Rivers Edge:

An Adult Participatory Net Zero Community

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RIVERS EDGE: AN ADULT PARTICIPATORY NET ZERO COMMUNITY

A Design Thesis Submitted to the
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University

By

Ian Schimke

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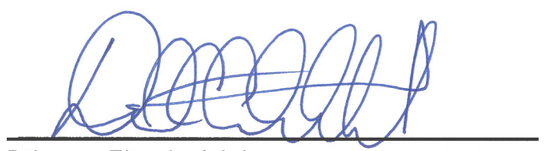
for the Degree of Masters of Architecture



Primary Thesis Advisor

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Thank you family, friends & professors for
encouraging me to pursue my passion.

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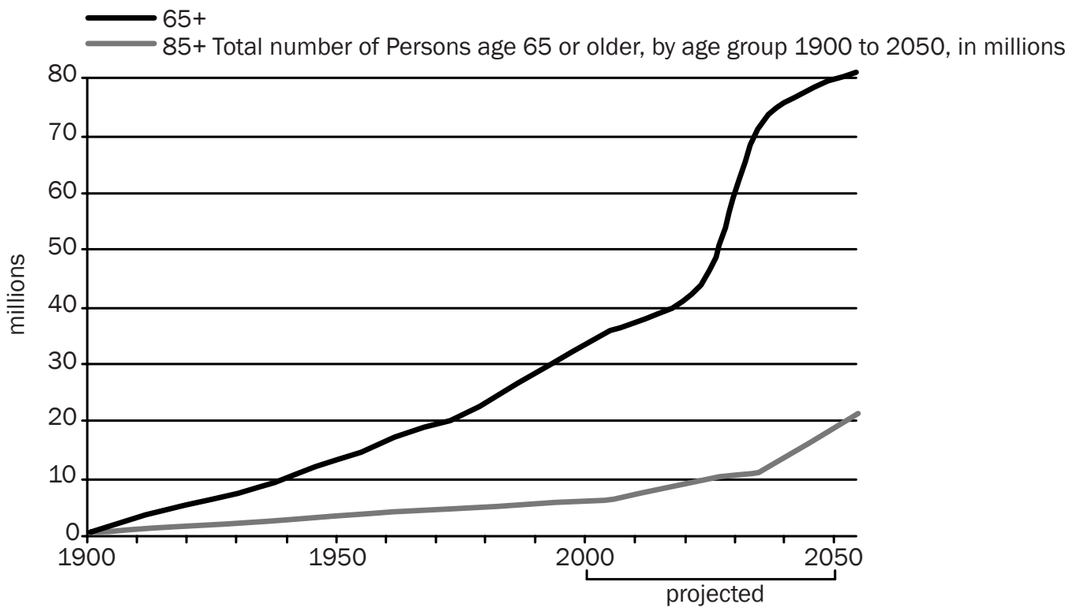
Thesis Abstract

The thesis abstract aims to inform the reader what the thesis is generally about. This short descriptive explanation sets the scene for what is expected to appear throughout the rest of the book.



“It is truly a democratic building. Nearly everyone who lives and works on the site has a hand in determining how it performs.” - jv DeSousa

We live in a time of social change - we have been given the challenge of transitioning from our fossil fuel-driven society into a clean zero-energy future. To date approximately 40 percent of U.S. energy consumption comes from residential and commercial buildings. Addressing this societal issue through design will begin to eliminate the negative effects of climate change and significantly reduce the energy cost for building owners and residents.

A multigenrational net zero residential building should foster interactive engagement and continuous excitement from its inhabitants to want to learn and educate the public about the participatory potential of a net zero community. A strong sense of cooperation is paramount in the success of a net zero community.

The research question this thesis investigates is; *How might the relation of young professionals and seniors manifest in net zero architecture?*

Thesis Narrative

In this section the thesis project is explained within the greater context of architecture and why it is important to myself. In addition, the project schedule is communicated both descriptively and visually, displaying the major phases of the project as well as the intended research methodologies.

EXPLANATION OF THESIS

Senior demographics within the United States are beginning to change drastically, and will continue to change over the coming decade. According to Perkins Eastman, a well established architecture firm who has extensive experience and research within senior living design notes, “Demographic projections for 2025 show the influence of the baby boom, with the population of those 65 growing to over 63 million and that of those over 85 to over 8 million. By 2030, approximately 19 percent of the population in the United States, or 71 million people will be over 65.” Increasing rapidly at 15 percent per decade, these demographic trends makes the senior population the fastest growing age group within the U.S. Without a doubt this current group of elders will have a lasting effect on the architecture and design profession. Thus it is important to begin to explore new design solutions before it becomes an issue. “The increasing number of older people, combined with changes in the way they want to live out their later years and their expectations of a high-quality life, is creating the need for new care and housing options.” Although it is important to respectfully challenge the status quo of senior living, there remains one characteristic which should be predominant in all, a sense of community. Senior living facilities should promote the quality of communal life, because life itself should not be spent unfulfilled or lonely. A sense of community can come through in design in many ways, however I am interested in learning if net zero design and the integration of young professionals into the program will foster a stronger sense of community. Therefore I will design a senior living community which focuses on keeping seniors actively connected through social interaction with young professionals and net zero engagement.

Research Question

How might the relation of young professionals and seniors manifest in net zero architecture?

This thesis will explore the design of a net zero living community for independent elders and young professionals. In addition, I will show other elder care functions including assisted living, skilled nursing & memory care as a part of a larger campus master plan. While the main focus of the design will be on net zero, independent elder living and young professional living, the other functions, assisted living, skilled nursing & memory care will be presented as separate phases. These separate phases will be presented within the campus master plan as well as developed forms within the final design.

PROJECT TYPOLOGY

An innovative net zero community within downtown St. Paul, Minnesota.

PROJECT EMPHASIS

The major elements of the thesis project in order of importance are as follows, 1. communal living, 2. net zero, 3. urban context, 4. senior living, & 5. young professionals

Communal living ranks as the project’s major emphasis. Creating spaces that foster community engagement from residents on a public, semi-public, semi-private & private scale will determine the success of the project. Finding common activities that both seniors and young professionals enjoy will help in the design of these spaces. Communal activities such as gardening, working in retail shops & giving tours will help keep seniors both physically and mentally active.

The second most important emphasis of the thesis project will entail net zero architecture. The focus on net zero deserves emphasis within the project, because it will play a major factor in the building design process as well as research. In order to use net zero design strategies within the design process, emphasis will be placed on topical literature readings. These readings will help as a guide when integrating different net zero strategies into the project.

PROJECT GOALS

Major Project Goals

- Develop a design solution for the overall thesis research question. How might the relation of young professionals and elderly people manifest in net zero architecture?
- Through literature and interviews, develop an understanding of why senior living facilities are designed the way they are.
- Through literature, develop an understanding of how to design for net zero.
- Through a digital simulation demonstrate that the proposed design meets net zero standards for its specific location.
- Respectfully develop a design solution within the urban context of downtown St. Paul, Minnesota that relates to it neighboring context.

Minor Project Goals

- Through the architecture develop spaces which encourage seniors to remain active within a community.
- Through the design process develop an efficient and well proportioned program.
- Propose a design concept which is both compelling to the baby boomer generation and the millennial generation.
- To provide exceptional views for the communities residents.
- Provide unique living units, as not everyone has the same needs and or wants.
- Through the architecture begin to blend the indoors and outdoors with the implementation of landscaping.

PROJECT CLIENT

A possible client for the thesis project would likely be a healthcare provider looking to establish a new style of senior living within an urban setting. As an adovcate for the environment this client is looking to build a community that at the end of each year has an electrical energy consumption of zero. Catering to seniors as well as younger professionals, this new model is a concept in which the client is interested in exploring. Seniors mentoring young professionals, and young professionals helping seniors through community interaction.

PROJECT JUSTIFICATION

The thesis project is important to me, because I believe the quality of design should not diminish as we age. Approximately two years

ago I experienced the loss of a loved one who had been living their final years in a senior living facility. About a month before passing, they were moved to a transitional care room. This room lacked any focus on the quality of life itself. Rather than providing an uplifting environment for the patient to reminisce on past memories, the room had similar qualities to that of a basement. Experiencing this situation I began to question whether there was a more elevated solution to senior living. One which promotes the quality of life through the design of the architecture.

This thesis topic is relevant to the broader context of architecture, because it explores the importance of designing for the elderly within a time of an aging population within the United States. According to the firm Perkins Eastman, “By 2030, approximately 19 percent of the population in the United States, or 71 million people will be over 65”. Clearly what we do with all of these elder people will be an important question needing to be explored.

This thesis project is applicable as a final project which demonstrates my knowledge and skills because, it researches and explores a topic which incorporates several architectural processes. These processes include learning about a topic and or typology through literature readings, case study reviews, in person qualitative interviews & design simulations. After completion of these processes I will take what I have learned and translate it into a final design.

RESEARCH DESIGN PLAN

The thesis project schedule for spring 2017 will be as follows, 1/3 design research & documentation and 2/3 design & presentation production. Starting with design research & documentation at the beginning of January 2017 and ending with a final presentation during the first week of May 2017.

Design Process

Based upon the research collected I hope to develop a design process throughout which explores solutions through sketching in layers and iterative physical model making, utilizing both 3D printing and hand made creations. These methods have proven to be most effective for me throughout the years as I work through a design problem.

After each work day I will assess where the project stands, comparing it to the overall thesis question and making sure that the proposed architecture does not stray away from the underlying research questions.

The major deliverables for the project will include process models, process sketches, final presentation boards & a completed book documenting the entirety of the thesis project.

Design Methodology & Project Schedule

During the design research & documentation phase, I will read through several topical literature readings, analyze (6) precedents, conduct (6) qualitative interviews & conduct a net zero digital simulation.

Before beginning any design, I will read through various topical literature readings. These readings are intended to help me further understand the basics to senior living design and net zero design. I will use these readings to help me focus on the considerations I will need to be aware of when designing for these typologies. During the precedent study review I intend to analyze a number of senior living and net zero precedents, and analyze their plans based on the buildings circulation, interior space proportion, structure, & interior space hierarchy. I am using this methodology to search for design similarities among a common typology. Based on what I discover, I will use the analyzed plans to help develop the interior layout of the project. Through the qualitative interview process I intend to speak with local senior living administrators, skilled nurses & local architects. By conducting these interviews I hope to develop a better understanding of why senior living facilities are designed the way they are. I will use the time during the interview to gain feedback on the design, and ask whether or not the proposed design actually works. Lastly, I intend to conduct a net zero digital simulation to test if the proposed design is actually meeting net zero standards for the intended location. I am using this methodology, because if I intend to mention that the proposed design is net zero, I am going to want to have proof. These simulations will be conducted later on in the design process. I will give myself 30 days to complete the design research & documentation portion of the thesis project. About half way through the research process, I will begin the design phase of the thesis project, starting with pre design.

The pre design phase will begin mid January, and will include preliminary conceptual design explorations based upon the collected design research. By the end of the pre design phase, ending the first week of February, I intend to have a thoughtfully developed concept which I can begin to further enhance within the proceeding schematic design phase.

Throughout the design of the project, most of the time spent will be reserved for the schematic design phase. Starting during the first week in February and ending after the first week in March, just in time for mid term critiques. This phase deserves to have the greatest amount of time, because it is during this phase when the design essence of the project is crafted. Additionally within the schematic design phase, I intend to develop the buildings form, the buildings relation with its site, major structural elements, exterior envelope, net zero design methods & interior programmatic layout. The end of the schematic design phase will lead directly into mid term critiques.

After mid term presentations and spring break I intend to leave 2 weeks for design development. Based on the feedback from the guest critiques I want to reserve some time for redevelopment of areas which may have been overlooked. This design development phase is scheduled to last from mid March and the end of March.

With one month remaining before final presentations, I intend to spend the final month of April producing presentation graphics, crafting the final presentation boards & preparing for the final presentation in front of guest critiques, faculty & peers.

Project Milestones

1. First week of February, have a well developed conceptual design.
2. First week of March, have a conceptual design developed as much as possible ready for review from outside critiques and peers.
3. End of March, be completely finished with the design of the building.
4. First week of May, be complete with all presentation materials and well prepared for a final presentation in front of guest critiques, faculty & peers.

Research Paper

The research paper begins to explore the question of whether or not net zero design is possible for a senior living community. Through multiple literature and journal readings on net zero, I became more aware of how might net zero design methods be integrated within the building design.

Senior care requires considerable amounts of energy from its buildings, however, is it possible to utilize net zero energy building methods to help eliminate the need for high energy consuming active systems? One of the largest generations within the U.S., the baby boomers, are rapidly aging and will soon be in need of assistance or long term care. As the aging baby boomer population continues to grow, the need for new care facilities increases, leading to an energy demand increase. “The huge baby boom generation, which transformed public and private institutions is poised to change our communities once again” (Eastman 2013). In order to begin to reduce the pending energy issue, due to the aging baby boomer population, various net zero energy building methods will need to be considered. Solar thermal, geothermal, passive ventilation, photovoltaics, and high performing insulation, are all net zero methods which can help decrease a facilities energy demand.

There are two major reasons why this topic is a current relevant issue worth researching. First, the need to increase building energy performance is more apparent than it ever was several years ago, and second, as one of the largest U.S. generations, the baby boomers, are, or are near retirement and will soon be in need of assistance or long term care. As studies over the years has shown building energy use within the U.S. has continued to rise, demanding more energy than transportation or industry. According to the U.S. department of energy, buildings, both residential and commercial combined, represent approximately 41 percent of energy consumption within the U.S., while transportation is roughly 28 percent, and industry is 31 percent. It is clearly evident that the need for higher building performance is necessary as the current U.S. building energy consumption is unsustainable. If no action is taken to reduce building energy consumption, the building percentage is only predicted to increase closer to 45 percent. Implementing energy performance change will not happen overnight, but will take several years to begin to see the return on investing for the future. One specific building area which is predicted to see a rise in activity is senior living. “According to the 2010 U.S. Census, 13 percent of the population – over 40 million people – is 65 or older. That represents an increase of more than 5 million since the 2000 Census and makes this the fastest-growing age group: 15 percent per decade” (Eastman 2013). Our current senior population has clearly grown to all-time records, but this is just the beginning as predictions show that number will almost double within the near future. “Demographic projections for 2025 show the influence of the baby boom with the population of those over 65 growing to over 63 million and that of those over 85 to over 8 million. By 2030, approximately 19 percent of the population in the United States, or 71 million people, will be over 65” (Eastman 2013). As our aging population increases questions of how to house such a significant amount of individuals, who are much different from previous generations, begins to arise. These questions are difficult to solve as Alexis Denton, AIA, who focuses on senior living at SmithGroupJJR in San Francisco notes, “A lot of people still feel uncomfortable talking or really thinking about aging. They don’t want to accept that they may eventually need this sort of environment and care for themselves” (Cimino 2016).Certainly now is a critical time to begin talking about designing for aging, as figures and numbers show we are soon to be surrounded by elders, and we should be prepared with thoughtful and efficient means of housing for each and every individual.

Without a doubt the aging baby boomer generation will soon have a lasting effect on senior living design, and how we care for future generations to come.

Within the preceding paragraphs, research has been conducted on the following net zero energy methods, they include, water collection & water use, photovoltaics, passive ventilation, geothermal, and high performance insulation.

Water collection & water usage are an important aspect of a net zero energy building design, because significant amounts of energy is needed to heat water for everyday tasks, which include but are not limited to cooking, cleaning, bathing, & grounds keeping. How a net zero energy building collects, stores, & uses water takes great thought into the design of an integrated system. One example of an energy conscious building which has seamlessly integrated a wonderfully designed water collection & water use system is the Bullitt Center located in Seattle, Washington. Unlike many traditional buildings which receive their water from the city, then heats it using hot water tanks or boilers, and eventually flushes it down the drain, the designers of the Bullitt Center chose a much more energy conscious route, as they understood the importance of water as a precious resource. “Scarcity of potable water is quickly becoming a serious issue as many countries around the world face severe shortages and comprised water quality. Even regions that have avoided the majority of these problems to date due to a historical presence of abundant fresh water are at risk: the impacts of climate change, highly unsustainable water use patterns, and the continued drawdown of major aquifers portend significant problems ahead” (Thomas 2016). Clearly there is a need for building designers to think critically regarding how they may integrate ways of efficiently using water within the built environment. A local architecture firm from Minneapolis, MN, MSR, did just that on a recent affordable multi-family housing project located in Minneapolis. The Rose, as the building is called, focuses heavily on sustainable design measures, including water collection & water use. Most notably the integration of two, three story tall solar thermal hot water heaters installed directly onto the facade of the building. “Water use at the Rose is expected to be half of a similarly sized conventional apartment building. Thirty-five percent of the hot water is solar-heated” (Hoekstra 2016). As MSR has proven within the design of the Rose, the integration of net zero water use methods should not be seen as impossible or unpractical within a large scale multi-residential building.

Photovoltaic energy has made leaping advancements within the past couple decades, however their presence within building design is still lacking. Due to current climate change, and fears of pending energy crises, the thought of an integrated photovoltaic energy production on a buildings envelope makes sense, as it is a successful and proven method of sustainable energy. Knowing the effectiveness of photovoltaic solar panels, are reasons why owners shy away from their use? Is it due to their increased upfront cost, their lacking attractiveness, or worry of learning how to use and maintain an uncommon technology? Whatever the leading issue may be, building owners should be aware that if there building is designed early on with high performance energy in mind, the need for hundreds of photovoltaic solar panels may be unnecessary. As noted from a journal article examining the life cycle cost of photovoltaic energy production within a multi-story residential

building in Denmark indicates that, “in order to build a cost-effective Net ZEB, the energy use should be reduced to a minimum leaving just a small amount of left over energy used to be covered by renewable energy generation” (Marszal, A. J., & Heiselberg, P. 2011). Knowing this, this should help building owners realize that in order to achieve a net zero building design, it does not need to be covered with photovoltaic solar panels. Instead of designing a pleasing array of solar panels covering the entire building’s exterior, the designer’s time may be more usefully put towards elements like high performing building skin design and specifying energy efficient systems and appliances. However, there may be a path which makes the installation of external photovoltaic solar panels obsolete. Most recently a group at Oxford University has made advancements within the design of photovoltaic solar cells rendering them virtually clear or transparent. In order for these solar cells to take on a transparent nature they need to have a sufficient ratio of organic and inorganic elements which allow viable light to pass through as well as strong enough semiconductors to collect the suns energy. As noted in an article posted within the Chemical & Engineering News magazine, “For use in windows, solar cells need to absorb enough light to produce sufficient energy but also let enough visible light through to be transparent. Organic photovoltaic materials can absorb infrared light and pass visible light, but they have low energy-conversion efficiencies. On the other hand, inorganic semiconductors, such as amorphous silicon, absorbs visible light strongly. So films of these materials must be thin to be transparent, thus decreasing the amount of photons they capture” (Savage 2014). Clearly, finding a balance between elements is what is making the transparent solar cell difficult to develop for the building industry. If a day does come where transparent solar cells have been developed to achieve optimal energy production, while remaining as transparent as a conventional window, photovoltaic integration within a buildings envelope should prove to be much more feasible than it currently is.

Providing a comfortable interior environment can be achieved through a mechanical system, however, these systems tend to need substantial amounts of energy to perform. While complete building ventilation through passive strategies may be less feasible, using a mixture of passive strategies along with a highly efficient mechanical system may be more plausible. As noted within Sun, Wind & Light, “One of the challenges for designers of passively cooled buildings is the selection of appropriate cooling strategies that are effective in the building’s climate” (DeKay, M., & Brown, G. Z. 2014). These strategies are not limited to but include cross ventilation, wind catchers, stack ventilation, night cooled mass, air to air heat exchangers, earth to air heat exchangers, and cooling towers. In order to identify appropriate strategies for a particular building it requires examining three main aspects, “climate, building type, and pattern of operation” (Kwok, A., & Grondzik, W. 2011). Once the climate data from a bioclimatic chart has been discovered based on the location of the building site, the designer needs to fully understand the building type and pattern of operation. There are two main groups which buildings tend to fall under regarding building cooling: skin-load dominated or internal-load dominate. Explained within The Green Studio Handbook, “Skin-load dominated buildings (most residential and small commercial buildings) do not generate much internal heat. Their cooling requirements are largely determined by exterior climate and the design of the building envelope. Internal-load dominated buildings (such a large office buildings) have occupant, lighting, and equipment heat loads that are not driven by exterior conditions” (Kwok, A., & Grondzik, W. 2011). Through a buildings preliminary program, the designer can begin to understand which category the project will likely fall under. After all three aspects have been thoroughly thought through, can the selection of various cooling strategies be experimented with and tested within the design of the building. Different spaces within the envelope of the building may benefit from some strategies while other may not, ultimately cooling a building is most beneficial when several strategies both passive and active are integrated as a whole system.

Within a net zero energy building design an important aspect to consider is how the building is acquiring the energy to heat or cool the interior environment, if a highly efficient HVAC system is installed. A popular option, if there is ample space, is geothermal. Geothermal can be an effective and efficient method of transporting energy from the earth’s ground or groundwater to the building’s mechanical system. When classifying geothermal systems, there tends to be two options, open looped or closed looped. According to an article written in the Consulting Specifying Engineer magazine, “In open systems, ground water is pumped into a building, the HVAC system heats or cools it, and then is pumped back into the ground. Closed systems are completely closed; that is, the same fluid pumps through the system over and over and never actually touches the ground” (Jarema 2011). The more common of the two systems tends to be the closed system, as it has the least potential for contaminating the earth’s environment. As mentioned, a geothermal system can require large areas of land, depending upon the building size, to effectively keep the interior environment at a comfortable temperature. “A typical building will require one acre of wells for every 65,000 sq ft of building floor area” (Jarema 2011). Clearly the site selection for a net zero energy building is profoundly an important consideration to carefully analyze, as an under sized geothermal system would be a waste. An example of a large scale thoughtfully well designed geothermal system can been seen at the Advocate Sherman Hospital located in Elgin, IL. The Advocate Sherman Hospital boasts the largest geothermal system within the U.S. for any hospital. Submerged under a 15 acre pond, the Sherman Hospital has integrated into its HVAC design, 171 loops of geothermal pipe. After installation, the system was put into effect immediately, providing patients and staff a comfortable interior environment to stay and work in. As noted within Net Zero Buildings magazine, “Management was impressed with the geothermal system and its potential to reliably provide building comfort at costs less than conventional systems” (Mesenbrink 2016). It is clearly evident from examining the Advocate Sherman Hospital, that a large scale geothermal system may be a possible strategy for a net zero energy building.

A thermal insulation layer is a critical component to any net zero energy building’s exterior wall assembly. This layer can be comprised from several different materials however, some are significantly higher performing than others, like VIPs, or vacuum insulated panels. Compared to conventional insulation products like batt insulation or ridged foam board, VIPs tend to have a noticeably higher thermal value per inch. For instance at the Waldsee BioHaus in Bemidji, MN, “The architect specified Vacupor VIPsmanufactured in Germany by Porextherm.

Each 2-inch thick panel measures 22 inches by 46 inches; according to the manufacturer, the panels have an R-value of 60 (R-30 per inch)" (Holladay 2006). It is interesting to note the use of these panels within a cold climate like that of Minnesota, and to know their effectiveness has been tested within a built design. The incredible thermal value of vacuum insulated panels can allow for extremely high performing walls at a fraction of the thickness conventional methods would need. As superior as vacuum insulated panels may sound, they do have disadvantages. Compared to other thermal materials, VIPs are one of the most expensive options currently available, this is one of the main reasons why the Waldsee BioHaus was covered in VIPs on only two of the building's surfaces. Other than cost, if a panel is ever punctured their thermal properties diminishes dramatically, as most of their high performance is derived from the vacuum sealing. "Despite the current difficulties that VIPs are facing in becoming a thermal building insulation material of choice, they represent one of the most promising thermal insulation technologies on the market today. Even if it will not be possible to create a market for them as for a standalone material for building insulation, it is likely that using VIPs in combination with other materials will be beneficial" (Alotaibi, S. S., & Riffat, S. 2014). Clearly the impact vacuum insulated panels may eventually have on the building industry could be a wonderful asset towards more buildings both existing and new achieving net zero standards.

As the Baby Boomer generation continues to age, the need for new senior care facilities will become more evident. Our current method of increasing the amount of poor performing traditional care facilities to house the next generation of seniors will only add to the continuing energy demand. A solution which is not sustainable. However, by focusing development on a net zero model which utilizes sustainable energy sources, like solar thermal, geothermal, passive ventilation, photovoltaics, and high performance insulation, facilities can begin to diminish their dependency on high energy active systems, ultimately decreasing their individual energy demand. Through continued research and development of net zero methods, can senior care facilities only begin to increase their energy efficiency, reducing their overall impact on our environment.

Annotated Bibliography

Alotaibi, S. S., & Riffat, S. (2014). Vacuum insulated panels for sustainable buildings: a review of research and applications. International Journal of Energy Research, 38(1), 1–19. https://doi.org/10.1002/er.3101

This journal highlights the use of vacuum insulated panels as highly efficient insulators to be used within a building's exterior envelope. Vacuum insulated panels have shown greater insulation performance than other conventional methods like batt & spray in insulation. Due to their exceptionally high performance, the ratio of thickness to thermal value is superior to most other products on the market, as the same thermal value can be achieved in a fraction of the space compared to traditional methods. With higher performance comes a higher cost. Compared to more traditional products, vacuum sealed panels cost significantly more upfront as well as if they lose their vacuum performance. A simple prick from a nail or shard of wood can significantly reduce their level of performance, rendering them virtually useless.

