INTERACTIVE LEARNING ARCHITECTURE

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A Design Thesis Submitted to the Department of Architecture at North Dakota State University.

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THE THESIS PROPOSAL

THESIS ABSTRACT:

The experiences in the formative years of a child's life can greatly impact their lives as adults. It is becoming more and more evident that children learn and adapt best when they are in an interactive learning environment. There needs to be an emphasis placed on imagination and play rather than an emphasis placed on "meeting the requirements" through testing and memorization.

This thesis will examine the issues at hand involving development in young children and how an exploration of a more interactive learning environment through architecture can benefit children in their early stages of life. To achieve this, research will be conducted on what type of design promotes interactive behavior and how to design spaces that convey a learning environment and/or a connection to nature. This research will then be applied to the design of a children's museum that will serve the Fargo/Moorhead community.

NARRATIVE OF THE THEORETICAL ASPECT OF THE THESIS:

I have always believed in the importance of a good education. When first entering college, I thought an education/teaching degree might be in my future. Many people in my life I really respect and look up to are educators. I'm certainly thankful for the many great teachers and professors I have had in all stages of my academic career. It is for this reason that I deeply care about the quality and thoughtfulness behind the design of learning spaces.

Architects have a responsibility to the students and teachers we design for. There has to be an emphasis on creating pleasurable spaces for students to exist in. Unfortunately, this has not always been the case in the past. Classrooms should be accessible and flexible for any learning opportunity. Natural daylight in classroom spaces should be a top priority for students of any age. Simple design considerations such as these can go a long way in creating a healthier learning environment.

Early education is especially impactful for children. It's not just about learning the alphabet or how to do basic math. The younger years in school are when children develop socially as well. Parents are always searching for ways to give their children extra opportunities for learning outside of the traditional school system. Some parents or guardians have sent children to Montessori schools as a way of promoting a more interactive learning experience. This type of learning can be very beneficial to children, and is often seen in the design and use of a Children's Museum.

It is my belief that every city should emphasize the development of children through the use of a Children's Museum. Children this century have slowly had their opportunity for hands on play diminish with the advances in technology. Its much easier as a parent to keep a child occupied with screens, and although there are certainly learning opportunities through the use of technology, it deprives kids of learning through collaboration with others. Children in the Fargo/Moorhead area need this added opportunity for growth and development in the form of exploratory play. An all-inclusive Children's Museum can promote this form of play between kids of all ages. My hope is to show the need for an emphasis on this form of interactive learning for kids in the Fargo/Moorhead community.

PROJECT TYPOLOGY:

The Children's Museum will be available to all members of the public. The Museum will consist of indoor and outdoor spaces that promote the ideas and values presented in the thesis research section. The spaces will be occupied by multiple different exhibits that aim to stimulate children in multiple different ways.

CASE STUDIES:

1. El Paso Children's Museum - El Paso, Texas
2. New Islands Brygge School - Copenhagen, Denmark
3. Xinsha Primary School - Shenzhen, China

EL PASO CHILDREN'S MUSEUM:

Location: El Paso, Texas

Typology: Children's Museum

Size: 70,000 sq ft.

Distinguishing Characteristics:
This building has less outdoor space than some of the school case studies examined in this thesis. However, it is the only building that makes use of a very curvilinear form amongst the four. Instead of trying to blend in, this project is looking to become an iconic building and a must visit when in El Paso.

Environmental Effect:
This project does use greenery to make the outdoor spaces more appealing. The building's outdoor spaces consist of a large terraced garden near the main entrance, an open space cut into the building's roof, and a cooling - mist playground. Local plant life and natural boulders will give these outdoor areas the desert feel of the environment surrounding El Paso.

Cultural Effect:
This museum is not just made for the people of El Paso, but for the people just across the Mexican border in Juarez as well. In fact, the museum will have an exhibit created through the partnership of the Museo La Rodadora, which resides in Juarez. This building will become a place where children can interact and play while also being exposed to new cultures and languages.

Structure:
This building is pretty generic structurally, using a column grid system and a truss roof system. What is interesting about the structure is the use of multiple roof types. Three of the roofs are curvilinear, while the fourth is pitched at a sharp angle.

Natural Light:
The interior of this museum flows nicely from one space or exhibit to another. The miniscule amount of interior walls allows sunlight from the windows on all four sides of the facade travel far into the spaces. This gives the illusion that the building has many windows, when in reality the design just makes really good use of the windows it does have.

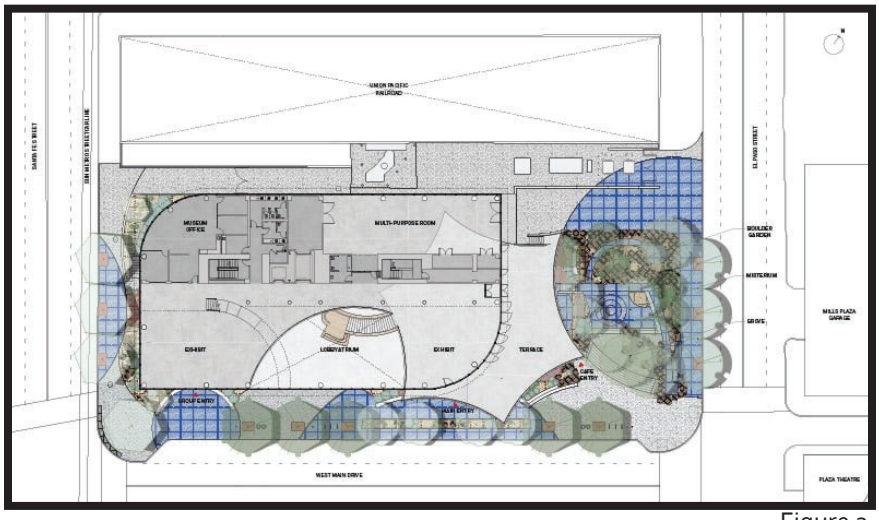


Figure 2

Massing:
The white exterior and four pitched roofs give this building the appearance of a cloud. The curtain wall that runs all along the bottom two levels of the building gives the illusion that it is floating. The openings on the exterior are placed in such a way that they do not take away from the form, but rather accent it in a very charming way.

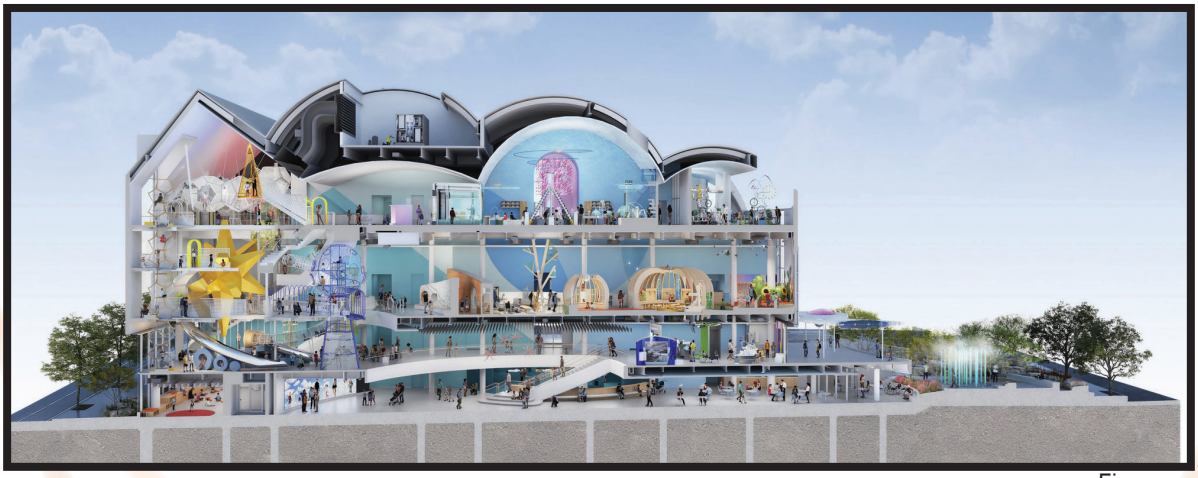


Figure 3

Circulation:
There are very few walls to break up the interior spaces horizontally. It is very convenient to reach the other end of the building. Vertically, there are multiple moments inside where an exhibit or some form of vertical circulation scratches multiple floors. This opens up those areas to more natural light and a smoother flow of traffic.

Hierarchy:
The building hierarchy travels from top to bottom. The Larger exhibits and more enclosed spaces are near the top, while the open lobby and circulation areas are on the first two floors accompanied by the curtain wall system. There is a similar relationship happening horizontally in the building, where the smaller exhibits are near the terraced garden side, and the larger exhibits are near the pitched roof side of the building.

Symmetry to balance:
This building is asymmetrical in just about every way. The exterior plan view shows an almost symmetrical building, other than the sharp corners being on opposite ends. However, the four different roof systems make this project very unique and attractive in an asymmetrical sense.

Conclusion:
This thesis will examine the interior planning of this case study and implement some of the design elements into the final design. The way natural light plays a role on the interior of this building is essential to creating positive learning spaces for children. This building creates a very dynamic and intriguing interior plan while keeping the outside very elegant and simple. Interior Design like this is what makes a children's museum so appealing to all who visit it.

Figure 4

Figure 5

NEW ISLANDS BRYGGE SCHOOL:

Location: Copenhagen, Denmark

Typology: Middle School

Size: 150,000sq ft.

Distinguishable Characteristics:
The New Islands Brygge School features a giant learning stair that runs from the street level of the building all the way up to the rooftop outdoor spaces. Rather than being for elementary age kids, this school building serves sixth through ninth grade students. The integration of green spaces and outdoor spaces also makes this project unique compared to other middle school buildings.

Environmental Effect:
This building uses a very large amount of natural resources, especially on the facade. The architects took into account the surrounding urban context to ensure the building, while being very pleasing to the eye, blends in with the surrounding neighborhood.

Figure 6

Cultural Effect:
The New Islands Brygge School is one that exceeds normal efforts to create a dynamic space that encourages movement and interaction during downtime. Students are more likely to socialize, eat, or learn than they are to bury their heads in a textbook or in their cell phone. This building could be the first of many in the Copenhagen area when the community sees it in full swing.

Structure:
The Structure of the entry onto the learning stair is almost like a very welcoming parking garage. A small cantilever extends past the columns to give shading to the side street below. A large portion of the roof of the building is completely usable and contributes to the overall function of the building.

Natural Light:
The building has many openings that allow for plentiful natural light into learning and congregational spaces. This along with almost a third of the building consisting of outdoor spaces means occupants will have every opportunity to access natural light during the day.

Figure 7


Figure 8


Figure 9

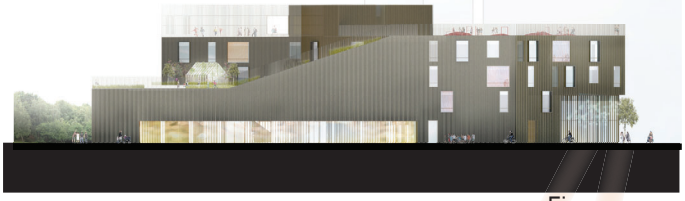


Figure 10

Massing:
The building form consists of an extruded triangle shape with multiple terraces or platforms. These platforms are where many of the outdoor spaces rest. Wood panels on the exterior give the building a soft feel while emphasizing the vertical elements of the facade.

Circulation:
The important circulation aspect to point out with this project is the connection between indoor and outdoor spaces. At each level there are multiple connections between inside and outside that make this project unique.

Hierarchy:
The lower two floors of this project consist of multiple small classrooms, as well as the larger gathering spaces such as the gym and the dining area. The third, fourth, and fifth floors have many indoor classrooms and smaller spaces, while also being home to all the outdoor terraces. As you move up the building, indoor spaces gradually become outdoor spaces.

Figure 11

Figure 12

Additive and Subtractive:
The entire building form relies on slowly carving out more indoor space and replacing it with outdoor space as one moves up the levels. This creates a subtractive form that still feels complete and sturdy.

Conclusion:
This building uses outdoor spaces very well and creates a wonderful experience in moving into them. This project shows that outdoor spaces don't have to just be on the ground or the roof, they can become a natural and organic design solution to creating an interactive building. It is important to keep in mind using outdoor spaces like this will not be very suitable for harsh North Dakota winters, but they are a design factor I would like to incorporate into my building in some way. Ultimately, this thesis should show the same commitment to creating an interactive learning space as the design of the New Islands Brygge School does.

XINSHA PRIMARY SCHOOL:

Location - Shenzhen, China

Typology - Elementary/Primary School

Size - 398,200 sq ft.

Distinguishing Characteristics:
This school is more than just classrooms and circulation. The entire building has little moments for the students to experience interactive play. This can be seen primarily in the courtyards, and where the little "green animals" sculptures are. There is also an elevated outdoor sports complex area that allows children to run and play.

Environmental Effect:
This school occupies its gaps with open green spaces to create a healthier and cleaner air environment for school children. There are also rows of trees aligned along the sides of the building to try to blend the environment with city-scape. The Platform structure gives natural cantilevers to each floor that provide shading and heat reduction.

Figure 13

Figure 14

Cultural Effect:
Xinsha Primary School is one of many that is a part of the "8 + 1 Futian New Campus Action Plan". This plan was put under way by the Shenzhen Municipal Planning bureau, and its goal is to explore a new type of primary school in a "campus" setting to deal with high density areas of the city.

Structure:
The main structure of this building can most accurately be described as "podium and tower". The main activity areas are elevated one story above street level. Below this the library, the "arcade" entry, and other larger enclosed spaces.

Natural Light:
The "S" shaped form of this building allows for an abundance of natural light to penetrate into the upper floors with ease. The form also allows sunlight to reach the first and second levels due to the voids in the "S" shaped structure.

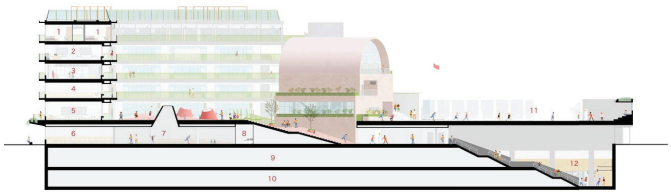
Figure 16

Figure 15

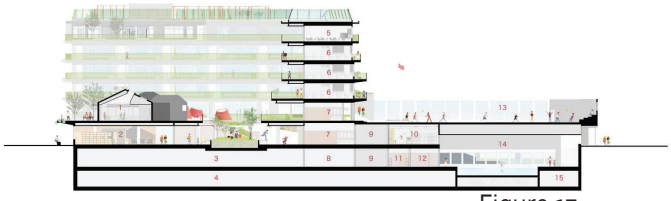
Massing:
The form of this building, while being very appealing, is mostly the solution to the study laid out in the "8 + 1 Futian New Campus Action Plan". It is likely influenced by the need for outdoor play areas and natural light.

