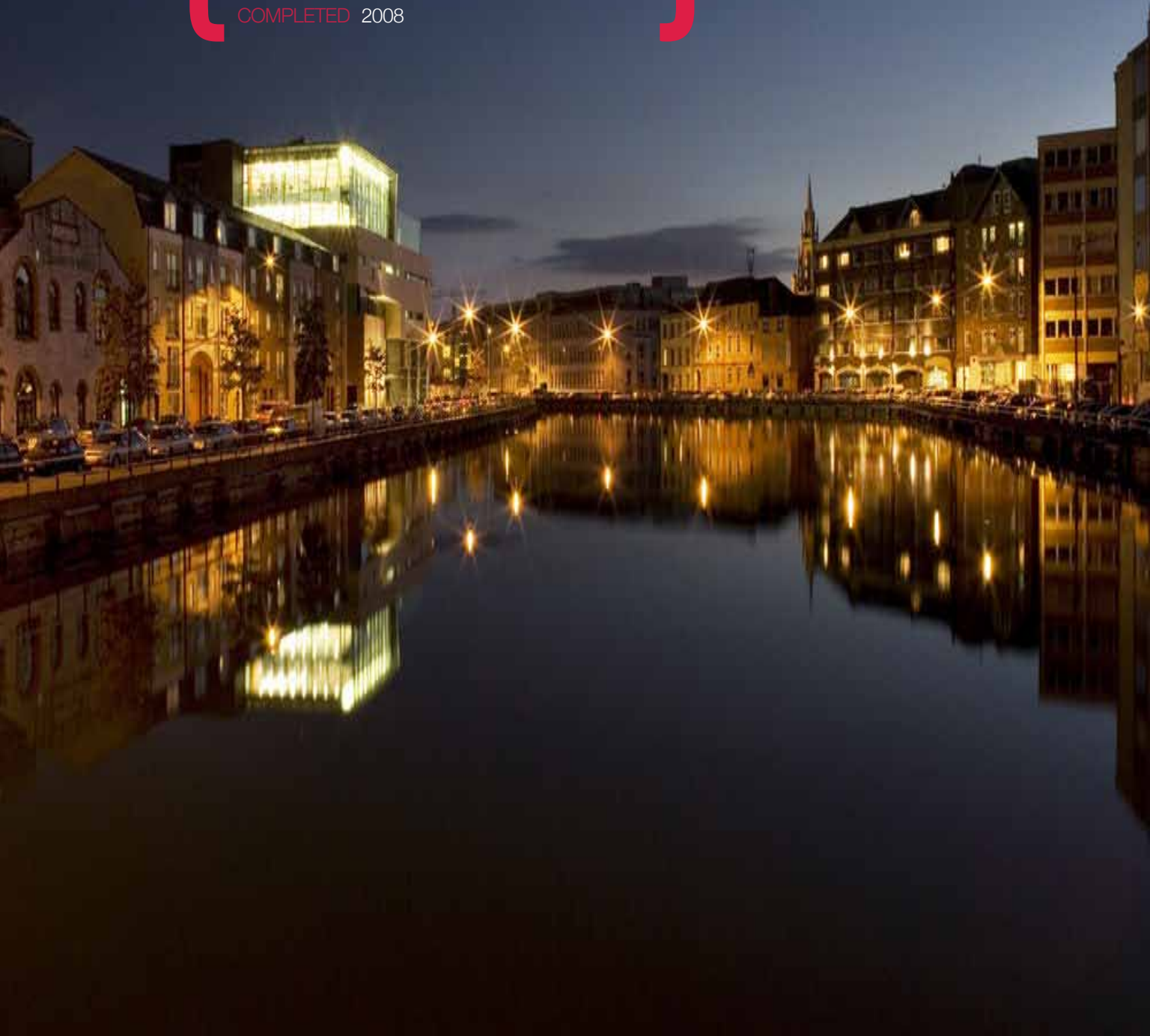
LOCATION CORK, IRELAND

ARCHITECT MURRAY O'LAOIRE ARCHITECTS

FLOOR AREA 130,000 SQUARE FEET

COST \$70,000,000

COMPLETED 2008



The Cork School of Music is an excellent example of an academic facility in an urban setting. It was built on the site of the previous school of music and has been regarded as a “dramatic contribution to the urban realm of Cork City” (Cork Institute of Technology, 2013). At the center of the building is a public concourse acting as the heart of administrative, performance, and education spaces.

The building contains a myriad of spaces, including a 450-seat rehearsal hall, theatre space, music library, recording and dance studios, offices, classrooms, and lecture halls. The form of the building reflects the river from which it is shaped around. The interior is occupied by very solid and geologically inspired spaces, reflecting the surroundings of Cork, Ireland. The main rehearsal hall has been praised for its acoustic quality and performance flexibility. A hydraulic stage and moveable ceiling and wall panels make it easy for students to experiment with multiple configurations spatially and acoustically.

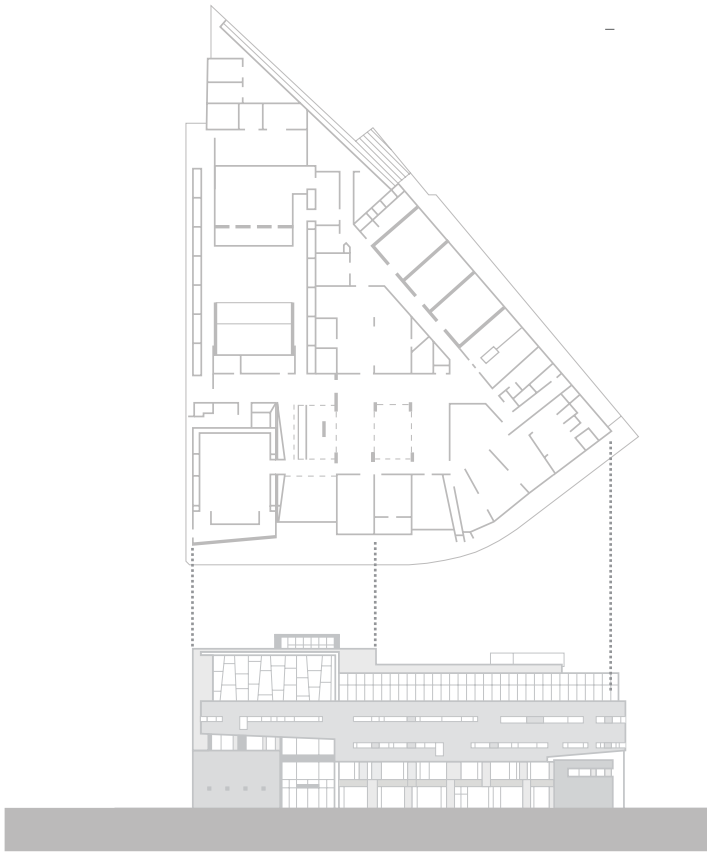


OPPOSITE
 Figure 27. CIT Cork School of Music. *Photo courtesy of Top Box Design & Murray O’Laoire Architects.*

TOP
 Figure 28. CIT 1. *Photo courtesy of World Buildings Directory.*

MIDDLE
 Figure 29. CIT 2. *Photo courtesy of World Buildings Directory.*

BOTTOM
 Figure 30. CIT 3. *Photo courtesy of World Buildings Directory.*



TOP.
Figure 31. Cork School plan to elevation.

BOTTOM.
Figure 32. Cork School section.



The palette of red sandstone, buff limestone, blue brick and animated glazing reinforces the design of a confident, civic, and contemporary set-piece by the river. The theatre, rehearsal hall and tuition studios are solid and geological in form while the curved limestone façade reflects the river bend.



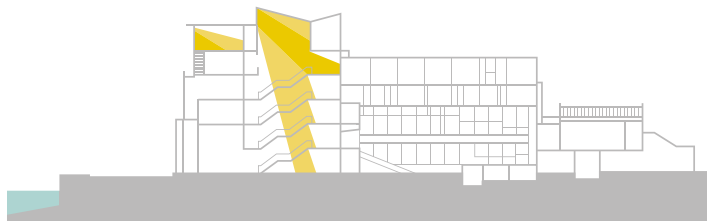
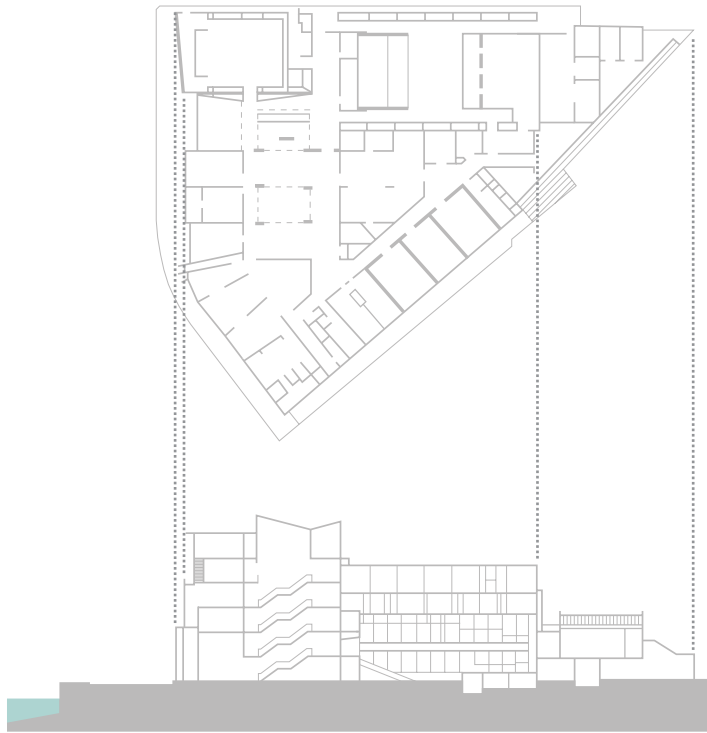
- *Mola Architecture* (CIT Cork School of Music, 2007)



TOP.
Figure 33. Cork School geometry in elevation.

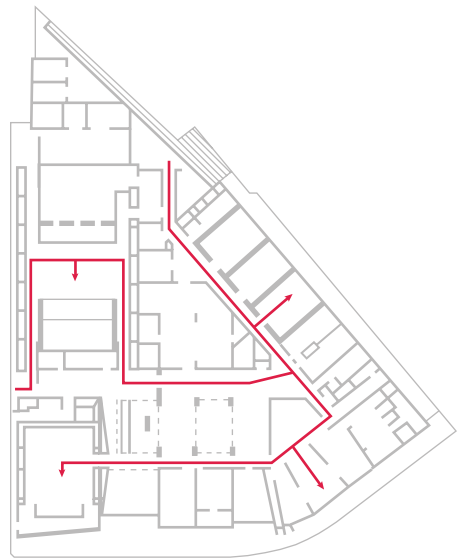
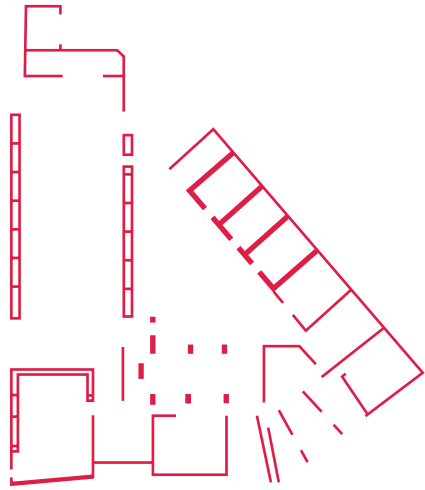
MIDDLE.
Figure 34. Cork School massing in section

BOTTOM.
Figure 35. Cork School hierarchy in elevation.



TOP.
Figure 36. Cork School plan to section.

BOTTOM.
Figure 37. Cork School natural light in plan.



TOP.
Figure 38. Cork School structure in plan.

BOTTOM.
Figure 39. Cork School circulation in plan.

DEE & CHARLES WYLY THEATRE

LOCATION DALLAS, TEXAS
ARCHITECT REX | OMA
FLOOR AREA 80,300 SQUARE FEET
COST \$354 MILLION
COMPLETED 2009



Wyly Theatre is a peculiar design when compared to other performance spaces. Instead of sprawling out across the landscape, as many concert halls tend to, the Wyly Theatre is designed vertically, stacking support spaces in ten stories above the stage and burying the lobby underground. Ground floor transparency between the indoor and the outdoor is accomplished through a 28-foot high curtain wall of sound-diffusing glass with integral shade controls.

The auditorium space itself is revolutionary in its flexibility. “The Dallas theater goes well beyond Walter Gropius’s idea of interchangeability between proscenium, thrust, and flat-floor arena in its ability to reconfigure in record time and with cost effectiveness” (Newhouse, 2012). The walls, floors, and seating within the space are all electronically adjustable.

The most recognized flaw in the design lies in the building’s circulation. The building’s entrance is positioned uncomfortably close to traffic, both vehicular and heavy pedestrian. A ramp carves out the underground entrance to the theatre, creating a lackluster descent into the building, rather than an ascension of grandiose. The interior circulation and



TOP
Figure 41. Wyly façade. Photo courtesy of Jonathan Barnes A&D.

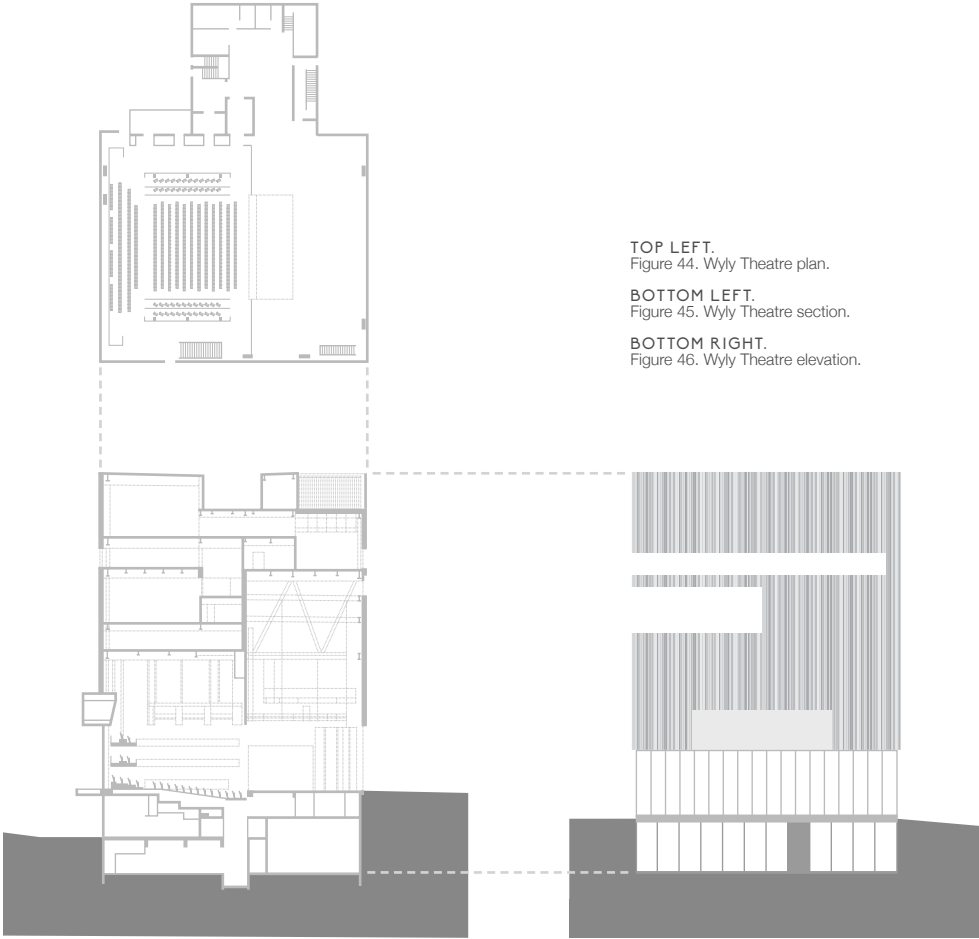
MIDDLE
Figure 42. Wyly ramp. Photo courtesy of Jonathan Barnes A&D.

BOTTOM
Figure 43. Wyly stage. Photo courtesy of Victoria Newhouse.

OPPOSITE
Figure 40. Dee and Charles Wyly Theatre. Photo courtesy of Artboom & OMA.

materiality choices continued this lack of grandiose through to the theatre. Accessing the concessions and restrooms while attending a performance requires moving between floors. This separation of the lobby and the auditorium by a set of stairs has proved problematic for elderly and disabled

theatergoers, as elevator access is available, yet unfortunately inconvenient. The rest of the building's circulation, according to Kevin Moriarty, the Dallas Theater Center's artistic director, is "unbelievably user friendly" (Newhouse, 2012).



TOP LEFT.
Figure 44. Wily Theatre plan.

BOTTOM LEFT.
Figure 45. Wily Theatre section.

BOTTOM RIGHT.
Figure 46. Wily Theatre elevation.

TOP RIGHT.
Figure 47. Wylly Theatre geometry in plan.
BOTTOM LEFT.
Figure 48. Wylly Theatre hierarchy in elevation
BOTTOM RIGHT.
Figure 49. Wylly Theatre massing in elevation.





I had everything in mind, including various kinds of music. It was meant to be an anti-dogmatic theater to show that anything can happen anywhere.



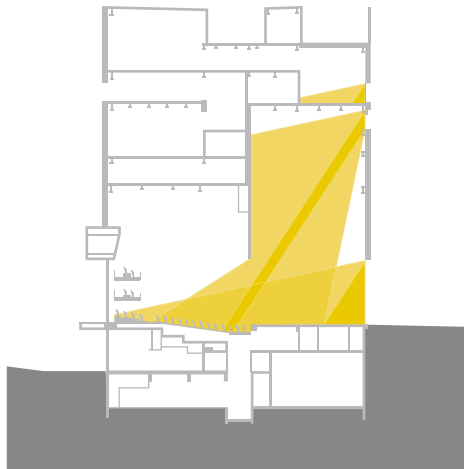
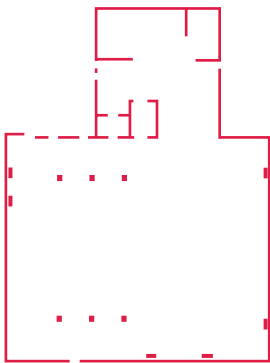
- Rem Koolhaas
(Newhouse, 2012)



TOP LEFT.
Figure 50. Wyly Theatre circulation in plan.

BOTTOM LEFT.
Figure 51. Wyly Theatre structure in plan.

BOTTOM RIGHT.
Figure 52. Wyly Theatre natural light in section.



SUMMARY

These three case studies portray the different aspects of my building typology. Each project possesses a different quality that will inform the semantics of the final design. My building typology fit three different criteria that I felt would be of utmost importance to study and analyze: performance space, practice space, and designing in an urban setting.

The Danish Radio Concert Hall is specific to performance space. The building has four different examples of performance spaces: an 1809-seat concert hall and three smaller, more intimate spaces.. My project is programmed for three different performance spaces: two performance halls and a recital hall.

The CIT Cork School of Music pertains more to practice and educational spaces. The building itself is a school, but contains several similar program requirements to my project. It is also located in an urban setting, sandwiched between other buildings in the city of Cork.

Wyly Theatre provides great insight to verticality in a performance building, which will contribute to my design because of its location in an urban infill setting. Wyly's building program contains similarities to the performance aspect of my project.

{ HISTORICAL
CONTEXT }

HISTORY OF THE PIANO

The piano has been around for almost three centuries now. Invented by Bartolomeo Cristofori in 1700, the piano (originally known as the fortepiano) was designed to compensate for the shortcomings of other keyboard instruments of the time, like the clavichord and harpsichord. The clavichord allowed for better control of volume and sustain, but was too quiet, while the harpsichord was very loud, but had little control over the expressiveness of the notes. The fortepiano produced a more dynamic range across the keyboard, allowed for better variation in volume, and controlled the sustain (Palmieri, 2003).

The fortepiano eventually evolved into the piano, which is quite a different instrument. The original range of the fortepiano was only four octaves—forty-nine keys. It increased to five octaves around the time of Mozart and six octaves with Beethoven (Palmieri, 2003). Today's piano contains seven and a third octaves, a total of 88 keys. Some models of the fortepiano had black natural keys and white accidental keys (Figure 53). The keys have since been standardized for all pianos, with white natural keys with black

accidentals. Sound quality has improved from the fortepiano to the piano as well. The timbre, or tonal quality, in older fortepianos is softer in volume and decays rapidly in the lower and higher registers. Modern pianos have more clear and consistent timbre across the keyboard.

Modern pianos can be found in two types: upright and grand. Upright pianos occupy less space, as their strings are oriented vertically rather than horizontally. Grand pianos come in a variety of sizes, ranging from baby grand (five feet long) to concert grand (up to ten feet long). All of today's pianos produce a consistent quality sound, but the general rule is that the longer the strings, the richer the sound. Because of the longer strings, the concert grand has the lowest inharmonicity of all pianos, meaning that the notes produce less overtones than pianos with shorter strings, making concert grands less harsh in tone than uprights.



Figure 53. Pianoforte de Johann Andreas Stein.
Photo by Gérard Janot.

MUSIC & ARCHITECTURE

The earliest form of musical performance is singing. Since music could be created with nothing more than the human body, it was easy to produce. The first evidence of instrumental performance came with the introduction of percussion instruments and horns, followed by stringed instruments, and eventually electronic music in the 20th century.

Stylistically, music has evolved similarly to architecture. There are different ages and styles of music that fit a specific time period. Much like the Medieval, Renaissance, and Baroque periods in architectural history, there are Medieval, Renaissance and Baroque periods in the history of music. In this case, the musical and architectural period correspond to the same era in history: Medieval from the 6th

century A.D. to the 14th century, Renaissance in the 15th and 16th centuries, and Baroque in the 17th and 18th centuries. Neoclassical/Romantic architecture coincides at the same time as Classical and Romantic music, in the 19th and early 20th centuries. Modern music and Modern architecture both began in the early 20th centuries while Postmodernism began in the late 20th century for each.

Before Medieval music there were the Greeks and the Romans, each with their own styles of music and architecture as well. “Of the early civilizations, Greece provided the musical culture of greatest significance for the development of Western music. The system of scales and modes, as well as a large part of the general philosophy concerning the nature and effect of musical sounds, has been inherited from the Greeks” (musical performance, 2013). Using this system of scales and their advanced understanding of

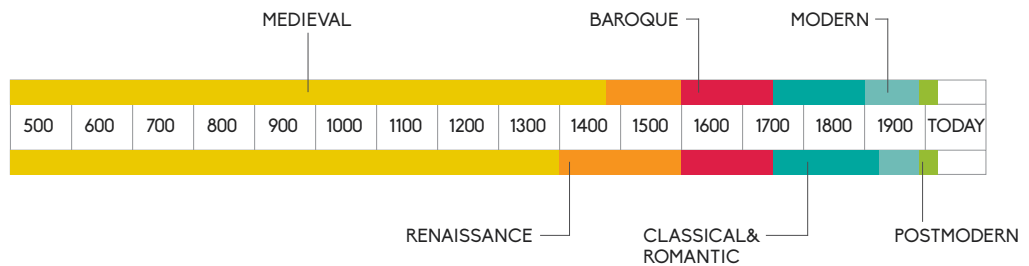


Figure 54. Music & architecture styles throughout history.

philosophy and psychology, they developed the theory of ethos, assigning specific mental and emotional states to different pitches and instrumental combinations. Music lied within the foundation of social order in Greek civilization. Music was an important part of education in Greece and musical performance grew to become a large part of public spectacle (musical performance, 2013).