Cimino, S. (2016, June 16). A New Take on Old. Retrieved September 4, 2016, from http://www.architectmagazine.com/aia-architect/aiavoices/a-new-take-on-old_o

Alexis Denton, AIA at SmithGroupJJR's in San Francisco provides insight into the need for senior living design. For several decades the idea of senior living communities has remained relatively the same. Alexis notes, "it's been about two decades since "assisted living" offered seniors and alternative". To Alexis what is holding many back from brainstorming new ideas for senior living communities is the fact that aging as a subject can "feel uncomfortable talking or really thinking about". This article helps point out current relevance of eldercare, and why it is an important topic of research. Although a short article, contacting Alexis Denton and asking her to expand on the issues revolving around the current methods of senior living may prove to be a successful follow up to her article in the Architect magazine.

DeKay, M., & Brown, G. Z. (2014). Passively Cooled Building. In Sun, Wind & Light Architectural Design Strategies (third edition, pp. 156–165). Hoboken, New Jersey: John Wiley & Sons, Inc.

The chapter "Passively Cooled Building" within Sun, Wind & Light provides key knowledge pertaining to successful methods of passive ventilation within a building. Throughout the chapter Dekay & Brown lay down rules and recommendations on how to implement passive strategies to help cooling a building's interior spaces. Not every method listed is suitable for every building, as choosing an appropriate strategy greatly depends on the climate zone. It points out that one cooling strategy alone will likely not solve a buildings cooling load, and rather a mix of different methods will need to be selected in order to achieve a well-balanced system.

Eastman, P. (2013). Senior Living Today. In Building Type Basics For Senior Living (second edition, pp. 2–3). Hoboken, New Jersey: John Wiley & Sons, Inc.

Within Building Type Basics For Senior Living, Perkins Eastman lays out the demographics of senior living today. According to their research the age group currently 65 and older represents 13 percent of the U.S. population, and is predicted by 2030 to increase to 19 percent of the U.S. population, due to the aging Baby Boomer generation. Clearly the aging population within the U.S. is climbing, and will be an issue within the near future. What is interesting to note is the U.S. is not the only country with a large group of aging individuals. For example, Perkins Eastman points out that "Asia is preparing for what many are referring to as an "aging tsunami"".

Hoekstra, J. (2016, April 19). The Rose. Retrieved October 2, 2016, from http://www.aia-mn.org/the-rose/

Within the outskirts of downtown Minneapolis, The Rose, a multi-family residential complex designed by local architects MSR, boasts many sustainable features, including the integration of a solar thermal hot water system. Unlike most urban buildings within the Minneapolis region which provide residents with hot water though the means of electrically heating or burning natural gas, The Rose heats 35 percent of its daily water consumption through solar energy. It is interesting to see the implementation of a solar thermal water heating system used with a cold climate. Knowing that such a system can work within a cold climate for a large multi-family residential complex furthers the interest of integrating a system within a senior living community, as means to help offset the need to heat significant amounts of water using active systems.

Holladay, M. (2006). A Passivhaus In Minnesota. Energy Design Update, 26(11), 1–7.

In this monthly issue from the energy design update, they point out several high performance energy methods used in the Bemidji, MN Passivhaus design by Stephan Tanner. As an experimental study and environmental learning center, the Waldsee BioHaus utilized several non-traditional energy saving methods, including the use of vacuum insulated panels on the roof and one exterior wall. Due to the high cost of vacuum insulated panels the project was able to only use them within a couple areas of the entire building's exterior. What is most interesting to note is the Waldsee BioHaus shares the same cold regional climate as a potential site location I am currently analyzing.

Jarema, W. (2011). Achieving net zero with geothermal systems. Consulting - Specifying Engineer.

This journal provides insight into why geothermal is such an important aspect to almost any net zero energy building. Geothermal is usually paired with an HVAC system, and is used as a passive strategy to heat or cool the building. There are 2 different types of geothermal systems, open or closed. The type most commonly used within commercial designs is the closed system, which pumps fluid through the ground and into the building repeatedly, using the earth's ground as a heat sink. Depending on the size of the building, William Jarema suggests leaving approximately 1 acre of space for wells per every 65,000 square feet of building.

Kwok, A., & Grondzik, W. (2011). Cooling. In The Green Studio Handbook (second edition, pp. 165–209). New York, NY: Architectural Press.

The section on cooling within The Green Studio Handbook helps define passive cooling strategies, provides implementation considerations, and gives a design procedure for each given strategy. The major strategies listed are cross ventilation, stack ventilation, evaporative cool towers, night ventilation

of thermal mass, earth cooling tubes, earth sheltering, and absorption chillers. Not every strategy will be an effective solution, so carefully selecting methods to implement will go hand in hand with what is appropriate for the climate zone.

Marszal, A. J., & Heiselberg, P. (2011). Life cycle cost analysis of a multi-story residential Net Zero Energy Building in Denmark. Energy, 36(9), 5600–5609. https://doi.org/10.1016/j.energy.2011.07.010

This journal article notes an important cost effective realization for a successful net zero energy building, and that is not to design a building and cover it with photovoltaic solar panels to offset the energy usage. Instead the best method is to reduce the energy usage to a minimum, then integrate photovoltaic solar panels to help cover the remaining usage. This tends to be a more economical solution for the potential building owner, as it does not mean there needs to be an astronomical portion of budget set aside for the integration of solar panels. This journal points out that it is possible to use only small amounts of photovoltaic solar panel and still be able to achieve a net zero building.

Mesenbrink, J. (2016, March). The GeoExchange Rate. March 2016, 5(1), 44.

John Mesenbrink provides insight into the largest geothermal system used within a healthcare typology. The Advocate Sherman Hospital located within Elgin, IL is home to the “largest hospital geothermal system in the U.S.”. The hospital utilizes a closed loop system containing 171 loops, which continuously run fluid through the system, under an 18ft deep 15 acre pond used as a heat sink, to passively heat or cooling the building. Such integration of a system on a large scale healthcare project helps solidify that geothermal can be used in just about any sort of condition. According to the hospitals manager of facilities, the staff at the hospital, including the board, were impressed with how well the geothermal system provided ample comfort throughout the building, at a fraction of the cost of traditional methods.

Savage, N. (2014, January 6). Clear Solar Cells Power Up Windows. January 2014, 92(1), 7.

Niel Savage’s article brings to the table a high tech innovative solution to the traditional exterior mount photovoltaic solar panel. Researchers at Oxford University have been working on creating a semitransparent solar cell which could have the possibility of being integrated into a building’s exterior glazing. Although not completely transparent the preliminary solar cells appear slightly gray as they need to absorb light to produce energy, however they also need to allow enough light through to appear transparent. This innovation is relevant to the building industry as it has the possibility of eliminating the need for free standing photovoltaic solar panels, by implementing solar cells into the building’s south facade.

Thomas, M. (2016). The Water Petal. In The Greenest Building (first edition, pp. 58–79). Portland, OR: Ecotone.

Within The Water Petal chapter of The Greenest Building, how the Bullitt Center changes the urban landscape, Mary Thomas brings forth several ways in which the building handles water collection and water use. As it rains the Bullitt Center begins to collect and store water within a 56,000 gallon cistern located within its basement. This significantly large amount of water, if needed, could “sustain its occupants during a 100-day dry spell”. Nothing gets wasted at the Bullett Center, as they have implemented systems into the building design which process and purify rain water into potable water, and when the potable water turns to greywater, a similar clean-up process is used before naturally releasing the water back into the aquifers. How a building receives and handles potable water is an important energy aspect to a net zero building.

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Mesenbrink, J. (2016, March). The GeoExchange Rate. March 2016, 5(1), 44.

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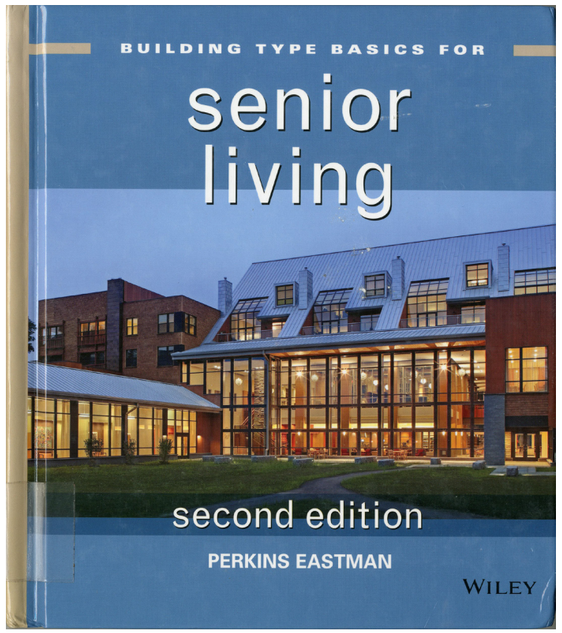
Literature Reviews

I read through several literature sources on the topics of senior living and net zero to become more familiar with each. While reading I wrote down specific quotes that I believe helps bring forth the importance of my research question.



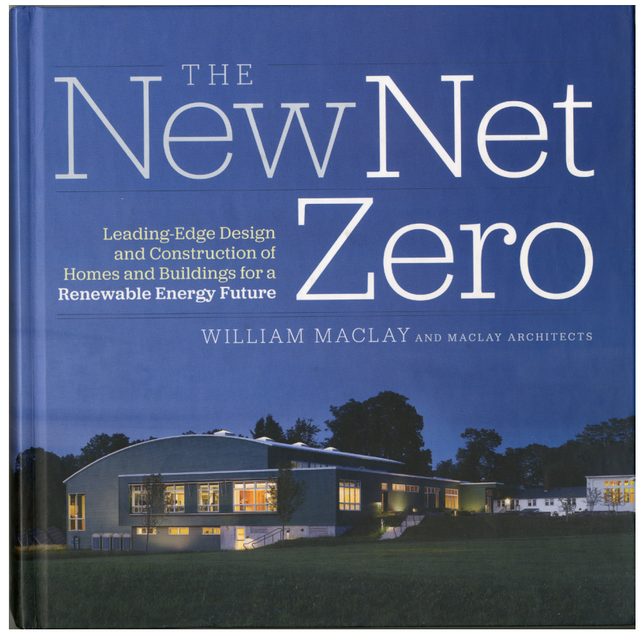
Top Take Aways

- **“According to the U.S. Census, 13 percent of the population-over 40 million people-is 65 or older. That represents an increase of more than 5 million since the 2000 Census and makes this the fastest-growing age group: 15 percent per decade.” (Eastman 2).**

- “It is often said that the value and meaning of a civilization can be documented from the record it leaves in the form of architecture, and that the true measure of the compassion and civility of a society lies in how well it treats its frail older people.” Regnier 1994, p. vii. (Eastman 5)

- “Because people are remaining healthy longer, they are able to age in place, relying on community-based services and family to meet their needs for healthcare and services. They are therefore accessing senior housing and care options later-often after they are very old and frail. This has reduced the demand for assisted living apartments in some markets, as they cater to healthier individuals who now choose to stay at home and access care services brought to them.” (Eastman 125).

- “One of the myths about older adults is that they want to be segregated with people their own age, enjoying views of the countryside. In fact, most would prefer to stay in their own community…” (Eastman 129).



Top Take Aways

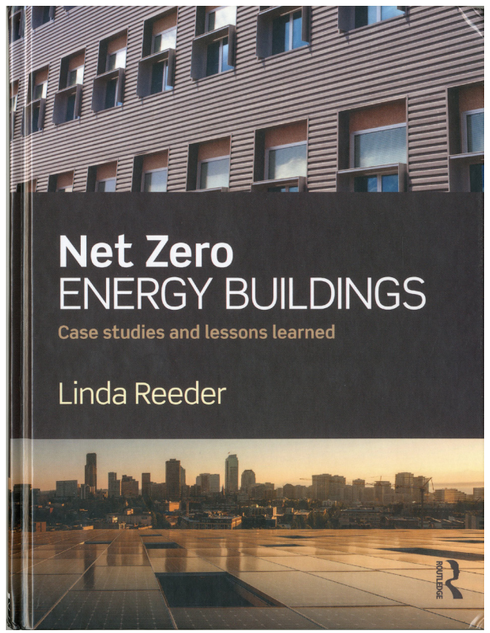
- **“In 2011 the world consumption of energy was 522 quads, and our nonrenewable reserves were more than seventy times greater than world energy consumption. So theoretically, if demand does not go up, we have seventy years of nonrenewable energy.” (Maclay et al 8).**

- “Is there a similar issue with renewable supply? No. In fact, renewable could produce more than 7,000 times as much power as is needed at today’s world consumption levels-every year, forever.” (Maclay et al 8).

- “Net zero Project. This accounts for projects where some or all of the renewable providing energy to the building are located beyond the confines of the building property.” (Maclay et al 23).

- “Net zero property. A building qualifies as net zero property if all the renewable used to cover the building’s consumption are located within the confines of the project property.” (Maclay et al 23).

- “Net zero footprint. To meet this classification, all of the renewable used to cover the buildings loads must reside within the footprint of the building itself, most often on the roof of the building.”(Maclay et al 23).



Top Take Aways

- "Knowing how to live sustainably doesn't necessarily make people want to live sustainably. Knowledge helps but it can't trump desire."" (Reeder 237).

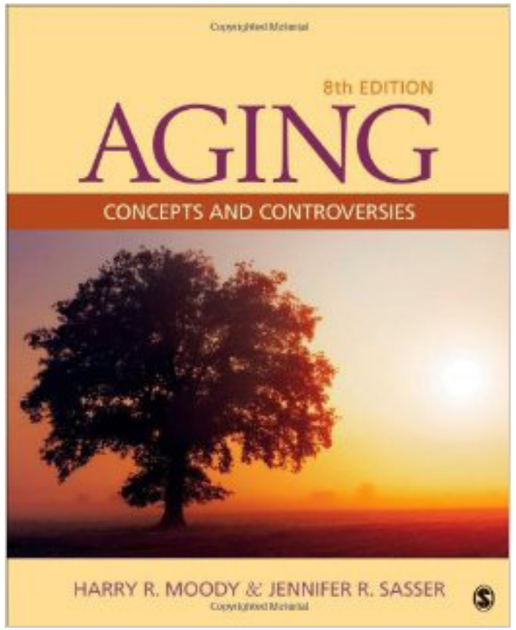
- **"Paisano Green Community is different from a net zero energy office or school, DeSousa said. It is a truly democratic building. Nearly everyone who lives and works on the site has a hand in determining how it performs." (Reeder 238).**

- "It is helpful to educate users in the project goals and the design strategies used to achieve them. This can help occupants understand the impact of their actions on the building's success. Occupants will also need to learn how to operate the building efficiently."(Reeder 253).

- "Not surprisingly, most users are unwilling, or would be unhappy, to sacrifice their comfort for a building's energy efficiency." (Reeder 253).

- "Occupants moving into a net zero energy building might need time to adjust to differences compared to a conventional building." (Reeder 254).

- "The difference in residential buildings is that the residents behave as they wish, without an employer or organizational culture to influence them." (Reeder 255).



Top Take Aways

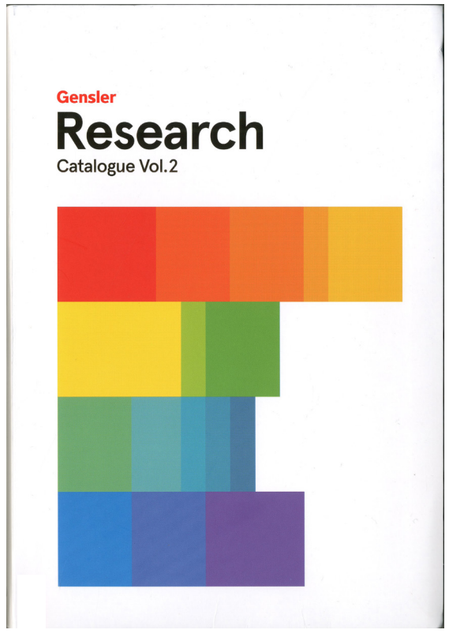
- "One of the earliest attempts to explain the position of old age in modern society is the disengagement theory of aging (Cumming & Henry 1961). The disengagement theory looks at old age as a time when both the older person and society engage in mutual separation, as in the case of retirement from work." (Moody & Sasser 10).

- "At the opposite pole from the disengagement theory is the activity theory of aging, which argues that the more active people are, the more likely they are to be satisfied with life." (Moody & Sasser 12).

- "The continuity theory aging makes a similar point, noting that as people grow older they are inclined to maintain as much as they can the same habits, personality, and style of life they developed in earlier years (Costa & McCrae, 1980)." (Moody & Sasser 12).

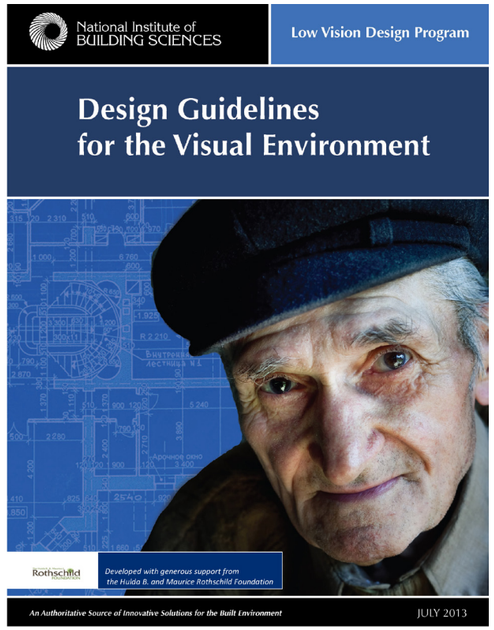
- **"One role well suited to older people in such an environment might be mentoring, or guiding the next generation in the capacity of teacher, coach, or counselor (Neikrug, 2000). Older adults who are serving as mentors, however, still have to develop up-to-date skills and attitudes if their advice is to be respected by younger workers." (Moody & Sasser 17).**

- "Creativity and wisdom depend on cognitive development over the life course. Whether our society cultivates such qualities among older people will depend, in the end, on creating more imaginative policies and institutions." (Moody & Sasser 27).



Top Take Aways

- **“Today’s 50- and 60- year-olds don’t see themselves as “old” and don’t view aging as a time of physical decline.” (Jernigan, Johnston, McAlister & Lin 182).**
- “Connectivity - The ability to maintain relationships with neighbors, coworkers, family, friends, and community members-both in-person and online.” (Jernigan, Johnston, McAlister & Lin 184).
- “Choice - Living in a location that fits one’s particular preferences, participating in activities that one chooses, and makes one’s own decisions about health-care.” (Jernigan, Johnston, McAlister & Lin 184).
- “Independence - Relying on others as little as possible for personal care and getting around, including use of public transportation, ride-sharing, and walking.” (Jernigan, Johnston, McAlister & Lin 184).
- “Wellness - Not only staving off disease but also managing long-term illness to lead to a productive and fulfilling life.” (Jernigan, Johnston, McAlister & Lin 184).
- **“If and when a move is required, this population is seeking a different type of aging community. Stress urban living with “active aging” amenities.” (Jernigan, Johnston, McAlister & Lin 184).**



Top Take Aways

- **Reduce as much glare as possible.**
- Stay away from highly polished surfaces.
- **Allow time for the eyes to adjust to new levels of light. (dark to light and light to dark).**
- The need for contrast between surfaces helps seniors with vision impairments.

Top Take Aways

- “Resilience is a necessity. It’s also life enhancing, reinforcing connections that define the human experience.” (Gensler Design Forecast (2017) 41).

- **“Climate change is making resilience more urgent and underscoring the impact we have on the environment. It is the great challenge of our time; it’s also our greatest opportunity.” (Gensler Design Forecast (2017) 41).**

- “When you address climate change, you are really opening the door to quality of life, and asking: How can design strengthen culture and community and enhance people’s lives?” (Gensler Design Forecast (2017) 41).

- “Resilience takes imagination. It springs from place and evolves our history” (Gensler Design Forecast (2017) 41).

In new model, Hopkins house has students, seniors living together

By MARA KLECKER , STAR TRIBUNE
June 13, 2016 - 8:54 PM

On a table near the door of the historic Hopkins home sat two stacks of rental applications: one for “older adult,” the other for “younger adult.”

The home, called Stepping Stones, is being reserved for the first time for one senior citizen and two college students or recent graduates. It’s part of a pilot program run by the senior housing nonprofit Augustana Care, and the hope is that the three roommates will live together in the recently renovated home, sharing meals and going grocery shopping, all while learning from someone at the other end of the age spectrum.

“Our society seems to be missing opportunities to allow both generations to benefit from each other,” said Mary Jo Thorne, Augustana Care’s regional housing director. “We need less technology use and more porch-sitting and storytelling. We’ve lost that concept.”

Though a few, similar intergenerational living programs have popped up in Europe in recent years, the model is new to the U.S., Thorne said.

The idea came out of a conversation last year when Augustana Care CEO Tim Tucker came to Thorne, seeking a creative solution for the newly acquired house adjacent to Augustana Care’s Chapel View campus.

Since 2009, Augustana has welcomed students and young adults into one of its Minneapolis apartment complexes, putting 20-somethings next door to 100-year-old residents. The model offered affordable housing to students who got to hear stories of the “good old days” while changing a light bulb or opening jars for their senior neighbors.

“We wanted to take it a step further and put them under one roof,” said Chapel View Housing Director Kelly Morgan. The Stepping Stones model “is new, creative and mutually beneficial. It’s only one house for now, but we hope to expand it in the metro area and watch it grow from there.”

The house has three levels with upstairs bedrooms, so Thorne said the senior renter will need to be mobile on stairs. For the younger applicants, priority will given to those going into fields relating to older adults, such as geriatrics, nursing or social work.

Top Take Aways

- “Our society seems to be missing opportunities to allow both generations to benefit from each other.”

- **Seniors don’t see themselves as old people, and sometimes are not necessarily ready to hang out with only old people.**

- “Students will be responsible for helping their older roommate with housecleaning, laundry and shopping. The three must get together for at least two shared meals per week.”

MARCH 10, 2017 19

THE LIST

LIST MAKER

Downtown living isn't just for the young and the restless

BY PATRICK REHKAMP
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PROVIDED BY ECUMEN

Abiitan Mill City residents Carole and Doug Baker Sr. (in picture at left) and Joyce Field (at right). Ecumen opened the downtown Minneapolis senior living facility in December.

Older adults seeking senior living options now can look in downtown Minneapolis near the Guthrie Theater.

Shoreview-based Ecumen opened Abiitan Mill City in December, which is the only senior living building in the downtown Minneapolis core (there are facilities in the nearby Loring Park and Elliot Park neighborhoods).

Abiitan has a full bar and restaurant open to the public, it's within easy walking distance of several Minneapolis attractions and amenities, and it has roughly 130 units available to seniors. Another feature is a woonerf, a roadway that will connect it to the Mississippi River parkway that is expected to be completed in 2019.

Several years ago, Ecumen wanted to build another facility. The senior living operator asked potential residents what they might like and the answer was pretty clear.

"It started with focus groups, [and the response was for something] in the Mill City area," said Ben Taylor, spokesman for Ecumen. "So coming out of that [came] the concept of urban senior living."

For aging seniors, driving can be problematic, so the ability to walk to places for errands is appealing. Others like being able to walk to sporting events, countless restaurants, public transit and fine arts attractions that are downtown.

Carole and Doug Baker Sr. moved into Abiitan several weeks ago and enjoy the fact that they're not isolated, which can be a problem in suburban senior living facilities.

"Carole [has] a bunch of friends down here," Doug said. (Editor's note: The Bakers son is Ecolab Inc. CEO Doug Baker Jr.)

Abiitan residents also have a variety of social activities available to them. Event coordinators arrange speakers on foreign arts and current events.

"This afternoon, a professor from [St. Catherine University is coming] to talk about China," said Joyce Field, another resident who moved in several weeks ago. "Intellectually, I have found this place to be very good."

Abiitan, which is located at 428 S. Second St., has roughly 85 independent living units and 48 memory care units. The size of units range from studios to more than 2,000 square feet. About 30 spots are occupied.

Taylor said Ecumen hasn't marketed the building aggressively because the facility just opened, and getting all parts of the structure online was step one.

Prices are comparable with other Ecumen locations (roughly $2,500 a month), but the refundable deposit isn't cheap – it ranges from $80,000 to $338,500.

While crime, especially at night, is an issue in parts of downtown, the Mill City neighborhood is relatively safe and the building is secured. Abiitan is also Ecumen's only location with a full liquor license, which will help build a sense of community since the bar is open to anyone.

"It's truly a unique concept," Taylor said. "Here, we knew with this location it really integrates [with the existing neighborhood]."

Top Take Aways

- Ecumen asked their residents where they like a new facility to be build and the answer was clear, downtown within an urban setting.
- **"For aging seniors, driving can be problematic, so the ability to walk to places for errands is appealing. Others like being able to walk to sporting events, countless restaurants, public transit and fine arts attractions that are downtown."**
- "Carole and Doug Baker Sr. moved into Abiitan several weeks ago and enjoy the fact that they're not isolated, which can be a problem in suburban senior living facilities."
- "Abiitan has a full bar and restaurant open to the public, its within easy walking distance of several Minneapolis attractions and amenities, and it has roughly 130 units available to seniors."

Telephone Interviews

I interviewed individuals who have experience in senior living design and or net zero design. I interviewed a mix of individuals including, architects and senior living facility CEO's. During each 30-40 minute interview I asked each individual about senior living design trends, net zero design integration and the possibility of incorporating young professionals into the program.

Rhys MacPherson

(Senior Associate)

Minneapolis, MN

MSR

Top Take Aways

- Took one year to sort out the building systems at The Rose.
- Located within the central courtyard of The Rose is a large community garden for all residents to use.
- The Rose used solar thermal as a renewable energy resource billboard.

Jon Rewer

(President & CEO)

Moorhead, MN

EVENTIDE Senior Living Communities

Top Take Aways

- Always thought there are some parallels between millennial and seniors.
- Target market 70’s and 80’s.
- More one bedroom and two bedroom, fewer studio and three bedroom.
- Difficult for customers to justify the extra cost of something like net zero.
- Discounted rent for young professional by helping senior residents.