Circulation to space:
This building is unique in that most of its circulation occurs outdoors, especially horizontally. Almost every room is accessed through some kind of outdoor balcony or corridor. These balconies occur all around the building and are not only used for circulation, but have applications in education as well.

Hierarchy:
This building uses the bottom two floors for many of the large congregation spaces, while the upper floors are used for individual classrooms and smaller spaces.



Section 1

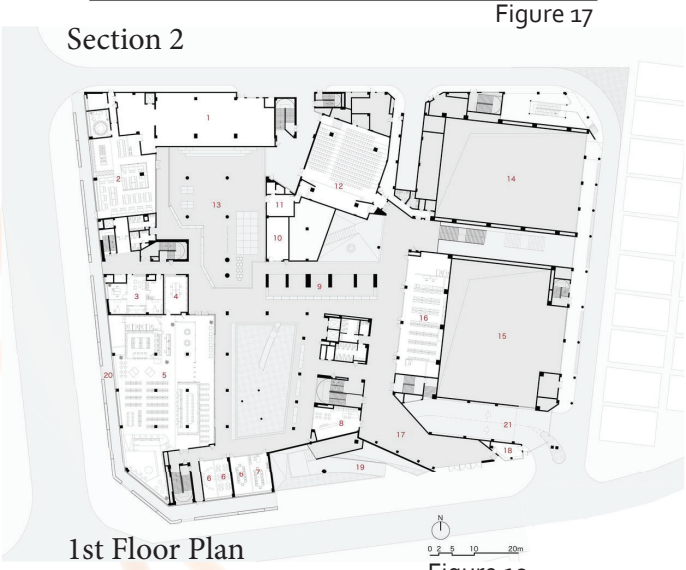


Section 2

Figure 17

Typical Plan Floor 3 & Up

Figure 18



1st Floor Plan

Figure 19

2nd Floor Plan

Figure 20

Additive and Subtractive:
The form of this building relies heavily on an additive/ subtractive style. The shape is essentially just a rectangle with two large voids cut out of the middle on either side to form an S.

Conclusion:
This case study shows an excellent way to design with an interactive mindset. The most obvious building elements that prove this are the multiple outdoor and indoor play areas that kids can utilize during break times, or in between classes. The circulation system is also a building element that forces social interaction between the children. The whole design concept of this building seems to give kids the freedoms they should have when in school, while also conveying structure and order where necessary. This thesis project will use similar principles of design to achieve the same influence on visiting children. Although on a smaller scale, this thesis will also be built in an urban area, so creating spaces for nature and safety will be a necessity to a successful design.

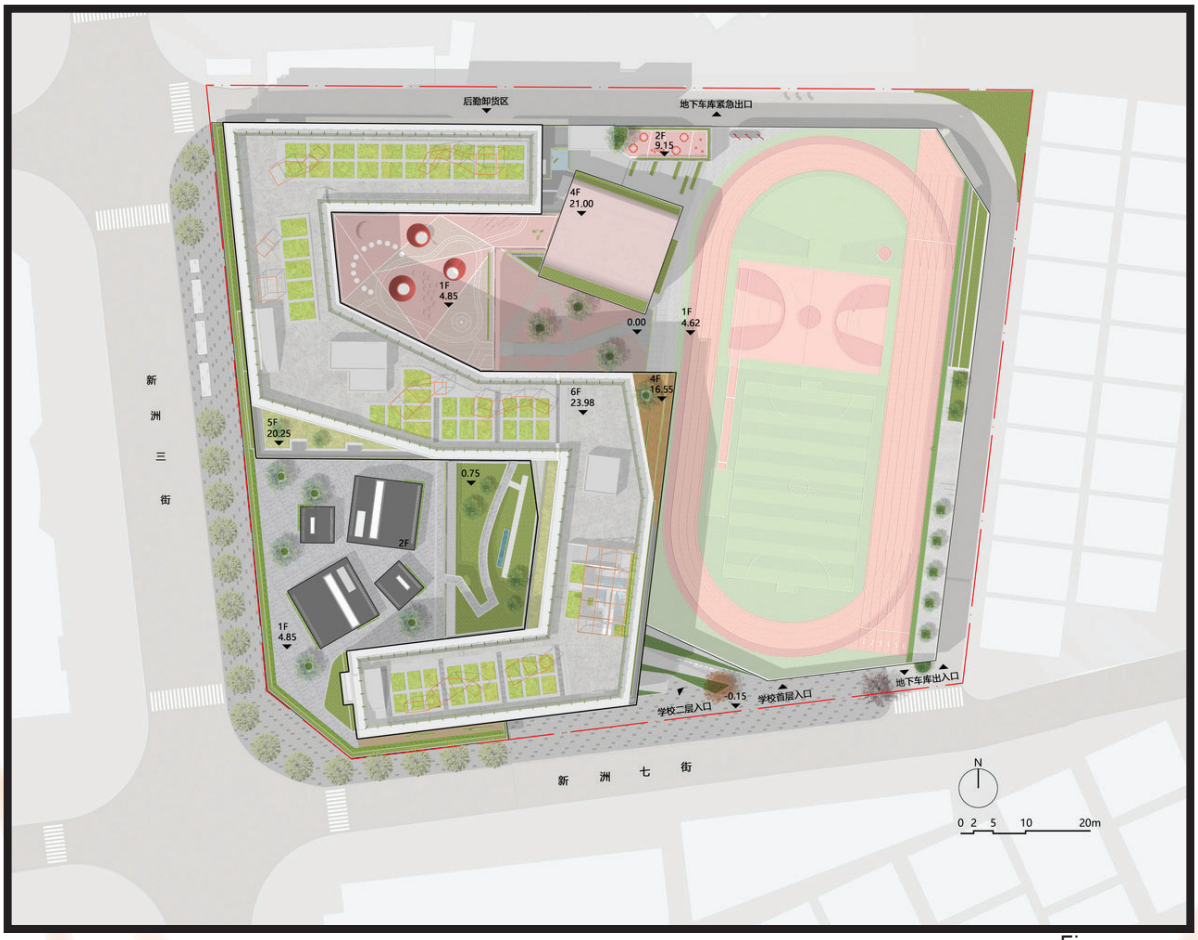


Figure 21

Case Studies - Comprehensive Summary:
All three of these case studies will impact the possible solutions to the design thesis. All three projects share similar characteristics that I will likely implement into the design solution. All three projects make very good use of outdoor spaces for their respective sites. They all take an urban setting and create spaces for students or children to learn outdoors. In combination with this, every case study examined here makes an effort to create indoor spaces with an abundance of natural light. The accessibility and ease of access from the well lit interior to the exterior learning or socializing areas is something to consider for the design thesis.

Xinsha Primary school uses outdoor circulation techniques very well. In order for students to travel from one place to the next, they often have to use the balcony system or travel across the top of the "podium" structure on the second floor. The natural balcony overhangs create sun shading for indoors, something that needs to be considered for the design thesis. The spatial relationships of this building are an interesting study as well. The larger gathering spaces being on the lower floors and the smaller classrooms on the upper floors gives a natural separation of learning and play, while also making constructibility more simple.

The New Islands Brygge School should be an inspiration in creating outdoor spaces that are truly usable. The large sheltered and unsheltered learning stair is a structure that should be implemented into any learning building. This building also has many of its large spaces located on the first two floors, while the smaller spaces are located on the floors above. This allows the building to be "carved" out naturally by the learning stair as it grows taller. The outdoor terraces this creates connect seamlessly to the inside of the building and offer a unique form of learning to students.

The El Paso Children's Museum is a representation of a building that seems to have had a very clear and elegant inspiration. This building, with its curved roof edges and curtain wall bottom, gives the impression of a floating cloud. The El Paso Children's Museum is most closely aligned spatially with what this design thesis will likely become. The lack of interior walls allows sunlight to travel far into the structure, and areas with multiple floor atriums gives the space a very open and bright feel. This building also makes a considerable effort to be for all people and all cultures, as they have partnered with a museum across the border to create exhibits that are experienced through the Spanish language.

MAJOR PROJECT ELEMENTS:

1. Large Indoor Atrium spaces filled with larger interactive play structures.

2. Large Outdoor space for nature to be emphasized. This space will connect visiting children to their environmental surroundings through stimulation of the senses.

3. Smaller tertiary play areas that allow for more intimate examples of interactive learning.

4. Separate Classroom Spaces that allow for any type of learning session. The classes taking place here would offer more guidance and structure for children.

5. Building necessities such as parking, circulation, bathrooms etc.

USER CLIENT DESCRIPTION:

1 **Children-**

- The primary user of most of the spaces in this building will be children. They will be the users most involved in all spaces of the building.
- Things like bathroom accessories, stairs, and door handles need to be appropriate sizes in some cases. Accessibility is always a priority.

2 **Parents/Guardians-**

- The parents or guardians of the children at play will most likely be in the building with them.
- Keeping doorways and bathroom accessories suitable for adults will be important.
- Seating areas for adults will be necessary so they can supervise their child's activities.

3 **Teachers/Employees**

- There will be people employed by the museum in general upkeep, teaching, and management positions.
- These employees will likely need their own spaces for leisure and work.

THE SITE:

The site I have chosen sits on the corner of 1st Ave. North and 3rd St. North in downtown Moorhead. It is currently the site of the American Crystal Sugar Headquarters. This site was chosen for its central location in the Fargo/Moorhead area and for its ability to promote the possibility for an iconic design that belongs to both cities.

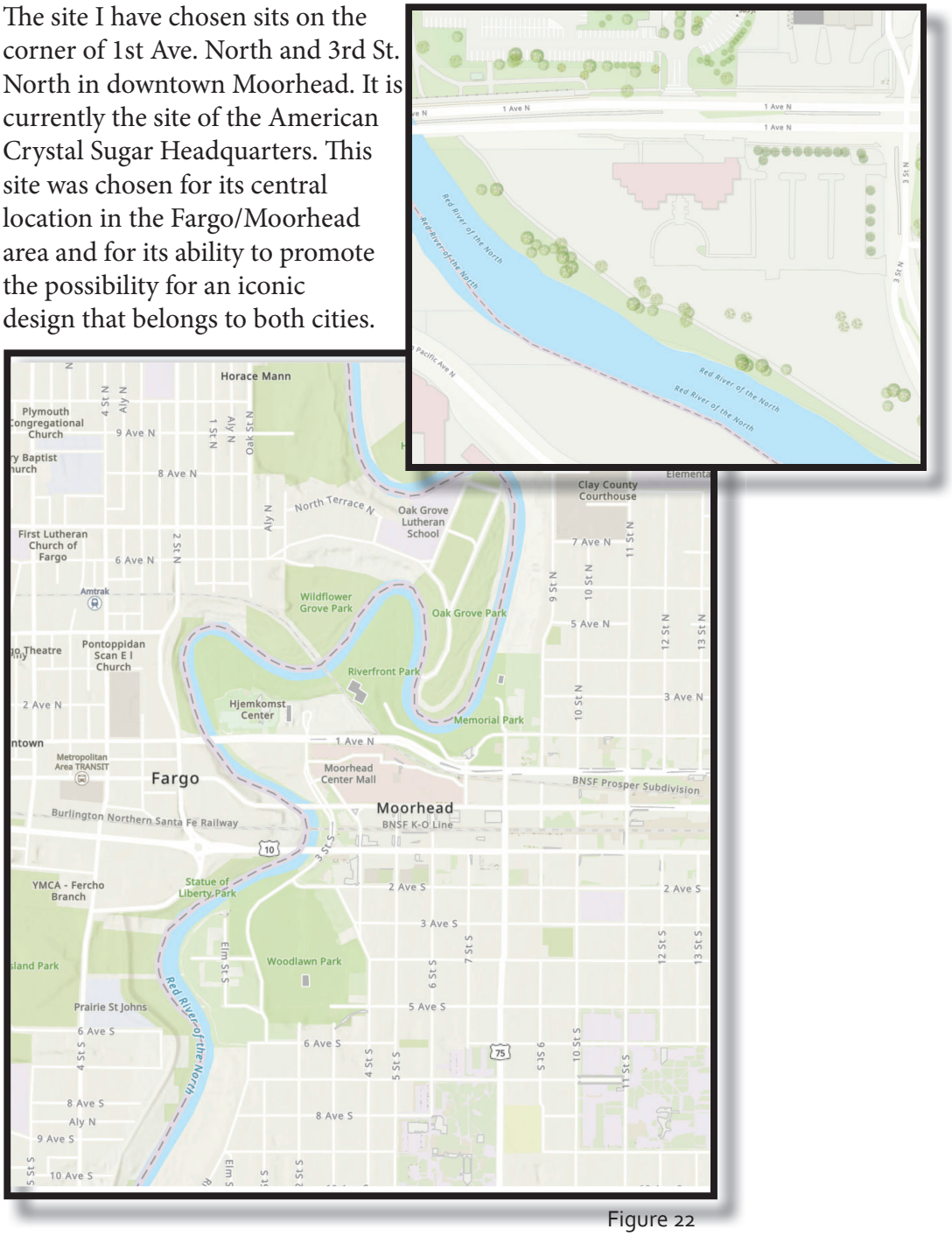


Figure 22

Figure 23

Figure 24

Figure 25

The site consists of the parking lot and American Crystal Sugar Headquarters Building. This Appealing site is in close proximity to the red River, and has easy access to parking. The Site is surprisingly quiet, as it is far enough away from any railroads to keep peaceful.

Figure 26

Figure 27

Figure 28

Figure 29

PROJECT EMPHASIS:

1. Promoting interactive learning and play between children. Pushing kids to be socially capable of resolving issues and solving problems they may come across in the exhibits.

2. Integrating nature into the design to instill an appreciation of the environment in younger generations. This will primarily take place in the outdoor spaces, but the interior exhibits could feature animal or plant life as well. Sustainability measures taken in the design of the building itself could also contribute to this.

3. Create an aesthetically pleasing building design that is easy to navigate and attractive to both kids and adults. This should be a place parents want to bring their kids to. The form and design should mimic imagination and creativity.

PROJECT GOALS:

1 **Academic**
This thesis project will be the most detailed and researched of my academic career. During the span of this project, I hope to further my knowledge in the field of educational design. I would also like to gain a better understanding of the technical and presentation aspects of a project, and how to best showcase my ideas.

2 **Professional**
There will always be opportunities to revitalize or redesign older educational spaces in the field of architecture. In some cases, an entire new school might be necessary for a community to provide for its student body. Part of this is practical. A school might need more space to accommodate a larger population. Newer buildings might be needed due to advances in technology. We as designers have a responsibility to do everything within our power to create better spaces for learning. Through this research and design process, I will become more experienced with the creative and presentation processes that will guide me on my future journey as a professional.