Since the beginning of human civilization, architecture and music have evolved in a very similar fashion. Changes in society have altered the path in which each of these forms of expressiveness has traveled throughout history. Individuals appear with revolutionary new ways of thinking and doing, creating major leaps and bounds in the course of stylistic expressions throughout history. All forms of art, whether it is music, painting, architecture, fashion, or photography, are composed of a series of styles that can be applied to a timeline. Each major societal revolution brings about a change in all forms of art. The next change in the global society will bring about the next era in both music and architecture.

MUSIC & CHICAGO

Since the early 20th century, Chicago has been a prominent center for music in the United States. Blues and Jazz, originating in the south, made their way to Chicago in the early 1900s during the migration of poor workers in the South to industrial cities in the North. While not the birthplace of Blues, Chicago is known as the Blues Capital of the World; many of the industry's most talented and influential musicians originated in or peaked after moving to Chicago (Berkey, 2010). The pioneers of Chicago-style Blues include figures from the early 20th century, such as Blind Lemon Jefferson, Ma Rainey, Georgia Tom, and Big Bill Broonzy. From 1940 to 1975, Blues was thriving in Chicago.

Chicago-style Jazz developed in Chicago during the 1920s and later evolved into Dixieland. Today, Jazz is an important part of Chicago culture with the Chicago Jazz Festival, which began in honor of Duke Ellington, shortly after his death in the summer of 1974. In 1979, the first official festival was held, and it became an annual tradition, held in the parks along the Michigan Avenue Streetwall ever since.

Soul became another large part of Chicago's

rich musical history during the 1960s and 1970s. The city also contributed greatly to Rock in the 1980s, House music in the early 2000s, and Hip-Hop today, producing famous musicians and bands like Styx, Plain White T's, Fall Out Boy, Adonis, Kanye West, and Lupe Fiasco.

Aside from musical genres, Chicago is also home to a multitude of venues for all kinds of musical performances. The city is full of clubs, operas, theatres, concert halls, and more. House of Blues Chicago is a famous landmark that has been around since 1996 and hosted the performances of some of the world's most renowned musicians, including The Who and Pearl Jam.

Perhaps the most famous concert venue in Chicago is the Chicago Symphony Orchestra, which "is consistently hailed as one of the greatest orchestras in the world" (Chicago Symphony Orchestra, 2013). It was first assembled in 1891 by Theodore Thomas, the world's most famous conductor in that time. The orchestra found its permanent home in Orchestra Hall at the Symphony Center in the historic Michigan Avenue Streetwall. The orchestra performs over 150 concerts each year, collaborating with internationally renowned conductors and artists.

The oldest and most consistent style of music that has quietly made its home in Chicago is classical music, of which nowadays, the Symphony Orchestra is center stage. It has been vastly popular since the city's foundation in 1833. The city's first school of music was opened in 1834 by a Miss Wythe and a second was opened a year later by Samuel Lewis, along with the arrival of a shipment of pianos (Schabas, 1989). The Chicago Academy of Music (later renamed Chicago Musical College) was founded in 1867. Other music education schools include the Chicago Conservatory of Music and Dramatic Art, the American Conservatory of Music, and the Sherwood Music School. Several universities and colleges added a music program in the late 19th and early 20th centuries, including Northwestern, DePaul, Roosevelt, and the University of Chicago. Since the beginning, music education has been an important part of the city's culture and continues to thrive as musical styles evolve.

{ PROJECT
GOALS }

ACADEMIC & PROFESSIONAL ---

The objectives I have set for myself and for this project are to become involved with the building far beyond just the design. Too many of my prior projects have focused so heavily on the external appearance of the structure that I have not yet acquired a substantial understanding of a building's inner workings. My intentions, while still focused heavily on design, are to explore the area between interior and exterior façades to truly comprehend an architectural assembly and the sustainable strategies used for LEED certification.

PERSONAL

I have always held a desire to combine the two biggest passions in my life: architecture and music, specifically the piano. My thesis is the perfect opportunity to explore the spatial and programmatic implications of a performance space, a typology I hold great interest in. It also allows me to explore the mathematical and theoretical connections between the musical scale and architecture through a design schematic, much like Corbusier's Modulor system.

{ SITE
ANALYSIS }

{ SITE NARRATIVE }

Chicago is the third largest city in the United States and the nineteenth largest metropolitan area in the world. It has existed for nearly two centuries, growing to become a beautifully sculpted urban jungle. The diversity in materiality of the built environment, the variance in the height of the skyline, and the city's orientation along Lake Michigan contribute to its rich character. "The Loop" is the busiest and most diverse area of Chicago, home to several of the tallest buildings in the region and the second tallest building in the United States.

Perhaps the most appealing qualities of Chicago beyond the built environment are Millennium Park and Grant Park, separating the bustling skyline from the glistening shore of Lake Michigan. Along the western edge

of these parks runs the historic Michigan Avenue, arguably the most well-known and aesthetically compelling street in the city. The street begins north of the Chicago River and runs south, dividing the built environment from the natural. Traveling south along Michigan, we pass by Hancock Tower and catch a glimpse of Trump Tower to our right as we cross the river. Shortly after crossing the river, Millennium Park emerges on our left, gesturing towards Lake Michigan in the distance. Millennium Park transitions to Grant Park, divided by the Art Institute of Chicago. Opposite the parks is a thirteen-block stretch of historic buildings—the Michigan Avenue streetwall—beckoning its inhabitants to journey past the open air and into the dense urban jungle.



Nestled in this historic stretch, between two slender, brick façades, is a void in the jungle; a hole in the wall. Looking inward, our eyes gaze across a deep stretch of loose gravel, where a building stood for over a century before being lost to neglect and demolished. Beyond the vacancy is a half-empty parking lot at the corner of Wabash and 9th Street. Across Wabash the skyline continues westward with a gradual increase in building height, hiding the rest of the city from view.

Facing Lake Michigan from the wall of the city, our eyes pass through dense vegetation: a row of trees planted neatly and evenly along the sidewalk adjacent to the site, a second row dividing Michigan Avenue into north- and southbound lanes, and a third row unevenly dispersed, parallel to the sidewalk in the

park, beginning an open expanse of luscious, contoured grass between the city and the lake. The park is filled with hills covered in trees and lawns decorated with sculptural elements, both present and past.

The landscape of Chicago is an intense metamorphosis between the natural and the built. The tumultuous waters of Lake Michigan meet the natural earth, sculpted by years of weathering and erosion, now subject to transmogrification brought by human hands. The gentle landscape flows gently from the water's edge to the city's façade, meeting the base of the built environment, angling arduously in ascension to the sky.



{ SITE HISTORY }

830 S Michigan Avenue was first developed in 1894. It became the home to the Young Women's Christian Association (YWCA), an entry point for thousands of young women in Chicago for late 19th century and early 20th century. The YWCA was designed by John M. Van Osdel II, the "son of Chicago's first architect" (South Loop Historical Society, 2009).

The building stood for 116 years, spending its last thirty years vacant and deteriorating (Smith, 2009). In January of 2010, demolition began on the terribly neglected building. Two months later, after some horrid discoveries in the buildings infrastructure during demolition, the former Young Women's Christian Association was no longer part of the Michigan Avenue street wall, adding a blemish to the face of Chicago.

While the YWCA was still standing, but vacant, there were plans to construct an 80-story residential tower on the parking lot

to the west of the YWCA, at the intersection of 9th and Wabash. It was planned that the façade of the YWCA would be preserved as an entrance to the residential complex from Michigan Avenue. Unfortunately, these plans fell through and the YWCA was demolished as no other solutions to its vacancy could be agreed upon. In efforts to rescue the historic component to the Michigan Avenue street wall, it was discovered that the building's foundation was too shallow and its façade was not properly adhered to the building (Smith, 2009).

The Young Women's Christian Association was the first building to be demolished in the Historic Michigan Avenue District, and landmark district created in 2001 to preserve the face of Chicago. Since 2010, the site has sat dormant, an empty reminder of what once was.



TOP
Figure 55. A bird's-eye view of Chicago from elevation 700 ft. above Lake Michigan. *Photo courtesy of Kaufmann, Weimer & Fabry Co.*

MIDDLE LEFT
Figure 56. Young Women's Christian Association (1894-2010). *Photo courtesy of The South Loop Historical Society.*

MIDDLE RIGHT
Figure 57. Johnson Publishing Company Building, 1971. *Photo courtesy of Martine Syms.*

BOTTOM LEFT
Figure 58. YWCA. *Photo courtesy of Chicago Savvy Tours.*

{ SITE OVERVIEW }

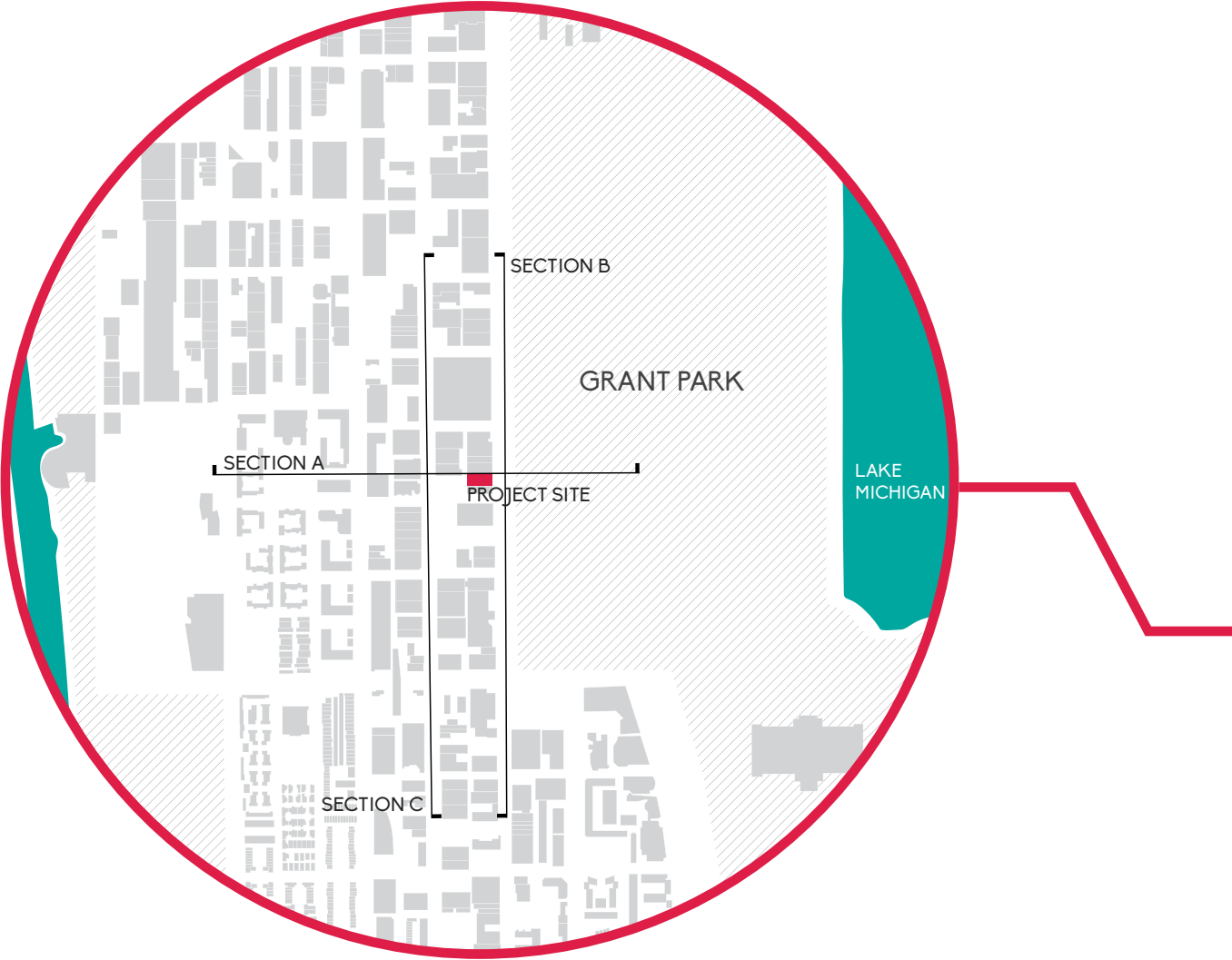
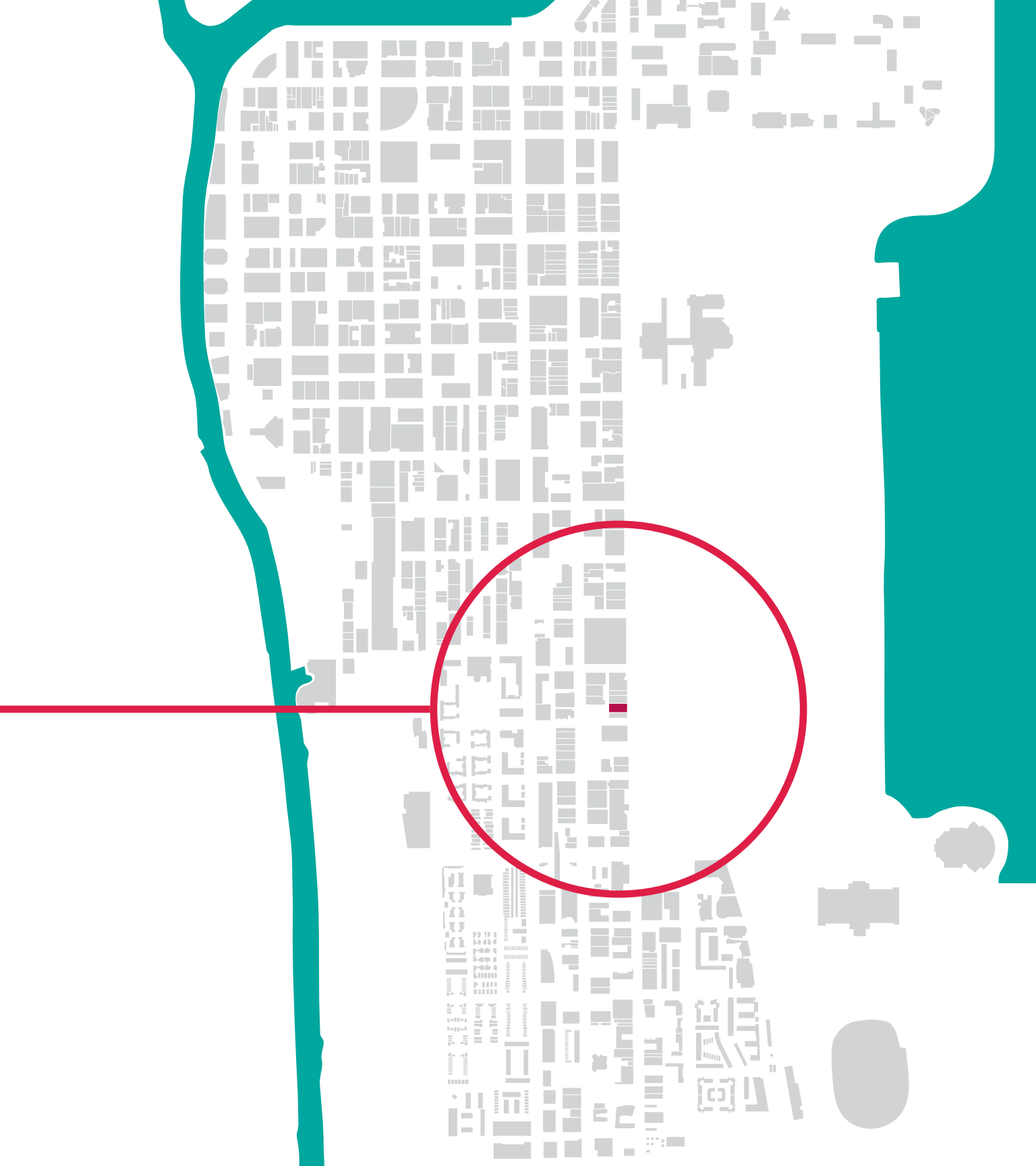


Figure 59. Site plan with section cuts.



{ MATERIALITY }

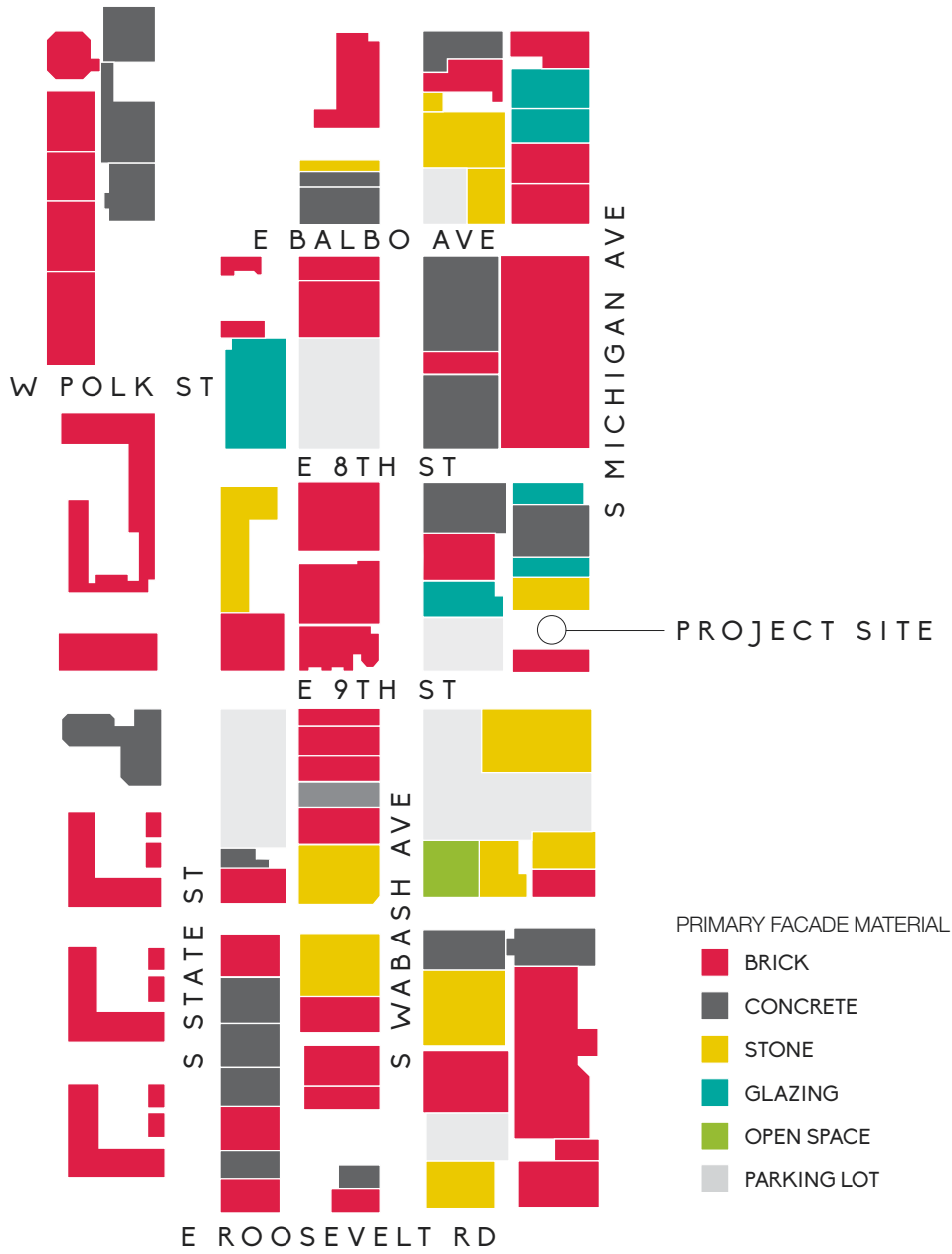




Figure 60. Materiality in section B.

MATERIALITY

The primary material used around the project site is brick. The façade of Michigan Avenue is diverse, however; brick in a variety of colors, different styles of stone, concrete, glazing, and metal panel, granting a future design a variety of material choices. The textures of these materials are fairly detailed—there are not many minimalist designs on this stretch of Michigan Avenue. Building heights along Michigan Avenue vary quite a bit, but maintain a consistent average, creating a uniform, yet dynamic skyline.

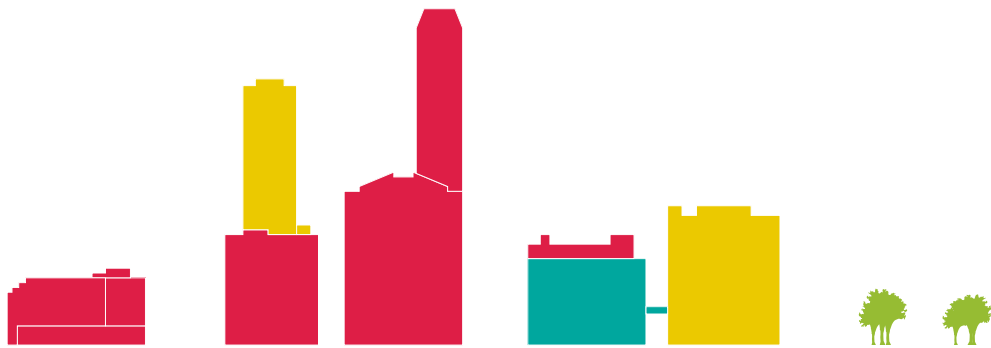


Figure 61. Materiality in section A.

{ LIGHT & SHADOW }

9:00

12:00

3:00

SUMMER SOLSTICE

EQUINOXES

WINTER SOLSTICE

■ PROJECT SITE



Figure 62. Shadow in section B.

LIGHT QUALITY

Due to the site's east-west orientation, the lack of buildings to the east, and the low height of buildings to the west, the site receives excellent sun exposure during spring, summer, and autumn. Winter months bring more shade due to the lower sun.

Half of the south edge of the site is exposed, receiving a fair amount of exposure during the warmer months, while the other half of the south edge is blocked by an eight-story building.

{ VISUAL FORM }

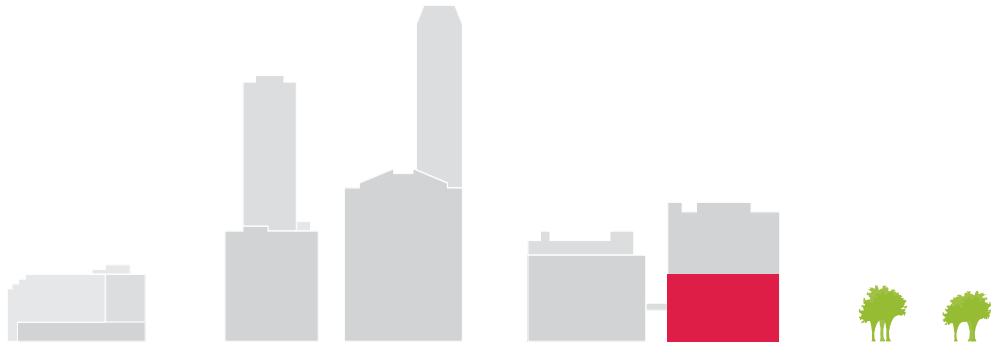


Figure 63. Site section A.