Joseph Vigil

(Founding Partner)

Boulder, CO

WORKSHOP8

Top Take Aways

- Workshop8 proposed the idea of going net zero for Paisano Green Community senior housing.
- Residents that moved into Paisano Green Community didn't know how their heating and cooling worked.
- Paisano Green Community residents are not engaged in the net zero design.
- Seniors living at Paisano Green Community are not necessarily interested in net zero, because they don't have to pay for their energy bill. The housing authority pays for utilities.
- Important to educate the residents on how to save energy.
- Every residential unit at Paisano has a south facing view to let in as much natural light as possible.

Joyce Palhamus

(Board of Directors, Firm Leader, Healthcare Design, Office Leader, Senior Living)

San Francisco, CA

SMITHGROUP JJR

Top Take Aways

- Tried placing seniors near younger kids in years past, didn't work as planned.
- Both younger professionals and seniors are interested in the same kinds of amenities. Both are searching for similar environments.
- Seniors are interested in an active lifestyle.
- As you age your world gets smaller.
- How can you make small dwellings cost effective, yet feel like home?
- Corridors can never be too short or never too long. A variety of destination lengths promotes health an wellness.

Alexis Denton

(Healthcare Interiors,
Senior Living)

San Francisco, CA

SMITHGROUP JJR

Top Take Aways

- Gerontology: the study of aging. Four subsets of gerontology - physiology, phycology, sociology & public policy.
- The three plagues of the elderly, loneliness, helplessness, and boredom.
- Aging in your own home can be isolating. Can be less social.
- Seniors are interested in walkable urban environments. Less interested in an isolated location.
- Its all about what is marketable.

Elizabeth Ann Fetner

(Executive Director)

Plymouth, MN

TRILLIUM WOODS
A Life Care Services Community™

Top Take Aways

- Seniors are looking for an opportunity to maintain their independence as long as possible.
- Eight dimensions of wellness, emotional, physical, environmental, financial, occupational, social, spiritual.
- Provide residents with several amenities.
- Elder not the preferred term.

Steve Leone

(Principal)

Trenton, NJ

spiezle
ARCHITECTURAL
GROUP

Top Take Aways

- Immersed himself in a senior living community for 24hrs and found it to be more of an emotional realization.
- Open rooms, greater visablitiy and shorter distances has a positive impact on keeping people engaged.
- Cost implication of net zero will always come up.
- We strive for an intergenerational approach. Helps learning through both generations.
- Friends of Philadelphia, a mixed use population with 30 year olds intermingled with seniors and it works beautifully.

Case Studies

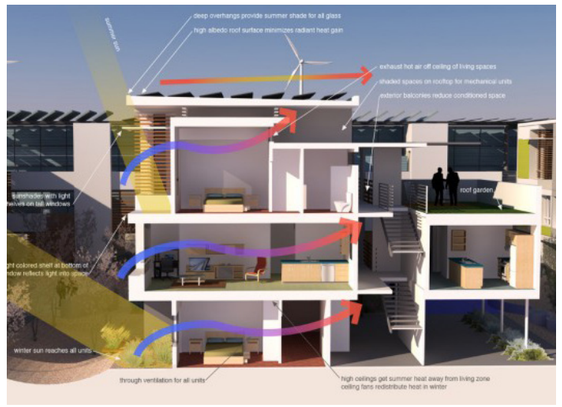
Four case studies were chosen based on their relevance to senior living, net zero or context.

Paisano Green Community Senior Housing

Location: El Paso, TX

Architects: WORKSHOP8

“Paisano Green Community is the **first NetZero**, fossil fuel free, LEED Platinum, **affordable senior housing** project in the United States. This 73 unit project is built on a 4.2 acre site, adjacent to the major border crossing between El Paso, Texas, and Juarez, Mexico. The design goals of the project were to create a place sensitive community for elderly residents that would **promote healthy living** and an environment encouraging the development of interpersonal relationships, all within a well designed set of energy efficient **high performance** buildings and grounds.” (hacep.org)



The Rose

Minneapolis, MN

Architects: MSR

“The Rose is a **high performance multi-family housing** development in Minneapolis, MN. It contains **42 market rate** and **48 affordable dwelling units** for people earning less than 50% AMI (Area Median Income) including some efficiency apartments for formerly homeless individuals transitioning to independent living. There are one, two and three bedroom configurations that will enable a broad community of residents to live here. Residents will enjoy the **5,000-square-foot community garden** and the 70-foot-wide **courtyard** between the two buildings – both spaces contain **areas for play and socializing**. “The building has been designed using the **Living Building Challenge** (LBC) as a guide,” says Paul Mellblom, AIA, MSR Design’s Principal.” (architectmagazine.com)

Eltheto Housing and Healthcare Complex

The Netherlands

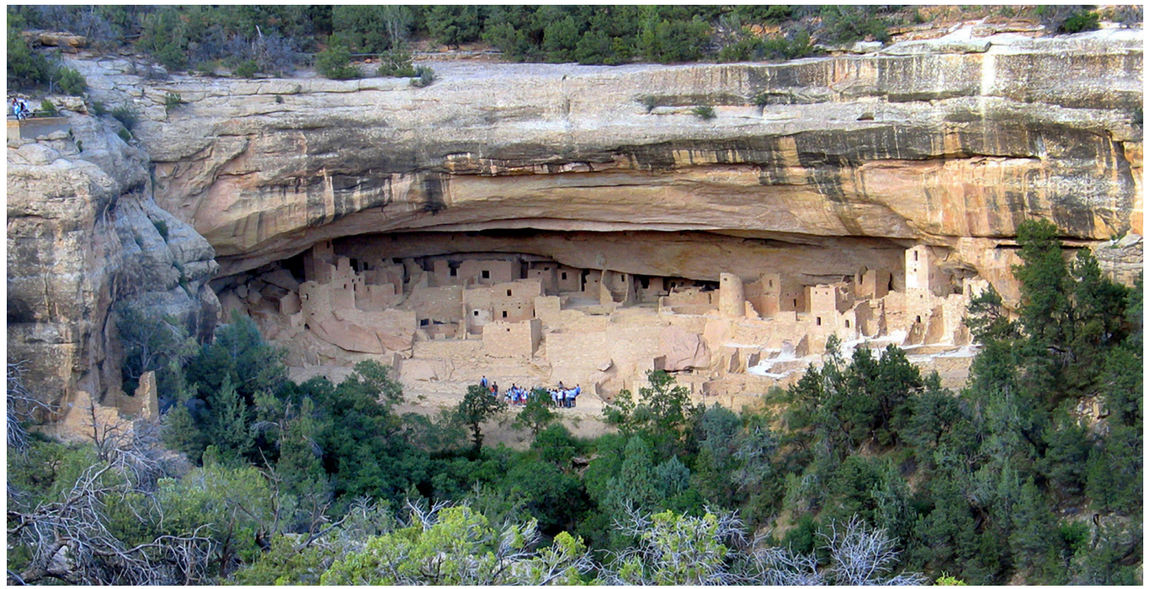
Architects: 2by4-architects

“In the small town of Rijssen 2by4-architects designed the new healthcare and housing complex ‘Eltheto’ **for elderly people**. Until recently elderly people were seen as a group that functions outside of modern society and are only in need of care. The contemporary healthcare centers and housing for elderly people are still designed according to his idea. Over the past decennia this resulted in a range of introvert buildings where the main focus is healthcare instead of the **quality of life itself**.” (archdaily.com)

Mesa Verde Cliff Dwellings

Mesa Verde, CO

Architects: Ancestral Puebloans



“The cliff dwellings of Mesa Verde are some of the most notable and best-preserved ruins in the North American continent. Sometime during the late 1190s, after primarily living on the mesa top for 600 years, many Ancestral Puebloans began living in pueblos they built **beneath the overhanging cliffs**. The structures ranged in size from one-room storage units to villages of more than 150 rooms. While still **farming the mesa tops**, they continued to **reside in the alcoves, repairing, remodeling, and constructing new rooms** for nearly a century. By the late 1270s, the population began migrating south into present-day New Mexico and Arizona. By 1300, the Ancestral Puebloan occupation of Mesa Verde ended.” (visitmesaverde.com)

Project Program

The project program outlines the scope of work to be designed. Whether interior or exterior, the scope of work is determined based on the needs of the typology and client. Through topical literature reviews, case studies & personal interviews with individuals who are involved with senior living, I hope to develop an innovative yet efficient program.

Space List

function	people	capacity	no. of units	area/ unit	net area	net area subtotal
LOBBY						
reception	2	0	1	100	100	
art space gallery	0	75	1	300	300	
net zero education	0	100	1	500	500	
waiting space	0	15	1	100	100	
public restrooms	0	4	2	75	150	
subtotal						1150
SENIORS						
studio	0	1	5	500	2500	
1 bedroom	0	2	15	700	10500	
2 bedroom	0	2	20	1000	20000	
community space	0	16	1	250	250	
subtotal						33250
YOUNG PROFESSIONALS						
studio	1	1	18	550	9900	
1 bedroom	2	2	14	700	9800	
2 bedroom	2	2	12	1100	13200	
community space	0	30	1	350	350	
subtotal						33250
WELLNESS CENTER						
exercise space	1	40	1	400	400	
mens lockers	0	20	1	200	200	
womens lockers	0	20	1	200	200	
yoga studio	0	20	1	300	300	
virtual biking studio	0	15	1	300	300	
e-bike studio	0	15	1	300	400	
subtotal						1800
COMMUNITY DINING						
kitchen	0	4	1	250	250	
dining space	0	75	1	2000	2000	
restrooms	0	1	1	100	100	
subtotal						2350

Space List

function	people	capacity	no. of units	area/ unit	net area	net area subtotal
MEDIA LAB						
lab space	0	20	1	300	300	
individual/small group	0	5	1	50	50	
server room	0	0	1	100	100	
library space	0	20	1	300	300	
subtotal						750
BIKE REPAIR						
bike repair space	0	8	1	250	250	
subtotal						250
BUILDING SERVICES						
photovoltaic batteries	0	0	1	200	200	
solar thermal service	0	0	1	200	200	
elevator equipment	0	0	6	50	300	
subtotal						700
EXPO SPACE						
lecture space	0	0	1	1000	1000	
breakout space	0	0	1	200	200	
storage	0	0	1	75	75	
subtotal						1275
RETAIL/ENTERTAINMENT						
food co-op	0	0	1	5000	5000	
bike shop	0	0	1	5000	5000	
restaurant	0	0	2	6000	12000	
cafe	0	0	2	4000	8000	
storage	0	0	6	100	600	
subtotal						30600
GREENHOUSE						
planting space	0	0	3	5000	15000	
storage	0	0	3	100	300	
subtotal						15300

Space List

function	people	capacity	no. of units	area/ unit	net area	net area subtotal
CONTINUING EDU						
collaboration space	0	50	1	1000	1000	
storage	0	0	1	100	100	
restrooms	0	4	1	100	100	
subtotal						1200
NET ZERO LAB						
lab space	4	10	1	900	900	
storage	0	0	1	100	100	
subtotal						1000
PUBLIC PLAZA						
public space	0	0	1	15000	15000	
subtotal						15000
COMM. GREENSPACE						
garden space	0	0	2	7500	15000	
subtotal						1000
UNDERGROUND PARKING						
angled parking	0	150	1	150000	150000	
subtotal						150000

Qualitative Comments

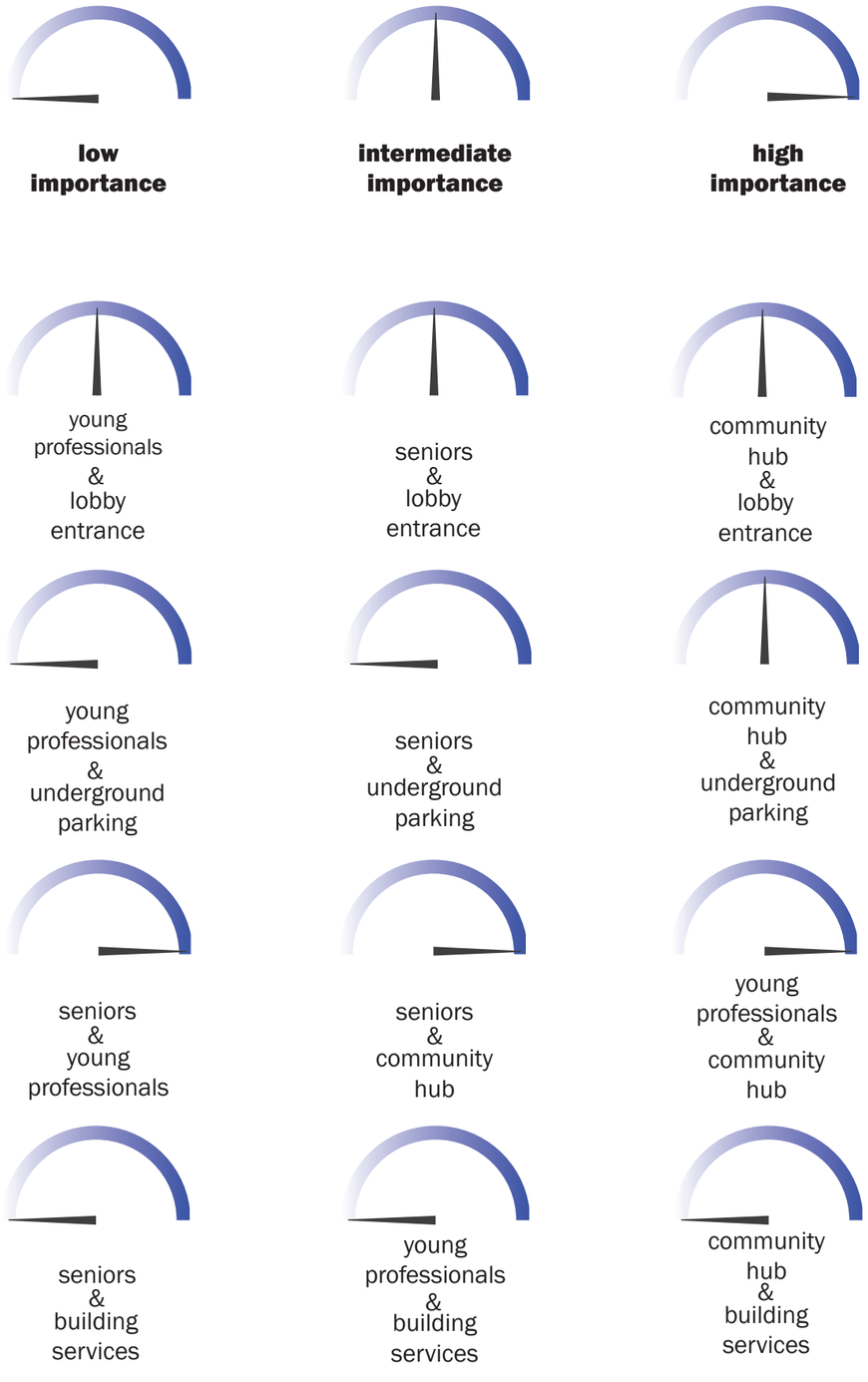
With a prominent southern building orientation, building users and visitors will experience ample amounts of natural light from any public or private space. In addition to ample amounts of natural light, the interior materials palette will evoke a sense of warmth through a natural material pallet inspired from The surrounded river landscape. Lastly, a lush contemporary landscaped entry condition should give any senior resident the reassurance that they are receiving highest quality of living even before walking through the door.

Building Area Summary

space name	people	capacity	net area	net gross	gross bldg area
lobby	3	194	1150	.5	1725
senior	0	99	33250	.5	49875
young professional	0	100	33250	.5	49875
community space	8	351	54125	.5	81187
building services	0	0	1000	.5	1500
underground parking	0	0	150000	.5	225000
subtotal					409162

Land Use Requirements

land use area	people	gross bldg area	floors	bldg footprint	land area
seniors	5	91655	6	15275	61100
parking	15	5700	1	5700	22800
young professionals	0	49875	3	16625	66500
parking	10	3800	1	3800	15200
administration	15	1690	1	1690	6760
parking	15	5700	1	5700	22800
amenities	11	10275	2	5137	20548
building services	0	1500	1	1500	6000
subtotal	71	170195		55427	221708



Problem Statements

FORM

Since the residents of the building will be elderly individuals, the design should convey an up lifting, and active environment.

Since some individuals may have lost a spouse and are now living alone, the design must include spaces which facilitate and encourage individual social interaction.

Since the site offers stunning views of the Mississippi River, the design should respond by placing high use building functions facing towards the river.

FUNCTION

Since visits from family and friends are encouraged, the design must respond with clearly identifiable way finding elements to help visitors find their way throughout the complex.

Since the site has limited vehicular access, the design must envision space saving way in which vehicles can circulate and park within the complex.

Since the number of senior citizens is rapidly growing, reaching unprecedented levels, the design must integrate energy saving net zero design methods.

ECONOMY

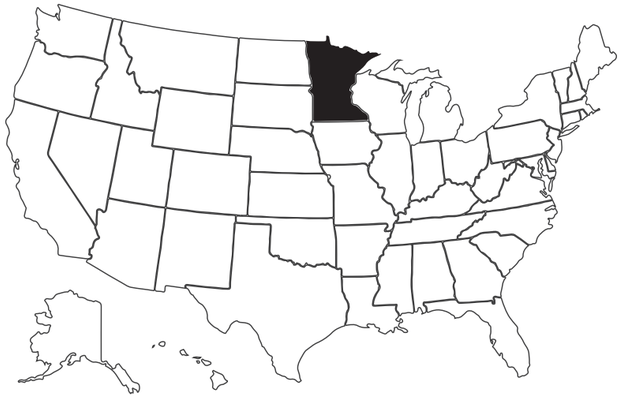
Since the project site location and adjacent site are intended for mixed use redevelopment, the master plan should allow for future expansion beyond the buildings original use.

TIME

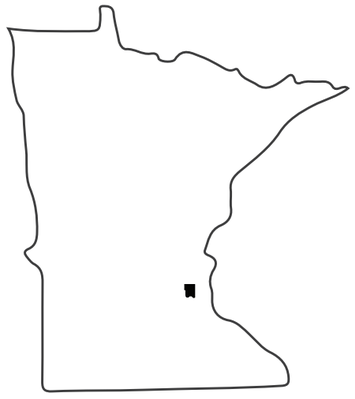
Since generational characteristics change dynamically and is uncertain, the master plan should provide a framework for trans formative expansion.

Proposed Site Location

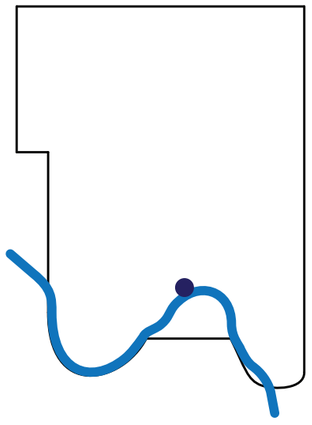
Site inventory and analysis marks the beginning of interpreting what was learned through the research, and translating it into a building design. After choosing an appropriate site for the building typology, inventory and analysis of items such as sun, wind, traffic, views from the site, & neighborhood context are recorded to help inform the beginning stages of the design process.



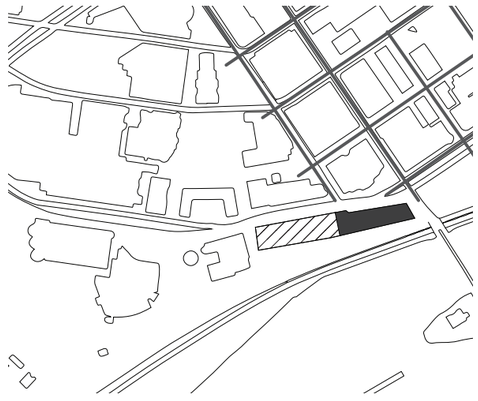
Minnesota within the US



Ramsey county within MN



Downtown St. Paul within Ramsey County



Site location within downtown St. Paul

Site location October 2016

Site location March 2017

Site location (evening)

Site location (morning)