3 **Personal**
I hope through the research and design involved in this project, I can help shed some light on the importance of thoughtful architectural design in educational buildings. We should always aim to improve the education of the youth in our world, and designing great buildings for kids is a very important part of that improvement. Through applicable research and meticulous design, my project could set an example of how we as architects can aim for better interactive and educational design.

PLAN FOR PROCEEDING:

Research Method:
Research will be conducted to determine how interactive architecture can influence a childs' behavior inside a building. I would also like to design spaces that promote a general feeling of knowledge and the desire for learning.

Some research will simply be conducted through online resources, and reading materials such as "The Montessori Method". I will also be conducting interviews with individuals who have had experience with this form of interactive education to gain their insight on what a well designed "learning space" might look like.

Community Expectations:
I need to better understand what the Fargo/Moorhead community expects from a children's museum project. The ultimate goal of this project is to design a space parents want to bring their children to.

Site Analysis:
How will this project typology change the site and surrounding area. There will likely be an added influx of people in the area of the building site. Accommodations need to be in place for increased vehicle and foot traffic.

PLAN FOR PROCEEDING:

Presentation Plan:

The presentation will consist of verbal and visual communication of my research findings and design ideas. These will be shown in the form of a thesis book, digital power point presentation, thesis design boards, and a contextual model.

Process Preservation:

Steps I will take to ensure the preservation of research include:

1. Seeking feedback regularly from advisor and peers.
2. Date and save all notes, sketches, and research findings.
3. Save research materials in folders corresponding to the targeted information.
4. Update thesis proposal and research throughout entire project.

Thesis Schedule:

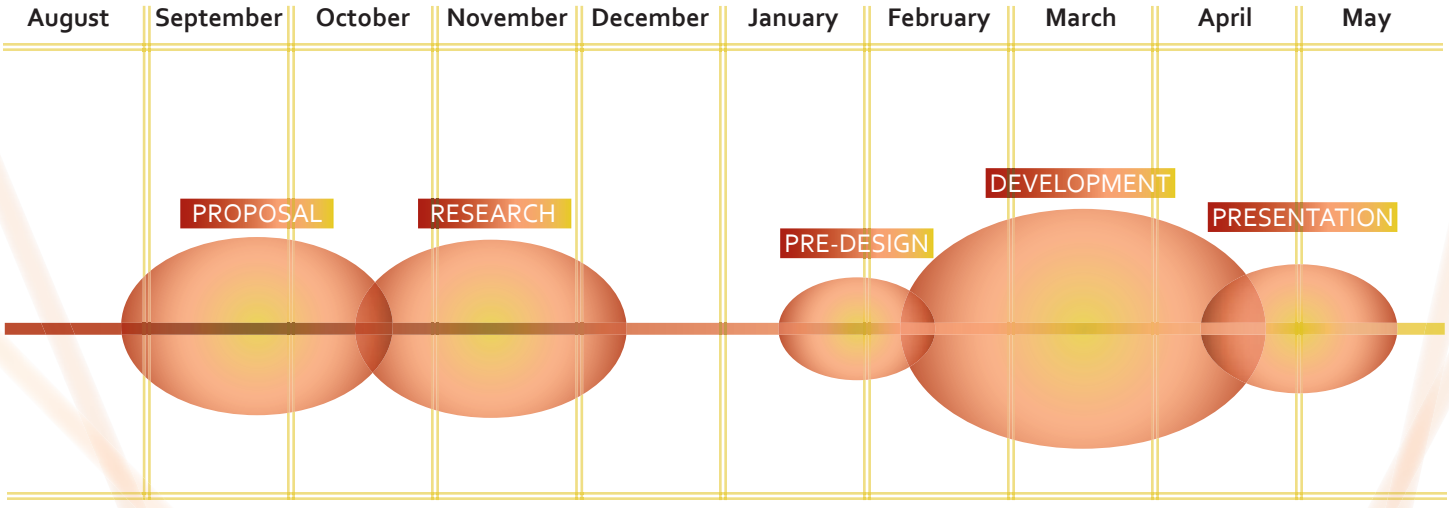


Figure 30

PART 2:
THE THESIS RESEARCH

LITERATURE REVIEWS:

Optimal Learning Spaces: Design Implications for Primary Schools

Authors: Peter S. Barrett and Dr. Yufan Zhang

This journal article was published by the Salford Centre for Research and Innovation (SCRI) in 2009. This article touches on the design implications of primary/elementary schools. These implications are broken down into three distinct categories; Naturalness, Individualization, and Level of stimulation. The article states that these factors most influence a child's ability to learn and grow. The following review will discuss how these factors can influence a learning environment, as laid out by the article.

The first element of building design that affects students is the level of naturalness the building possesses. "The emotional systems have evolved over the millennia in response to the natural environment. Spatial configurations, light, noise, heat and air quality have been consistently proved to have a significant impact on students' academic achievement and ability to perform" (Peter S. Barrett and Dr. Yufan Zhang). The combination of the building factors light, sound, temperature, and air quality can drastically change a students ability to learn. All of these factors should be within ranges that contribute to creating as "natural" or comfortable an environment as possible. The aspect that is most influenced by architects out of these is the lighting. "Good natural light helps to create a sense of physical and mental comfort, and its benefits seem to be more far-reaching than merely being an aid to sight" (Peter S. Barrett and Dr. Yufan Zhang). Orientation of the building, number of windows, and absence of obstruction on the building site all contribute to adding more natural light. An East/West orientation will allow for the most natural light, as the sun will shine on the south facade all day long. Clerestory windows can be used all around the building to let light deep inside. Preventing trees from blocking windows or sunny areas of the building will also let in more natural light. Controlling sound is also necessary to help students learn.

Location of the site, layout of the building, and materials used in rooms can influence the sound control part of the design. The location site should be quiet enough where outside noise factors don't have an affect on children. Interior spaces can control noise based on where they are located in the building, and what kind of materials or construction is used to create it. Temperature is relatively easy to control in modern times, but there is still a way to influence temperature through the design of buildings. Windows let in an abundance of natural light, but they also create larger problems with heat gain and heat loss. Building shape and layout also has a significant impact on how sustainable the building is by controlling heat gains and losses. Air quality might seem like a simple issue to handle inside buildings, but there are a lot of design choices and decisions that affect air quality. Using materials that are renewable and natural will prevent carbon emissions. Providing Operable windows is another way to keep the air quality inside the building high.

Another aspect of building design that influences users is its individualism. "As an individual matures their brain builds a very personal set of connections between primary reinforcers (basic needs) and complex representations of secondary reinforcers (features in the world). Taken together with the situated nature of memory, these personal value profiles lead to highly individual responses to space. This provides a sound basis to raise the potential importance of 'individualisation' as an additional, key, underlying design principle" (Peter S. Barrett and Dr. Yufan Zhang). Individualism isn't just about the uniqueness of the design. It is more about the choices the architect provides the visitor when they enter the building. Rooms and windows are the primary factors that affect choice when visiting a building. It is important to remember not to think of rooms as separate enclosed areas, but as separate spaces within the building. There should never be only one way to experience a building, especially in an environment that promotes interactive learning. Flexibility is another aspect of design that influences choice when experiencing a space. Open plans and room size will influence the amount of flexibility a building has. In buildings meant for learning there should be a flexibility that allows for rearrangement of the furniture or exhibits.

Although there should always be choices and flexibility in every space in educational buildings, the architect should never lose sight of the connection between spaces in the design. The circulation elements of the design are what will make the building feel connected and whole. This also applies to the connection of the building to the landscape, and the building to the community.

The final aspect of building design that influences users is the level of stimulation. "Combinations of pleasantness and different levels of arousal yield either excitement or relaxation. When the level of stimulation is appropriate for given situations, certain reactions take place positively in the brain and mind, affecting mood, mental clarity and energy levels" (Peter S. Barrett and Dr. Yufan Zhang). This stimulation is largely driven by the complexity of design, color choices, and the texture choices in materials used. Complexity of design is largely driven by the appearance of the building inside and out. A building with large windows and a dynamic material selection will stimulate students' minds more than a cinder block box with small windows will. The appearance of the building must have diversity and order in a harmonious combination. It shouldn't be such a spectacle that the spaces in the building become useless, but it should be stimulating enough to intrigue children and get them thinking about their surroundings. Color choices in design are very important and can influence moods in children. "Children of kindergarten through elementary-school ages are mostly extroverted by nature. A warm, bright colour scheme complements this tendency, thereby reducing tension, nervousness, and anxiety; color may be light salmon, soft, warm yellow, pale yellow-orange, coral and peach" (Peter S. Barrett and Dr. Yufan Zhang). Each room should exhibit a color that is appropriate for the function of that space. The last stimuli that can be used to influence learning is texture. Texture in its most basic sense can be whittled down to two categories; natural(soft) elements, and built(hard) elements. Implementing outdoor space is a great way to create natural textured stimuli for kids to enjoy. Covering outdoor areas is a good way to ease the transition from outside to inside. Outdoor areas can use any number of materials to exhibit different textures. These include sand, dirt, gravel, plants, paths and water to name a few. Outdoor spaces are a necessity in breaking up the hardscape that is naturally the built environment.

These three principles (Naturalness, Individualization, and level of stimulation) give architects the rules of designing great educational spaces. If the three main principles that influence learning environments are followed, the learning spaces architects create for children will progressively become a more complete educational experience.

The Third Teacher

Author(s): Bruce Mau Design et al.

"Learning is far more complicated than once thought but also far simpler than commonly presumed. The complications arise because learning involves more than just school, curriculum, and test results. It is, rather, the result of the complex interplay between the child's body, diet, family life, security, neighborhood, teachers, school, peers, access to information, and a great deal more" (Bruce Mau Design et al.). It is true that the process of learning and education has become more complex due to increased research and an incredible surge of what technology is capable of. This text examines the environment of educational buildings as "The Third Teacher" and how it affects students' ability to learn. Students first create relationships with adults (parents and teachers) then with their peers, and then with the surrounding environment. The book is split into eight separate sections that examine how to connect an educational building with students. The sections include Basic Needs, Minds at Work, Bodies in Motion, Community Connections, Sustainable Schools, Realm of the Senses, Learning for All, and Rewired Learning.

Basic Needs:
The basic needs section of this text addresses the necessary steps designers must take to create a comfortable learning environment for children. This section acknowledges safety as a need for each child before they are ready to learn. If a child does not feel safe and secure, nothing else about the learning space matters. Another basic need addressed in the text is the necessity to design for speech and hearing. This allows the teacher to hear the students, the students to hear the teachers, and the students to hear each other. A healthy balance between reflective and absorbing acoustical materials should create this effect. Another important basic need is sunlight. Well lit learning spaces and gathering spaces have proved to lead to better test scores and better attendance numbers.

Minds at Work:
The minds at work section of this text deals with the architect's thought process behind the design of the educational building. "The principal goal of education is to create men who are capable of doing new things, not simply repeating what other generations have done - men who are creative, inventive and discoverers" (Bruce Mau Design et al.). The most basic way of achieving this goal in education is to make the building "new". This means designing for the future and innovating based on the technology we have now and might have soon, rather than what we had in the past. There is also the idea of allowing children to make their own choices of what to do in the space they occupy. The best way to accomplish this is to try to emulate museums by offering a variety of physical objects to interact with. This helps kids visualize what they like, and what their strengths are. During group or singular activities, it is important to make an effort to display what kids have learned or accomplished in their creative efforts. This gets the child's peers engaged while allowing adults to track progress in a visual way. There is also a necessity for the combination of multiple disciplines in a learning space. Combining arts with science and math can lead to both little and big discoveries for students. There needs to be an effort to transport part of the surrounding community or landscape into the building. This allows students to feel comfortable while learning about their physical place in the world.

Bodies in Motion:
"Watching a child makes it obvious that the development of his mind comes through his movements" (Bruce Mau Design et al.). This quote by Maria Montessori addresses how important physical movement is to learning. Kids learn an incredible amount through their observations and physical experiences in the world. A big part of this observation is in the furniture provided for students. Chairs that allow for twisting and moving actually increase a student's ability to concentrate. Another key element to implementing this design strategy is through the design of the physical education facilities. Students should be proud and excited to participate in activities in the space. A well designed physical activity space will reinforce the connection between physical activity and overall well being. The key to unlocking interactive play isn't just in the design of indoor physical activity spaces, but in the design of exterior natural play areas as well. Creating areas with lush grasses and trees will be enough to encourage interactive play and discovery. The ultimate goal of interactive play is to build kids social skills while also improving their motor skills and self-confidence. This is achievable by designing safe walls and structures that are climbable and part of the natural environment.

Community Connections:
"I believe that the school is primarily a social institution… I believe that education, therefore, is a process of living and not a preparation of future living" (Bruce Mau Design et al.). This is a quote by John Dewey, an American philosopher and educator. He believes that educational buildings should not only be a place for students, but a place for the entire community to participate and thrive socially. One way of doing this is by creating connections with similar building typologies in the community. This could be libraries, recreational facilities, or other schools. To achieve these connections, the architect must think how those connections could benefit the children involved.

Sustainable Schools:
This chapter of "The Third Teacher" text deals with economic, educational, environmental, and moral reasons why designing sustainable schools is needed. We as architects always need to be thinking about future generations and the environmental impact our buildings have on the local community, and the world. To show this process to kids, it may be a good idea to reveal the inner workings of the building. This means leaving the mechanical and plumbing systems visible when appropriate, so kids can learn how the building operates. Another way to show the connection to nature is to highlight the site and surrounding landscape. Designers can call attention to the site through landscaping, design, and signage. It is important to allow students or children to learn what sustainable strategies are. A process as simple and helpful as recycling can be taught to children at a young age. While the more interested and older students can learn the sustainability methods of the building in a more detailed way if they want to. In order to give children the connection to nature they deserve, it is necessary to get out of the city. This can be taken literally with site selection, but if a site is located in a densely populated area, steps can be taken to create green spaces that allow children to connect with the environment.

Realm of the Senses:
According to this chapter of the text, the senses "are the gateway to the mind, particularly the developing mind" (Bruce Mau Design et al.). It is important to provide the opportunities for young children to use all of their senses to observe the spaces around them. One way to accomplish this is to have outdoor spaces with gardens. This allows children to better understand how farming works, and where their food comes from. The outdoor garden stimulates the sight, smell, touch, and taste senses all at once. Every element of the building should be created with all five senses in mind. Each individual sense has its own importance, but combining them together is how we experience our surroundings. It is also how children manage to learn and retain any information about their surroundings at any given time. There should be a concerted effort to create multiple areas where kids can learn by touching or manipulating things with their hands.

Every area should have a paint color that stimulates the feelings appropriate for the function of the space. Forcing kids to use sound to map their surroundings is important for their development. Teaching kids what is okay to taste, and what is not okay, is something every child needs to learn. Kids also need to learn how to determine their surroundings and safety using their smell. One way to create an environment that is really immersive for children is to design an area where kids can remove their shoes. This removal of shoes then becomes the physical act that represents the need for mental preparation for learning. Observational learning through senses is the most beneficial strategy for teaching kids about our world.