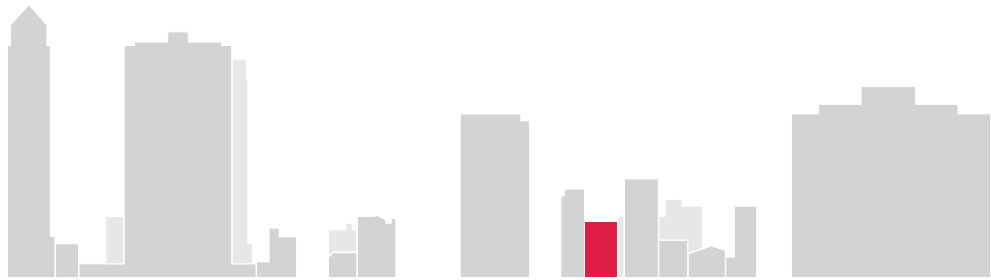


Figure 64. Site section B.

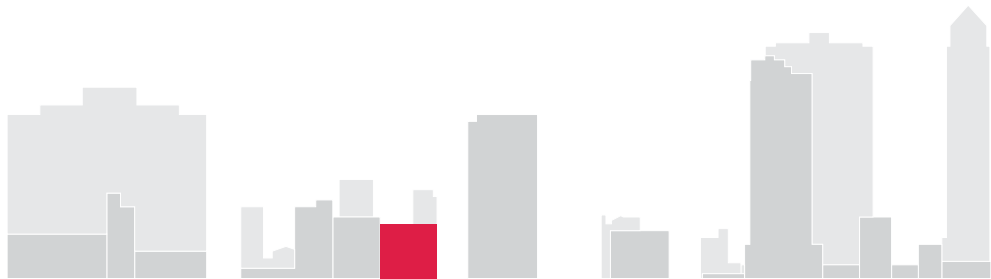


Figure 65. Site section C.

HUMAN CHARACTERISTICS & DISTRESS

The project sites sit between two busy streets in downtown Chicago—Michigan Avenue to the east and Wabash Avenue to the west—and is split in two by an alley. The eastern half of the site is currently unoccupied, fenced off, and covered in gravel. A parking lot resides on the western half of the site. The lot was about half full the day that I visited the site. There are a multitude of parking lots downtown, so it is expected that some of them may be used less than others.

The site has been previously developed. A building sat on the eastern half of the site until 2010 when it was torn down. The lot has been vacant ever since. It is covered in gravel with some weeds poking through the surface of the site. After a good rain, pools of water form on the site. This is not much of a concern as the site is a case of urban infill and the majority of the footprint of the site will be occupied by a building.

{ CIRCULATION }





Figure 66. The "L" train. Photo by Jakob Lawman.

CHICAGO TRANSIT AUTHORITY

The Chicago Transit Authority (CTA) is in charge of the United States' second largest transit station, serving approximately 1.7 million riders every day. It contains different train routes and over 120 bus routes in Chicago and 35 surrounding suburbs (Chicago Transit Authority, 2013).



Figure 67. Divvy. Photo by Jakob Lawman.

DIVVY BIKES

Divvy is a bike-share system in Chicago, supplying the city with over 4,000 bikes at over 400 stations. A 24-hour pass is \$7.00, while an annual membership is \$75.00, each option allowing unlimited 30-minute trips 24 hours a day, 365 days a year (Divvy Bikes, 2013).

{ NOISE }





Figure 68. Jackson & Lake Shore Drive. Photo by Jakob Lawman.

SOURCES OF NOISE

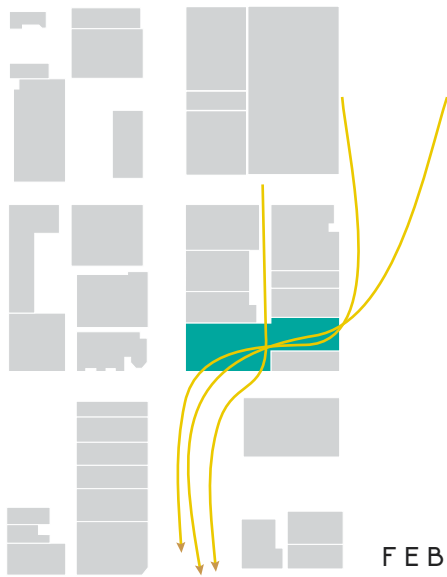
The primary source of sound around the project site is vehicular traffic. It is located near two medium-activity intersections on Michigan Avenue and Wabash Avenue and one and a half blocks from the “L” train. An average of 33,000 vehicles drive past the project site on Michigan and 9,000 on Wabash every day. The “L” Green and Orange lines pass by about every 10 minutes. The noise created by this traffic is pretty consistent, but mostly noninvasive to an indoor environment.

Other sources of noise on the site may include construction work and events held in Grant Park, but there are trees along Michigan Avenue to buffer noise from the park.

{ WIND & AIR MOVEMENT }



OCTOBER — JANUARY



FEBRUARY — SEPTEMBER



Figure 69. Oak Street Beach. Photo by Jakob Lawman.

THE WINDY CITY”

Because of Chicago’s location on Lake Michigan, the city has been nicknamed “The Windy City.” Due to the nature of the built environment in Chicago, wind tunnels are created in the streets and alleys between buildings. The full west and east edges and part of the south edge will be exposed to wind.

{ GEOLOGY & HYDROLOGY }

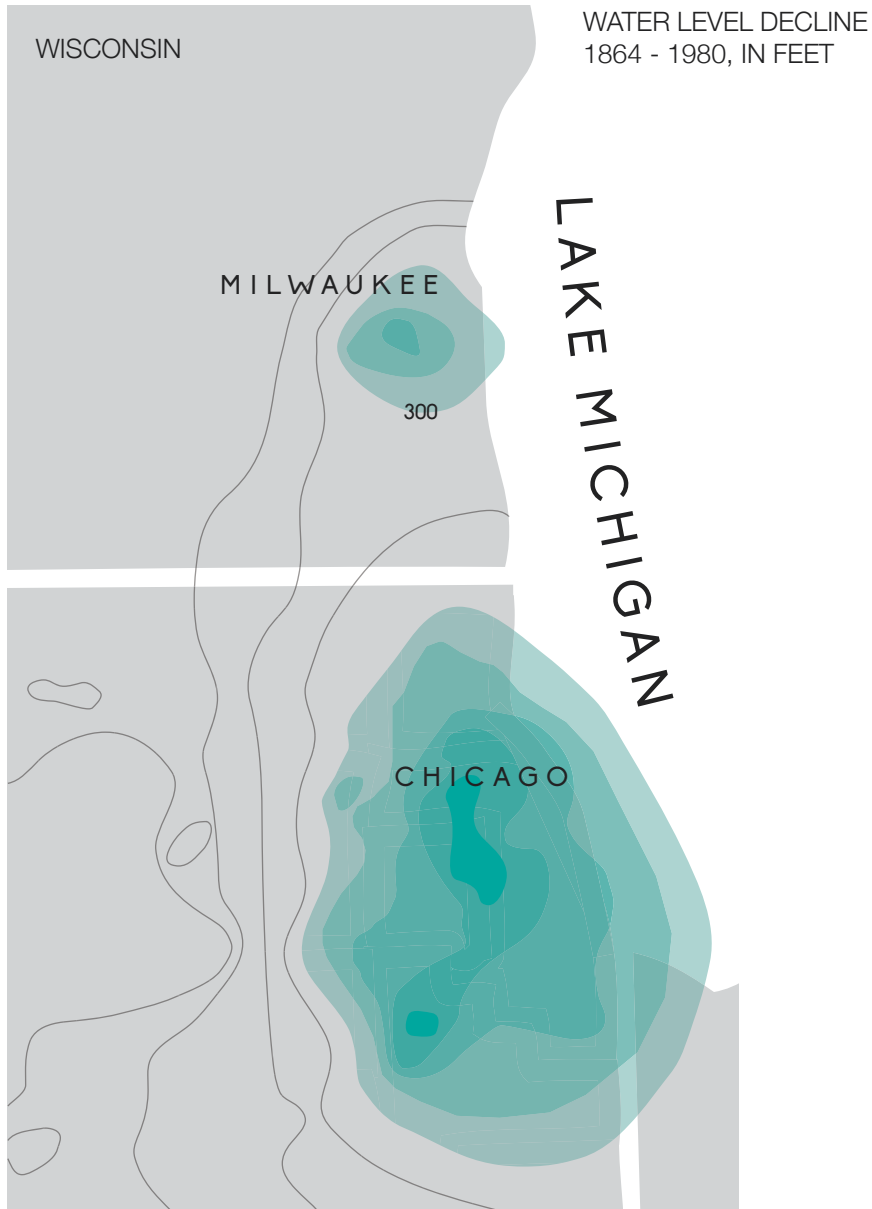




Figure 70. Lincoln Park Lagoon. Photo by Jakob Lawman.

SOILS

TYPE	802B — orthents, loamy, undulating
TAXONOMY	Entisol
SLOPE	1 to 6 percent
DRAINAGE CLASS	Well drained
WATER TABLE	42 to 60 inches
PROFILE	Loam, clay loam

WATER TABLE

The groundwater levels between 1864 and 1980 fell as much as 900 feet in the Chicago area. Groundwater has been the primary source of drinking water for much of the Great Lakes region, leading to its gradual decline in the past century and a half.

{ ZONING }

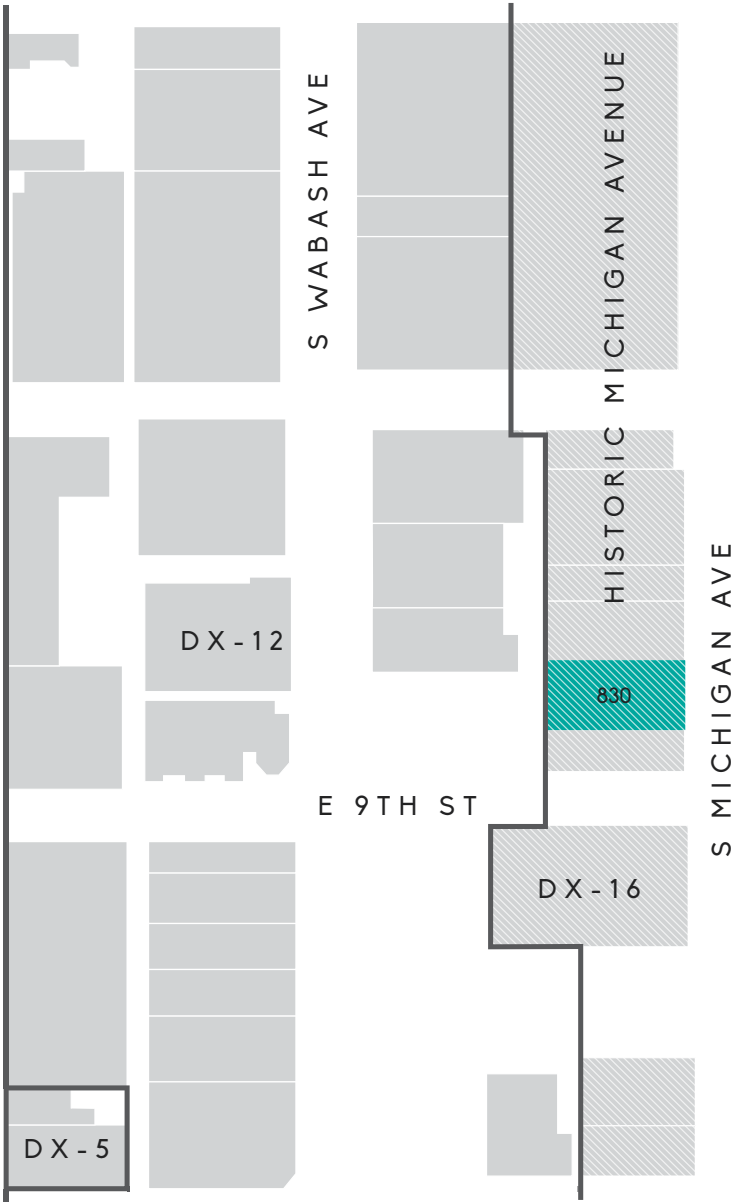




Figure 71. Southeast from Willis Tower Skydeck, 103rd floor. Photo by Jakob Lawman.

ZONING

The project site resides in the Downtown Mixed-Use zoning district, but is divided into two more specific zoning districts. The east half of the site is DX-16 and resides in the Historic Michigan Avenue landmark district, while the west half of the site is located in the DX-12 zoning district.

830 S MICHIGAN AVENUE

ZONE	DX-16
FAR	16
SETBACKS	None

{ SITE RECONNAISSANCE }

TOP LEFT

Figure 72. Site, NW. *Photo by Jakob Lawman.*

BOTTOM LEFT

Figure 74. Site, W on sidewalk. *Photo by Jakob Lawman.*

TOP RIGHT

Figure 73. Site, SW. *Photo by Jakob Lawman.*

BOTTOM RIGHT

Figure 75. Site, W across street. *Photo by Jakob Lawman.*



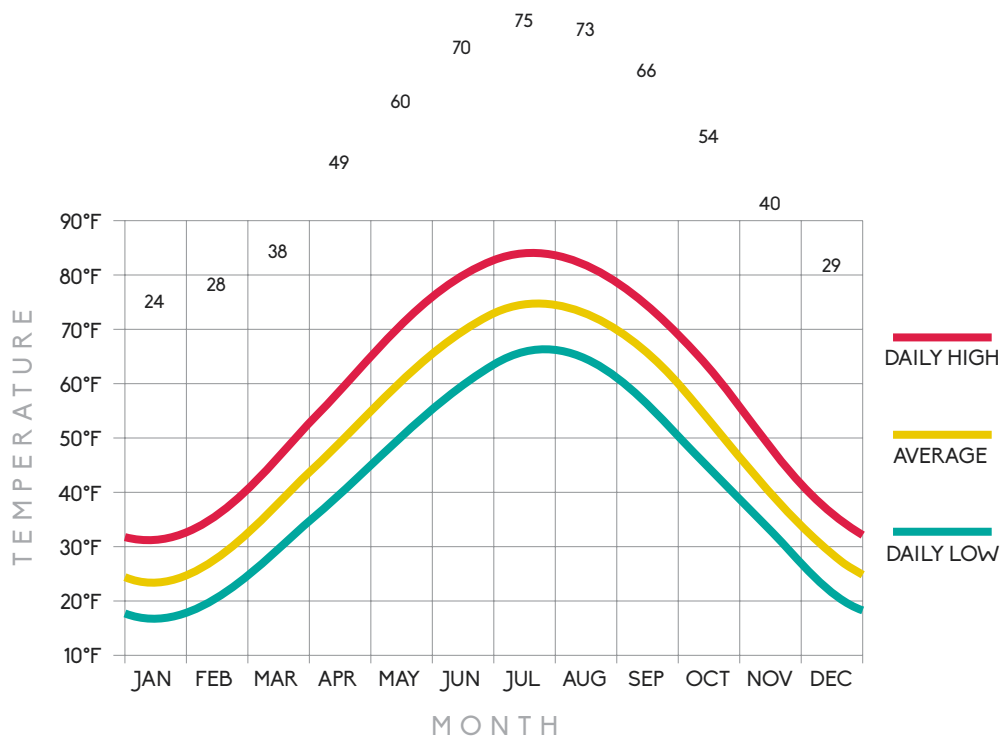
TOP LEFT & RIGHT.
Figure 76. Grant Park, N. *Photo by Jakob Lawman.*

BOTTOM LEFT.
Figure 77. John A. Logan Statue, Grant Park, NW.
Photo by Jakob Lawman.

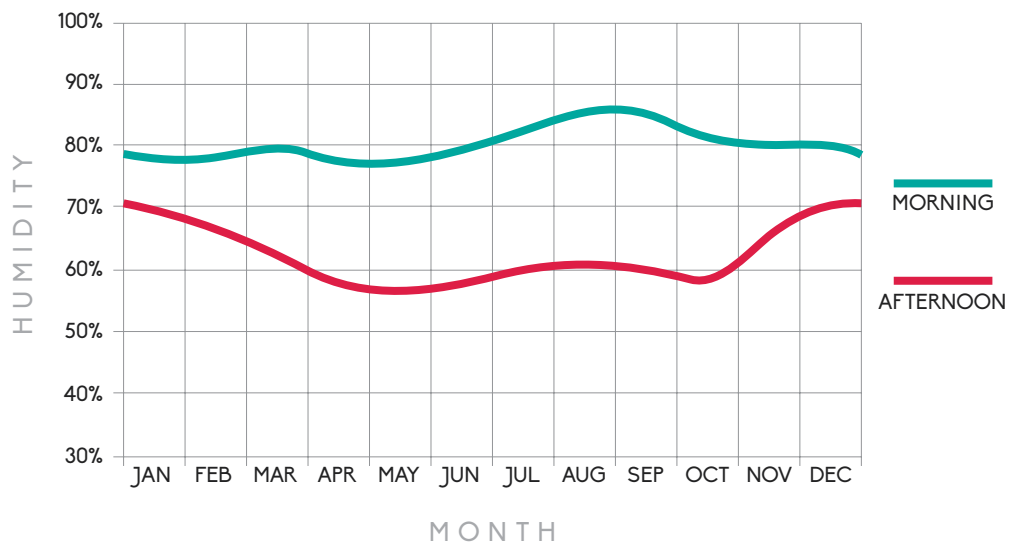
BOTTOM RIGHT.
Figure 78. Agora, Grant Park, N. *Photo by Jakob Lawman.*