Bike share across street

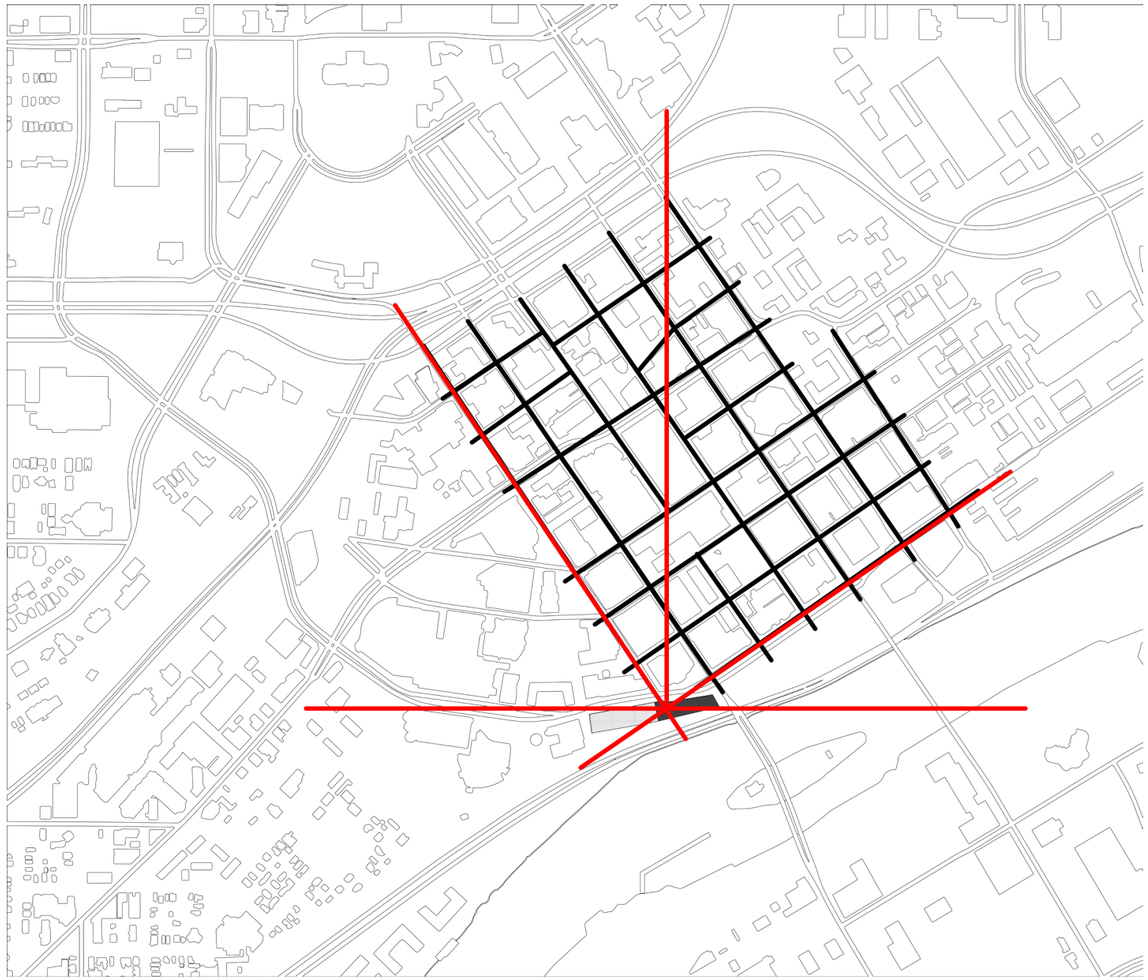
Dock across Mississippi River

Kayaking nearby site location

Demolition on site location

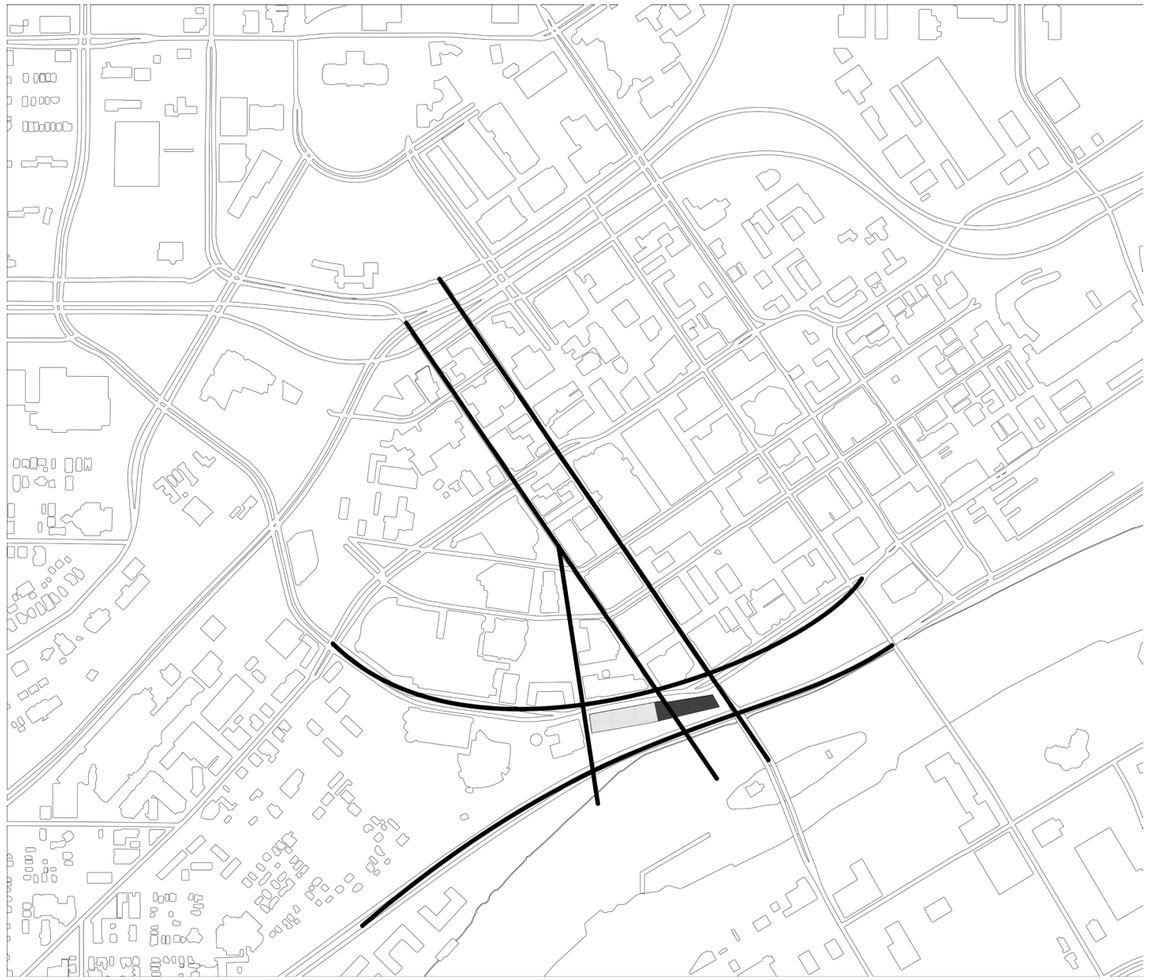
River biking and walking paths

Boathouses across river



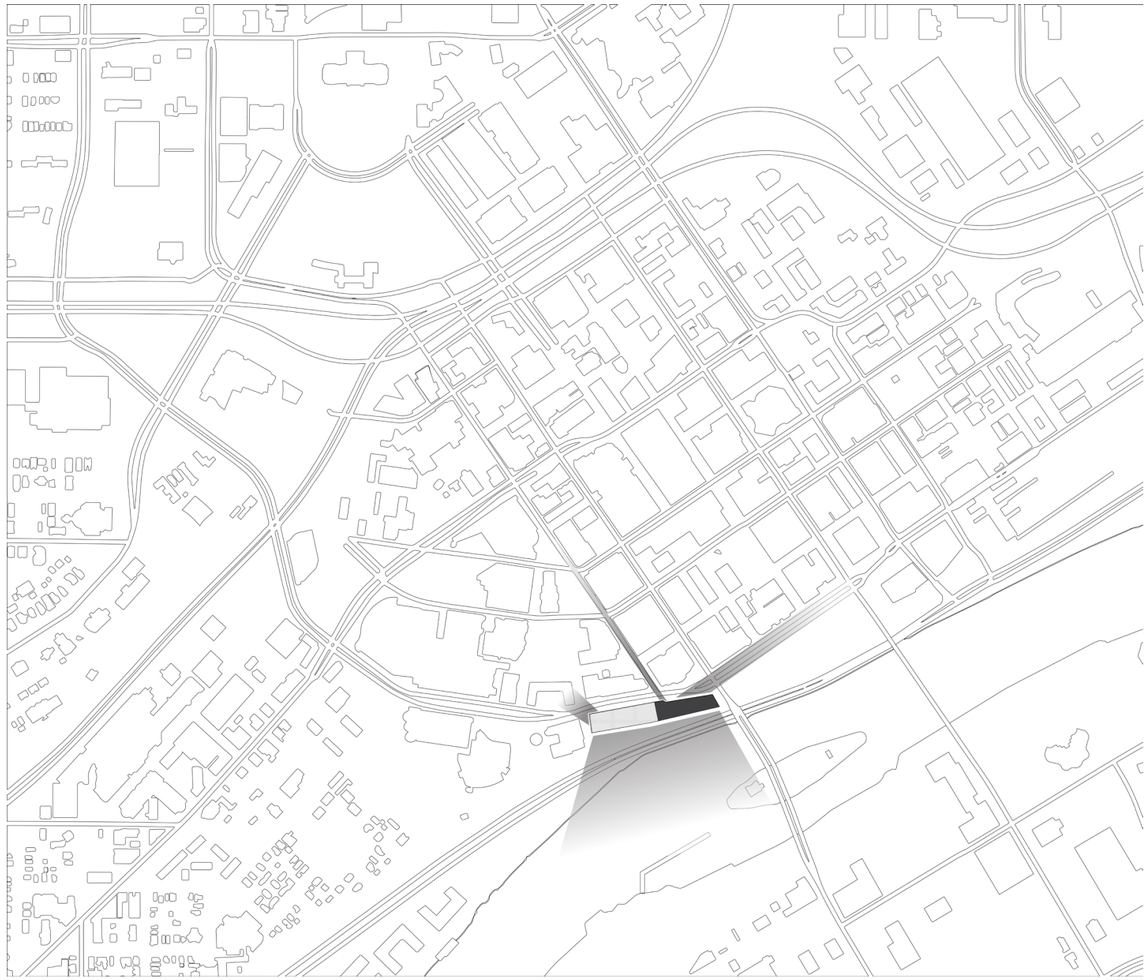
Downtown St. Paul city grid

Downtown St. Paul is laid out within a rotated orthogonal grid, with the proposed site location located at the south end.



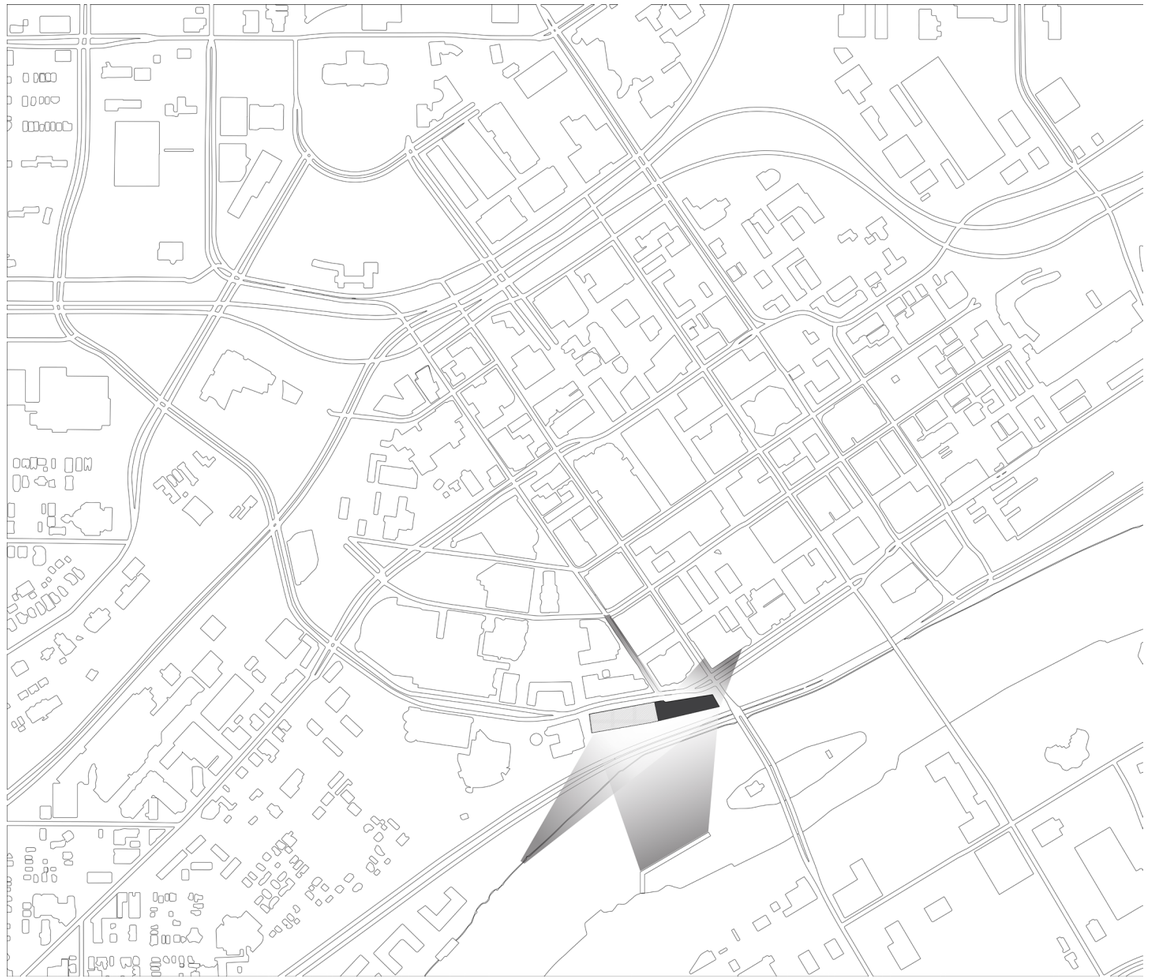
Major axis near site

These major axis near the proposed site location will begin to help create special moments within the design, and or provide guidance with the design of the building form.



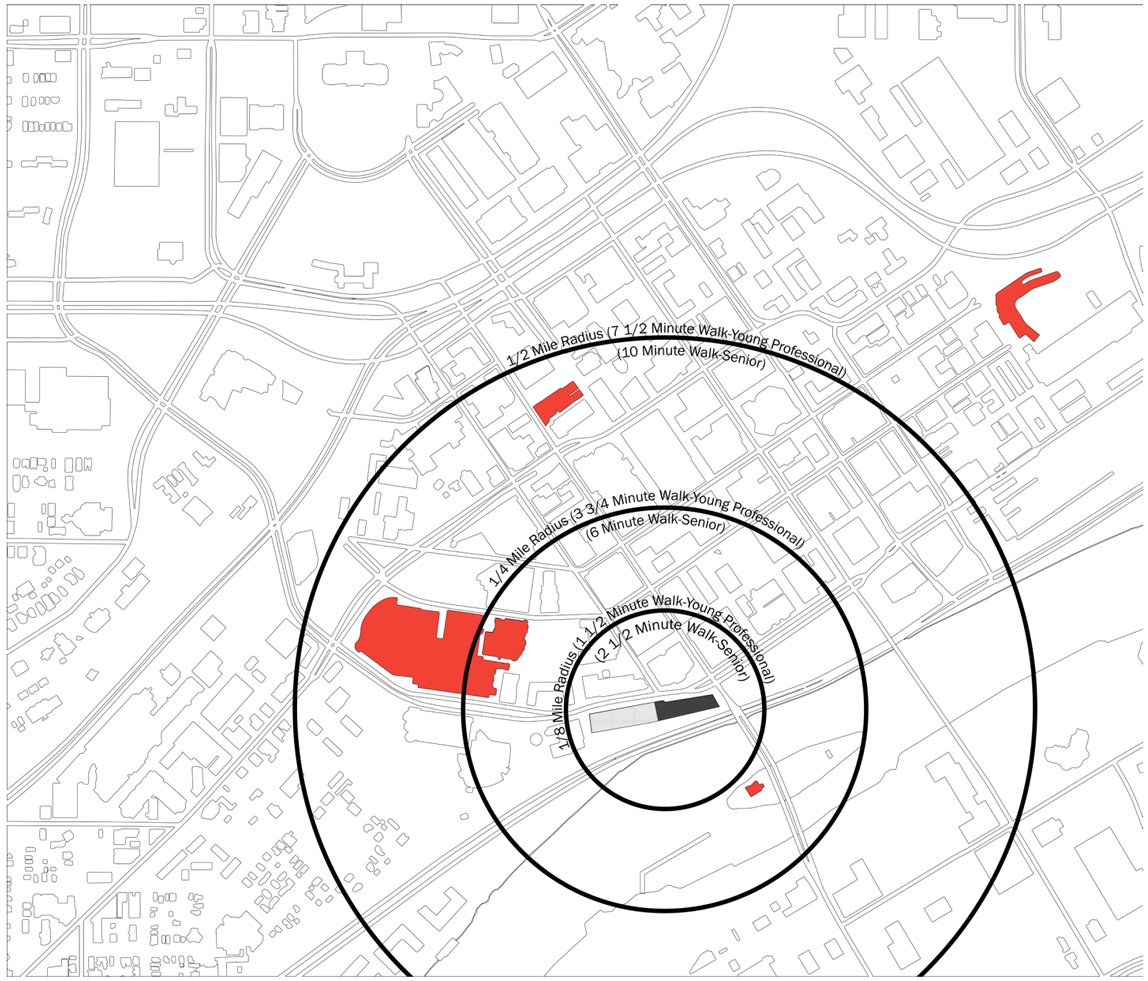
Views from the site

Due to the sites unique location, views from the site may be dramatically different depending upon where one is located. To the north, the major downtown area and to the south the natural Mississippi River edge.



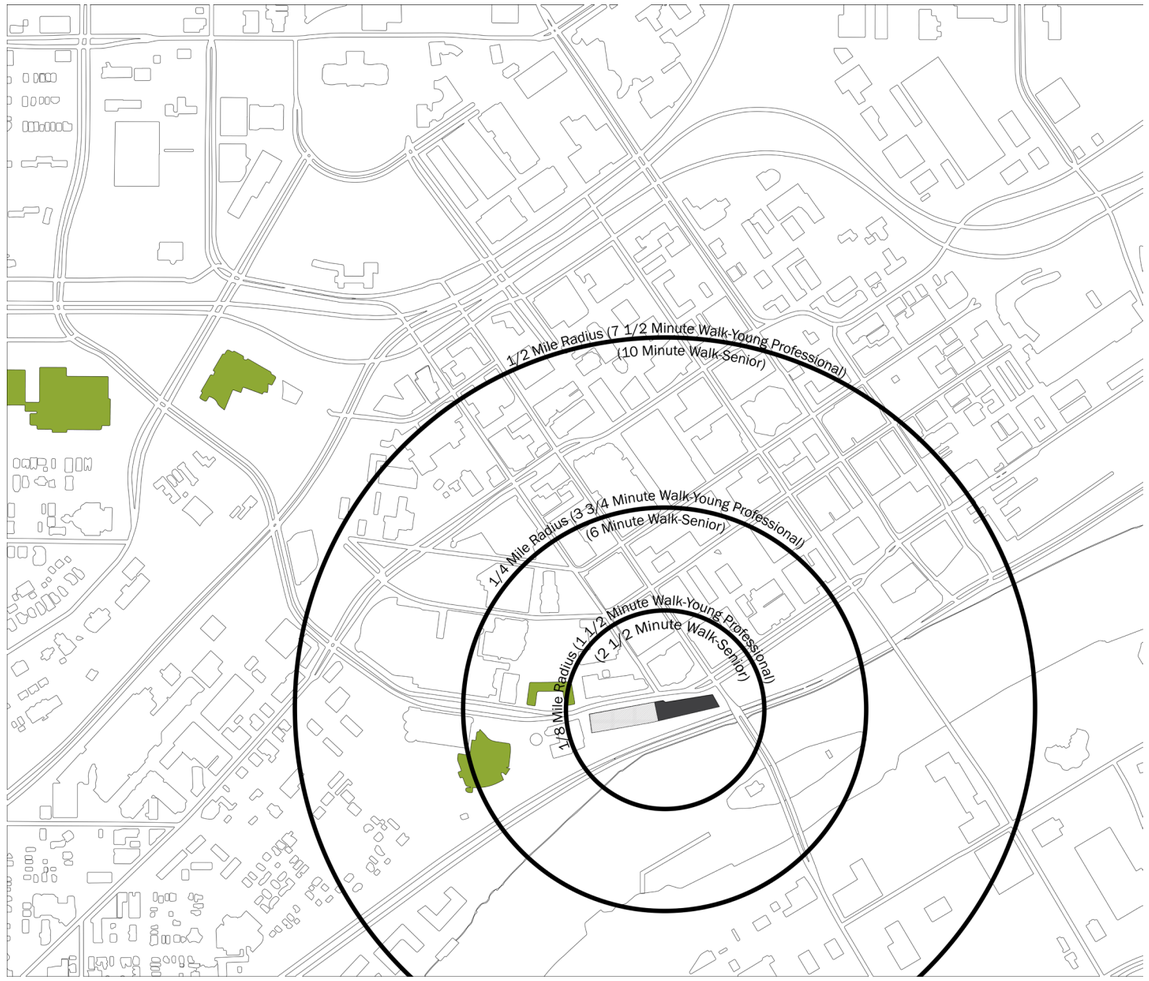
Views to the site

This prominently viewed site is located at the south end of downtown and could be described as the front door of St. Paul, because it can be seen from many angles as one approaches downtown.



Major entertainment

Located nearby are several major entertainment venues within both walking and driving distance from the proposed site location.

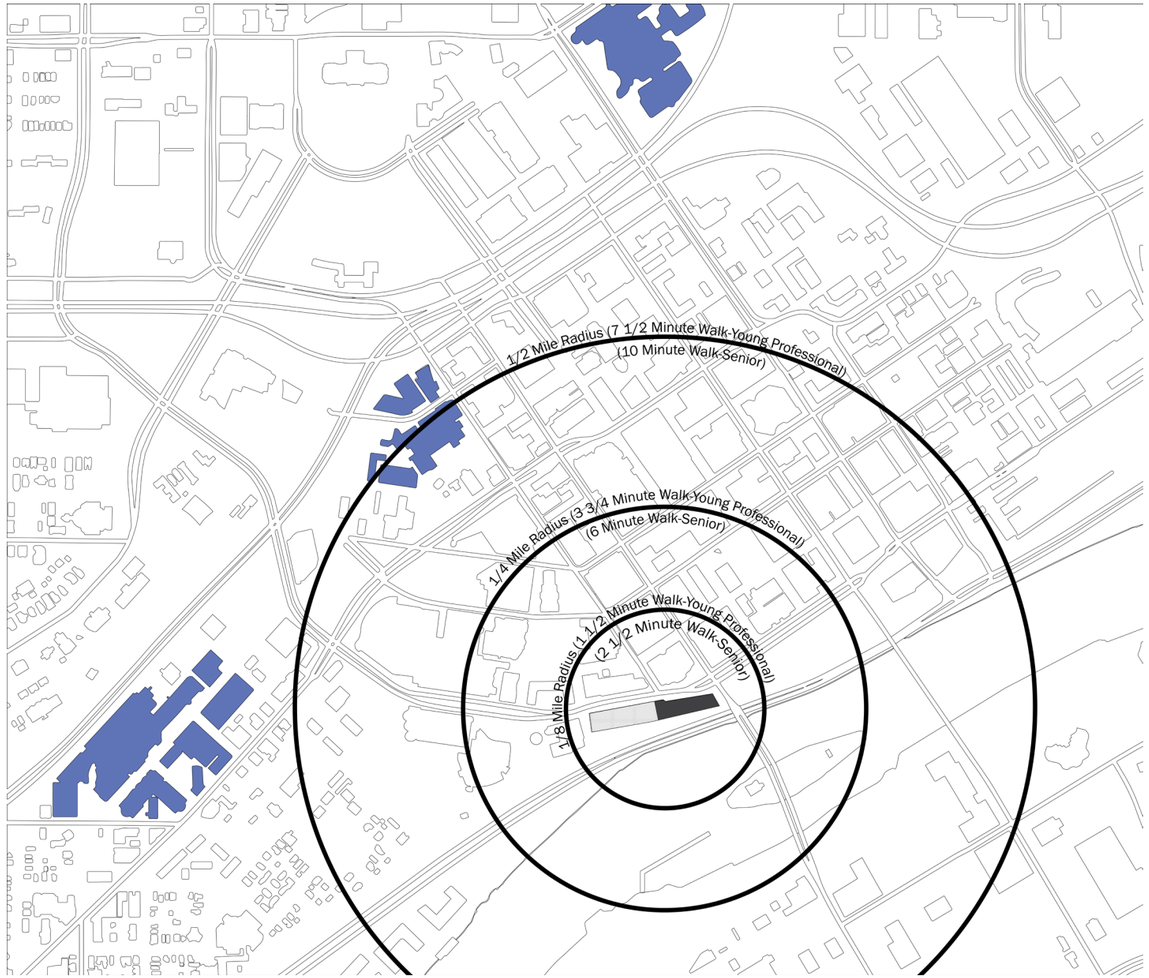


Major education

Continuing education can be important to younger professionals and seniors so being within close proximity will help both generations stay mentally active.

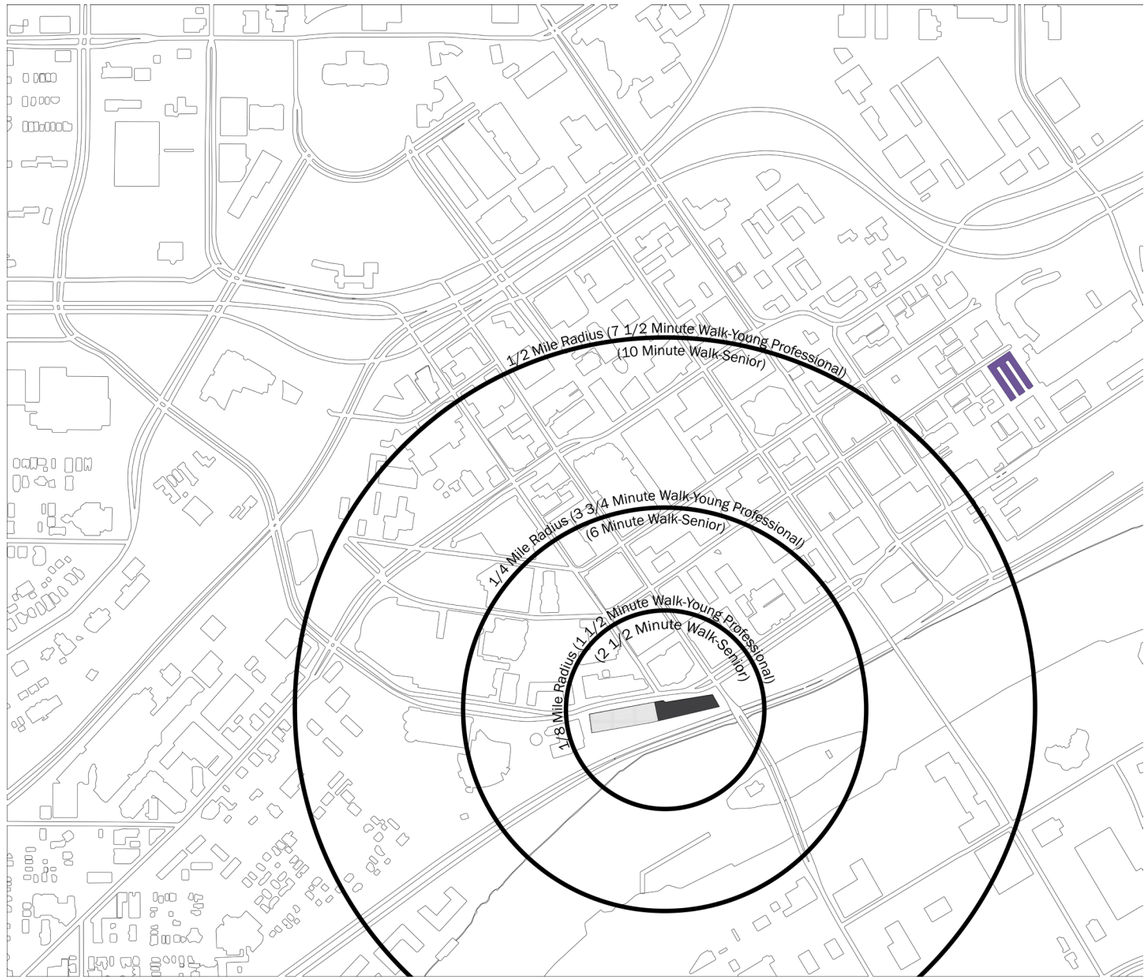
Parks nearby

The site location is near several parks and greenspaces that are easy for both young professionals and seniors to travel to.



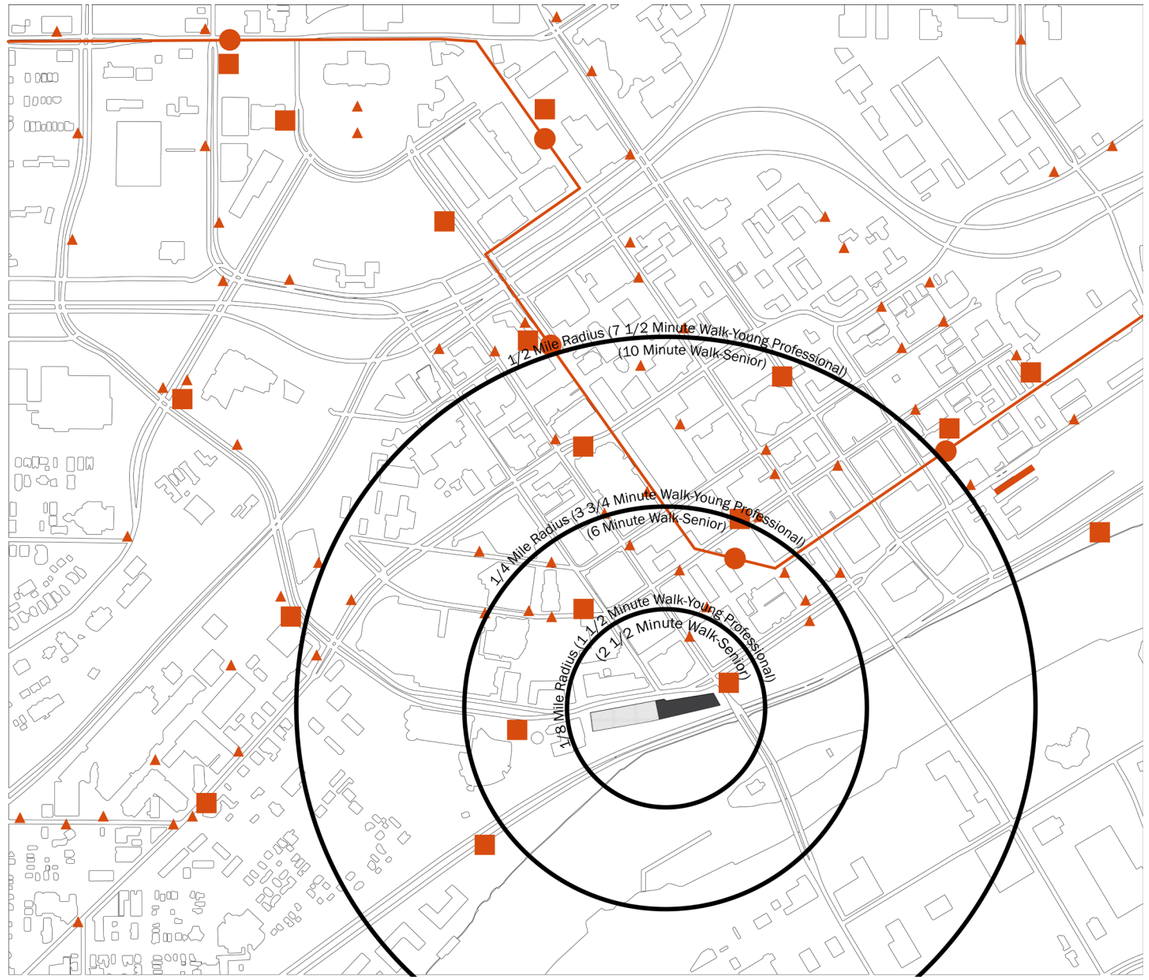
Major healthcare campuses

Not as close to walk to, however there are (3) major healthcare campuses within a short drive to in case of any health related emergency.