Learning for All:
"Knowledge is the most democratic source of power" (Bruce Mau Design et al.). This quote by Alvin Toffler defines the responsibility designers have to make educational buildings for all people. This is especially needed when designing accessible spaces for children with disabilities. To make a learning environment inclusive, the designer must think about multiple different developmental perspectives. To create a more comfortable environment for students, it is necessary to create home-like environments that are engaging for students. Thinking about social interactions that are engaging for all students is an important part of the design process.

Rewired Learning:
The designer must think of technology as another form of learning, rather than a distraction to students. All children, regardless of financial backgrounds, should have access to technology for their future benefit. An effective way to accomplish this is to plan for the unknown. This means leaving opportunities for new technologies to take the place of the old ones, and designing spaces that allow teachers to change expectations and methods according to technological advancements.

Conclusion:
The eight sections of this book give guidance to designers on what to think about during the design process of educational buildings. To summarize, it is important to think of all children, how they experience the world, and what exactly the designer wants them to feel or learn in their experience visiting the building.

RESEARCH SUMMARY:

The research from these two articles combined with multiple other sources have created the guidelines that will greatly influence the design solution of this thesis. These readings are ultimately aiming to get the designer thinking about putting the child in the center of the design. The design must ultimately engage all children and encourage them to participate in the social atmosphere that will be their surroundings. This means the design of the building must be unique and implement design strategies that present learning opportunities for all who visit. This can be done with the naturalness of the building, the individualism of the design, and the stimulation of the built environment. When applied correctly, these three aspects of the design can create a coherent design solution.

When putting the child at the center of the learning process, the designer must first address the needs of the children. They need to feel safe, energized and healthy. This can be achieved through material use and sunlight control. Children learn best when they are thrown into an active learning environment, so combining multiple areas of education can help kids discover their own interests and strengths. Singular and group activities can be used to show off work, or to work together on projects that further develop social skills and collaboration. It is important to break up mind stimulating methods with body and mind stimulating activities. Giving children the opportunity to learn through interactive play and exercise will help them make new connections and develop socially. These connections can be made between the children and the surrounding community as well, by creating relationships and partnerships with the surrounding educational buildings of the area. The learning spaces must be sustainable, not only to create one less building that produces CO_2 emissions, but to give kids a lesson in sustainability by just visiting the building. This will give kids a deeper and more personal connection to nature, which will hopefully influence them to take better care of the earth than their previous generations have.

The entirety of the building should be experienced interactively through stimulation of all five senses. Individual experiences may be prioritized in certain exhibits, but the child should feel all senses stimulated during the extent of their visit to the educational building. The design must surpass all expectations in meeting the criteria for accessible design. Educational buildings should be the most welcoming of all typologies, and accessibility is the biggest step in fulfilling that goal. Lastly, the building should be technologically advanced and teach kids the benefits of technology. There should also be an effort made to leave room for technological improvements as we as a civilization advance.

All of this research supports the idea that children's museums are a necessary educational building that allows children to learn and grow socially in an environment outside of their school. The opportunities for interactive play are not abundant outside of the school system. Any community would benefit from the addition of a children's museum, as it would improve social, mental, and physical development of the children who visit.

PROJECT JUSTIFICATION:

This thesis project will be the most comprehensive research & design project I have ever completed. This project gives me the opportunity to learn more about myself and my design process while investigating a thesis topic that interests me and that I believe would benefit a lot of people. My aim with this research will be to show people why investment in education should be a top priority in this country. I will convince others why the design and construction of a suitable children's museum is necessary for the betterment and growth of the Fargo/Moorhead community.

I ultimately chose this project typology because I care deeply about education and I felt I had identified a need in the Fargo/Moorhead area. There is a need for children to have opportunities to grow and learn outside the classroom. This space should be a place for children to run around at their own discretion and participate in interactive play with other kids in the local community. I feel that this is a necessity for every young child as it will help with their mental and social development as they learn to live in this world. I also have multiple educators who are family members, and close friends of mine who I respect and trust when they articulate their needs to create an effective learning space. The reason we invest in better educational facilities is to improve the quality of life of children, and to invest in the future generations that will occupy this planet after we are gone. I believe we as architects have a responsibility to design the best possible spaces for teaching and learning; and that by doing so, we are not only making an investment in children, but also in the longevity of our species and our world.

SOCIAL, CULTURAL, AND HISTORICAL CONTEXT:

Social Context:

"Whether this year's kindergarten student will merely survive or positively thrive in the decades to come depends in large measure on the experiences she has in school. Those experiences will be shaped by adults, by peers, and ultimately by places, by the physical environments where she does her learning. United in the conviction that environment is our children's third teacher, we can begin anew a vital mission: designing today's schools for tomorrow's world" (Bruce Mau Design et al.). This passage from "The Third Teacher" text examines why the building environment a child learns in is so crucial to her progression. Naturally, teachers and peers will always have more influence on children, but with all three "teachers" working together, educational buildings, and the environments they create, could become something far greater than we ever could have possibly imagined as designers.

Historical Narrative:

The idea of studying childhood development and implementing the research into teaching and learning is not a new concept. The actual discipline of developmental psychology arose in the late nineteenth century. The early practice of this study dealt almost exclusively with child and adolescent development. The philosopher John Locke (1632-1704) is considered the father of modern learning theory. Locke was one of the first philosophers to tackle the idea of developmental psychology and his big conclusion was "to emphasize the role of the environment in development" (History of Developmental Psychology). Jean-Jacques Rosseau (1712-1778) is considered the father of classical developmental psychology. He was the first philosopher/psychologist to suggest that development takes place in stages. "Among the many contextual forces which contributed to the rise of developmental psychology in the United States, the child study movement was the most important. This movement, which emerged during the latter part of the nineteenth century, focused on the welfare of children and, among other things, helped to bring about the passage of laws governing child labor and compulsory education.

Its leadership was assumed by G. Stanley Hall (1844-1924)" (History of Developmental Psychology). In the late eighteenth and early nineteenth centuries, John Dewey made his mark on child development psychology. He posed questions that we are still trying to answer today such as; "which aspects of development are universal? Which are expressions of local culture?" (History of Developmental Psychology). Around this same time, other pioneer developmentalists were creating new theories and studying new ways to approach child development. Other psychologists of the time include James Mark Baldwin (1861-1934), Alfred Binet (1857-1911), and of course, Maria Montesorri (1870-1952). Montessori is famous for creating The Montessori method, a style of teaching that puts the child at the center, and focuses on hands-on learning and collaborative play. Early in the 1930's, Sigmund Freud founded the psychoanalytic approach to developmental psychology. Freud is known for creating the theory of psycho-sexual development, which has been widely questioned and challenged during its prominence in developmental psychology. Up until the 1940's, much of developmental psychology was normative. This psychology method was promoted most by Arnold Gesell(1880-1961) and his mentor, G. Stanley Hall. This method encouraged parents to relax and trust more in children making a connection with nature and vice versa. John Watson (1878-1958) is considered the father of behaviorism. He started learning theory and approached all developmental studies from a learning point of view. Another theorist who followed Watson's research was B. F. Skinner (1904-1990). Skinner was a strict behaviorist who stressed the role of operant learning in child development. His studies led to experiments that demonstrated the need for reinforcement when teaching children. Jean Piaget (1896-1980) made his mark on the field in the late 1900's. He studied the child as a blooming scientist, whose scientific observations of the world are constrained by their own cognitive ability. As a child progresses through each stage of development, Piaget argued that more and more observations were unlocked and the child could then understand their environment and the world fuller. The future of developmental psychology is becoming increasingly concerned with the context of development. This meshes well with many of the ideas presented in this thesis, as the research conducted in this project will be meant to inspire people to push for change in government policies and resource allocation that will improve the context of development for children.

SITE ANALYSIS:

Location:

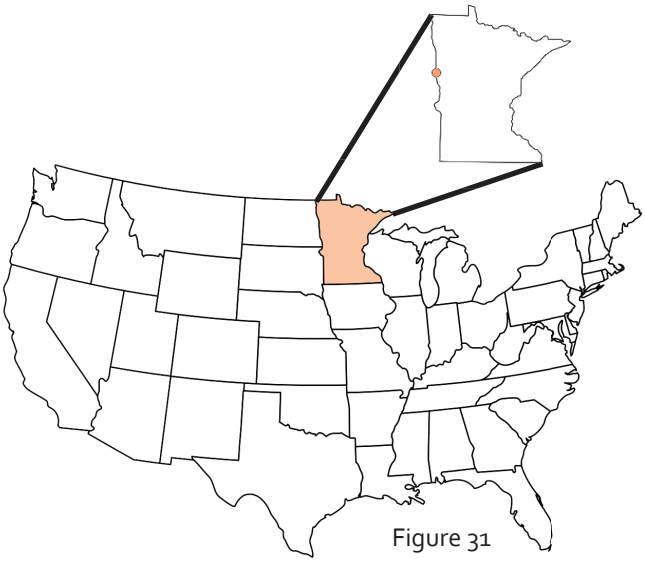


Figure 31

The site is located in Moorhead, MN right on the Red River. It rests in between the 1st Ave, N bridge and the Center Ave. bridge that grants access from Fargo to Moorhead and vice versa. This location was chosen due to its central location in Moorhead and Fargo, and for its appealing location near downtown but still within nature by the river.

Fargo has not had a children's museum since Yunker Farm closed down in 2019 due to Covid-19 halting business. With the growth in technology, it is getting more difficult to keep kids stimulated for extended periods of time. There needs to be opportunities for children to grow and learn outside of the school system in the Fargo/ Moorhead community.

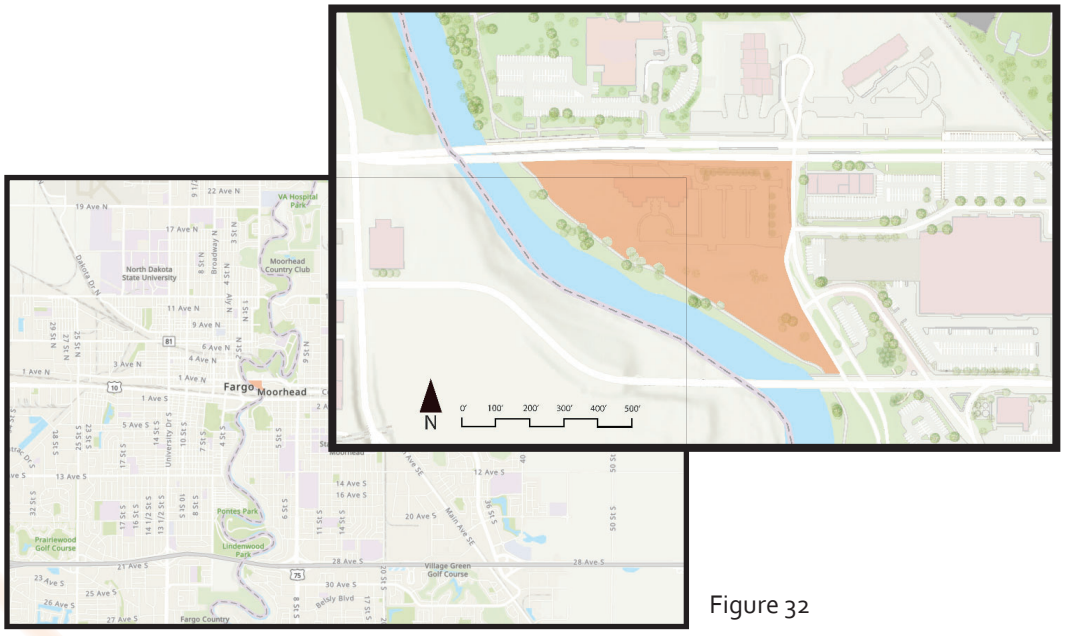


Figure 32

SITE ANALYSIS:

Building Information:

Building Code Regulations:

Allowable building height:

The project must not exceed:
- 180ft in height
- 12 stories

Maximum building coverage:

The project has unlimited building area potential, and is only prohibited by the required setbacks.

SITE ANALYSIS:

Zoning and Context:

A majority of the land surrounding the site fits into the Neighborhood Commercial or Downtown Mixed-Use zoning categories. The only other zoning type nearby is a few "public Use" areas where public parks exist.

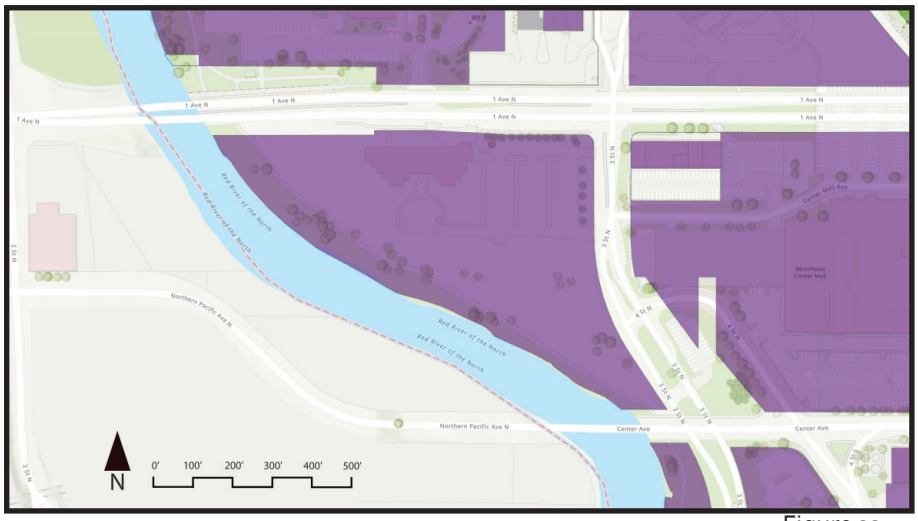


Figure 33

The site has multiple notable existing buildings around it. The buildings that might have an effect on the site are the Hjemkomst Center, The One Riverside Apartments, and thE Park View Terrace Apartments to the north. Notable buildings to the east include the Center Mall North strip mall, and the Moorhead Center Mall.