{ CLIMATE
DATA }

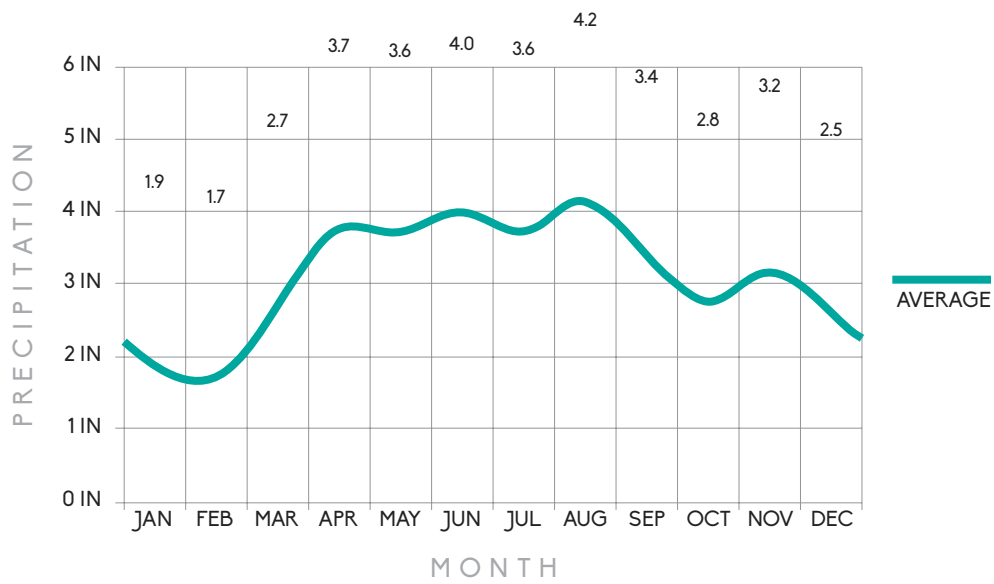
{ TEMPERATURE }



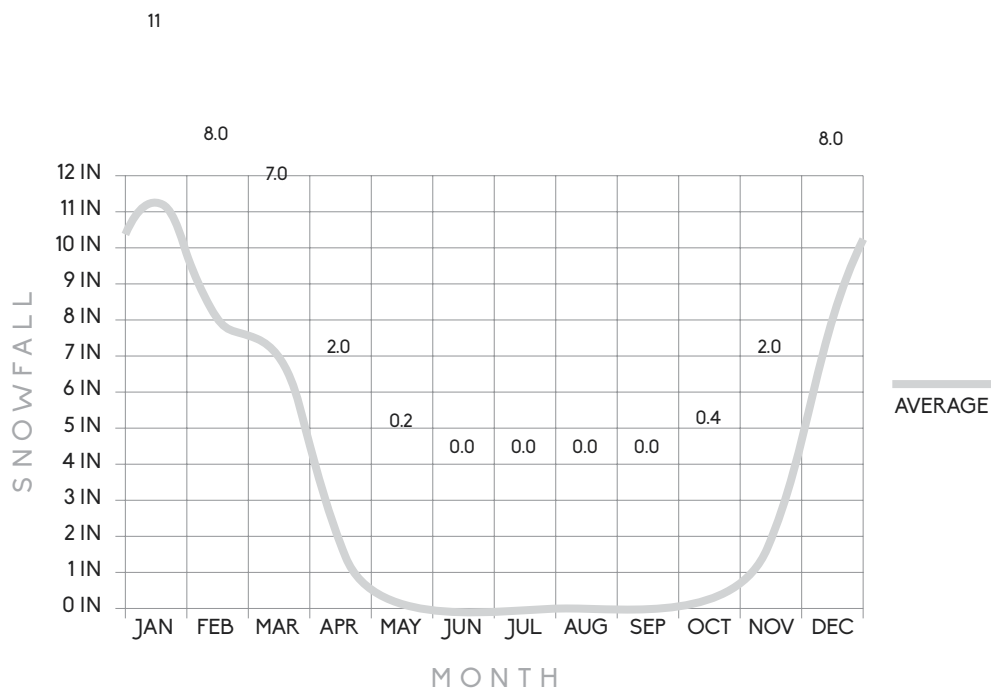
{ HUMIDITY }



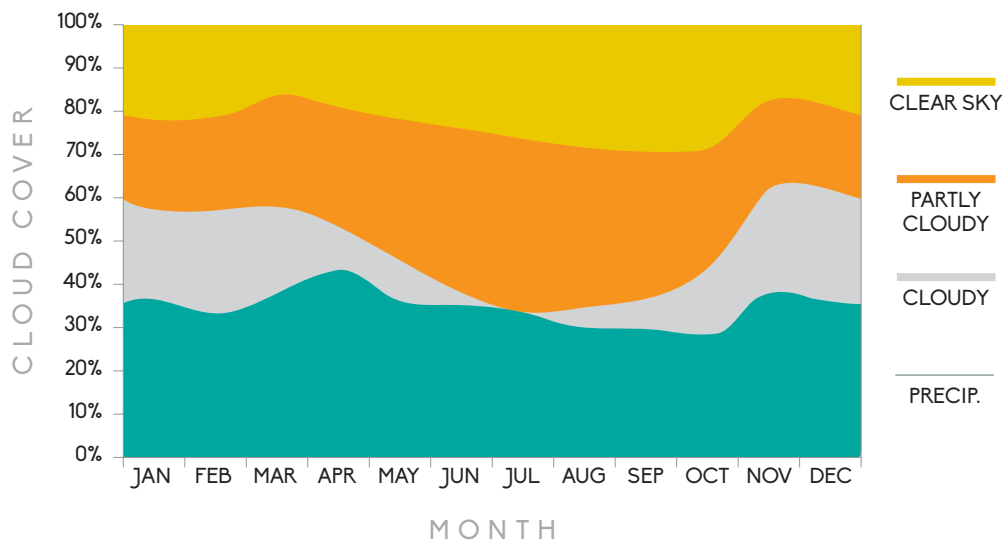
{ PRECIPITATION }



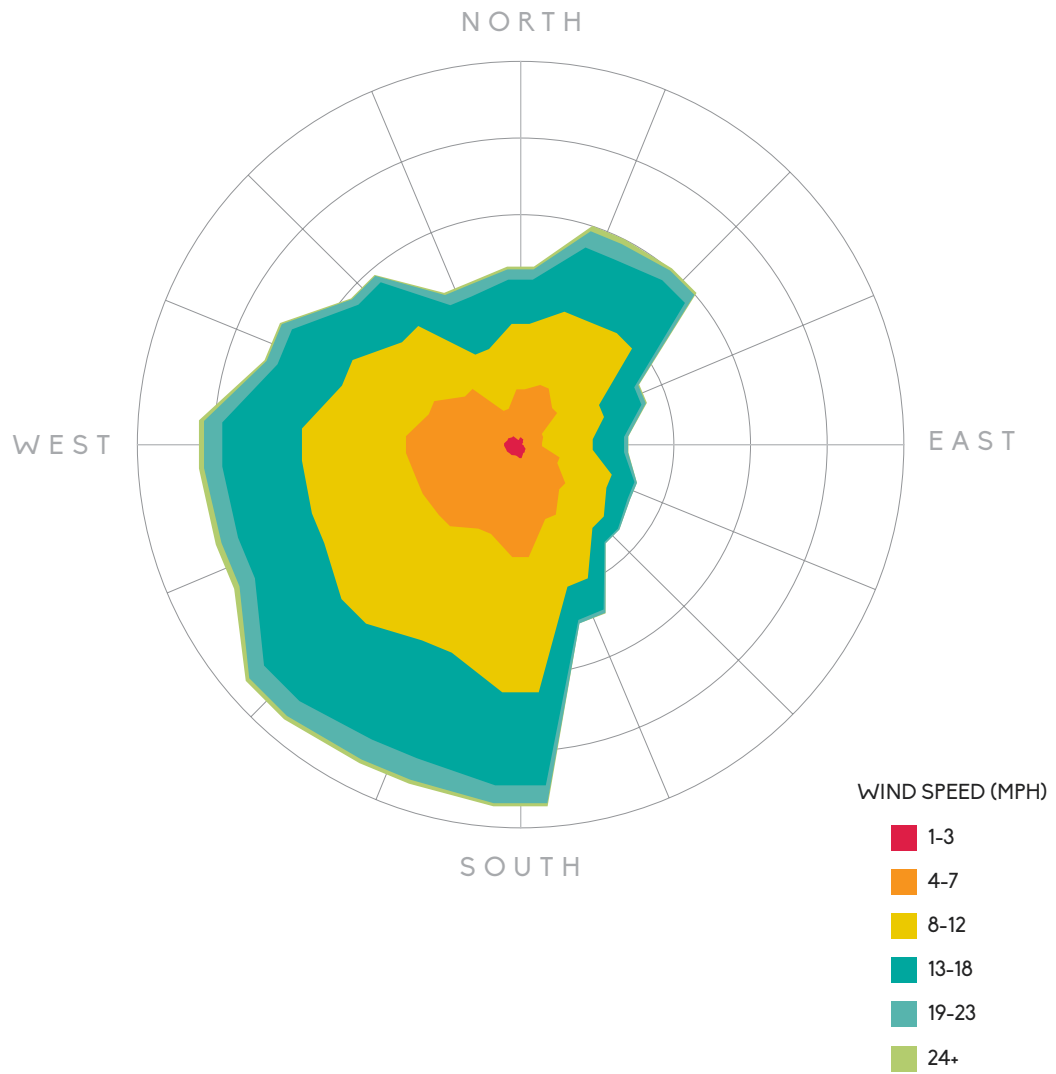
{ SNOWFALL }



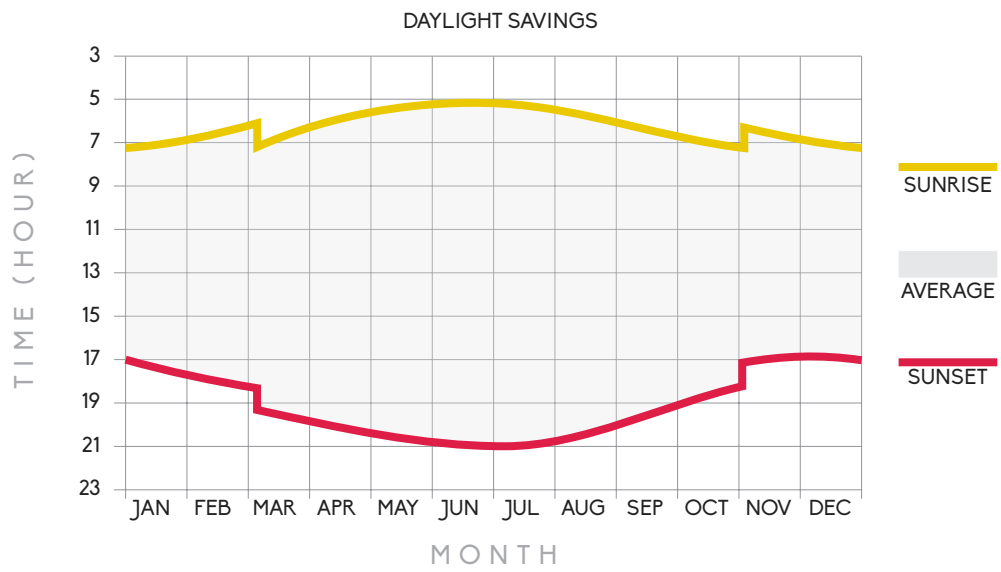
{ CLOUD COVER }



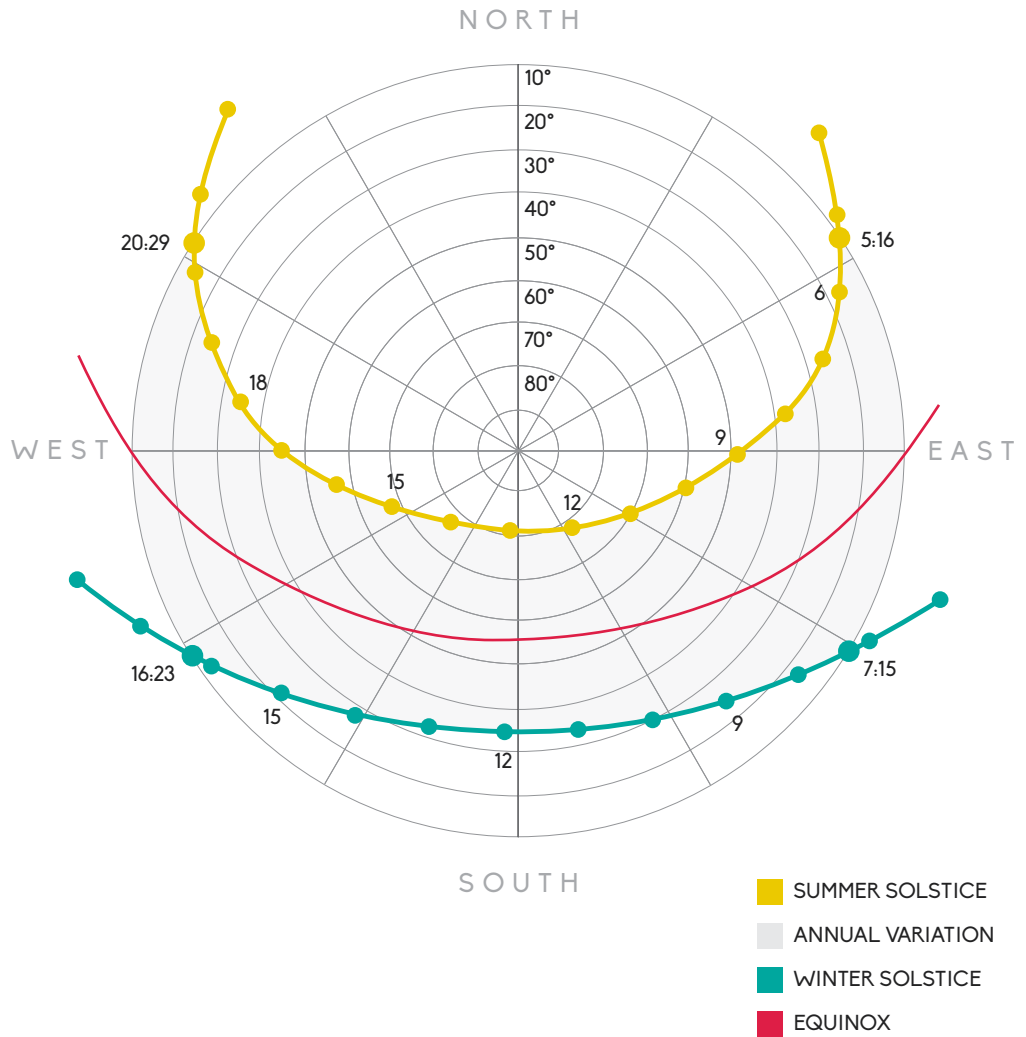
{ WIND ROSE }



{ SUNRISE & SUNSET }

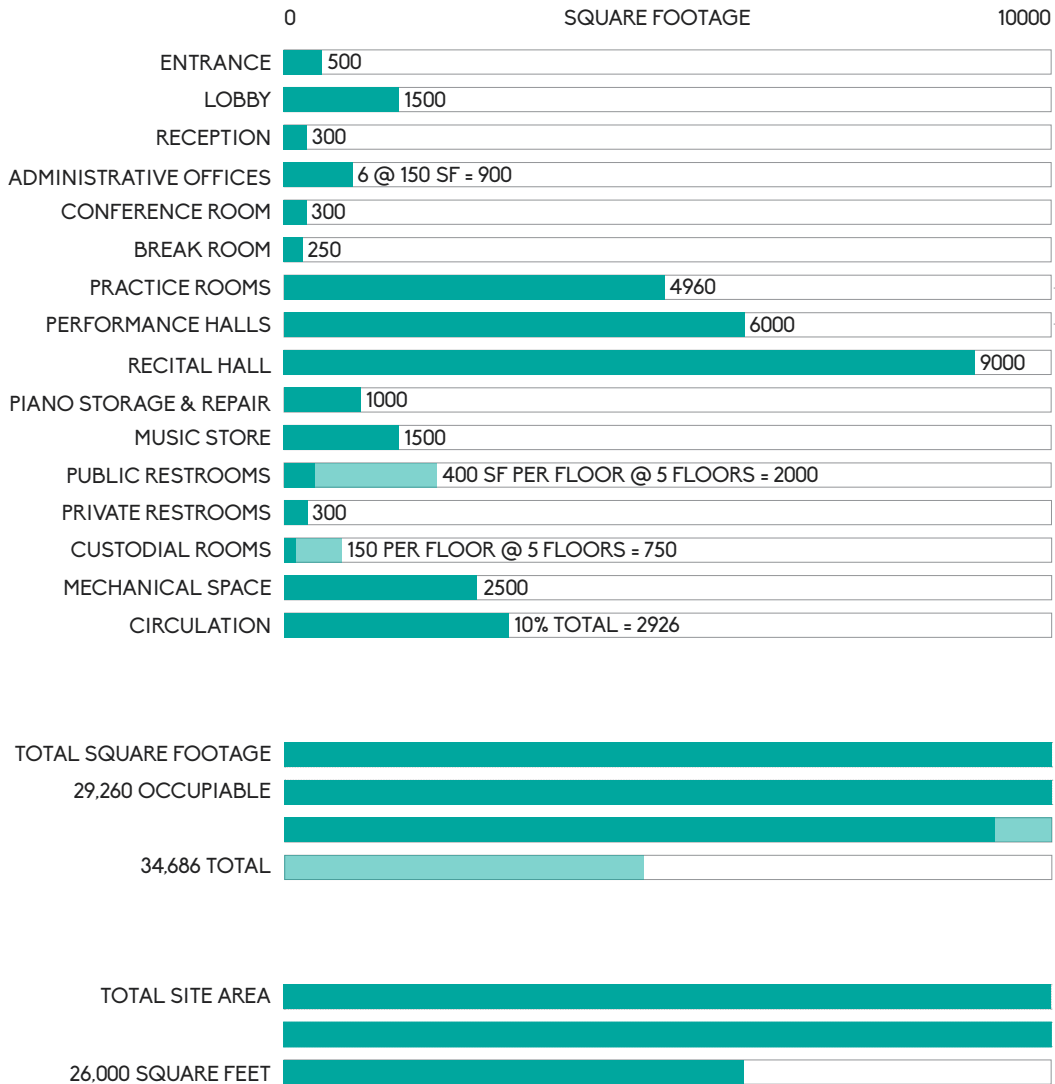


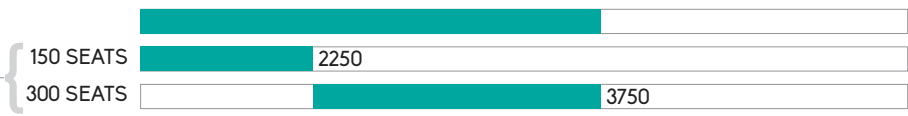
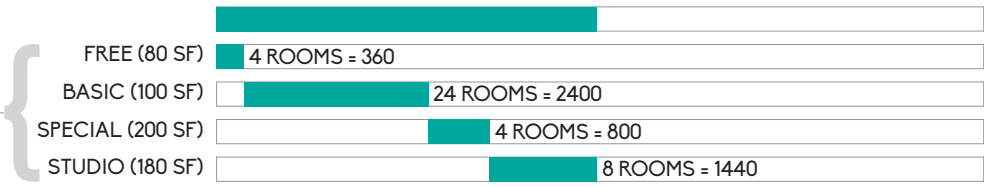
{ SUN PATH }



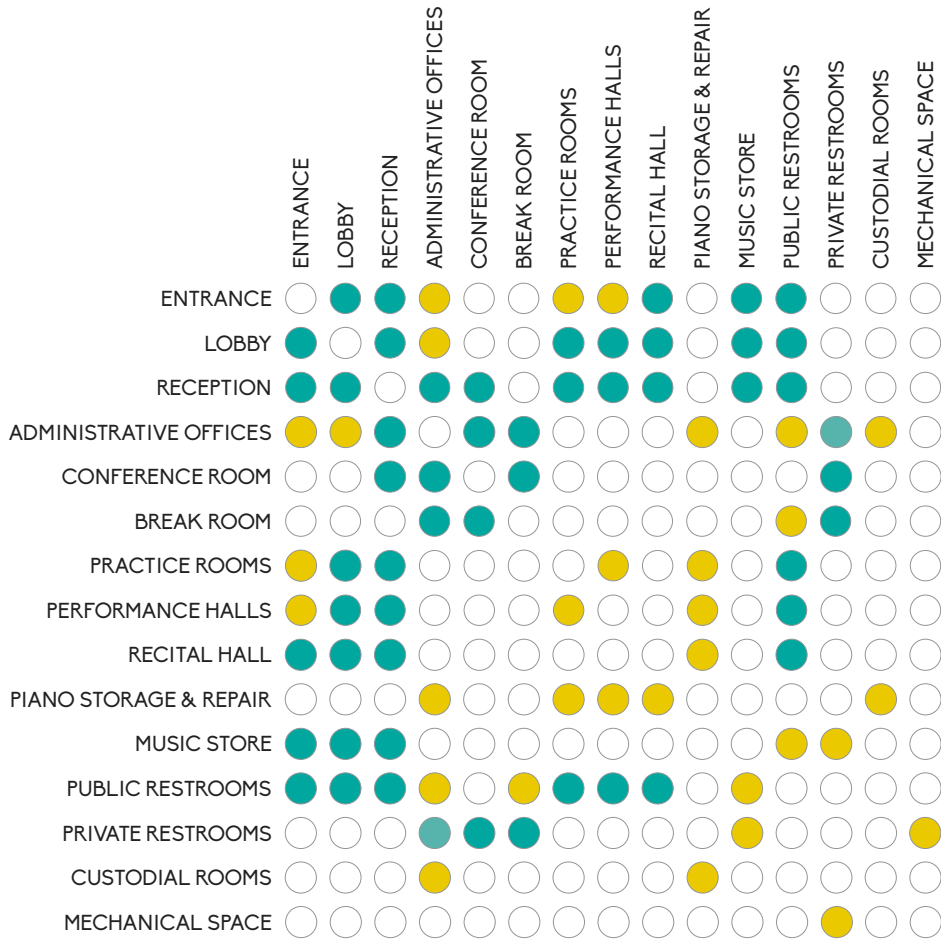
{ PROGRAMMATIC
REQUIREMENTS }

{ SPACE ALLOCATION }





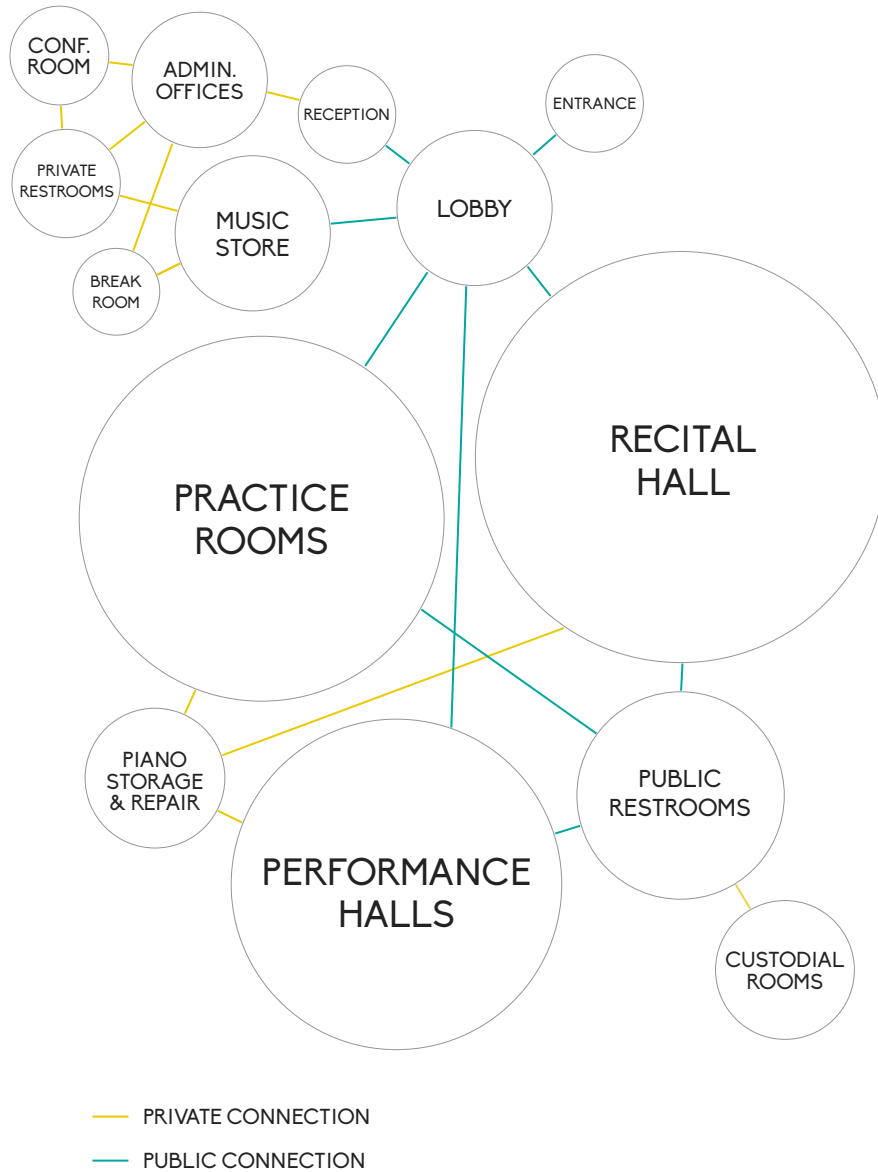
{ INTERACTION MATRIX }



- NO RELATION
- INDIRECT CONNECTION
- DIRECT CONNECTION



{ INTERACTION NET }

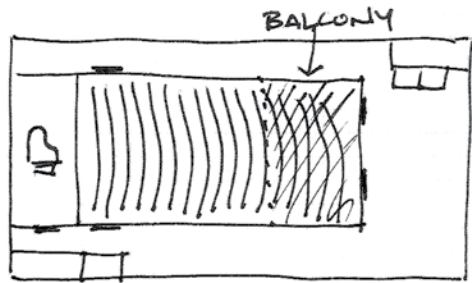




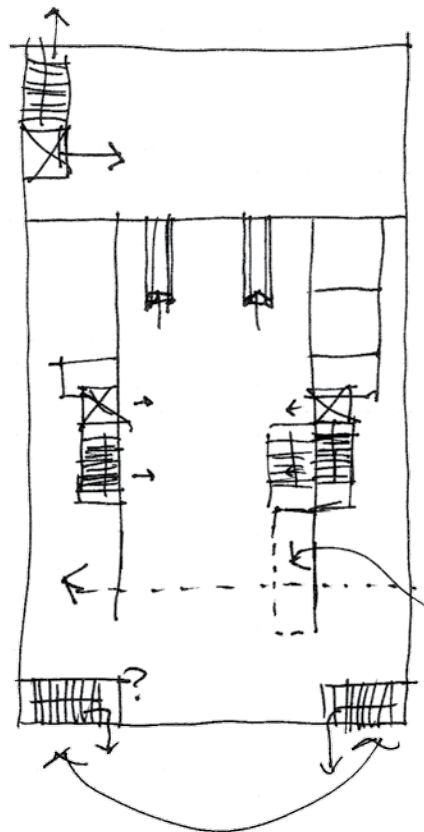
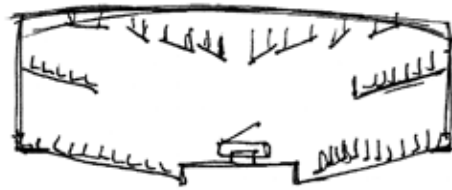
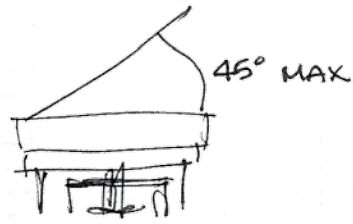
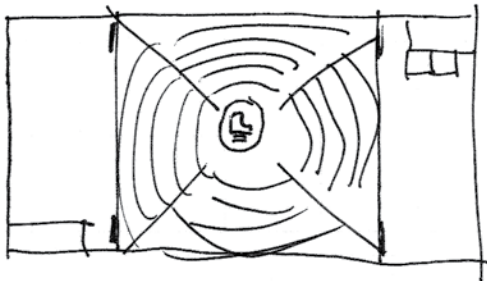
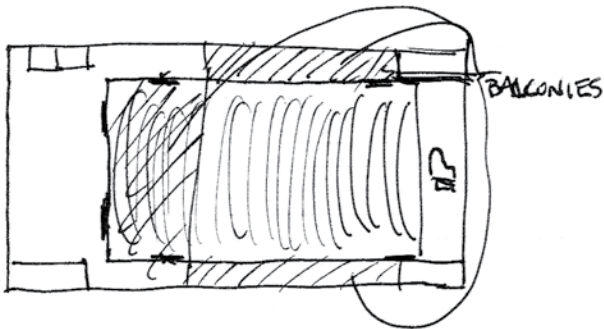
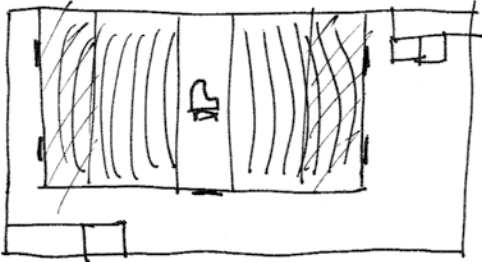
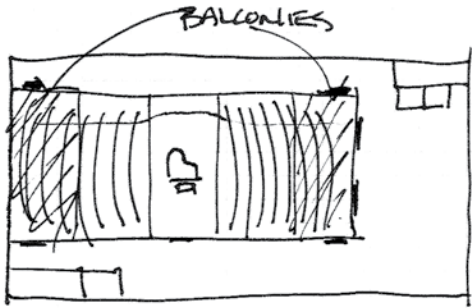
THE DESIGN