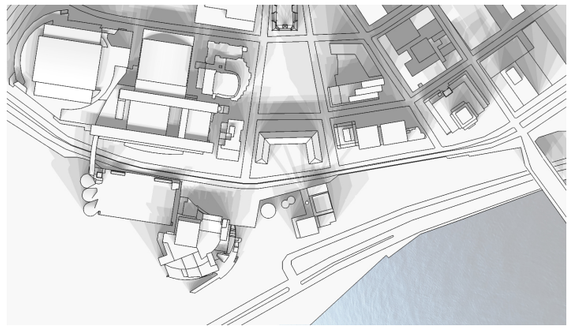
Farmers market

Due to the lengthy walk to the local farmers market, integrating new community gardens and greenhouses into the design will be necessary towards achieving a net zero community.

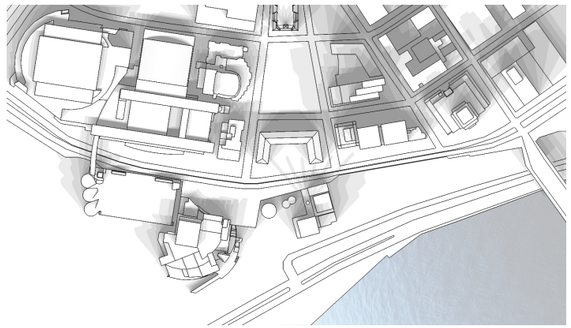


Public transit (light rail, bike share & bus)

Proposing a new bus stop along Kellogg Boulevard will help residents access the greater downtown St. Paul area and all of its amenities



Jan. 21st 9am-3pm



Feb. 21st 9am-3pm

Mar. 21st 9am-3pm

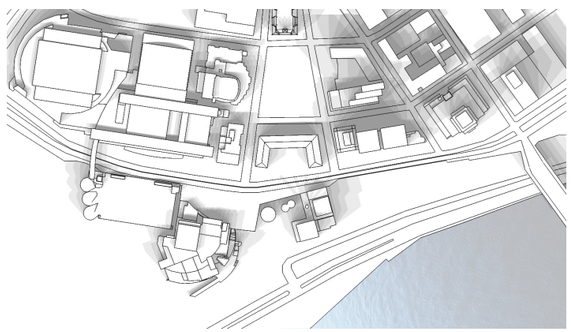
April 21st 9am-3pm

May 21st 9am-3pm

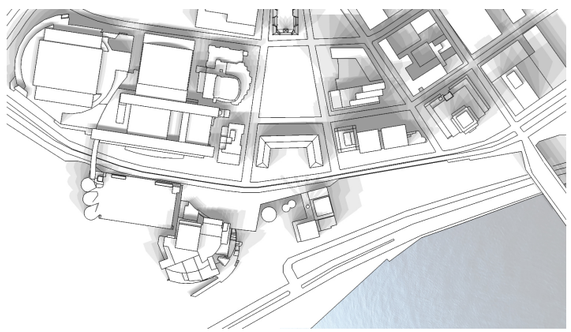
June 21st 9am-3pm

July 21st 9am-3pm

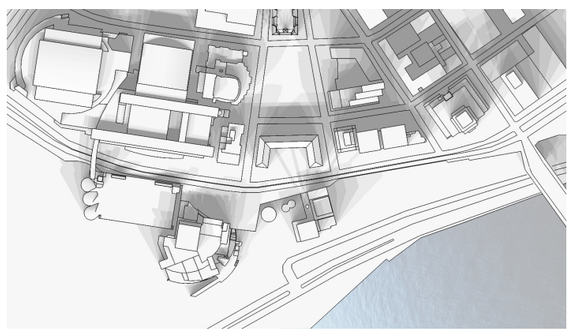
Aug. 21st 9am-3pm



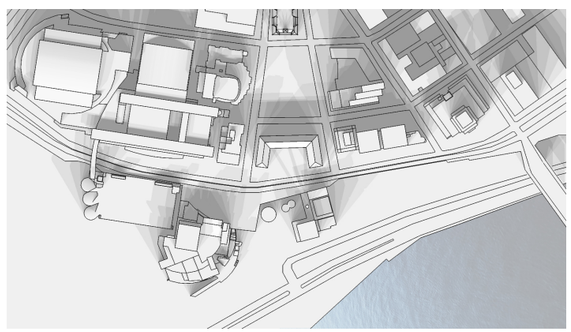
Sept. 21st 9am-3pm



Oct. 21st 9am-3pm

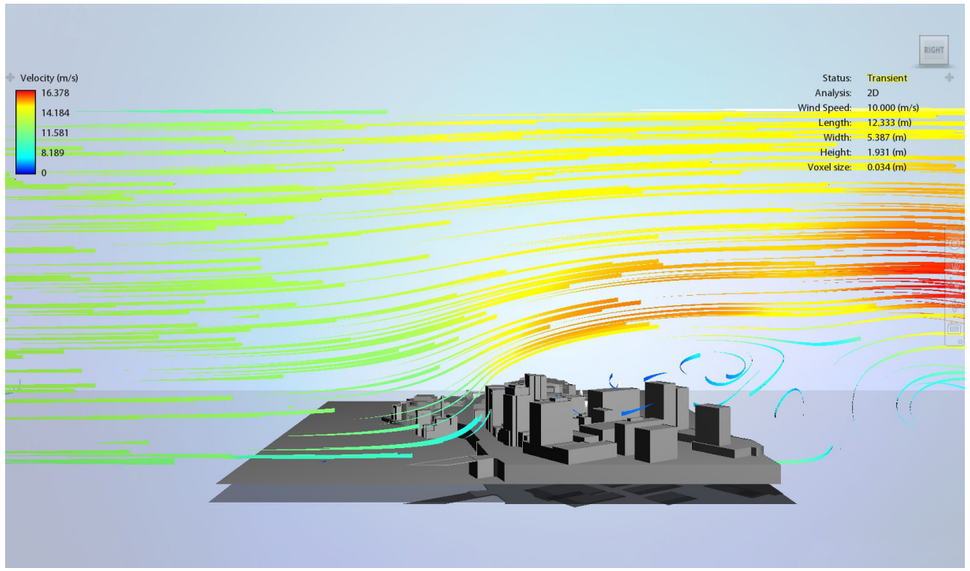


Nov. 21st 9am-3pm

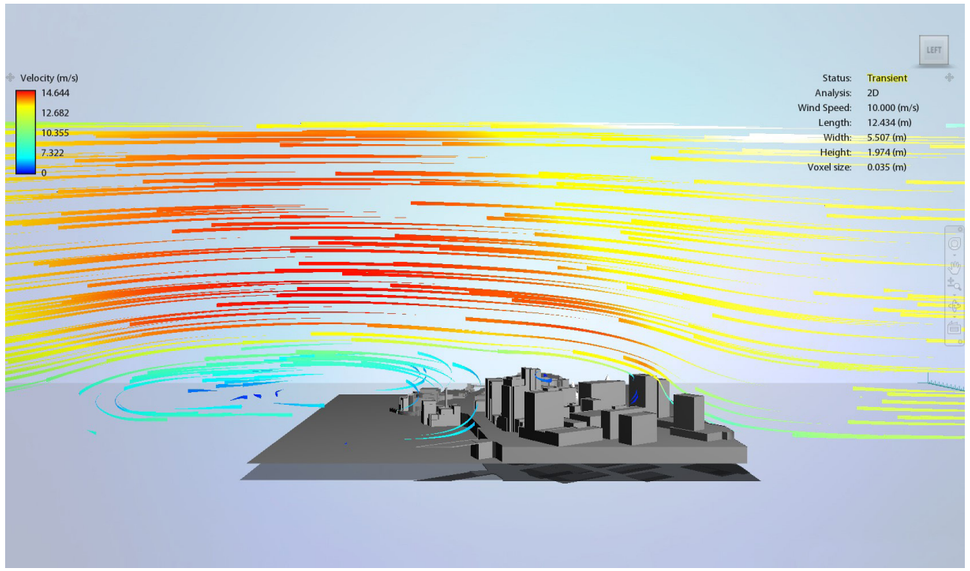


Dec. 21st 9am-3pm

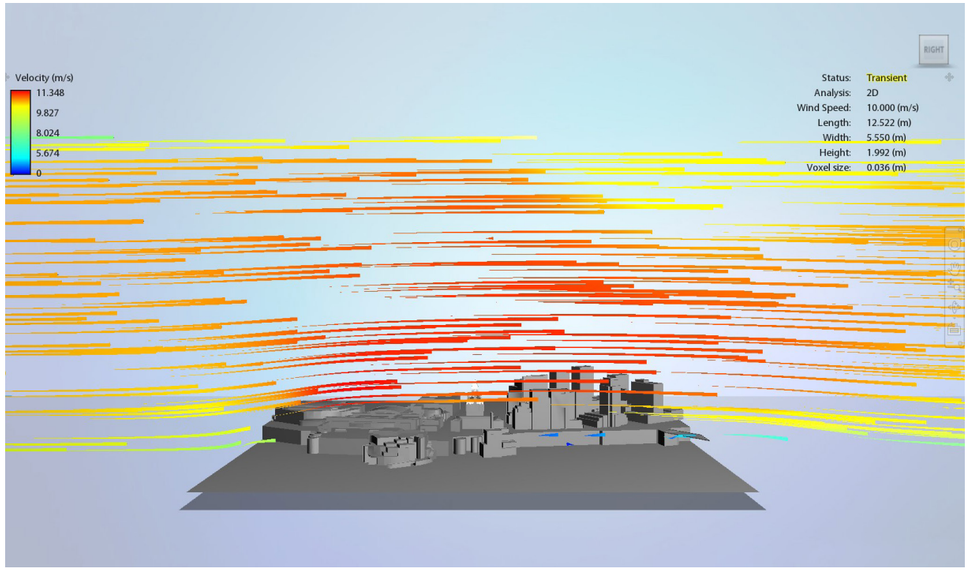
Through a yearly sun study, it is clear to note that the site location receives ample amounts of unobstructed direct sunlight. Taking advantage of as much direct sunlight as possible will help reduce the overall electrical lighting load, decreasing building cost & eliminating unnecessary lights.



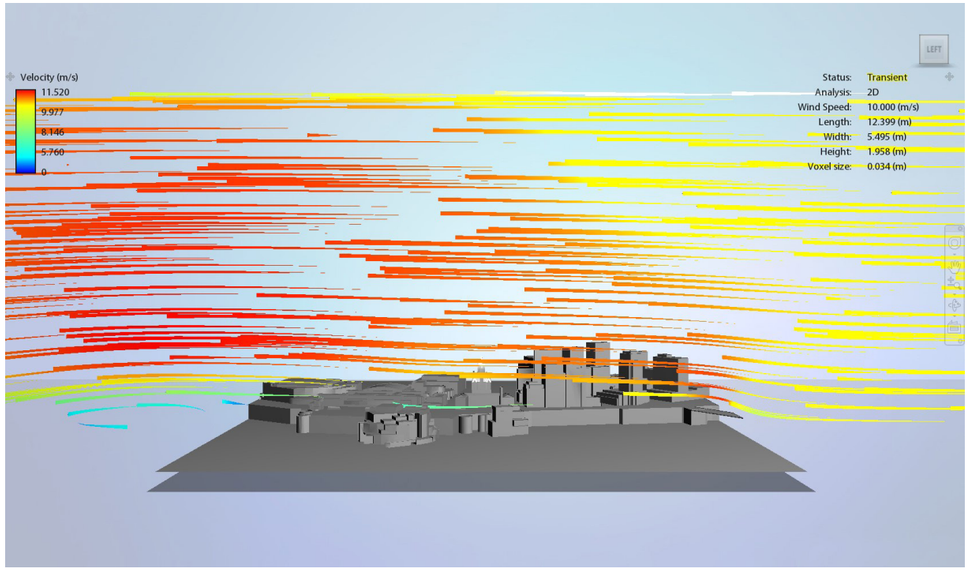
Southward wind through existing site



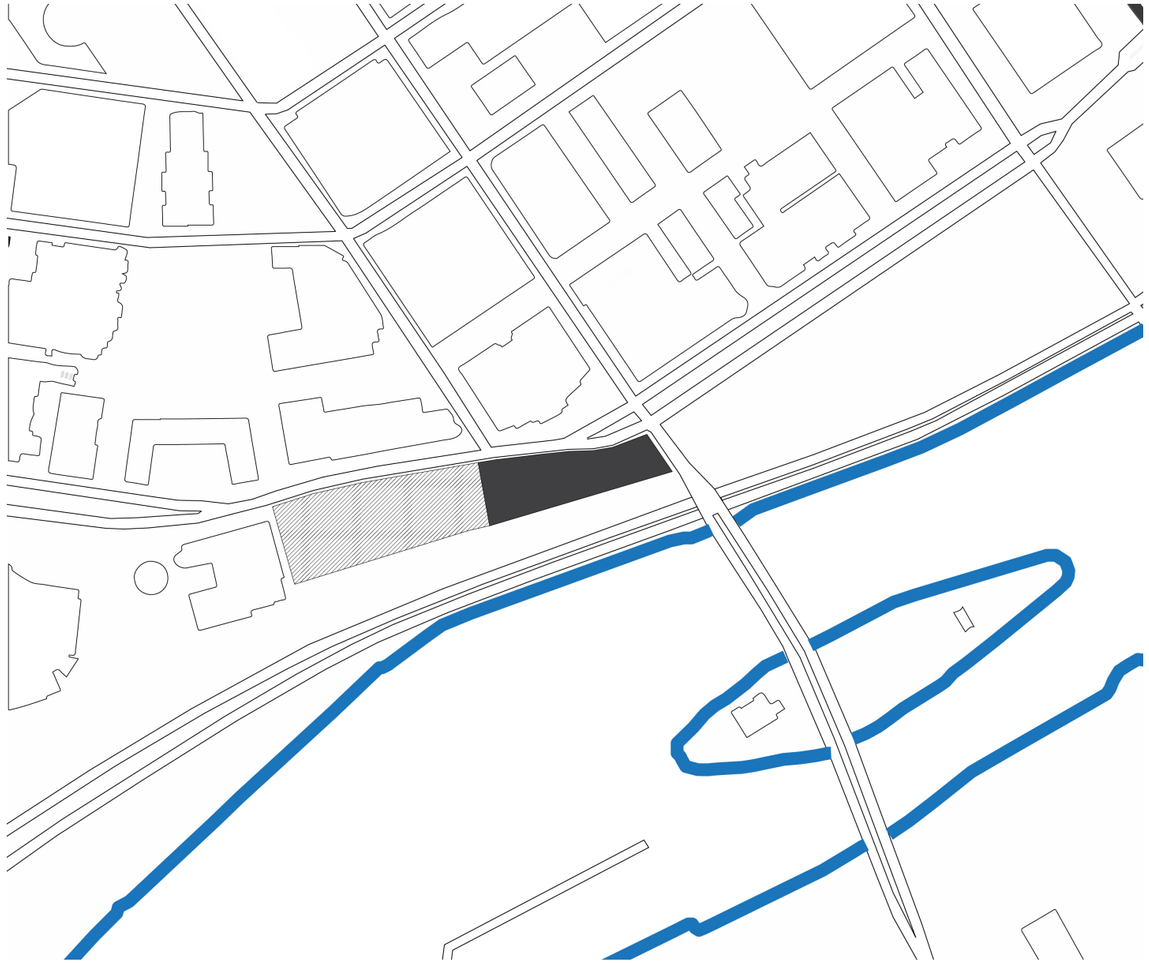
Northward wind through existing site



Westward wind through existing site



Eastward wind through existing site



Site area not flooded

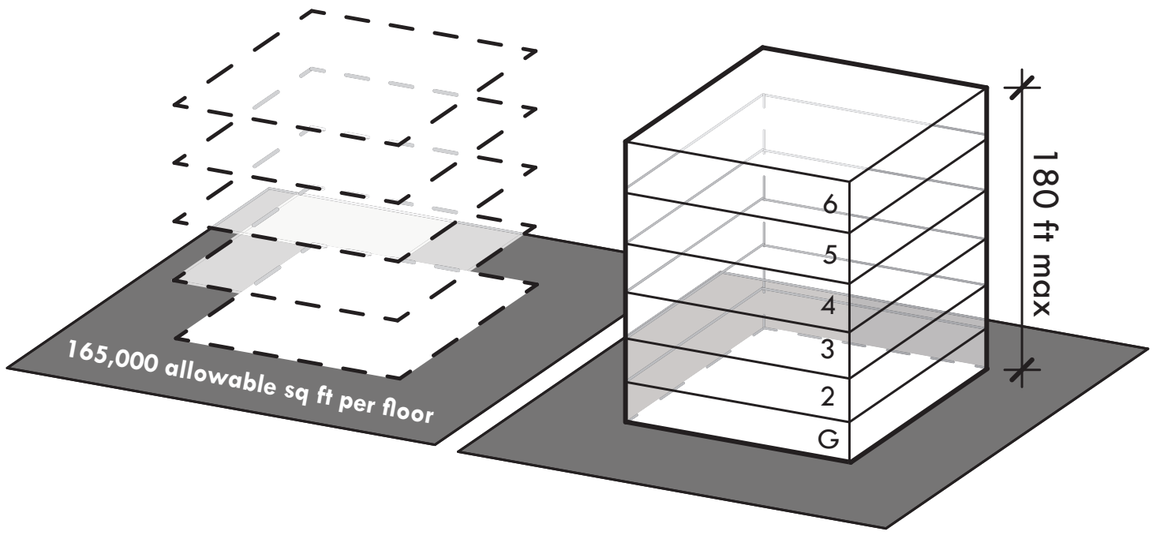
100 year flood area

Due to the closeness of the Mississippi River and the potential for flooding to occur on site, the programmatic elements that make up the lower levels needs to be less important so that if flooding does occur, the lower levels of the building do not become a major loss. This strategic move is in response to resilient design.

Building Code

Building codes are a critical guidelines which need to be followed as they were formed to help protect the health, safety & welfare of the public. While following these code guidelines is required, interpreting these guidelines to help enhance the design is how good projects can become great projects.

The building codes which the thesis project will need to follow include occupancy classification (R-2) for independent living, occupancy classification (I-1) for assisted living & occupancy classification (I-2) for skilled nursing. The International Code Council defines the residential group as, “the use of a building or structure, or a portion thereof, for sleeping purposes…”. Where as the institutional group is defined is defined as, “the use of a building or structure, or a portion thereof, in which people are cared for or live in a supervised environment, having physical limitations because of health or age are harbored for medical treatment, health care, personal care or other care or treatment, or in which the liberty of the occupants is restricted.”. More specifically, according to the international code council, (R-2) is intended for, “residential occupancies containing sleeping units or more than two dwelling units where the occupants are primarily permanent in nature”. Apartment buildings are included within an (R-2) classification. Group (I-1) is intended for, “buildings, structures or parts thereof housing more than 16 persons, on a 24-hour basis, who because of age, mental disability or other reasons, live in a supervised residential environment that provides personal care services. The occupants are capable of responding to an emergency situation without physical assistance from staff and are capable of self-preservation.”. Assisted living facilities are included within an (I-1) classification. Group (I-2) is intended for, “buildings and structures used for medical, surgical, psychiatric, nursing, health or custodial care for persons who are not capable of self-preservation. Nursing homes are included within an (I-2) classification.



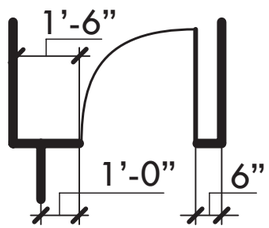
occupancy load 200

occupancy load 200 x .3 in = 60 in exit width

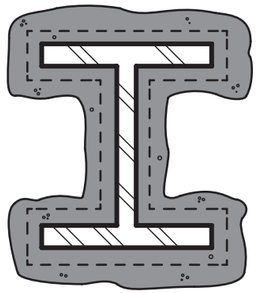
60 in exit width / 12 in = 5 ft exit width

5ft exit width / 3 ft = (2) 3’-0” exit doors

Base upon occupancy load approximation, I can expect to need at a minimum (2) 3’-0” wide exit doors at the entrance of the building. At least one of the exiting doors will need to be automated in order to accommodate those who need further assistance.

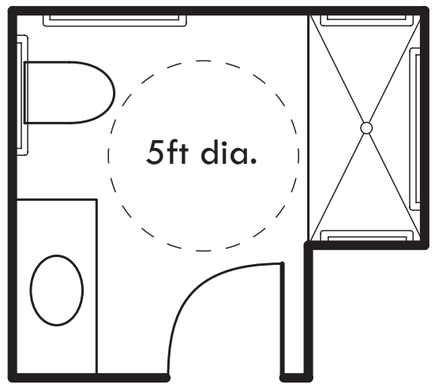


To comply with ADA requirements all doors must follow the minimum illustrated measurements shown above. Depending upon the direction of the door swing, there need a minimum 18 inches of approach space on the pull side, and a minimum 12 inches on the push side.



construction type 1-B

Following a type 1-B building construction, the building design will need to comply with the following fire code. Primary structure 2 hour, bearing walls exterior 2 hour, bearing walls interior 2 hour, non bearing walls interior 0 hour, floor construction 2hour & roof construction 1 hour.