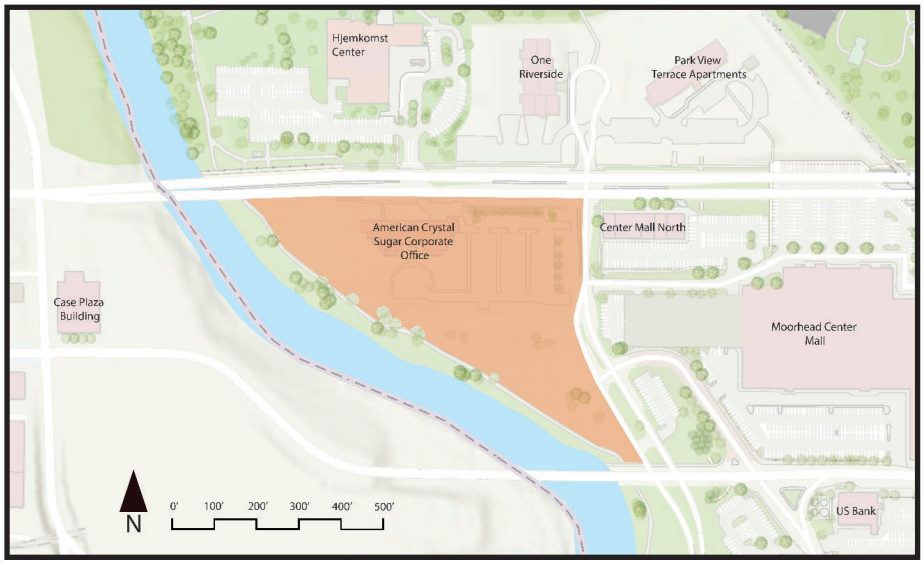


Figure 34

SITE ANALYSIS:

Climate Information:

It is always a design challenge to create a functioning building fit for a climate as interchangeable and intense as the one in Moorhead, MN. Moorhead has short hot summers and long cold winters. Details of the building have to be fit to withstand average temperatures for winter (0 degrees Fahrenheit) and average temperatures during summer (83 degrees Fahrenheit). Average total precipitation year round is approximately 25 total inches. Moorhead gets hit hard with snowfall, averaging 58 inches each year. Winds in the Fargo/ Moorhead area are most high during the winter months and usually calm down during the summer. The days in moorhead are over 15 hours at their longest. At their shortest, there is sunlight for under 9 hours a day.

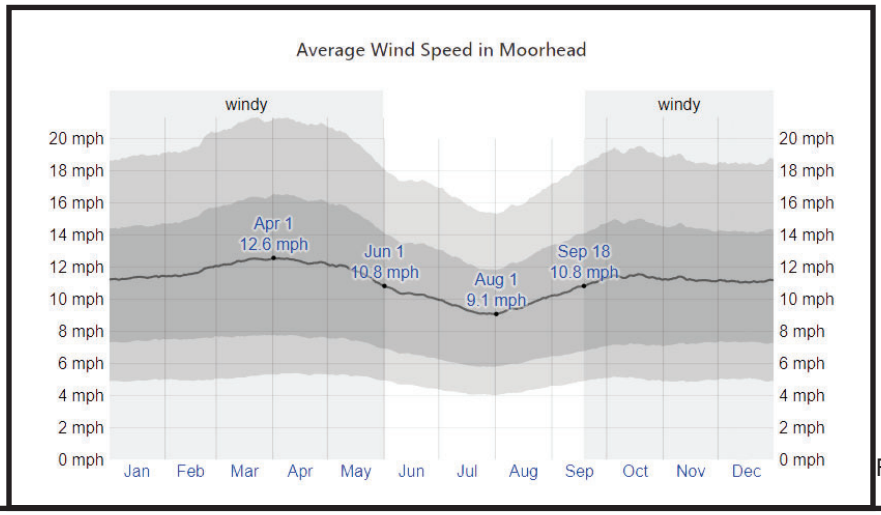


Figure 35

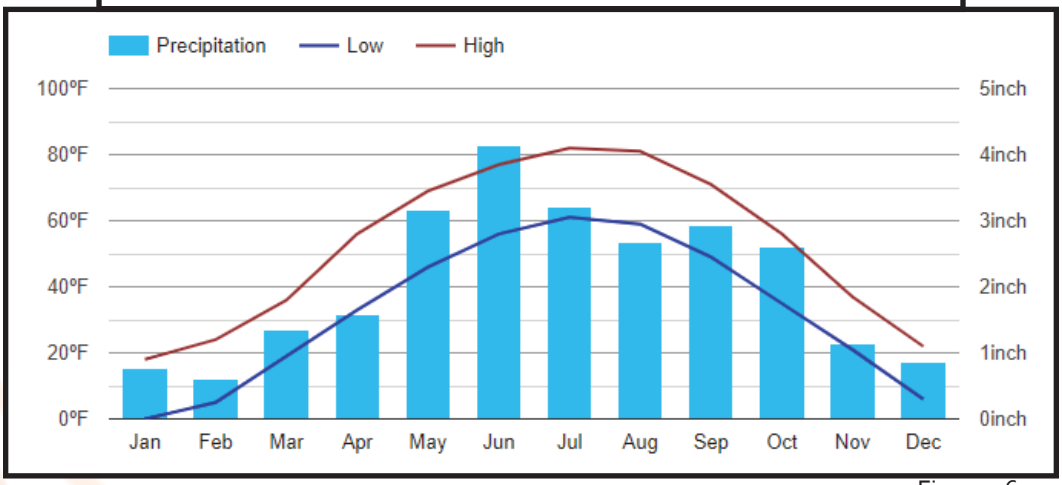


Figure 36

SITE ANALYSIS:

The Red River and The Flood Plane:

Planning for future possibility of flooding will be necessary for this site. Although the city is much more prepared for flooding now, the flood in 2009 turned this site into an island.

Figure 37

Figure 38

Figure 39

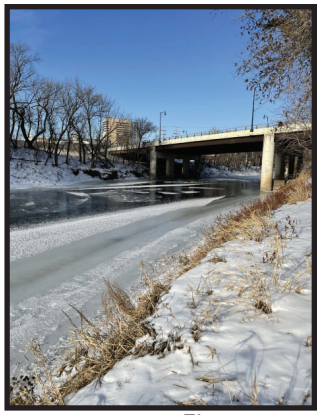


Figure 40

SITE ANALYSIS:

Vegetation:

Most of the existing trees on site are deciduous located near and around the river. There are however many pine trees that surround the existing parking lot on the site. The deciduous trees by the river consist mostly of box elder varieties, but there are also some large Elm trees on the existing site.

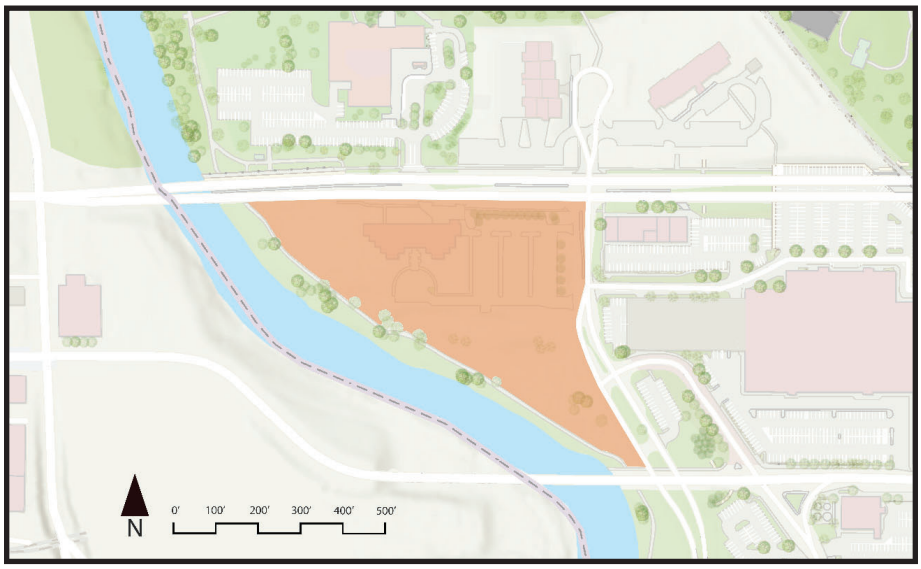


Figure 41

Figure 42

Figure 43

SITE ANALYSIS:

Roads and Circulation:

The site is a relatively quiet one due to there only being one busy street nearby. There some rarely used walking paths that run by the river available to the public. One real benefit of this site is the large amount of parking options just to the east. Most of which is located in the parking ramp for the Moorhead Center Mall.

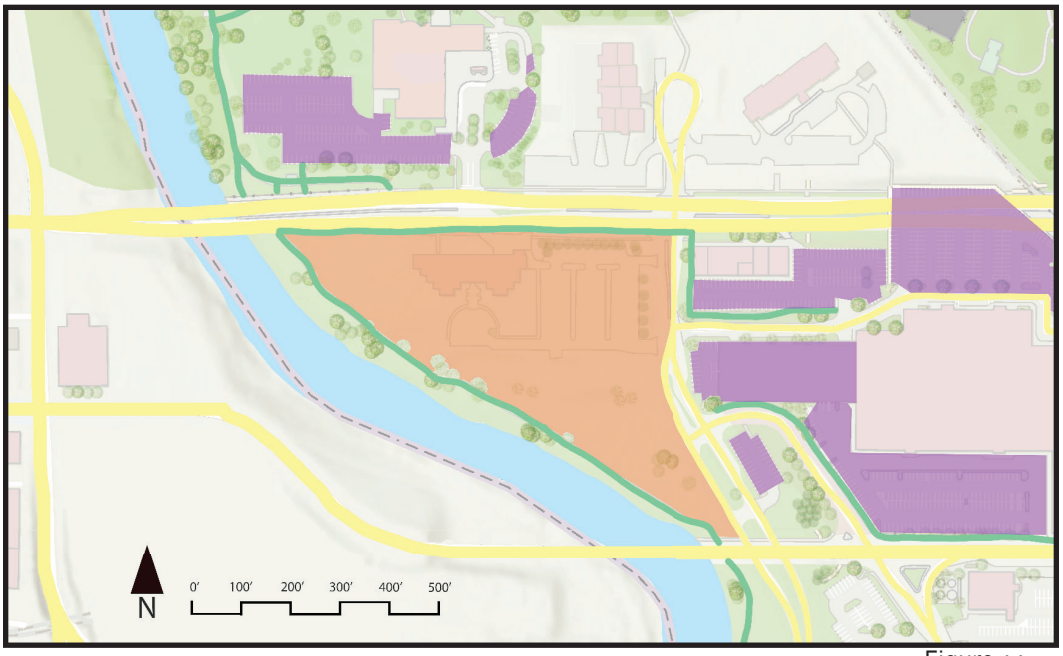


Figure 44

The Site

Walking Paths

Major Roadways

Red River

Existing Parking

Figure 44

SITE ANALYSIS:

Topography:

Most of the build-able site area rests on a relatively flat area of land. The closer to the river edge, the steeper it gets. Although some of this area is developed, much of it is open grass areas with a few trees that slopes down toward the river at different angles. Interestingly, the slope is most severe in the middle of the property next to the river. The slope on the property to the north and south edges is a more gradual one.

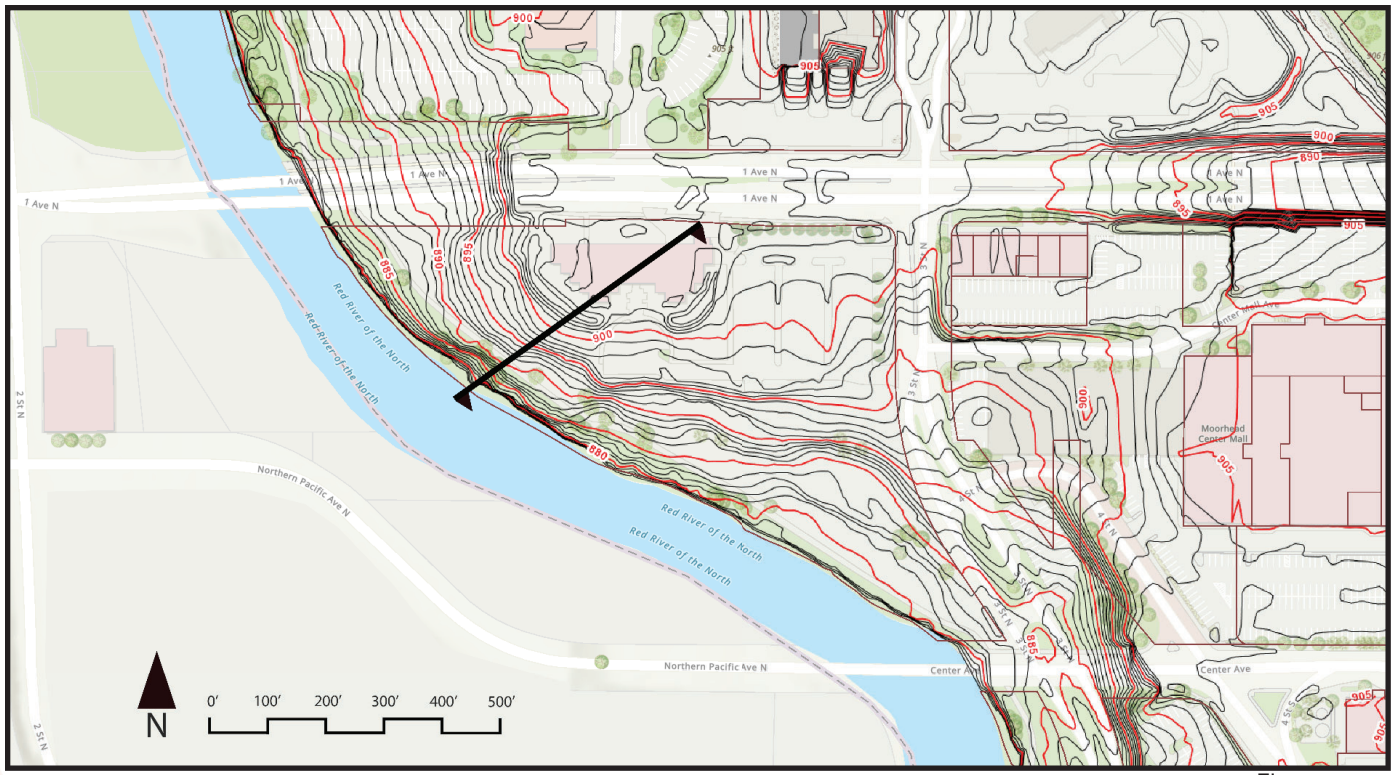


Figure 45

Elevation of Topography:

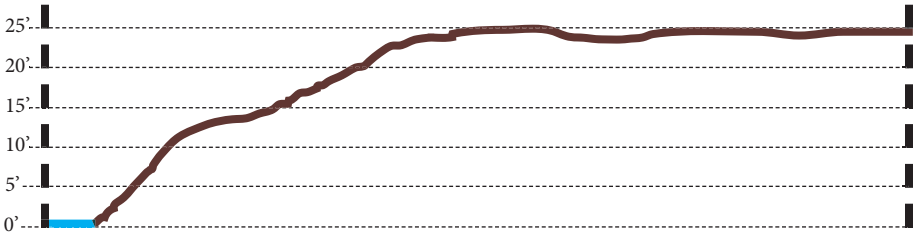


Figure 46

SITE ANALYSIS:

Views from the site:

South toward NP Ave. bridge
Figure 47

East toward Moorhead Center Mall
Figure 48

1st Ave. bridge looking west
Figure 49

Hjemkomst Center to the north
Figure 50

Looking west toward the river and under 1st Ave. bridge
Figure 51

PERFORMANCE CRITERIA:

Criteria Explained:

My design will be measured in its performance with sustainability, Spatial relationships, Natural lighting, Educational impact, psychological impact, behavioral patterns of users and code compliance. All of these aspects will be taken into consideration when designing the building and throughout the research process. I will obtain these performance measures through the help and guidance of my peers and teachers and of other design professionals during the design process. These will be determined through measuring of spaces, implementation of thesis research, climate considerations, showing basic knowledge of code regulations, and being able to communicate how my building might make a visitor feel, or what the design might influence them to do. This analysis will largely be done through examination of my thesis research and implementation of that research into my building design. I will be producing drawings in the form of plans, sections, details, elevations, and renderings to communicate the aspects of the building that are listed above. I will then be able to use tools to determine how my building will perform sustainably, spatially, educationally, and psychologically. To judge how I meet the criteria for performance of the building, I will take a step back and try to examine my project and research from the point of view of not having seen it before. This way I can try to be unbiased in my examination and produce conclusions that will hopefully say my building exemplifies all the attributes I have listed to base the judgment criteria on.