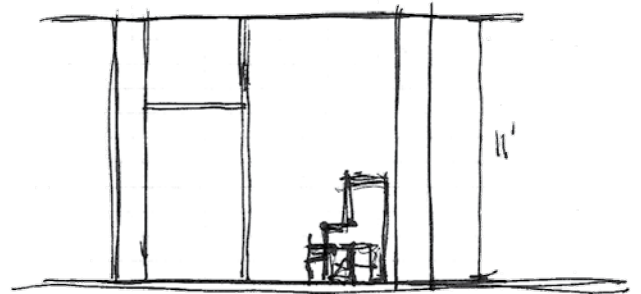
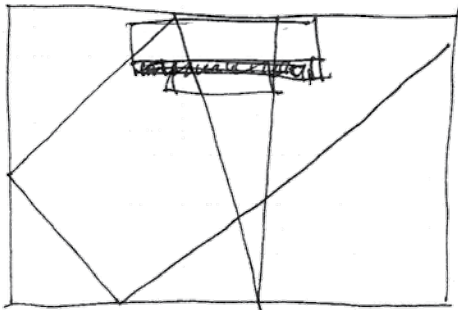
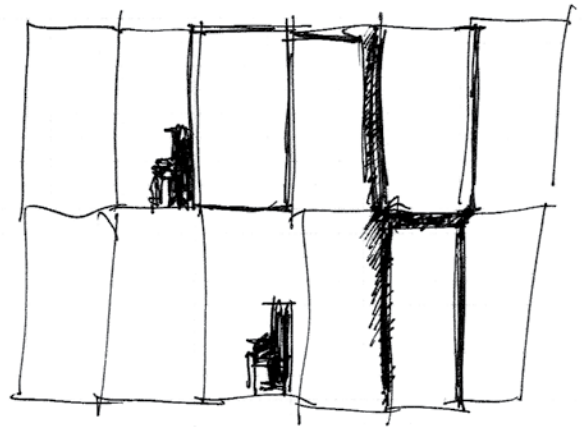
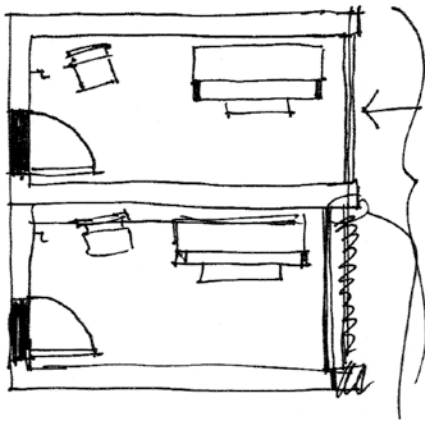
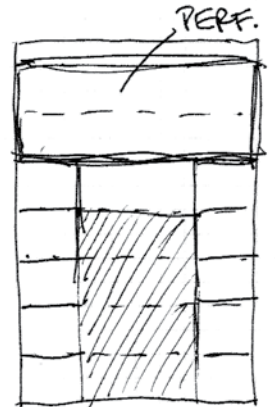
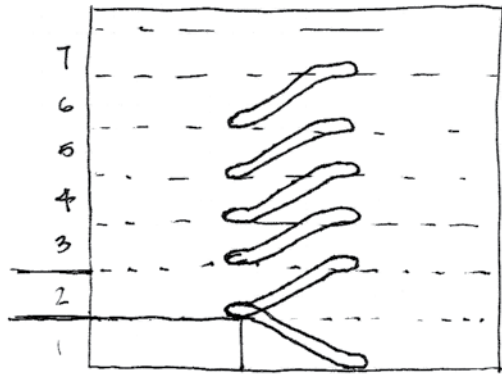
DESIGN
PROCESS



MICHIGAN

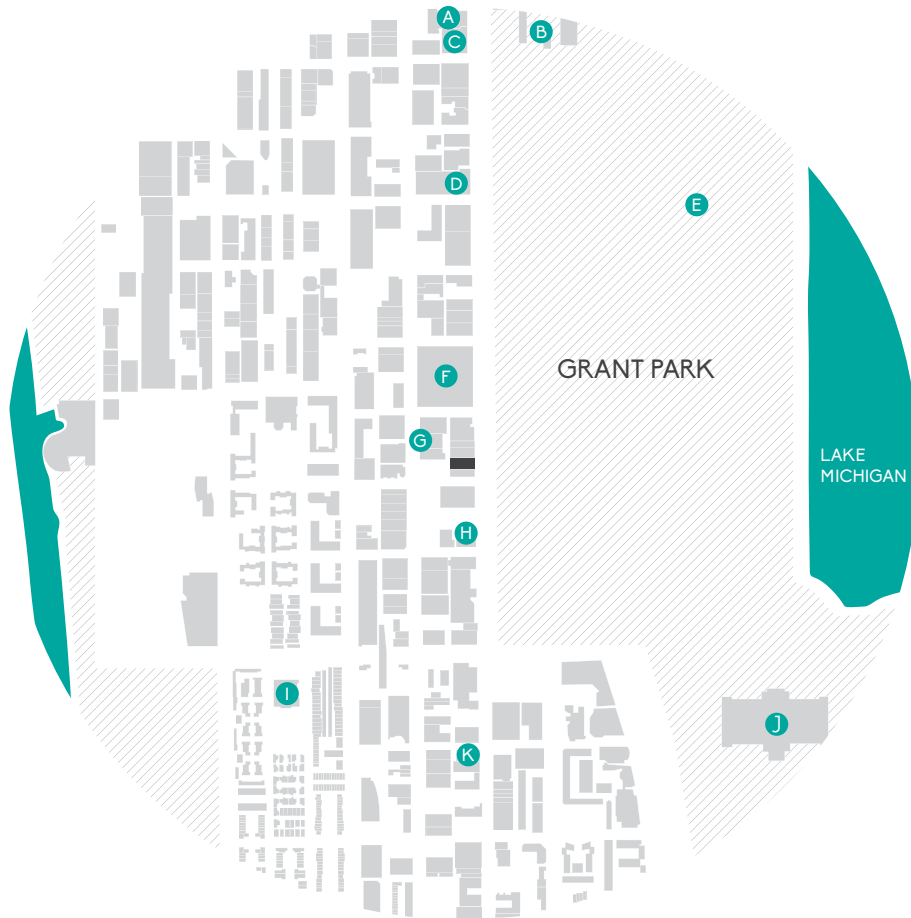


ADACIO
ANDANTE
MODERATO
ALLEGRO
PRESTO



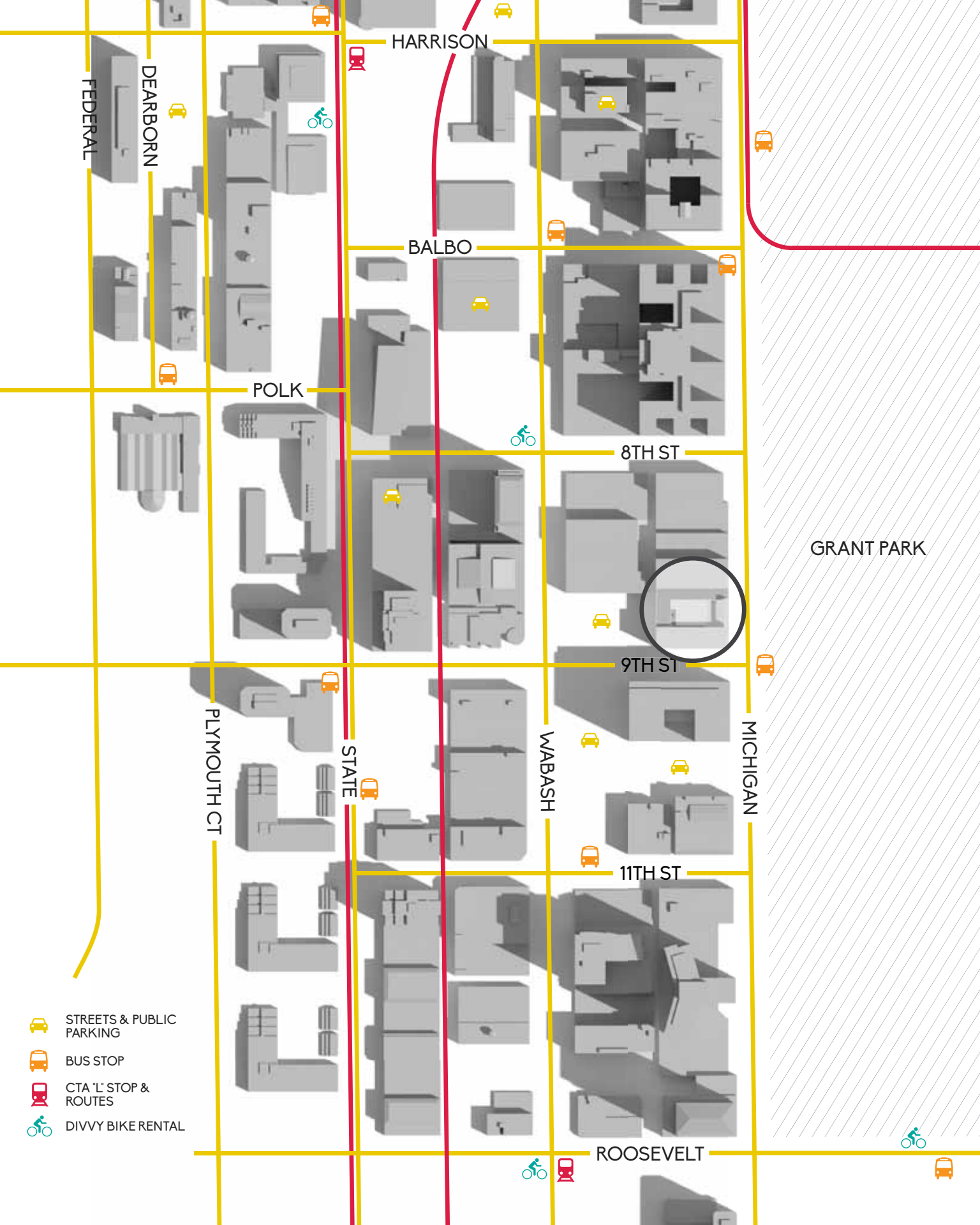
{ DESIGN
SOLUTION }

{ CONTEXT }



It was critical to locate Adagio on a site that was able to play off local social resources and become a service to those who passed by the site regularly.

- A CHICAGO SYMPHONY ORCHESTRA
- B CHICAGO ART INSTITUTE
- C CHICAGO ARCHITECTURE FOUNDATION
- D CHICAGO COLLEGE OF PERFORMING ARTS
- E BUCKINGHAM FOUNTAIN
- F HILTON CHICAGO
- G EAST-WEST UNIVERSITY MUSIC DEPARTMENT
- H COLUMBIA COLLEGE MUSIC DEPARTMENT
- I SOUTH LOOP ELEMENTARY SCHOOL
- J THE FIELD MUSEUM
- K SHERWOOD COMMUNITY MUSIC SCHOOL



HARRISON

BALBO

POLK

8TH ST

9TH ST

11TH ST

ROOSEVELT

GRANT PARK

FEDERAL

DEARBORN

PLYMOUTH CT

STATE

WABASH

MICHIGAN

STREETS & PUBLIC PARKING

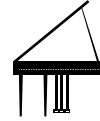
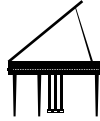
BUS STOP

CTA 'L' STOP & ROUTES

DIVVY BIKE RENTAL

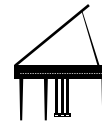
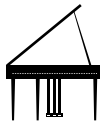
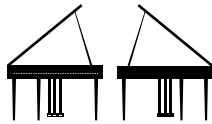


{ PROGRAM ELEMENTS }



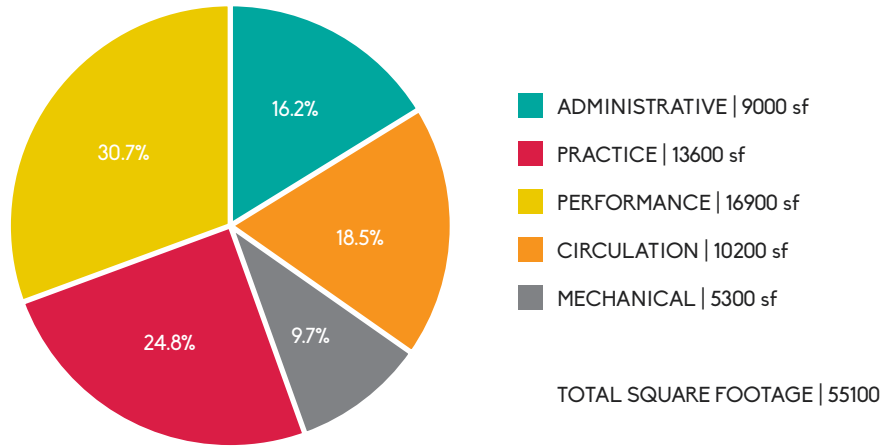
FREE ROOM	UPRIGHT ROOM	GRAND ROOM	PIANO STUDIO
6 ROOMS	20	8	10
FREE	MEMBERSHIP	MEMBERSHIP	LEASE
1 OCCUPANT	1	1	2

PRACTICE

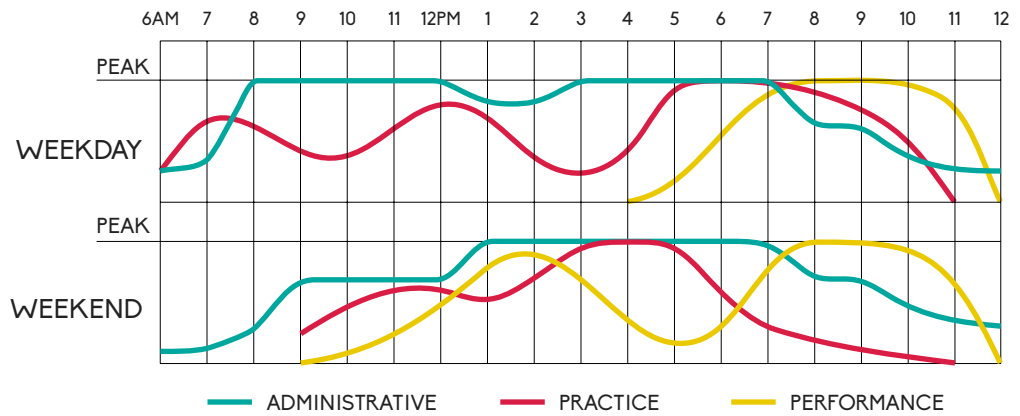


RECORDING STUDIO	DUELING PIANOS	AUDITORIUM	RECITAL HALL
1	1	1	1
HOURLY RATE	FREE	RESERVATION	TICKET SALES
1	2	100	648

PERFORMANCE



SPACE ALLOCATION



BUILDING USAGE

{ ADAGIO }

Adagio offers a variety of different environments for people to practice and perform. There are 34 practice rooms containing either an upright or baby grand piano. Six of them are free to the public and the remaining require a membership to Adagio. Access to the practice rooms is then granted via member key card access.

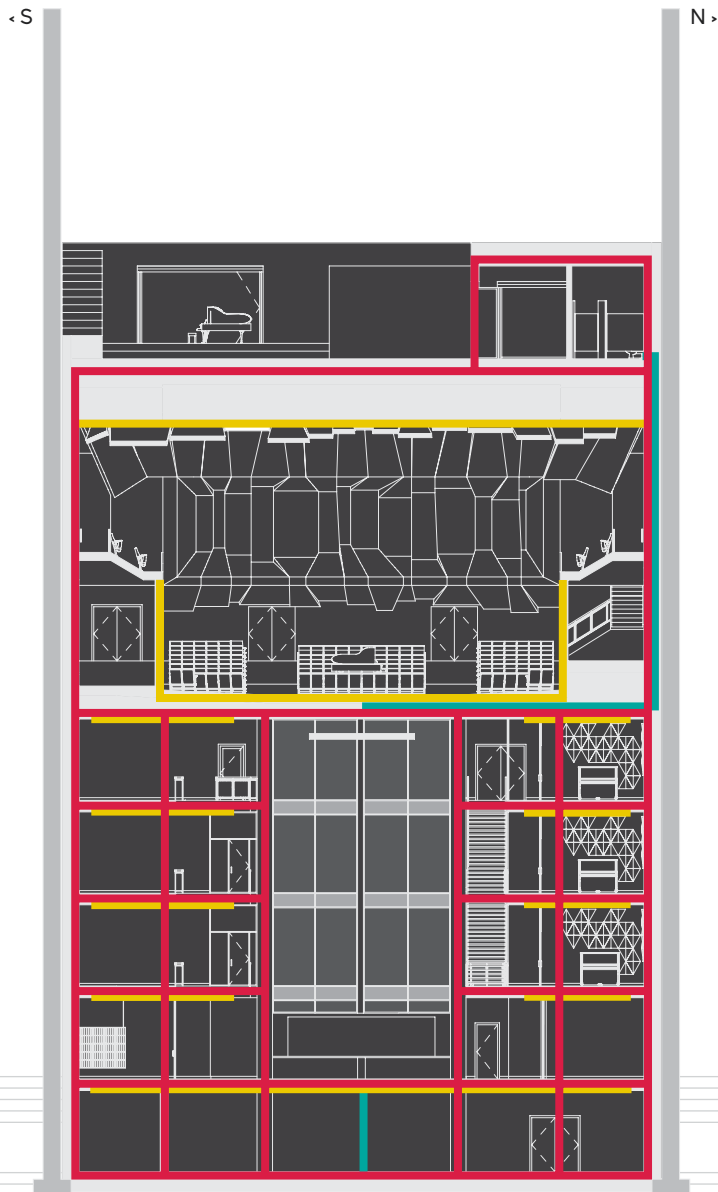
Ten piano studios occupy the southwest corner of the building on three floors. These are available for professionals, educators, and others to lease and use for a private studio or piano lessons.

There are a number of spaces for performance throughout the building. The second floor houses a lounge for dueling pianos, the fourth floor contains a 100-seat auditorium, the fifth & sixth floors hold the 658-seat recital hall, and the rooftop offers entertainment during the warmer months of the year before and after performances.

The first floor of the building houses a reception center for managing memberships and facilitating events throughout the building. Adjacent to the reception is a sheet music library, where members can borrow copies of music for use in the practice rooms.