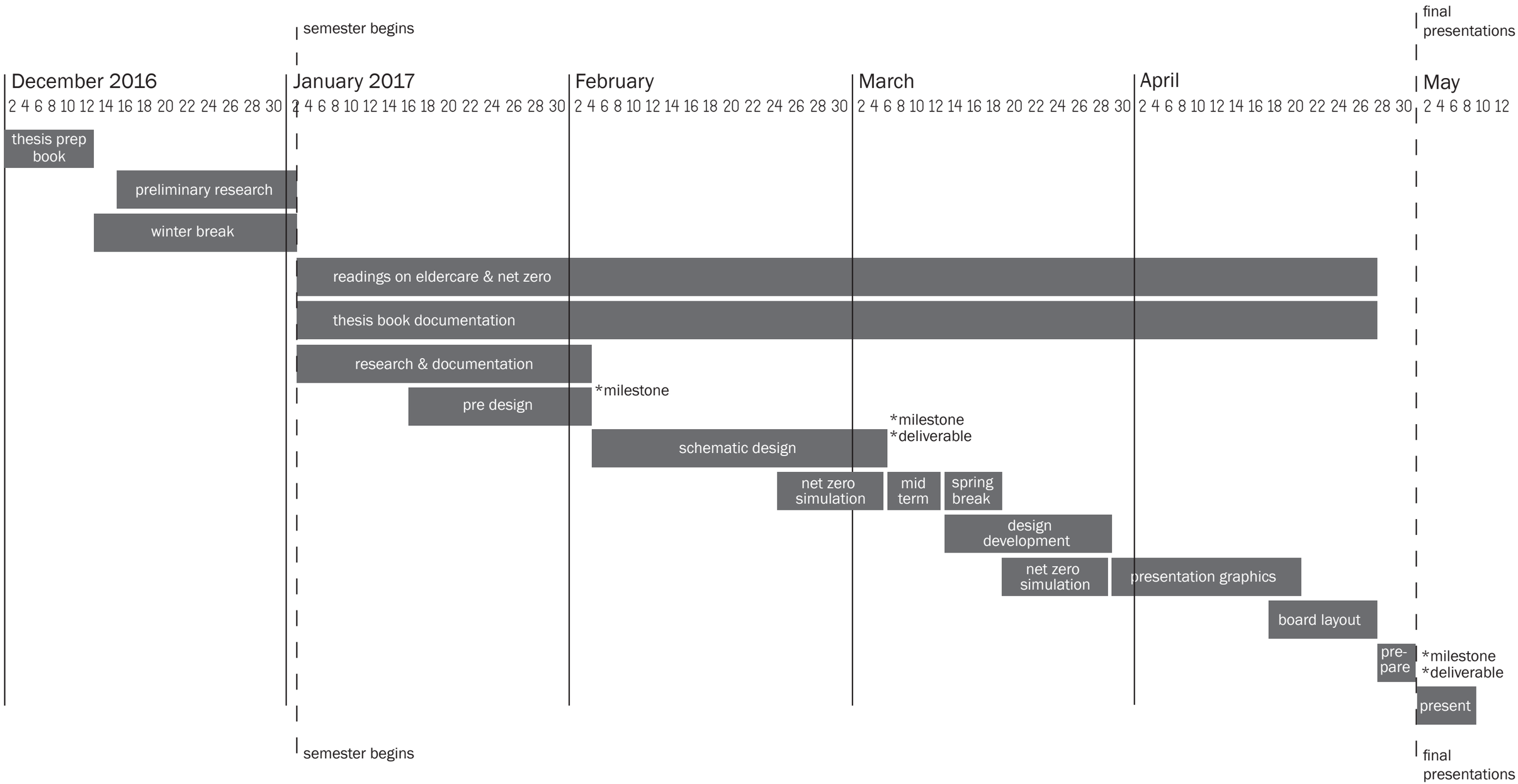


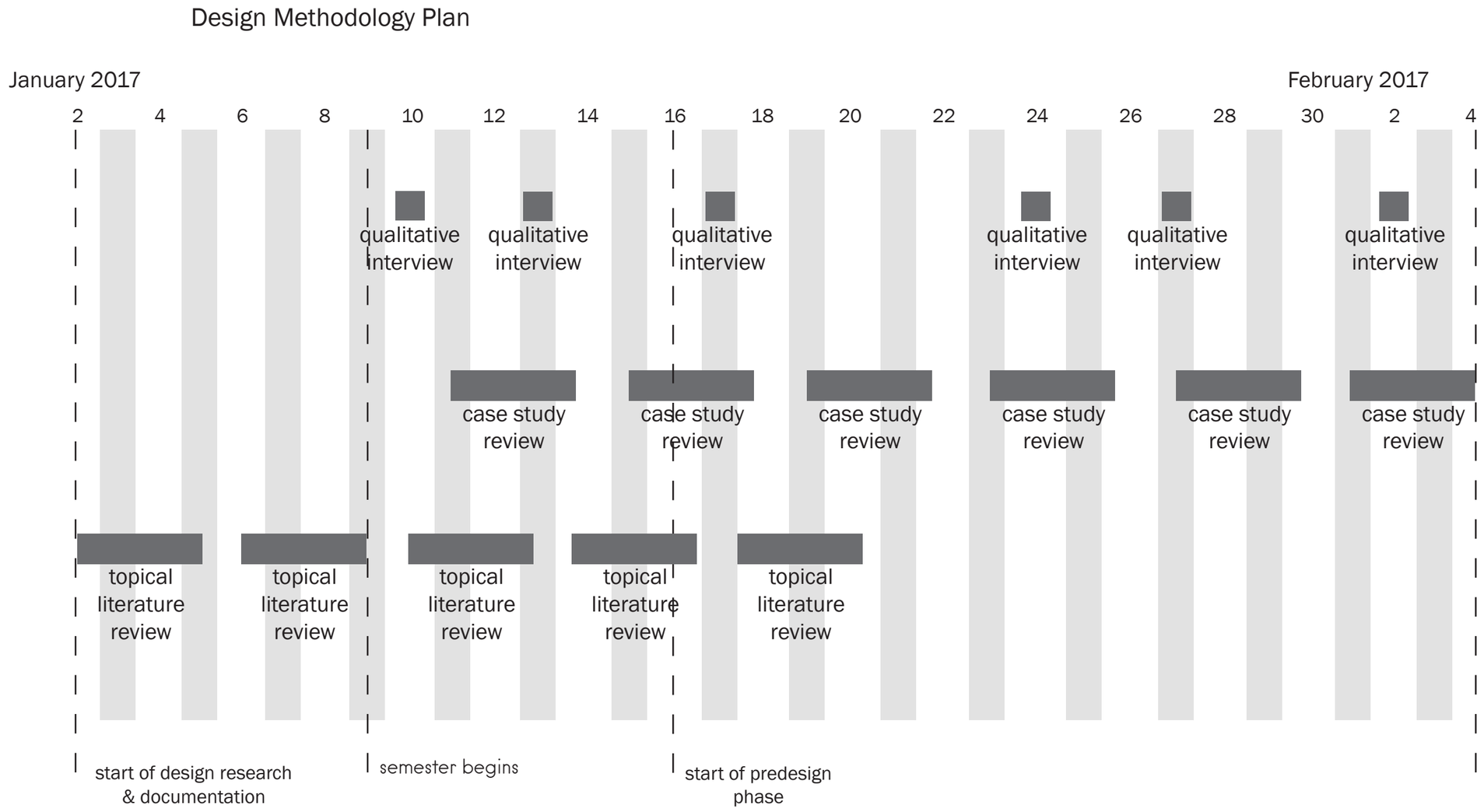
To comply with ADA requirements all public restrooms and senior resident bathrooms should be sized to accommodate a wheelchairs 5 foot turning diameter. In addition to the 5 foot turning diameter, sufficient bar grabs and ADA compliant sink will be needed as well.

Plan For Proceeding

With a short amount of time to complete the thesis project over the 2017 spring semester, it is critical that I remain organized and follow a strict project schedule. The project schedule will be a useful tool as it lays out the phases of the project, pinpoints major milestones & begins to formulate what deliverables will be useful during each phase. Although it is in my best interest to follow the schedule as best as I can, the schedule may change and adapt as the project progress throughout the semester.

Thesis Project Schedule





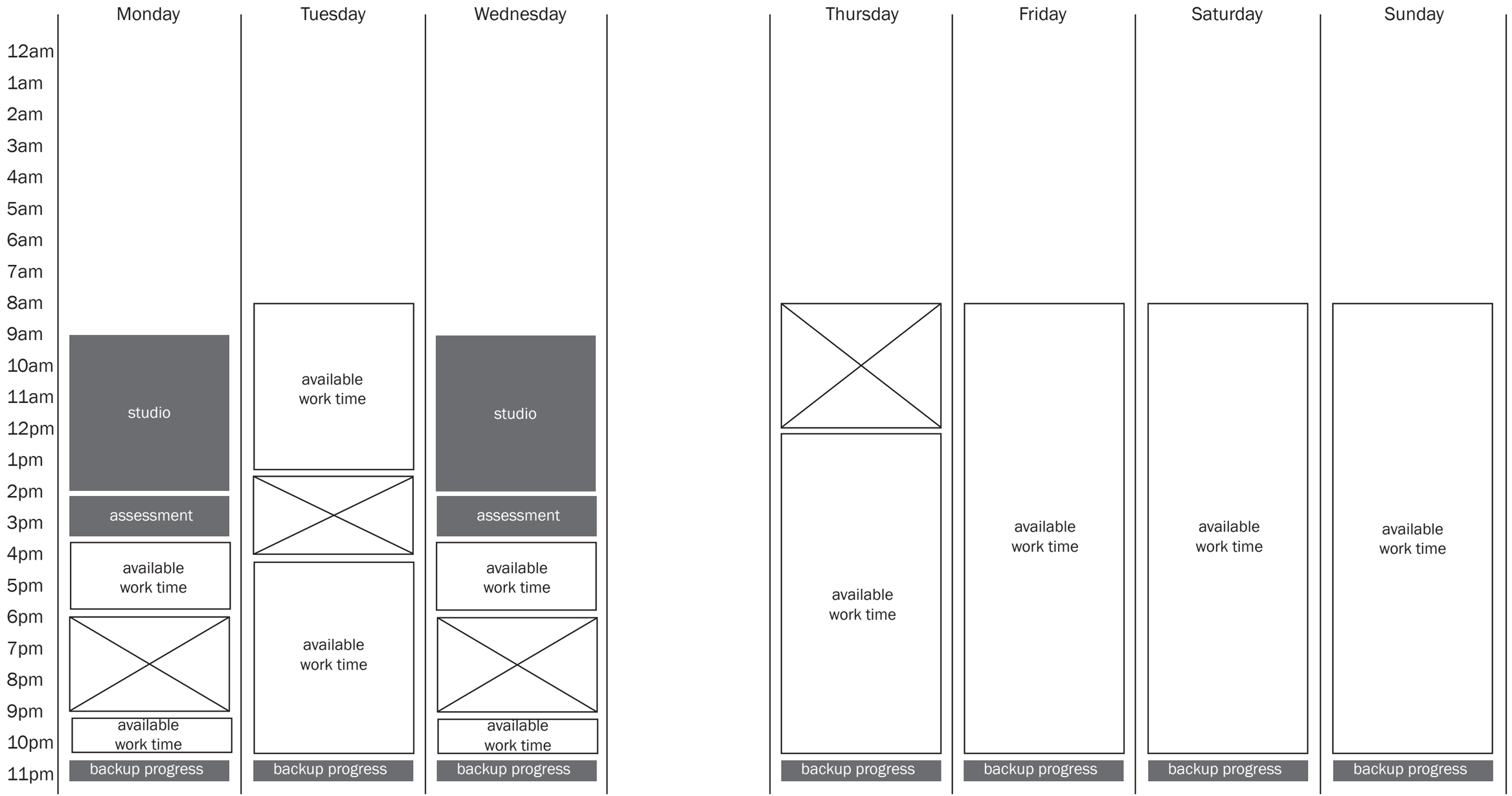
Topical Literature Review : I read through several literature sources on the topics of senior living and net zero to become more familiar with each. While reading I wrote down specific quotes that I believe helps bring forth the importance of my research question.

Case Study Review : Four case studies were chosen based on their relevance to senior living, net zero or context.

Qualitative Interview : I interviewed individuals who have experience in senior living design and or net zero design. I interviewed a mix of individuals including, architects and senior living facility CEO's. During each 30-40 minute interview I asked each individual about senior living design trends, net zero design integration and the possibility of incorporating young professionals into the program.

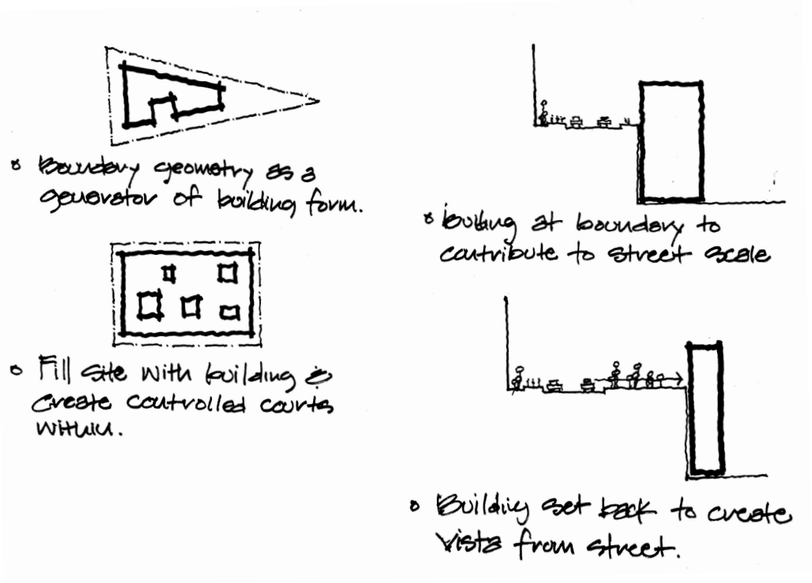
Digital Simulation : I conducted a simple energy analysis of the proposed design concept through an Autodesk service called Green Building Studio. This simple simulation presented to me the total annual electrical energy consumption and cost of electrical energy.

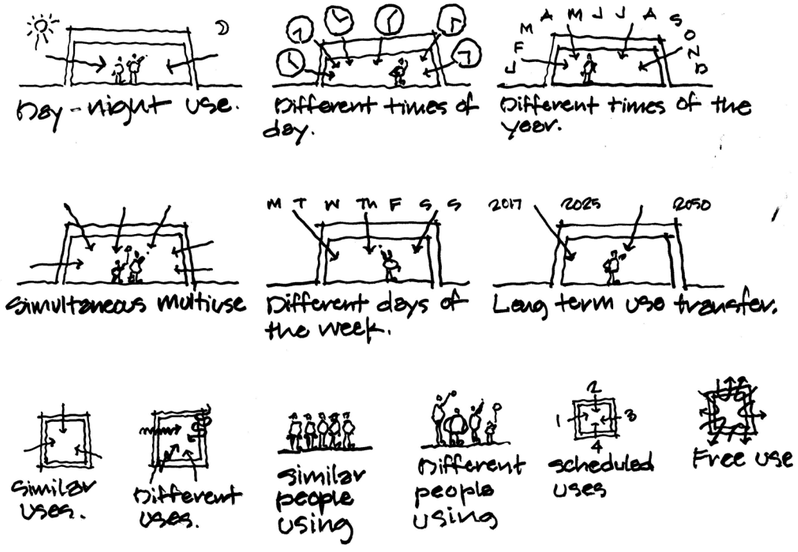
Typical Work Week Plan



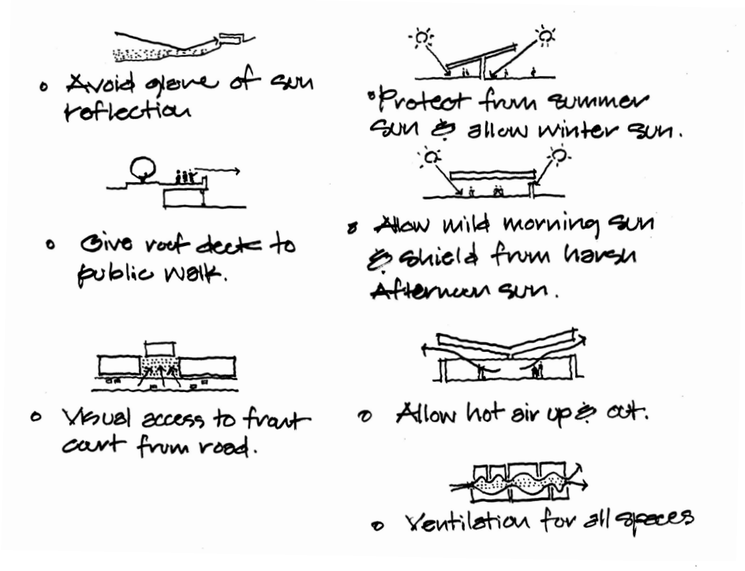
Design Concept

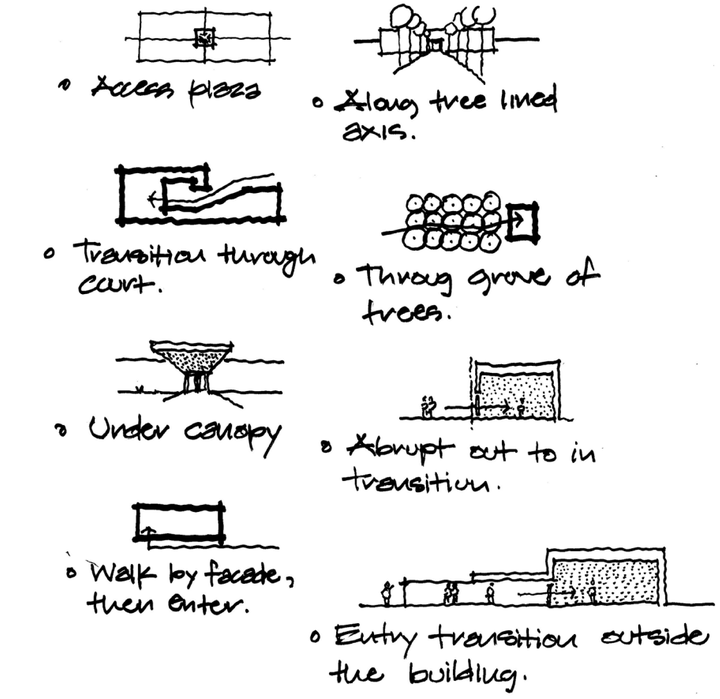
After an intensive research process and sorting through take always, a design concept began to take shape. This design concept is only a concept and not a final solution. Through the design process an idea is never complete, it is forever changing.



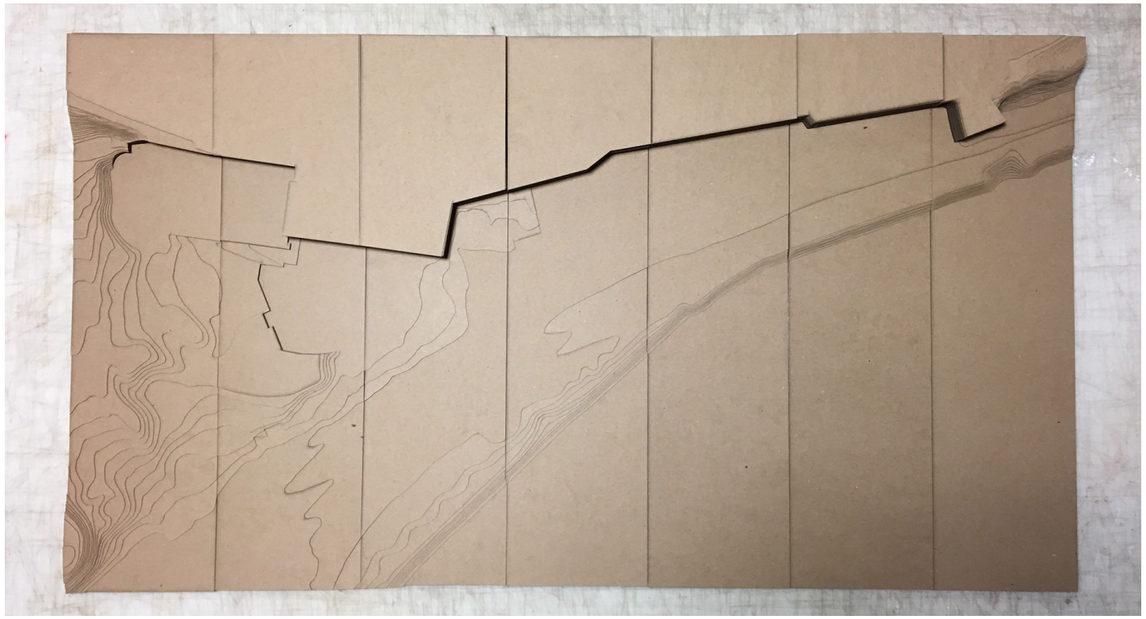


Throughout the conceptual design phase I regularly consulted the *Concept Sourcebook a vocabulary of architectural forms* by Edward T. White. Although this tool was published in the 70's, it still posses an abundance of timeless architectural concepts that are relevant to any project. Some of these concepts illustrated above helped me make decisions early on during preliminary design concepts.

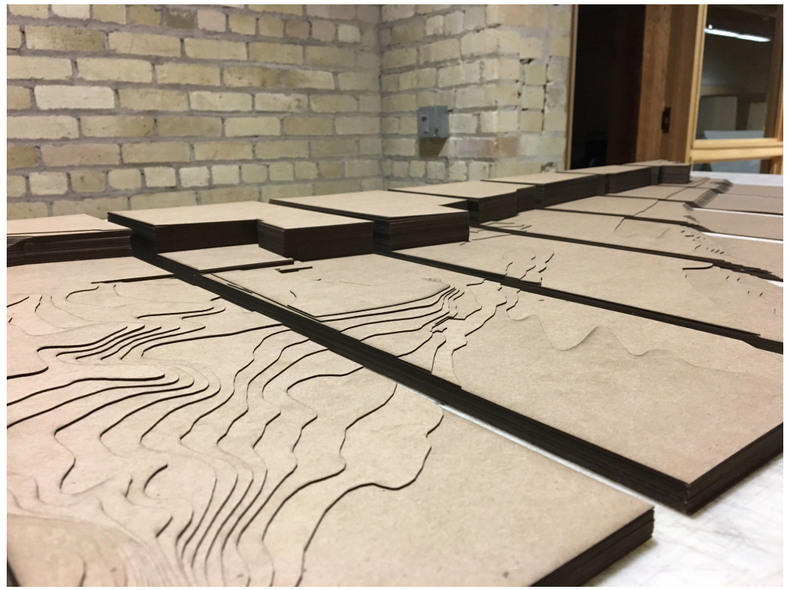


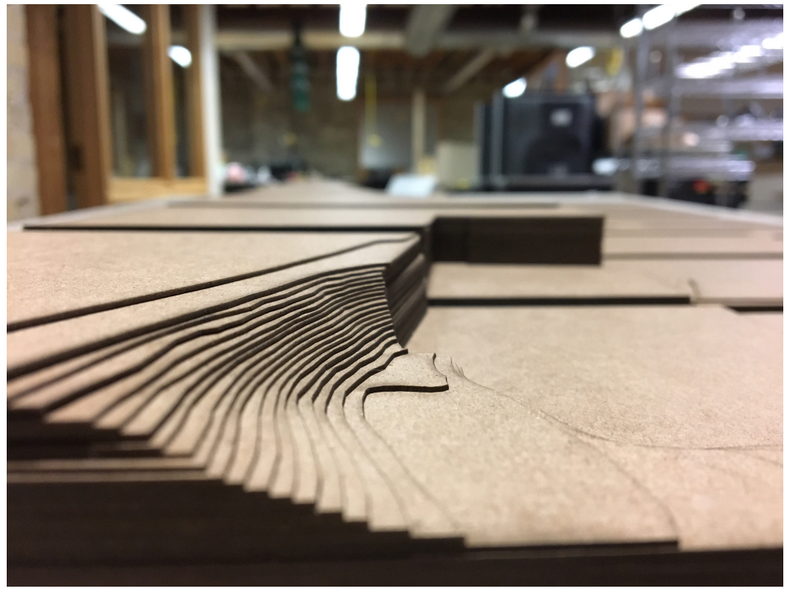


Site model 1 to 60 (open)

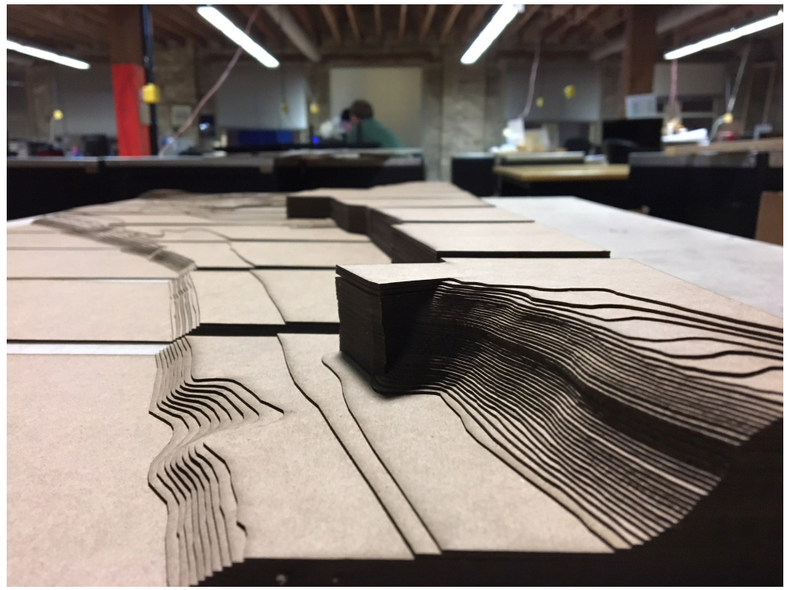


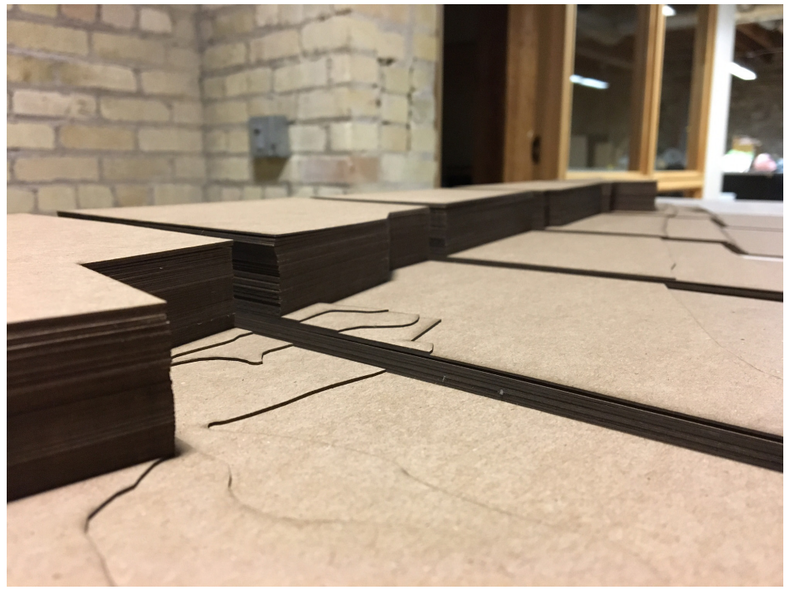
Site model 1 to 60 (closed)





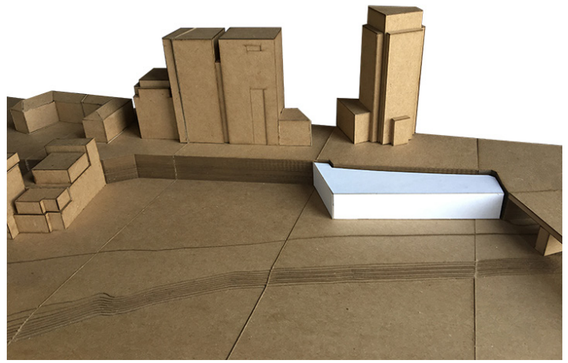
Site model 1 to 60 assembly

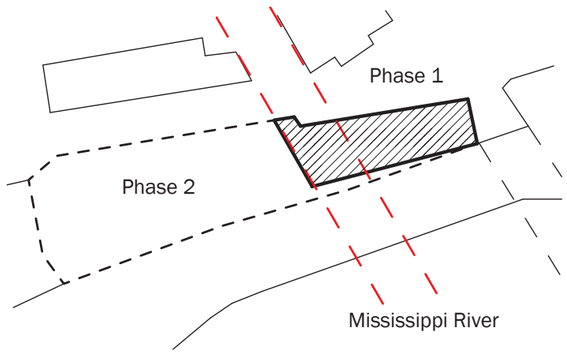




Site model 1 to 60 assembly

1

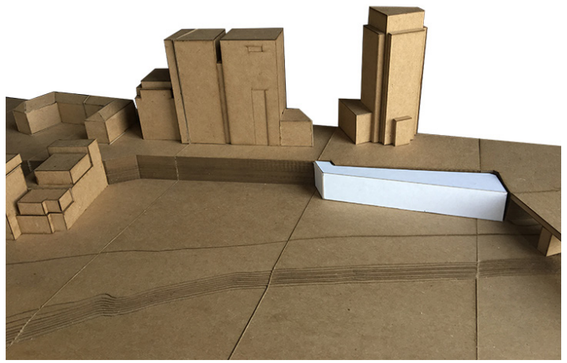


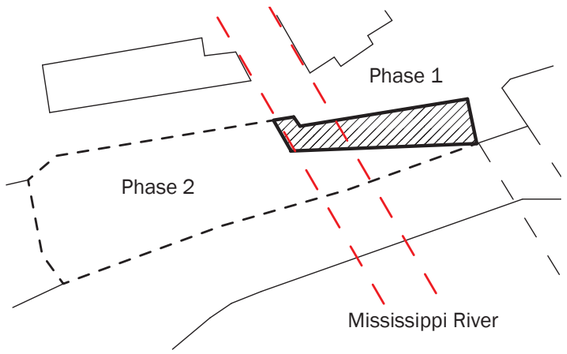


Using the property boundary to generate a building form.

South facade is parallel with major north south transportation axis.

2

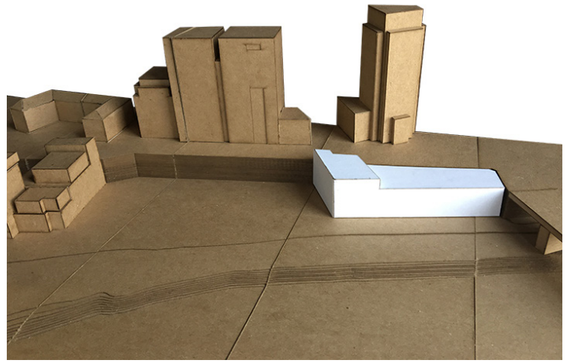


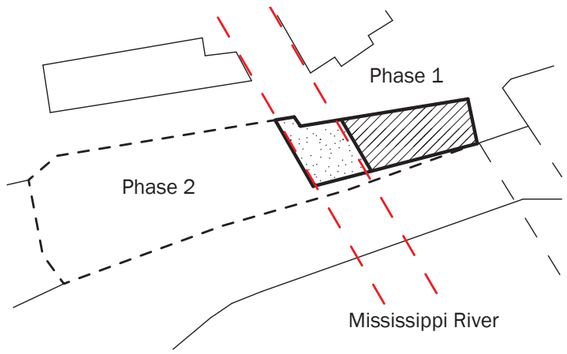


Using the property boundary to generate a building form.

South facade is angle to face true south.

3



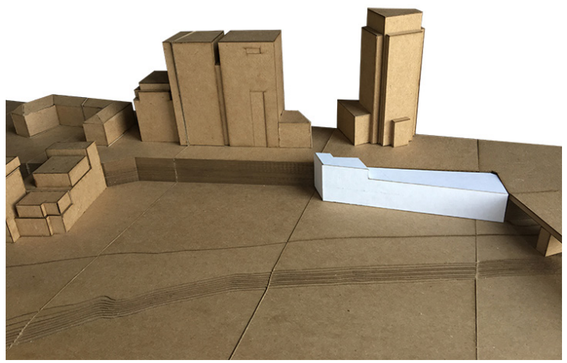


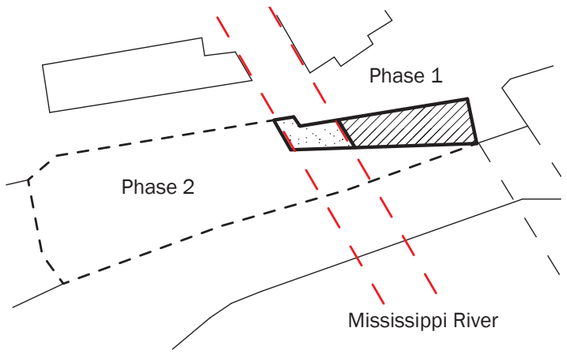
Using the property boundary to generate a building form.

South facade is parallel with major north south transportation axis.

Adding a sense of hierarchy at end of street axis.

4



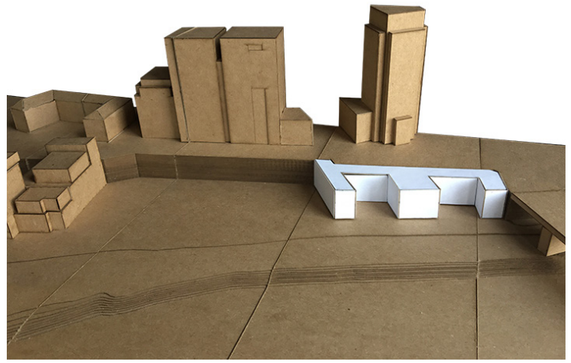


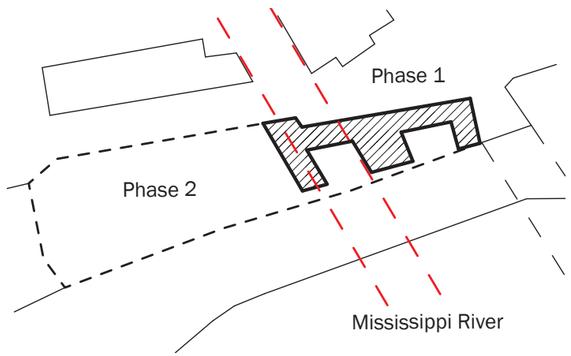
Using the property boundary to generate a building form.

South facade is angle to face true south.

Adding a sense of hierarchy at the end of street axis.

5



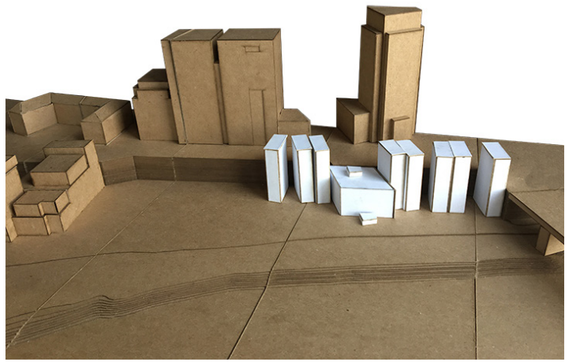


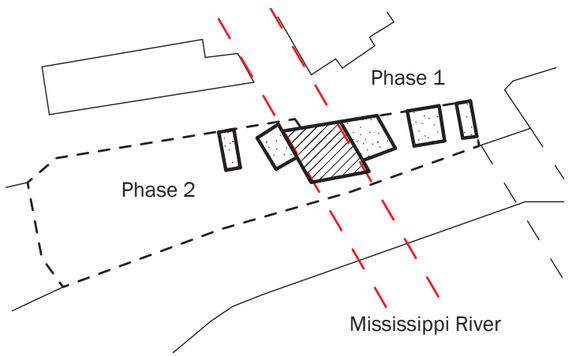
Using the property boundary to generate a building form.

South facades are parallel with major north south transportation axis.

Experimenting with subtracting space to create courtyards.

6





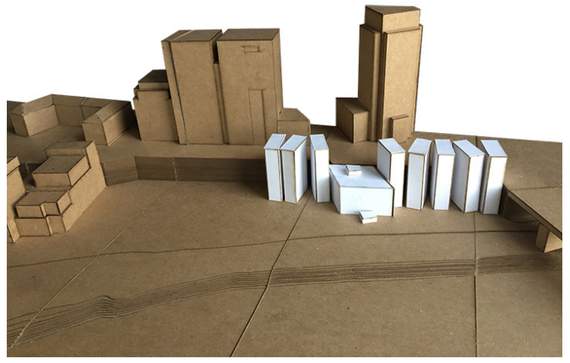
Using the property boundary to generate a building form.

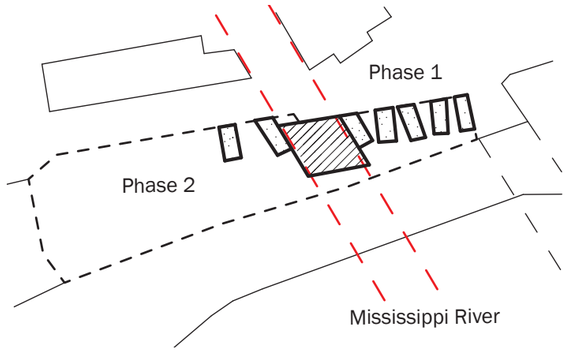
Experimenting with breaking up the solid building form.

Multi story community hub with street level public/community plaza located in line with street axis

Single and double loaded towers connected through interior atriums.

7





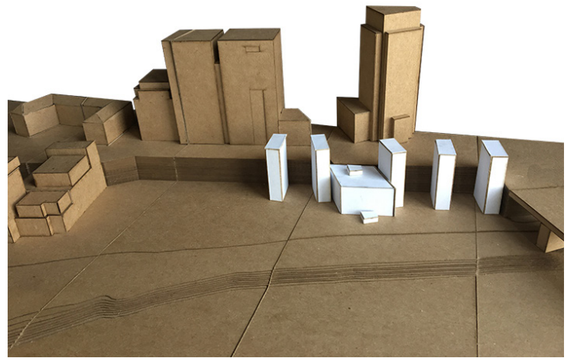
Using the property boundary to generate a building form.

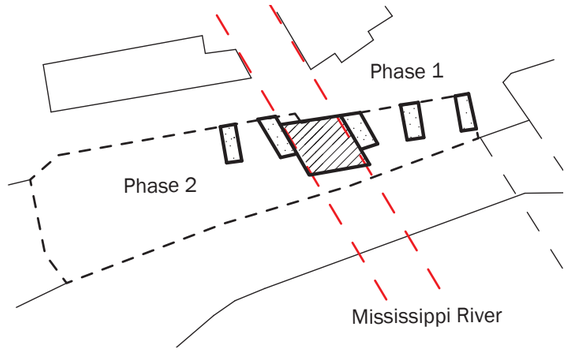
Experimenting with breaking up the solid building form.

Multi story community hub with street level public/community plaza located in line with street axis

Single loaded towers connected by interior atriums.

8





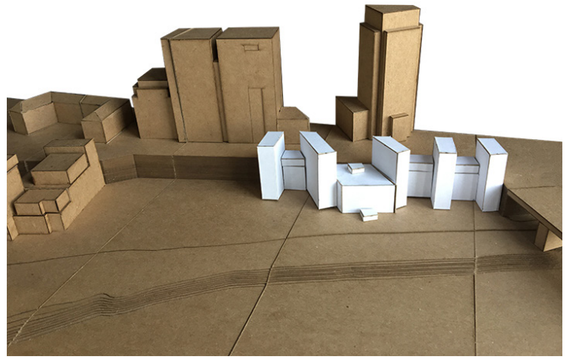
Using the property boundary to generate a building form.

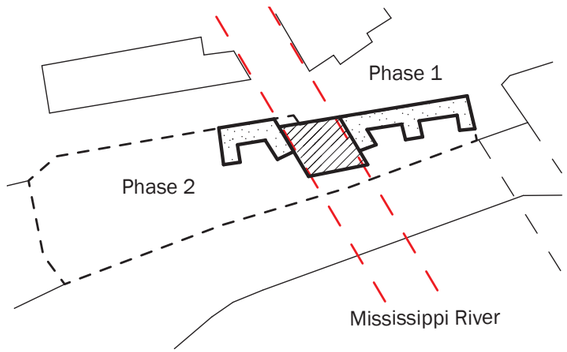
Experimenting with breaking up the solid building form.

Multi story community hub with street level public/community plaza located in line with street axis

Single loaded towers creating view windows between.

9





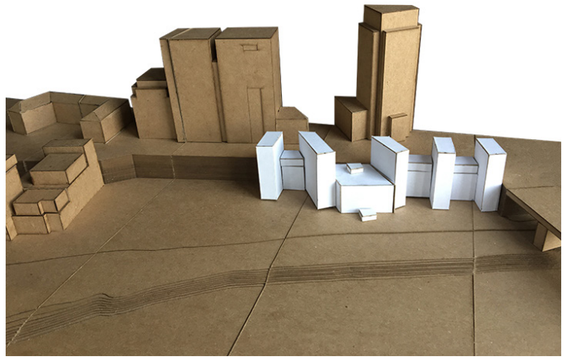
Using the property boundary to generate a building form.

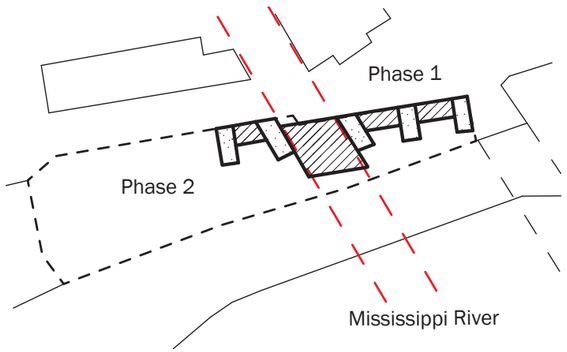
Experimenting with breaking up the solid building form.

Multi story community hub with street level public/community plaza located in line with street axis

Single loaded towers with view windows filled in with connecting space.

10



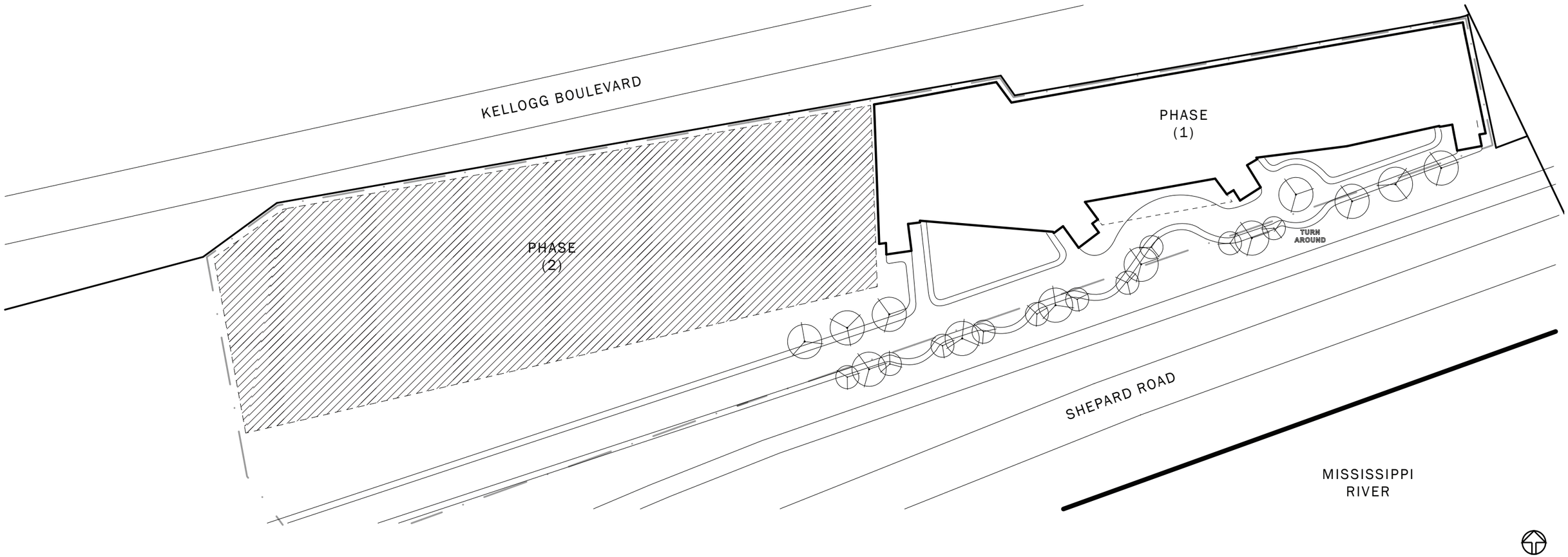


Using the property boundary to generate a building form.

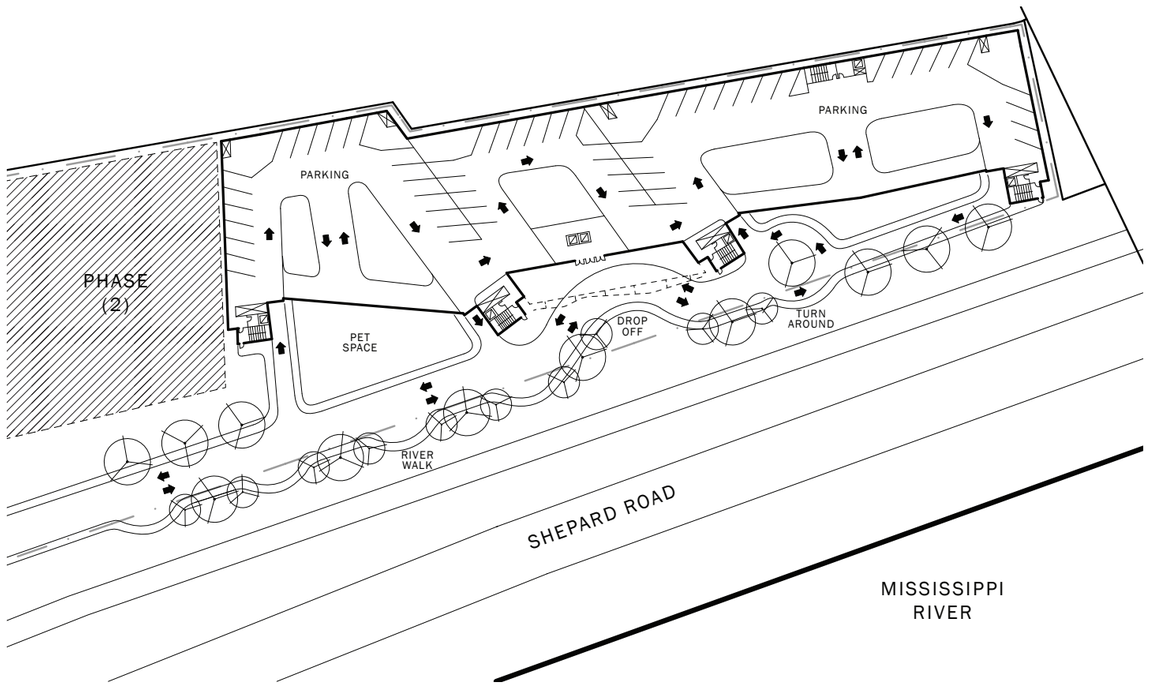
Experimenting with breaking up the solid building form.

Multi story community hub with street level public/community plaza located in line with street axis

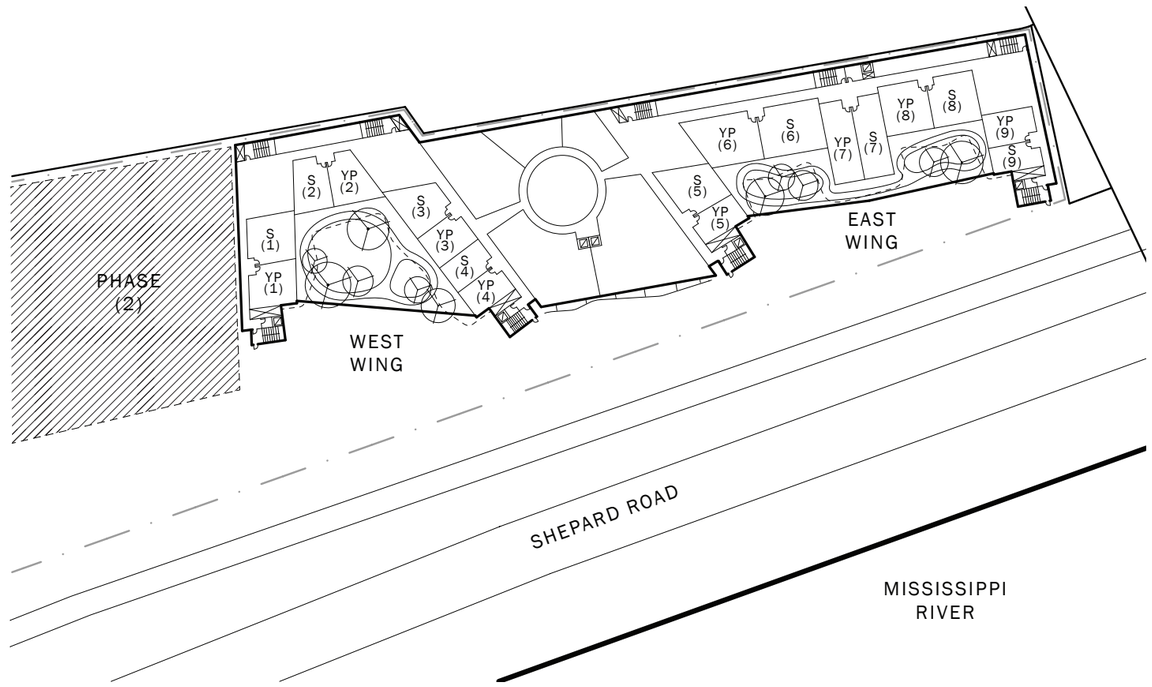
Single loaded towers with view windows and connecting space.



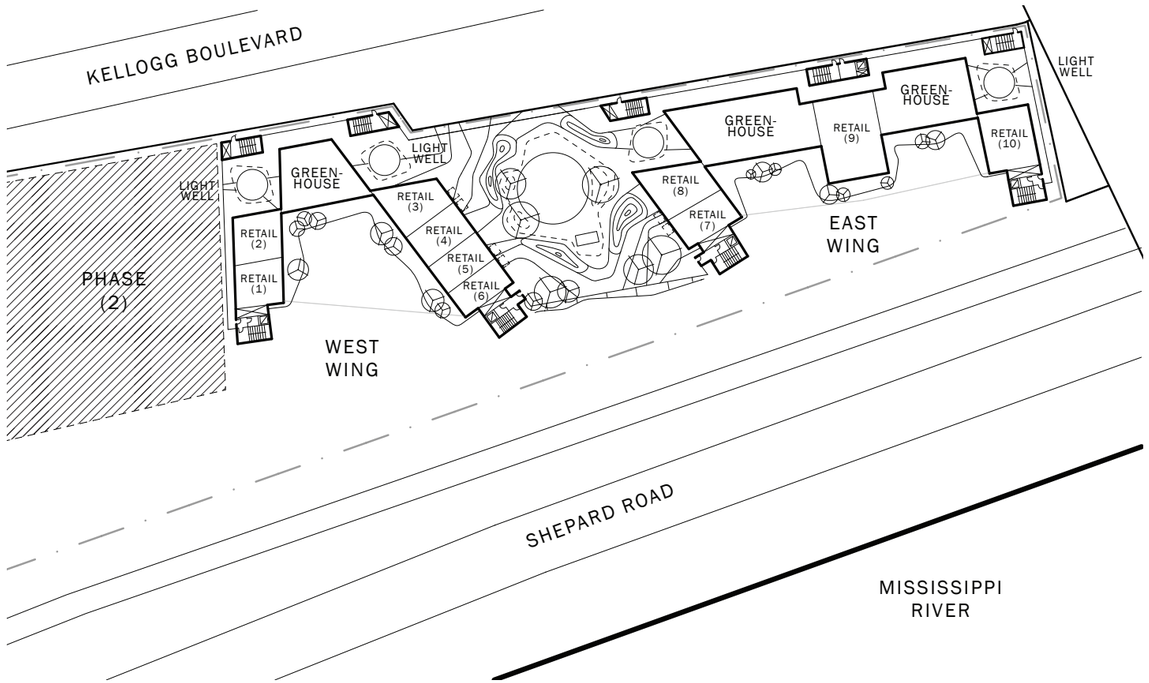
Site Master Plan (Phase 1 & Phase 2)



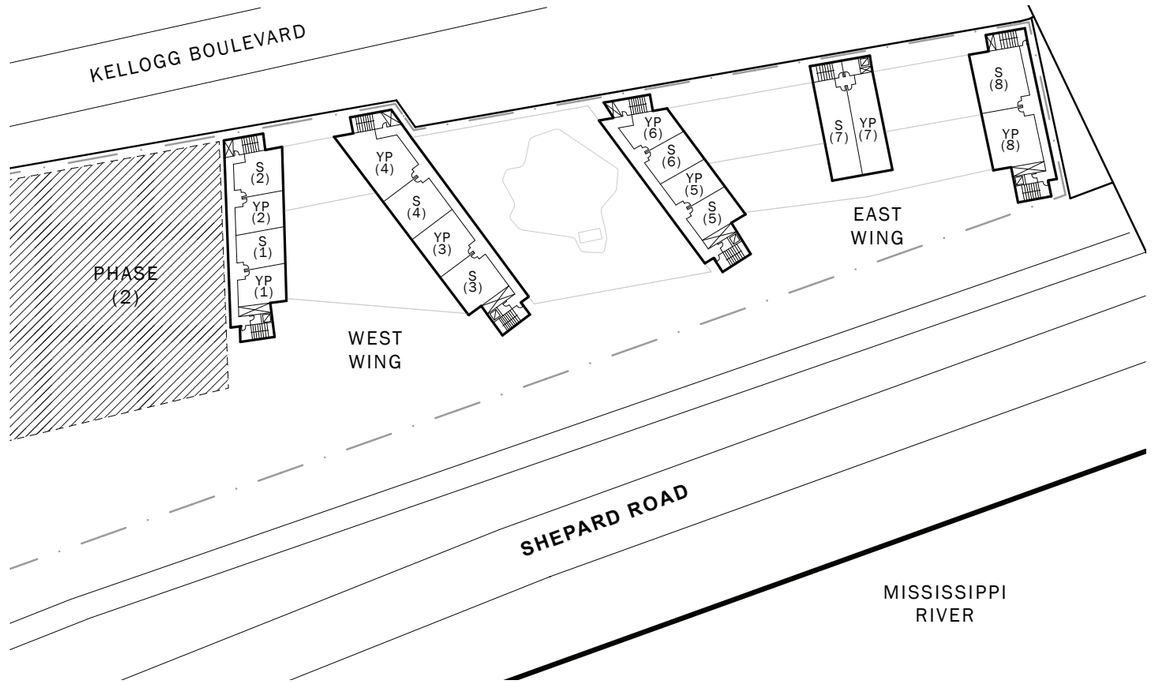
Ground Floor - Floor 3



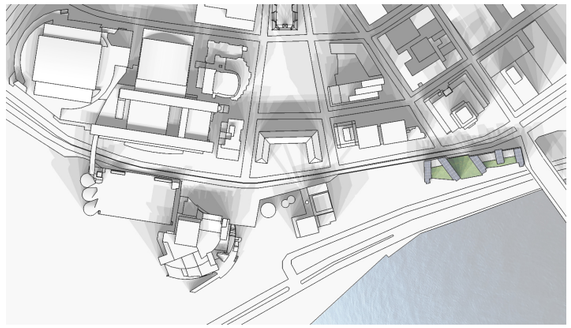
Floor 4 - Floor 7



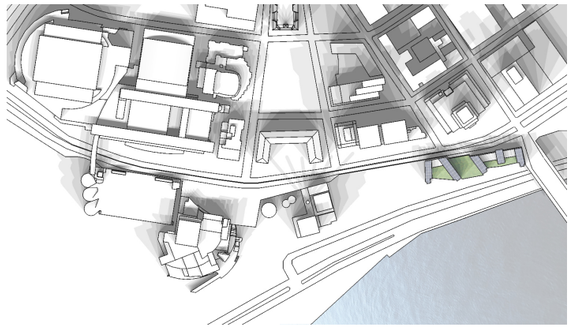
Floor 8 - Floor 9



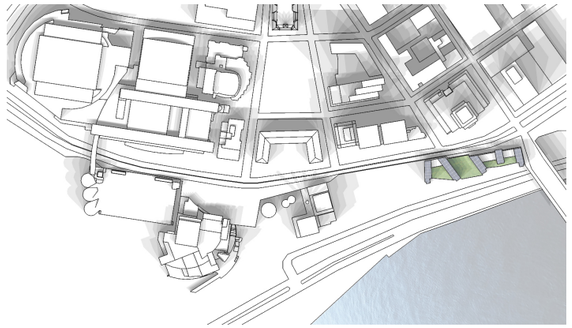
Floor 10 - Floor 11



Jan. 21st 9am-3pm



Feb. 21st 9am-3pm



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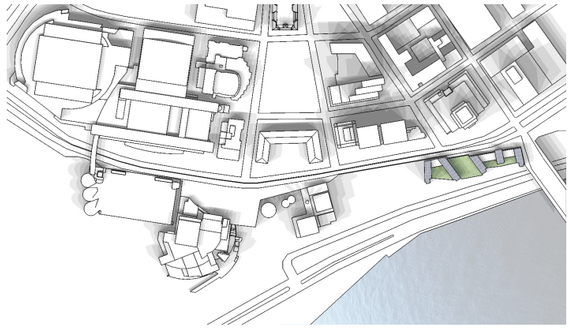

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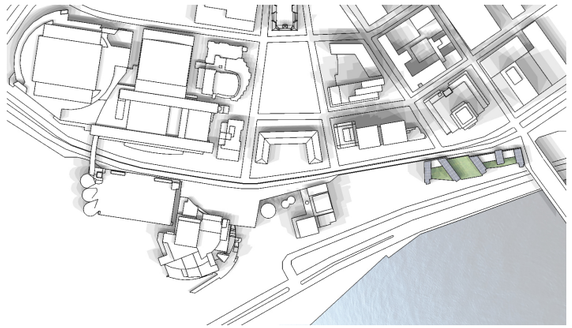

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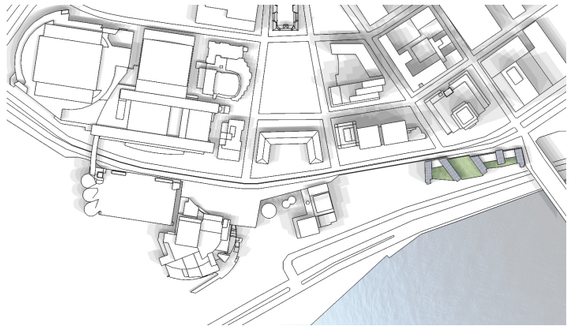

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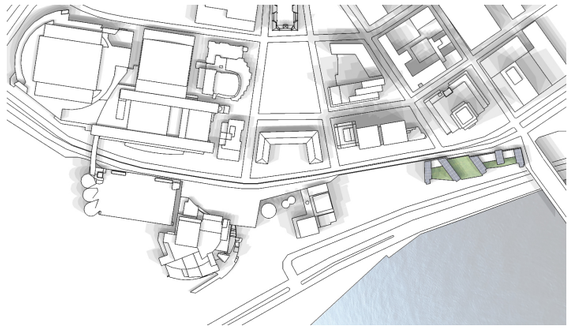

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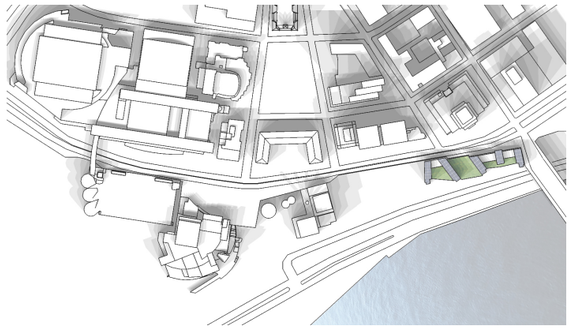

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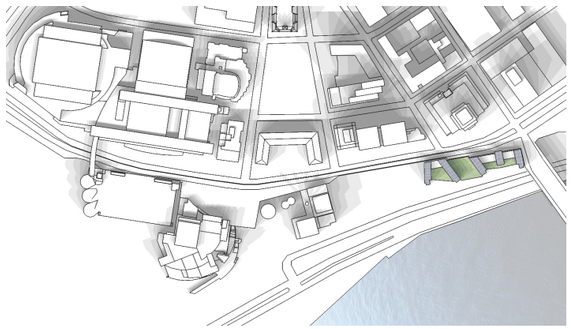

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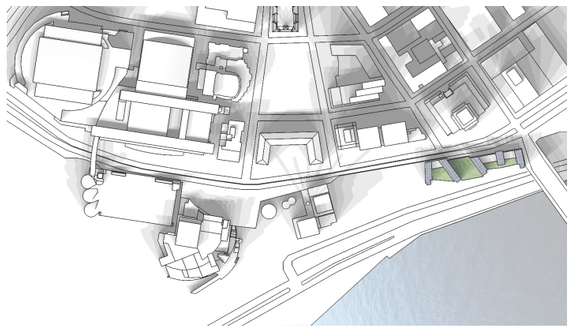

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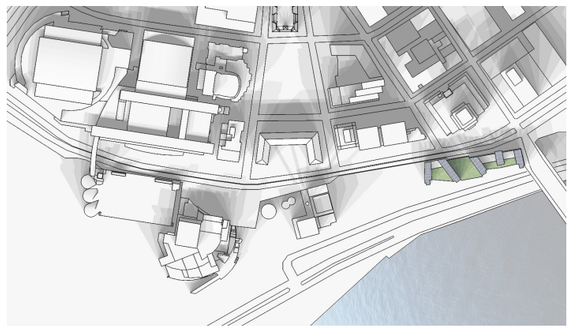

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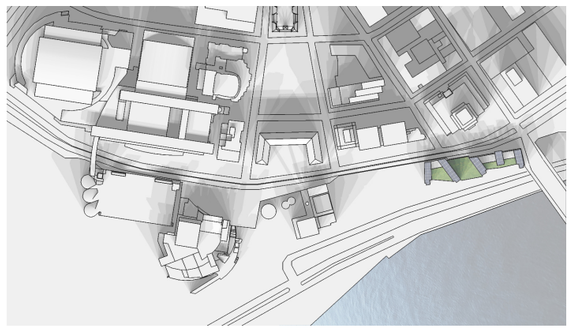
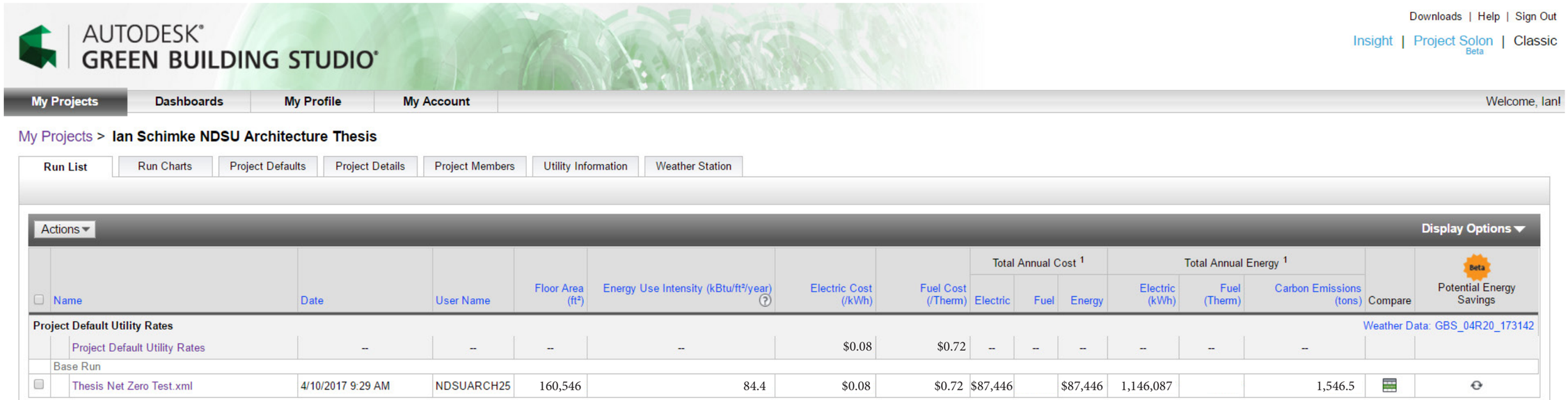


Dec. 21st 9am-3pm


AUTODESK®
GREEN BUILDING STUDIO®
Downloads | Help | Sign Out
Insight | Project Solon Beta | Classic
My Projects
Dashboards
My Profile
My Account
Welcome, Ian!
My Projects > Ian Schimke NDSU Architecture Thesis
Run List
Run Charts
Project Defaults
Project Details
Project Members
Utility Information
Weather Station
Actions
Display Options
Name
Date
User Name
Floor Area (ft²)
Energy Use Intensity (kBtu/ft²/year)
Electric Cost (/kWh)
Fuel Cost (/Therm)
Total Annual Cost 1
Electric
Fuel
Energy
Total Annual Energy 1
Electric (kWh)
Fuel (Therm)
Carbon Emissions (tons)
Compare
Potential Energy Savings
Project Default Utility Rates
Weather Data: GBS_04R20_173142
Project Default Utility Rates
Base Run
Thesis Net Zero Test.xml
4/10/2017 9:29 AM
NDSUARCH25
160,546
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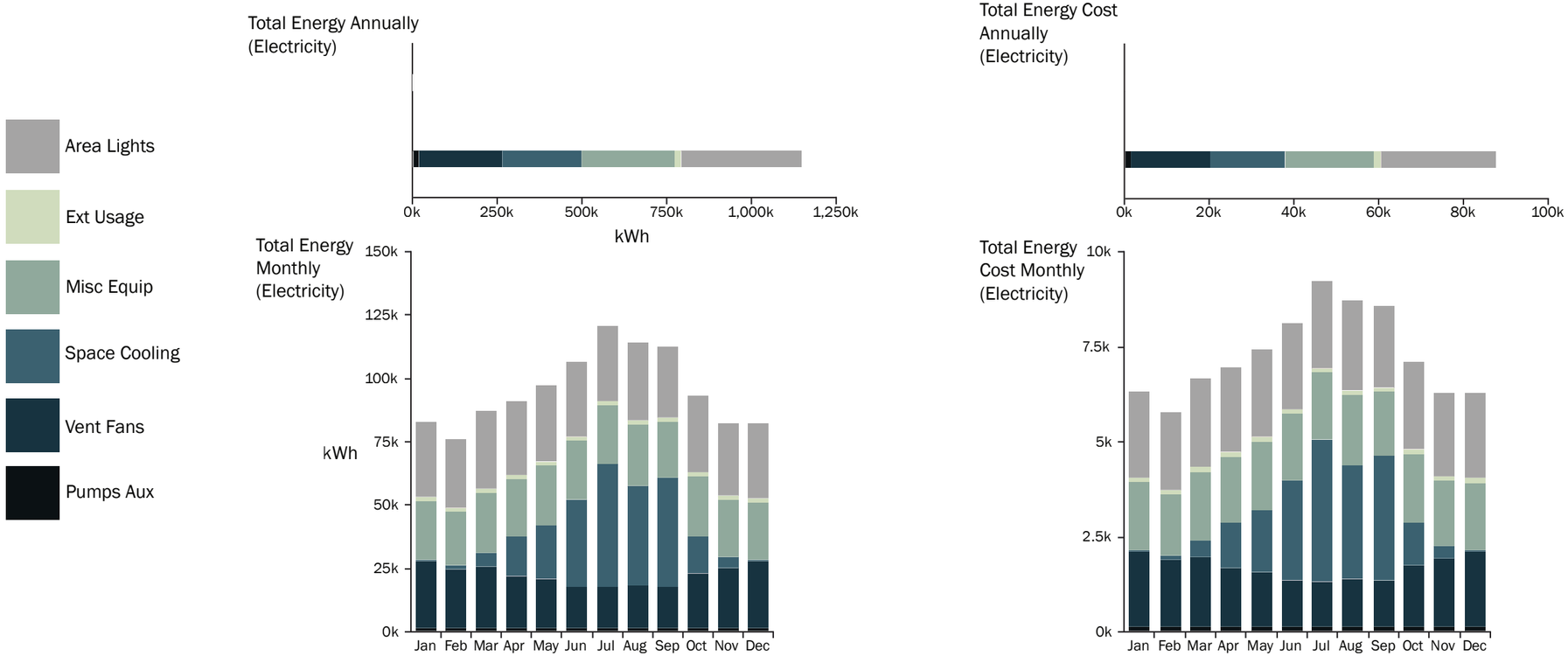

Area Lights
Ext Usage
Misc Equip
Space Cooling
Vent Fans
Pumps Aux
Total Energy Annually (Electricity)
0k
250k
500k
750k
1,000k
1,250k
kWh
Total Energy Monthly (Electricity)
150k
125k
100k
75k
50k
25k
0k
kWh
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Total Energy Cost Annually (Electricity)
0k
20k
40k
60k
80k
100k
Total Energy Cost Monthly (Electricity)
10k
7.5k
5k
2.5k
0k
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

Run Name: Thesis Net Zero Test.xml

Energy and Carbon Results | US EPA Energy Star | Water Usage | Photovoltaic Analysis | LEED Daylight | 3D VRML View | Export and Download Data Files | Design Alternatives

Project Template Applied: Ian Schimke NDSU Architecture Thesis_default
Location: St Paul, MN

Building Type: MultiFamily
Floor Area: 160,546 ft²

Electric Cost: $0.08 / kWh
Fuel Cost: $0.72 / Therm

Utility Data Used: Project Default Utility Rates

1 Base Run

Energy, Carbon and Cost Summary	
Annual Energy Cost	$156,787
Lifecycle Cost	$2,135,435
Annual CO_2 Emissions	
Electric	987.2 tons
Onsite Fuel	559.3 tons
Large SUV Equivalent	140.6 SUVs / Year
Annual Energy	
Energy Use Intensity (EUI)	84 kBtu / ft² / year
Electric	1,146,087 kWh
Fuel	96,437 Therms
Annual Peak Demand	307.5 kW
Lifecycle Energy	
Electric	34,382,610 kW
Fuel	2,893,097 Therms
Assumptions	

2 Design Alternative

Create a Design Alternative to improve your building performance.

Carbon Footprint

Base Run Carbon Neutral Potential	Annual CO_2 Emissions tons
1 Base Run	1,546.5
Onsite Renewable Potential	-1.4
Natural Ventilation Potential	-390.2
Onsite Biofuel Use	-559.3
Net CO_2 Emissions	**595.6**

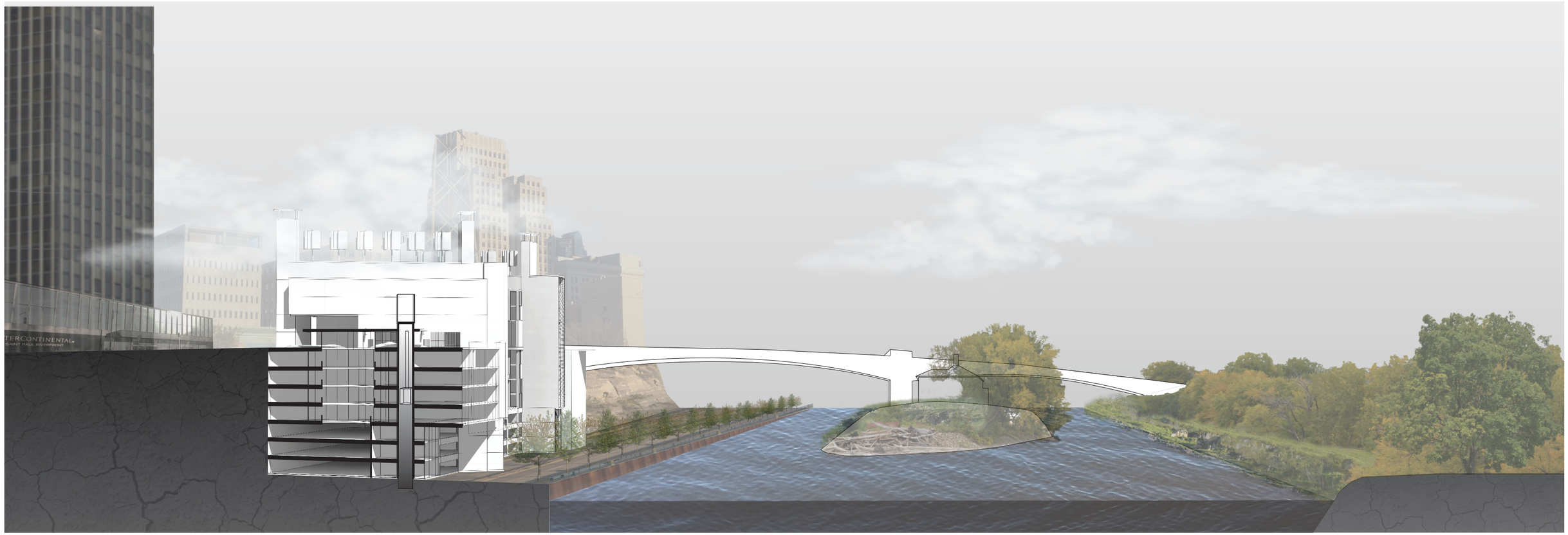
Net Large SUV Equivalent: 54.1 SUVs / Year

Assumptions

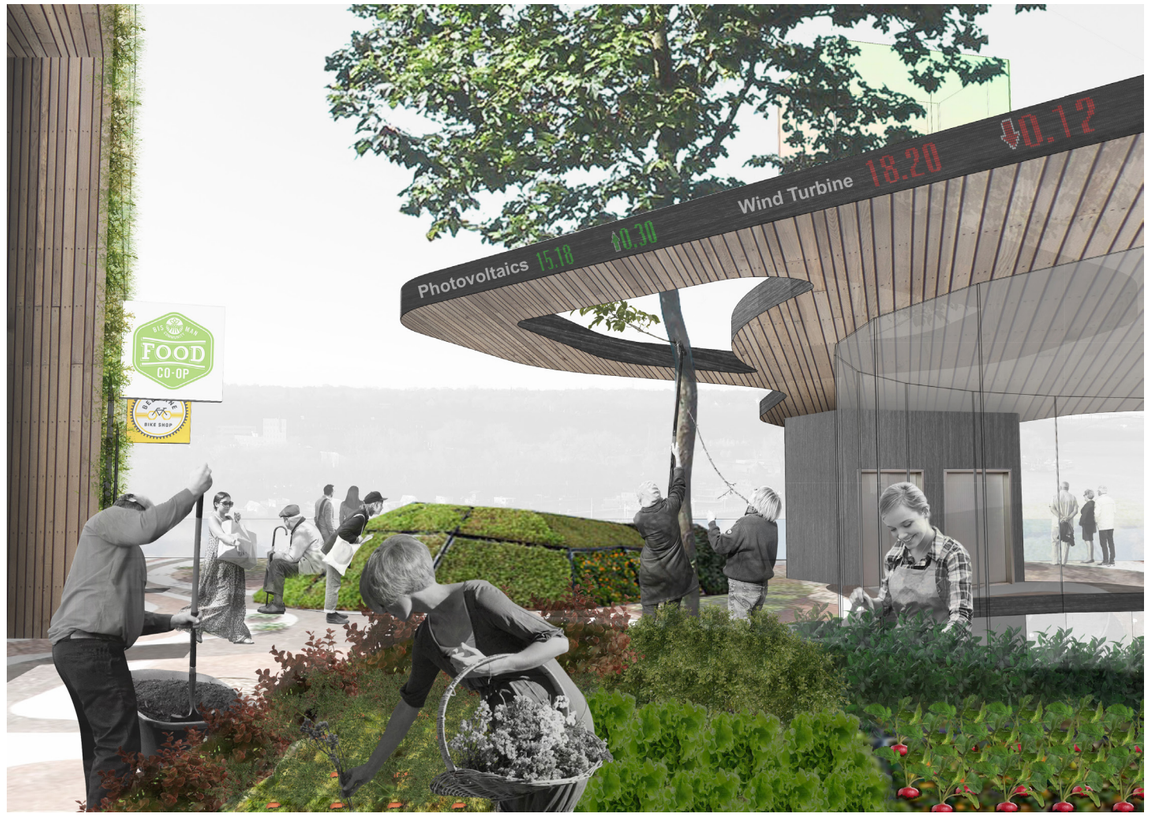
Electric Power Plant Sources in Your Region	
Fossil	77 %
Nuclear	15 %
Hydroelectric	3 %
Renewable	4 %
Other	0 %

Assumptions

Exterior perspective looking north from dock on Mississippi River



Site & building section looking west towards Wabasha Bridge & Raspberry Island



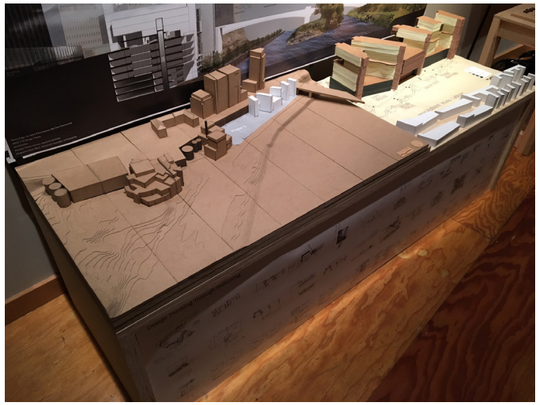
Within a **public** setting young professionals and seniors work together within the public plaza at the several community retail shops and tending to the public vegetable berms.

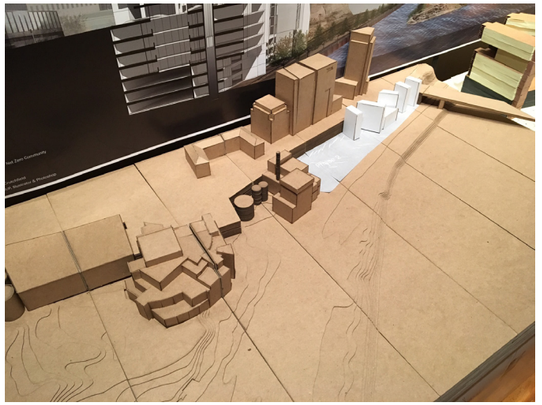
Within a **semi-public** setting young professionals and seniors find themselves working together in the community greenhouses. Tending to, experimenting with, and gathering vegetables and vegetation for the community residents.

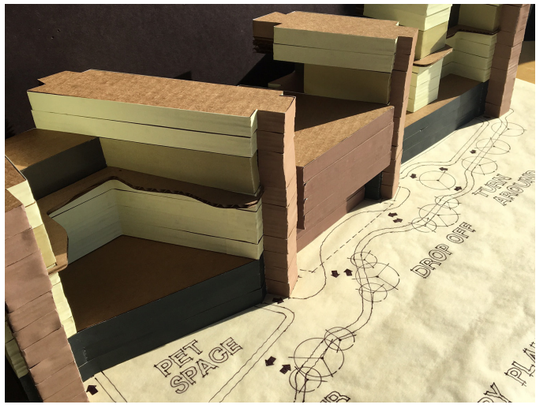
Within a **semi-private** setting young professionals and seniors can be seen giving tours to the public or sharing meals in the residents community kitchen.

Within a **private** setting young professionals and seniors can gather to chat about life and tell stories, or they can use these more intimate spaces to continue their education on communal living and the latest net zero principles.

Completed thesis display







Through modeling I was able to develop a building form that is in response to neighboring context as well as programmatic elements. I used these simple models as tools to help me explore several preliminary building forms and configurations as I worked through the design process. The current design iteration consists of two residential wings branching off of a multi-story community hub. Shown above are images from the final thesis display.

Final thesis presentation

Final thesis boards

Appendix

Located within the appendix are the references used throughout the thesis, my previous studio experience & my personal information.

References

Denton, Alexis. Telephone interview from Renaissance Hall, January 27, 2017.

Fetner, Elizabeth Ann. Telephone interview from Renaissance Hall, January 30, 2017.

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Previous Studio Experience

2nd year

fall: Joan Vorderbruggen

tea house

spring: Darryl Booker

dance studio

dwelling

3rd year

fall: Paul Gleye

fargo visitor center

downtown student center

spring: David Crutchfield

ndsu library

scjohnson research facility

4th year

fall: Bakr Aly Ahmed

san francisco highrise

spring: Malini Srivastava

passivhaus design build

5th year

fall: Malini Srivastava

high performance envelopes

Ian J. Schimke

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