Space Allocation Table:

Space:	Square Feet (SQ)	Percentage (%)
Lobby	5,000	7.30%
Large Exhibit Space	25,000	36.40%
Small Exhibit Space	8,000	11.70%
Classroom Space	4,000	5.80%
Outdoor Exhibit Space	12,000	17.50%
Cafeteria Space	3,000	4.40%
Office Space	800	1.20%
Bathrooms	3,800	5.50%
Mechanical	7,000	10.00%
Total	68,600	100%

Figure 52

Space Interaction Matrix:

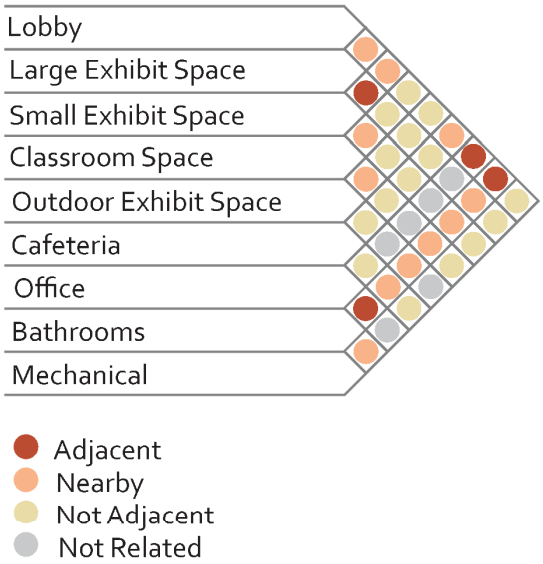


Figure 53

Space Interaction Diagram:

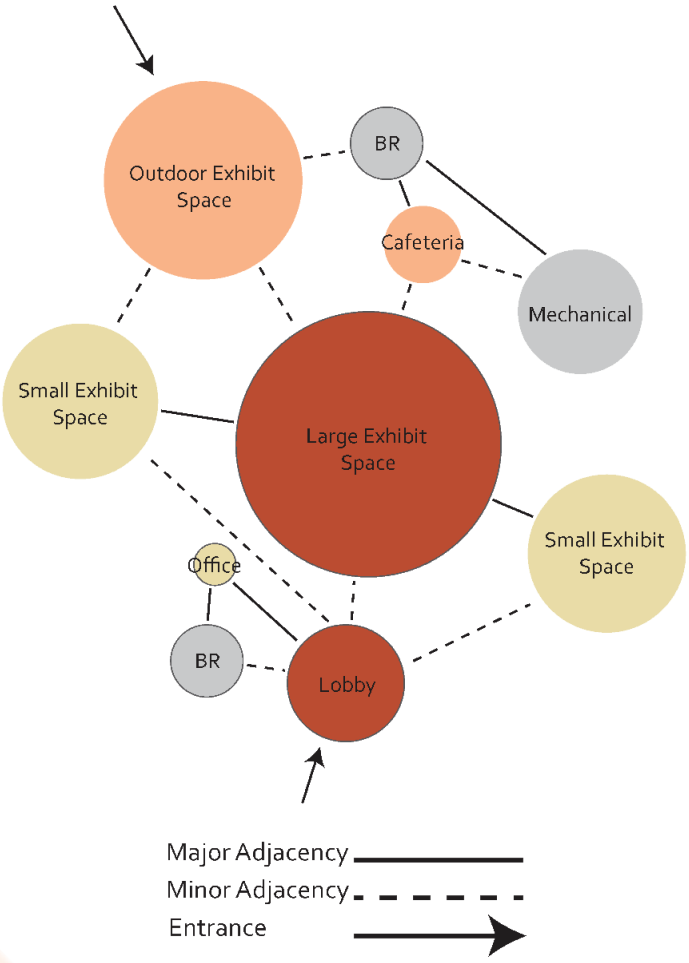
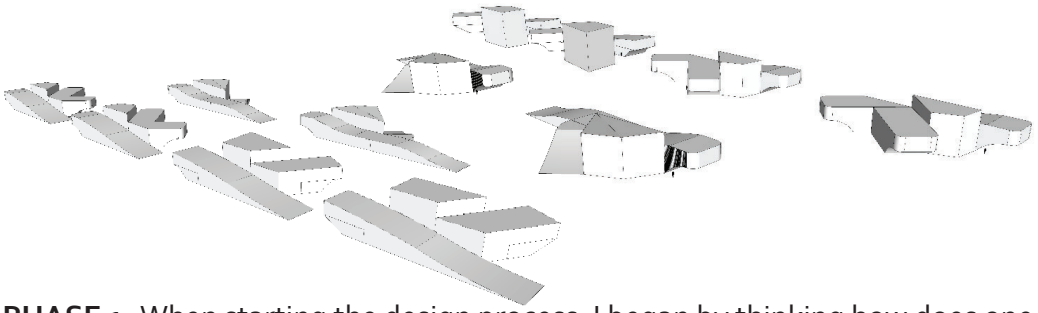


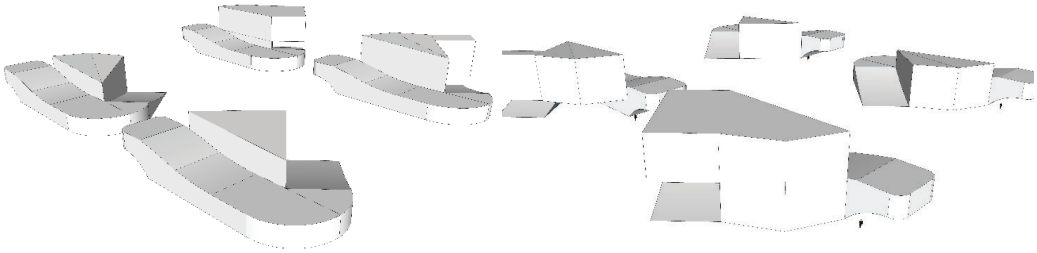
Figure 54

PART 3:
THE DESIGN SOLUTION

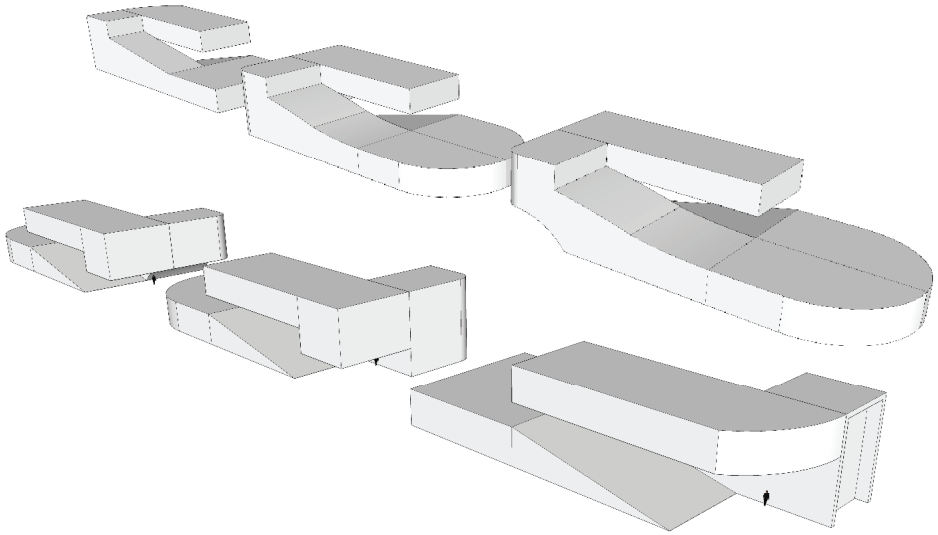
DESIGN PROCESS:



PHASE 1: When starting the design process, I began by thinking how does one create a building that is physically interactive. I thought about using the spaces that are not normally used. This thinking led me to a walkable roof.

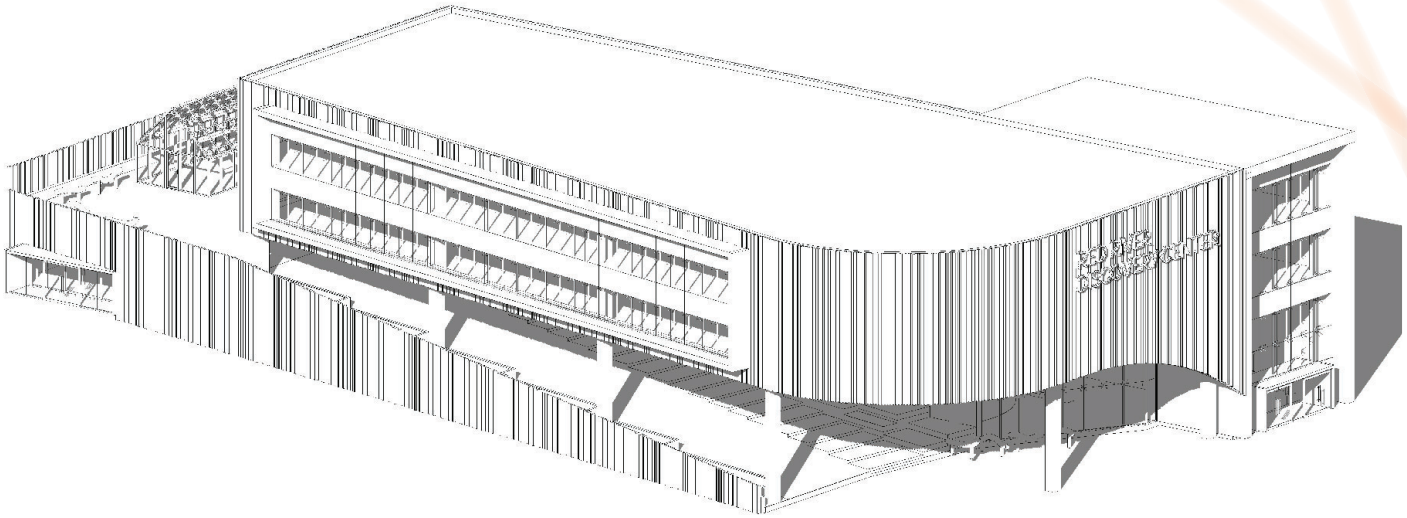


PHASE 2: The issue I kept running into with phase one of my design ideas is the building footprint. It became way too large and occupied too much space on the site. My solution to this problem was to create a turn in the ramp that brought it back toward the main entrance to the building. The next issue with these masses to address was the amount of unused space above the ramp.

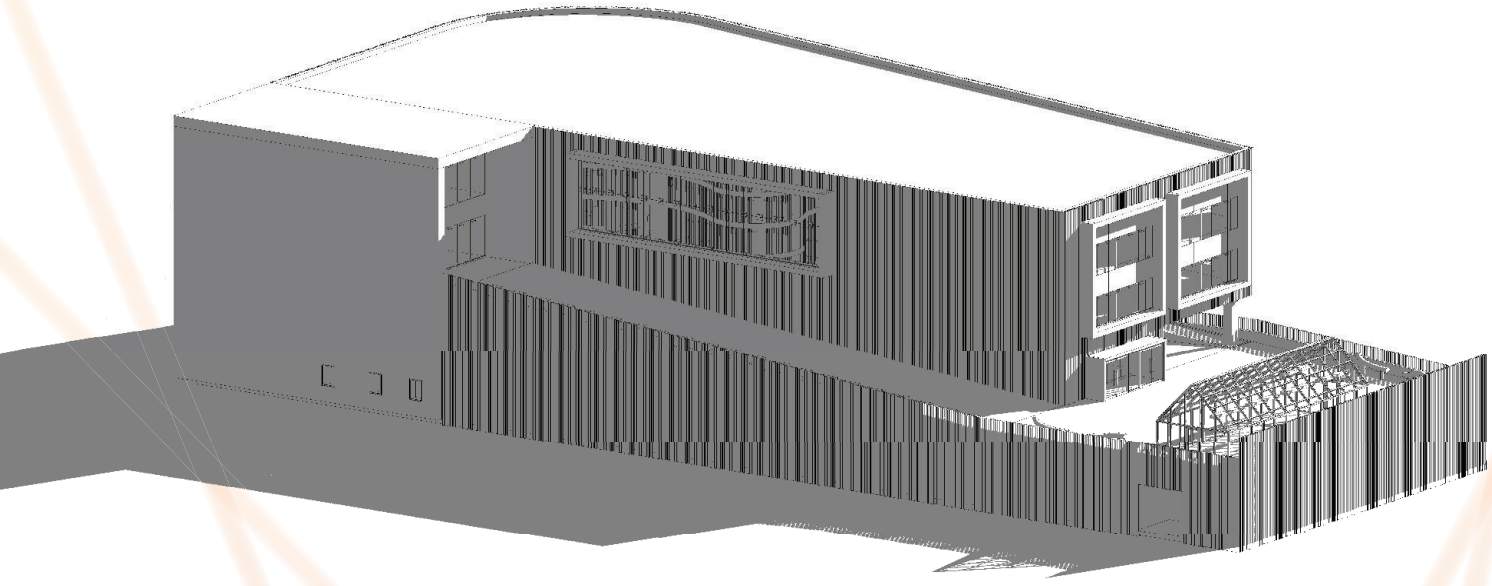


PHASE 3: Rather than leave the ramp open above, I reclaimed that space to serve the purpose of housing more exhibits for the building. This gave me a form I liked while also maximizing the amount of usable space on the building footprint.