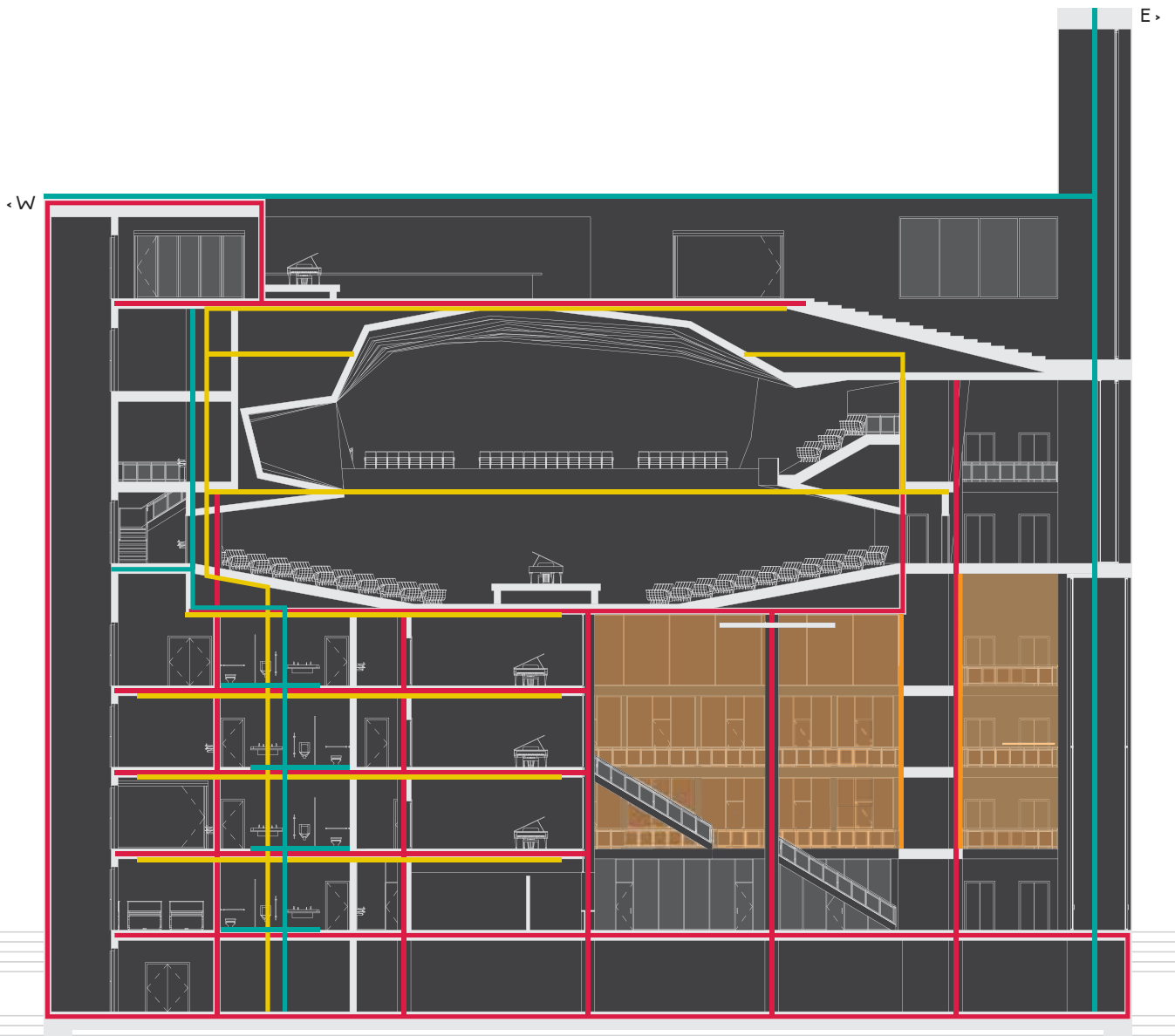


{ TRANVERSE SECTION }



- PLUMBING
- STRUCTURE
- HVAC
- FIRE PROTECTION

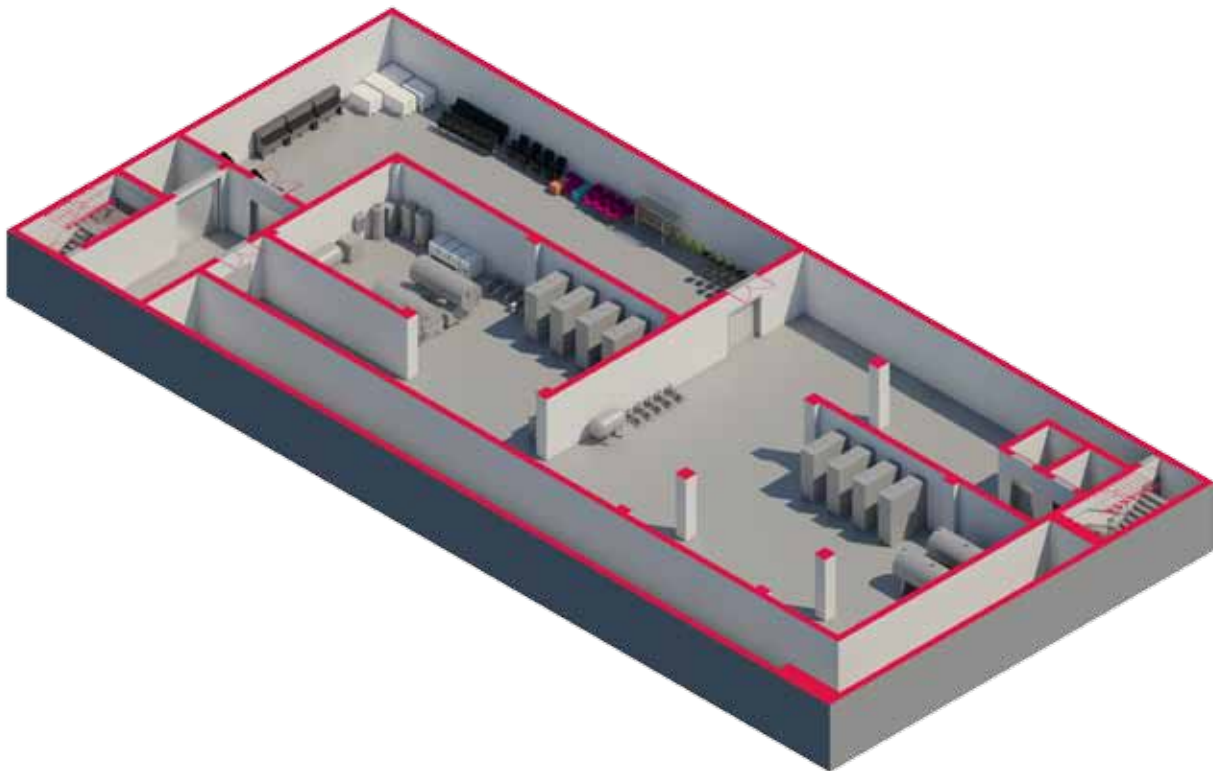
{ LONGITUDINAL SECTION }



{ BASEMENT }

MECHANICAL SPACE
STORAGE

The sublevel of Adagio provides an overflow storage area for extra pianos, sheet music, and furniture. All of the mechanical systems are housed in the basement as well.



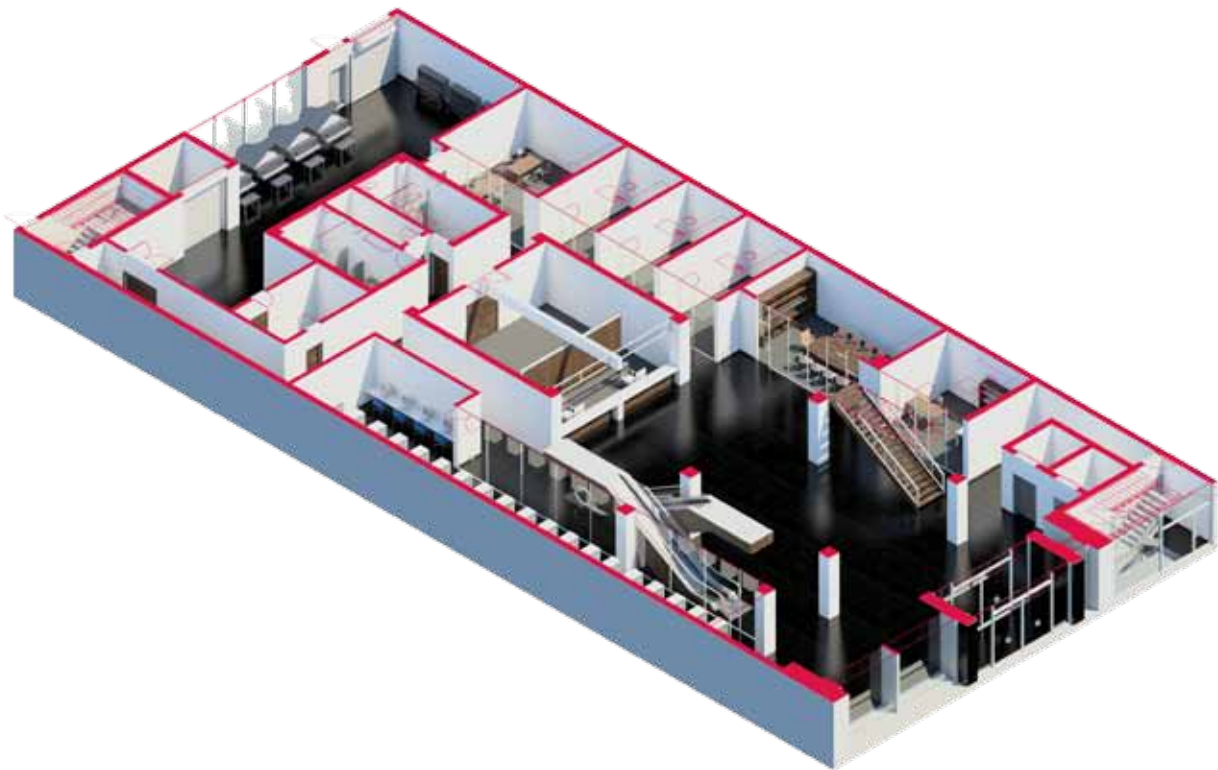


3D SECTION

{ FIRST FLOOR }

SHEET MUSIC LIBRARY | 1100 sf
ADMINISTRATIVE OFFICES | 800 sf
CONFERENCE ROOM | 350 sf
BREAK ROOM | 350 sf
PIANO REPAIR | 1600 sf

Surrounded by practice rooms and the sound of material palette derived from piano keys and the instruments wooden body, the atrium is truly a celebration of the piano.





CENTRAL ATRIUM

{ SECOND FLOOR }

PRACTICE ROOMS | 1975 sf

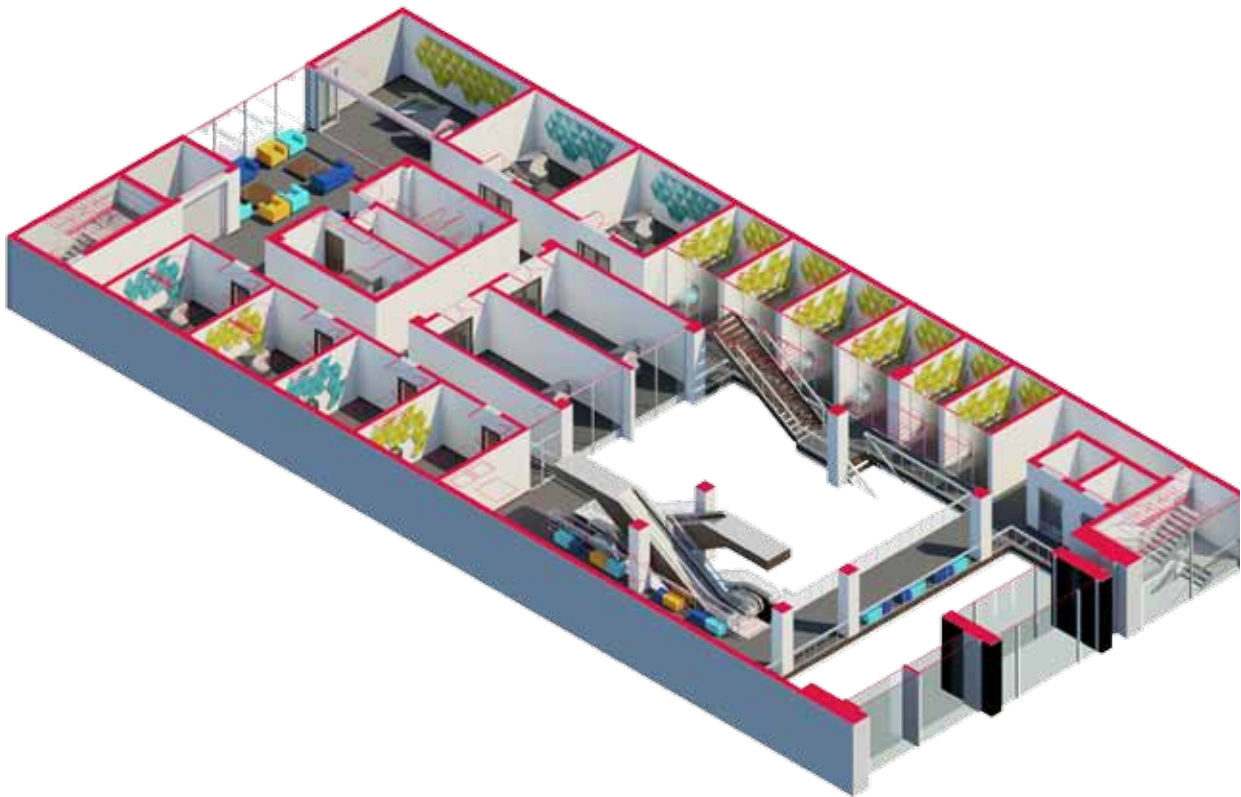
PIANO STUDIOS | 975 sf

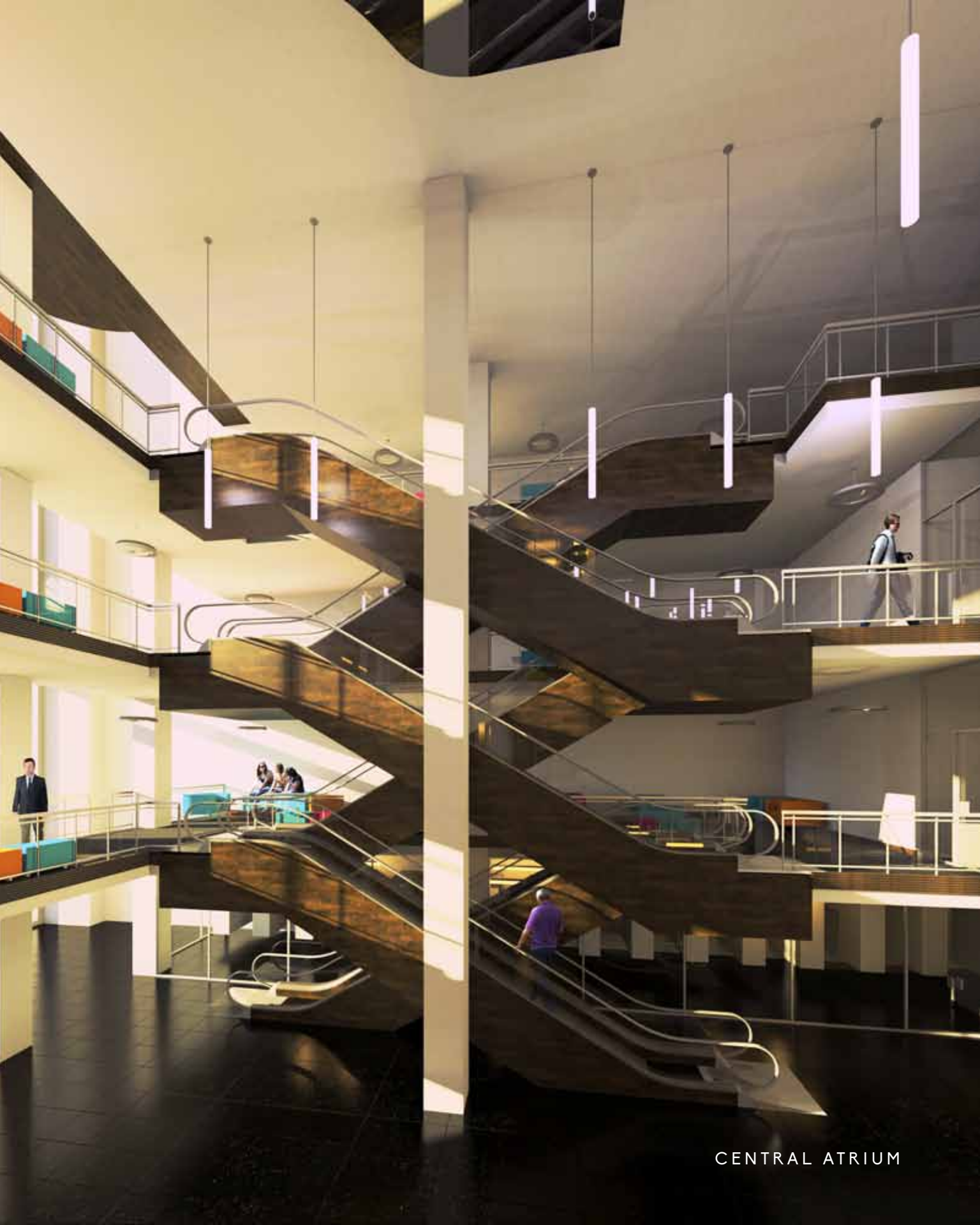
DUELING PIANOS | 425 sf

WEST LOUNGE | 800 sf

SOUTH LOUNGE | 875 sf

The atrium continues through the first four floors of the building, connecting spaces visually and auditorily. The west side of the second floor houses the dueling pianos performance lounge.





CENTRAL ATRIUM



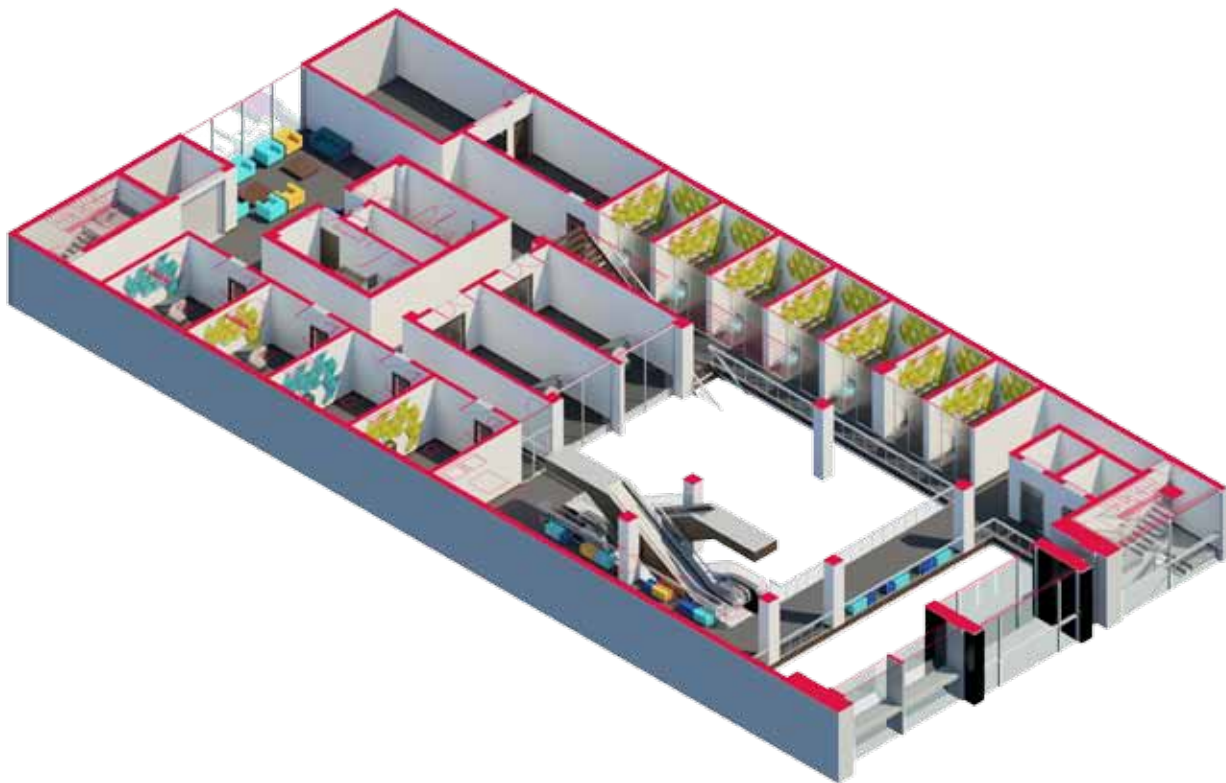


DUELING PIANOS

{ THIRD FLOOR }

PRACTICE ROOMS | 1525 sf
PIANO STUDIOS | 975 sf
RECORDING STUDIO | 750 sf
WEST LOUNGE | 800 sf
SOUTH LOUNGE | 875 sf

Much like the second floor, the practice rooms are located on the north side of the building and the piano studios are located to the south. A recording studio occupies the west side of this floor.





COM. THE CENTER FOR PIANO

CENTRAL ATRIUM

{ FOURTH FLOOR }

PRACTICE ROOMS | 1525 sf

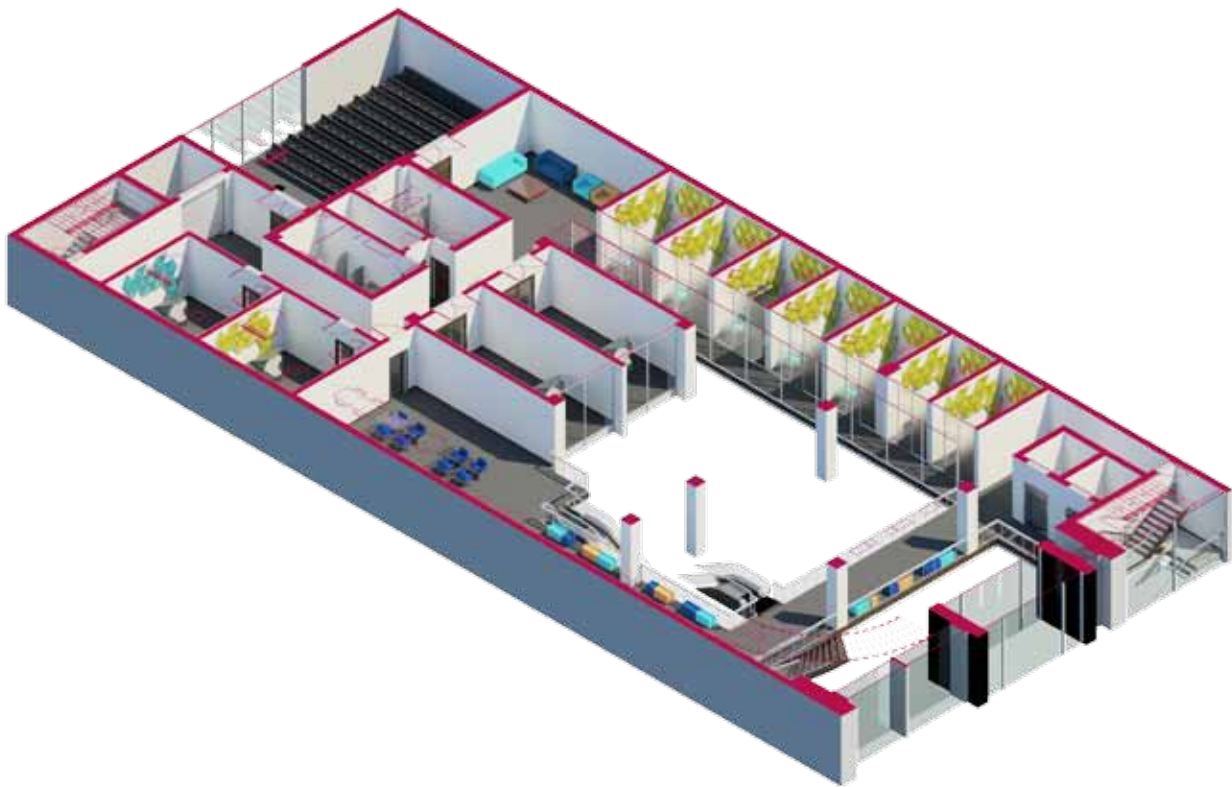
PIANO STUDIOS | 500 sf

AUDITORIUM | 1000 sf

WEST LOUNGE | 575 sf

SOUTH LOUNGE | 1450 sf

The practice rooms in the center of the building are meant to act as showcases, to perform silently for the atrium. The west side of the fourth floor serves as an auditorium for student recitals and more impromptu performances.





SHOWCASE PRACTICE ROOM





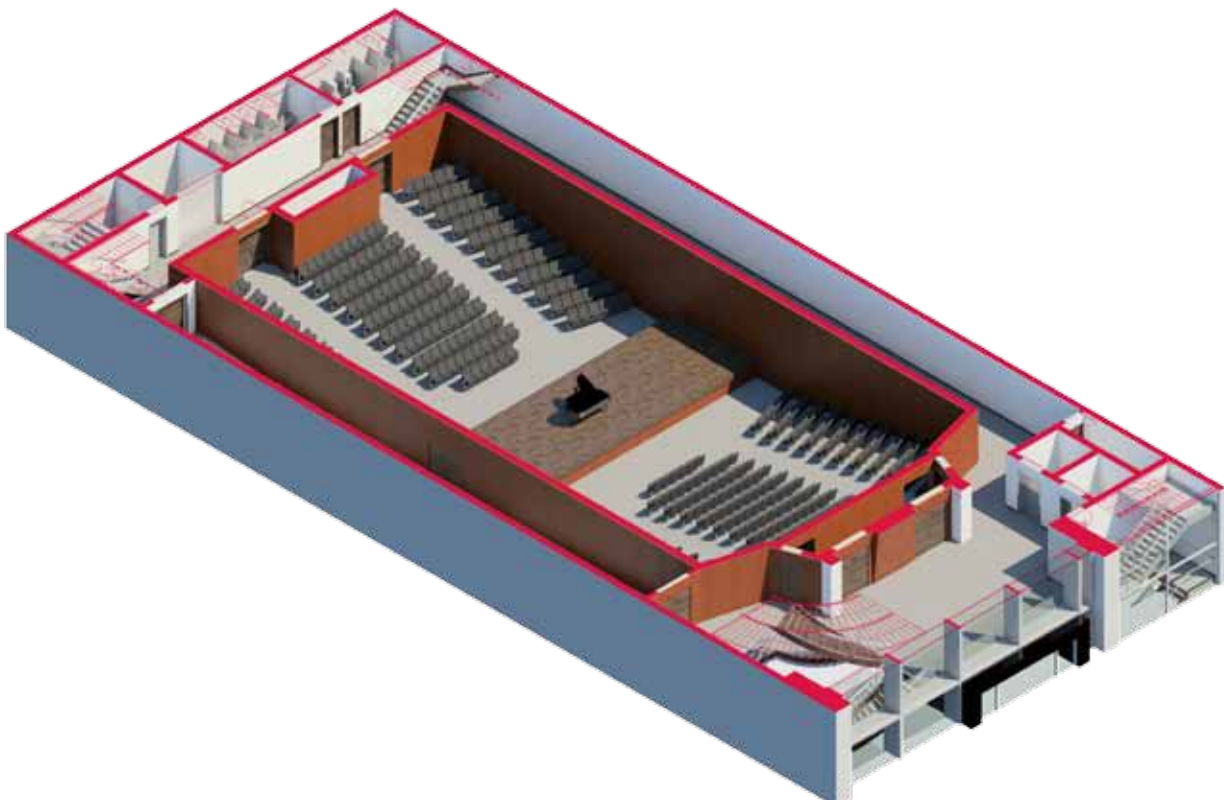
RECITAL RECEPTION

{ FIFTH FLOOR }

RECITAL HALL | 5400 sf

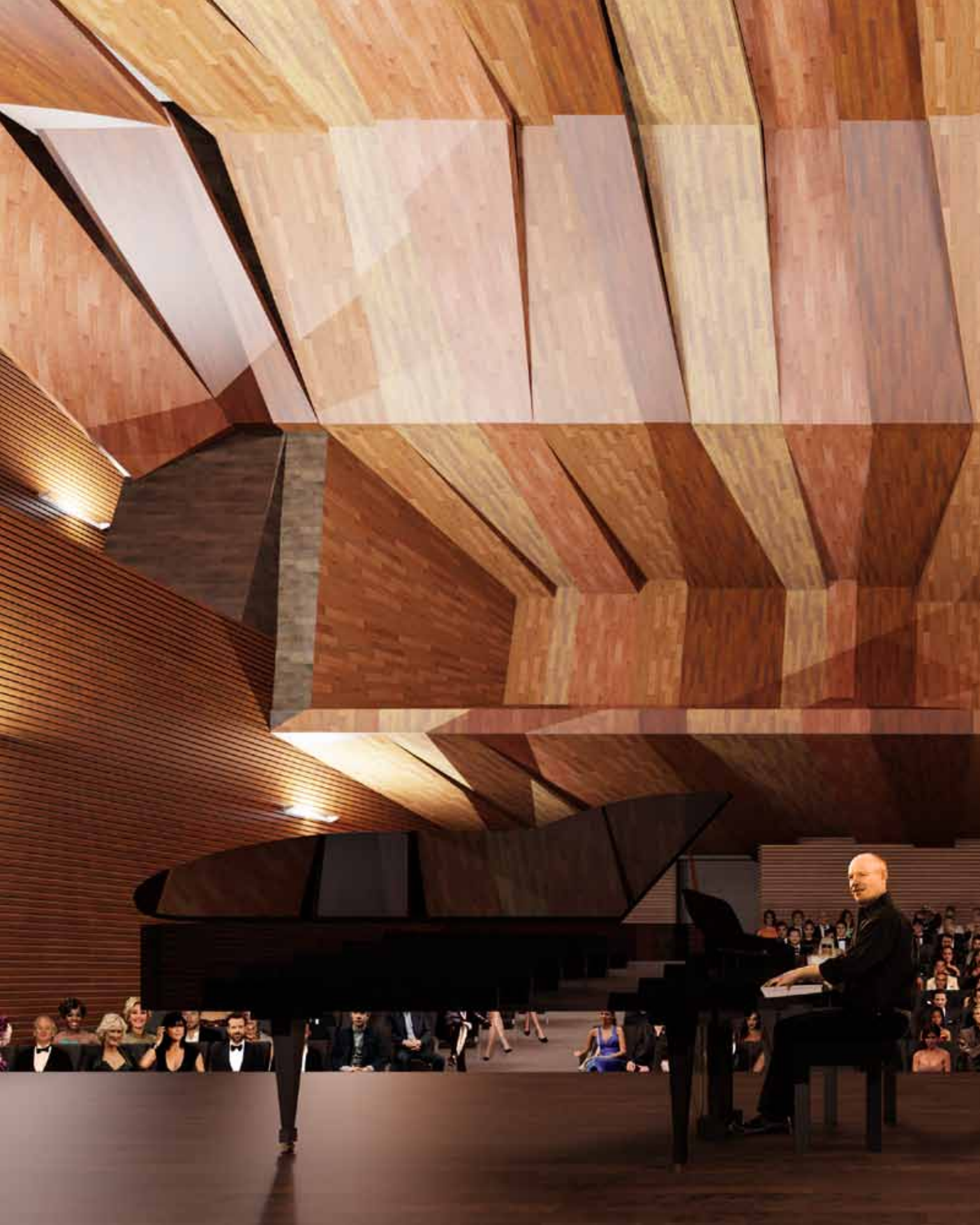
RECEPTION | 1300 sf

The fifth floor of Adagio houses the illustrious Recital Hall, containing 476 seats plus 8 ADA accessible seats on its main level. Additionally, the upper and side balconies hold 66 and 108 seats respectively, bringing the occupancy to 658 total guests.





STAGE FROM UPPER BALCONY



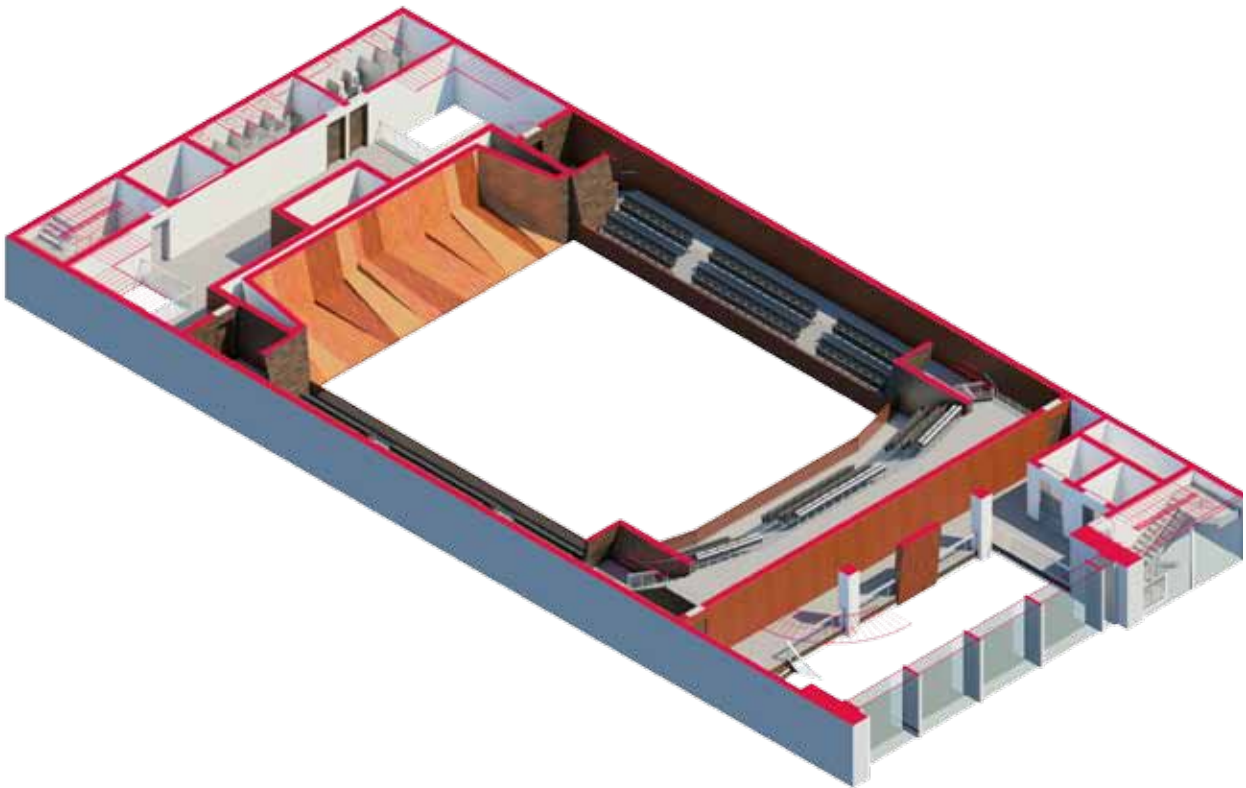


THE STAGE

{ SIXTH FLOOR }

UPPER BALCONY | 950 sf
SIDE BALCONIES | 1900 sf
WEST MEZZANINE | 650 sf
EAST MEZZANINE | 900 sf

The balconies surround the stage on three sides, creating an atmosphere that glorifies the piano as being the complete center of the room.



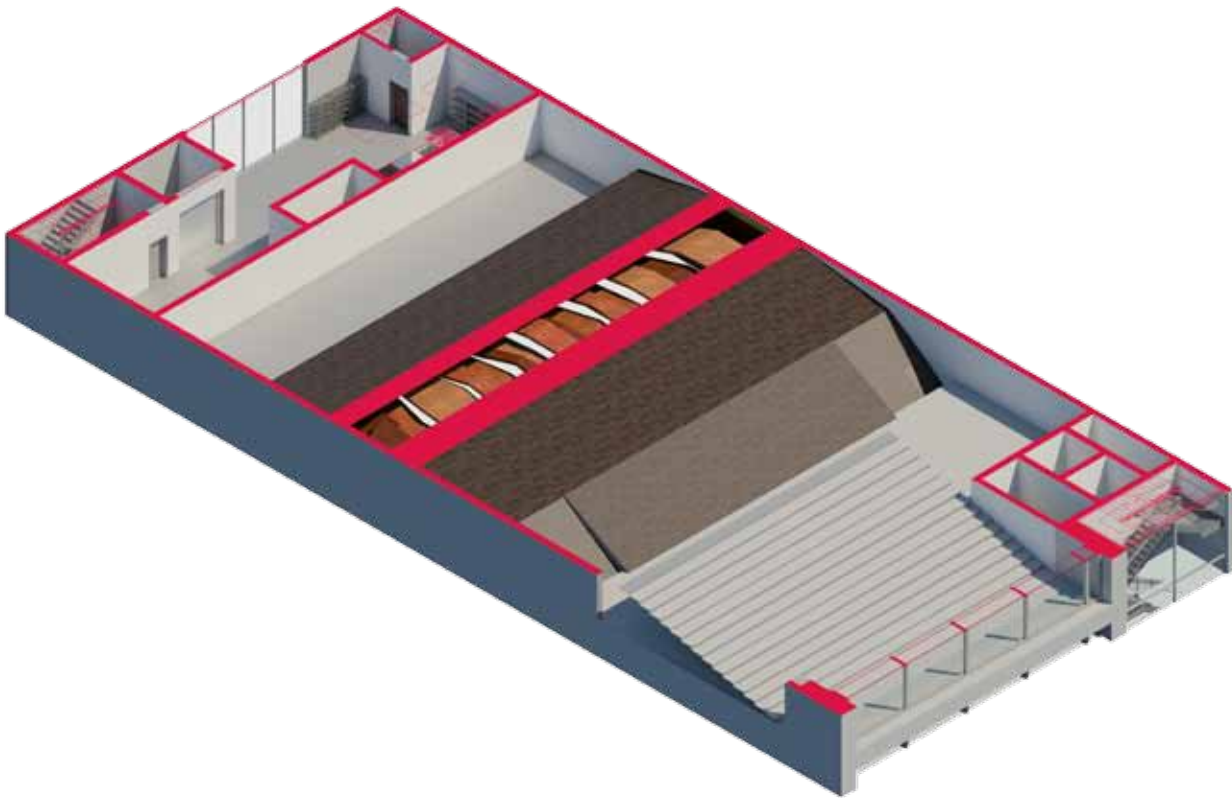


STAGE FROM SIDE BALCONY

{ SEVENTH FLOOR }

CATERING KITCHEN | 1500 sf
ROOFTOP OBSERVATION DECK

Between the recital hall and the rooftop, there is an intermediate space occupied primarily by the recital hall ceiling, though the west side functions as a kitchen for catered events, refreshments, and the rooftop bar, while the east side is a continuation of the outdoor rooftop observation deck.



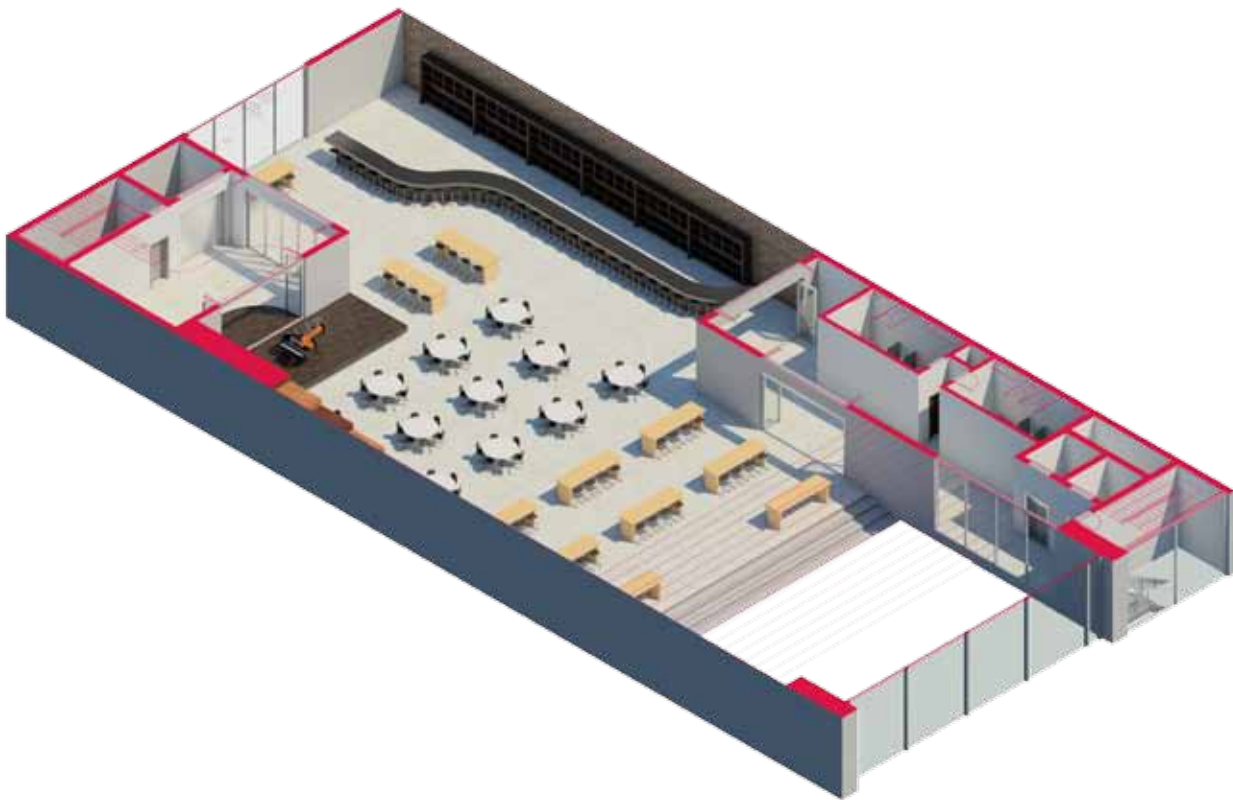


ROOFTOP OBSERVATION DECK

{ ROOFTOP }

- BAR
- OUTDOOR STAGE
- ROOFTOP OBSERVATION DECK

The rooftop would primarily function as a place for guests to gather before and after events in the recital hall. It is equipped with a stage for piano performance as well as an observation deck that looks east to Grant Park and Lake Michigan.

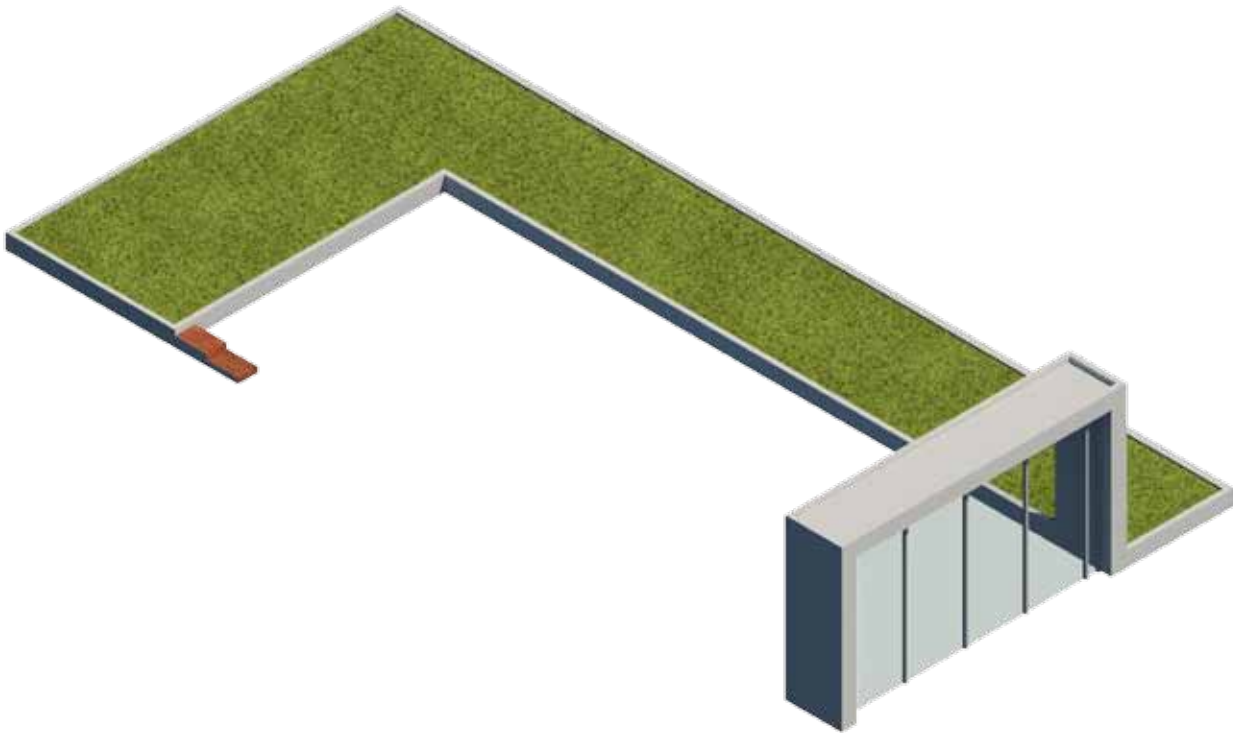


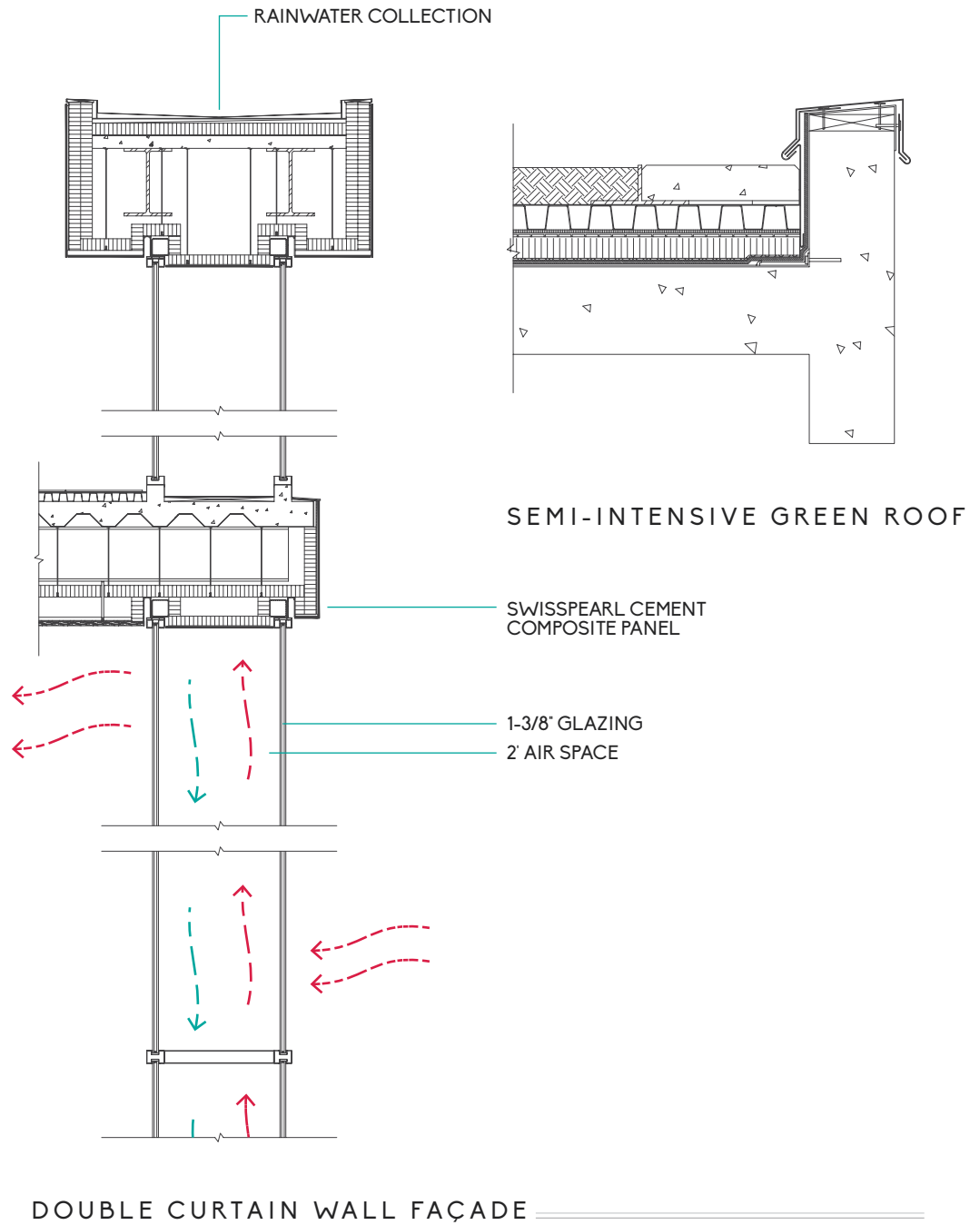


ROOFTOP BAR

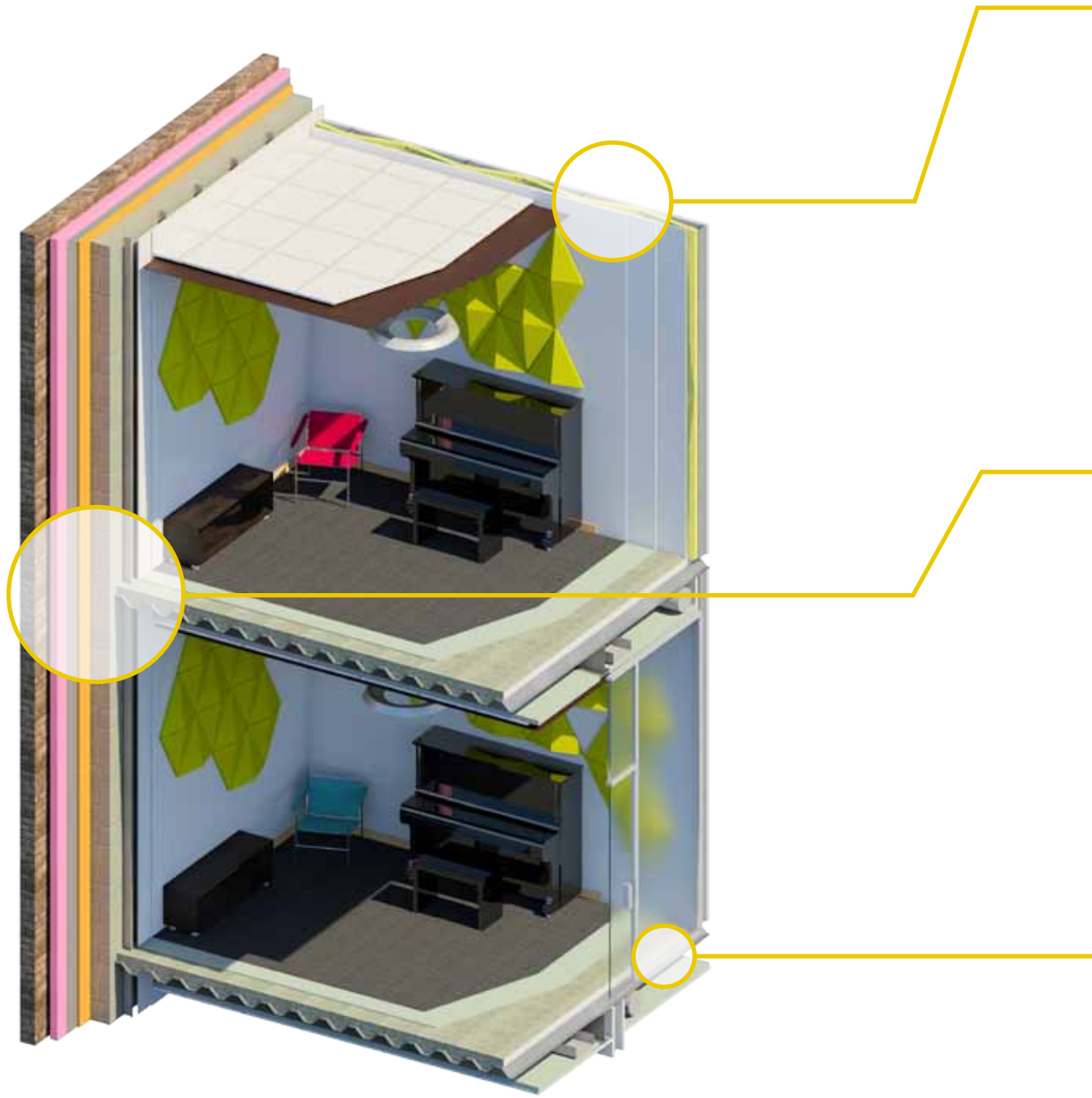
{ GREEN ROOF }

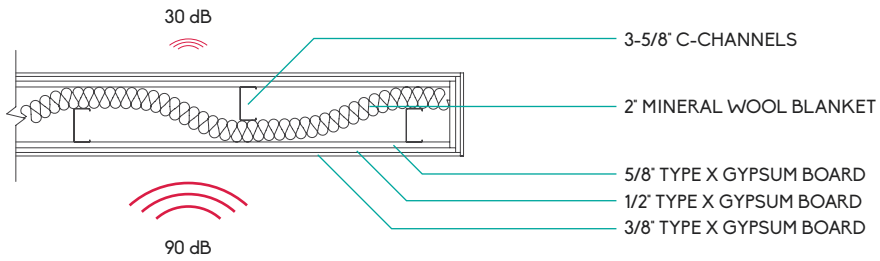
Green roofs are required on many Chicago buildings and Adagio is no exception. It occupies approximately 60% of the building footprint and contributes to the reduction of the heat island effect and the collection of rainwater for non-potable building uses.



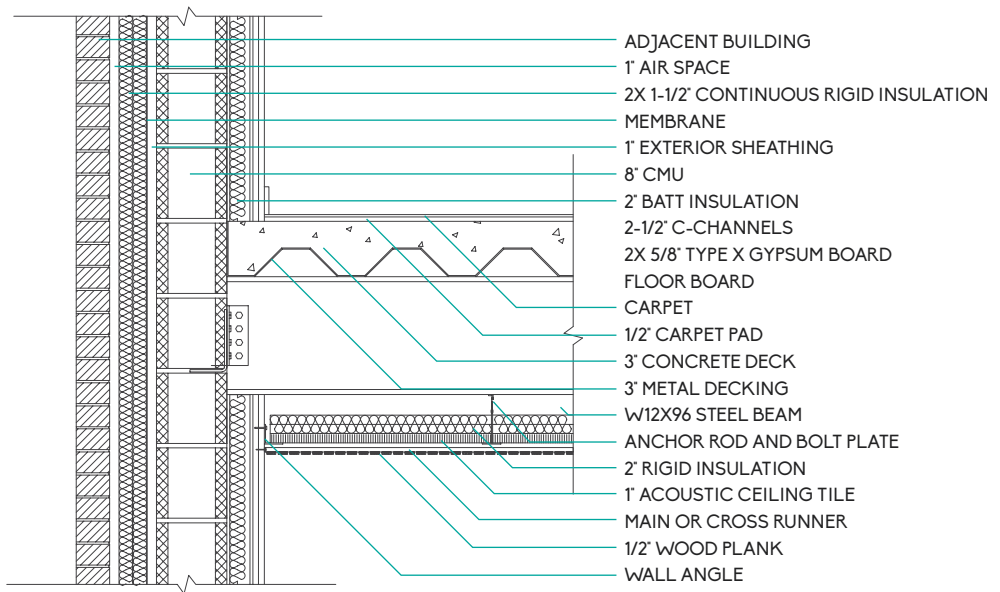


{ PRACTICE ROOMS }

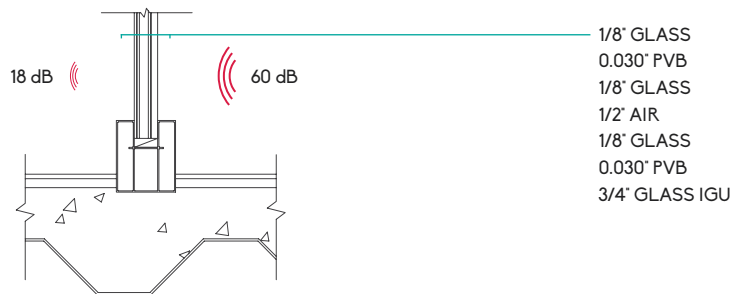




INTERIOR ACOUSTIC WALL PARTITION

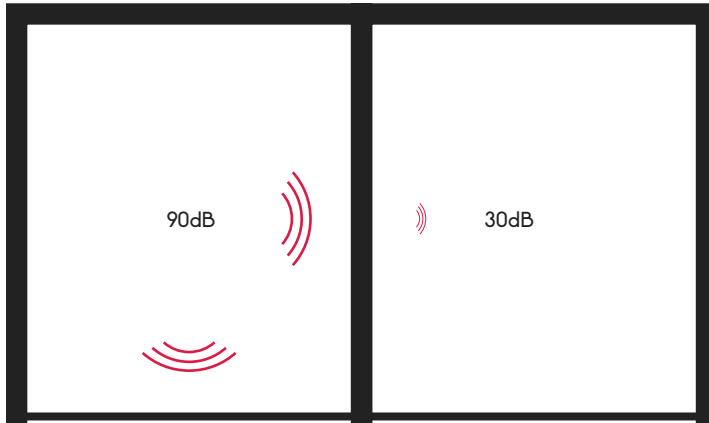


EXTERIOR WALL DETAIL

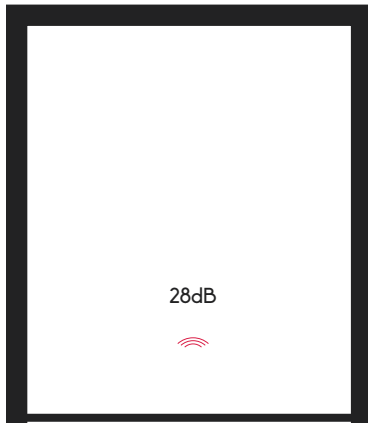


INTERIOR ACOUSTIC GLAZING PARTITION

{ PRACTICE ROOMS }

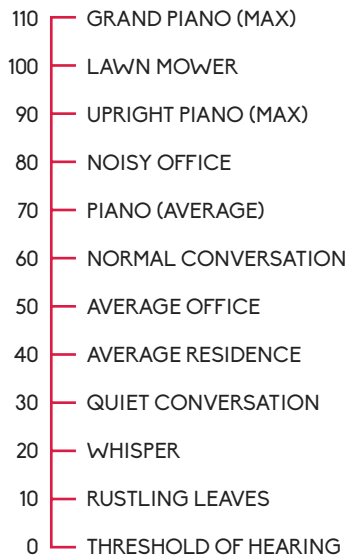


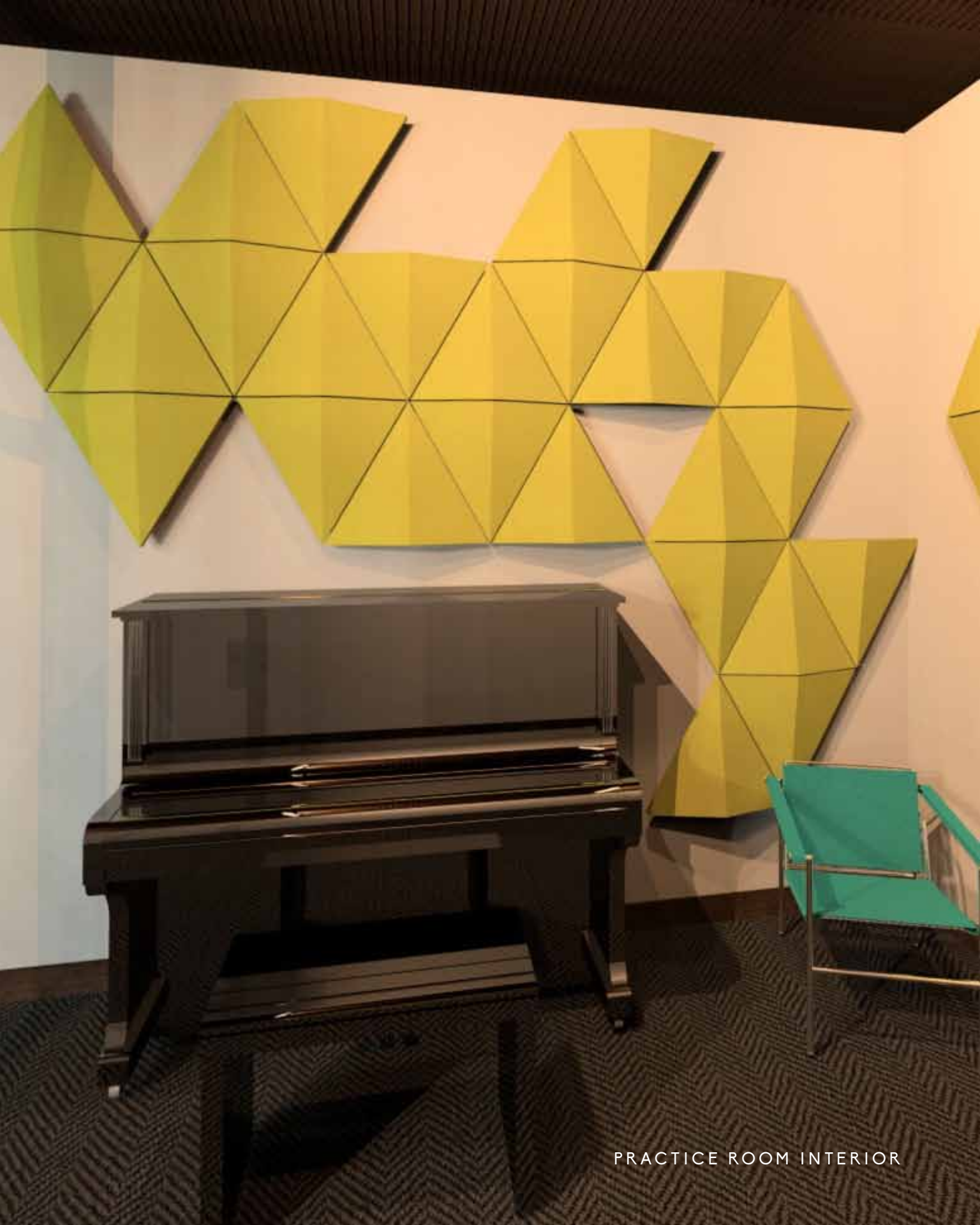
48dB



70dB

DECIBEL SCALE



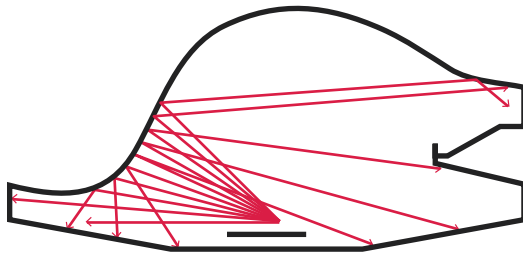


PRACTICE ROOM INTERIOR

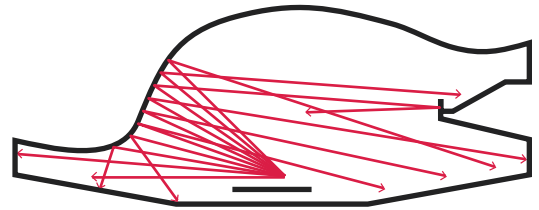
{ RECITAL HALL }

The objective of the acoustic analysis was to optimize a space in such a way that the piano could sit in the very center of everything. To maintain the classic and dynamic look of an open piano on the stage, I objected to removing the piano's lid, which would have easily allowed sound to travel symmetrically throughout the space. Instead, the piano kept its lid and the space around it became acoustically optimized for its performance.

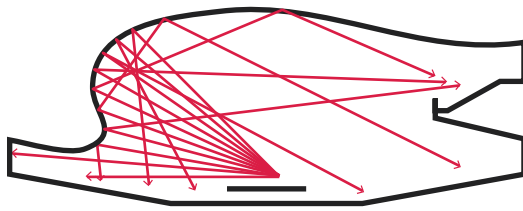
Before Iteration 1, the recital hall was entirely symmetrical, but to spread the acoustics from the 45° angle introduced by the piano lid, one side was modified to bounce the sound to all spaces more equally. The massframe of the recital hall could continue to be refined even further to allow for very specific reverberation times and the piano lid may be lowered or removed altogether to give the space different acoustical properties.



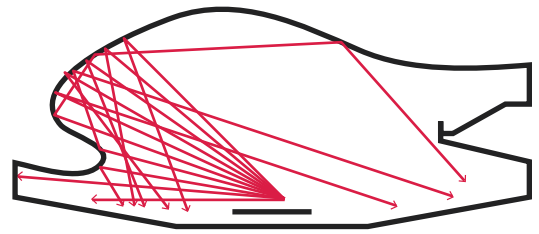
ITERATION 1



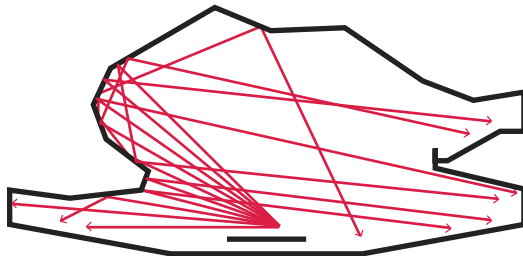
ITERATION 4



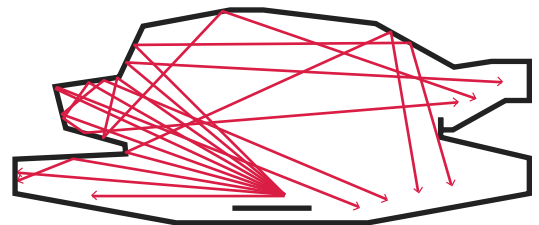
ITERATION 7



ITERATION 8



ITERATION 11



ITERATION 16





RECITAL HALL

{ FINAL
INSTALLATION }







FINÉ

{ REFERENCES }

Ateliers Jean Nouvel. (2009, January 17). *Opening Concert House Danish Radio* [Press release]. Retrieved from jmaniere@jeannouvel.fr (30 Oct, 2013).

Barbour, D. (2010, February). The Dee and Charles Wyly Theatre combines innovative design with total flexibility. *Lighting & Sound America*, xx, 38-44. Retrieved from <http://www.lightingandsoundamerica.com/Wyly.pdf>

Benefits of Music Study. (n.d.). From *Music Teacher's National Association*. Retrieved from <http://www.mtna.org/parent-and-student-resources/choosing-a-music-teacher/>

Berkery, J. (2010). *The Chicago Blues: A Brief History*. Retrieved December 14, 2013 from <http://www.upchicago.com/chicago-blues-history>

Changizi, M. (2009). Why does music make us feel? *Scientific American*. Retrieved November 11, 2013, from <http://www.scientificamerican.com/article.cfm?id=why-does-music-make-us-fe>

Chicago Loop Alliance (CLA). (2011). *Loop economic study & impact report*. Retrieved from http://chicagoloopalliance.com/Resources/Files/2011_Loop_Economic_Study_FINAL.pdf

Chicago Symphony Orchestra. (2013). Retrieved December 14, 2013 from <http://cso.org/About/default.aspx>

Chicago Transit Authority (CTA). (2013). Retrieved December 9, 2013 from <http://www.transitchicago.com/about/overview.aspx>

CIT Cork School of Music. (2007). Retrieved November 10, 2013 from <http://www.molaarchitecture.com/projects/CSM.html>

Cork Institute of Technology. (2013). Retrieved December 11, 2013 from <http://www.cit.ie/aboutcit/facultiesandcolleges/citcorkschoolormusic/>

Divvy Bikes. (2013). Retrieved December 9, 2013 from <http://divvybikes.com/about>

- Logeswaran, N. & Bhattacharya, J. (2009). Crossmodal transfer of emotion by music. *Neuroscience Letters*(455), 129-133. Retrieved from http://www.academia.edu/258576/Crossmodal_transfer_of_emotion_by_music
- Mark, T. C. (1981). Philosophy of piano playing: Reflections on the concept of performance. *Philosophy and Phenomenological Research*, 41(3), 299-324. Retrieved from <http://www.jstor.org/stable/2107454>
- Martin, M. (2010, June 18). Research shows that playing an instrument provides health benefits. *Piano Teachers Federation*. Retrieved September 11, 2013, from <http://pianoteachersfederation.org/research-shows-that-playing-an-instrument-provides-health-benefits>
- musical performance. (2013). In *Encyclopædia Britannica*. Retrieved from <http://www.britannica.com/EBchecked/topic/399251/musical-performance>
- Newhouse, V. (2012). *Site and sound*. New York, New York: Monacelli Press.
- Phillips, R. (2006). *Celebrating 300 years of the piano*. Retrieved from <http://www.ptg.org/userfiles/file/docs/300YearsPiano.pdf>
- Palmieri, R. (Ed.). (2003). *Encyclopedia of keyboard instruments, Volume 2*. Routledge.
- Salimpoor, V. N., Benovoy, M., Larcher, K., Dagher, A., & Zatorre, R. J. (2011). Anatomically distinct dopamine release during anticipation and experience of peak emotion to music. *Nature Neuroscience*, 14, 257-262. doi:10.1038/nn.2726
- Schabas, Ezra. (1989). *Theodore Thomas: America's Conductor and Builder of Orchestras, 1835–1905*. Champaign, Illinois: University of Illinois Press.
- Singerman-Knight, R. (2013). *Why playing the piano is an excellent form of stress relief*. Retrieved from <http://rebeccasingermanknight.com/2013/04/>

Smith, P. (2009). Landmark to be torn down. *Columbia Chronicle*. Retrieved from <http://columbiachronicle.com/landmark-to-be-torn-down/>

South Loop Historical Society, The. (2009). Retrieved from <http://www.southloophistory.org/buildings/ywca.htm>

Steinway & Sons. (2013). *Piano for body, mind, and soul*. Retrieved from <http://www.steinway.com/news/articles/piano-for-body-mind-and-soul/>

Toyoshima, K., Fukui, H., & Kuda, K. (2011). Piano playing reduces stress more than other creative art activities. *International Journal of Music Education, 29*, 257-262. doi:10.1177/0255761411408505

Warren, C. W. (1973). Brunelleschi's dome and Dufay's motet. *The Musical Quarterly, 59*(1), 92-105. Retrieved from <http://www.jstor.org/stable/741461>

Yamaha Corporation of America. (2005). Playing a musical instrument reverses stress on the genomic level [Press release]. Retrieved from <http://blog.apastyle.org/apastyle/2010/09/how-to-cite-a-press-release-in-apa-style.html>

Zuk, R. (2013). Three musical interpretations of Le Corbusier's Modulor. *Nexus Network Journal, 15*, 155-170. doi:10.1007/s00004-013-0143-y



Figure 79. Cloudgate reflection. *Photo by Jakob Lawman.*

{ PERSONAL IDENTITY }

CONTACT 4725 TOWNLINE RD
INDEPENDENCE, MN 55357
(612).991.9232
JAKOB.LAWMAN@ME.COM

HOMETOWN INDEPENDENCE, MN



"AH, MUSIC. A MAGIC FAR BEYOND ALL WE DO HERE!"
- ALBUS DUMBLEDORE