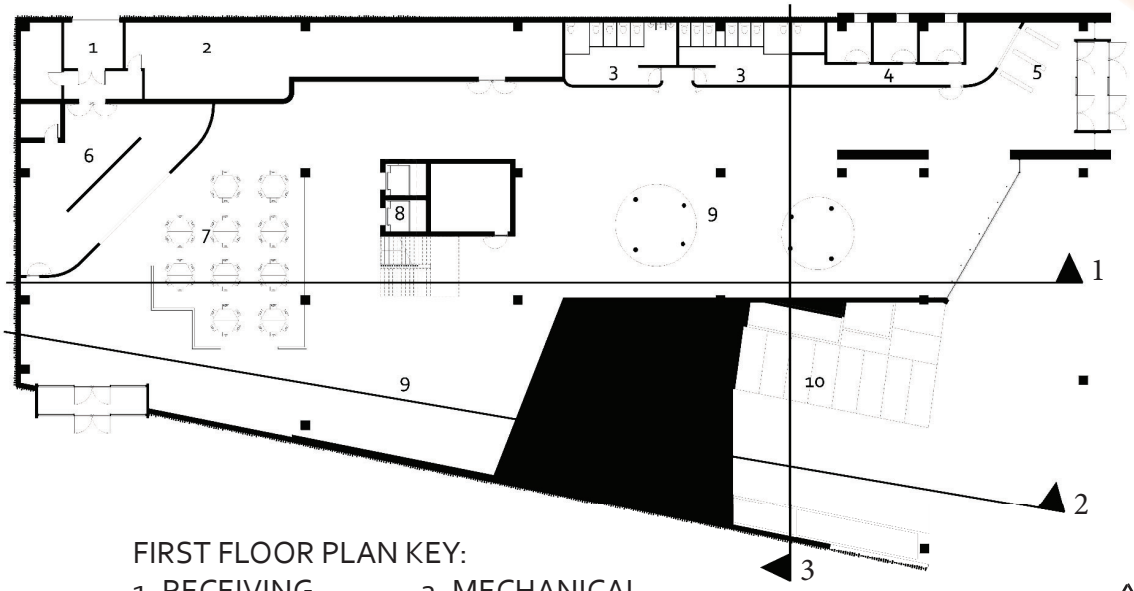
FINAL DESIGN:



The final design utilizes the ramp to connect three of the four floors of the building to one another. Visitors can use the incline, or steps to move through the space. This ramp offers another way to experience the building vertically and contributes to the individualism of the project. The floors above the ramp have large south facing windows to maximize daylighting into the exhibit spaces. On the second level balcony, there is open space, exhibits and a greenhouse to teach kids about vegetation in other climates, and where our food comes from. This all contributes to stimulating children through all of their senses in multiple different ways.

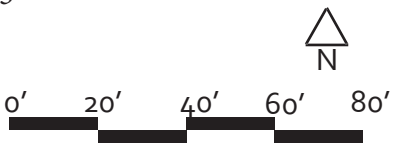


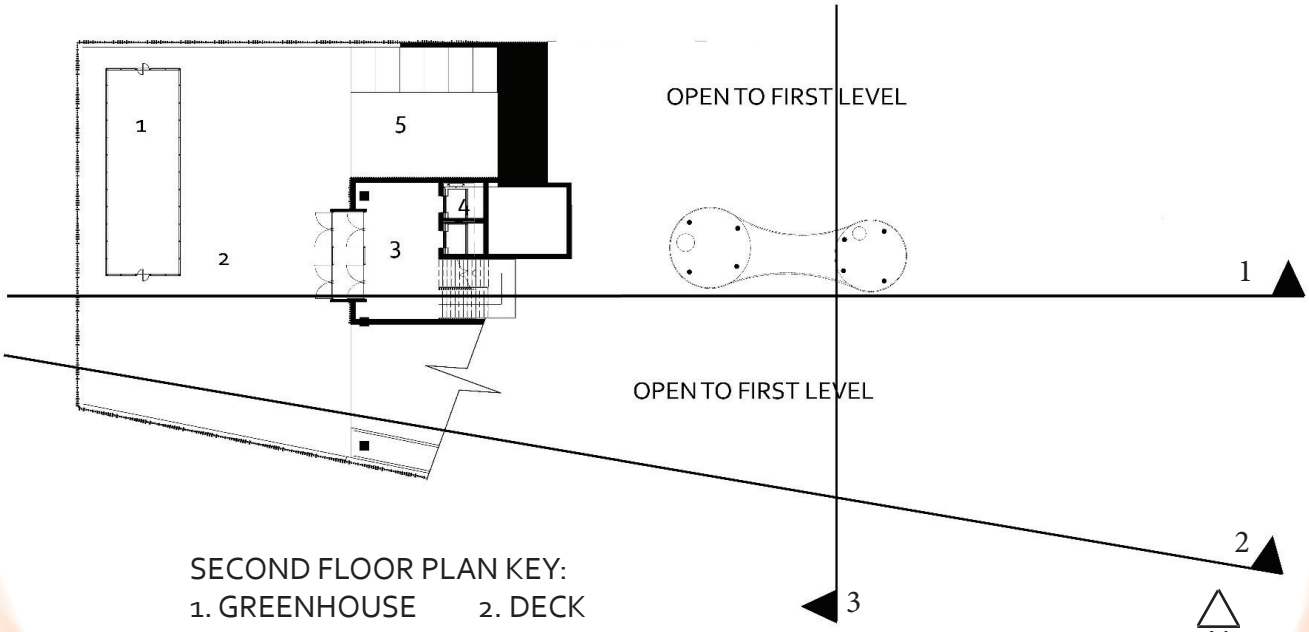
FLOOR PLANS:



FIRST FLOOR PLAN KEY:

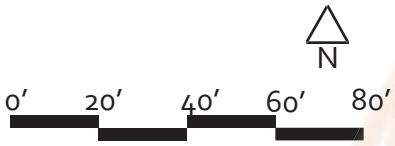
1. RECEIVING
2. MECHANICAL
3. RESTROOMS
4. EMPLOYEE
5. MAIN ENTRY
6. KITCHEN/SERVICE
7. CAFETERIA
8. ELEVATORS/STAIRS
9. EXHIBIT SPACE
10. RAMP



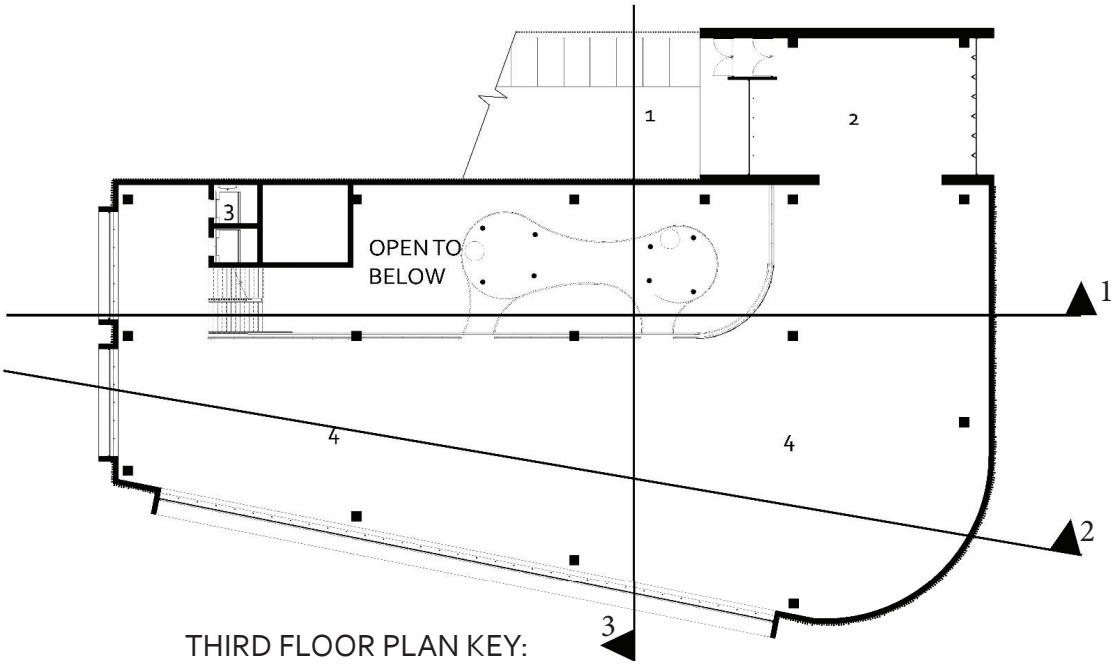


SECOND FLOOR PLAN KEY:

1. GREENHOUSE
2. DECK
3. SECOND FLOOR LOBBY
4. ELEVATORS/STAIRS
5. RAMP

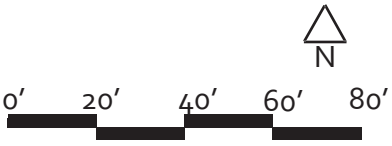


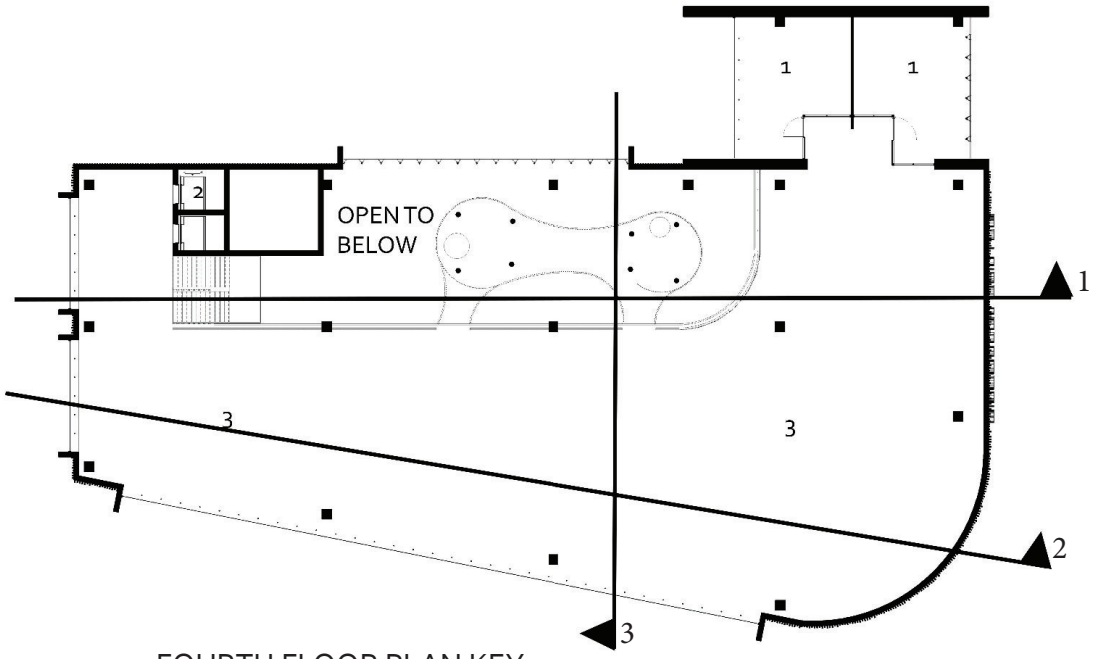
FLOOR PLANS:



THIRD FLOOR PLAN KEY:

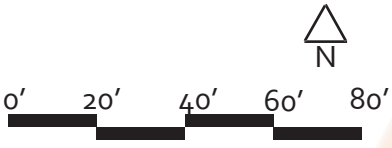
1. RAMP
2. THIRD FLOOR ENTRY
3. ELEVATORS/STAIRS
4. EXHIBIT SPACE



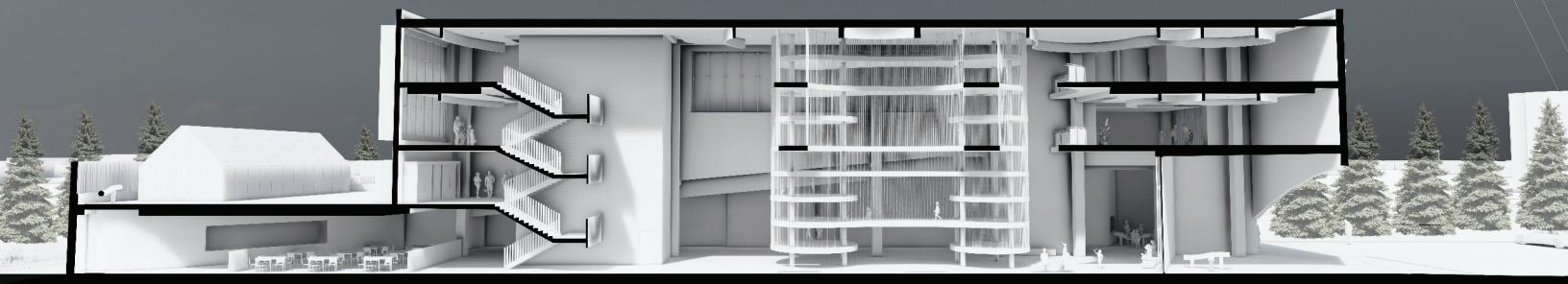


FOURTH FLOOR PLAN KEY:

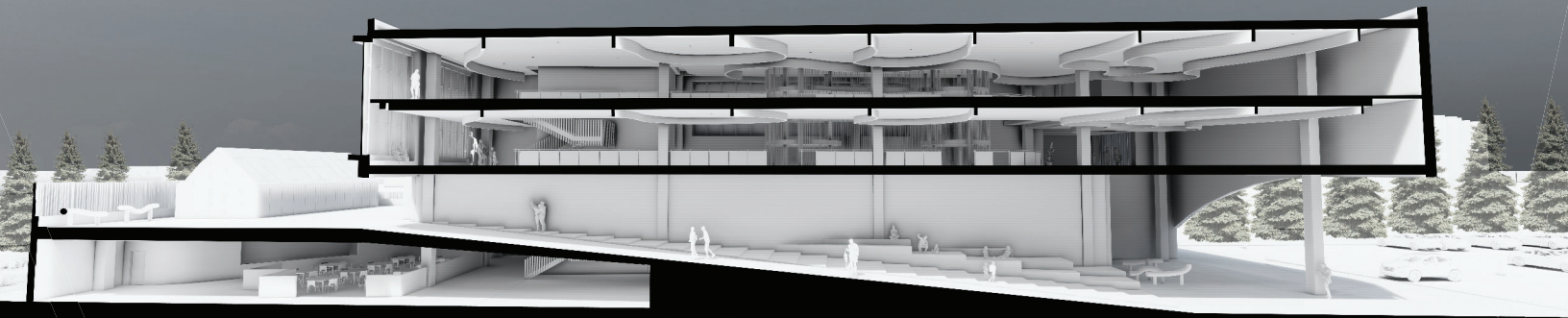
1. CLASSROOM SPACE
2. ELEVATOR/STAIRS
3. EXHIBIT SPACE



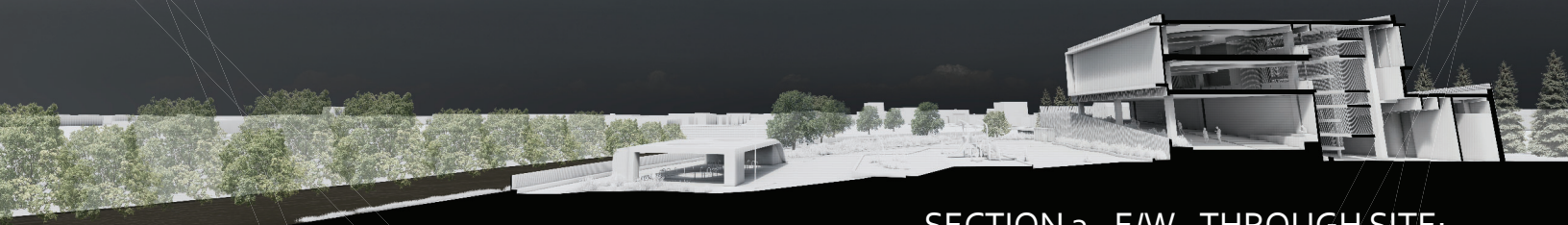
SECTIONS:



SECTION 1 - E/W - THROUGH ATRIUM:

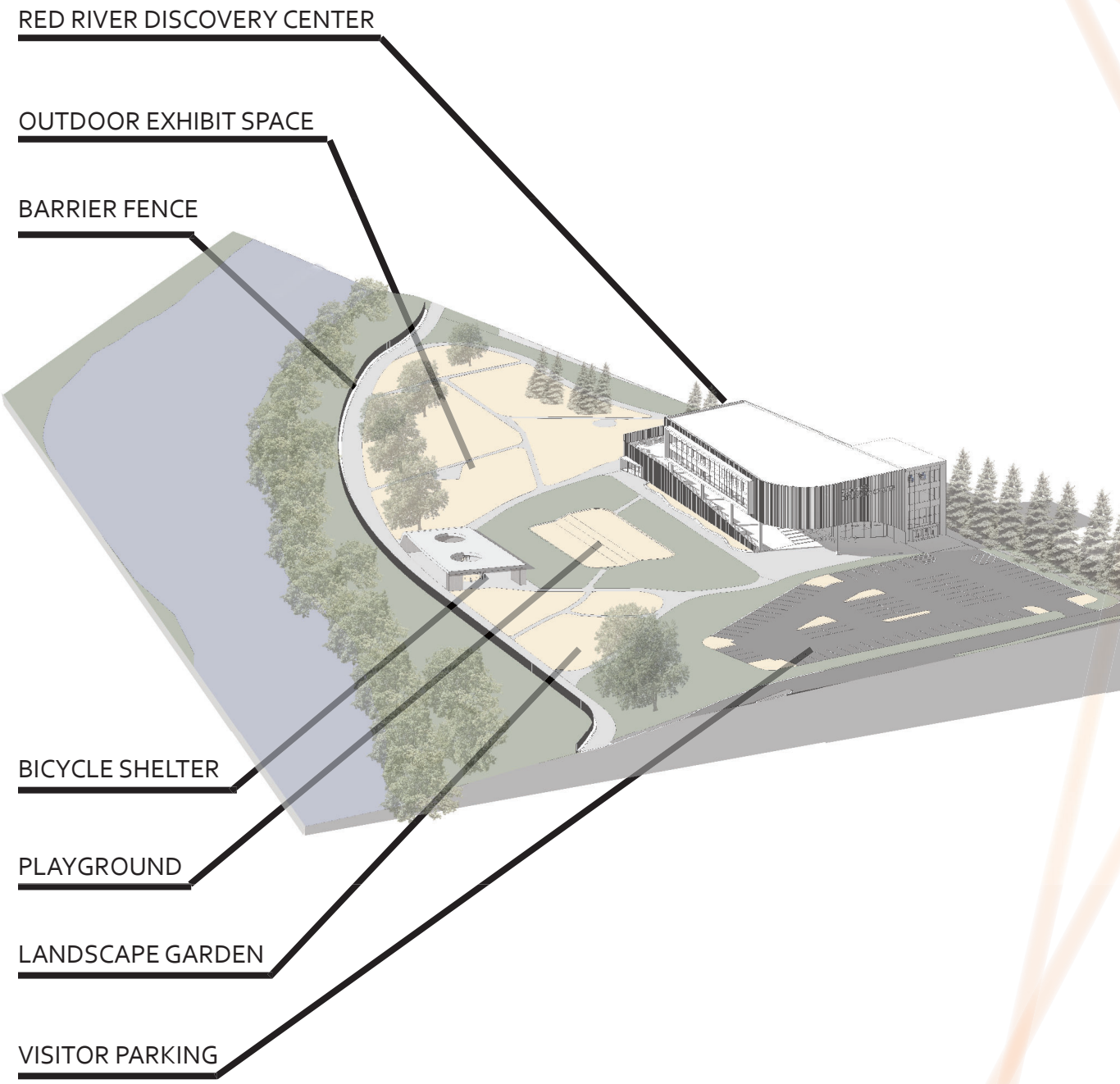


SECTION 2 - E/W - THROUGH RAMP:

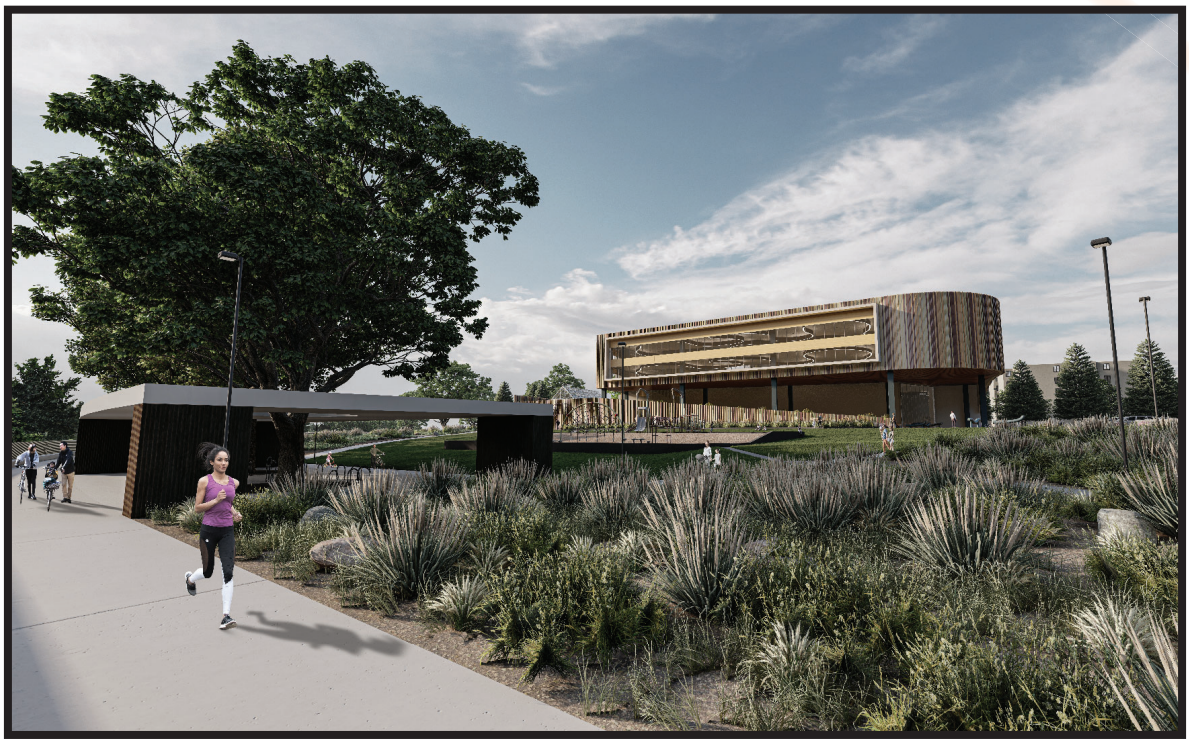


SECTION 3 - E/W - THROUGH SITE:

SITE DESIGN:


RED RIVER DISCOVERY CENTER
OUTDOOR EXHIBIT SPACE
BARRIER FENCE
BICYCLE SHELTER
PLAYGROUND
LANDSCAPE GARDEN
VISITOR PARKING

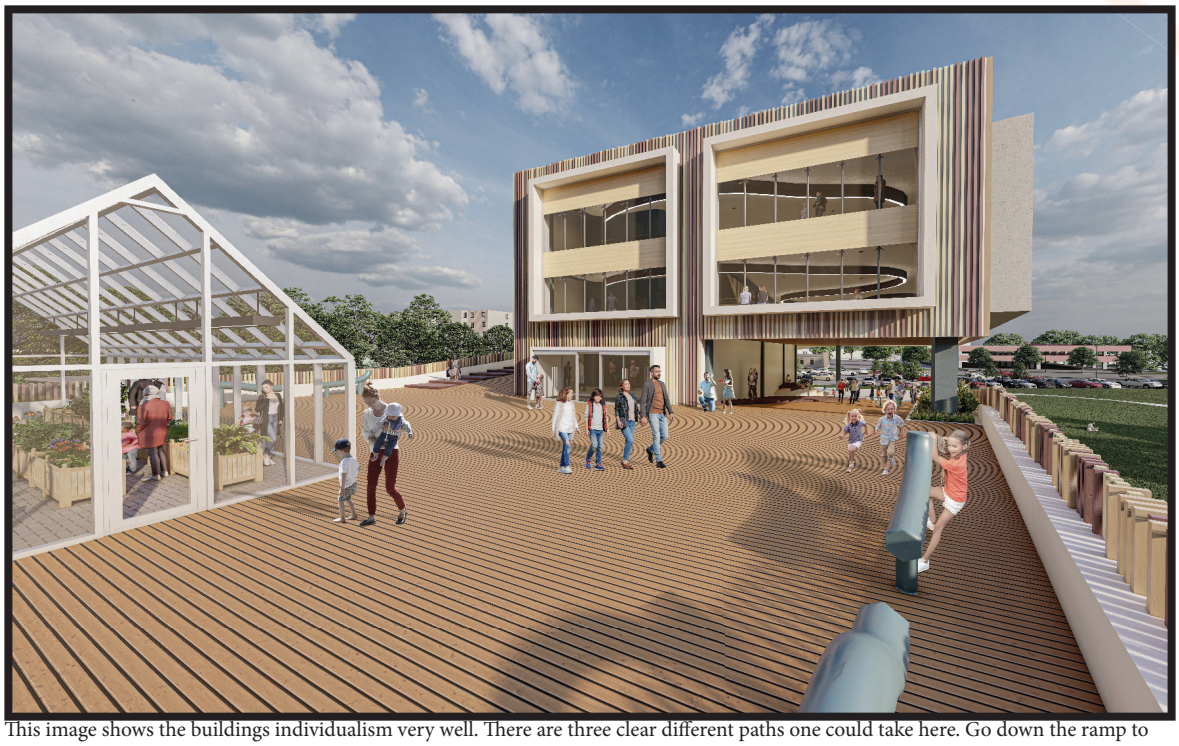
RENDERS:



The gardens around the site give the opportunity to stimulate senses in a meaningful and calming way. This image shows the planter garden with vegetation found outside of town in natural areas. The bike shelter connects the building to the surrounding city through a healthier and more sustainable form of transportation.

The larger of the two gardens also has opportunities for children to interact with exhibits and sculptures along the paths. This image shows what one of these exhibits could be in a simple way. Kids can sit, climb, and play on top of a multi-tier platform that allows them to see the building from a different perspective while also challenging them in unique ways.

RENDERS:



This image shows the buildings individualism very well. There are three clear different paths one could take here. Go down the ramp to the front entry or site, go inside and use the stairs or elevators, or go up the ramp to access the third floor. The building is allowing each individual to experience its spaces in any way they see fit. This image also shows the utilization of forms and masses that encourage kids to climb or interact with. It doesn't take much to spark curiosity in the mind of a child, and these sculptures do just that.

The interior of the building has dozens of exhibits that challenge children in different ways. Physical, social, and mental challenges will engage kids in their surroundings and force them to provide solutions to the problems they are facing. On top of developing these skills, the interior of this building is just plain fun for any child or adult to experience with the ones they love most.

RENDERS:

My Project efficiently reaches all three aspects of my research in an exceeding fashion. Comfortability and level of naturalness is acquired through the interchangeability of spaces, the ease of change of airflow, and the excessive, but controllable amount of daylight. Every public area of this building has some kind of diffused or direct daylight shining into its spaces. Individualism is present all through the building design. Each user can experience the spaces in any way they see fit, and they have multiple options to do so. The largest decision one makes when approaching the front of the building is whether to take the ramp way up to the roof deck to explore, or to enter the inside of the building and experience the exhibits. There are multiple areas of the building that allow this individual experience. The deck is another, while the third floor also creates this choice. There are also multiple areas on the site that allow for decision making and individual experience. Stimulation is achieved all throughout the project. The interior of the building has many color pallets and exhibits to stimulate sight, hearing, and feeling. The greenhouse outdoors give children the opportunity to stimulate their taste and smell senses. Other areas on the site offer stimulating experiences to all visitors as well.

The Project meets all three of its goals in the design:

1. Design a space that encourages interactivity and a healthy learning experience.
   This is done through the research explained above.
2. Integrate nature into the design to give kids an appreciation for the environment.
   This is achieved through the use of the site, as well as the greenhouse located on the roof deck.
3. Design an aesthetically pleasing building that all people want to experience.
   This is achieved through the harmonious connection between building and landscape, and project and community. The interesting and unique design is unlike anything in the surrounding area and will draw in people if only just to see the building itself.

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PAST STUDIO EXPERIENCE:

Second Year Experience:

First Semester - Cindy Urness
- Meditation Center
- Boathouse

Second Semester - Milton Yergens
- Marfa Small House
- Mixed Use apartment building

Third Year Experience:

First Semester - Bakr Aly Ahmed
- Wood Project - Olympic Stadium
- Masonry Project - Resort

Second Semester - Regin Schwaen
- Concrete Project - House
- Steel Project - Office Building

Fourth Year Experience:

First Semester - David Crutchfield
- Capstone Studio - Highrise

Second Semester - Mark Barnhouse
- Marvin Windows Competition - House
- Sponge City Miami - Water Reclamation Center

Fifth Year Experience:

First Semester - Ganapathy Mahalingam
- Concert Hall

Second Semester - Bakr Aly Ahmed
- Thesis Project - Children's Museum

BOARD EXHIBIT: